ICES COOPERATIVE RESEARCH REPORT

RAPPORT DES RECHERCHES COLLECTIVES

NO. 255

Report of the ICES Advisory Committee on Fishery Management, 2002

Copenhagen, 21 May – 30 May 2002
Copenhagen, 9 October – 17 October 2002

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International Council for the Exploration of the Sea
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Preface

The ICES Advisory Committee for Fishery Management met twice in 2001, 21 - 30 May- and 9 - 17 October 2002. Both meetings were held at the ICES Headquarters, Palægade 2–4, Copenhagen. Attendance is listed on the following pages.

ACFM in its advice includes a description on how the Precautionary Approach have been interpreted in the ICES advice, see Form of Advice in the Introductory Chapter.

The reports are in response to requests from Management Commissions (EC, IBSFC, NEAFC, and NASCO) and from member countries. The management advice is presented stock by stock in Sections 3 to 8 where also the answers to special requests are given.

The requests from Management Commissions are now divided into two parts: recurrent advice that is specified by Memorandum of Understanding between the Management Commissions and ICES and Special Requests. Recurrent advice includes assessment of stock status and management advice for the more important stocks in the Northeast Atlantic. This advice is provided in the same form as used by ICES Advisory Committee for Fishery Management in recent years.

The special requests dealt with in this report included:

- From IBSFC on

- pelagic fisheries
- selectivity in Cod trawls
- research Plan for Central Baltic Herring
- From NEAFC and the coastal states on special problems related to the management of blue whiting.
- From EC on
- European sea bass.
- in-year review of the assessment of plaice in Division IIIa (Skagerrak-Kattegat), of Herring in the Celtic Sea, of Northern hake and of sole in the Bay of Biscay.
- rebuilding plans for cod and hake stocks
- overestimation in the Forecasting of Haddock and Whiting by-catch in the Industrial Fisheries
- concerning review of a study of Multiannual TAC arrangements for Flatfishes
- From Finland on in-year revision of the advice for Herring in Subdivision 30 (Gulf of Bothnia)
- From UK on the effects of the Mackerel box

ICES Fisheries Adviser
ICES Headquarters, Copenhagen
December 2002

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, SPRING 2002

PARTICIPANTS	AFFILIATION	A	B
T. Jakobsen	Chair	X	X
C. O'Brien	Chair of Resource Management Committee	X	X
B. MacKenzie	Chair of Baltic Committee	X	X
J. Rice	Chair of Consultative Committee	X	
W. Vanhee	Belgium	X	X
D. Rivard	Canada	X	X
S. Reeves	Denmark	X	X
T. Saat	Estonia	X	X
A. Leskelä	Finland	X	X
A. Forest	France	X	X
C. Hammer	Germany	X	X
S. Schopka	Iceland	X	X
C. Kelly	Ireland	X	X
G. Kornilovs	Latvia	X	X
M. Pastoors	Netherlands	X	X
D. Skagen	Norway	X	X
J. Horbowy	Poland	X	X
	Portugal		
V. Shlibanov	Russia	X	X
C. Porteiro	Spain	X	X
B. Sjöstrand	Sweden	X	X
P. Kunzlik	UK	X	X
S. Cadrin	USA	X	X
E. Kirkegaard	Observer European Commission	X	X
F. Biagi	Observer European Commission	X	X
	Observer NAFO		
J. Boje	Observer Greenland	X	X
J. Reinert	Observer Faroe Islands	X	X
E. Hjorleifsson	Chair of North-Western WG		X
M. Plikshs	Chair of Baltic Fisheries Assessment WG		X
T. Pakarinen	Chair of Baltic Salmon and Trout Assessment WG		X
A. Gudmundsdottir	Chair of Northern Pelagic and Blue Whiting Fisheries WG		X
E. Torstensen	Chair of Herring Assessment WG for the Area South of 62°N		X
S. Mehl	Chair of Arctic Fisheries WG		X
M. Pawson	Chair of SG on Sea Bass		X
M. Smith	Expert from Flatfish project team		X
M. Bell	Chair of WG on Nephrops Stocks		X
H. Lassen	ICES Fisheries Adviser	X	X
H. Sparholt	ICES Fisheries Assessment Scientist	X	X

A **Plenary Sessions 21 May and 27-30 May 2002**
B **Sub-Groups 22-25 May 2002**

ADVISORY COMMITTEE ON FISHERY MANAGEMENT

PARTICIPANTS AT MEETING, AUTUMN 2002

PARTICIPANTS	AFFILIATION	A	B
T. Jakobsen	Chair	X	X
P. Degnbol	Incoming Chair of ACFM	X	
C. O'Brien	Chair of Resource Management Committee	X	X
J. Rice	Chair of Consultative Committee	X	
W. Demaré	Belgium	X	X
D. Rivard	Canada	X	X
S. Munch-Petersen	Denmark	X	X
T. Saat	Estonia	X	X
J. Raitaniemi	Finland	X	X
A. Biseau	France and Chair of WG on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim	X	X
C. Zimmermann	Germany	X	X
E. Hjorleifsson	Iceland	X	X
C. Lordan	Ireland	X	X
M. Plikshs	Latvia	X	X
F. van Beek	Netherlands	X	X
O. Smedstad	Norway	X	X
J. Horbowy	Poland	X	X
M. Azevedo	Portugal	X	X
Y. Efimov	Russia	X	X
C. Porteiro	Spain	X	X
B. Sjöstrand	Sweden and Chair of Pandalus WG	X	X
J. Hjelm	Sweden		X
P. Kunzlik	UK	X	X
M. Terceiro	USA	X	X
K. Patterson	Observer European Commission	X	X
	Observer Greenland		
	Observer Faroe Islands		
S. Flatman	Chair of Southern Shelf Demersal Stock WG		X
M. Pastoors	Chair of Demersal Stocks in the North Sea and Skagerrak WG		X
D. Skagen	Chair of Mackerel, Horse Mackerel, Sardine and Anchovy WG		X
M. Armstrong	Chair of Northern Shelf Demersal Stocks WG		X
H. Lassen	ICES Fisheries Adviser	X	X
H. Sparholt	ICES Fisheries Assessment Scientist	X	X

A Plenary Sessions 14-17 October 2002
B Sub-Groups 9-12 October 2002

1 ICES Advice

1.1 The Form of ICES Advice

ICES recognises that "changes in fisheries systems are only slowly reversible, difficult to control, not well understood, and subject to change in the environment and human values" (FAO 1996). Therefore, ICES agrees that a precautionary approach should be applied to fishery management. Biological reference points, stated in terms of fishing mortality rates or biomass, are key concepts in implementing a precautionary approach. They are predefined benchmarks (limit reference points) that should be avoided to ensure that stocks and their exploitation remain within safe biological limits, and against which assessments should evaluate the status of the stock.

The concept of safe biological limits was introduced in ICES advice in 1981 and further developed in 1986 (Serchuk and Grainger, 1992). The aim of keeping stocks within 'safe biological limits' was described in the UN Agreement on Straddling Fish Stocks and Highly Migratory Stocks: a stock should be kept at a sustainable level by keeping it above a minimum biomass benchmark, and by keeping the fishing mortality below a maximum fishing rate benchmark. In 1998, ICES introduced precautionary biological reference points as the basis for its advice.

ICES provides advice on fishery management aimed at keeping the risk that the spawning biomass may fall below a minimum limit low. The minimum spawning stock biomass benchmark is described by the symbol $\mathbf{B_{lim}}$ (the biomass limit reference point). The value of $\mathbf{B_{lim}}$ is set on the basis of historical data, and chosen such that below it, there is a high risk that recruitment will 'be impaired' (seriously decline) and on average be significantly lower than at higher SSB. When information about the dependence of recruitment on SSB is absent or inconclusive, there will be a value of SSB, below which there is no historical record of recruitment. $\mathbf{B_{lim}}$ is then set close to this value to minimize the risk of the stock entering an area where stock dynamics is unknown.

Below $\mathbf{B_{lim}}$ there is a higher risk that the stock could 'collapse'. The meaning of 'collapse' is that the stock has reached a level where it suffers from severely reduced productivity. 'Collapse' does not mean that a stock is at high risk of biological extinction, but does mean that recovery to improved status is likely to be slow, and dependent of effective conservation measures.

The fishing mortality rate should not be higher than an upper limit $\mathbf{F_{lim}}$ which is the fishing mortality that, if maintained, will drive the stock to the biomass limit.

Spawning biomass and fishing mortality can only be estimated with uncertainty. Therefore, operational reference points are required to take account of this. To keep the true risk low that spawning biomass falls below $\mathbf{B_{lim}}$, the estimated spawning biomass should in practice be kept above a higher level that allows for this uncertainty. Therefore, ICES applies a 'buffer zone' by setting a higher spawning biomass reference point $\mathbf{B_{pa}}$ (the biomass precautionary approach reference point). ICES advises that when the spawning biomass is estimated to be below $\mathbf{B_{pa}}$, management action should be taken to increase the stock to above $\mathbf{B_{pa}}$.

Similarly, to be certain that fishing mortality is below $\mathbf{F_{lim}}$, fishing mortality should in practice be kept below a lower level $\mathbf{F_{pa}}$ that allows for uncertainty as well. ICES advises that when fishing mortality is estimated to be above $\mathbf{F_{pa}}$, management action to reduce it to $\mathbf{F_{pa}}$ should be taken. Such advice is given even if the spawning biomass is above $\mathbf{B_{pa}}$ because fishing mortalities above $\mathbf{F_{pa}}$ are not sustainable.

ICES gives advice on many stocks for which there is no analytical assessment and accordingly no basis for setting reference points as described above. Also in these cases ICES uses a precautionary approach, but alternative models are applied, with reference points referring to properties of the stock or fishery that can be estimated, for example catch per unit of effort instead of biomass.

The ICES advice is primarily risk-averse, i.e. it aims at reducing the risk of something undesirable happening to the stocks. Biological target reference points are also part of the Precautionary Approach, but setting targets for fisheries management involves socio-economic considerations. Therefore, ICES does not propose values for Target Reference Points, and at least until now Management Agencies have not identified management targets based on socio-economic benefits. Hence Target Reference Points have not been directly used in the advice. This means that even if the ICES advice is followed and therefore the stock should be protected from impaired productivity, exploitation of most stocks is likely to be sub-optimal, i.e. the long-term yield is lower than it could be.

Managers are invited to develop management strategies. ICES will comment on these and consider if they are consistent with the precautionary approach. If they are, ICES will frame the advice to be consistent with the adopted management targets.

Framework for advice

When an assessment shows that the spawning biomass is below $\mathbf{B_{pa}}$ ICES regards the stock as being 'outside safe biological limits', regardless of the fishing mortality rate, and ICES will provide advice to increase spawning biomass above $\mathbf{B_{pa}}$, which may involve

reducing fishing mortality to levels below $\mathbf{F_{pa}}$ possibly by a large amount cannot be achieved in the short-term, ICES will recommend the development of a rebuilding plan specifying measures to increase SSB above $\mathbf{B_{pa}}$ in an appropriate time scale depending on the biological characteristics of the stock and other relevant factors.

When an assessment shows that the stock is above $\mathbf{B_{pa}}$ but that the fishing mortality is above $\mathbf{F_{pa}}$, the stock is 'harvested outside safe biological limits'. ICES will then recommend that the fishing mortality be reduced below $\mathbf{F_{pa}}$ in the short term.

The ICES reference points in current use were set in 1998 using the stock and fishery data then available, as a provisional step in the implementation of the precautionary approach. In some cases, it has been necessary to change these reference point values as a result of changes in the data or the productivity of the stock, In order to improve consistency with the framework described above, and take advantage of new biological and fisheries information acquired on many stocks. ICES will review all these values in 2003.

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ICES 1998. Report of the Precautionary Approach to Fisheries Management. Copenhagen, 3–6 February 1998. ICES CM 1998/ACFM:10.

ICES 2002. Report of the Study Group on the Further Development of the Precautionary Approach to Fisheries Management. Lisbon, 4–8 March 2002. ICES CM 2002/ACFM:10

Serchuk, F M. and Grainger, J. R. 1992. Development of the basis and form of ICES Fisheries Management Advice; Historical background (1976–1990) and the new form of ACFM Advice (1991 - ?). ICES CM 1992/Assess:20.

Report of the 11th Dialogue Meeting Nantes January 1999, ICES Coop. Res. Rep. 228 (1999).

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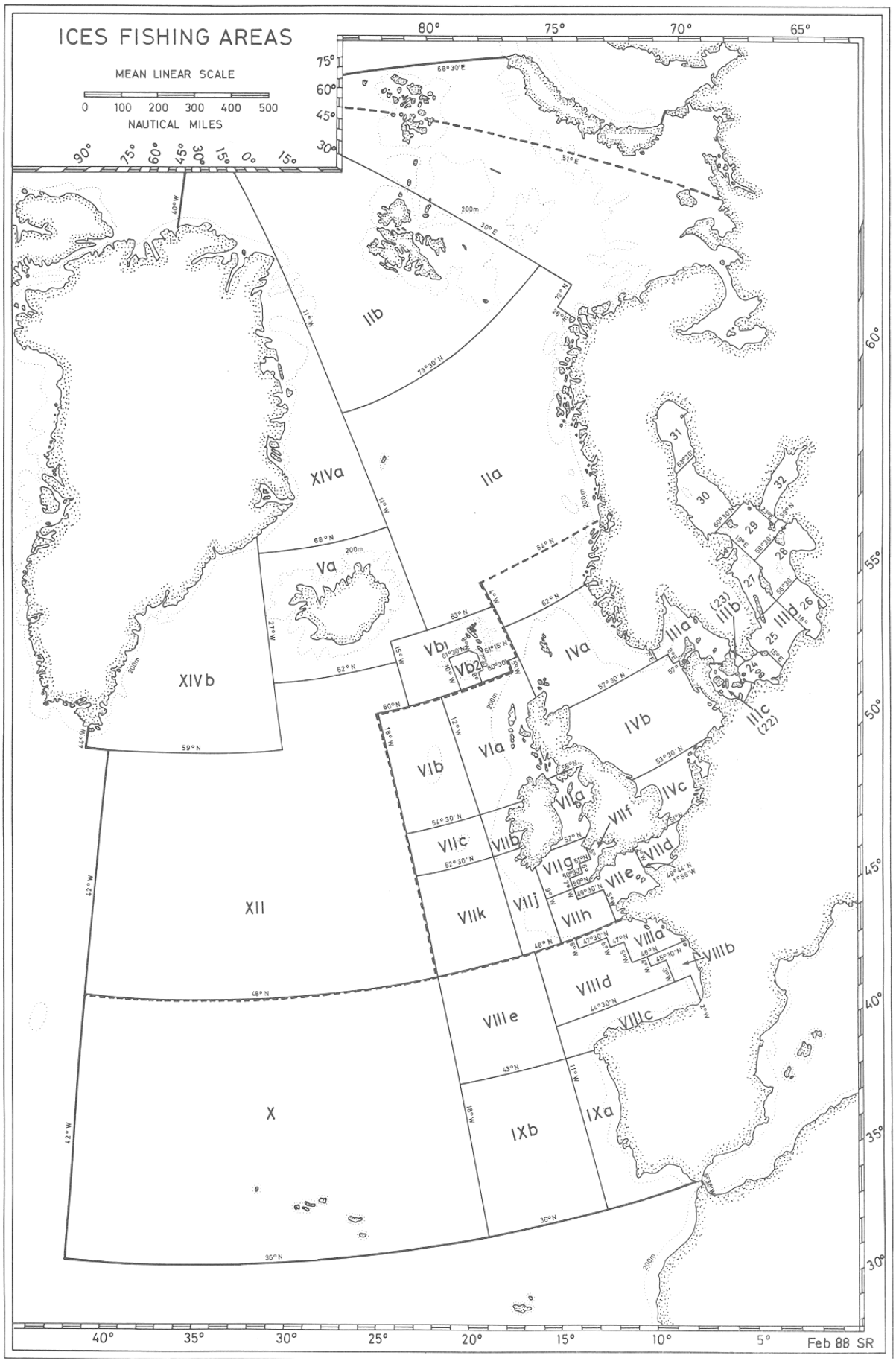
ICES FISHING AREAS
MEAN LINEAR SCALE
0 100 200 300 400 500
NAUTICAL MILES
I
IIa
IIb
IIIa
IIIb
IIIc
IIIc (22)
IIIb (23)
IIIa 24
IIIb 25
IIIb 26
IIIb 27
IIIb 28
IIIb 29
IIIb 30
IIIb 31
IIIb 32
IVa
IVb
IVc
Va
Vb1
Vb2
VIa
VIb
VIIa
VIIb
VIIc
VIId
VIIe
VIIf
VIIg
VIIh
VIIj
VIIk
VIIIa
VIIIb
VIIIc
VIIId
VIIIe
IXa
IXb
X
XII
XIVa
XIVb
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2 INTRODUCTORY ITEMS

2.1 Introduction

The Advisory Committee on Fishery Management (ACFM) consists of one designated fisheries scientist from each of the ICES member countries. The committee has an independently elected chair and the chairs of the scientific committees on Resource Management, Living Resource and Baltic are *ex-officio* members. The committee meets twice each year to review assessments and give advice on the status of fish stocks and to provide catch options for the coming year. The basis for the advice is reports of assessment working groups. These assessment reports are reviewed by sub-groups of ACFM members. Assessment Working Group chairs participate in these reviews.

The assessments presented in this report are carried out using the best catch data available to ICES. These data are not necessarily identical with the official statistics but, where appropriate, include estimates of unreported landings as well as corrections for misallocation of catches by area and species. Despite considerable effort exerted on this problem, there is no guarantee that all instances of misreporting were discovered. Often the catch data used by ICES are collated on a stock rather than an area basis, and so straightforward comparisons between these figures and the official statistics, which are provided on an area basis, are not appropriate.

In the assessments, ICES tries to estimate the total catch taken, including slipped catches, discards, landings which are not officially reported, and the composition of the industrial by-catches. These amounts of different species, which have to be included in the estimates of what has been taken from a given stock in order for the assessments to be correct, thus appear in the tables and figures in this report. These discards, slipped fish, unreported landings, and industrial by-catches vary considerably between different stocks and fisheries, being negligible in some cases and constituting important parts of the total removal from other stocks. In recent years more information on discards has been collected through observer programme.

The catch data used in the assessments are given in the "table" section of this report. In cases where there might be doubt, it has been indicated if discards, by-catches, and estimates of unreported landings are included in the assessments. Estimates of catches landed as by-catches, especially from the industrial fisheries, are included in the assessments wherever data allow it and are included in the catch options.

It should be noted that, in general, catches in the industrial fisheries of protected species above the minimum landing size which are sorted and landed for human consumption, are included in the estimates of human consumption landings, both in the catch input data and in the projected catch options. Estimates of industrial by-catches cover, in most cases, that part of the by-catch which is used for reduction purposes.

In the past there have been problems associated with discrepancies between the official landing figures reported to ICES by member countries and corresponding catch data used by ICES. ICES recognises the need for a clear identification of the categories of the catch data used for assessments and whenever possible specifies the composition of the catch data used to estimate fishing mortalities. ICES also attempts to identify factors contributing to the total fishing mortality in the various stocks, e.g.:

- recorded landings,
- discards at sea,
- slipping of unwanted catches,
- losses due to burst nets etc.,
- unreported landings,
- catch reported as other species,
- catch reported as taken in other areas,
- catch taken as by-catch in other fisheries.

It is recognised that it may not always be possible to reveal the sources of the data. It is, however, indicated whether the data originate from sampling programmes, field observations, interviews, etc., in order to allow ICES and other interested parties to evaluate the quality of the data, and hence the basis for the assessment.

The overall responsibility for obtaining reliable, adequate and timely fisheries statistics, e.g. for publication in *ICES Fisheries Statistics,* rests with the national offices for fisheries statistics and fisheries research institutes. These agencies are also responsible for providing the catch data needed for assessments. They should ensure that catch statistics are collected on a gear basis and that the species composition of landings is determined in the case where landings are made unsorted by species.

2.2 Quality of Fishery Statistics

The quality of the assessments are directly linked to the quality of the fisheries data and ICES has expressed the greatest concern in past ACFM advice over the quality of catch and effort data from most of the important fisheries in the ICES area. ICES stressed that the immediate consequences of this are that ICES will be unable to provide reliable estimates of current stock sizes and forecasts that have been used to set TACs. Trends in stock size and the overall status of the stock can sometimes be evaluated from research vessel surveys, but such information alone cannot be used to give the short-term TAC advice usually required.

2.3 Catch projections for the current and following year

The Catch Option table is a basis part of the ICES advice and these catch options are based on assumptions about the total catch in the current or intermediate year. This value has been debated, especially when it is larger than the total TAC for the given year.

The catch assumption is a projection of trends in the fisheries and the projection is based on case specific conditions. In many cases, ICES considers two alternatives: 1) to assume that the catch will be equal to the TAC (a TAC constraint) or 2) to assume that the fishing mortality, F, will continue equal to that of previous year (a $F_{status\ quo}$ constraint). In some cases the stock unit used by ICES does not match the TAC area used by the management agencies. In those cases it can be difficult to establish how the TAC will restrict the catch from the stock and often the F *status quo* is used.

Calculation of the best estimate of the *status quo* fishing mortality by age varies between stocks. The form of the estimate depends of temporal trends in the fishing mortalities and in the exploitation pattern. Also the variance of the estimate in individual years needs to be considered. In several cases a mean over the last three years are used sometimes scaled to the level of fishing mortality in the most recent year.

2.4 Answer to special request from EC on Mixed Fisheries

EC DG Fish has requested scientific advice on mixed fisheries for 2002 as follows:

1. *The relevant ICES assessment working groups should be asked, as soon as possible, to propose appropriate definitions of fishing fleets, as far as possible, as operationally distinct and functionally homogenous units. When considering such definitions, account should be taken of the definitions of fleet sectors that exist in Community legislation (particularly Regulation 850/98 and its amendments) and these sectors should be used where possible and appropriate. For the fleet sectors defined as above, estimate landings (and discards where available), disaggregated by species, fleet, and ICES division (or subdivision where possible), for the years 1999, 2000 and 2001.*

2. *These data should be provided to the Commission services for the attention of STECF as soon as possible after the meetings of each assessment working group. Where there are gaps in the available information, ICES should draw the attention of STECF to these deficiencies.*

3. *SGRST/STECF will, after the annual advice has been provided by ACFM, be asked to use the aforementioned data to make fishery-based calculations and forecasts corresponding to some scenarios based on ACFM advice.*

ICES Comments:

Information on species composition of the catch by fisheries has been reviewed for stocks in the North Sea and is provided in the Overview section for that area (Table 3.5.1.3a). This served to identify the fleets for which landings appear as a mixture of various species. This information is consistent with the common knowledge that these fleets often operate on a species mix, e.g. cod, haddock, and whiting for some or plaice, sole, and cod for others.

It was noted that information is available at the set-by-set level and that such a level of detail may reveal more on the mixtures encountered when fishing these stocks. More detailed information is being assembled for these stocks, as well as for stocks in other areas, and will be considered by a Subgroup of STECF shortly as indicated in the letter from DG Fish. Also, the ACFM Study Group on the Development of Fishery-based Forecasts (SGDFF) will meet in early 2003 to review approaches to the operational definition of fishery based on individual voyage data within various groups, define fishery-based data requirements for multi-fishery, mixed-species forecasts, and agree on data formats for the compilation of national datasets into international fishery-based datasets. It has not been possible to compile similar data for other areas where fisheries occur that are similar to the North Sea mixed demersal fisheries.

The relevant ICES Working Groups have been asked to consider these problems at the next round of the assessments in 2003.

2.5 Structure of the Report

Information and advice are provided on an area basis. Thus, all stocks belonging to a given area are placed in a separate section, together with an overview of the state of the stocks and fisheries in that area. Special requests from Commissions or member countries of ICES are placed in the section dealing with the respective area and stock.

Exceptions to this structure are that the report to the North Atlantic Salmon Conservation Organization and reports on *Nephrops* (Section 3.14) and on European eel (Section 3.16) are provided as separate sections. Section 3.15 provides some preliminary information on the status of European Sea bass stocks.

3 Review of the Stocks

3.1 Stocks in the Northeast Arctic (Subareas I and II)

3.1.1 Overview

Major stocks and landings

The total landings of fish and invertebrates in this area in 2001 were in the order of 2.7 million t. These catches were taken from a variety of demersal and pelagic stocks.

The major demersal stocks in the Northeast Arctic include cod, haddock, saithe, and northern shrimp. In addition, redfish, Greenland halibut, and flatfishes (e.g., long rough dab, plaice) are common on the shelf and at the continental slope, with ling and tusk found also at the slope and in deeper waters. In 2001, landings of 0.7 million t were taken from the stocks of cod, haddock, saithe, redfish, and Greenland halibut. An additional catch of about 100 000 t was taken from demersal stocks, including crustaceans, not assessed at present.

The major pelagic stocks are capelin, herring, and polar cod. The highly migratory species blue whiting and mackerel extend their feeding migrations into this region. The international fishery for herring in 2001 was 770 000 t. The capelin fishery in the Barents Sea in 2001 was 406 000 t. In addition, there were landings from Subareas I and II of 592 000 t blue whiting in 2001 (including Divisions Va and XIVa-b) and 92 000 t mackerel in 2000 (including Division Vb).

Invertebrate species of krill, copepods, and amphipods are considered to be important food resources for the fish stocks in this area. Marine mammals play an important role as predators on fish. Several other species of fish and invertebrates are found in the area. Species with relatively small landings include salmon, halibut, hake, pollack, whiting, Norway pout, anglerfish, wolffish, lumpsucker, argentines, grenadiers, flatfishes, horse mackerel, dogfishes, skates, crustaceans, and molluscs.

Fleets and fisheries

The fleets operating in this area are:

1. Factory and freezer trawlers operating in the whole area all year round targeting mainly cod, haddock and saithe and taking other species as by-catch. The number of these vessels has been stable in recent years, at a lower level than previously.

2. Fresh fish trawlers operating in Subarea I and Division IIa all year round targeting mainly cod and haddock, taking other species as by-catch. The number of these vessels has been reduced in recent years.

3. Freezer trawlers operating in Subarea I and Division IIb fishing shrimp. The number of these vessels has been stable.

4. Large purse seiners and pelagic trawlers targeting herring, mackerel, blue whiting, capelin, and polar cod in seasonal fisheries in this region. These vessels fish some of the same species in other areas as well.

5. Small fresh fish trawlers targeting shrimp and capelin in near-coast areas in Subarea I. The size of this fleet has decreased in recent years.

6. A fleet of vessels using conventional gears (gillnet, longline, handline, and Danish seine) mainly in near-shore fisheries targeting various demersal species all around the year. This fleet, together with fleets 7 and 8, accounts for approximately 30% of landings of demersal stocks. This share is maintained by quota allocation. When vessels in this fleet are modernised or replaced, there is a trend towards medium-sized (app. 15–20 m) multi-gear vessels with crews of 3–5.

7. Small purse seiners targeting saithe in coastal waters in a seasonal fishery, to a large extent vessels belonging to the group using conventional gears.

8. Longliners operating offshore targeting non TAC-restricted species, mainly ling, blue ling and tusk. These vessels are generally larger than those in the coastal fisheries and use technologically advanced auto-line systems.

Management measures

The fisheries in Subareas I and II are managed by TAC constraints for the main stocks and by allocation of TAC shares amongst states with established fishing interests. These Subareas consist mainly of waters within EEZs but also contain some waters outside EEZs.

For the main species the fisheries in the EEZs are regulated by quotas at a variety of scales (vessels, fleets, species, season). Management measures also regulate minimum landing size, mesh size, and use of sorting

grids. Since January 1997 use of sorting grids in the trawl fisheries has been mandatory for most of the Barents Sea and Svalbard area. Minimum landing size is also a minimum catching size, implying that vessels have to avoid fishing grounds with small-sized fish. Discarding is prohibited in some EEZs. Time and area closures may be implemented to protect small fish.

Compilation of effort data relevant to the different species is difficult when the fisheries are regulated by vessel quotas. In some cases the effort targeted at the main species, e.g., cod, may be calculated, but it is almost impossible to calculate effort for non-target species.

Current status in the Northeast Arctic

The recent developments in the stocks of cod, haddock, saithe, Greenland halibut, redfishes, herring, and capelin are summarised in the following.

The stocks of cod and *Sebastes mentella* are outside safe biological limits, haddock is harvested outside safe biological limits, while saithe is within safe biological limits.

The status of the Greenland halibut stock is not precisely known. SSB shows signs of improvement but is still among the lowest in the time-series, and recruitment in recent years is also estimated to be well below the historic average.

The available information on *Sebastes marinus* is insufficient to assess the stock properly, but there are strong signs in the surveys of reduced recruitment, and both the coastal survey and commercial CPUE indicate a decrease for larger fish.

The capelin stock is within safe biological limits although the recent stock increase has culminated and the stock has decreased slightly in the last year.

Norwegian spring-spawning herring is harvested at or slightly above safe biological limits. The spawning stock is declining, but is still considered to be within safe biological limits.

Considerable effort has been devoted to investigating multispecies interactions. Some of these investigations have reached the stage where quantitative results are available for use in assessments. Growth of cod depends on availability of prey such as capelin, and variability in cod growth has had major impacts on the cod fishery. Cod are able to compensate only partially for low capelin abundance, by switching to other prey species. Low capelin abundance has caused high cannibalism on juvenile cod, and increased predation in impacts on other prey species, e.g. juvenile herring and haddock. Herring predation on capelin larvae is believed to be partially responsible for the recruitment failure of capelin when young herring are abundant in the Barents Sea.

The annual consumption of herring and capelin by marine mammals (particularly harp seals and minke whales) has been estimated to be in the order of 5 million t. The composition and distribution of species in the Barents Sea depend considerably on the position of the polar front which separates warm and salty Atlantic waters from colder and fresher waters of arctic origin. Variation in the recruitment of some species including cod and herring has been associated with changes in the influx of Atlantic waters into the Barents Sea.

3.1.2 Cod in Subareas I and II

3.1.2.a Northeast Arctic cod

State of stock/fishery: The stock is outside safe biological limits. Fishing mortality in the last four years has been among the highest observed and well above $\mathbf{F}_{pa}$, even above $\mathbf{F}_{lim}$, and is not sustainable. SSB has been below $\mathbf{B}_{pa}$ since 1998. Surveys indicate below average 1999 and 2000 year classes and a very poor 2001 year class.

Management objectives: In recent years, the advice has been to reduce fishing mortality below $\mathbf{F}_{pa}$ (=0.42) and to keep the spawning stock above 500 000 t, which was considered to be the minimum value required to have a low probability of poor recruitment. This approach was incorporated into a management objective in the years 1997–1999. The latest agreement in the Joint Russian-Norwegian Fisheries Commission sets a TAC of 435 000 t (including 40 000 t Norwegian Coastal cod) for 2001, 2002, and 2003. The intention is that this TAC could be revised either if the stock situation is more serious than known at the time of the agreement, or if the stock is assessed to be within safe biological limits. ICES considers that TACs under this agreement are well above those that would correspond to the application of the precautionary approach.

Precautionary Approach reference points: The biological information on historic stock and recruitment sizes has been revised. These revisions have altered some of the historic values substantially, with two consequences. Spawning biomasses associated with some historic recruitment are now estimated to have been lower and current reference points may be revised. ACFM in May 2001 and the external peer-review in October 2001 considered that more detailed analyses were required as a basis for new reference points and recommended that old values be used until such studies were completed. This work should be undertaken by a dedicated Study Group that will meet before the next AFWG meeting in 2003, building upon the work of the most recent AFWG.

Reference points (1998)

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 112 000 t	$\mathbf{B}_{pa}$ is set at 500 000 t, the value below which the probability of below average year classes increases
$\mathbf{F}_{lim}$ is 0.70	$\mathbf{F}_{pa}$ be set at 0.42. This value is considered to have a 95% probability of avoiding the $\mathbf{F}_{lim}$

Technical Basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = examination of stock-recruit plot
$\mathbf{F}_{lim}$ = Median value of $\mathbf{F}_{loss}$	$\mathbf{F}_{pa} = 5^{th}$ percentile of $\mathbf{F}_{loss} = \mathbf{F}_{lim}$ x 0.6

Advice on management: In order to harvest the stock within safe biological limits, ICES recommends a considerable reduction in fishing mortality to below $\mathbf{F}_{pa}$ (0.42). This corresponds to catches in 2003 of less than 305 000 t.

Relevant factors to be considered in management: The TAC for 2002 was set considerably higher than recommended by ICES. The pre-agreed TAC for 2003 (435 000 t, including 40 000 t of Norwegian coastal cod) is expected to result in a fishing mortality well above $\mathbf{F}_{pa}$.

Evidence of under-reporting of catches in recent years is accumulating. Both discards and unreported landings will reduce the effect of management measures and it is important that management agencies ensure that all catches are counted against the TAC regulations.

The majority of the spawning stock comprises first time spawners. Evidence has shown that the eggs and larvae of first-time spawners are less viable than those of other mature fish, but also that the overall spawning period is reduced when the spawning stock consists of fewer age groups. Both these factors can reduce the reproductive potential of the stock for the same biomass.

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$ = 0.84; Catch = 523 ; SSB(2003) = 429 .

F	Basis	Landings 2003	SSB 2004
0.00	0	0	850
0.17	0.2*$\mathbf{F}_{sq}$	134	740
0.34	0.4*$\mathbf{F}_{sq}$	251	647
0.42	$\mathbf{F}_{pa}$ (=0.5*$\mathbf{F}_{sq}$)	305	605
0.51	0.6*$\mathbf{F}_{sq}$	355	566
0.63	Catch2003=Catch2001 (0.75*$\mathbf{F}_{sq}$)	425*	512
0.84	1.0*$\mathbf{F}_{sq}$	529	435

*Corresponding to expected landings of 426 000 t created by the pre-agreed quota of 435 000 t Northeast Arctic cod +Norwegian Coastal cod.
Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: In previous assessments, fishing mortality $F_{(5-10)}$ in the most recent years was often underestimated and stock numbers overestimated in the annual assessments of the stock. The current assessment does not present such retrospective patterns, and it is inferred that this over/underestimation is less evident for this assessment. The estimated stock numbers in 2001 are close to last years assessment, while the estimate for F in 2001 (0.84) is higher than expected from a TAC-constrained forecast in last years assessment (0.66), but lower than assumed by the F status quo forecast (0.91). The expectation of future SSBs is much higher than what was projected in 2001. This is mainly due to a much higher maturation rate for ages 6-8 observed in surveys in the autumn 2001 and in the winter of 2002. The projections are based on the assumption that high maturation rates prevail in 2003 and 2004. This assumption is supported by historical experience.

Elaboration and special comment: Changes in growth, maturity, and cannibalism are linked to abundance of capelin. Capelin abundance has increased since 1997 and is expected to stay at a high level in 2002. A considerable reduction in cod cannibalism has been observed since 1996, while a small increase in mean weight at age is observed since 2000. Annual variation in growth and maturity can be substantial for this stock.

The fishery for Northeast Arctic cod is conducted both by an international trawler fleet operating in offshore waters, and by vessels using gillnets, longlines, handlines, and Danish seine operating both offshore and in the coastal areas. Quotas were introduced in the trawl fishery in 1978 and for the fisheries with conventional gears in 1989. In addition to quotas the fisheries are regulated by mesh size limitations (including sorting grids), a minimum catching size, a maximum by-catch of undersized fish, maximum by-catch of non-target species, closure of areas with high densities of juveniles, and by seasonal and area restrictions. Since January 1997 sorting grids have been mandatory for the trawl fisheries in most of the Barents Sea and Svalbard area. The fisheries are controlled by inspections of the trawler fleet at sea, by a requirement of reporting to catch control points when entering and leaving the EEZs, and by inspections for all fishing vessels when landing the fish. Keeping a detailed fishing log-book on board is mandatory for most vessels, and large parts of the fleet report to the authorities on a daily basis. There is some evidence that the present catch control and reporting systems are not sufficient to prevent under-reporting of catches.

The assessment is based on analysis of catch-at-age data, using one commercial CPUE series and three survey series. Estimates of cannibalism are included in the natural mortality. Alternative assessment methods (Fleksibest) are in development.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

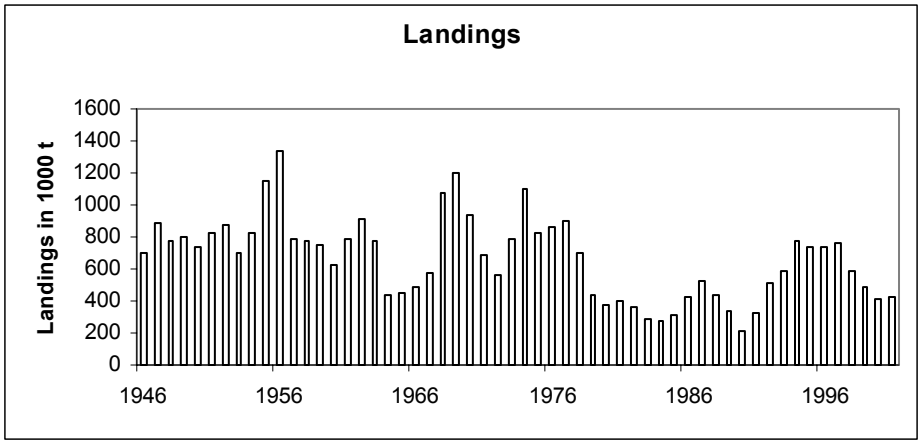
Yield and spawning biomass per Recruit F-reference points:

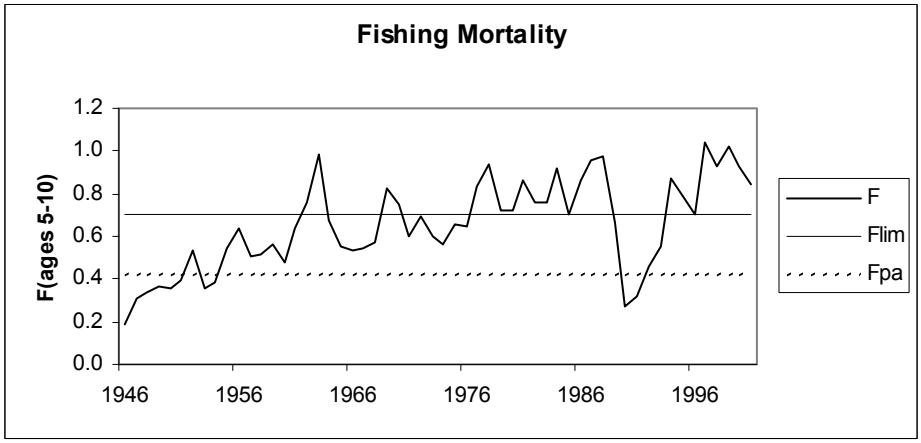
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average Current	0.842	1.083	0.744
$\mathbf{F}_{max}$	0.251	1.261	3.907
$\mathbf{F}_{0.1}$	0.128	1.158	7.165
$\mathbf{F}_{med}$	0.937	1.062	0.623

Catch data (Tables 3.1.2.a.1–3):

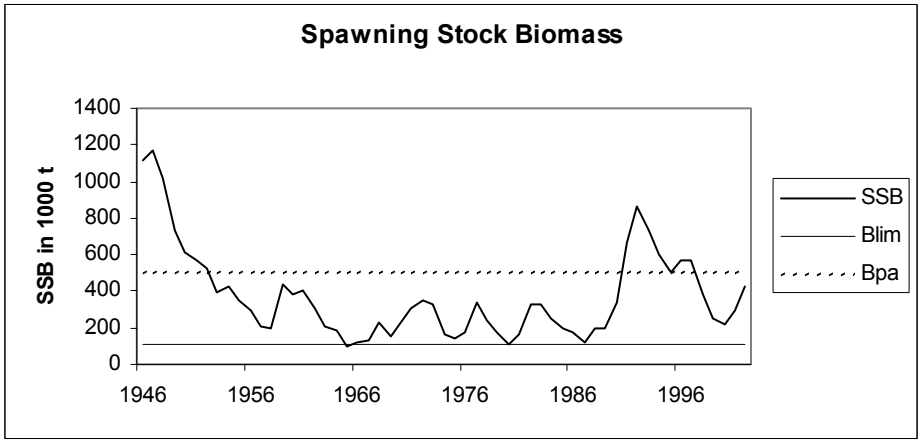
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[1]	Official landings	ACFM landings[1]	Unreported landings
1987	Gradual reduction in F	595	560	552	523	
1988	F = 0.51; TAC (Advice November 87) (Revised advice May 88)	530 (320-360)	590 451	459	435	
1989	Large reduction in F	335	300	348	332	
1990	F at $\mathbf{F}_{low}$; TAC	172	160	210	212	25
1991	F at $\mathbf{F}_{low}$; TAC	215	215	294	319	50
1992	Within safe biological limits	250[2]	356	421	513	130
1993	Healthy stock	256[2]	500	575	582	50
1994	No long-term gains in increased F	649[2]	700	795	771	25
1995	No long-term gains in increased F	681[2]	700	763	740	
1996	No long-term gains in increased F	746[2]	700	759	732	
1997	Well below $\mathbf{F}_{med}$	< 993	850	775[3]	762	
1998	F less than $\mathbf{F}_{med}$	514	654	597[4]	593	
1999	Reduce F to below $\mathbf{F}_{pa}$	360	480		485	
2000	Increase B above $\mathbf{B}_{pa}$ in 2001	110	390		415	
2001	High prob. of SSB>$\mathbf{B}_{pa}$ in 2003	<263	395		426	
2002	Reduce F to well below 0.25	<181	395			
2003	Reduce F to below $\mathbf{F}_{pa}$	<305				

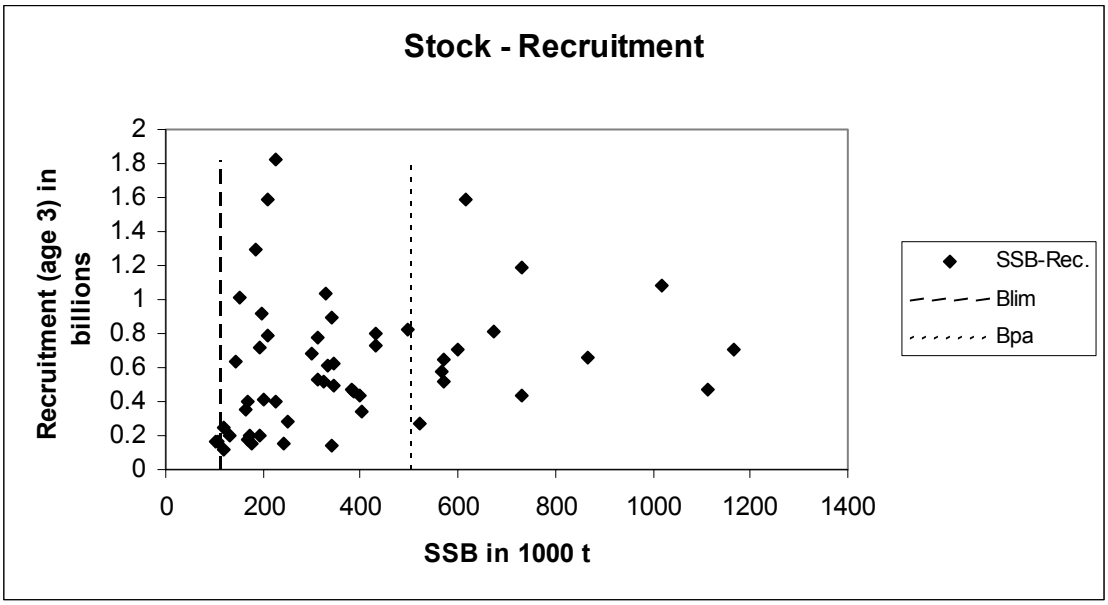
[1]Norwegian coastal cod not included. [2]Catch at *status quo* F. [3]Spain data not included. [4]Germany, Ireland, Spain not included. Weights in '000 t.

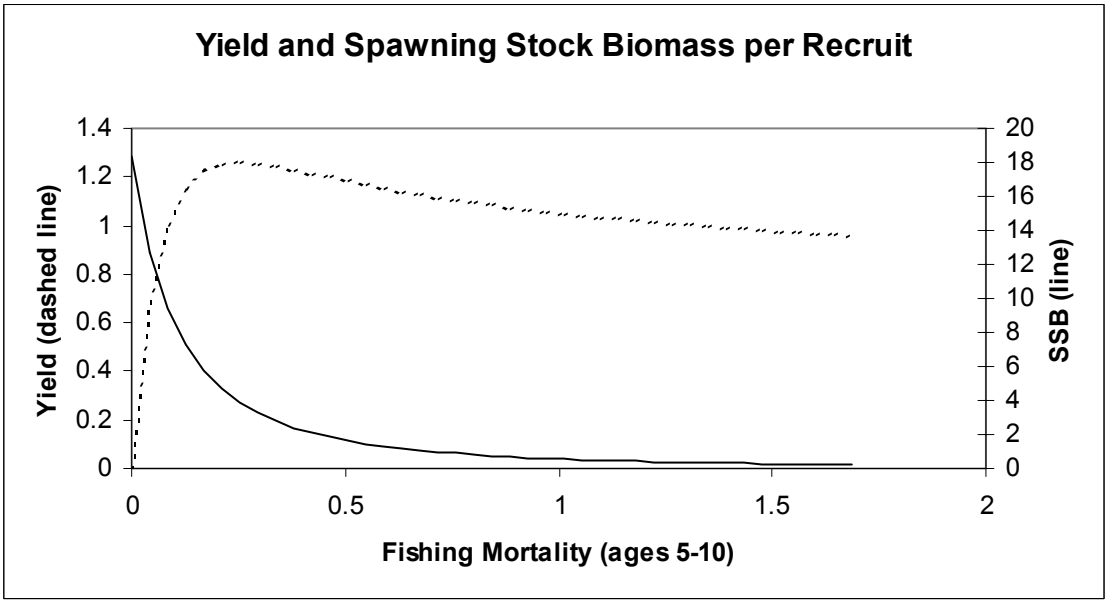

Landings
Landings in 1000 t
1600
1400
1200
1000
800
600
400
200
0
1946
1956
1966
1976
1986
1996


Fishing Mortality
F(ages 5-10)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1946
1956
1966
1976
1986
1996
F
Flim
Fpa

Recruitment (age 3)
Recruitment in billions
2
1.5
1
0.5
0
1946
1956
1966
1976
1986
1996


Spawning Stock Biomass
SSB in 1000 t
1400
1200
1000
800
600
400
200
0
1946
1956
1966
1976
1986
1996
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 3) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 5-10)

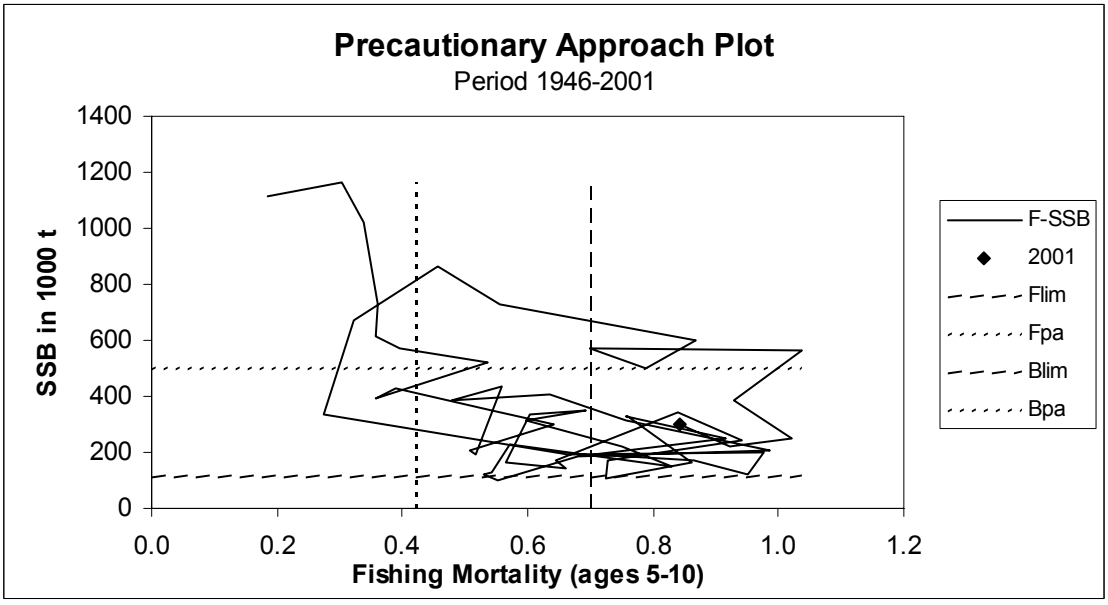

Precautionary Approach Plot
Period 1946-2001
SSB in 1000 t
Fishing Mortality (ages 5-10)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.1.2.a.1 Northeast Arctic COD. Total catch (t) by fishing areas and unreported catch (Data provided by Working Group members.)

Year	Subarea I	Division IIa	Division IIb	Unreported catches	Total catch
1961	409,694	153,019	220,508		783,221
1962	548,621	139,848	220,797		909,266
1963	547,469	117,100	111,768		776,337
1964	206,883	104,698	126,114		437,695
1965	241,489	100,011	103,430		444,983
1966	292,253	134,805	56,653		483,711
1967	322,798	128,747	121,060		572,605
1968	642,452	162,472	269,254		1,074,084
1969	679,373	255,599	262,254		1,197,226
1970	603,855	243,835	85,556		933,246
1971	312,505	319,623	56,920		689,048
1972	197,015	335,257	32,982		565,254
1973	492,716	211,762	88,207		792,685
1974	723,489	124,214	254,730		1,102,433
1975	561,701	120,276	147,400		829,377
1976	526,685	237,245	103,533		867,463
1977	538,231	257,073	109,997		905,301
1978	418,265	263,157	17,293		698,715
1979	195,166	235,449	9,923		440,538
1980	168,671	199,313	12,450		380,434
1981	137,033	245,167	16,837		399,037
1982	96,576	236,125	31,029		363,730
1983	64,803	200,279	24,910		289,992
1984	54,317	197,573	25,761		277,651
1985	112,605	173,559	21,756		307,920
1986	157,631	202,688	69,794		430,113
1987	146,106	245,387	131,578		523,071
1988	166,649	209,930	58,360		434,939
1989	164,512	149,360	18,609		332,481
1990	62,272	99,465	25,263	25,000	212,000
1991	70,970	156,966	41,222	50,000	319,158
1992	124,219	172,532	86,483	130,000	513,234
1993	195,771	269,383	66,457	50,000	581,611
1994	353,425	306,417	86,244	25,000	771,086
1995	251,448	317,585	170,966		739,999
1996	278,364	297,237	156,627		732,228
1997	273,376	326,689	162,338		762,403
1998	250,815	257,398	84,411		592,624
1999	159,021	216,898	108,991		484,910
2000	137,197	204,167	73,506		414,870
2001[1]	146,461	182,121	97,766		426,347

[1]Provisional figures

Table 3.1.2.a.2 Northeast Arctic COD. Nominal catch (t) by countries (Subarea I and Divisions IIa and IIb combined). (Data provided by Working Group members.)

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep. Germany	Norway	Poland	United Kingdom	Russia[2]	Others	Total all countries
1961	3,934	13,755	3,921	8,129	268,377	-	158,113	325,780	1,212	783,221
1962	3,109	20,482	1,532	6,503	225,615	-	175,020	476,760	245	909,266
1963	-	18,318	129	4,223	205,056	108	129,779	417,964	-	775,577
1964	-	8,634	297	3,202	149,878	-	94,549	180,550	585	437,695
1965	-	526	91	3,670	197,085	-	89,962	152,780	816	444,930
1966	-	2,967	228	4,284	203,792	-	103,012	169,300	121	483,704
1967	-	664	45	3,632	218,910	-	87,008	262,340	6	572,605
1968	-	-	225	1,073	255,611	-	140,387	676,758	-	1,074,084
1969	29,374	-	5,907	5,543	305,241	7,856	231,066	612,215	133	1,197,226
1970	26,265	44,245	12,413	9,451	377,606	5,153	181,481	276,632	-	933,246
1971	5,877	34,772	4,998	9,726	407,044	1,512	80,102	144,802	215	689,048
1972	1,393	8,915	1,300	3,405	394,181	892	58,382	96,653	166	565,287
1973	1,916	17,028	4,684	16,751	285,184	843	78,808	387,196	276	792,686
1974	5,717	46,028	4,860	78,507	287,276	9,898	90,894	540,801	38,453	1,102,434
1975	11,309	28,734	9,981	30,037	277,099	7,435	101,843	343,580	19,368	829,377
1976	11,511	20,941	8,946	24,369	344,502	6,986	89,061	343,057	18,090	867,463
1977	9,167	15,414	3,463	12,763	388,982	1,084	86,781	369,876	17,771	905,301
1978	9,092	9,394	3,029	5,434	363,088	566	35,449	267,138	5,525	698,715
1979	6,320	3,046	547	2,513	294,821	15	17,991	105,846	9,439	440,538
1980	9,981	1,705	233	1,921	232,242	3	10,366	115,194	8,789	380,434
						Spain				
1981	12,825	3,106	298	2,228	277,818	14,500	5,262	83,000	-	399,037
1982	11,998	761	302	1,717	287,525	14,515	6,601	40,311	-	363,730
1983	11,106	126	473	1,243	234,000	14,229	5,840	22,975	-	289,992
1984	10,674	11	686	1,010	230,743	8,608	3,663	22,256	-	277,651
1985	13,418	23	1,019	4,395	211,065	7,846	3,335	62,489	4,330	307,920
1986	18,667	591	1,543	10,092	232,096	5,497	7,581	150,541	3,505	430,113
1987	15,036	1	986	7,035	268,004	16,223	10,957	202,314	2,515	523,071
1988	15,329	2,551	605	2,803	223,412	10,905	8,107	169,365	1,862	434,939
1989	15,625	3,231	326	3,291	158,684	7,802	7,056	134,593	1,273	332,481
1990	9,584	592	169	1,437	88,737	7,950	3,412	74,609	510	187,000
1991	8,981	975		2,613	126,226	3,677	3,981	119,427[3]	3,278	269,158
			Greenland							
1992	11,663	2	3,337	3,911	168,460	6,217	6,120	182,315	1,209	383,234
									Iceland	
1993	17,435	3,572	5,389	5,887	221,051	8,800	11,336	244,860	9,374	3,907	531,611
1994	22,826	1,962	6,882	8,283	318,395	14,929	15,579	291,925	36,737	28,568	746,086
1995	22,262	4,912	7,462	7,428	319,987	15,505	16,329	296,158	34,214	15,742	739,999
1996	17,758	5,352	6,529	8,326	319,158	15,871	16,061	305,317	23,005	14,851	732,228
1997	20,076	5,353	6,426	6,680	357,825	17,130	18,066	313,344	4,200	13,303	762,403
1998	14,290	1,197	6,388	3,841	284,647	14,212	14,294	244,115	1,423	8,217	592,624
1999	13,700	2,137	4,093	3,019	223,390	8.994	11,315	210,379	1,985	5,898	484,910
2000	13,350	2,621	5,787	3,513	192,860	8,695	9,165	166,202	7,562	5,115	414,870
2001[1]	12,500	2,910	5,727	4,521	188,420	9,196	8,698	183,572	5,835	4,968	426,347

[1]Provisional figures
[2]USSR prior to 1991
[3]Includes Baltic countries

Table 3.1.2.a.3 Northeast Arctic cod (Subareas I and II)

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-10
1946	728139	1112776	706000	0.1857
1947	425311	1165059	882017	0.3047
1948	442592	1019114	774295	0.3398
1949	468348	729879	800122	0.3619
1950	704908	615339	731982	0.3566
1951	1083753	568705	827180	0.3966
1952	1193111	520599	876795	0.5348
1953	1590377	396417	695546	0.3572
1954	641584	429694	826021	0.3879
1955	272778	346919	1147841	0.5437
1956	439602	299823	1343068	0.6401
1957	804781	207840	792557	0.5089
1958	496824	195377	769313	0.5169
1959	683690	432489	744607	0.5596
1960	789653	383479	622042	0.4789
1961	916842	404228	783221	0.6348
1962	728338	311678	909266	0.7576
1963	472064	208207	776337	0.9866
1964	338678	186570	437695	0.6789
1965	776941	102315	444930	0.5533
1966	1582560	120722	483711	0.5302
1967	1295416	129784	572605	0.5439
1968	164955	227215	1074084	0.5704
1969	112039	151870	1197226	0.8292
1970	197105	224482	933246	0.7493
1971	404774	311662	689048	0.5956
1972	1015319	346511	565254	0.6928
1973	1818949	332913	792685	0.6020
1974	523916	164491	1102433	0.5633
1975	621616	142028	829377	0.6595
1976	613942	171238	867463	0.6457
1977	348054	341385	905301	0.8379
1978	638490	241536	698715	0.9406
1979	198489	174699	440538	0.7264
1980	137734	108253	380434	0.7241
1981	150865	166925	399038	0.8632
1982	151821	326131	363730	0.7583
1983	166793	327176	289992	0.7560
1984	397650	251077	277651	0.9162
1985	523306	193455	307920	0.7039
1986	1035454	170219	430113	0.8652
1987	286148	118247	523071	0.9520
1988	204602	201850	434939	0.9773
1989	172786	193794	332481	0.6645
1990	242748	339048	212000	0.2732
1991	411773	672212	319158	0.3229
1992	720655	867395	513234	0.4568
1993	893685	729229	581611	0.5543
1994	806991	599519	771086	0.8675
1995	657537	498092	739999	0.7888
1996	432544	570175	732228	0.6993
1997	702402	564544	762403	1.0372
1998	819138	385842	592624	0.9299
1999	521661	253253	484910	1.0201
2000	579764	219375	414868	0.9237
2001	462355	297853	426347	0.8423
2002	278000	429735		
Average	601585	371938	666649	0.6512

3.1.2.b Norwegian Coastal cod

State of stock/exploitation: At present, the SSB is the lowest observed in the time-series extending back to 1984. The stock has declined continuously since 1994, and fishing mortality increased from 1991 to 1999; since then it has stabilised. Recruitment in recent years has been well below average. The landings increased steadily from 1991 and up to 1997; since then they have decreased. The assessment reflects the general trends in the development of the stock, though it is not regarded as accurate.

Management objectives: There are no explicit management objectives for this stock. Management objectives should be defined, taking the status of the stock into consideration. In particular considerations should be given to the possibility of managing Norwegian Coastal cod separately from Northeast Arctic cod.

Precautionary Approach reference points: No precautionary reference points have been proposed for this stock, but candidate reference points are under investigation.

Advice on management: ICES recommends a considerable reduction in fishing mortality to allow the SSB to rebuild.

Relevant factors to be considered in management: The TAC for 2002 was set considerably higher than recommended by ICES. Due to the low stock size, the agreed TAC for 2002 (40 000 t) is not expected to be taken. The SSB is historical low, and the year classes recruiting to the SSB over the next few years seem to be well below average. Unless fishing mortality is reduced considerably, a further decrease in the total stock biomass and SSB is expected. Management measures should be implemented to ensure that catches, in particular, are reduced in areas where, and in seasons when, the proportion of Norwegian Coastal cod in the catch is large compared to Northeast Arctic cod.

Norwegian Coastal cod is managed as part of the Norwegian Northeast Arctic cod fishery. An expected yield of 40 000 t from the Coastal cod has been added annually since the mid-1970s to the quota for Northeast Arctic cod. If this practice is followed in 2003 and the quota is taken, both the stocks (Norwegian Coastal cod and Northeast Arctic cod) will continue to be overexploited. If Norwegian Coastal cod could be managed independently of Northeast Arctic cod, ACFM for 2002 would advise that the fishing mortality be reduced by at least 80% compared to F in 2001 in order to halt the decline in the spawning stock.

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$ = 0.48; Landings(2002) = 27; SSB(2003) = 45.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0*$\mathbf{F}_{sq}$	0	60
0.10	0.2*$\mathbf{F}_{sq}$	5	54
0.19	0.4*$\mathbf{F}_{sq}$	10	49
0.27	0.56*$\mathbf{F}_{sq}$ = $\mathbf{F}_{pa}$	13	45
0.29	0.6*$\mathbf{F}_{sq}$	14	44
0.38	0.8*$\mathbf{F}_{sq}$	18	40
0.48	1.0*$\mathbf{F}_{sq}$	22	36

Weights in '000 t.

Comparison with previous assessment and advice: The calculated fishing mortality F_{4-7} and SSB in 2000 are almost the same for last year's assessment and this year's assessment (F- 0.49, 0.46; SSB- 65 000 t, 67 000 t). The recruitment in 2000 is approximately 30 % reduced in this year's assessment (21.7 mill, 14.6 mill). The change in catchability dependent on stock for age 2 causes most of the difference in recruitment. This is also more in accordance with the survey data. Last year ICES advised a 65% reduction in fishing mortality if this stock could be managed independently from Northeast Arctic cod to halt the decline in SSB. Due to the continued decline in SSB a greater reduction in fishing mortality is advised this year.

Assessment year	F_{4-7} year 2000	SSB year 2000	Total stock biomass year 2000	Recruits age 2 year 2000
2001	0.49	65	121	22
2002	0.46	67	121	15

Elaboration and special comment: The fishery for Norwegian Coastal cod is part of a directed fishery on cod in Norway using a variety of traditional gears, including trawl, and has been conducted for several decades. The catches include both Northeast Arctic cod and Norwegian Coastal cod in some areas and in some periods of the year. In Finnmark 43 likely spawning areas for Norwegian Coastal cod have been identified. Among these 24 are closed for Danish seine fishery in the first five months of the year. Trawl fisheries for roundfish are not allowed at any time of the year within 4 nautical miles of the coast.

The method of catch separation by otolith pattern has been used in recent years to estimate landings from the Norwegian Coastal cod stock. The landings data are not considered to be estimated precisely.

The stock was assessed by XSA using commercial catch-at-age data and an acoustic survey series. The catch data used in analysis go back to 1984 and the survey series to 1995.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

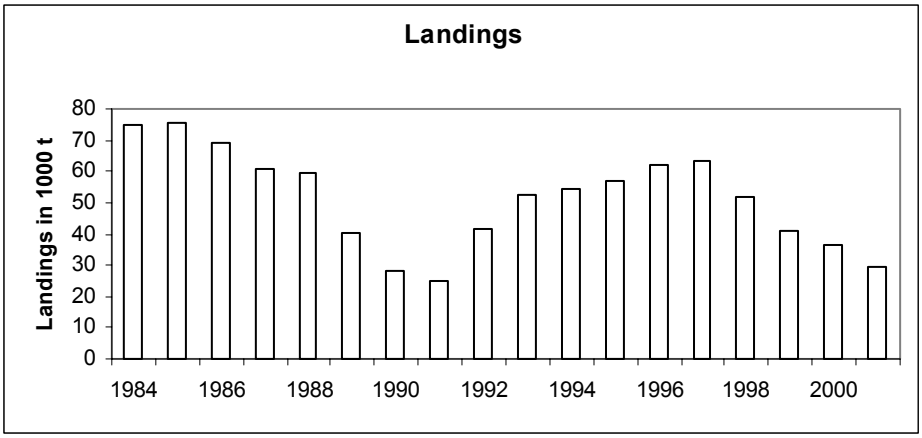
Yield and spawning biomass per Recruit F-reference points:

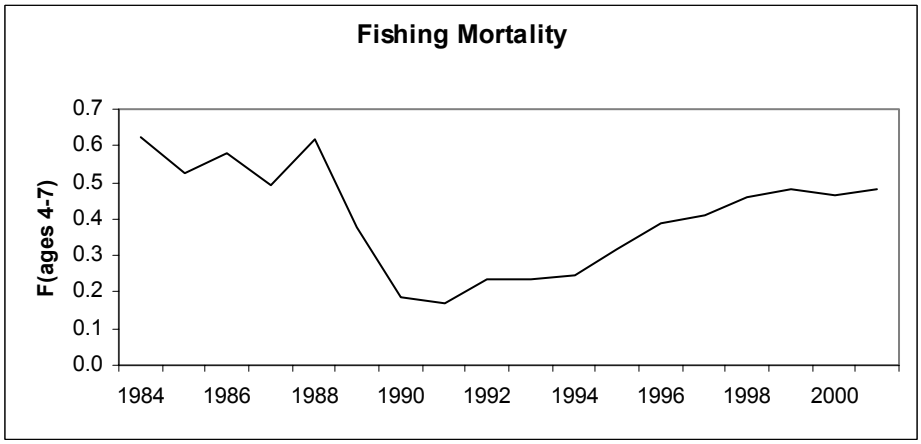
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.482	1.237	2.246
$\mathbf{F}_{max}$	0.543	1.239	1.891
$\mathbf{F}_{0.1}$	0.248	1.128	5.324
$\mathbf{F}_{med}$	0.283	1.164	4.561

Catch data (Table 3.1.2.b.1):

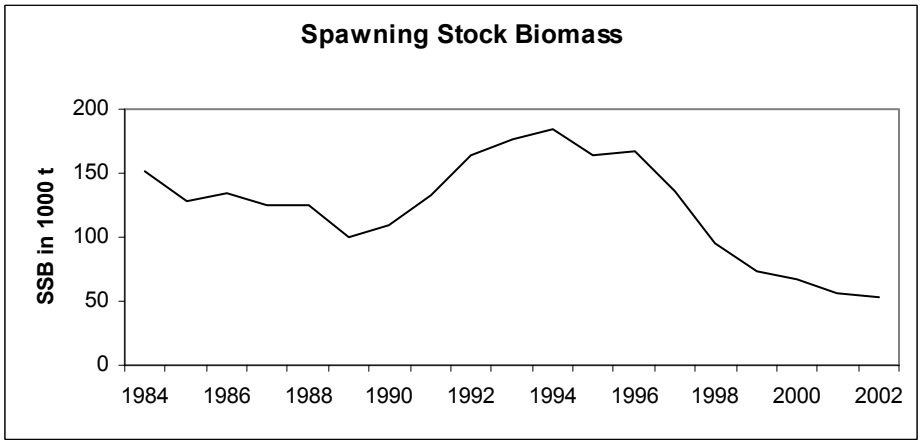
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings[3]	ACFM landings[2]
1987	Not assessed		40		61
1988	Not assessed		40		59
1989	No advice		40		40
1990	No advice		40		28
1991	Included in TAC for Subareas I and II		40		25
1992	Shot forecast included in TAC for I and II		40		42
1993	Shot forecast included in TAC for I and II		40		53
1994	No advice		40		55
1995	No advice		40		57
1996	No advice		40		62
1997	No advice		40		63
1998	No advice		40		52
1999	No advice		40		41
2000	No advice		40		37
2001	Reduce F considerably	22	40		30
2002	catches should be reduced by the same proportion as for Northeast Arctic cod	13	40		
2003	Reduce F considerably				

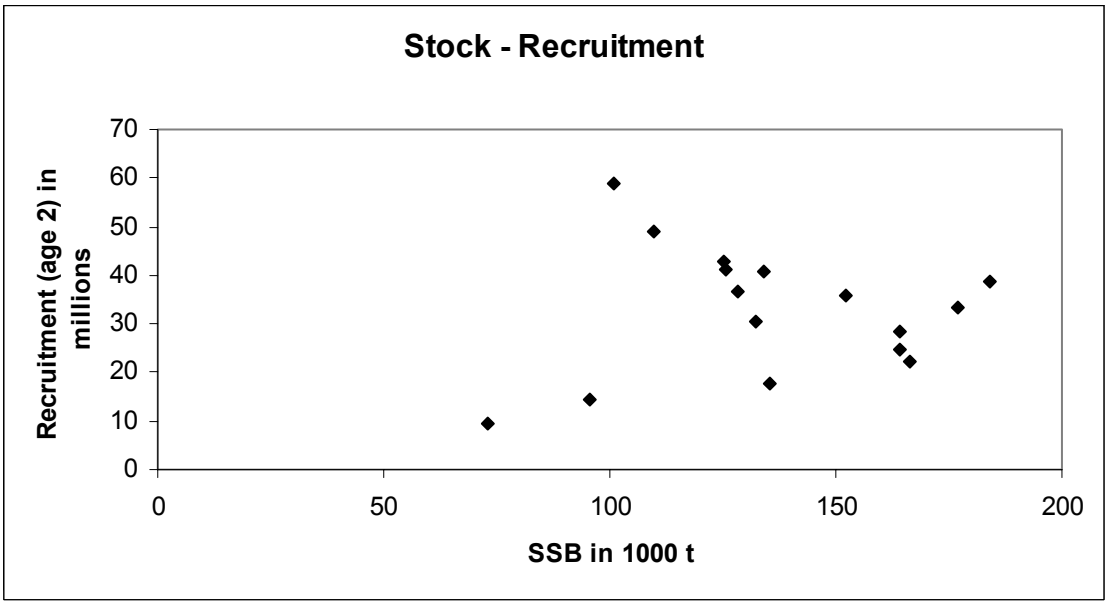
[1]40 000 tons has been added annually to the agreed TAC of Northeast Arctic cod. [2] Estimated according to otolith type. [3] No official landings. Weights in '000 t


Landings
Landings in 1000 t
0
10
20
30
40
50
60
70
80
1984
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 4-7)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1984
1986
1988
1990
1992
1994
1996
1998
2000

Recruitment (age 2)
Recruitment in millions
0
20
40
60
80
100
1984
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
0
50
100
150
200
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002


Stock - Recruitment
Recruitment (age 2) in millions
70
60
50
40
30
20
10
0
0
50
100
150
200
SSB in 1000 t

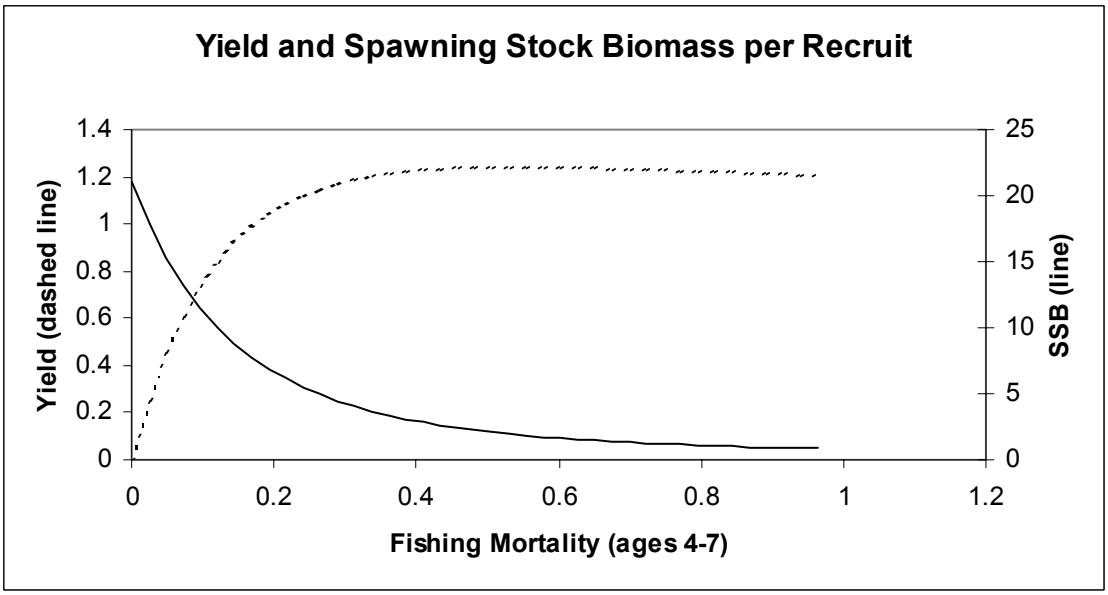

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 4-7)

Table 3.1.2.b.1 Landings of Norwegian Coastal cod in Subareas I and II.

Year	Landings in '000 t.
1984	74
1985	75
1986	69
1987	61
1988	59
1989	40
1990	28
1991	25
1992	42
1993	53
1994	55
1995	57
1996	62
1997	63
1998	52
1999	41
2000	37
2001	30*)
Average 1984–2000	51

*) Provisional data.

Table 3.1.2.b.2 Norwegian Coastal cod

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1984	87940	152179	74824	0.6221
1985	74505	128255	75451	0.5275
1986	35630	134048	68905	0.5806
1987	36691	125243	60972	0.4916
1988	40602	125633	59294	0.6195
1989	42923	100696	40285	0.3752
1990	41032	109904	28127	0.1835
1991	58757	132162	24822	0.1700
1992	49051	164026	41690	0.2353
1993	30332	177070	52557	0.2347
1994	24889	184271	54562	0.2452
1995	33212	164088	57207	0.3174
1996	38672	166524	61776	0.3891
1997	28213	135197	63319	0.4108
1998	22098	95564	51572	0.4567
1999	17556	73102	40732	0.4818
2000	14617	67267	36715	0.4647
2001	9536	56584	29699	0.4817
2002	9536	53739		0.4800
Average	36621	123450	51251	0.4088

3.1.3 Northeast Arctic haddock (Subareas I and II)

State of stock/exploitation: The stock is outside safe biological limits. Fishing mortality in 2001 is estimated to be well above the proposed $\mathbf{F}_{pa}$ and has been above $\mathbf{F}_{lim}$ in 1997 - 1999 and around $\mathbf{F}_{lim}$ in 2000 - 2001. The SSB in 2002 is estimated to be below (72 000 t) the $\mathbf{B}_{pa}$ of 80 000 t, but is expected to increase to above $\mathbf{B}_{pa}$ in the short-term. The 1999 - 2000 year classes are indicated to be above average.

Management objectives: There have been no management objectives other than managing the stock within safe biological limits. However, for any management objectives to be consistent with the precautionary approach, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$ and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (Unchanged since 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 50 000 t, the SSB below which only poor year classes have been observed.	$\mathbf{B}_{pa}$ be set at 80 000 t, which is considered to be the minimum SSB required to provide a 95% probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in the assessments and stock dynamics.
$\mathbf{F}_{lim}$ is 0.49, the fishing mortality associated with potential stock collapse.	$\mathbf{F}_{pa}$ is set at 0.35. This value is considered to have a high probability of keeping F below $\mathbf{F}_{lim}$.

Technical Basis:

$\mathbf{B}_{lim}$: only poor recruitment has been observed from 4 years of SSB < 50 000 t and all moderate or large year classes have been produced at higher SSB.	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.67$.
$\mathbf{F}_{lim}$ = median value of $\mathbf{F}_{loss}$.	$\mathbf{F}_{pa} = \mathbf{F}_{med}$. The stock has sustained higher fishing mortality for most of the period after 1950 without collapsing; however, low SSB has often resulted.

Advice on management: ICES recommends that fishing mortality be reduced to below $\mathbf{F}_{pa}$ = 0.35, corresponding to catches of less than 101 000 t in 2003.

Comparison with previous assessment and advice: Mean fishing mortality in 2001 (0.46) is estimated as the same value used as *status quo* fishing mortality last year. Last year's assessment predicted the SSB in 2002 to be 76 000 t, compared to 72 000 t in the current assessment.

Relevant factors to be considered in management: A substantial portion of the NEA haddock catch is taken as by-catch in the NEA cod fishery.

Catch forecast for 2003:
Basis: F(2002)=$\mathbf{F}_{sq}$ = F(99-01) = 0.52; landings = 100; SSB(2003) = 100.

F (2003)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.00	0.00 * $\mathbf{F}_{sq}$		0	194
0.10	0.20 * $\mathbf{F}_{sq}$		33	176
0.21	0.40 * $\mathbf{F}_{sq}$		63	160
0.31	0.60 * $\mathbf{F}_{sq}$		91	146
0.35	0.67 * $\mathbf{F}_{sq}$ ($\mathbf{F}_{pa}$)		101	141
0.42	0.80 * $\mathbf{F}_{sq}$		116	133
0.52	$\mathbf{F}_{sq}$		139	122

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Elaboration and special comment: The above average year classes are expected to enter the fishable stock in 2002, and the SSB and total biomass is expected to increase.

The results of the forecast are also sensitive to the estimates of variable maturity and natural mortality rates. The latter will very much depend on the development of the capelin and cod stocks in the near future.

Fishing mortality has been above $\mathbf{F}_{lim}$ a number of times during the 50-year time-series. The stock has been able to withstand these periods of over-fishing due to the occasional recruitment of exceptionally strong year classes.

The fishery is mainly a trawl fishery, in some periods only as by-catch in the fishery for cod. Quotas restrict the fishery. The fishery is also regulated by a minimum catching size, a minimum mesh size in trawls and Danish seine, a maximum by-catch of undersized fish, closure of areas with high density of juveniles, and other area and seasonal restrictions.

The analytical assessment is based on catch-at-age data and 3 surveys, and it includes predation by NEA cod.

Source of information: Report of the Arctic Fisheries Working Group, April 2002 (ICES CM 2002/ACFM:18).

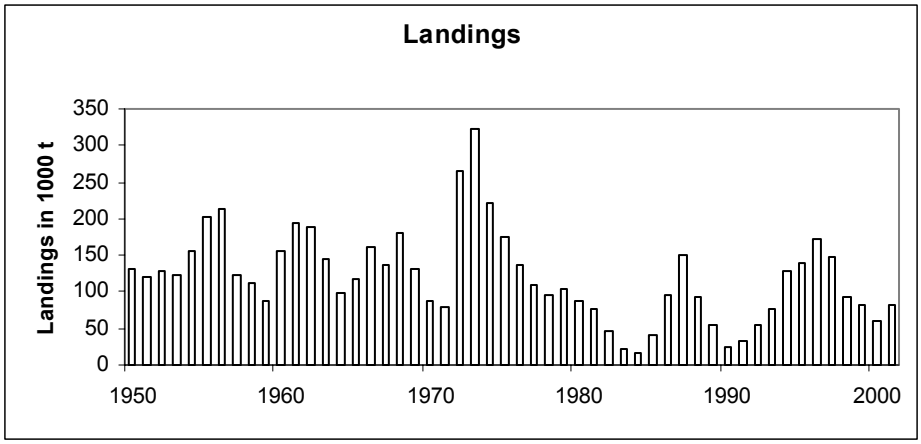
Yield and spawning biomass per Recruit F-reference points:

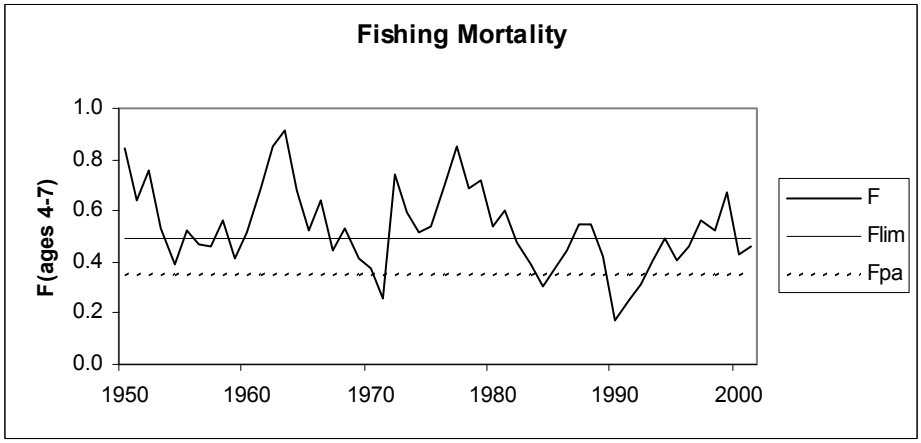
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.531	0.685	0.645
$\mathbf{F}_{max}$	1.203	0.710	0.249
$\mathbf{F}_{0.1}$	0.195	0.578	1.679
$\mathbf{F}_{med}$	0.288	0.634	1.155

Catch data (Tables 3.1.3.1-3):

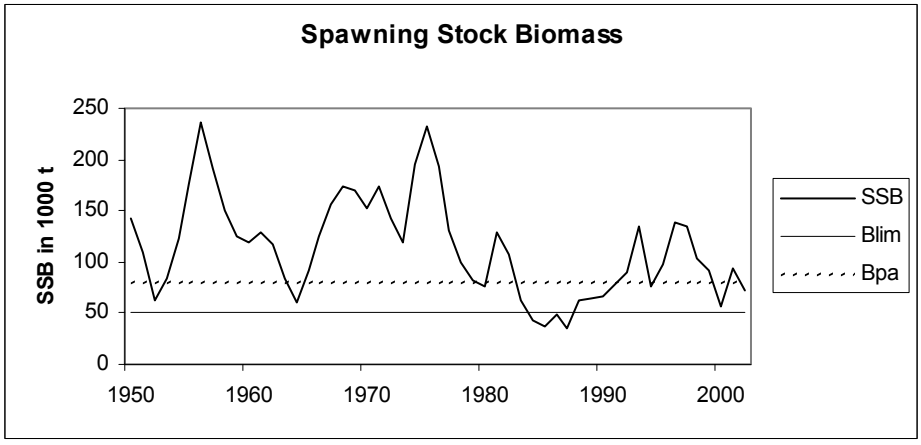
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[1]
1987	No increase in F; TAC	160	250	155	151
1988	No increase in F	<240	240	95	92
1989	Large reduction in F	69	83	60	55
1990	No directed fishery	-	25	27	26
1991	No directed fishery	-	28	34	34
1992	Within safe biological limits	35[2]	63	58	54
1993	No long-term gains in increasing F	56[2]	72	83	78
1994	No long-term gains in F>$\mathbf{F}_{med}$	97[3]	120	125	121
1995	No long-term gains in F>$\mathbf{F}_{med}$	122[3]	130	139	138
1996	No long-term gains in F>$\mathbf{F}_{med}$	169[3]	170	177	173
1997	Well below $\mathbf{F}_{med}$	<242	210	152	149
1998	Below $\mathbf{F}_{med}$	120	130	100	94
1999	Reduce F below $\mathbf{F}_{pa}$	74	78	82	82
2000	Reduce F below $\mathbf{F}_{pa}$	37	62	61	61
2001	Reduce F below $\mathbf{F}_{pa}$	<66	85	81	81
2002	Reduce F below $\mathbf{F}_{pa}$	<64	85		
2003	Reduce F below $\mathbf{F}_{pa}$	< 101			

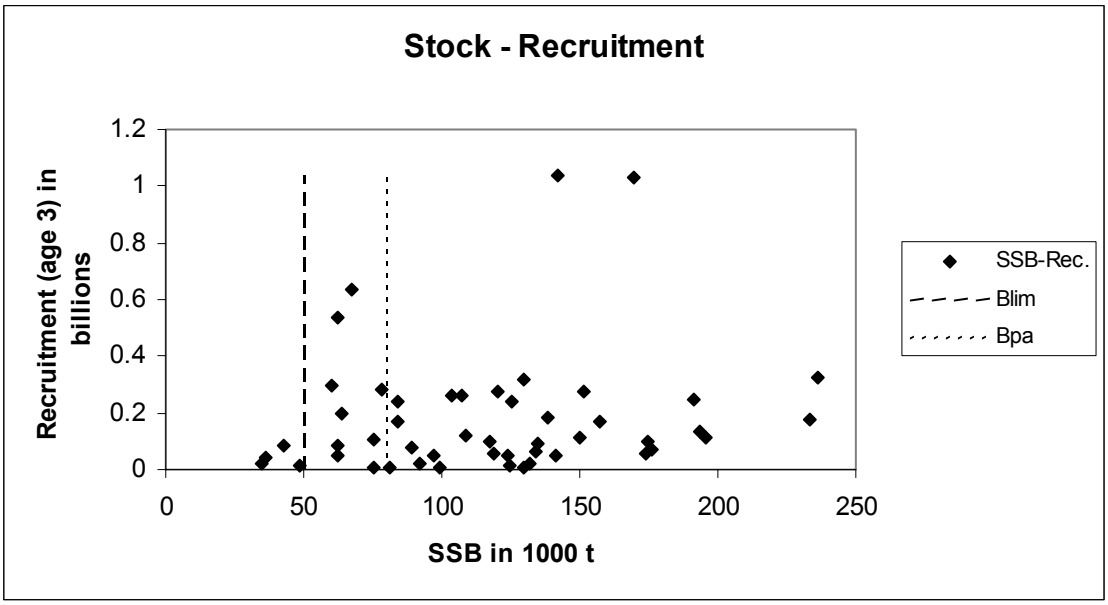
[1]Haddock in Norwegian coastal areas south of 67°N not included. [2]Predicted catch at *status quo* F. [3]Predicted landings at $\mathbf{F}_{med}$. Weights in '000 t.

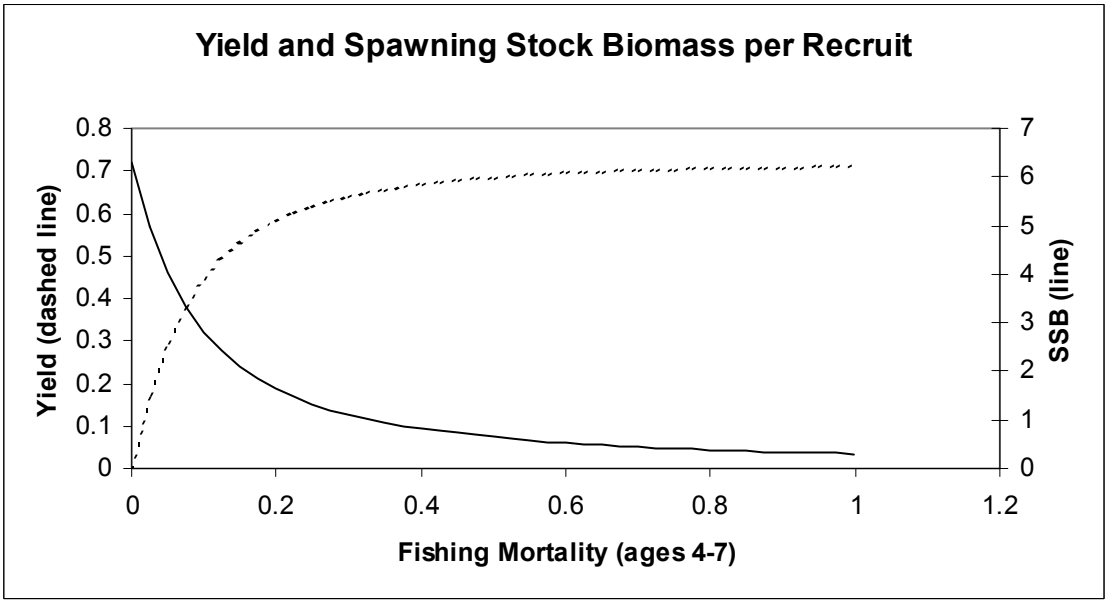

Landings
Landings in 1000 t
350
300
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000


Fishing Mortality
F(ages 4-7)
1.0
0.8
0.6
0.4
0.2
0.0
1950
1960
1970
1980
1990
2000
F
Flim
Fpa

Recruitment (age 3)
Recruitment in billions
1.2
1
0.8
0.6
0.4
0.2
0
1950
1960
1970
1980
1990
2000


Spawning Stock Biomass
SSB in 1000 t
250
200
150
100
50
0
1950
1960
1970
1980
1990
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 3) in billions
1.2
1
0.8
0.6
0.4
0.2
0
0
50
100
150
200
250
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 4-7)

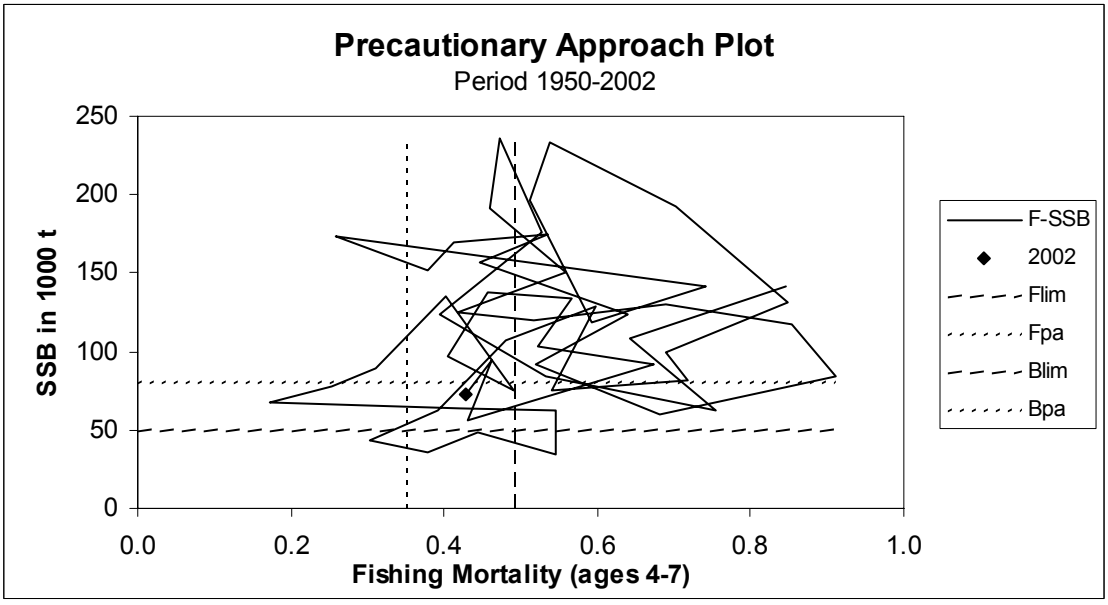

Precautionary Approach Plot
Period 1950-2002
SSB in 1000 t
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 4-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.1.3.1 Northeast Arctic HADDOCK. Total nominal catch (t) by fishing areas.

Year	Subarea I	Division IIa	Division IIb	Total
1960	125 026	27 781	1 844	154 651
1961	165 156	25 641	2 427	193 224
1962	160 561	25 125	1 723	187 408
1963	124 332	20 956	936	146 224
1964	79 262	18 784	1 112	99 158
1965	98 921	18 719	943	118 578
1966	125 009	35 143	1 626	161 778
1967	107 996	27 962	440	136 397
1968	140 970	40 031	725	181 726
1969	89 948	40 306	566	130 820
1970	60 631	27 120	507	88 257
1971	56 989	21 453	463	78 905
1972	221 880	42 111	2 162	266 153
1973	285 644	23 506	13 077	322 226
1974	159 051	47 037	15 069	221 157
1975	121 692	44 337	9 729	175 758
1976	94 054	37 562	5 648	137 264
1977	72 159	28 452	9 547	110 158
1978	63 965	30 478	979	95 422
1979	63 841	39 167	615	103 623
1980	54 205	33 616	68	87 889
1981	36 834	39 864	455	77 153
1982	17 948	29 005	2	46 955
1983	7 550	13 872	185	21 607
1984	4 000	13 247	71	17 318
1985	30 385	10 774	111	41 270
1986	69 865	26 006	714	96 585
1987	109 425	38 181	3 048	150 654
1988	43 990	47 087	668	91 745
1989	31 116	23 390	353	54 859
1990	15 093	10 344	303	25 741
1991	18 772	14 417	416	33 605
1992	30 746	22 177	964	53 887
1993	47 574	27 010	3 037	77 621
1994	75 059	46 329	7 315	128 703
1995	70 390	54 169	14 118	138 677
1996	112 781	57 189	3 294	173 264
1997	78 335	67 917	2 504	148 756
1998	45 471	47 774	701	93 946
1999	36 096	42 036	4 214	82 346
2000	25 312	31 857	4 126	61 292
2001[1]	34 964	39 464	6 851	81 280

[1]Provisional figures. Norwegian catches on Russian quotas are included.

Table 3.1.3.2 Northeast Arctic HADDOCK. Nominal catch (t) by countries, Subarea I and Divisions IIa and IIb combined.

Year	Faroe Islands	France	German Dem.Re.	Fed. Re. Germ.	Norway	Poland	United Kingdom	Russia[2]	Others	Total
1960	172	-	-	5 597	46 263	-	45 469	57 025	125	154 651
1961	285	220	-	6 304	60 862	-	39 650	85 345	558	193 224
1962	83	409	-	2 895	54 567	-	37 486	91 910	58	187 408
1963	17	363	-	2 554	59 955	-	19 809	63 526	-	146 224
1964	-	208	-	1 482	38 695	-	14 653	43 870	250	99 158
1965	-	226	-	1 568	60 447	-	14 345	41 750	242	118 578
1966	-	1 072	11	2 098	82 090	-	27 723	48 710	74	161 778
1967	-	1 208	3	1 705	51 954	-	24 158	57 346	23	136 397
1968	-	-	-	1 867	64 076	-	40 129	75 654	-	181 726
1969	2	-	309	1 490	67 549	-	37 234	24 211	25	130 820
1970	541	-	656	2 119	37 716	-	20 423	26 802	-	88 257
1971	81	-	16	896	45 715	43	16 373	15 778	3	78 905
1972	137	-	829	1 433	46 700	1 433	17 166	196 224	2 231	266 153
1973	1 212	3 214	22	9 534	86 767	34	32 408	186 534	2 501	322 226
1974	925	3 601	454	23 409	66 164	3 045	37 663	78 548	7 348	221 157
1975	299	5 191	437	15 930	55 966	1 080	28 677	65 015	3 163	175 758
1976	536	4 459	348	16 660	49 492	986	16 940	42 485	5 358	137 264
1977	213	1 510	144	4 798	40 118	-	10 878	52 210	287	110 158
1978	466	1 411	369	1 521	39 955	1	5 766	45 895	38	95 422
1979	343	1 198	10	1 948	66 849	2	6 454	26 365	454	103 623
1980	497	226	15	1 365	61 886	-	2 948	20 706	246	87 889
1981	381	414	22	2 398	58 856	**Spain**	1 682	13 400	-	77 153
1982	496	53	-	1 258	41 421	-	827	2 900	-	46 955
1983	428	-	1	729	19 371	139	259	680	-	21 607
1984	297	15	4	400	15 186	37	276	1 103	-	17 318
1985	424	21	20	395	17 490	77	153	22 690	-	41 270
1986	893	33	75	1 079	48 314	22	431	45 738	-	96 585
1987	464	26	83	3 106	69 333	99	563	76 980	-	150 654
1988	1 113	116	78	1 324	57 273	72	435	31 293	41	91 745
1989	1 218	125	26	171	31 825	1	590	20 903	-	54 859
1990	875	-	5	128	17 634	-	494	6 605	-	25 741
1991	1 117	60	**Greenld**	219	19 285	-	514	12 388	22	33 605
1992	1 093	151	1 719	387	30 203	38	596	19 699	1	53 887
1993	546	1 215	880	1 165	36 590	76	1 802	34 700	646	77 620
1994	2 761	678	770	2 412	64 688	22	4 673	51 822	877	128 703
1995	2 833	598	1 351	2 675	72 864	14	3 108	54 516	718	138 677
1996	3 743	537	1 524	942	89 500	669	2 275	73 857	217	173 264
1997	3 327	495	1 877	972	97 789	424	2 340	41 228	304	148 756
1998	1 566	241	854	385	68 747	257	1 241	20 559	96	93 946
1999	1 003	64	252	437	48 632	652	694	30 520	92	82 346
2000	631	169	432	931	34 172	582	814	22 738	823	61 292
2001 [1]	1 210	223	547	552	41 307	1 030	1 061	34 307	1 043	81 280

[1]Provisional figures. Norwegian catches on Russian quotas are included.
[2]USSR prior to 1991.

Table 3.1.3.3 Northeast Arctic haddock (Subareas I and II).

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1950	66659	141935	132125	0.8463
1951	559068	108612	120077	0.6417
1952	60807	62334	127660	0.7550
1953	1034439	84356	123920	0.5328
1954	121819	123672	156788	0.3945
1955	51259	175946	202286	0.5264
1956	169575	236247	213924	0.4723
1957	52103	191645	123583	0.4608
1958	68171	150055	112672	0.5596
1959	326744	125043	88211	0.4168
1960	244019	119949	154651	0.5160
1961	110098	129477	193224	0.6904
1962	243007	117497	187408	0.8544
1963	275625	83849	146224	0.9120
1964	319121	60371	99158	0.6827
1965	101722	91817	118578	0.5204
1966	239634	124337	161778	0.6388
1967	296489	156951	136397	0.4457
1968	17718	174348	181726	0.5349
1969	17567	169326	130820	0.4138
1970	166355	151760	88257	0.3789
1971	95566	173993	78905	0.2575
1972	1030295	141625	266153	0.7427
1973	272646	118951	322226	0.5934
1974	53376	196005	221157	0.5128
1975	49193	233119	175758	0.5381
1976	56822	193162	137264	0.7018
1977	115516	131602	110158	0.8483
1978	172972	99070	95422	0.6896
1979	136676	81189	103623	0.7182
1980	18971	75448	87889	0.5415
1981	6250	129398	77153	0.5987
1982	8370	107261	46955	0.4803
1983	4844	62549	21607	0.3910
1984	8447	42839	17318	0.3021
1985	259365	36304	41270	0.3779
1986	534320	48421	96585	0.4448
1987	83800	34976	150654	0.5459
1988	42214	62577	91745	0.5469
1989	16798	63620	54859	0.4206
1990	24553	67047	25741	0.1735
1991	82431	78391	33605	0.2538
1992	197383	89290	53887	0.3115
1993	635492	134714	77621	0.4029
1994	279527	75436	128703	0.4915
1995	75138	96989	138677	0.4056
1996	89996	138077	173264	0.4581
1997	102792	133994	148756	0.5663
1998	46071	103797	93946	0.5222
1999	183240	91890	82346	0.6741
2000	63912	55669	61292	0.4306
2001	262041	94201	81280	0.4609
2002	252000	72385		0.4271
Average	184963	114029	121063	0.5288

3.1.4 Northeast Arctic saithe (Subareas I and II)

State of stock/exploitation: The stock is within safe biological limits. Fishing mortality in 2001 is below $\mathbf{F}_{pa}$ and SSB in 2002 is well above $\mathbf{B}_{pa}$. After a long period of low stock size, the stock recovered during the 1990s with the recruitment of several above-average year classes. The exploitation pattern has shifted to the older ages due in part to the increase in minimum landing size (1999).

Management objectives: There are no explicit management objectives for this stock. For management objectives to meet precautionary criteria, their aim should be to reduce or maintain fishing mortality below $\mathbf{F}_{pa}$ and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 89 000 t, the lowest observed SSB in the 35-year time-series	$\mathbf{B}_{pa}$ is set at 150 000 t, the SSB below which the probability of poor year classes increases
$\mathbf{F}_{lim}$ is 0.45, the fishing mortality associated with potential stock collapse	$\mathbf{F}_{pa}$ be set at 0.26. This value is considered to have a 95% probability of avoiding the $\mathbf{F}_{lim}$

Technical Basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = examination of stock-recruit plot
$\mathbf{F}_{lim}$ = Median value of $\mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{lim} * 0.6$

Advice on management: ICES advises that fishing mortality should be below $\mathbf{F}_{pa}$, corresponding to a catch in 2003 of less than 168 000 t.

Comparison with previous assessment and advice: Comparison with previous assessments shows that there has been a tendency to overestimate the fishing mortality in the assessment year.

Relevant factors to be considered in management: The estimation of incoming recruitment for forecasting purposes is difficult as the year classes are estimated by the acoustic survey after they have started recruiting to the fishery, and migration out from the near coast areas causes variation in the distributional availability of 2-year-old saithe.

Catch forecast for 2003:
Basis: TAC; Landings (2002) = 152; F(2002)=0.24; SSB(2003) = 370.

F(2003 onwards)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.04	$0.2\mathbf{F}_{sq}$		32	503
0.09	$0.4\mathbf{F}_{sq}$		63	474
0.13	$0.6\mathbf{F}_{sq}$		91	447
0.17	$0.8\mathbf{F}_{sq}$		118	422
0.22	$\mathbf{F}_{sq}$		144	398
0.26	$\mathbf{F}_{pa}(\mathbf{1.2F}_{sq})$		**169**	**375**

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: At $\mathbf{F}_{status\ quo}$ the catch is expected to increase slightly during the period, to 155 000 t in 2007. At the same fishing mortality SSB is expected to increase to about 420 000 t in 2006.

Elaboration and special comment: Since the early 1960s, the fishery has been dominated by purse seine and trawl fisheries, with a traditional gill net fishery for spawning saithe as the third major component. The purse seine fishery is conducted in coastal areas and fjords. Historically, purse seiners and trawlers have taken roughly equal shares of the catches. Recent regulation changes led to less relative amounts taken by purse seine in 2000 and in 2001.

Based on the TAC set and estimates of catches for other gears, quotas are set for purse seine and trawl fisheries. In the Norwegian fishery, quotas may be transferred between purse seiners and trawlers based on negotiations if it becomes clear that the quota allocated to one of the fleets will not be taken.

In addition to quotas, the fisheries are managed by minimum mesh size limitations, minimum landing size, by-catch regulations, and area closures. On March 1st 1999 the minimum landing size was increased to 45 cm for trawl and conventional gears, and to 42 cm (north of Lofoten) and 40 cm (between 62°N and Lofoten) for purse seine, with an exception for the first 3000 t purse seine catch between 62°N and 65°30′N, where the minimum landing size remains at 35 cm.

The analytical assessment is based on catch-at-age data, an acoustic survey data, and revised CPUE data from two commercial fleets.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

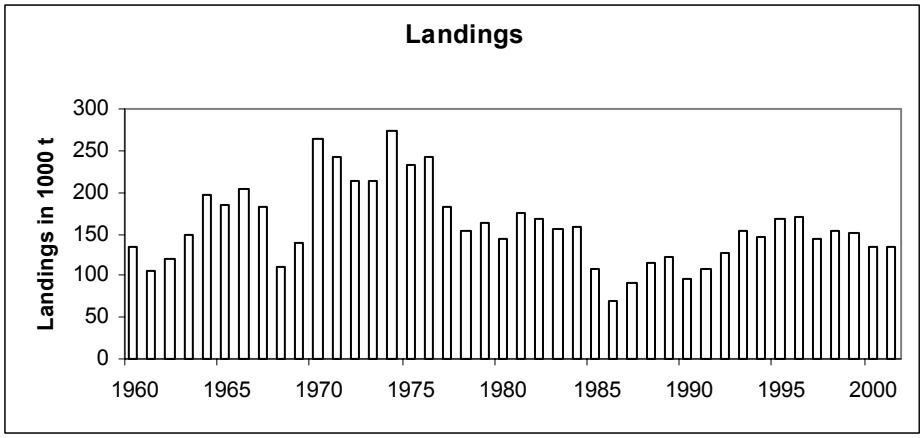
Yield and spawning biomass per Recruit F-reference points:

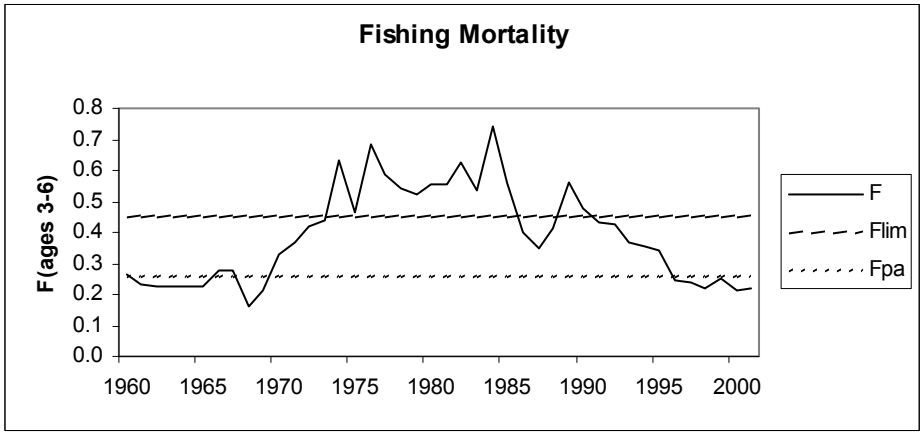
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.218	0.743	2.040
$\mathbf{F}_{max}$	0.257	0.746	1.697
$\mathbf{F}_{0.1}$	0.114	0.675	3.680
$\mathbf{F}_{med}$	0.345	0.739	1.189

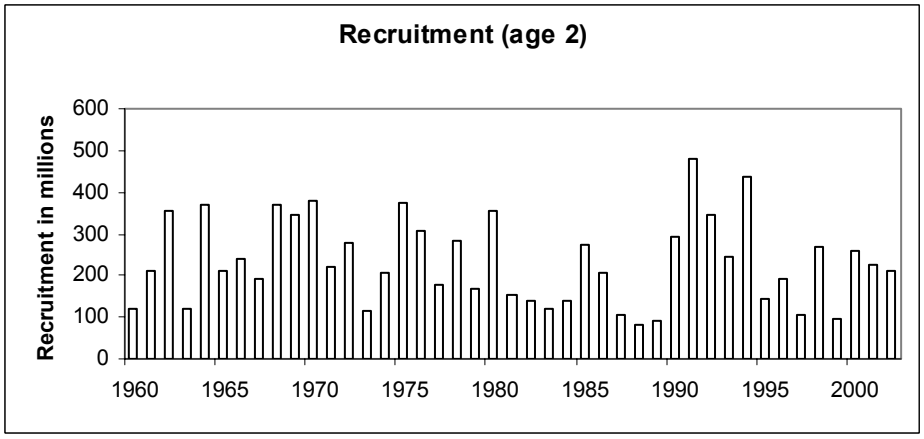
Catch data (Tables 3.1.4.1–2):

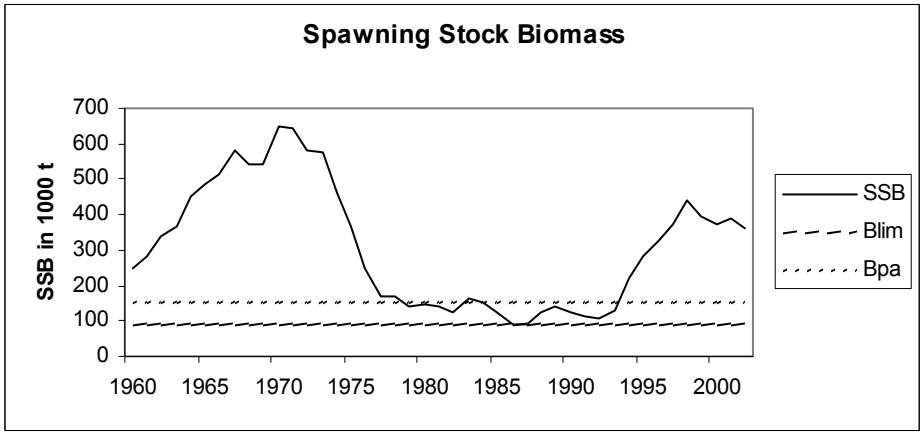
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[2]	Official landings	ACFM landings
1987	No increase in F; TAC; protect juveniles	90	-	92	92
1988	No increase in F	< 83	-	114	114
1989	*Status quo* F; TAC	120	120	122	122
1990	F ≤ $\mathbf{F}_{med}$; TAC	93	103	96	96
1991	F at $\mathbf{F}_{low}$; TAC	90	100	107	107
1992	Within safe biological limits	115	115	128	128
1993	Within safe biological limits	132[1]	132	154	154
1994	No increase in F	158[1]	145	147	147
1995	No increase in F	221[1]	165	168	168
1996	No increase in F	158[1]	163	171	171
1997	Reduction of F to $\mathbf{F}_{med}$ or below	107	125	144	144
1998	Reduction of F to $\mathbf{F}_{med}$ or below	117	145[3]	154	154
1999	Reduce F below $\mathbf{F}_{pa}$	87	144[4]	150	150
2000	Reduce F below $\mathbf{F}_{pa}$	89	125[5]	135	135
2001	Reduce F below $\mathbf{F}_{pa}$	<115	135	134	134
2002	Maintain F below $\mathbf{F}_{pa}$	< 152	152		
2003	Maintain F below $\mathbf{F}_{pa}$	< 168			

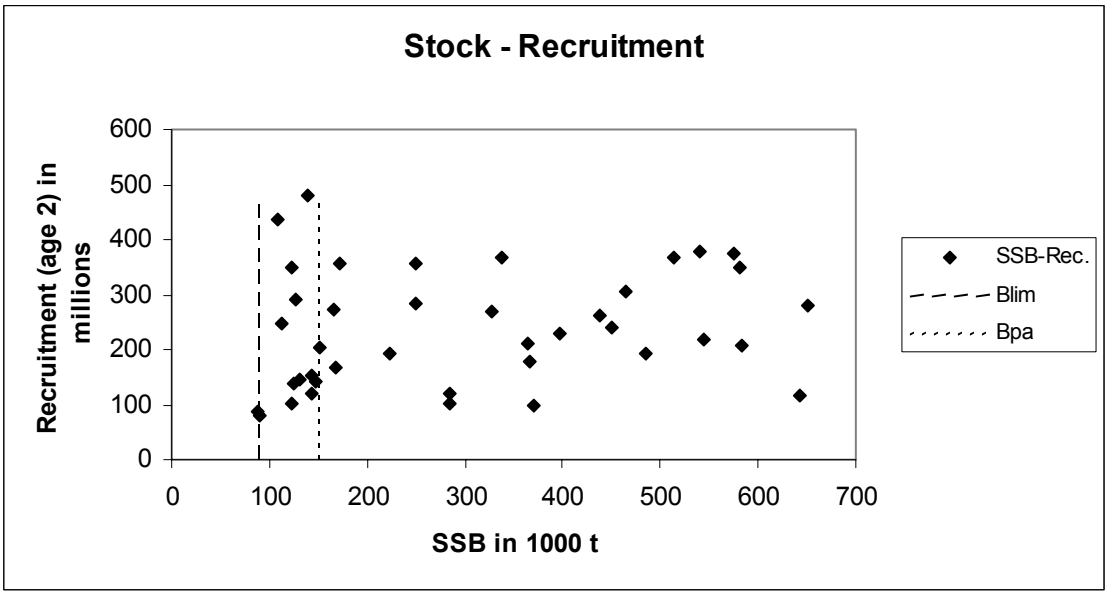
[1] Predicted catch at *status quo* F. [2]Set by Norwegian authorities. [3] TAC first set at 125 000 t, increased in May 1998 after an inter-sessional assessment. [4] TAC set after an inter-sessional assessment in December 1998. [5] TAC set after an inter-sessional assessment in December 1999. Weights in '000 t.

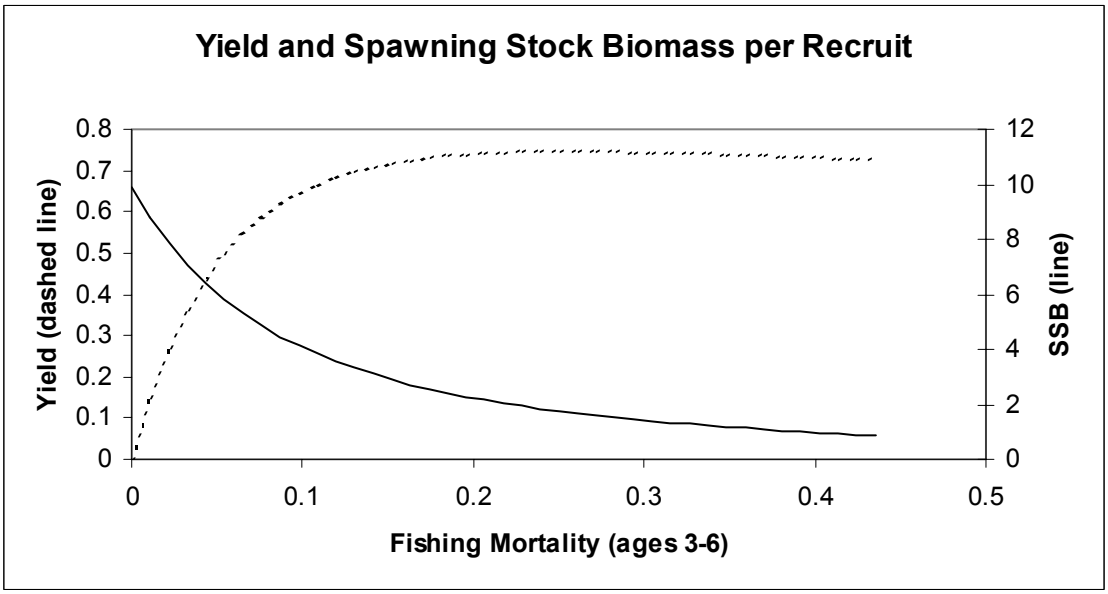

Landings
Landings in 1000 t
300
250
200
150
100
50
0
1960
1965
1970
1975
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 3-6)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
F
Flim
Fpa


Recruitment (age 2)
Recruitment in millions
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
700
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
12
10
8
6
4
2
0
SSB (line)
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)

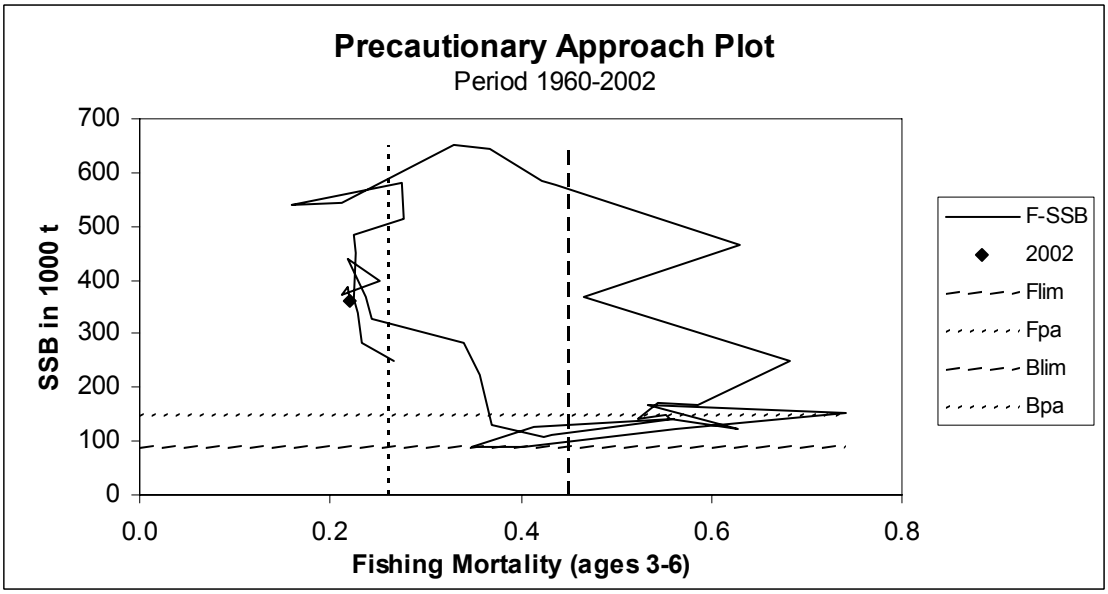

Precautionary Approach Plot
Period 1960-2002
SSB in 1000 t
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 3-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.1.4.1 Northeast Arctic saithe. Nominal catch (t) by countries, Subarea I and Divisions IIa and IIb combined, as officially reported to ICES.

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep. Germany	Norway	Poland	Portugal	Russia[3]	Spain	UK (Eng. & Wales)	UK (Scotland)	Others[5]	Total all countries
1960	23	1,700	-	25,948	96,050	-	-	-	-	9,780	-	14	133,515
1961	61	3,625	-	19,757	77,875	-	-	-	-	4,595	20	18	105,951
1962	2	544	-	12,651	101,895	-	-	912	-	4,699	-	4	120,707
1963	-	1,110	-	8,108	135,297	-	-	-	-	4,112	-	-	148,627
1964	-	1,525	-	4,420	184,700	-	-	84	-	6,511	-	186	197,506
1965	-	1,618	-	11,387	165,531	-	-	137	-	6,741	5	181	185,600
1966	-	2,987	813	11,269	175,037	-	-	563	-	13,078	-	41	203,788
1967	-	9,472	304	11,822	150,860	-	-	441	-	8,379	-	48	181,326
1968	-	-	70	4,753	96,641	-	-	-	-	8,781	2	-	110,246
1969	20	193	6,744	4,355	115,140	-	-	-	-	13,585	-	23	140,033
1970	1,097	-	29,362	23,466	151,759	-	-	43,550	-	15,469	221	-	264,924
1971	215	14,536	16,840	12,204	128,499	6,017	-	39,397	13,097	10,361	106	-	241,272
1972	109	14,519	7,474	24,595	143,775	1,111	-	1,278	13,125	8,223	125	-	210,456
1973	7	11,320	12,015	30,338	148,789	23	-	2,411	2,115	6,593	248	-	213,769
1974	46	7,119	29,466	33,155	152,699	2,521	-	38,931	7,075	3,001	103	5	264,121
1975	28	3,156	28,517	41,260	122,598	3,860	6,430	13,389	11,397	2,,623	140	55	233,453
1976	20	5,609	10,266	49,056	131,675	3,164	7,233	9,013	21,661	4,651	73	47	242,486
1977	270	5,658	7,164	19,985	139,705	1	783	989	1,327	6,853	82	-	182,817
1978	809	4,345	6,484	18,190	121,069	35	203	381	121	2,790	37	-	154,464
1979	1,117	2,601	2,435	14,823	141,346	-	-	3	685	1,170	-	-	164,180
1980	532	1,016	-	12,511	128,878	-	-	43	780	794	-	-	144,554
1981	236	194	-	8,431	166,139	-	-	121	-	395	-	-	175,498
1982	339	82	-	7,224	159,643	-	-	14	-	731	1	-	168,034
1983	539	418	-	4,933	149,556	-	-	206	33	1,251	-	-	156,936
1984	503	431	6	4,532	152,818	-	-	161	-	335	-	-	158,786
1985	490	657	11	1,873	103,899	-	-	51	-	202	-	-	107,147
1986	426	308	-	3,470	66,152	-	-	27	-	54	21	-	67,396
1987	712	576	-	4,909	85,710	-	-	426	-	54	3	1	92,391
1988	441	411	-	4,574	108,244	-	-	130	-	436	6	-	114,242
1989	388	460[2]	-	606	119,625	-	-	23	506	-	702	-	122,310
1990	1,207	340[2]	-	1,143	92,397	-	-	52	-	681	28	-	95,848
1991	963	77[2]		2,003	103,283	-	-	504[4]	-	449	42	5	107,326
			Greenland										
1992	165	1,890[2]	734	3,451	119,765	-	-	964	6	516	25	-	127,606
1993	31	566[2]	78	3,687	139,288	-	1	9,509	4	408	7	5	153,584
1994	67	151[2]	15	1,863	141,589	-	1	1,640	655	548	9	6	146,544
1995	172[2]	222[2]	53	934	165,001	-	4	1,144	-	589	99	18	168,174
1996	248[2]	365[2]	176[2]	2,615	166,149	-	24	1,159	9[2]	690[2]	16	47[2]	171,498
1997	193[2]	560	363[2]	2,915	137,054	-	12	1,774	45[2]	676	123	45[2]	143,760
1998	366[2]	932	437[2]	2,936	144,468	-	49[2]	3,836	407[2]	355		36[2]	153,822
1999	181[2]	638[2]	655[2]	2,473	141,828	-	18[2]	3,929	35[2]	339		1786[2]	150,272
2000[1]	224[2]	237[2]	651[2]	2,570[6]	126,336		46	4,652	167[2]	443		41[2]	135,170
2001	510[2]	315[2]	701[2]	2,680[6]	124,510		75	4,951	89[2]	202		58[2]	134,100

[1]Provisional figures.
[2]As reported to Norwegian authorities.
[3]USSR prior to 1991.
[4]Includes Estonia.
[5]Includes Denmark, Netherlands, Iceland, Ireland, and Sweden.
[6]As reported by Working Group members.

Table 3.1.4.2 Northeast Arctic saithe (Subareas I and II).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1960	121650	250637	133515	0.2667
1961	213269	283486	105951	0.2338
1962	355505	338725	120707	0.2289
1963	121815	365250	148627	0.2244
1964	368899	449676	197426	0.2262
1965	210354	484948	185600	0.2254
1966	241202	513916	203788	0.2767
1967	191872	581741	181326	0.2751
1968	367843	541060	110247	0.1606
1969	347431	543704	140060	0.2117
1970	379815	649874	264924	0.3292
1971	219524	642605	241272	0.3671
1972	278465	583004	214334	0.4217
1973	117299	575501	213859	0.4369
1974	206220	465237	274121	0.6295
1975	373549	367038	233453	0.4665
1976	305466	250083	242486	0.6827
1977	178776	168172	182817	0.5849
1978	283592	171151	154464	0.5435
1979	167695	142902	164180	0.5219
1980	356256	148301	144554	0.5529
1981	152601	142792	175516	0.5567
1982	140072	124433	168034	0.6284
1983	118917	166089	156936	0.5338
1984	137583	151736	158786	0.7412
1985	271774	121959	107183	0.5619
1986	204445	89699	70458	0.4030
1987	103576	88546	92391	0.3484
1988	79269	126498	114242	0.4131
1989	88874	139803	122310	0.5613
1990	292154	123646	95848	0.4802
1991	481538	112728	107326	0.4319
1992	347604	107543	127516	0.4246
1993	246197	130275	153584	0.3706
1994	436623	222342	146544	0.3563
1995	145294	283728	168174	0.3394
1996	193393	327007	171498	0.2440
1997	103367	370121	143760	0.2370
1998	268957	437533	153822	0.2187
1999	96455	396553	150274	0.2524
2000	260052	373975	135170	0.2131
2001	228000	388289	134100	0.2175
2002	212000	359930		0.2200
Average	232913	309354	159790	0.3865

3.1.5 Redfish in Subareas I and II

Table 3.1.5.1 REDFISH in Subareas I and II. Nominal catch (t) by countries in Subarea I, Divisions IIa and IIb combined as officially reported to ICES.

Year	Canada	Denmark	Faroe Islands	France	Germany[4]	Greenland	Iceland	Ireland	Netherlands	Norway	Poland	Portugal	Russia[5]	Spain	UK (E&W)	UK (Scot.)	Total
1984	-	-	-	2,970	7,457	-	-	-	-	18,650	-	1,806	69,689	25	716	-	101,313
1985	-	-	-	3,326	6,566	-	-	-	-	20,456	-	2,056	59,943	38	167	-	92,552
1986	-	-	29	2,719	4,884	-	-	-	-	23,255	-	1,591	20,694	-	129	14	53,315
1987	-	+	450[3]	1,611	5,829	-	-	-	-	18,051	-	1,175	7,215	25	230	9	34,595
1988	-	-	973	3,349	2,355	-	-	-	-	24,662	-	500	9,139	26	468	2	41,494
1989	-	-	338	1,849	4,245	-	-	-	-	25,295	-	340	14,344	5[2]	271	1	46,688
1990	-	37[3]	386	1,821	6,741	-	-	-	-	34,090	-	830	18,918	-	333	-	63,156
1991	-	23	639	791	981	-	-	-	-	49,463	-	166	15,354	1	336	13	67,768
1992	-	9	58	1,301	530	614	-	-	-	23,451	-	977	4,335	16	479	3	31,773
1993	8[3]	4	152	921	685	15	-	-	-	18,319	-	1,040	7,573	65	734	1	29,517
1994	-	28	26	771	1026	6	4	3	-	21,466	-	985	6,220	34	259	13	30,841
1995	-	-	30	748	692	7	1	5	1	16,162	-	936	6,985	67	252	13	25,899
1996	-	-	42[3]	746	618	37	-	2	-	21,675	-	523	1,641	408	305	121	26,118
1997	-	-	7	1,011	538	39[2]	-	11	-	18,839	1	535	4,556	308	235	29	26,109
1998	-	-	98	567	231	47[3]	-	28	-	26,273	13	131	5,278	228	211	94	33,199
1999	-	-	108	61[3]	430	97	14	10	-	24,634	6	68	4,422	36	247	62	30,195
2000	-	-	67[3]	25[3]	222	51[3]	65	1[3]	-	19,187[2]	2	131	4,631	87		203[6]	24,672
2001[1]	-	-	69[3]	46[3]	436	34[3]	38	5	-	23,122[2]	5	186	4,738	199[2]		239[6]	29,117

[1] Provisional figures.
[2] Working Group figure.
[3] As reported to Norwegian authorities.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6] UK(E&W)+UK(Scot.)

3.1.5.a *Sebastes mentella* in Subareas I and II

State of stock/exploitation: The stock is considered to be outside safe biological limits. Although the current assessments are only indicative of the relative trends in stock size, they show that the spawning stock is close to its historical low. The 1991–2000 year classes are indicated to be well below those of the 1980s.

Management objectives: No explicit management objectives have been established for this stock. Consistent with the precautionary approach a management plan, including monitoring of the development of the stock and of the fishery, with corresponding regulations, should be developed and implemented.

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points for biomass are under investigation.

Advice on management: ICES recommends that there be no directed fishery on this stock until a significant increase in spawning stock biomass has been detected in surveys with a following increase in the number of juveniles. In addition, the by-catch of redfish in other fisheries should be reduced to the lowest possible level.

Relevant factors to be considered in management: Recruitment failure has been observed in surveys since 1991, and this indicates that the stock will decrease unless immediate action is taken. In this connection it is of vital importance that the juvenile age classes be given the strongest protection from being caught as by-catch in any fishery, i.e., the shrimp fisheries in the Barents Sea and Svalbard area. This will ensure that the recruiting year classes can contribute as much as possible to the stock rebuilding.

More than 50% of the 1987–1990 year classes (approx. 29–36 cm) have currently recruited to the spawning stock. These year classes will be followed by at least 10 poor ones and consequently offer the last opportunity of increasing the spawning stock for a number of years to come. This opportunity will be lost unless the year classes are exploited with significantly reduced fishing mortality.

Based on estimates of current SSB and the size of year classes in the 1990s, this stock will not be able to support a directed fishery for at least several more years. Rather, it will be necessary to prevent the stock from declining further, to maintain measures to protect this stock from by-catch in other fisheries in the medium-term to SSBs much below any previously observed.

Comparison with previous assessment and advice: No significant changes.

Elaboration and special comment: The only directed fishery for *S. mentella* is a trawl fishery. In addition, by-catches are taken in cod and shrimp-trawl fisheries. After the introduction of sorting grids in 1993, discarding in the shrimp fishery was reduced. Small redfish less than 18-20 cm are, however, not sorted out by the grid, and criteria for the maximum number of redfish per kilogram shrimp are enforced (10 juvenile redfish per 10 kg shrimp). Additional protection for adult *S. mentella* comprise area closures.

Traditionally, the directed fishery was conducted by Russia and other East-European countries on grounds from south of Bear Island towards Spitsbergen. From the mid-1970s to the mid-1980s large catches were taken annually. From the mid-1980s Norwegian trawlers started fishing along the continental slope (around 500 m depth) further south, on grounds never harvested before, and inhabited primarily by mature fish. After a sharp decrease in the landings from the traditional area until 1987, this fishery on new grounds resulted in a temporary increase in the landings until 1991, after which the landings declined. Since 1991 the fishery has been dominated by Norway and Russia.

Because of the slow growth of this species, the surveys should detect improvements to incoming year classes for several years before they contribute to the fisheries or the spawning population.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

References: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Tables 3.1.5.a.1–5):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings[1]	ACFM landings of *S. mentella*
1987	Precautionary TAC	70[1]	85	35	11
1988	$F \leq \mathbf{F}_{0.1}$; TAC	11	-	41	16
1989	*Status quo* F; TAC	12	-	47	24
1990	*Status quo* F; TAC	18	-	63	35
1991	F at $\mathbf{F}_{med}$; TAC	12	-	68	49
1992	If required, precautionary TAC	22	-	32	16
1993	If required, precautionary TAC	18	18	30	13
1994	If required, precautionary TAC	-	-	31	13
1995	Lowest possible F	-	-	26	10
1996	Catch at lowest possible level	-	-	26	8
1997	Catch at lowest possible level	-	-	26	9
1998	No directed fishery, reduce by-catch	-	-	33	14
1999	No directed fishery, reduce by-catch	-	-	30	11
2000	No directed fishery, by-catch at lowest possible level	-	-	25	10
2001	No directed fishery, by-catch at lowest possible level	-	-	29	19
2002	No directed fishery, by-catch at lowest possible level	-	-		
2003	No directed fishery, by-catch at lowest possible level	-			

[1] Includes both *S. mentella* and *S. marinus*. Weights in '000 t.

Sebastes mentella in Subareas I and II

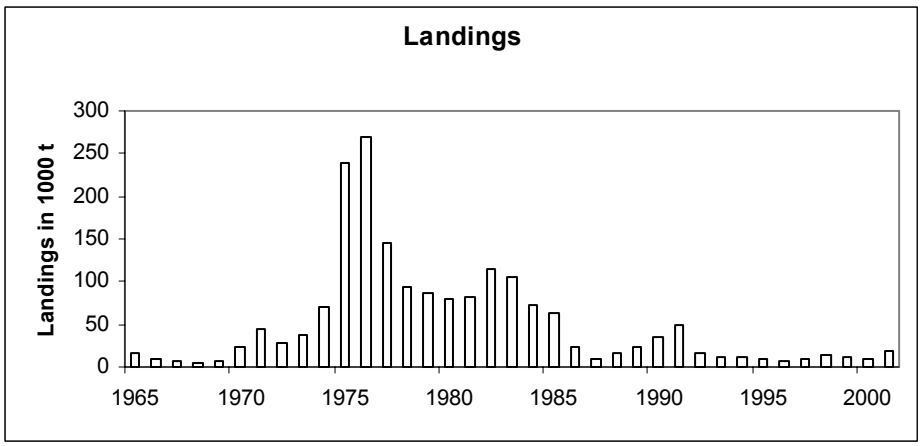


Table 3.1.5.a.1 *Sebastes mentella*. Nominal catch (t) by countries in Subarea I, Divisions IIa and IIb combined.

Year	Canada	Denmark	Faroe Islands	France	Germany[3]	Greenland	Ireland
1986	-	-	-	-	1,252	-	-
1987	-	-	200	63	1,321	-	-
1988	No species-specific data available by country.						
1989	-	-	335	1,093	3,833	-	-
1990	-	-	108	142	6,354	36	-
1991	-	-	487	85	-	23	-
1992	-	-	23	12	-	-	-
1993	8	4	13	50	35	1	-
1994	-	28	4	74	18	1	3
1995	-	-	3	16	176	2	4
1996	-	-	4	75	119	3	2
1997	-	-	4	37	81	16	6
1998	-	-	20	73	100	14	9
1999	Iceland	-	73	26	202	50	3
2000	48	-	50	12	62	29	1
2001[1]	33	-	52	16	198	17	4

Year	Norway	Poland	Portugal	Russia[4]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	1,274	-	1,273	17,815	-	84	-	23,112[2]
1987	1,488	-	1,175	6,196	25	49	1	10,518
1988	No species-specific data available by country.							15,586
1989	4,633	-	340	13,080	5	174	1	23,494
1990	10,173	-	830	17,355	-	72	-	35,070
1991	33,592	-	166	14,302	1	68	3	48,727
1992	10,751	-	972	3,577	14	238	3	15,590
1993	5,182	-	963	6,260	5	293	-	12,866
1994	6,511	-	895	5,021	30	124	12	12,721
1995	2,646	-	927	6,346	67	93	4	10,284
1996	6,053	-	467	925	328	76	23	8,075
1997	4,657	1	474	2,972	272	71	7	8,597
1998	9,733	13	125	3,646	177	93	41	14,045
1999	7,884	6	65	2,731	29	112	28	11,208
2000	6,151	2	115	3,519	87		130[5]	10,206
2001[1]	14,291	5	179	3,775	198		120	18,887

[1] Provisional figures.
[2] Including 1 414 tonnes in Division IIb not split on countries.
[3] Includes former GDR prior to 1991.
[4] USSR prior to 1991.
[5]UK(E&W)+UK(Scot.)

Table 3.1.5.a.2 *Sebastes mentella*. Nominal catch (t) by countries in Subarea I.

Year	Faroe Islands	Germany[4]	Greenland	Norway	Russia[5]	UK(Eng. &Wales)	Iceland	Total
1986[3]	-	-	-	1,274	911	-	-	2,185
1987[3]	-	2	-	1,166	234	3	-	1,405
1988	No species-specific data presently available							
1989	13	-	-	60	484	9[2]	-	566
1990	2	-	-	-	100	-	-	102
1991	-	-	-	8	420	-	-	428
1992	-		-	561	408	-	-	969
1993	2[2]	-	-	16	588	-	-	606
1994	2[2]	2	-	36	308	-	-	348
1995	2[2]	-	-	20	203	-	-	225
1996	-	-	-	5	101	-	-	106
1997	-	-	3[2]	12	174	1[2]	-	190
1998	20[2]	-	-	26	378	-	-	424
1999	69[2]	-	-	69	489	-	-	626
2000	-	-	-	43	406	-	48[2]	497
2001[1]	-	-	-	4	296	-	33[2]	333

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.

Table 3.1.5.a.3 *Sebastes mentella*. Nominal catch (t) by countries in Division IIa.

Year	Faroe Islands	France	Germany[4]	Greenland	Ireland	Norway
1986[3]	-	-	1,252	-	-	-
1987[3]	200	63	970	-	-	149
1988	No species-specific data presently available					
1989	312[2]	1,065[2]	3,200	-	-	4,573
1990	98[2]	137[2]	1,673	-	-	8,842
1991	487[2]	72[2]	-	-	-	32,810
1992	23[2]	7[2]	-	-	-	9,816
1993	11[2]	15[2]	35	1[2]	-	5,029
1994	2[2]	33[2]	16[2]	1[2]	2[2]	6,119
1995	1[2]	16[2]	176[2]	2[2]	2[2]	2,251
1996	-	75[2]	119[2]	3[2]	-	5,895
1997	-	37[2]	77	12[2]	2[2]	4,422
1998	-	73[2]	58[2]	14[2]	6[2]	9,186
1999	-	16[2]	160[2]	50[2]	3[2]	7,358
2000	50[2]	11[2]	35[2]	29[2]	-	5,975
2001[1]	33[2]	12[2]	161[2]	17[2]	4[2]	13,987

Year	Portugal	Russia[5]	Spain	UK(Eng.& Wales)	UK (Scotland)	Total
1986[3]	1,273	16,904	-	84	-	19,513
1987[3]	1,156	4,469	-	34	1	7,042
1988	No species-specific data presently available					
1989	251	9,749	-	158[2]	1[2]	19,309
1990	824	6,492	-	9	-	18,075
1991	159[2]	7,596	-	23[2]	-	41,147
1992	824[2]	1,096	-	27[2]	-	11,793
1993	648[2]	5,328	-	2[2]	-	11,069
1994	687[2]	4,692	8[2]	4[2]	-	11,564
1995	715[2]	5,916	65[2]	41[2]	2[2]	9,187
1996	429[2]	677	5[2]	42[2]	19[2]	7,264
1997	410[2]	2,341	9[2]	48[2]	7[2]	7,365
1998	118[2]	2,626	55[2]	65[2]	41[2]	12,241
1999	56[2]	1,340	14[2]	94[2]	26[2]	9,117
2000	98[2]	2,167	18[2]		103[6]	8,486
2001[1]	105[2]	2,716	6[2]		95[6]	17,136

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6] UK(E&W)+UK(Scot.)

Table 3.1.5.a.4 *Sebastes mentella*. Nominal catch (t) by countries in Division IIb.

Year	Canada	Denmark	Faroe Islands	France	Germany[5]	Greenland	Ireland
1986[4]	Data not available on countries						
1987[4]	-	-	-	-	349	-	-
1988	No species-specific data presently available						
1989	-	-	10	28	633	-	-
1990	-	-	8[2]	5[2]	4,681	36[2]	-
1991	-	-	-	13[2]	-	23	-
1992	-	-	-	5[2]	-	-	-
1993	8[2]	4[2]	-	35[2]	-	-	-
1994	-	28[2]	-	41[2]	-	-	1[2]
1995	-	-	-	-	-	-	2[2]
1996	-	-	4[2]	-	-	-	2[2]
1997	-	-	4[2]	-	3	1[2]	4[2]
1998	-	-	-	-	42[2]	-	3[2]
1999	-	-	4[2]	10[2]	42[2]	-	-
2000	-	-	-	1[2]	27[2]	-	1[2]
2001[1]	-	-	19[2]	4[2]	37[2]	-	-

Year	Norway	Poland	Portugal	Russia[6]	Spain	Eng. & Wales	Scotland	Total
1986[4]	Data not available on countries							1,414
1987[4]	173	-	19	1,493	25	12	-	2,071
1988	No species-specific data presently available							
1989	-	-	89	2,847	5	7[2]	-	3,619
1990	1,331	-	6	10,763	-	63[2]	-	16,893
1991	774	-	7	6,286	1	45[2]	3[2]	7,152
1992	374	-	148[2]	2,073	14	211[2]	3[2]	2,826
1993	137	-	315[2]	344	57[3]	291[2]	-	1,191
1994	356	-	208[2]	21	22[3]	120[2]	12[2]	809
1995	375	-	212[2]	227	2[3]	52[2]	2[2]	872
1996	153	-	38[2]	147	323[2]	34[2]	4[2]	705
1997	223	1[2]	64[2]	457	263[2]	22[2]	-	1,042
1998	521	13[2]	7[2]	642	122[2]	28[2]	1[2]	1,379
1999	457	6[2]	9[2]	902	15[2]	18[2]	2[2]	1,465
2000	133	2[2]	17[2]	946	69[2]		27[7]	1,223
2001[1]	300	5[2]	74[2]	763	192[2]		25[7]	1,419

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Split on species according to the 1992 catches.
[4] Based on preliminary estimates of species breakdown by area.
[5] Includes former GDR prior to 1991.
[6] USSR prior to 1991.
[7] UK(E&W)+UK(Scot.)

3.1.5.b *Sebastes marinus* in Subareas I and II

State of stock/exploitation: It has not been possible to assess the state of this stock with respect to safe biological limits. Available data from the Barents Sea/Svalbard surveys and commercial CPUE on larger fish do not indicate any large recent changes in the adult stock, but the data are too noisy to detect moderate changes. Results from the coastal and fjord survey series, however, indicate a decrease also for larger fish since 1995. Indices from surveys in young fish areas in the Barents Sea and Svalbard waters indicate a declining trend in recruitment.

Management objectives: No explicit management objectives have been established for this stock.

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points for biomass are under investigation.

Advice on management: Consistent with a precautionary approach, ICES recommends that a management plan, including monitoring of the development of the stock and of the fishery, with corresponding regulations, should be developed and implemented as a prerequisite to continued fishing.

Relevant factors to be considered in management: The low abundance of pre-recruit fish in the last year's surveys followed by a decreased survey abundance of fishable biomass confirmed by reduced commercial catches are all signs of a disturbing stock decline.

Comparison with previous assessments and advice: The current assessment is just an update of last year's assessment, and all present available information confirms last year's evaluation of the stock status.

Elaboration and special comment: The fishery is mainly conducted by Norway accounting for 80–90% of the total catch. Germany also has a long tradition of a trawl fishery for this species. The fish are caught mainly by trawl and gillnet, and to a lesser extent by longline, Danish seine, and handline, in that order. Some of the catches are taken in mixed fisheries together with saithe and cod. Important fishing grounds are the Møre area (Svinøy), Halten Bank, outside Lofoten and Vesterålen, and at Sleppen outside Finnmark.

Except for some area restriction and by-catch regulations most of the fishery for *S.marinus* is at present a free fishery. This is not appropriate for the current stock situation.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

Catch data (Tables 3.1.5.b.1-5):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings[1]	ACFM landings of *S. marinus*
1987	Precautionary TAC	-	-	35	24
1988	Reduction in F; TAC	15	-	41	26
1989	*Status quo* F; TAC	24	-	47	23
1990	*Status quo* F; TAC	23	-	63	28
1991	Precautionary TAC	24	-	68	19
1992	If required, precautionary TAC	25	-	32	16
1993	Precautionary TAC	12	12	30	17
1994	If required, precautionary TAC	-	-	31	18
1995	If required, precautionary TAC	-	-	26	16
1996	If required, precautionary TAC	-	-	26	18
1997	If required, precautionary TAC	-	-	26	18
1998	Management plan required as pre-requisite to continued fishing	-	-	33	19
1999	Management plan required as pre-requisite to continued fishing	-	-	30	19
2000	Management plan required as pre-requisite to continued fishing	-	-	25	14
2001	Management plan required as pre-requisite to continued fishing	-	-	29	10
2002	Management plan required as pre-requisite to continued fishing	-	-		
2003	Management plan required as pre-requisite to continued fishing	-			

[1]Includes both *S. mentella* and *S. marinus* . Weights in '000 t.

Sebastes marinus in Subareas I and II

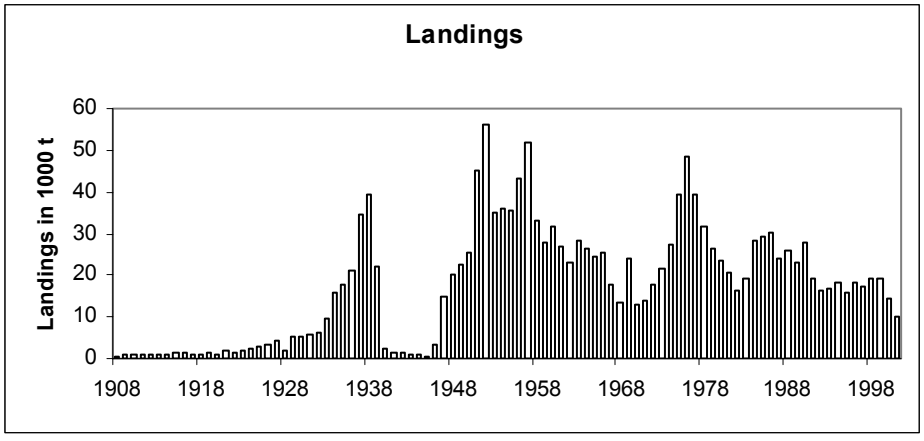


Table 3.1.5.b.1 *Sebastes marinus*. Nominal catch (t) by countries in Subarea I and Divisions IIa and IIb combined.

Year	Faroe Islands	France	Germany[2]	Greenland	Iceland	Ireland	Netherlands
1986	29	2,719	3,369	-	-	-	-
1987	250	1,553	4,508	-	-	-	-
1988	No species-specific data presently available on countries						
1989	3	796	412	-	-	-	-
1990	278	1,679	387	1	-	-	-
1991	152	706	981	-	-	-	-
1992	35	1,289	530	623	-	-	-
1993	139	871	650	14	-	-	-
1994	22	697	1,008	5	4	-	-
1995	27	732	517	5	1	1	1
1996	38	671	499	34	-	-	-
1997	3	974	457	23	-	5	-
1998	78	494	131	33	-	19	-
1999	35	35	228	47	14	7	-
2000	17	13	160	22	16	-	-
2001[1]	17	30	238	17	5	1	-

Year	Norway	Portugal	Russia[3]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986	21,680	-	2,350	-	42	14	30,203
1987	16,728	-	850	-	181	7	24,077
1988	No species-specific data presently available on countries						25,908
1989	20,662	-	1,264	-	97	-	23,234
1990	23,917	-	1,549	-	261	-	28,072
1991	15,872	-	1,052	-	268	10	19.041
1992	12,700	5	758	2	241	2	16,185
1993	13,137	77	1,313	8	441	1	16,651
1994	14,955	90	1,199	4	135	1	18,120
1995	13,516	9	639	-	159	9	15,616
1996	15,622	55	716	81	229	98	18,043
1997	14,182	61	1,584	36	164	22	17,512
1998	16,540	6	1,632	51	118	53	19,154
1999	16,750	3	1,691	7	135	34	18,987
2000	13,036	16	1,112	-		73[4]	14,465
2001[1]	8,831	7	963	1		119[4]	10,230

[1] Provisional figures.
[2] Includes former GDR prior to 1991.
[3] USSR prior to 1991.
[4] UK(E&W)+UK(Scot.)

Table 3.1.5.b.2 *Sebastes marinus*. Nominal catch (t) by countries in Subarea I.

Year	Faroe Islands	Germany[4]	Greenland	Iceland	Norway	Russia[5]	UK(Eng &Wales)	UK (Scotland)	Total
1986[3]	-	50	-	-	2,972	155	32	3	3,212
1987[3]	-	8	-	-	2,013	50	11	-	2,082
1988	No species-specific data presently available								
1989	-	-	-	-	1,763	110	4[2]	-	1,877
1990	5	-	-	-	1,263	14	-	-	1,282
1991	-	-	-	-	1,993	92	-	-	2,085
1992	-	-	-	-	2,162	174	-	-	2,336
1993	24[2]	-	-	-	1,178	330	-	-	1,532
1994	12[2]	72	-	4	1,607	109	-	-	1,804
1995	19[2]	1[2]	-	1[2]	1,947	201	1[2]	-	2,170
1996	7[2]	-	-	-	2,245	131	3[2]	-	2,386
1997	3[2]	-	5[2]	-	2,431	160	2[2]	-	2,601
1998	78[2]	5[2]	-	-	2,109	308	30[2]	-	2,530
1999	35[2]	18[2]	9[2]	14[2]	2,114	360	11[2]	-	2,562
2000	-	1[2]	-	16[2]	1,843	146	-	12[6]	2,018
2001[1]	-	11[2]	-	5[2]	1,067	128	-	16[6]	1,227

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6]UK(E&W)+UK(Scot.)

Table 3.1.5.b.3 *Sebastes marinus*. Nominal catch (t) by countries in Division IIa.

Year	Faroe Islands	France	Ger-many[4]	Green-land	Ire-land	Nether-lands	Norway	Port-ugal	Russia[5]	Spain	UK (Eng. & Wales)	UK (Scotland)	Total
1986[3]	29	2,719	3,319	-	-	-	18,708	-	2,195	-	10	11	26,991
1987[3]	250	1,553	2,967	-	-	-	14,715	-	800	-	170	7	20,462
1988	No species-specific data presently available												
1989	3[2]	784[2]	412	-	-	-	18,833	-	912	-	93[2]	-	21,037
1990	273	1,684	387	-	-	-	22,444	-	392	-	261	-	25,441
1991	152[2]	706[2]	678	-	-	-	13,835	-	534	-	268[2]	10[2]	16,183
1992	35[2]	1,294[2]	211	614	-	-	10,536	-	404	-	206[2]	2[2]	13,302
1993	115[2]	871[2]	473	14[2]	-	-	11,959	77[2]	940	-	431[2]	1[2]	14,881
1994	10[2]	697[2]	654[2]	5[2]	-	-	13,330	90[2]	1,030	-	129[2]	-	15,945
1995	8[2]	732[2]	328[2]	5[2]	1[2]	1	11,466	2[2]	405	-	158[2]	9[2]	13,115
1996	27[2]	671[2]	448[2]	34[2]	-	-	13,329	51[2]	449	5[2]	223[2]	98[2]	15,335
1997	-	974[2]	438	18[2]	5[2]	-	11,708	61[2]	1,199	36[2]	162[2]	22[2]	14,623
1998	-	494[2]	116[2]	33[2]	19[2]	-	14,326	6[2]	1,078	51[2]	85[2]	52[2]	16,261
1999	-	35[2]	210[2]	38[2]	7[2]	-	14,598	3[2]	976	7[2]	122[2]	34[2]	16,030
2000	17[2]	13[2]	159[2]	22[2]	-	-	11,176	16[2]	658	-	-	61[6]	12,122
2001[1]	17[2]	30[2]	227[2]	17[2]	1[2]	-	7,693	6[2]	612	1[2]	-	103[6]	8,707

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Based on preliminary estimates of species breakdown by area.
[4] Includes former GDR prior to 1991.
[5] USSR prior to 1991.
[6]UK(E&W)+UK(Scot.)

Table 3.1.5.b.4 *Sebastes marinus*. Nominal catch (t) by countries in Division IIb.

Year	Faroe Islands	Germany[5]	Greenland	Norway	Portugal	Russia[6]	Spain	UK(Eng. & Wales)	UK (Scotland)	Total
1986	-									+
1987[4]	-	1,533	-	-	-	-	-	-	-	1533
1988	No species-specific data presently available									
1989	-	-	-	66	-	242	-	-	-	308
1990	-	-	1[2]	210	-	1,157	-	-	-	1,368
1991	-	303	-	44	-	426	-	-	-	773
1992	-	319	9[2]	2	5[2]	180	2	35[2]	-	552
1993	-	177	-	-	-	43	8[3]	10[2]	-	238
1994	-	282	-	18	-	60	4[3]	6[2]	1[2]	371
1995	-	187	-	103	7	33	-	-	-	330
1996	4	51[2]	-	27	5	136	76[2]	3[2]	-	302
1997	-	20	-	43	-	225	-	-	-	288
1998	-	10[2]	-	105	-	246	-	3[2]	-	364
1999	-	-	-	38	-	355	-	2[2]	-	395
2000	-	-	-	17	-	308	-	-	-	325
2001[1]	-	-	-	71	1[2]	223	-	-	-	295

[1] Provisional figures.
[2] Split on species according to reports to Norwegian authorities.
[3] Split on species according to the 1992 catches.
[4] Based on preliminary estimates of species breakdown by area.
[5] Includes former GDR prior to 1991.
[6] USSR prior to 1991.

Table 3.1.5.b.5 *Sebastes marinus* in Subareas I and II. Total international landings 1908-2001 (thousand tonnes).

Year	Landings '000 t	Year	Landings '000 t
1908	0.65	1957	51.61
1909	1.00	1958	33.12
1910	1.03	1959	28.07
1911	1.01	1960	31.77
1912	1.01	1961	26.73
1913	0.81	1962	22.82
1914	1.14	1963	28.10
915	1.31	1964	26.55
1916	1.46	1965	24.31
1917	1.16	1966	25.63
1918	1.11	1967	17.73
1919	1.51	1968	13.35
1920	1.17	1969	24.07
1921	1.83	1970	12.82
1922	1.47	1971	13.82
1923	1.94	1972	17.73
1924	2.21	1973	21.44
1925	2.72	1974	27.27
1926	3.19	1975	39.13
1927	4.47	1976	48.58
1928	1.95	1977	39.51
1929	5.28	1978	31.74
1930	5.29	1979	26.48
1931	5.88	1980	23.41
1932	6.10	1981	20.83
1933	9.59	1982	16.37
1934	15.86	1983	19.26
1935	17.69	1984	28.38
1936	21.03	1985	29.48
1937	34.59	1986	30.20
1938	39.17	1987	24.08
1939	21.87	1988	25.91
1940	2.29	1989	23.23
1941	1.68	1990	28.07
1942	1.43	1991	19.04
1943	1.02	1992	16.19
1944	0.92	1993	16.65
1945	0.56	1994	18.12
1946	3.57	1995	15.62
1947	14.88	1996	18.04
1948	20.00	1997	17.51
1949	22.36	1998	19.15
1950	25.56	1999	18.99
1951	45.30	2000	14.47
1952	56.17	2001	10.23
1953	34.83	Average	17.32
1954	35.78		
1955	35.47		
1956	43.38		

3.1.6 Greenland halibut in Subareas I and II

State of stock/exploitation: The state of the stock is uncertain. In the current assessment both the total stock size and SSB are considered to be low in historical terms, but have been improving slowly in recent years. Fishing mortality in the most recent years is estimated to be slightly below the long-term average. Recruitment has been rather stable, but low since 1990. The catch of Greenland halibut in 2002 is expected to be much higher (17 000 t) than the corresponding ICES advice (<11 000 t).

Management objectives: No explicit management objectives have been established for this stock.

Reference points: No precautionary reference points have been proposed for this stock, but candidate reference points are under investigation.

Advice on management: ICES recommends to reduce catches to below 13 000 t for 2003 in order to increase the stock. Furthermore, additional measures to control catches should be implemented.

Relevant factors to be considered in management: Although many aspects of the assessment remain uncertain, all fishery-independent indices of stock size indicate positive trends in recent years. However, given the uncertainties in the assessment a reduction in fishing mortality is desirable to ensure stock improvement. Current management measures have reduced fishing mortality somewhat. Additional management measures to control catches, e.g. TACs, area closures, and reduced by-catch limits, need to be introduced and enforced effectively. The rebuilding plan proposed in 2001 is aimed at increasing SSB. ICES still considers, cf. the advice above, that actions should be taken to increase SSB.

Over the past 10 years the average catch has been 13 000 t and since the mid-1990s, SSB has steadily increased.

Comparison with previous assessment and advice: SSB in the 2001 assessment was estimated using a maturity ogive for both sexes while the SSB given this year uses one for females only. This change caused a revision in the perception of the trend and status of the stock; the current assessment indicates a slight increase from a historical low in the mid-1990s and a slight reduction in estimated fishing mortality for 1999 and 2000 compared to the 2001 assessment.

Elaboration and special comment: The assessment is considered uncertain due to age-reading problems and evidence of unreported landings that could not be taken into account. Nevertheless, it is considered that the assessment reflects the state of the stock reasonably well.

Since 1992, the fishery has been regulated by allowing a directed fishery only by small coastal longline and gill net vessels. By-catches of Greenland halibut in the trawl fisheries have been limited by permissible by-catch per haul and an allowable by-catch retention limit on board the vessel.

An analytical assessment was based on commercial catch-at-age data, two survey series, and one experimental commercial CPUE series. This assessment is only accepted as indicative of trends.

Source of information: Report of the Arctic Fisheries Working Group, 16 – 25 April 2002 (ICES CM 2002/ACFM:18).

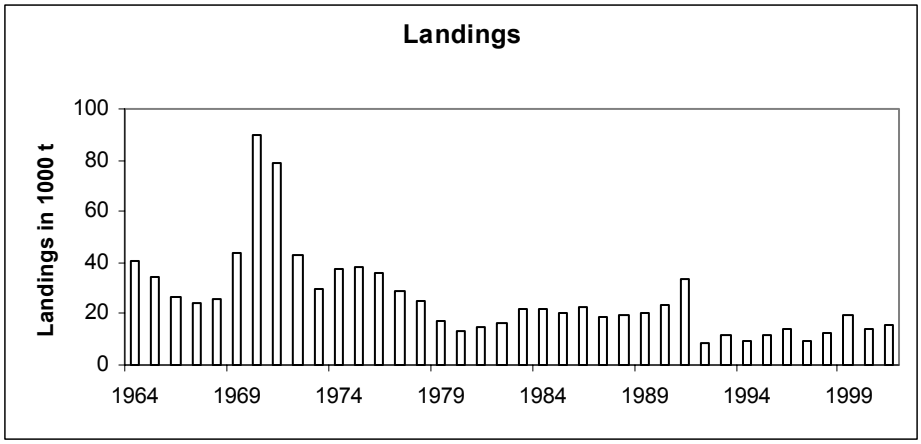
Yield and spawning biomass per Recruit F-reference points:

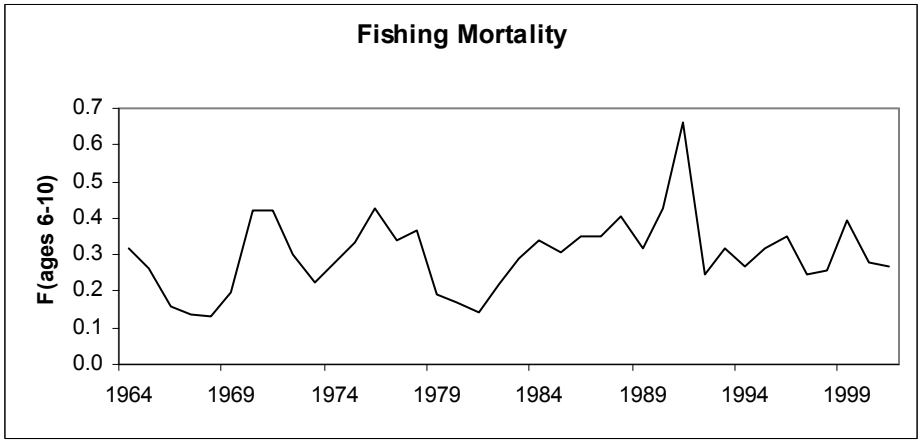
	Fish Mort Ages 6-10	Yield/R	SSB/R
Average Current	0.267	1.054	1.699
$\mathbf{F}_{max}$	0.157	1.090	3.324
$\mathbf{F}_{0.1}$	0.076	0.995	6.609
$\mathbf{F}_{med}$	0.237	1.067	2.002

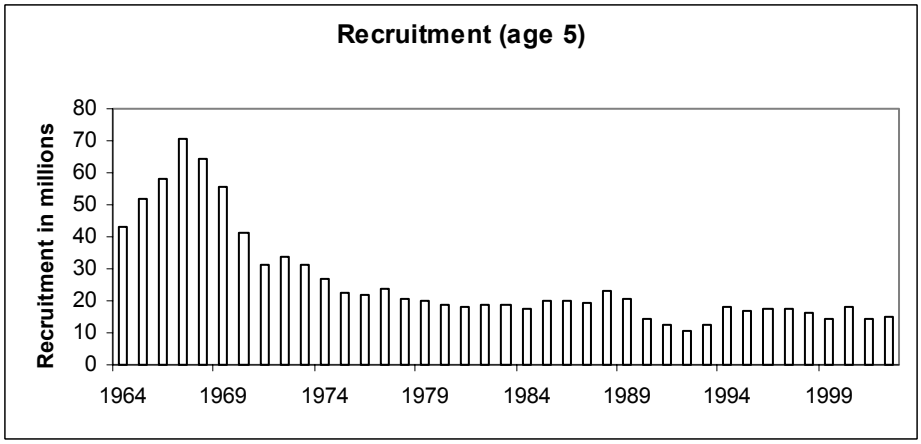
Catch data (Tables 3.1.6.1–5):

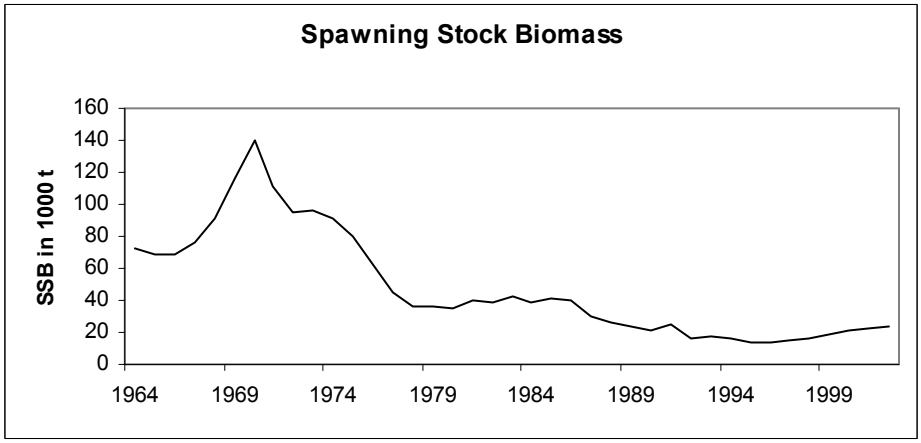
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	-	-	19	19
1988	No decrease in SSB	19	-	20	20
1989	F = F(87); TAC	21	-	20	20
1990	F = F (89); TAC	15	-	23	23
1991	F at $\mathbf{F}_{med}$; TAC; improved expl. pattern	9	-	33	33
1992	Rebuild SSB(1991)	6	7[1]	9	9
1993	TAC	7	7[1]	12	12
1994	F < 0.1	< 12	11[1]	9	9
1995	No fishing	0	2.5[2]	11	11
1996	No fishing	0	2.5[2]	14	14
1997	No fishing	0	2.5[2]	10	10
1998	No fishing	0	2.5[2]	13	13
1999	No fishing	0	2.5[2]	19	19
2000	No fishing	0	2.5[2]	14	14
2001	Reduce catch to rebuild stock	< 11	2.5[2]	16	16
2002	Reduce F substantially	< 11	2.5[2]		
2003	Reduce catch to increase stock	< 13			

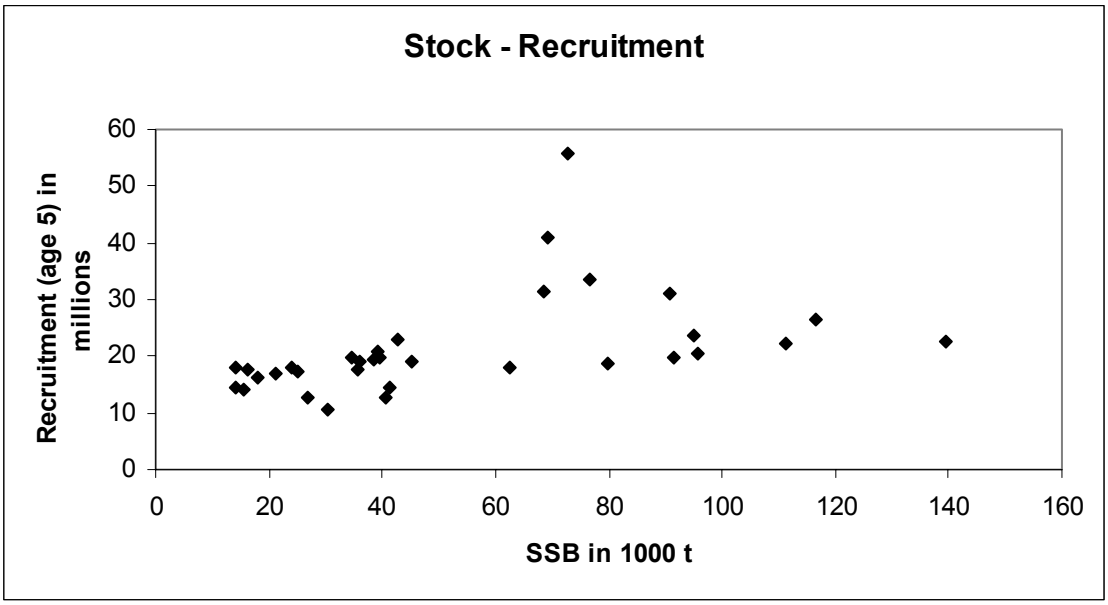
[1]Set by Norwegian authorities. [2]Set by Norwegian authorities for the non-trawl fishery; allowable by-catch in the trawl fishery is additional to this. Weights in '000 t.


Landings
Landings in 1000 t
100
80
60
40
20
0
1964
1969
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 6-10)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1964
1969
1974
1979
1984
1989
1994
1999


Recruitment (age 5)
Recruitment in millions
80
70
60
50
40
30
20
10
0
1964
1969
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
160
140
120
100
80
60
40
20
0
1964
1969
1974
1979
1984
1989
1994
1999


Stock - Recruitment
Recruitment (age 5) in millions
0
10
20
30
40
50
60
0
20
40
60
80
100
120
140
160
SSB in 1000 t

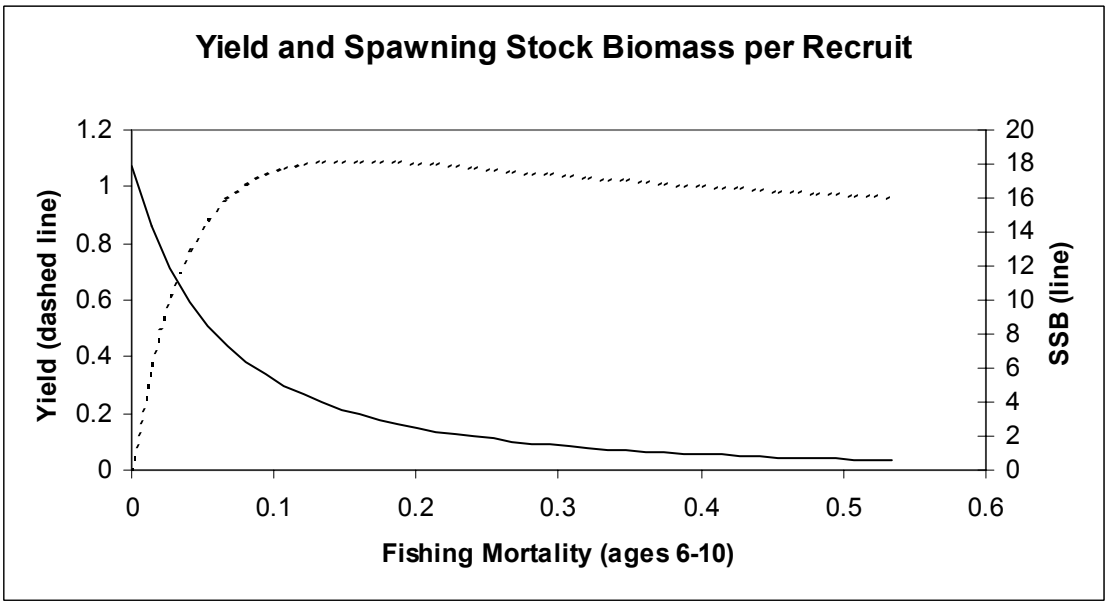

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.2
0.4
0.6
0.8
1
1.2
SSB (line)
0
2
4
6
8
10
12
14
16
18
20
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 6-10)

Table 3.1.6.1 Greenland halibut. Nominal catch (t) by countries (Subarea I, Divisions IIa and IIb combined) as officially reported to ICES.

Year	Denmark	Estonia	Faroe Isl.	France	Germany	Greenland	Iceland	Ireland	Lithuania
1984	0	0	0	138	2,165	0	0	0	0
1985	0	0	0	239	4,000	0	0	0	0
1986	0	0	42	13	2,718	0	0	0	0
1987	0	0	0	13	2,024	0	0	0	0
1988	0	0	186	67	744	0	0	0	0
1989	0	0	67	31	600	0	0	0	0
1990	0	0	163	49	954	0	0	0	0
1991	11	2,564	314	119	101	0	0	0	0
1992	0	0	16	111	13	13	0	0	0
1993	2	0	61	80	22	8	56	0	30
1994	4	0	18	55	296	3	15	5	4
1995	0	0	12	174	35	12	25	2	0
1996	0	0	2	219	81	123	70	0	0
1997	0	0	27	253	56	0	62	2	0
1998	0	0	57	67	34	0	23	2	0
1999	0	0	94	0	34	38	7	2	0
2000	0	0	0	0	15	0	16	0	0
2001[1]	0	0	0	0	58	0	18	1	0

Year	Norway	Poland	Portugal	Russia[3]	Spain	UK (E&W)	UK (Scot.)	Total
1984	4,376	0	0	15,181	0	23	0	21,883
1985	5,464	0	0	10,237	0	5	0	19,945
1986	7,890	0	0	12,200	0	10	2	22,875
1987	7,261	0	0	9,733	0	61	20	19,112
1988	9,076	0	0	9,430	0	82	2	19,587
1989	10,622	0	0	8,812	0	6	0	20,138
1990	17,243	0	0	4,764[2]	0	10	0	23,183
1991	27,587	0	0	2,490[2]	132	0	2	33,320
1992	7,667	0	31	718	23	10	0	8,602
1993	10,380	0	43	1,235	0	16	0	11,933
1994	8,428	0	36	283	1	76	2	9,226
1995	9,368	0	84	794	1,106	115	7	11,734
1996	11,623	0	79	1,576	200	317	57	14,347
1997	7,661	12	50	1,038	157[2]	67	25	9,410
1998	8,435	31	99	2,659	259[2]	182	45	11,893
1999	15,004	8	49	3,823	319[2]	94	45	19,517
2000	9,223[2]	3	37	4,568	375[2]	112	43	14,392
2001[1]	10,875	2	35	4,692	198[2]	100	30	16,011

[1] Provisional figures.
[2] Working Group figures.
[3] USSR prior to 1991.

Table 3.1.6.2 Greenland halibut. Nominal catch (t) by countries in Subarea I as officially reported to ICES.

Year	Estonia	Faroe Islands	Fed. Rep. Germany	Greenland	Iceland	Norway	Russia[3]	Spain	UK (E & W)	UK (Scot.)	Total
1984	-	-	-	-	-	593	81	-	17	-	691
1985	-	-	-	-	-	602	122	-	1	-	725
1986	-	-	1	-	-	557	615	-	5	1	1,179
1987	-	-	2	-	-	984	259	-	10	+	1,255
1988	-	9	4	-	-	978	420	-	7	-	1,418
1989	-	-	-	-	-	2,039	482	-	+	-	2,521
1990	-	7	-	-	-	1,304	321[2]	-	-	-	1,632
1991	164	-	-	-	-	2,029	522[2]	-	-	-	2,715
1992	-	-	+	-	-	2,349	467	-	-	-	2,816
1993	-	32	-	-	56	1,754	867	-	-	-	2,709
1994	-	17	217	-	15	1,165	175	-	+	-	1,589
1995	-	12	-	-	25	1,352	270	84	-	-	1,743
1996	-	2	+	-	70	911	198	-	+	-	1,181
1997	-	15	-	-	62	610	170	-	+	-	857
1998	-	47	+	-	23	859	491	-	2	-	1,422
1999	-	91	-	13	7	1,101	1,203	-	+	-	2,415
2000	-	-	+	-	16	920[2]	1,169	-	1	-	2,106
2001[1]	-	-	+	-	18	844[2]	951	-	2	-	1,815

[1]Provisional figures.
[2] Working Group figures.
[3] USSR prior to 1991.

Table 3.1.6.3 Greenland halibut. Nominal catch (t) by countries in Division IIa as officially reported to ICES.

Year	Estonia	Faroe Islands	France	Fed. Rep. Germ.	Green land	Ireland	Norway	Port ugal	Russia[5]	Spain	UK (E & W)	UK (Scot.)	Total
1984	-	-	138	265	-	-	3,703	-	5,459	-	1	-	9,566
1985	-	-	239	254	-	-	4,791	-	6,894	-	2	-	12,180
1986	-	6	13	97	-	-	6,389	-	5,553	-	5	1	12,064
1987	-	-	13	75	-	-	5,705	-	4,739	-	44	10	10,586
1988	-	177	67	150	-	-	7,859	-	4,002	-	56	2	12,313
1989	-	67	31	104	-	-	8,050	-	4,964	-	6	-	13,222
1990	-	133	49	12	-	-	8,233	-	1,246[2]	-	1	-	9,674
1991	1,400	314	119	21	-	-	11,189	-	305[2]	-	+	1	13,349
1992	-	16	108	1	13[4]	-	3,586	15[3]	58	-	1	-	3,798
1993	-	29	78	14	8[4]	-	7,977	17	210	-	2	-	8,335
1994	-	-	47	33	3[4]	4	6,382	26	67	+	14	-	6,576
1995	-	-	174	30	12[4]	2	6,354	60	227	-	83	2	6,944
1996	-	-	219	34	123[4]	-	9,508	55	466	4	278	57	10,744
1997	-	-	253	23	-[4]	-	5,702	41	334	1	21	25	6,400
1998	-	-	67	16	-[4]	1	6,661	80	530	5	74	41	7,475
1999	-	-	-	20	25[4]	2	13,064	33	734	1	63	45	13,987
2000	-	-	-	10	-[4]	-	7,774[2]	18	690	1	65	43	8,601
2001[1]	-	-	-	49	-[4]	1	8,923[2]		13	-	56	30	9,798

[1]Provisional figures.
[2]Working Group figure.
[3]As reported to Norwegian authorities.
[4]Includes Division IIb.
[5] USSR prior to 1991.

Table 3.1.6.4 Greenland halibut. Nominal catch (t) by countries in Division IIb as officially reported to ICES.

Year	Den mark	Estonia	Faroe Isl.	Fra nce	Fed. Rep. Germ.	Ire land	Lith uania	Norway	Po land	Port ugal	Russia[4]	Spain	UK (E&W)	UK (Scot.)	Total
1984	-	-	-	-	1,900	-	-	80	-	-	9,641	-	5	-	11,626
1985	-	-	-	-	3,746	-	-	71	-	-	3,221	-	2	-	7,040
1986	-	-	36	-	2,620	-	-	944	-	-	6,032	-	+	-	9,632
1987	+	-	-	-	1,947	-	-	572	-	-	4,735	-	7	10	7,271
1988	-	-	-	-	590	-	-	239	-	-	5,008	-	19	+	5,856
1989	-	-	-	-	496	-	-	533	-	-	3,366	-	-	-	4,395
1990	-	-	23[2]	-	942	-	-	7,706	-	-	3,197[2]	-	9	-	11,877
1991	11	1,000	-	-	80	-	-	14,369	-	-	1,663[2]	132	+	1	17,256
1992	-	-	-	3[2]	12	-	-	1,732	-	16	193	23	9	-	1,988
1993	2[3]	-	-	2[3]	8	-	30[3]	649	-	26	158	-	14	-	889
1994	4	-	1[3]	8[3]	46	1	4[3]	881	-	10	41	1	62	2	1,061
1995	-	-	-	-	5	-	-	1,662	-	24	297	1,022	32	5	3,047
1996	+	-	-	-	47	-	-	1,204	-	24	912	196	39	+	2,422
1997	-	-	12	-	33	2	-	1,349	12	9	534	156[2]	46	+	2,153
1998	-	-	10	-	18	1	-	915	31	19	1,638	254[2]	106	4	2,996
1999	-	-	3	-	14	-	-	839	8	16	1,886	318[2]	31	-	3,115
2000	-	-	-	-	5	-	-	529[2]	3	19	2,709	374[2]	46	-	3,685
2001[1]	-	-	-	-	9	-	-	1,108[2]	2	22	3,017	198[2]	42	-	4,398

[1]Provisional figures.
[2]Working Group figure.
[3]As reported to Norwegian authorities.
[4] USSR prior to 1991.

Table 3.1.6.5 Greenland halibut in Subareas I and II.

Year	Recruitment Age 5 thousands	SSB tonnes	Landings tonnes	Mean F Ages 6-10
1964	42840	72644	40391	0.3146
1965	51686	69254	34751	0.2643
1966	57828	68557	26321	0.1601
1967	70443	76709	24267	0.1376
1968	64280	90723	26168	0.1309
1969	55932	116540	43789	0.1988
1970	41112	139620	89484	0.4204
1971	31550	111283	79034	0.4223
1972	33555	94880	43055	0.3019
1973	31061	95795	29938	0.2252
1974	26642	91519	37763	0.2787
1975	22540	79760	38172	0.3360
1976	22098	62686	36074	0.4264
1977	23687	45322	28827	0.3409
1978	20592	35938	24617	0.3659
1979	19700	35653	17312	0.1911
1980	18602	34654	13284	0.1720
1981	17875	39586	15018	0.1445
1982	18928	38430	16789	0.2188
1983	19002	42792	22147	0.2912
1984	17808	39254	21883	0.3383
1985	19925	41175	19945	0.3053
1986	19854	40620	22875	0.3513
1987	19423	30373	19112	0.3491
1988	22960	26843	19587	0.4056
1989	20706	24116	20138	0.3189
1990	14501	21053	23183	0.4245
1991	12624	24960	33320	0.6605
1992	10485	16093	8602	0.2457
1993	12807	18115	11933	0.3191
1994	17910	15671	9226	0.2703
1995	16857	14210	11734	0.3199
1996	17385	14095	14347	0.3500
1997	17676	15157	9628	0.2469
1998	16283	16643	12507	0.2550
1999	14080	18814	19350	0.3956
2000	17894	20819	14392	0.2806
2001	14306	22695	16011	0.2670
2002	15169	23344		
Average	25862	48369	26184	0.3012

3.1.7 Norwegian spring-spawning herring

State of stock/exploitation: The stock is inside safe biological limits. The stock is harvested at or slightly below $\mathbf{F}_{pa}$ = 0.15. The recruitment of the very strong 1992 year class led to an increase in SSB in 1997 to approximately 9 million t, but SSB has since declined to just over 5 million t in 2001. The incoming year classes 1998 and 1999 are estimated to be strong.

Management objectives: EU, Faroe Islands, Iceland, Norway, and Russia agreed to implement a long-term management plan. This plan consists of the following elements:

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the critical level ($\boldsymbol{B}_{lim}$) of 2 500 000 t.*
2. *For the year 2001 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of less than 0.125 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of this fishing mortality rate.*
3. *Should the SSB fall below a reference point of 5 000 000 t ($\boldsymbol{B}_{pa}$), the fishing mortality rate, referred under paragraph 2, shall be adapted in the light of scientific estimates of the conditions to ensure a safe and rapid recovery of the SSB to a level in excess of 5 000 000 t. The basis for such an adaptation should be at least a linear reduction in the fishing mortality rate from 0.125 at $\boldsymbol{B}_{pa}$ (5 000 000 t) to 0.05 $\boldsymbol{B}_{lim}$ (2 500 000 t).*
4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

ICES considers that the objectives of this agreement are consistent with the precautionary approach.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 2.5 million t	$\mathbf{B}_{pa}$ be set at 5.0 million t.
$\mathbf{F}_{lim}$ not considered relevant for this stock	$\mathbf{F}_{pa}$ be set at F = 0.15

Technical basis:

$\mathbf{B}_{lim}$: MBAL	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa}=\mathbf{B}_{lim}$ * exp(0.4*1.645) (ICES Study Group 1998)
$\mathbf{F}_{lim}$:	$\mathbf{F}_{pa}$: ICES Study Group 1998

Advice on management: ICES advises that this fishery should be managed according to the agreed management plan, corresponding to a catch of 710 000 t in 2003.

Rebuilding plan: Incorporated to the agreed long-term management strategy.

Catch forecast for 2003:
Basis: TAC constraint; Landings (2002) = 850; F_w(2002) =0.17; SSB(2002)=5300; SSB (2003) = 5800.

F_w(2003)	Multiplier	Catch (2003)	Landings (2003)	SSB (2004)
0.103	0.69 * Fw(2001)	600	600	5965
0.113	0.75 * Fw(2001)	650	650	5913
0.124	0.83 * Fw(2001)	710	710	5850
0.131	0.87 * Fw(2001)	750	750	5807
0.14	0.93 * Fw(2001)	800	800	5755
0.15	$\mathbf{F}_{pa}$=1.0 * Fw(2001)	850	850	5703

Weights in '000 t.

For 2002 landings of 850 000 t were assumed to correspond to the agreed TAC. In recent years the actual catch was close to the TAC, but in 2001 the catch was less than the TAC.
F_w=weighted F, used in the management plan. Flat selection used from age 8 onwards.

Medium- and long-term projections: The medium-term view of the stock is very sensitive to the estimate of the 1999 year class. The 1999 year class is now estimated to be much lower than assumed last year. Therefore the medium term projections now indicate lower future yields and SSB.

Comparison with previous assessment and advice: Last year the spawning stock estimate for 2001 was 6.1 million t. This year's estimate of the spawning stock in 2001 is 5.2 million t. The catch forecasted for 2003 is lower than the catch forecasted in 2001 for 2002. This is due to lower estimates of recruitment than were used earlier.

Relevant factors to be considered in management: In spite of the strong 1998 and 1999 year classes, continued fishing under the present management agreement gives a

low probability of falling below $\mathbf{B}_{lim}$ in the medium-term, but a probability of about 50% of the spawning stock falling below $\mathbf{B}_{pa}$ (5.0 million t).

Elaboration and special comment: The main catches from the fishery in 2001 were taken by Norway (495 000 t), Iceland (78 000 t), Russia (109 000 t), and Faroe Islands (34 000 t). Lesser catches were taken by a number of EU fleets (54 000 t). The fisheries in general follow closely the migration of the stock as it moves from the wintering and spawning grounds along the Norwegian coast to the summer feeding grounds in the Jan Mayen and international areas. The Norwegian fishery exploits the stock as it migrates to and remains on the wintering areas and during the spawning period. The Icelandic fishery takes place mainly in May and June, and most catches are taken in international waters and in the Jan Mayen EEZ. The main Russian catches are taken along the shelf region of the Norwegian EEZ in spring as the stock moves from the spawning grounds, and also in August and September in the eastern part of the international area and in the Norwegian zone. The Faroese catches, taken mainly in spring and early summer, are from the Norwegian zone and from the Jan Mayen area. Most of the EU catches are taken in the international area and in the Norwegian zone.

A large increase in fishing effort, new technology, and environmental changes contributed to the collapse of this stock around 1970. Recruitment failed when the SSB was reduced below 2.5 million t. In the years following the collapse the aim was to rebuild the spawning stock above this minimum limit. In order to reach this goal, fishing mortality was kept low. However, recruitment remained poor and SSB increased only slowly until a very strong year class occurred in 1983. As this year class recruited, management between 1985 and 1993 aimed at restricting the fishing mortality to 0.05, although the actual F was much higher in some years. Year classes after 1983 were on average more than four times stronger than those produced between 1970 and 1982, and SSB continued to increase. Starting in 1989 a succession of above-average to very strong year classes were produced, promoting full recovery of the SSB and allowing expansion of fisheries. Up to 1994, the fishery was almost entirely confined to Norwegian coastal waters. Since 1992 the coastal fishery has increased sharply. During the summer of 1994 there were also catches in the offshore areas of the Norwegian Sea for the first time in 26 years. The geographical extent of this fishery increased in 1995, with nine nations participating and a total catch exceeding 900 000 t. The fishery expanded further in 1996 and the annual level of the fishery was in the order of 1.2-1.5 million t in the period 1996-2000. An international management agreement includes a TAC consistent with a maximum fishing mortality of F=0.125 from 2002. A pre-agreed stock recovery strategy was introduced to the management agreement in 2001.

Juveniles and adults of this stock form an important part of the ecosystem in the Barents Sea and the Norwegian Sea. The herring has an important role as transformer of the plankton production to higher trophic levels (cod, seabirds, and marine mammals). It is therefore important to facilitate a high production of the herring.

A report based on the distribution of herring over the summer feeding areas in 2002 by an international ICES co-ordinated survey will be available in September 2002.

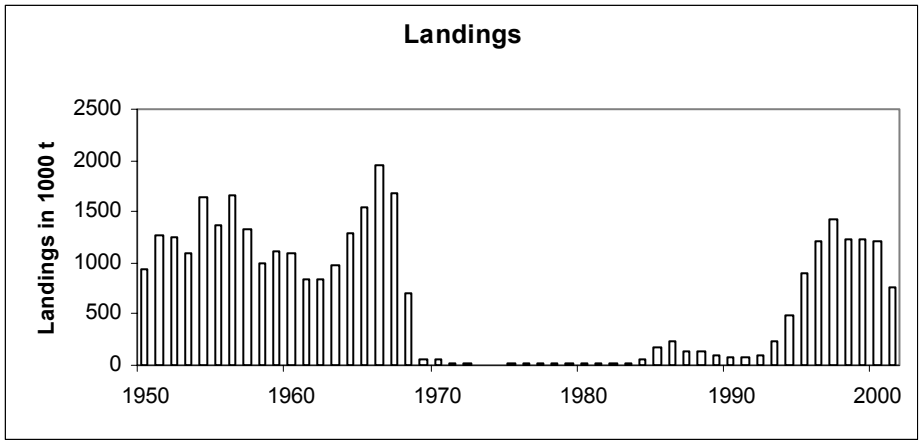
Data and assessment: Analytical assessment based on catch, survey data (acoustic surveys of adults and juveniles, larval index), and tagging data.

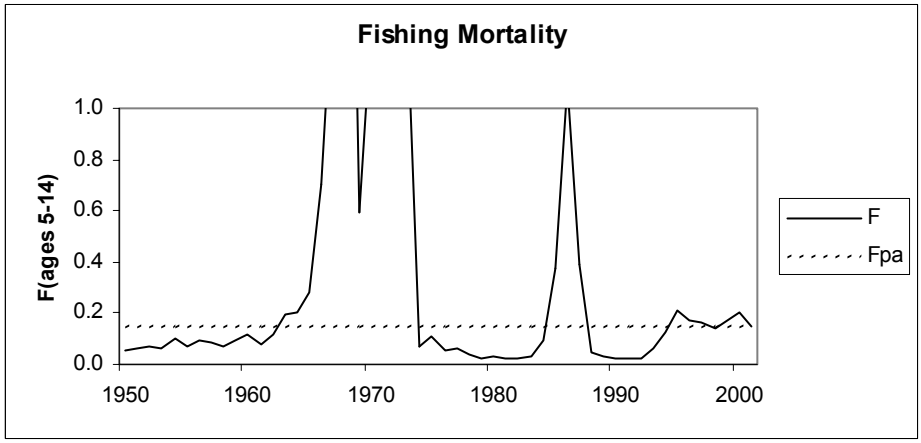
Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

Catch data (Tables 3.1.7.1–3).

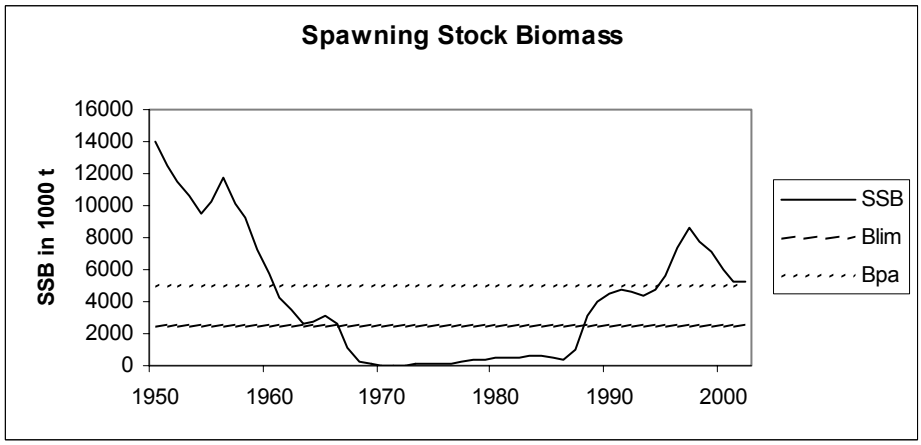
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	150	115	127
1988	TAC	120–150	120	135
1989	TAC	100	100	104
1990	TAC	80	80	86
1991	No fishing from a biological point of view	0	76	85
1992	No fishing from a biological point of view	0	98	104
1993	No increase in F	119	200	232
1994	Gradual increase in F towards $\mathbf{F}_{0.1}$; TAC suggested	334	450	479
1995	No increase in F	513	None[1]	906
1996	Keep SSB above 2.5 million t	-	None[2]	1 217
1997	Keep SSB above 2.5 million t	-	1 500	1 420
1998	Do not exceed the harvest control rule	-	1 300	1 223
1999	Do not exceed the harvest control rule	1 263	1 300	1 235
2000	Do not exceed the harvest control rule	max 1 500	1 250	1 207
2001	Do not exceed the harvest control rule	753	850	770
2002	Do not exceed the harvest control rule	853	850	
2003	Do not exceed the harvest control rule	710		

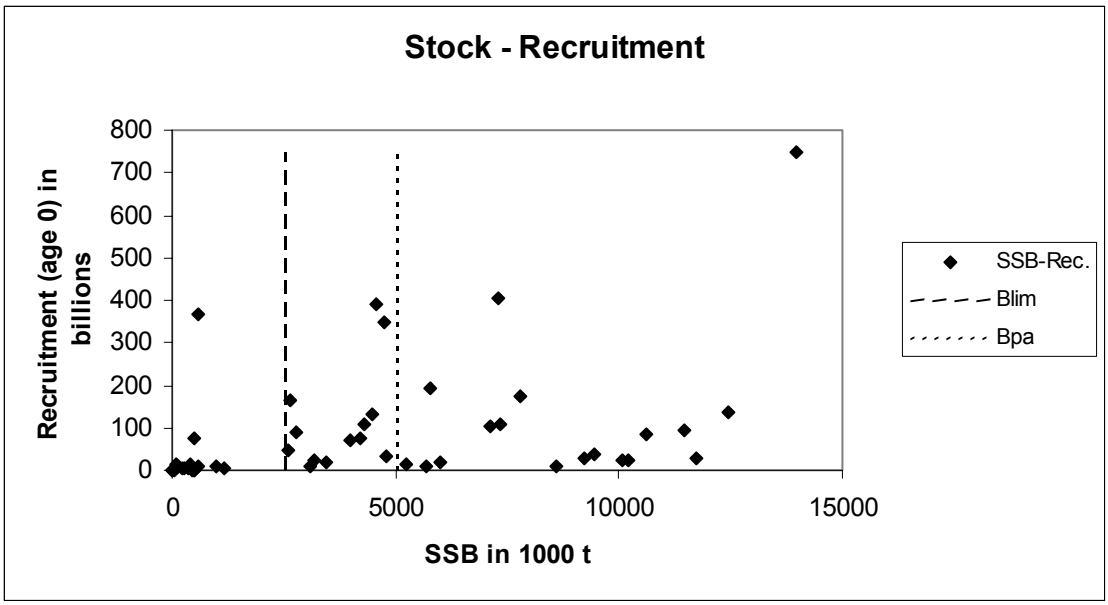
[1]Autonomous TACs totaling 900 000 t; [2]Autonomous TACs totaling 1 425 000 t were set by April 1996. Weights in ‘000 t.

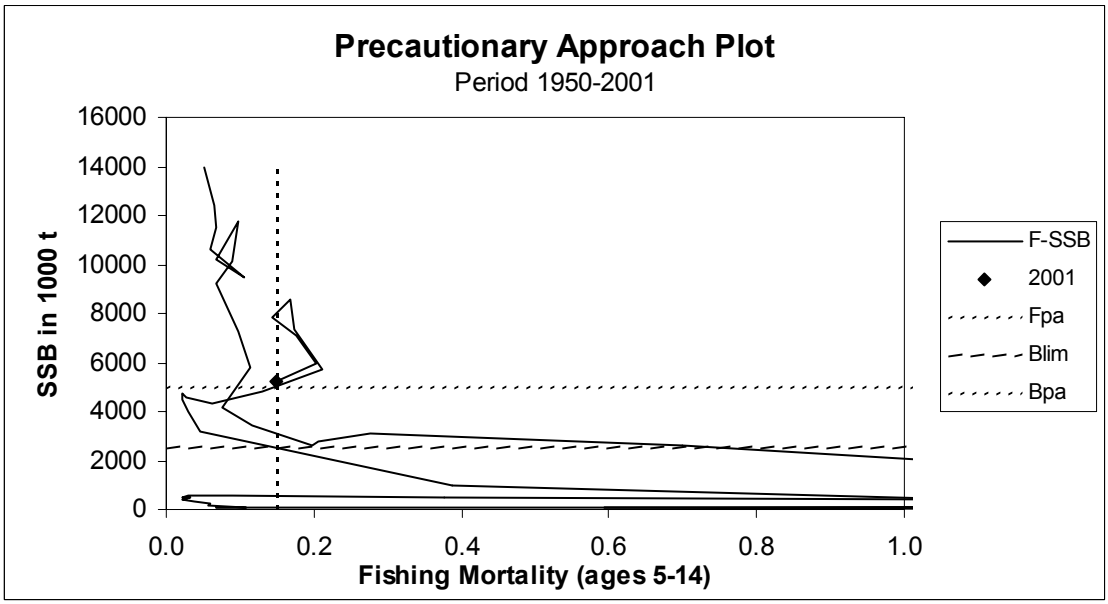

Landings
Landings in 1000 t
2500
2000
1500
1000
500
0
1950
1960
1970
1980
1990
2000


Fishing Mortality
F(ages 5-14)
1.0
0.8
0.6
0.4
0.2
0.0
1950
1960
1970
1980
1990
2000
F
Fpa

Recruitment (age 0)
Recruitment in billions
800
700
600
500
400
300
200
100
0
1950
1960
1970
1980
1990
2000


Spawning Stock Biomass
SSB in 1000 t
16000
14000
12000
10000
8000
6000
4000
2000
0
1950
1960
1970
1980
1990
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
800
700
600
500
400
300
200
100
0
0
5000
10000
15000
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Precautionary Approach Plot
Period 1950-2001
SSB in 1000 t
16000
14000
12000
10000
8000
6000
4000
2000
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 5-14)
F-SSB
2001
Fpa
Blim
Bpa

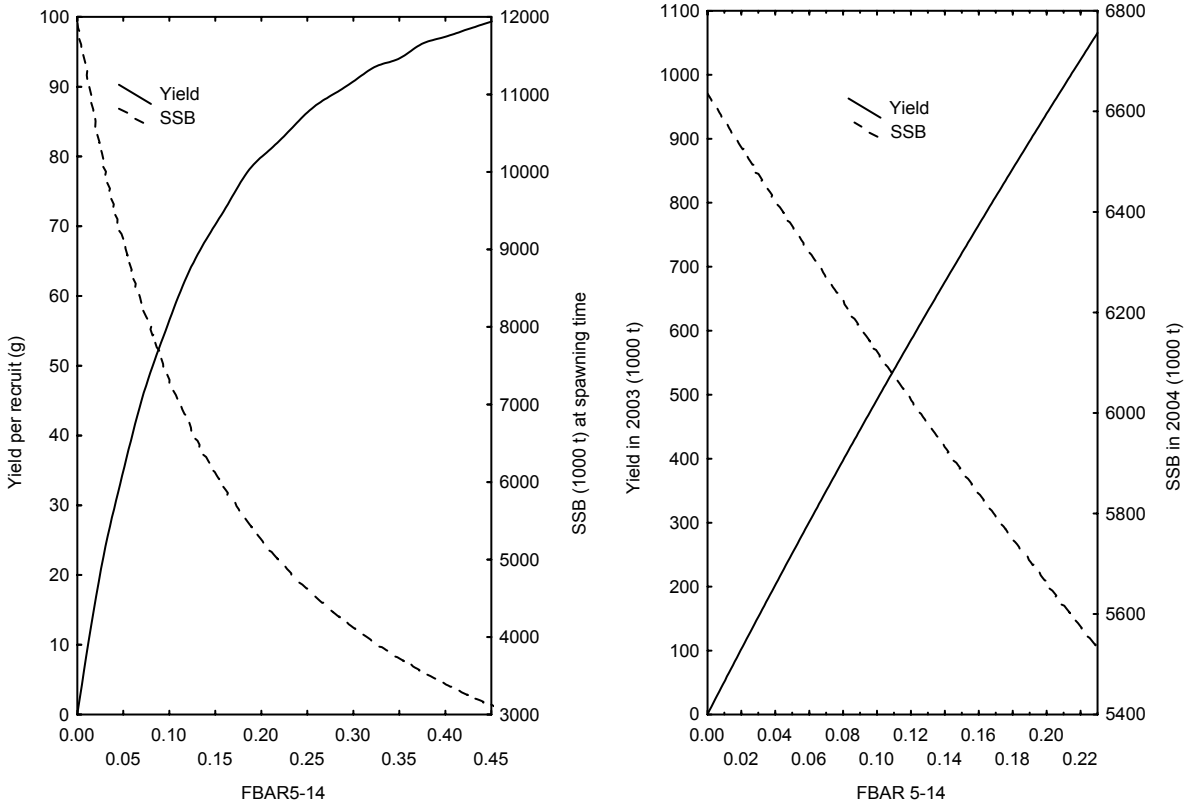


Figure 3.1.7.1 Results of yield-per-recruit analysis. Short-term predictions.

Table 3.1.7.1 Catches of Norwegian spring-spawning herring (tonnes) since 1972.

Year	A	B[1]	C	D	Total	Total catch used in WG
1972	-	9895	3,266[2]	-	13,161	13,161
1973	139	6,602	276	-	7,017	7,017
1974	906	6,093	620	-	7,619	7,619
1975	53	3,372	288	-	3,713	13,713
1976	-	247	189	-	436	10,436
1977	374	11,834	498	-	12,706	22,706
1978	484	9,151	189	-	9,824	19,824
1979	691	1,866	307	-	2,864	12,864
1980	878	7,634	65	-	8,577	18,577
1981	844	7,814	78	-	8,736	13,736
1982	983	10,447	225	-	11,655	16,655
1983	3,857	13,290	907	-	18,054	23,054
1984	18,730	29,463	339	-	48,532	53,532
1985	29,363	37,187	197	4,300	71,047	169,872
1986	71,122[3]	55,507	156	-	126,785	225,256
1987	62,910	49,798	181	-	112,899	127,306
1988	78,592	46,582	127	-	125,301	135,301
1989	52,003	41,770	57	-	93,830	103,830
1990	48,633	29,770	8	-	78,411	86,411
1991	48,353	31,280	50	-	79,683	84,683
1992	43,688	55,737	23	-	99,448	104,448
1993	117,195	110,212	50	-	227,457	232,457
1994	288,581	190,643	4	-	479,228	479,228
1995	320,731	581,495	0	-	902,226	902,226
1996	462,248	758,035	0	-	1,220,283	1,220,283
1997[5]			0	-	1,426,507	1,426,507
1998[5]			0	-	1,223,131	1,223,131
1999[6]			0	-	1,235,433	1,235,433
2000[7]			0	-	1,207,201	1,207,201
2001[8]			0	-	770,066	770,066

A = catches of adult herring in winter

B = mixed herring fishery in remaining part of the year

C = by-catches of 0- and 1-group herring in the sprat fishery

D = USSR-Norway by-catch in the capelin fishery (2-group)

1 Includes also by-catches of adult herring in other fisheries

2 In 1972, there was also a directed herring 0-group fishery

3 Includes 26,000 t of immature herring (1983 year class) fished by USSR in the Barents Sea

4 Preliminary, as provided by Working Group members

5 Details of catches by fishery and ICES area given in ICES 1999

6 Details of catches by fishery and ICES area given in ICES 2000

7 Details of catches by fishery and ICES area given in ICES 2001

8 Details of catches by fishery and ICES area given in Tables 3.2.3-3.2.5

Table 3.1.7.2 Total catch of Norwegian spring-spawning herring (tonnes) since 1972. Data provided by Working Group members.

Year	Norway	USSR/ Russia	Denmark	Faroes	Iceland	Ireland	Nether-lands	Greenland	UK	Germany	France	Sweden	Total
1972	13,161	-	-	-	-	-	-	-	-	-	-	-	13,161
1973	7,017	-	-	-	-	-	-	-	-	-	-	-	7,017
1974	7,619	-	-	-	-	-	-	-	-	-	-	-	7,619
1975	13,713	-	-	-	-	-	-	-	-	-	-	-	13,713
1976	10,436	-	-	-	-	-	-	-	-	-	-	-	10,436
1977	22,706	-	-	-	-	-	-	-	-	-	-	-	22,706
1978	19,824	-	-	-	-	-	-	-	-	-	-	-	19,824
1979	12,864	-	-	-	-	-	-	-	-	-	-	-	12,864
1980	18,577	-	-	-	-	-	-	-	-	-	-	-	18,577
1981	13,736	-	-	-	-	-	-	-	-	-	-	-	13,736
1982	16,655	-	-	-	-	-	-	-	-	-	-	-	16,655
1983	23,054	-	-	-	-	-	-	-	-	-	-	-	23,054
1984	53,532	-	-	-	-	-	-	-	-	-	-	-	53,532
1985	167,272	2,600	-	-	-	-	-	-	-	-	-	-	169,872
1986	199,256	26,000	-	-	-	-	-	-	-	-	-	-	225,256
1987	108,417	18,889	-	-	-	-	-	-	-	-	-	-	127,306
1988	115,076	20,225	-	-	-	-	-	-	-	-	-	-	135,301
1989	88,707	15,123	-	-	-	-	-	-	-	-	-	-	103,830
1990	74,604	11,807	-	-	-	-	-	-	-	-	-	-	86,411
1991	73,683	11,000	-	-	-	-	-	-	-	-	-	-	84,683
1992	91,111	13,337	-	-	-	-	-	-	-	-	-	-	104,448
1993	199,771	32,645	-	-	-	-	-	-	-	-	-	-	232,457
1994	380,771	74,400	-	2,911	21,146	-	-	-	-	-	-	-	479,228
1995	529,838	101,987	30,577	57,084	174,109	-	7,969	2,500	881	556	-	-	905,501
1996	699,161	119,290	60,681	52,788	164,957	19,541	19,664	-	46,131	11,978	-	22,424	1,220,283
1997	860,963	168,900	44,292	59,987	220,154	11,179	8,694	-	25,149	6,190	1,500	19,499	1,426,507
1998	743,925	124,049	35,519	68,136	197,789	2,437	12,827	-	15,971	7,003	605	14,863	1,223,131
1999	740,640	157,328	37,010	55,527	203,381	2,412	5,871	-	19,207	-	-	14,057	1,235,433
2000	713,500	163,261	34,968	68,625	186,035	8,939	-	-	14,096	3,298	-	14,749	1,207,201
2001[1]	495,036	109,054	24,038	34,170	77,693	-	6,439	-	12,230	1,588	-	9,818	770,066

[1] Preliminary, as provided by Working Group members.

Table 3.1.7.3 Norwegian spring-spawning herring.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean Fw Ages 5-14
1950	747374656	13973473	933000	0.0510
1951	138271856	12440190	1278400	0.0662
1952	93898752	11481773	1254800	0.0680
1953	83577056	10613262	1090600	0.0605
1954	39702936	9445040	1644500	0.1046
1955	23753764	10209083	1359800	0.0687
1956	27477146	11716413	1659400	0.0966
1957	23650648	10092566	1319500	0.0893
1958	27810502	9220304	986600	0.0677
1959	405342656	7297327	1111100	0.0966
1960	191338608	5769169	1101800	0.1144
1961	73282680	4192520	830100	0.0767
1962	17712882	3464804	848600	0.1163
1963	164640160	2635437	984500	0.1967
1964	90556040	2795154	1281800	0.2063
1965	7932618	3067483	1547700	0.2775
1966	45349292	2595295	1955000	0.6998
1967	3582245	1145486	1677200	1.5174
1968	4638550	219026	712200	3.4514
1969	9607348	77541	67800	0.5946
1970	620670	30718	62300	1.3252
1971	209800	8231	21100	1.5272
1972	907351	1854	13161	1.5716
1973	12701698	74400	7017	1.3382
1974	8500675	85341	7619	0.0681
1975	2942588	91377	13713	0.1072
1976	10018746	145980	10436	0.0558
1977	5039343	283511	22706	0.0588
1978	6133163	354752	19824	0.0390
1979	12434718	385577	12864	0.0223
1980	1539331	468611	18577	0.0322
1981	1091881	502691	13736	0.0224
1982	2329740	501560	16655	0.0207
1983	369237184	572712	23054	0.0299
1984	11404527	597396	53532	0.0902
1985	77134728	495227	169872	0.3771
1986	11516681	414411	225256	1.0917
1987	9714410	990639	127306	0.3886
1988	24571120	3173305	135301	0.0472
1989	72537216	3964735	103830	0.0298
1990	132600400	4497853	86411	0.0212
1991	349603520	4725509	84683	0.0229
1992	392433184	4583487	104448	0.0268
1993	107313712	4316113	232457	0.0630
1994	34715184	4784792	479228	0.1289
1995	11482169	5684302	905501	0.2126
1996	109362248	7328347	1220283	0.1744
1997	10204600	8583621	1426507	0.1670
1998	172066692	7801115	1223131	0.1444
1999	104319503	7140983	1235433	0.1752
2000	19600858	5987621	1207201	0.2040
2001	12298016	5217729	770054	0.1481
2002		5288000		
Average	83001655	4179884	648031	0.3414

3.1.8 Barents Sea capelin (Subareas I and II, excluding Division IIa west of 5°W)

State of stock/exploitation: The stock is within safe biological limits. The maturing component in autumn 2002 was estimated to be 1.3 mill. tonnes, and is predicted to be 0.7 mill. tonnes at the time of spawning in 2003 without fishing. This is above $\mathbf{B}_{lim}$ with a very high probability.

Management objectives: The fishery is managed according to a target escapement strategy, with a harvest control rule allowing (with 95% probability) the SSB to be above $\mathbf{B}_{lim}$, taking account of predation by cod.

Reference points:

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is set equal to 200 000 t, which is above the SSB_{1989}, the lowest SSB that has produced a good year class.	$\mathbf{B}_{pa}$ not defined (not relevant).
$\mathbf{F}_{lim}$ not defined (not relevant).	$\mathbf{F}_{pa}$ not defined (not relevant).

Advice on management: **In order to stay above $\mathbf{B}_{lim}$ with more than 95% probability, the catch in 2003 should be less than 310 000 t. ICES further recommends that the fishery should be directed on the spawning stock in the period January-April.**

Relevant factors to be considered in management: The estimated annual consumption of capelin by cod has varied between 0.2 and 3.0 million t over the period 1984-2001. Young herring consume capelin larvae, and this predation pressure is thought to be one of the causes for the poor year classes of capelin in the periods 1984–1987 and in 1992–1994. The abundance of herring in the Barents Sea is expected to increase from a low level in 2002 to an intermediate level in 2003.

There is no direct measurement of the SSB at spawning time for this stock. The SSB is estimated based on the results of the survey in September/October and projections taking into account growth, maturation, and mortality, as well as uncertainties in these parameters and in the survey. Hence, the historical estimates in Table 3.1.8.2 are median values of the modelled stochastic SSB and will change e.g. if there are changes in the historical stock values for Northeast Arctic cod. For this stock, a $\mathbf{B}_{lim}$ equal to the value of the 1989 spawning stock biomass, which is the lowest SSB having produced an outstanding year class, at least after 1980, is considered a good basis for such a reference point in a non-herring situation. The median value of the 1989 spawning stock biomass is 96 000 t, adjusted upwards from 69 000 t last year. The assessment method may not yet account for all sources of uncertainty, and there are inconsistencies in the data series. Thus, it is considered appropriate to use a somewhat higher value for $\mathbf{B}_{lim}$. The $\mathbf{B}_{lim}$ currently adopted by ICES is 200 000 t.

Keeping the stock above $\mathbf{B}_{lim}$ is intended to be a safeguard against recruitment failure. The expectation is that recruitment would be larger at a spawning stock larger than $\mathbf{B}_{lim}$. Furthermore, herring can have a negative influence on capelin recruitment and such an effect should be considered if it can be quantified. Adjustment of the harvest strategy, perhaps including a target biomass reference point, should also be investigated to take the uncertainty in the predicted amount of spawners together with the role of capelin as a prey item into account.

Catch forecast for 2003: The spawning stock in 2003 is projected from the acoustic survey in September-October 2002. For catches in 2003 below 310 000 t, the probability of having an SSB below 200 000 t is less than 5%, and with a catch of 310 000 tonnes, the expected SSB is 440 000 t. Only catches of mature fish have been considered. The proportion of large fish (suitable for human consumption) in the spawning stock is similar to the three previous years, but high compared to most years in the time-series.

Elaboration and special comments: The spawning stock in 2003 will consist almost exclusively of fish from the 1999 and 2000 year classes. The survey estimate at age 1 of the 2001 year class is the lowest since the 1994 year class, and is far below the long-term average. Observations during the international 0-group survey in August 2002 indicated that the size of the 2002 year class is somewhat above the long-term mean.

Since 1979, the fishery has been regulated by a bilateral agreement between Norway and Russia (formerly USSR). The catches have been very close to the advice in all years since 1987.

The assessment and stock history is based on joint Russian-Norwegian acoustic surveys mainly during September each year. From 1998 onwards, a model incorporating predation from cod has been used for predicting SSB and for estimating the historical time-series of SSB.

Sources of information: Report from the 2002 joint Russian-Norwegian meeting to assess the Barents Sea capelin stock, Kirkenes, October 7-9, 2002. Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, April-May 2002 (ICES CM 2002/ACFM:19).

Catch data (Tables 3.1.8.1–3):

Year	ICES Advice	Recommended TAC	Agreed TAC	ACFM catch
1987	Catches at lowest practical level	0	0	0
1988	No catch	0	0	0
1989	No catch	0	0	0
1990	No catch	0	0	0
1991	TAC	1000[1]	900	933
1992	SSB > 4–500 000 t	834	1100	1123
1993	A cautious approach, SSB > 4–500 000 t	600	630	586
1994	No fishing	0	0	0
1995	No fishing	0	0	0
1996	No fishing	0	0	0
1997	No fishing	0	0	1
1998	No fishing	0	0	1
1999	SSB> 500 000 t	79[1]	80	101
2000	5% probability of SSB< 200 000 t	435[1]	435	414
2001	5% probability of SSB< 200 000 t	630[1]	630	568
2002	5% probability of SSB< 200 000 t	650[1]	650	645[2]
2003	5% probability of SSB< 200 000 t	310[1]		

[1]Winter-spring fishery. [2] Includes the remaining part of the quota, set aside for Russian autumn fishery. Weights in '000 t.

Table 3.1.8.1 Barents Sea CAPELIN. International catch ('000 t) as used by the Working Group.

Year	Winter				Summer-Autumn			Total
	Norway	Russia	Others	Total	Norway	Russia	Total	
1965	217	7	0	224	0	0	0	224
1966	380	9	0	389	0	0	0	389
1967	403	6	0	409	0	0	0	409
1968	460	15	0	475	62	0	62	537
1969	436	1	0	437	243	0	243	680
1970	955	8	0	963	346	5	351	1314
1971	1300	14	0	1314	71	7	78	1392
1972	1208	24	0	1232	347	11	358	1591
1973	1078	35	0	1112	213	10	223	1336
1974	749	80	0	829	237	82	319	1149
1975	559	301	43	903	407	129	536	1439
1976	1252	231	0	1482	739	366	1105	2587
1977	1441	345	2	1788	722	477	1199	2987
1978	784	436	25	1245	360	311	671	1916
1979	539	343	5	887	570	326	896	1783
1980	539	253	9	801	459	388	847	1648
1981	784	428	28	1240	454	292	746	1986
1982	568	260	5	833	591	336	927	1760
1983	751	374	36	1161	758	439	1197	2358
1984	330	257	42	628	481	367	849	1477
1985	340	234	17	590	113	164	278	868
1986	72	51	0	123	0	0	0	123
1987	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
1991	528	156	20	704	31	195	226	929
1992	620	247	24	891	73	159	232	1123
1993	402	170	14	586	0	0	0	586
1994	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	1	1	1
1998	0	0	0	0	0	1	1	1
1999	46	32	0	78	0	23	23	101
2000	283	95	8	386	0	28	28	414
2001	368	180	8	557	0	11	11	568
2002[1]	391	228	0	619	0			

[1] Preliminary values.

Table 3.1.8.2 Barents Sea CAPELIN. Stock summary table. Recruitment and total biomass are survey estimates back-calculated to 1 August (before the autumn fishing season). Maturing biomass is the survey estimate of fish above maturity length (14.0 cm). SSB is the median value of the modeled stochastic spawning stock biomass (after the winter/spring fishery).

Year	Stock biomass August 1	Maturing biomass survey Oct. 1	Recruitment Age 1, August 1	Spawning stock biomass, assessment model	Landings	Herring biomass age 1 and 2
1965					224	
1966					389	
1967					409	
1968					537	
1969					680	
1970					1314	
1971					1392	
1972	5831	2182			1592	
1973	6630	1350	1140	*	1336	5
1974	7121	907	737	*	1149	160
1975	8841	2916	494	*	1439	280
1976	7584	3200	433	78	2587	153
1977	6254	2676	830	*	2987	162
1978	6119	1402	855	74	1916	199
1979	6576	1227	551	23	1783	143
1980	8219	3913	592	37	1648	233
1981	4489	1551	466	1030	1986	184
1982	4205	1591	611	623	1760	32
1983	4772	1329	612	69	2358	40
1984	3303	1208	183	61	1477	1598
1985	1087	285	47	*	868	1629
1986	157	65	9	*	123	751
1987	107	17	46	27	0	707
1988	361	200	22	*	0	263
1989	771	175	195	96	0	358
1990	4901	2617	708	154	0	674
1991	6647	2248	415	835	929	1335
1992	5371	2228	396	266	1123	2225
1993	991	330	3	63	586	3520
1994	259	94	30	67	0	2368
1995	189	118	8	45	0	763
1996	467	248	89	58	0	282
1997	866	312	112	127	1	664
1998	1860	931	188	156	1	1069
1999	2580	1718	171	505	106	1361
2000	3840	2099	475	760	414	1480
2001	3480	2019	128	751	568	555
2002	2122	1290	67	544	645[2]	40
Average	3742	1369	354	280	903	774

* Vanishing spawning stocks. [2] Includes the remaining part of the quota, set aside for Russian autumn fishery.

Table 3.1.8.3 Barents Sea CAPELIN. Larval abundance estimate (10^{12}) in June, and 0-group index in August.

Year	Larval abundance	0-group index
1981	9.7	570
1982	9.9	393
1983	9.9	589
1984	8.2	320
1985	8.6	110
1986	-	125
1987	0.3	55
1988	0.3	187
1989	7.3	1300
1990	13.0	324
1991	3.0	241
1992	7.3	26
1993	3.3	43
1994	0.1	58
1995	0.0	43
1996	2.4	291
1997	6.9[1]	522
1998	14.1[1]	428
1999	36.5[1]	722
2000	19.1[1]	303
2001	10.7[1]	221
2002	22.4[1]	327

[1]Is probably an underestimate, since the vessel was not allowed to work in Russian EEZ.

3.1.9 Northern Prawn (*Pandalus borealis*)

State of stock/exploitation: This stock is probably within safe biological limits. Surveys indicate that the biomass is lower than the long-term mean (1984–2001) (Figure 3.1.9.1). No estimates of fishing mortality are available. Fishing effort for both Russia and Norway declined in 2001.

Management objectives: There are no explicit management objectives for this stock.

Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES advises that current catch rates are sustainable.

Relevant factors to be considered in management: Shrimp is an important prey for several fish species, especially cod. Consumption by cod significantly influences shrimp population dynamics and should be taken into account in management. Cod consumption estimates are on average much higher than shrimp landings (Figure 3.1.9.3). The biomass of shrimp consumed by cod decreased in 2001. Survey indices since 1985 indicate that the shrimp biomass has varied cyclically without trend over that period.

Elaboration and special comment: Reported landings for all countries show a substantial increase in catches between 1995 (25 000 t) and 2000 (83 000 t) and a significant decrease in 2001 (Table 3.1.9.1). Catch increases from 1994–1999 encouraged the fishery to invest in larger vessels and new technology. The adoption of multiple trawl gears, predominantly by Norway, is not accounted for in the Norwegian CPUE series (Figure 3.1.9.2).

In the Svalbard area the shrimp fisheries are regulated by the number of effective fishing days and the number of vessels by country. In the Barents Sea and Svalbard area, Norwegian rules stipulate that the fisheries are to be regulated by the smallest allowable shrimp size (a maximum 10% of the catch weight may consist of shrimp less than 15 mm carapace length, CL) and by provisions of the fishing licenses. The Russian Economic Zone TAC is established each year by Russian authorities. In the Barents Sea and the Svalbard area fishing grounds are closed if by-catch limits for cod, haddock, redfish, or Greenland halibut are exceeded.

No analytical assessment is available. Commercial CPUE series and survey series are considered to be of reasonable quality, although in the future account will have to be taken of efficiency increases due to the use of multi-rig trawls.

Source of information: Report of the Arctic Fisheries Working Group, 16 - 25 April 2002 (ICES CM 2002/ACFM:18).

Shrimp (*Pandalus borealis*)

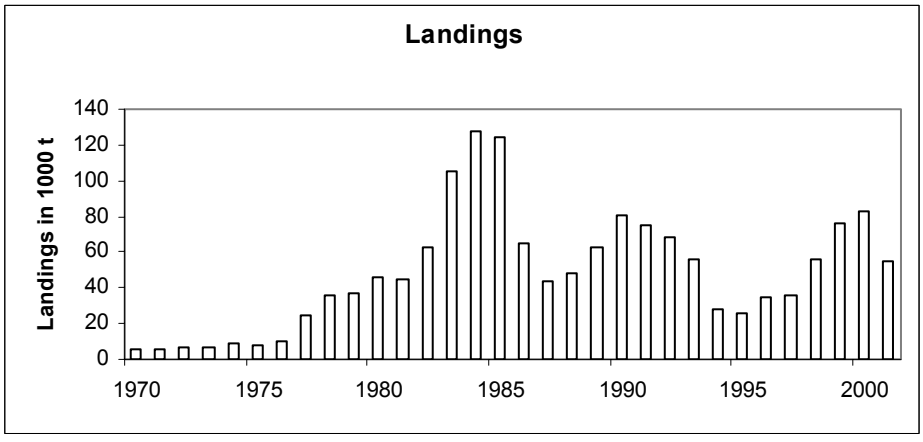


Table 3.1.9.1 Nominal shrimp catches (t) by country (Subareas I and II combined). Data provided by ICES and Working Group members.

Year	Norway	Russia	Others	Total
1970	5,508	0	0	5,508
1971	5,116	0	0	5,116
1972	6,772	0	0	6,772
1973	6,921	0	0	6,921
1974	8,008	992	0	9,000
1975	8,197	0	2	8,199
1976	9,752	548	0	10,300
1977	6,780	12,774	4,854	24,408
1978	20,484	15,859	0	36,343
1979	25,435	10,864	390	36,689
1980	35,061	11,219	0	46,280
1981	32,713	10,897	1,011	44,621
1982	43,451	15,552	3,835	62,832
1983	70,798	29,105	4,903	104,806
1984	76,636	43,180	8,246	128,062
1985	82.123	32,104	10,262	124,489
1986	48,569	10,216	6,538	65,232
1987	31,353	6,690	5,324	43,367
1988	32,021	12,320	4,348	48,698
1989	47,064	12,252	3,432	62,748
1990	54,182	20,295	6,687	81,164
1991	39,663	29,434	6,156	75,253
1992	39,657	20,944	8,021	68,622
1993	32,663	22,397	806	55,866
1994	20,116	7,108	1,063	28,333
1995	19,337	3,564	2,319	25,220
1996	25,445	5,747	3,320	34,512
1997	29,079	1,493	5,164	35,735
1998	44,792	4,895	6,103[1]	55,790
1999[5]	52,612	10,765	12,292[2]	75,669
2000[5]	54,979	19,596	8,241[3]	82,816
2001[5]	41,216	5,846	8,136[4]	55,198

[1] Catches reported by Estonia, Faroe Island, Iceland, Lithuania, Portugal, Spain, and UK(Eng.Wal.NI).
[2] Catches reported by Estonia, Faroe Islands, Germany, Greenland, Iceland, Lithuania, Portugal Spain, and UK(Eng.Wal.NI).
[3] Catches reported by Estonia, Faroe Islands, Iceland, Lithuania, Portugal, Spain, and UK.
[4] Catches reported by Estonia, Faroe Islands, Lithuania, Portugal, Spain, and UK.
[5] Preliminary data.

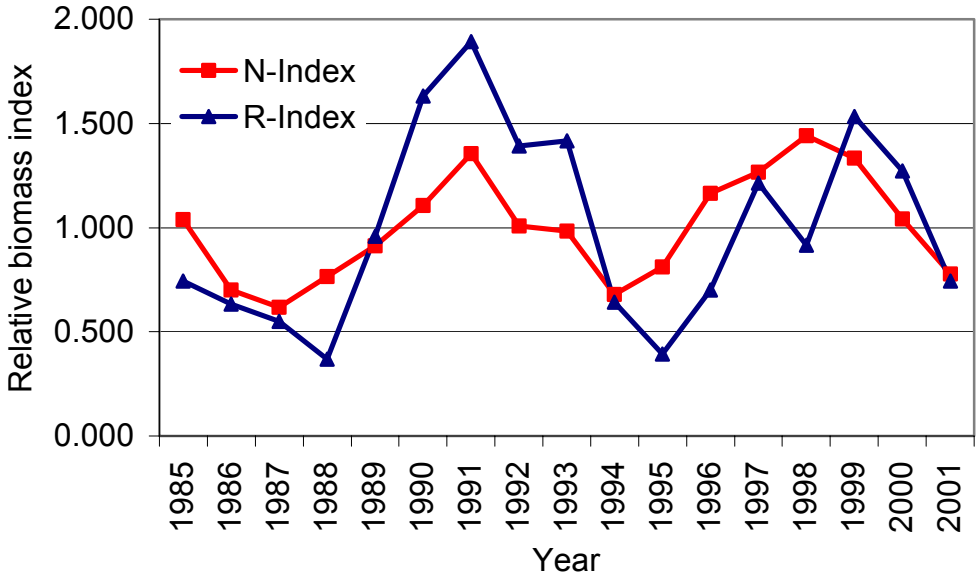


Figure 3.1.9.1 Shrimp biomass indices, from Norwegian and Russian surveys, scaled to the long-term mean (1985–2000).

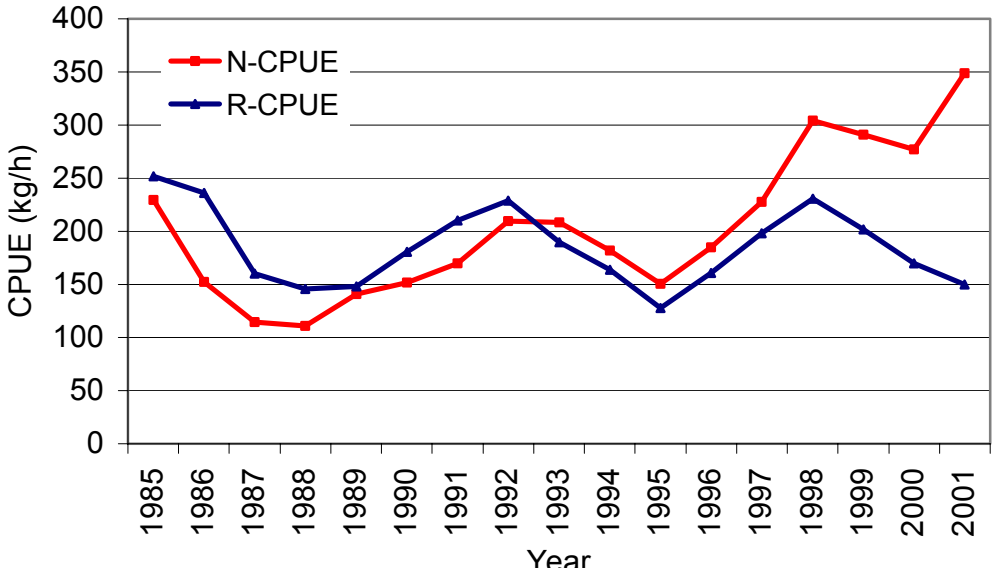


Figure 3.1.9.2 Shrimp CPUE indices for Norway and Russia (vessels <1300hp) (Subareas I and II).

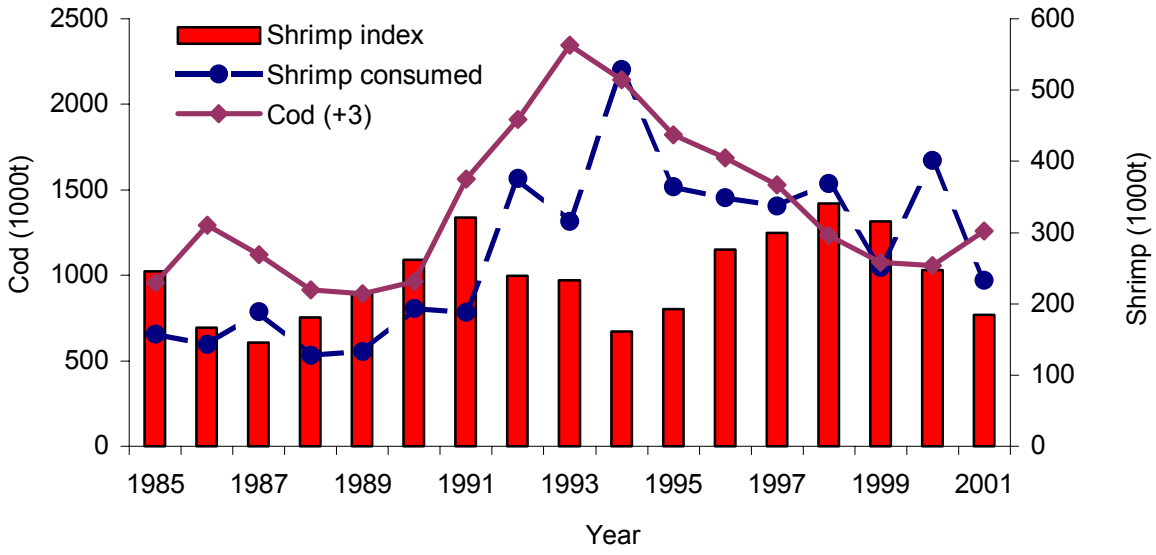


Figure 3.1.9.3 Biomass indices from the Norwegian surveys, biomass estimate for cod (age 3 years and older) and the shrimp consumed by the cod in the Barents Sea.

3.2 Stocks in Northwestern Areas (Division Va and Subareas XII and XIV)

3.2.1 Overview

The fisheries

Stocks in the northwestern areas have been exploited mainly by Icelandic vessels since the mid-seventies. However, vessels of other nationalities have also been operating in Subareas XII and XIV during this period. In the most recent years freezer and factory trawlers of various nationalities have been increasing in number in the pelagic deep-water fishery on redfish in Subareas XII and XIV. Norwegian vessels have also taken part in the capelin fishery, mainly in the Jan Mayen area.

The fisheries for the main pelagic species, Icelandic summer-spawning herring and capelin in the Iceland-East Greenland-Jan Mayen area, are almost exclusively carried out by purse seiners, although in recent years catches of herring by pelagic trawls have increased. The demersal species are mainly exploited by stern trawlers but considerable fisheries for cod are also carried out by gillnets, longline and handline. In general, effort is considered to have stabilised at high levels in recent years. Exceptions to this include the fisheries on herring and capelin, where harvest control rules have been implemented. Fisheries in these areas use the most up-to-date equipment both for navigation and in fish-detection. More effective fishing gears have been introduced in the fisheries, not least pelagic trawls, but there have also been substantial improvements of other gears such as bottom trawl, longline, and handline. New fishing technology permits fishing deeper with pelagic trawls.

Management measures

The demersal fisheries have been managed by TACs since 1984 and the pelagic fisheries since the seventies (except for pelagic redfish, which have been regulated since 1989). Fisheries in these areas are managed on a transferable quota system basis considered to lead to economic benefits in the long term. Each vessel (or factory) is allocated a proportion of the TAC of a fish stock and this proportion can be traded on a free-market. All fisheries are subject to a range of other management measures such as fishing gear regulations, closed areas, and closed seasons. Efforts have been made to prohibit discards through the introduction of a minimum catching size instead of a minimum landing size. These measures, however, are partly counterbalanced by other constraints on the fisheries such as quotas.

The state of stocks

The fish stocks considered in this report include the largest stocks in these areas: capelin, cod, and redfish. These and other species spawn in the warmer regions of Atlantic water, but they differ substantially in their distribution patterns during other periods of their life cycle. Greenland halibut and deep-sea *Sebastes mentella* are the only demersal deep-water species among the stocks considered. Saithe is migratory and migrations between Norway and Iceland have been observed. Pelagic redfish (both pelagic deep-sea and oceanic *Sebastes mentella*) constitute a vast resource although increasing effort is directed towards it. A number of other demersal commercial stocks inhabit both the continental shelf, e.g. flatfish species, and deeper waters, e.g. ling, blue ling, and tusk. Most of these stocks are regulated by TACs.

Most of the largest stocks have been at low levels during the most recent decade. Deep-sea *S. mentella* on the shelf is stable at a low level. Due to good recruitment in recent years the haddock is expected to increase rapidly. Saithe and Greenland halibut stock have both been declining for more than a decade but seem now to be starting to rebuild slowly. The capelin stock is considered to be at a relatively high level of stock biomass. The Icelandic summer-spawning herring has been increasing steadily during the last two decades and is at a higher level of stock size than observed in previous periods. Further information on the demersal stocks at Greenland and Iceland are given in a later section of this overview.

Other issues

The resources in the area have generally been managed on the basis of fairly long and detailed time-series of data. There are well known difficulties with the assessments, for example age readings of slow-growing species such as redfish and Greenland halibut. The problems are the same in these areas as elsewhere. Greenland halibut, pelagic redfish stocks in the Irminger Sea (Subareas XII and XIV), and deep-sea *S. mentella* on the shelf (Subareas V, XII and XIV) are the stocks with the most apparent need for improvements in data analysis and in the gathering of auxiliary information. Such auxiliary information required is trawl abundance or acoustic stock indices. Comprehensive assessment of these large and widely distributed stocks is a challenging task, which requires full-scale international cooperation.

Interaction between commercially valuable species is frequently observed but appears to be most pronounced for few species. The most important predator-prey relationships are the cod-capelin and cod-*Pandalus* interactions. Cod growth depends on capelin abundance and cod predation influences the recruitment of *Pandalus*. The high abundance of deep-water *Pandalus* in Icelandic waters in recent years is considered to be a result of this interaction caused by the low cod stock. Baleen whales have not been harvested commercially for some time and a continued increase in the

abundance of cetaceans is likely to result in increased natural mortality on stocks such as cod in Division Va.

Demersal stocks at Greenland and Iceland

The cod at Greenland and Iceland have four components spawning in different areas: A West Greenland offshore component spawning off Southwest Greenland (now virtually non-existing), an inshore component found in various West Greenland fjords, a component spawning off East Greenland, and a component spawning off Iceland. Eggs and larvae from the East Greenland-Iceland components are carried by the Irminger current to West Greenland. The inflow of larvae varies from year to year but for some year classes, such as those of 1973 and 1984, this inflow was very important.

Emigration of mature offshore cod from West Greenland is well known and most evident for year classes which were earlier observed as 0-group drifting from Iceland to Greenland.

The fishery off West Greenland has traditionally consisted of an offshore trawl fishery and an inshore fishery mostly using poundnets. The catches have fluctuated substantially, but declined dramatically after 1989, and the offshore fishery has now ceased.

Cod catches off East Greenland have also fluctuated widely and decreased sharply in 1993, when the directed cod fishery failed totally due to very low catch rates.

All available information confirms the severely depleted state of the cod stock off Greenland. The offshore stock may be considered to be almost non-existent at the present time. Strong year classes observed at Iceland as 0-groups in 1997–1999 only appeared as moderate at age 1 in bottom trawl surveys in Greenland waters. A rise in water temperatures at East- and West Greenland may provide the basis for a higher recruitment to the West Greenland area. The inshore stock component has historically been small and available information indicates that recruitment will be low during the next few years.

In Icelandic waters, the cod stock has shown signs of some recovery due to better recruitment of 1997-2000 year classes after a long period of poorer recruitment. The Icelandic saithe stock is considered to be outside safe biological limits. Saithe is taken in mixed fisheries with cod. The Icelandic haddock has for more than a decade been exploited at a very high fishing mortality. The stock is increasing from a low level in recent years. Several strong year classes have entered or are expected to enter the fishery.

The fishery for Greenland halibut in Subareas V and XIV is conducted by various nations but is still dominated by Icelandic trawlers in Division Va. The fishery in Divisions XIVb and Vb constitutes now about a third of the total fishery for Greenland halibut within Subareas V and XIV. Surveys have only recently been initiated for Greenland halibut. All indices, surveys as well as commercial CPUEs, suggest that the stock has stabilised and may be rebuilding slowly.

3.2.2 Cod

3.2.2.a Greenland cod (ICES Subarea XIV and NAFO Subarea 1)

State of stock/exploitation: The stock is outside safe biological limits. The offshore component is severely depleted since 1990 with some recovery potential as derived from recent survey indices. The dramatic decrease in stock abundance was associated with changes in environmental conditions, emigration and high fishing mortalities. Inshore catches and CPUE are presently low and both have declined continuously since 1991. Recruitment to the inshore component has been poor since the 1993 year class and indices indicate that the inshore stock is still declining. Only the offshore catches in Greenland are subject to a TAC regulation. The inshore fishery is unregulated. This gives cause for concern about the exploitation rate of the inshore component.

Management objectives: Greenland and EU established an agreement on fisheries valid from 2001 to 2006. A variable TAC regulation has been agreed, with annual TACs adjusted to take account of ICES advice on stock status. The agreement also provides for a transfer of catches into future years, should a rapid increase in stock occur.

No reference points have been proposed for this stock, so the Agreement cannot be evaluated relative to the Precautionary Approach. However, TAC for 2002 is not consistent with the current ICES advice, and ICES stresses that any multi-year management plan should ensure that fisheries do not expand until a substantial increase in biomass and recruitment is evident.

Advice on management: ICES recommends that no fishery should take place until a substantial increase in biomass and recruitment is evident. A recovery plan for both the inshore and offshore components should be developed in order to take advantage of strong year classes when they occur and to protect all inshore spawning components.

Relevant factors to be considered in management: Technical measures to avoid the by-catch of juvenile cod should be maintained (mandatory use of a 22 mm sorting grid since October 1, 2000).

Comparison with previous assessment and advice: The advice is the same as last year. The last analytical assessment was performed in 1996.

Elaboration and special comment: The historic fishery was mainly targeted at cod with some redfish as a by-catch. The fishery was international until the declaration of EEZs in the 1970s. During the 1980s EU vessels, mainly freezer trawlers, dominated the offshore fishery. During the late 1980s the offshore fishery was based almost exclusively on the 1984 and 1985 year classes. Thereafter, a total failure of the directed cod fishery indicated a stock collapse.

In Greenland waters there are inshore fjord stocks and offshore stocks. Given suitable climatic conditions (water temperature) and prudent management, sustained production of offshore cod is possible. However, interaction between the East Greenland and Irminger currents during the early 1970s and 1980s has apparently rendered climatic conditions unsuitable for offshore cod in some years. Combined with high fishing mortality, this caused the offshore cod stock to be severely depleted. In order to take advantage of suitable climatic conditions when they occur, it is necessary to protect the remaining biomass of offshore cod.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Tables 3.2.2.a.1–2):

Year	ICES advice for Subarea XIV[1]	Pred. catch corresp. to advice	Agreed TAC			ACFM Inshore Catch	ACFM total catch inshore + offshore		
			East	West	Total		East	West	Total
1987	TAC	5	11.5	12.5		8	7	12	19
1988	No increase in F	10[2]	11.5	53		23	9	63	72
1989	TAC	5	15	90		39	15	112	126
1990	No specific recommendation	-	15	110	125	30	34	98	132
1991	No advice	-	25	90	115	19	22	20	42
1992	No advice	-	17.25	66	99.25	6	11	6	17
1993	No fishing	0	17.25	66	83.25	2	1	2	3
1994	No fishing on offshore stock complex	0	17.25	66	83.25	2	< 1	2	3
1995	No fishing on offshore stock complex	0	17.25	66	83.25	2	< 1	2	2
1996	No fishing on offshore stock complex	0	17.25	66	83.25	1	< 1	1	1
1997	No fishing on offshore stock complex	0	17.25	66	83.25	1	< 1	1	1
1998	No fishing on offshore stock complex	0	17.25	66	83.25	< 1	< 1	< 1	< 1
1999	No fishing on offshore stock complex	0	17.25	66	83.25	< 1	< 1	< 1	< 1
2000	No commercial fishing	0	17.25	66	83.25	< 1	< 1	< 1	< 1
2001	No commercial fishing	0	17.25	66	83.25[3]	< 1	< 1	< 1	< 1
2002	No commercial fishing	0	17.25	66	83.25[3]				
2003	No commercial fishing	0	17.25	66	83.25[3]				

[1] Advice for NAFO Subarea 1 provided by NAFO Scientific Council.
[2] Preliminary catch corresponding to advice. Weights in '000 t.
[3] Since 2001 the agreed TAC is based on a variable system accounting for the actual stock status and more flexibility between East and West Greenland. The given TAC figures represent maximum levels, which could be taken in case of stock recovery only.

Greenland cod (ICES Subarea XIV & NAFO Subarea 1)

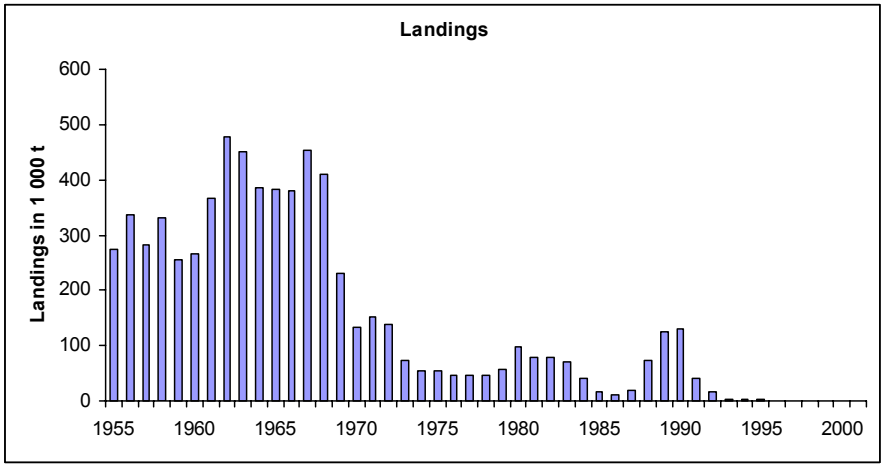


Table 3.2.2.a.1 Nominal catch (tonnes) of Cod in NAFO Subarea 1, 1988-2001 as officially reported to NAFO.

Country	1988	1989	1990	1991	1992	1993	1994
Faroe Islands	-	-	51	1	-	-	-
Germany	6.574	12.892	7.515	96	-	-	-
Greenland	52.135	92.152	58.816	20.238	5.723	1.924	2.115
Japan	10	-	-	-	-	-	-
Norway	7	2	948	-	-	-	-
UK	927	3780	1.631	-	-	-	-
Total	59.653	108.826	68.961	20.335	5.723	1.924	2.115
WG estimate	62.653 [2]	111.567 [3]	98.474 [4]	-	-	-	-

Country	1995	1996	1997	1998	1999	2000 [1]	2001 [1]
Faroe Islands	-	-	-				
Germany	-	-	-				
Greenland	1.710	948	904	319	622		
Japan	-	-	-				
Norway	-	-	-				
UK	-	-	-				
Total	1.710	948	904	319	622	307	
WG estimate	-	-	-	-	-	-	-

[1]) Provisional data reported by Greenland authorities
[2]) Includes 3,000 t reported to be caught in ICES Subarea XIV
[3]) Includes 2,741 t reported to be caught in ICES Subarea XIV
[4]) Includes 29,513 t caught inshore

Table 3.2.2.a.2 Nominal catch (tonnes) of cod in ICES Subarea XIV, 1988-2001 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994
Faroe Islands	12	40	-	-	-	-	1
Germany	12.049	10.613	26.419	8.434	5.893	164	24
Greenland	345	3.715	4.442	6.677	1.283	241	73
Iceland	9	-	-	-	22	-	-
Norway	-	-	17	828	1.032	122	14
Portugal							
Russia		-	-	-	126		-
UK (Engl. and Wales)	-	1.158	2.365	5.333	2.532	-	-
UK (Scotland)	-	135	93	528	463	163	-
United Kingdom	-	-	-	-	-	46	296
Total	12.415	15.661	33.336	21.800	11.351	-	408
WG estimate	9.457 [1]	14.669 [2]	33.513 [3]	21.818 [4]	-	736	-
						-	

Country	1995	1996	1997	1998	1999	2000	2001 [5]
Faroe Islands	-	-	-	-	6		
Germany	22	5	39	128	13	3	92
Greenland	29	5	32	37 [5]	+ [5]		
Iceland	1	-	-		-	-	
Norway	+	1	-	+	2	- [5]	
Portugal				31	-	-	
Russia	-	-	-				
UK (E/W/NI)	232	181	284	149	95	149	
UK (Scotland)	-	-	-				
United Kingdom							129
Total	284	192	355	345	116		
WG estimate	-	-	-	-	-	-	

[1]) Excluding 3,000 t assumed to be from NAFO Division 1F and including 42 t taken by Japan
[2]) Excluding 2,741 t assumed to be from NAFO Division 1F and including 1,500 t reported from other areas assumed to be from Subarea XIV and including 94 t by Japan and 155 t by Greenland (Horsted, 1994)
[3]) Includes 129 t by Japan and 48 t additional catches by Greenland (Horsted, 1994)
[4]) Includes 18 t by Japan
[5]) Provisional data

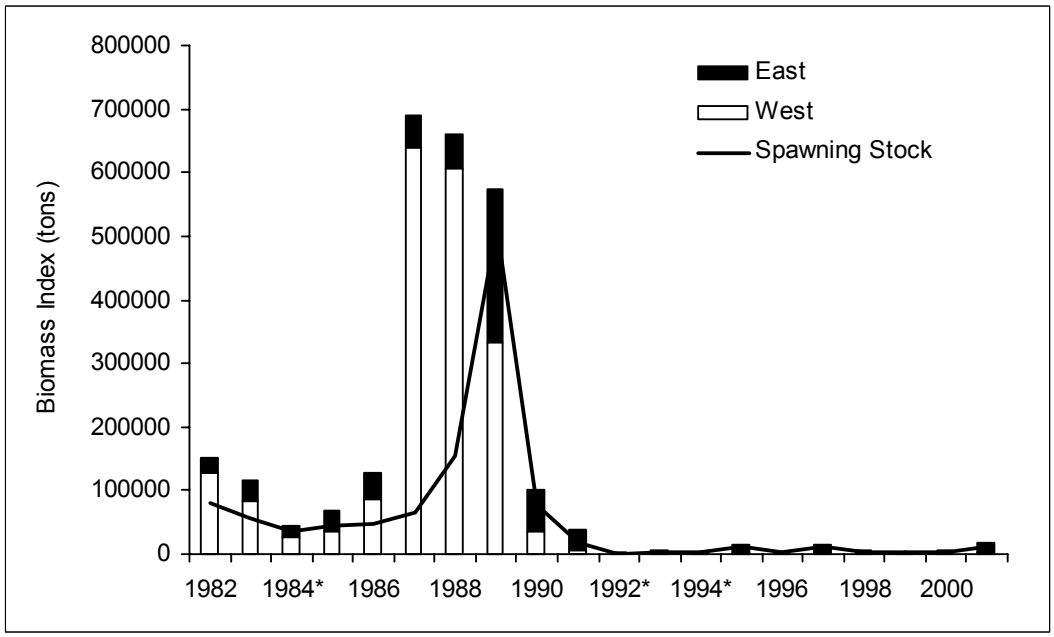


Figure 3.2.2.a.1 Cod off Greenland (offshore component). Aggregated survey biomass indices for West and East Greenland and spawning stock biomass, 1982-2001. *) incomplete survey coverage.

3.2.2.b Icelandic cod (Division Va)

State of stock/exploitation: SSB is currently estimated to be about 285 000 t, 70 000 t above its historic low of 215 000 t (1983) but well below the long-term average of 480 000 t, and the current (2001) F of 0.81 is well above $\mathbf{F}_{med}$. Recruitment was poor or below average for the year classes 1985–1996. The 1997 to 2000 year classes are estimated at about average size, but the first signs of the 2001 year class indicate that it is very poor. Fishing mortality dropped markedly in 1994 and 1995 in accordance with the measures taken by Iceland to reduce fishing effort against cod, but has increased since then.

Management objectives: A formal Harvest Control Rule was implemented for this stock in 1995. The TAC for a fishing year was set as a fraction (25%) of the "available biomass", which is computed as the biomass of age 4 and older fish, - B(4+) - averaged over the two adjacent calendar years. In the long term, this should correspond to a fishing mortality of about 0.4. That harvest control rule was considered to be in accordance with the precautionary approach.

In spring 2000 the government introduced an amendment to the catch rule limiting interannual changes in catches to 30 000 t. Limited studies, using a similar approach as when the initial catch rule was adopted were the basis for this amendment. ICES has not evaluated the amendment. Changes in the catch from 2002 to 2003 according to the harvest control rule are less than 30 000 t.

Precautionary Reference Points: Reference points have not been defined for this stock.

Advice on management: ICES advises to apply the Harvest Control Rule, which takes 25% of the 4+ biomass, corresponding to a projected catch of 183 000 t in 2003.

Relevant factors to be considered in management: The catch consistent with the application of the Harvest Control Rule results in an estimated F(5-10) of 0.45 in 2003, which is somewhat above the expected value (0.40) when the HCR was adopted.

The stock was overestimated in the years 1998-2000, but the current assessment is more consistent with previous year's assessment. The overestimation in 1998-2000 as well as the application of the amended catch rule, lead to considerably higher realized fishing mortality in recent years than was intended. Failure of the HCR to reduce F or rebuild SSB can be attributed to this pattern of overestimating stock size as well as the excessive catches allowed by the 30 000 t stabilizer in the amended catch rule. A working group was set up by the Icelandic Ministry of Fisheries in 2001 with the objectives to analyse the experience of using the HCR and try out alternative approaches, taking into account obvious shortcomings of the current harvest control rule. This working group should deliver a preliminary report before the start of the next fishing year September 1st 2002.

At present fishing mortality is high (F(5-10) in 2001 about 0.8), and ages 4 and 5 account for more than 70% of the fishable biomass (4+). This will be reflected in the age composition of the catches in 2003 where age group 6 and younger will represent about 80% of the landings. The age composition of the spawning stock is highly skewed. Spawners at age 5 and younger will constitute about 60% of the spawning stock biomass in 2003, and fish older than 10 years less than 4%. Increased age diversity has been shown to be associated with improved recruitment for this stock. Taking into account the relatively high proportions of young fish in both the fishable as well as in the spawning stock, and considering that the fishing mortality has never been at or lower than the intended F since the implementation of the catch rule, management authorities should consider setting a TAC for 2003 that would generate an F less than 0.40.

Catch forecast for 2003:
Basis: TAC/national estimates. Landings (2002) = 190 ; F(2002)= 0.59; B(4+,2002) = 680 ; SSB(2002) = 285 ; B(4+,2003) = 785.

F(2003 onwards)	Basis	Catch (2003)	SSB (2003)	B(4+) (2004)	SSB (2004)
0.32	0.4F(01)	138	367	1023	489
0.41	0.5F(01)	167	360	987	458
0.45	HCR	183	356	969	443
0.49	0.6F(01)	195	353	954	429
0.65	0.8F(01)	246	340	892	378
0.81	1.0F(01)	294	328	837	336
0.97	1.2F(01)	336	316	787	300

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections based on the amended catch control rule indicate low probability that the fishable biomass (age 4+) will remain as low as observed in the last decade (Figure 3.2.2.b.1).

Comparison with previous assessment and advice: The fishable biomass 4+ in 2001 was estimated at 577 000 t in last year's assessment compared to 640 000 t in the current assessment. This difference of 63 000 t, or 11%, is well within the confidence limits of last year's point estimate. The observed increase in the mean weight at age for the age groups 4-8, compared to last years prediction, accounts for about 2/3 of the discrepancies, but the rest is caused by a relatively small differences in the estimated stock in number in 2001. The SSB is now estimated to have been 311 000 t at spawning time in the

year 2001. Last year's estimate of 219 000 t was markedly lower. The sharp increase in the observed maturity-at-age in 2001 for age groups 3-7 does account for the bulk of this increase, but some increase in mean weight at age was also observed for age groups less than 10 in the SSB.

The year classes 1997-2000 were estimated at 185, 170, 185, and 175 millions, respectively, in last year's assessment compared to 180, 165, 176, and 210 in the current assessment.

The main causes of the overestimation of this stock in the years 1998-2000 are now considered to be the use of a combination of commercial CPUE and survey indices for calibration of stock assessment models and high availability of cod in the years 1997 and 1998. The causes for the presumed increase in availability in those years are still not understood. Many factors have been mentioned such as: hydrographical changes, capelin availability, increased availability with reduced effort (disturbance), variable natural mortality, emigration, increased discards, etc.

Elaboration and special comment: In order to protect juvenile fish, fishing is prohibited in areas where the number of small cod (< 55 cm) in the catches exceeds 25%.

The catch estimates are based on landings only. The amount of discarding has not been documented.

From 1977–1983, demersal fishing was limited to a certain number of days each year, but this system, as implemented, failed to meet the objective of limiting fishing mortality and a transferable boat quota system was introduced in 1984. TACs are set for each fishing year, which runs from 1 September through to 31 August in the following year. Catches have exceeded national advice and national TACs considerably for the past decade.

ICES TAC advice on this stock was first given for 1993. In the most recent years catches have been close to the agreed TAC.

Based on extensive simulation work indicating that the biomass would grow under the catch rule, ICES concluded that the 25% catch rule adopted by Iceland for Icelandic cod was consistent with the precautionary approach. Realised fishing mortalities since the implementation of the catch rule have generally exceeded $\mathbf{F}_{med}$ = 0.52, while F=0.4 was expected from the long-term application of the catch rule. The estimate of the percentage has been

1995 /96	1996 /97	1997 /98	1998 /99	1999/ 2000	2000/ 2001	2001/ 2002
27%	27%	30%	35%	39%	37%	35%

In years of high recruitment a larval drift to Greenland is sometimes observed, resulting in a large year class at Greenland as well. In some other years an immigration of adult cod from Greenland has taken place, which has been taken into account in the assessment.

Data and assessment: The analytical assessment is based on catch and survey data using the TSA programme. Exploratory assessments with similar data inputs, using five alternative software products with three different assessment models, gave similar results. Catch-at-age data as well as survey indices are considered reliable.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

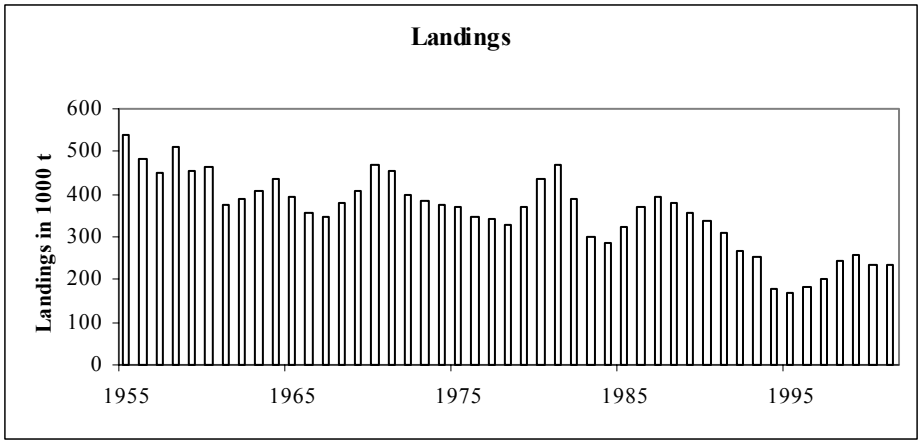
	Fish Mort Ages 5-10	Yield/R	SSB/R
Average Current	0.608	1.610	1.186
$\mathbf{F}_{max}$	0.324	1.778	4.342
$\mathbf{F}_{0.1}$	0.154	1.623	8.829
$\mathbf{F}_{med}$	0.541	1.728	2.424

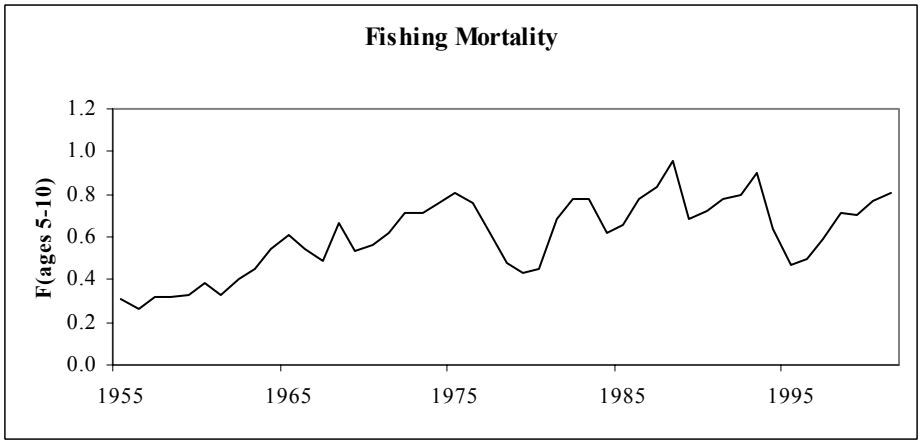
Catch data (Tables 3.2.2.b.1-2):

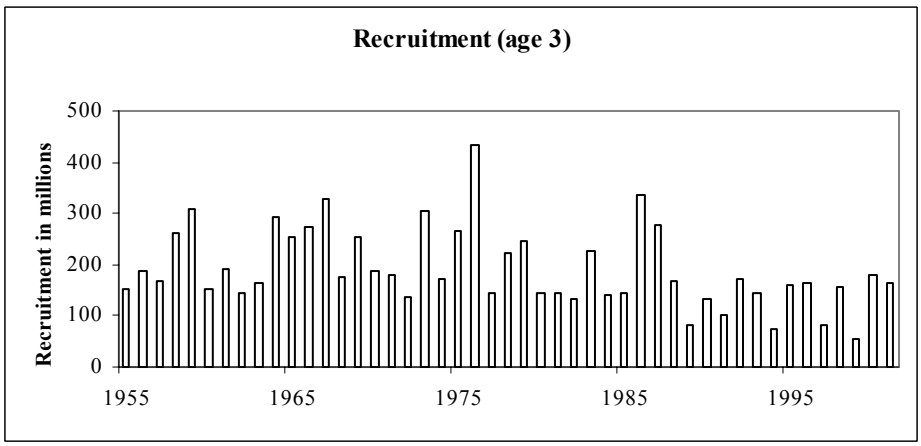
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1988[1]	National advice	300[1]	350[1]	378[1]
1989[1]	National advice	300[1]	325[1]	356[1]
1990[1]	National advice	250[1]	300[1]	335[1]
1991[1]	National advice	240[1]	245[1]	309[1]
1992[2]	National advice	250[2]	265[2]	274[2]
1993[2]	TAC	190[2]	205[2]	241[2]
1994[2]	TAC	150[2]	165[2]	197[2]
1995[2]	TAC	130[2]	155[2]	165[2]
1996[2]	Apply catch rule	162[2]	155[2]	170[2]
1997[2]	Apply catch rule	186[2]	186[2]	202[2]
1998[2]	Apply catch rule	218[2]	218[2]	227[2]
1999[2]	Apply catch rule	250[2]	250[2]	254[2]
2000[2]	Apply catch rule	247[2]	250[2]	257[2]
2001[2]	Apply catch rule	203[2]	220[2]	221
2002[2]	Apply catch rule	164[2]	190[2]	
2003[2]	Apply catch rule	183[2]		

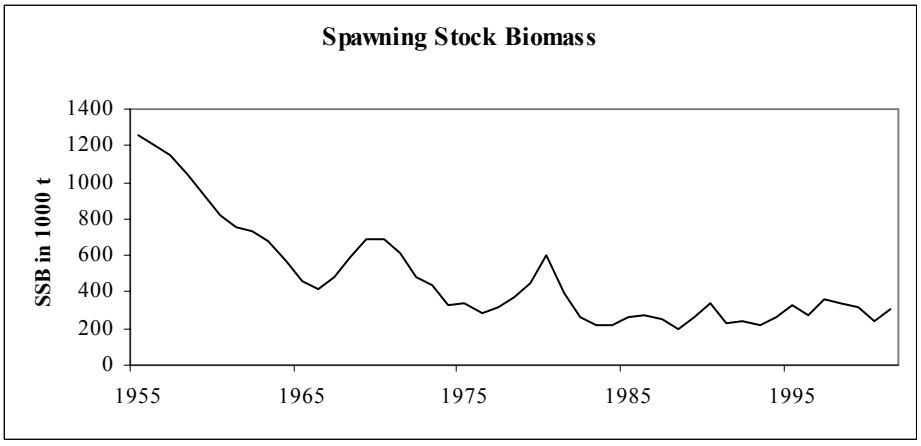
[1]Calendar year. [2]National fishing year ending 31 August. (Weights in '000 t).

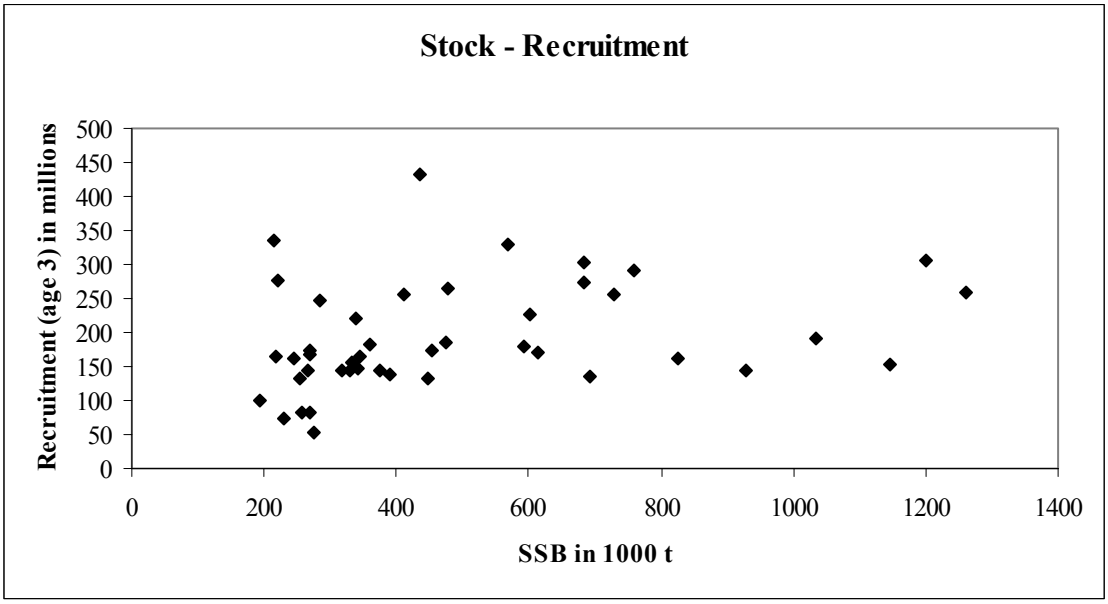
Icelandic cod (Division Va)

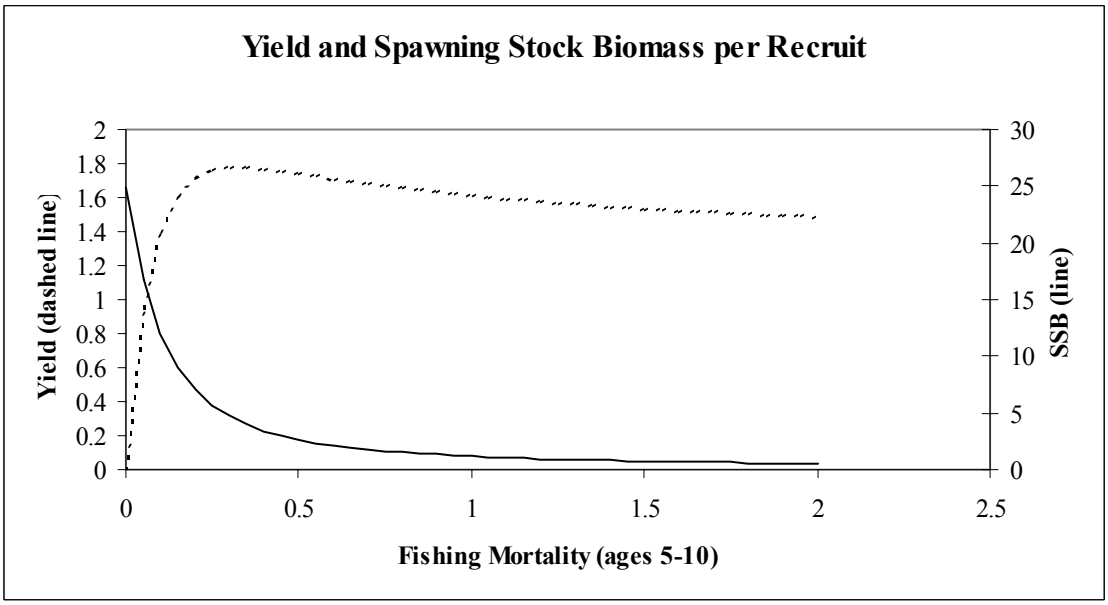









Stock - Recruitment
Recruitment (age 3) in millions
500
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
SSB in 1000 t


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
30
25
20
15
10
5
0
0
0.5
1
1.5
2
2.5
Fishing Mortality (ages 5-10)

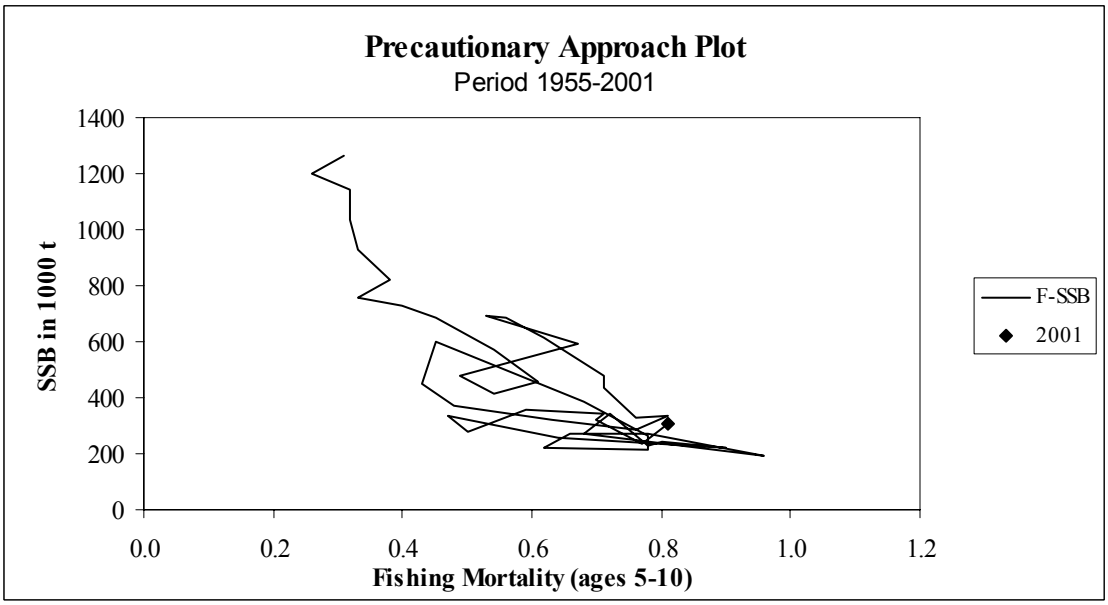

Precautionary Approach Plot
Period 1955-2001
SSB in 1000 t
1400
1200
1000
800
600
400
200
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 5-10)
F-SSB
2001

Table 3.2.2.b.1 Nominal catch (tonnes) of cod in Division Va, by countries, 1987–2000 as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993
Belgium	597	365	309	260	548	222	145
Faroe Islands	1,848	1,966	2,012	1,782	1,323	883	664
Germany	-	-	-	-	-	-	-
Greenland	-	-	-	-	-	-	-
Iceland	389,808	375,741	353,985	333,348	306,697	266,662	251,170
Norway	4	4	3	-	-	-	-
UK	-	-	-	-	-	-	-
Total	392,257	378,076	356,309	335,390	308,568	267,767	251,979
WG estimate	-	-	-	-	-	-	-

Country	1994	1995	1996	1997	1998	1999	2000
Belgium	136	-	-	-	-	-	-
Faroe Islands		739	599	408	1,078	1,247	1,176
Germany	-	-	-	-	9	21	15
Greenland	-	-	-	-	-	25	-
Iceland	177,919	168,685	181,052	202,745	241,545	258,658	234,362
Norway	-	-	7	-	-	85	101
UK	-	-	-	-	-	16	
Total	178,809	169,424	181,658	203,153	242,632	260,052	235,687
WG estimate	-	-	-	-	-	-	[2]

Country	2001[1]
Belgium	
Faroe Islands	1129
Germany	
Greenland	
Iceland	233,969
Norway	
UK	
Total	
WG estimate	235,098

1) Provisional.
2) Additional landings by Iceland of 1602 t, and Faroes of 33 t are included.

Table 3.2.2.b.2 Cod at Iceland. Division Va. Landings ('000 tonnes), average fishing mortality of age groups, recruitment (at age 3 in millions), and spawning stock at spawning time ('000 tonnes).

Year	Landings	F5-10	SSB	Recruitment age 3
1955	538	0.31	1261	147
1956	481	0.26	1199	202
1957	452	0.32	1145	176
1958	509	0.32	1034	260
1959	453	0.33	928	307
1960	465	0.38	825	153
1961	374	0.33	760	191
1962	387	0.4	729	143
1963	410	0.45	683	163
1964	434	0.54	569	292
1965	394	0.61	454	255
1966	357	0.54	412	273
1967	345	0.49	476	328
1968	381	0.67	594	174
1969	406	0.53	693	255
1970	471	0.56	684	186
1971	453	0.62	615	178
1972	399	0.71	477	136
1973	383	0.71	436	303
1974	375	0.76	329	170
1975	371	0.81	339	265
1976	348	0.76	283	432
1977	340	0.63	319	143
1978	330	0.48	375	222
1979	368	0.43	447	246
1980	434	0.45	602	144
1981	469	0.68	389	143
1982	388	0.78	266	134
1983	300	0.78	214	226
1984	284	0.62	219	139
1985	325	0.66	268	144
1986	369	0.78	268	336
1987	392	0.83	253	278
1988	378	0.96	192	168
1989	356	0.68	268	83
1990	335	0.72	343	132
1991	309	0.78	230	101
1992	268	0.8	244	174
1993	252	0.9	219	146
1994	179	0.64	258	74
1995	169	0.47	333	161
1996	182	0.5	277	165
1997	203	0.59	359	83
1998	243	0.71	344	155
1999	260	0.7	322	54
2000	236	0.77	237	181
2001	235	0.81	311	165

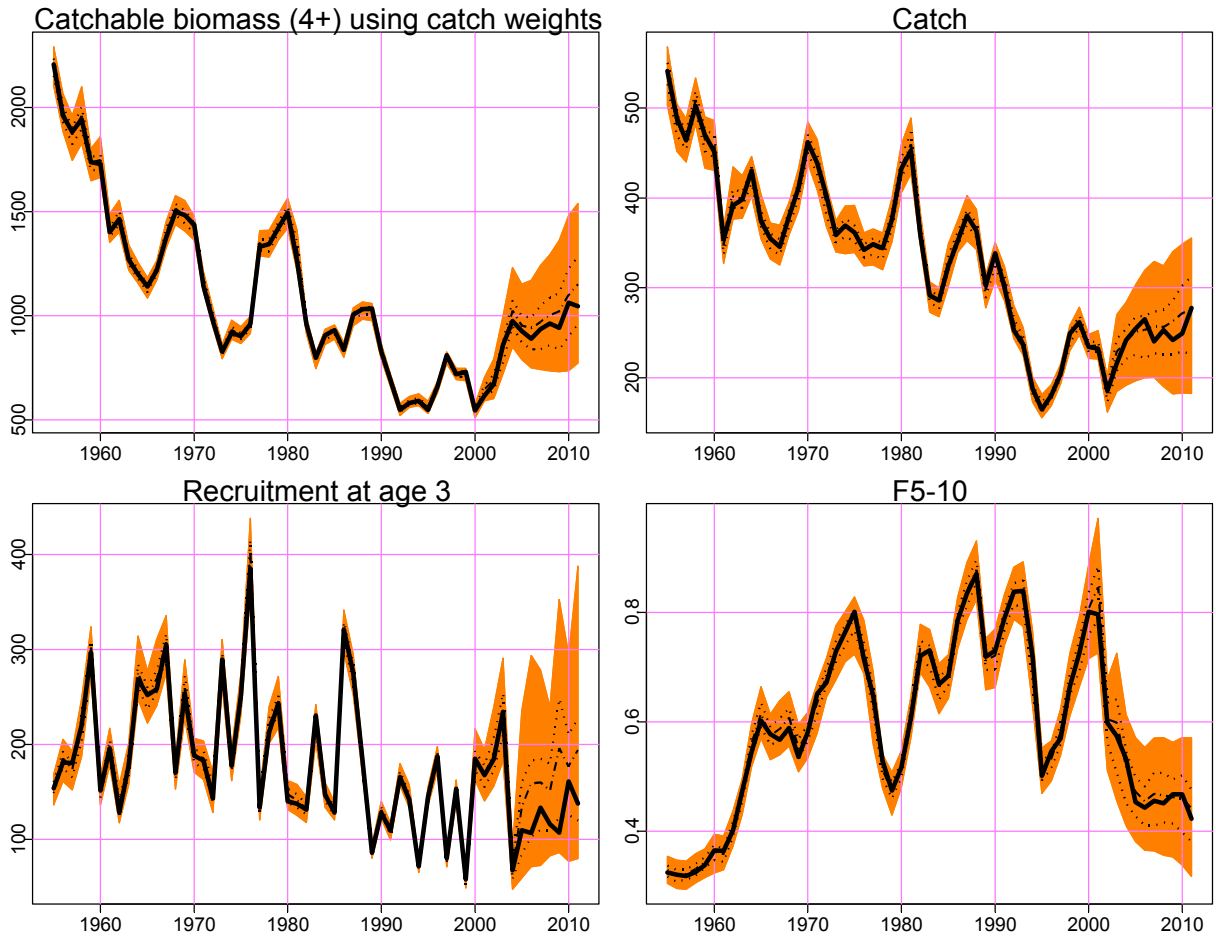


Figure 3.2.2.b.1 **AD-CAM** medium-term projections based on the amended harvest control rule. Shown in the figure are 5 and 95 percentiles (shaded areas), 25 and 75 percentiles (dashed lines) mean and median.

3.2.3 Icelandic haddock (Division Va)

State of stock/exploitation: The SSB decreased from the early 1990 to 2000-2001 when it was the second lowest in the last two decades, but it increased by 30% from 2001 to 2002 due to the strong 1998 year class. Recruitment and spawning stock fluctuate widely. The strong year class from 1995 is now mostly fished out, but there is evidence from the Icelandic groundfish survey that year classes 1998-2000 are all very strong. Fishing mortality has been high and above the $\mathbf{F}_{pa}$ since 1984, showing an increasing trend since 1996.

Management objectives: There is no explicit management objective for this stock.

Precautionary Approach reference points: $\mathbf{F}_{pa}$ (= .47) equal to $\mathbf{F}_{med}$ was provisionally proposed in 2000.

Advice on management: ICES advises that fishing mortality in 2003 should be reduced to below the provisionally proposed $\mathbf{F}_{pa}$ = 0.47, which corresponds to a catch of less than 55 000 t.

Relevant factors to be considered when managing this fishery: SSB and recruitment are highly variable. SSB is relatively low, but is forecast to increase in coming years due to good recruitment.

Discard and mortality of haddock slipping through gear meshes are potentially problems, which, if taken into account, would lower the fishing mortality that maximises yield. Figures on discards indicate that they were relatively high from 1994 to 1997, but reduced after that. Discards in the projection period are anticipated to be relatively small.

Catch forecast for 2003:
Basis: TAC/National estimates[1]: Landings (2002) = 45, F(2002) = 0.57, SSB(2003) = 98. .

F(2003)	Basis	Landings (2003)	SSB (2004)
0.17	$\mathbf{F}_{0.1}$	22	156
0.47	Provisional $\mathbf{F}_{pa}$	55	132
0.57	F2002	65	125
0.75	F2001	81	114
0.94	1.25F2001	95	103

[1]Based on landings in the first 4 months of 2002. Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Assuming that the harvesting strategy of F=0.47 is followed, there is high probability that the fishable biomass will increase in the short term (Figure 3.2.3.1). Later development is dependent on future recruitment.

Comparison with previous assessment and advice: The present assessment is more optimistic about the state of the stock than last year's assessment. This change in perception of the stock is mostly driven by the groundfish survey 2002 which gives a more optimistic view of the incoming year classes than the two previous surveys (Figure 3.2.3.1). Estimates of incoming year classes from the surveys 2001 and 2002 are unusually contradicting, with the 2002 survey indicating much higher recruitment (Table 3.2.3.3, Figure 3.2.3.2).

Stock numbers have been reliably assessed in the past, but the estimated biomass was consistently too high due to over-estimated weights-at-age. This has possibly led to higher fishing mortalities than intended. A revision of the stock weights in 1999 is thought to have alleviated this problem.

Elaboration and special comment: Iceland extended its fisheries jurisdiction to 200 miles in 1975, resulting in a temporary reduction in fishing mortality. In the demersal fisheries, the mesh size in trawls increased from 120 mm to 135 mm in 1976 and to 155 mm the following year. From 1977-1983, demersal fishing was limited by a number of days each year. As this system failed to limit fishing mortality a transferable boat quota system was introduced in 1984. TACs are set for each fishing year (1 September to 31 August).

The Icelandic haddock stock is subject to substantial fluctuations in SSB and recruitment, with large year classes dominating the catch in some years. The data from the currently available time-series do not indicate reduced recruitment at low SSB.

Data and Assessment: The analytical assessment is based on catch and survey data using the same settings as in 2001.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

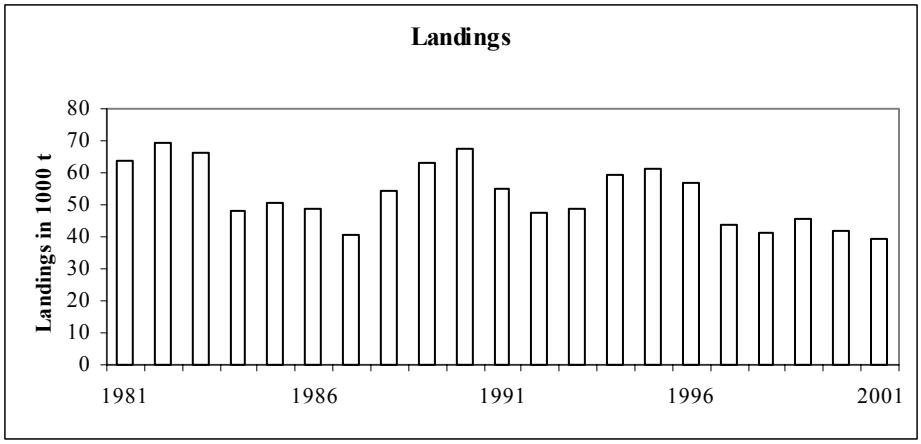
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	1.000	0.784	0.681
$\mathbf{F}_{max}$	0.399	0.846	1.617
$\mathbf{F}_{0.1}$	0.169	0.758	3.097
$\mathbf{F}_{med}$	0.482	0.843	1.366

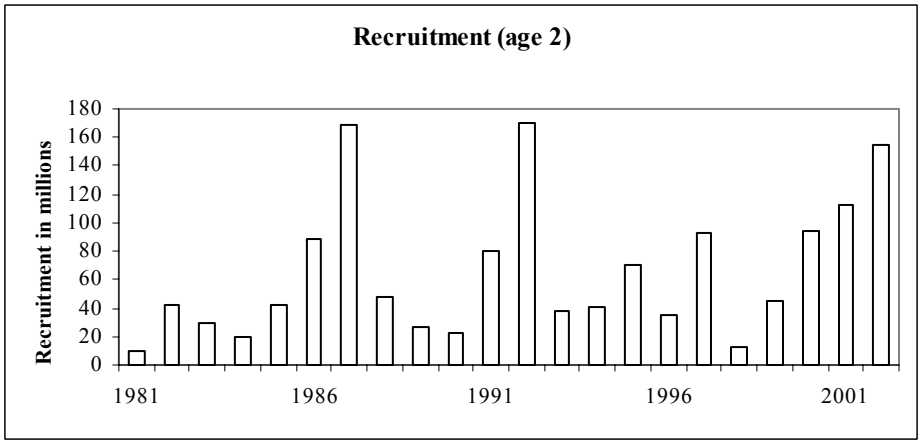
Catch data (Tables 3.2.3.1–3):

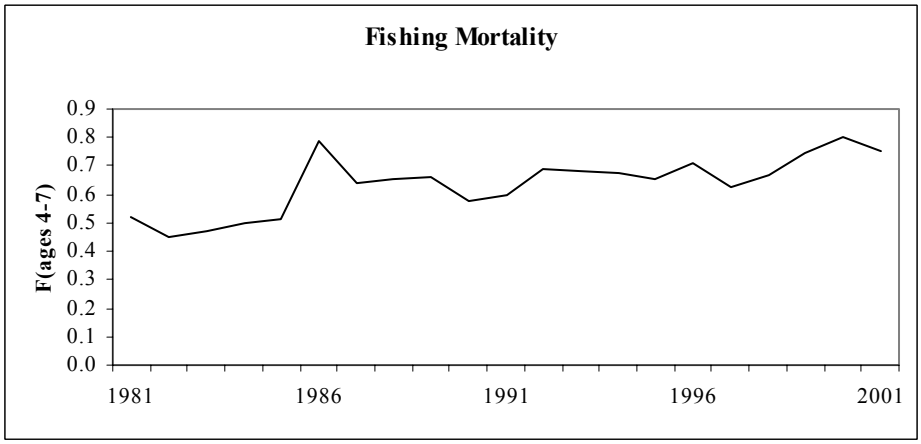
Year	ICES Advice	Advice[4]	Agreed TAC	Official Landings	ACFM Catch
1987[1]		50	60	41	41
1988[1]		60	65	54	54
1989[1]		60	65	63	63
1990[1]		60	65	67	67
1991[2]		38	48	41	55
1992[3]		50	50	46	47
1993[3]		60	65	46	49
1994[3]		65	65	57	59
1995[3]		65	65	61	61
1996[3]		55	60	54	57
1997[3]		40	45	51	44
1998[3]		40	45	41	41
1999[3]		35	35	45	46
2000[3]	F reduced below $\mathbf{F}_{med}$	35	35	42	42
2001[3]	F reduced below provisional $\mathbf{F}_{pa}$	31	30	40	40
2002[3]	F reduced below provisional $\mathbf{F}_{pa}$	30	41		
2003[3]	F reduced below provisional $\mathbf{F}_{pa}$	55			

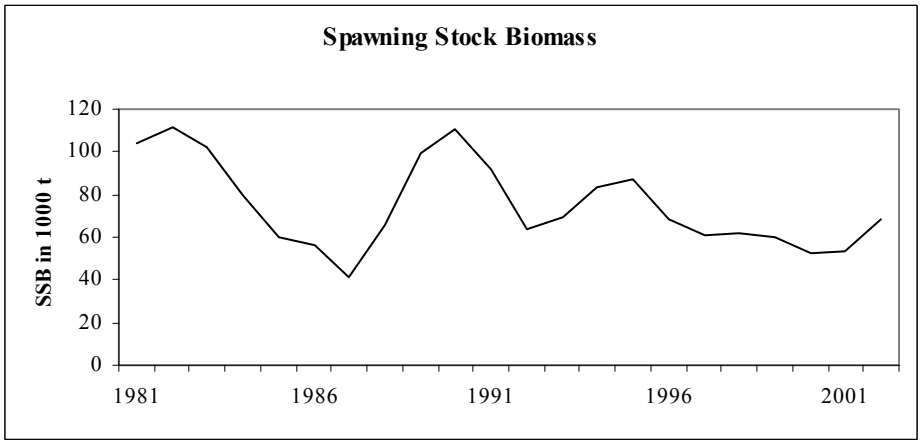
[1] Calendar year. [2] January/August. [3] National TAC for year ending 31 August. [4] National advice before 2000. Weights in '000 t.

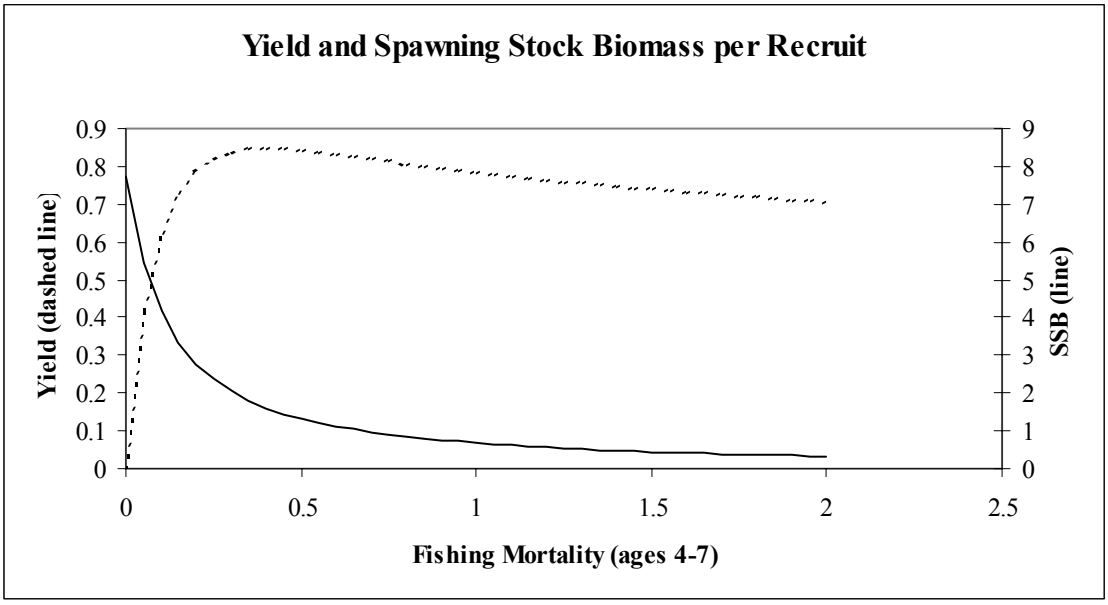
Icelandic haddock (Division Va)

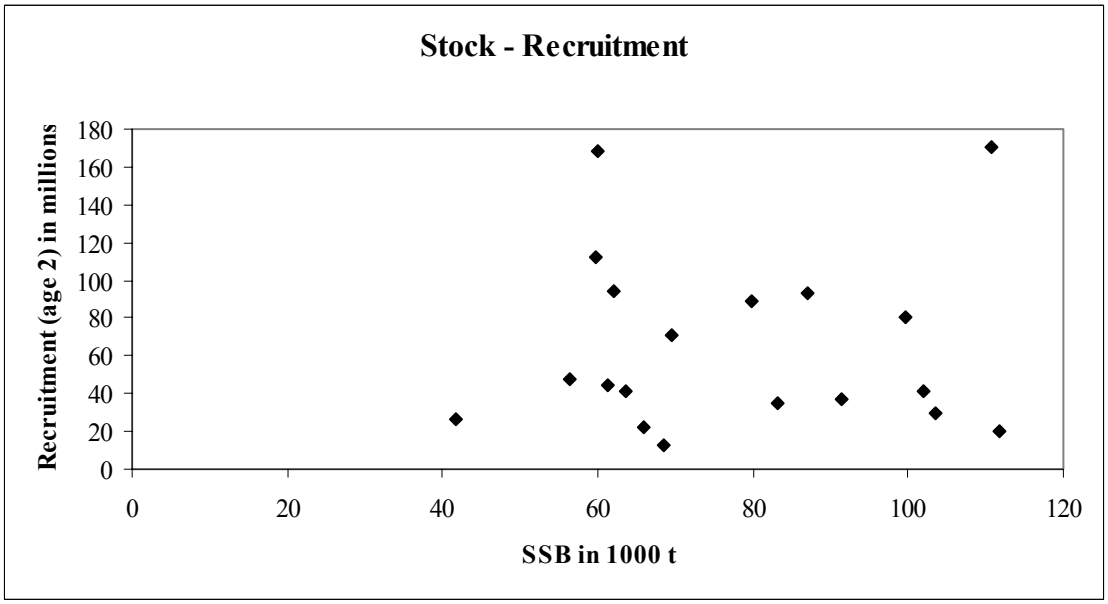









Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9
8
7
6
5
4
3
2
1
0
0
0.5
1
1.5
2
2.5


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120

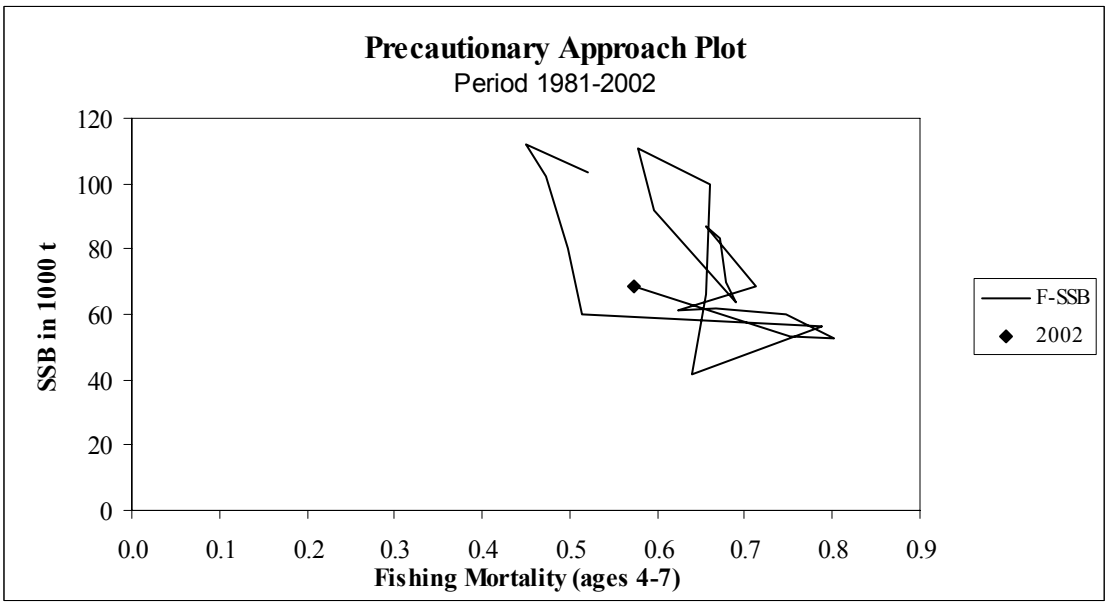

Precautionary Approach Plot
Period 1981-2002
SSB in 1000 t
Fishing Mortality (ages 4-7)
F-SSB
2002
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

Table 3.2.3.1 Icelandic haddock. Landings by nation.

HADDOCK Va								
Country	1978	1979	1980	1981	1982	1983	1984	1985
Belgium	807	1010	1144	673	377	268	359	391
Faroe	2116	2161	2029	1839	1982	1783	707	987
Iceland	40552	52152	47916	61033	67038	63889	47216	49553
Norway	13	11	23	15	28	3	3	+
UK								
Total	43488	55334	51112	63560	69425	65943	48285	50933

HADDOCK Va								
Country	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	257	238	352	483	595	485	361	458
Faroe	1289	1043	797	606	603	773	757	754
Iceland	47317	39479	53085	61792	66004	53516	46098	46932
Norway		1	+					
UK								
Total	48863	40761	54234	62881	67202	53774	47216	48144

HADDOCK Va								
Country	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	248							
Faroe	911	758	664	340	639	624	968	609
Iceland	58408	60061	56223	43245	40795	44557	41199	39038
Norway	1	+	4					
UK								
Total	59567	60819	56891	43585	41434	45481	42167	39647

Table 3.2.3.2 Icelandic haddock (Division Va)

	Recruits Age 2	Totalbio	Totspbio	Landings	Yield /SSB	Fbar4-7
1981	9753	216822	103616	63580	0.6136	0.5213
1982	42216	198240	111800	69325	0.6201	0.4505
1983	30162	162056	102033	65943	0.6463	0.4731
1984	19932	125235	79931	48285	0.6041	0.4981
1985	41756	116169	60071	50933	0.8479	0.5137
1986	89227	114951	56443	48863	0.8657	0.7872
1987	168086	131273	41677	40801	0.9790	0.6393
1988	47662	161666	65989	54236	0.8219	0.6566
1989	26664	175174	99652	62979	0.6320	0.6591
1990	22362	151173	110642	67200	0.6074	0.5771
1991	80236	135986	91532	54732	0.5980	0.5952
1992	170306	133987	63532	47212	0.7431	0.6892
1993	37456	137434	69600	48844	0.7018	0.6793
1994	41187	135751	83282	59345	0.7126	0.6721
1995	70431	131693	86912	61131	0.7034	0.6548
1996	34505	113318	68381	56958	0.8330	0.7121
1997	92926	101537	61286	44053	0.7188	0.6247
1998	12774	94613	62142	41434	0.6668	0.6678
1999	44861	92783	59698	45481	0.7619	0.7459
2000	94659	93968	52895	42167	0.7972	0.8022
2001	112000[1]	110504	53165	39647	0.7457	0.7519
2002	155000[1]	145970[2]	68877[2]	45000[2]	0.6533[2]	0.5740[2]
Arith. Mean	65643	135468	75143	52643	0.7215	0.6338
Units	(thousands)	(tonnes)	(tonnes)	(tonnes)		

[1] ADCAM estimates
[2] Predicted

Table 3.2.3.3 Icelandic haddock. Recruitment estimates by different methods.

Recruitment (million 2 year old.)									
Year class	RTC3	RTC3 no shrinkage	Adapt	Std. XSA	ADCAM	XSA from age 1	Survey 2001	Survey 2002	Used values
1998	83		99	94	98	101			
1999	106	117	114	123	112	117	102	164	112
2000	133	166	165		155		115	214	155
2001	35	35	33		27			32	29

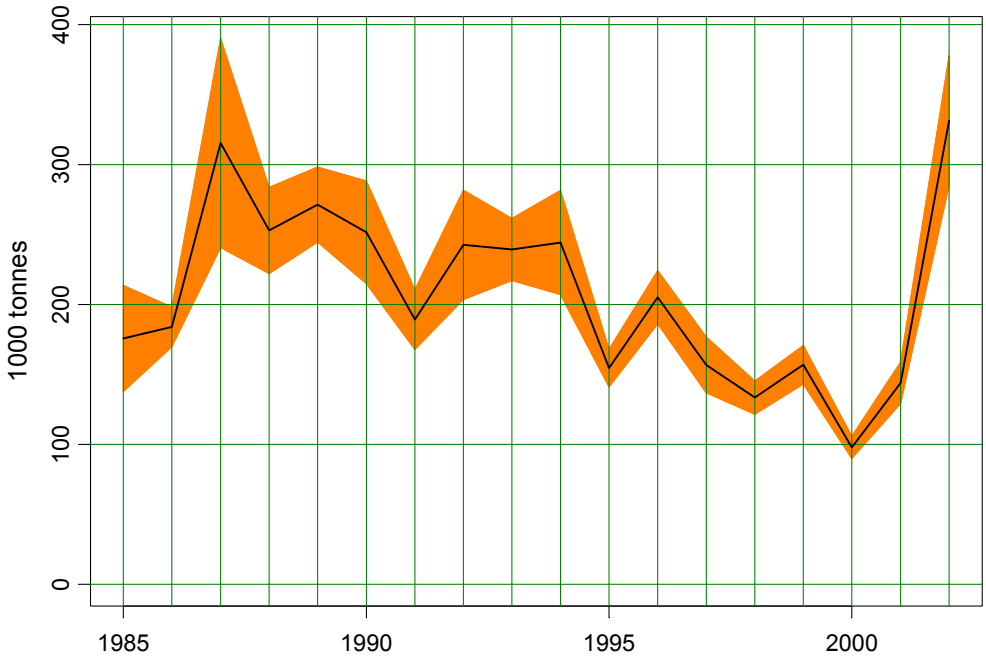


Figure 3.2.3.1 Haddock in Division Va. Biomass indices from the groundfish survey. Shaded areas show 2 times the standard error in the survey biomass.

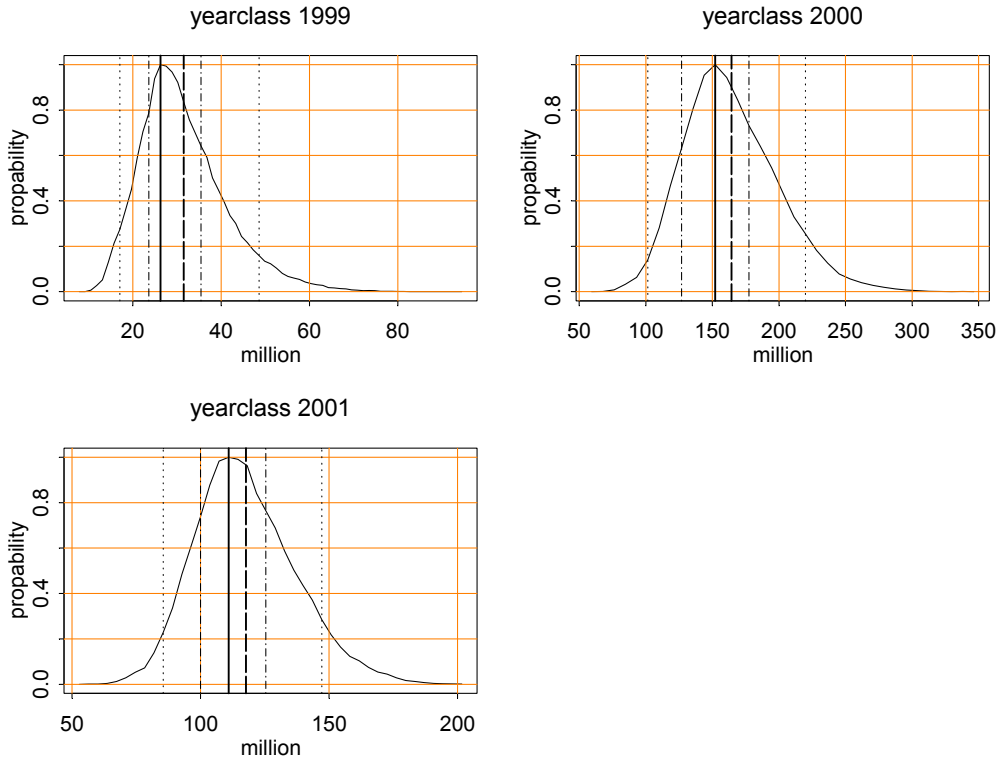


Figure 3.2.3.2 Haddock in Division Va. Posterior profiles of recruitment estimates for year classes 1999 – 2001 as 2 year olds. The vertical lines in the figure show 5, 25, 50, 75 and 95 percentiles as well as the mean.

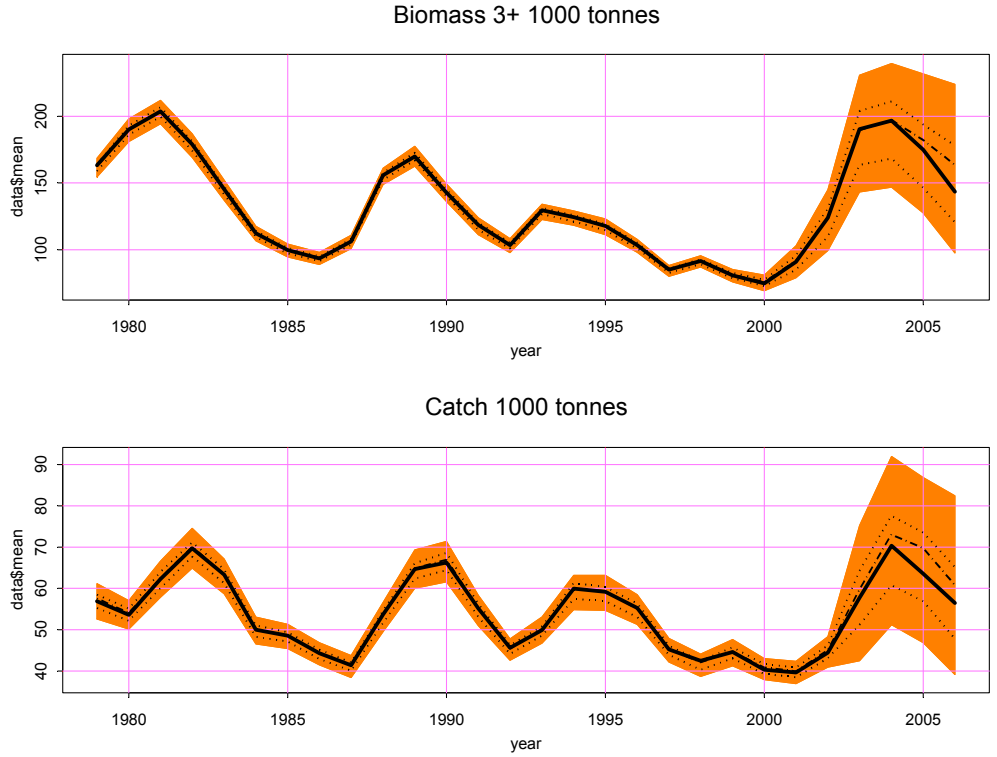


Figure 3.2.3.3 Haddock in Division Va. Results from simulations fishing at F=0.47 after 2002. Assessment error lognormal with CV = 0.1. Shown in the figure are 5 and 95 percentiles (shaded areas), 25 and 75 percentiles (dashed lines) mean and median.

3.2.4 Saithe in Icelandic waters (Division Va)

State of stock/exploitation: The stock is outside safe biological limits. SSB is below $\mathbf{B}_{pa}$ and close to $\mathbf{B}_{lim}$. Fishing mortality has been above $\mathbf{F}_{pa}$ (0.30) for all years except two during the last two decades. Since 1997, fishing mortality has been gradually reduced and F_{2001} is estimated close to $\mathbf{F}_{pa}$. Recruitment has been below the long-term average since 1989.

Management objectives: There is no explicit management objective for this stock. However, for any management objective to meet precautionary criteria, F should be less than $\mathbf{F}_{pa}$ and spawning stock biomass should be greater than $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed in 1998 that:
$\mathbf{B}_{lim}$ is set tentatively at 90 000 t	$\mathbf{B}_{pa}$ be set at 150 000 t
$\mathbf{F}_{lim}$ is as yet undefined	$\mathbf{F}_{pa}$ be set at 0.3

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$ estimate in 1998	$\mathbf{B}_{pa}$: observed low SSB values in 1978–1993
$\mathbf{F}_{lim}$:	$\mathbf{F}_{pa}$: fishing mortality sustained for 3 decades

Advice on management: ICES advises that the fishing mortality is reduced to 2/3 of $\mathbf{F}_{pa}$ as a first step to rebuild the stock. This corresponds to a fishing mortality of 0.20 and a catch of 24 000 t in 2003. A rebuilding plan should be developed.

Relevant factors to be considered by management: Recruitment has been consistently low since 1989. A reduction in fishing mortality is advised both for cod and haddock in Division Va. To the extent that saithe is caught in mixed demersal fisheries, a general effort reduction will help to improve the exploitation also for saithe, but measures need to be taken to keep by-catches of saithe in mixed fisheries as low as possible.

Catch forecast for 2003:
Basis: TAC: Landings (2002) = 37; F(2002) = 0.35 (=1.04F(2001)); SSB(2003) = 105. No discards assumed.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0	0	147
0.20	0.6F(2001)	24	125
0.25	0.75F(2001)	30	122
0.27	0.8F(2001)	32	121
0.30	$\mathbf{F}_{pa}$=0.9F(2001)	35	116
0.33	F(2001)	38	113
0.41	1.2F(2001)	45	108

Weights in '000t. Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Last year's assessment indicated that SSB had been below $\mathbf{B}_{lim}$ since 1998 and did not show clear signs of improvements. This led to advice for no directed fishery. This year's assessment indicates that SSB was below $\mathbf{B}_{lim}$ from 1997 to 2000, but has been increasing since 1999 and was above $\mathbf{B}_{lim}$ in 2001. Also estimates of the recent fishing mortalities are somewhat lower and recruitment somewhat higher in the current assessment than in last year's assessment. Together these factors suggest that the stock has begun to rebuild in the most recent years, although slowly. Hence, the most severe catch restrictions possible are no longer considered essential, but strict controls on F will be necessary for several years, in order to rebuild the stock above $\mathbf{B}_{pa}$.

Elaboration and special comment: Time-series analysis (TSA) tuned with survey was used to estimate fishing mortalities. Migrations from other stocks were included in the stock assessment for the third time. ADAPT and XSA (with revised settings) tuned with survey data gave comparable results with TSA. Saithe are taken in a mixed demersal fishery although they may be targeted at certain times, especially in times of high stock abundance. In order to protect juvenile fish, fishing is prohibited in areas where the number of small saithe in the catches exceeds a given percentage.

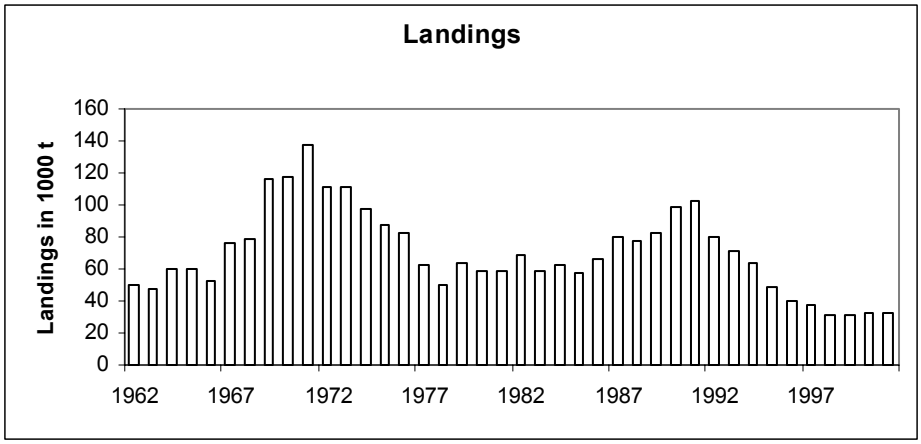
ICES recommends to evaluate the possibility of imposing closed areas to protect spawning aggregations of saithe.

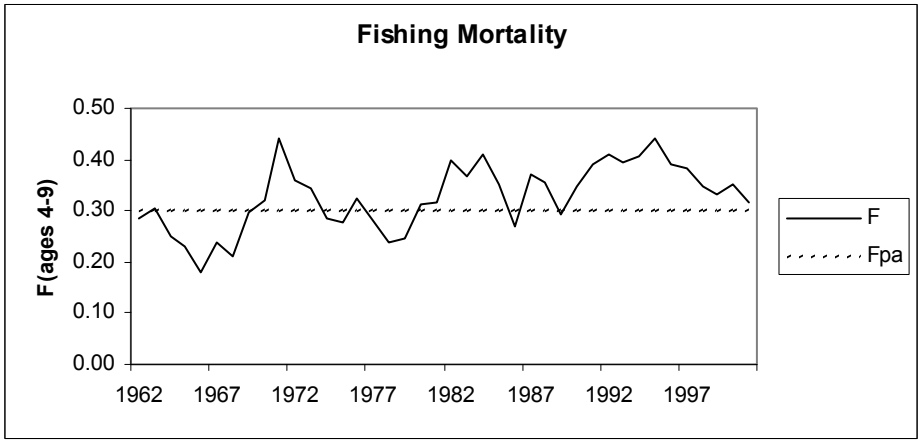
Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

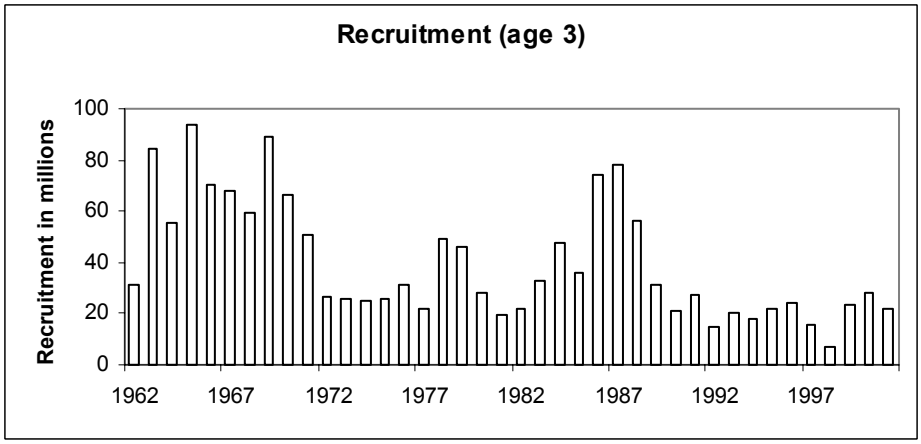
Catch data (Tables 3.2.4.1–2):

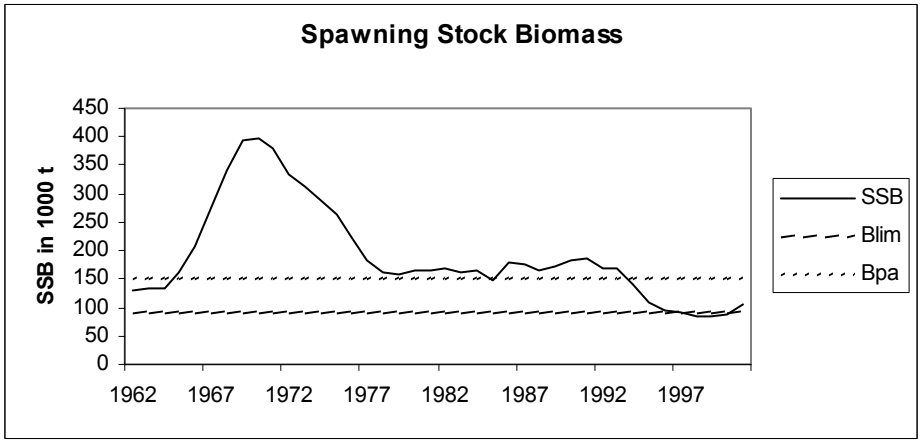
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	64	70	81
1988	TAC	64	80	77
1989	TAC	80	80	82
1990	TAC	80	90	98
1991	TAC	87	65	103
1992	TAC	70	75[2]	80
1993	Marginal gains from increase in F	75[1]	95[2]	72
1994	No measurable gains from increase in F	84[1]	85[2]	64
1995	No measurable gains from increase in F	72[1]	75[2]	49
1996	No measurable gains from increase in F	65[1]	70[2]	41
1997	No measurable gains from increase in F	52[1]	50[2]	37
1998	F below $\mathbf{F}_{med}$ = 0.23	30[3]	30[2]	32
1999	F below 60% of F(97)	28	30[2]	31
2000	F below 60% of F(98)	24	30[2]	33
2001	F=70% of F(99)	25	30[2]	32
2002	No directed fishing	-	37[2,3]	
2003	2/3 $\mathbf{F}_{pa}$ to rebuild stock	24		

[1]Catch at *status quo* F. [2]For year ending 31 August. [3]TAC set originally set at 30, changed to 37 at end of 2001. Weights in '000 t.


Landings
Landings in 1000 t
160
140
120
100
80
60
40
20
0
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 4-9)
0.50
0.40
0.30
0.20
0.10
0.00
1962
1967
1972
1977
1982
1987
1992
1997
F
Fpa


Recruitment (age 3)
Recruitment in millions
100
80
60
40
20
0
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
450
400
350
300
250
200
150
100
50
0
1962
1967
1972
1977
1982
1987
1992
1997
SSB
Blim
Bpa

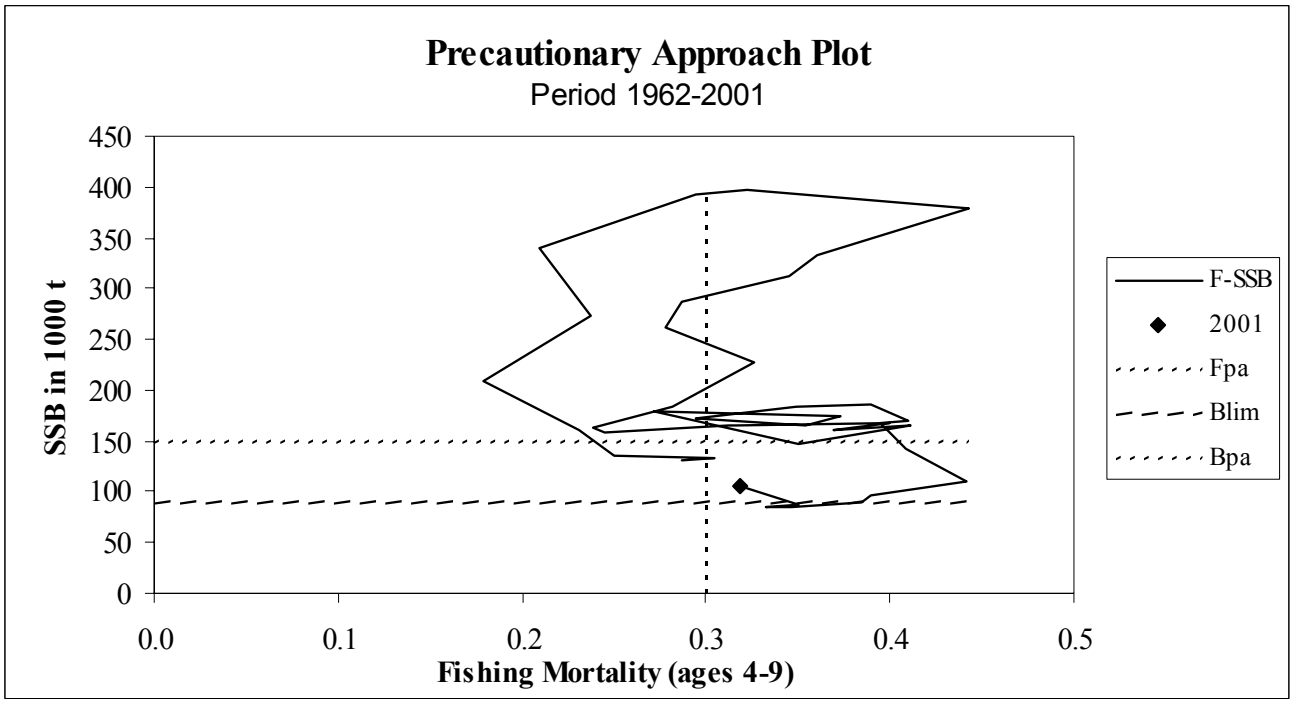

Precautionary Approach Plot
Period 1962-2001
SSB in 1000 t
450
400
350
300
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 4-9)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.2.4.1 Nominal catch (tonnes) of SAITHE in Division Va by countries, 1982-2001, as officially reported to ICES.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Belgium	201	224	269	158	218	217	268	369
Faroe Islands	3,582	2,138	2,044	1,778	783	2,139	2,596	2,246
France	23	-	-	-	-	-	-	-
Iceland	65,124	55,904	60,406	55,135	63,867	78,175	74,383	79,810
Norway	1	+	-	1	-	-	-	-
UK (Engl. and Wales)	-	-	-	29	-	-	-	-
Total	70,913	60,249	64,703	59,086	66,854	82,518	79,235	82,425
WG estimate	-	-	-	-	66,376[2)]	-	-	

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium	190	236	195	104	30	-	-	-	-
Faroe Islands	2,905	2,690	1,570	1,562	975	1,161	803	716	997
France	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	1	1	1	-	3
Iceland	95,032	99,390	77,832	69,982	63,333	47,466	39,297	36,548	30,531
Norway	-	-	-	-	-	1	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
Total	98,127	102,316	79,597	71,648	64,339	48,629	40,101	37,264	31,531
WG estimate		102,737[3)]	-	-	-	-	-		

Country	1999[)]	2000[)]	2001[1]
Belgium	-		
Faroe Islands	700	228	128
France	-		
Germany	2		
Iceland	30560	32898	31837
Norway	6		
UK (Engl. and Wales)	2		
Total	31270	33126	31965
WG estimate			

1) Provisional.
2) Additional catch of 1,508 t by Faroe Islands included.
3) Additional catch of 451 t by Iceland included.

Table 3.2.4.2 Saithe in Division Va. Summary table from a VPA run with F in 2001 from TSA, calibrated with survey data.

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-9
1962	30999	131495	50000	0.287
1963	84106	132811	48000	0.304
1964	55196	134478	60000	0.250
1965	94063	161200	60000	0.231
1966	70223	207827	52000	0.179
1967	68329	272626	76000	0.237
1968	59671	340913	79000	0.210
1969	88749	393200	116000	0.295
1970	66329	396236	117000	0.322
1971	50637	378082	137000	0.443
1972	26455	332879	111000	0.361
1973	26104	313070	111000	0.345
1974	25125	287185	98000	0.287
1975	25928	262239	88000	0.278
1976	31237	226588	82000	0.326
1977	21672	184129	62000	0.282
1978	49437	163137	50000	0.238
1979	45748	159536	64000	0.245
1980	28028	165551	58347	0.312
1981	19463	164760	59001	0.316
1982	22060	168385	68933	0.400
1983	32706	161624	58266	0.369
1984	47723	164545	62716	0.411
1985	35662	147536	57101	0.350
1986	74415	179673	66376	0.271
1987	78365	174156	80531	0.373
1988	56104	165627	77247	0.354
1989	31160	171529	82425	0.294
1990	21431	182697	98127	0.349
1991	27512	184864	102737	0.389
1992	14774	169331	79597	0.410
1993	20555	167262	71648	0.395
1994	17877	142029	64339	0.408
1995	21694	109678	48629	0.442
1996	24263	96037	40101	0.390
1997	15242	89826	37264	0.384
1998	7268	84797	31531	0.347
1999	23537	83857	31290	0.333
2000	28000	87088	32430	0.350
2001	22000	105661	31965	0.318
Average	39746	191104	70040	0.327

3.2.5 Greenland halibut in Subareas V and XIV

State of stock/exploitation: The stock is harvested outside safe biological limits. Recent Fs are estimated to be above the proposed $\mathbf{F}_{pa}$ and close to $\mathbf{F}_{MSY}$. Even though the recent historical development of SSB and fishing mortality are not well estimated, it is likely that fishing mortality has decreased and biomass increased in recent years. Survey biomass indices have increased to some extent from a low in 1996.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: The ASPIC model provides estimates of the biomass relative to $\mathbf{B}_{MSY}$ and of F relative to $\mathbf{F}_{MSY}$. The ratio $F/\mathbf{F}_{MSY}$ equal to 0.67 is used in the advice as an upper boundary for F.

Advice on management: ICES recommends that the fishing mortality be reduced below $0.67*\mathbf{F}_{MSY}$. This corresponds to catches in 2003 for the total stock of less than 23 000 t.

Relevant factors to be considered in management: For a number of years total catches have exceeded the advised TAC. The management approaches in the three areas (Divisions Va, Vb, and XIVb) differ. At present the fishery in Division Vb is subject to effort limitation and the fisheries in Divisions XIVb and Va are catch limited. The agreed TAC in Division Va has been close to the recommended TAC for the entire area. The combination of different management measures in different Subareas means that there is no control over total fishing mortality for this stock.

Medium- and long-term projections: Forward projections of population biomass and fishing mortality were made under three different harvesting regimes, including estimates of uncertainty, assuming a catch in 2002 of 30 000 t. Fishing at $\mathbf{F}_{pa}$ ($2/3\mathbf{F}_{MSY}$), it is expected that the biomass will increase and have a 50% probability of reaching $\mathbf{B}_{MSY}$ by 2005. Fishing at $\mathbf{F}_{sq}$ ($\sim\mathbf{F}_{MSY}$), the biomass will increase more slowly, and it is expected to have at least a 50% probability of reaching $\mathbf{B}_{MSY}$ by 2007. Fishing at 30 000 t annually implies a considerable risk that the stock will remain low.

Comparison with previous assessment and advice: The advice is based on a production model as was done last year, and the results and advice are consistent.

Elaboration and special comment: Since the nursery grounds are not known and the juveniles therefore not monitored, and as Greenland halibut is a slow-growing species, which first appears in the catches at age 5, a possible recruitment failure will only be detected in the fishery some 5–10 years after it occurs.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Tables 3.2.5.1–6):

Year	ICES Advice	Predicted catch Corresp. To advice	Agreed TAC Va	Catch in Va	ACFM Catch V,XIV
1987	No increase in F	28	30	45	47
1988	No increase in F	28	30	49	51
1989	TAC	33	30	59	61
1990	No advice	-	45	37	39
1991	TAC	40	30	35	38
1992	TAC	30	25	32	35
1993	No increase in effort	28[1]	30[2]	34	41
1994	No increase in effort	34[1]	30[2]	29	37
1995	TAC	32	30[2]	27	36
1996	TAC	21	20[2]	22	36
1997	60% reduction in F from 1995	13	15[2]	18	30
1998	70% reduction in F from 1996	11	10[2]	11	20
1999	65% reduction in F from 1997	11	10[2]	11	20
2000	60% reduction in F from 1998	11	10[2]	15	26
2001	catch less than 98-99 catch	20	20	17	28
2002	F reduced below 0.67*$\mathbf{F}_{MSY}$	21	20		
2003	F reduced below 0.67*$\mathbf{F}_{MSY}$	23			

[1]Catch at *status quo* F. [2]Year ending 31 August. Weights in '000 t.

Greenland halibut in Subareas V and XIV

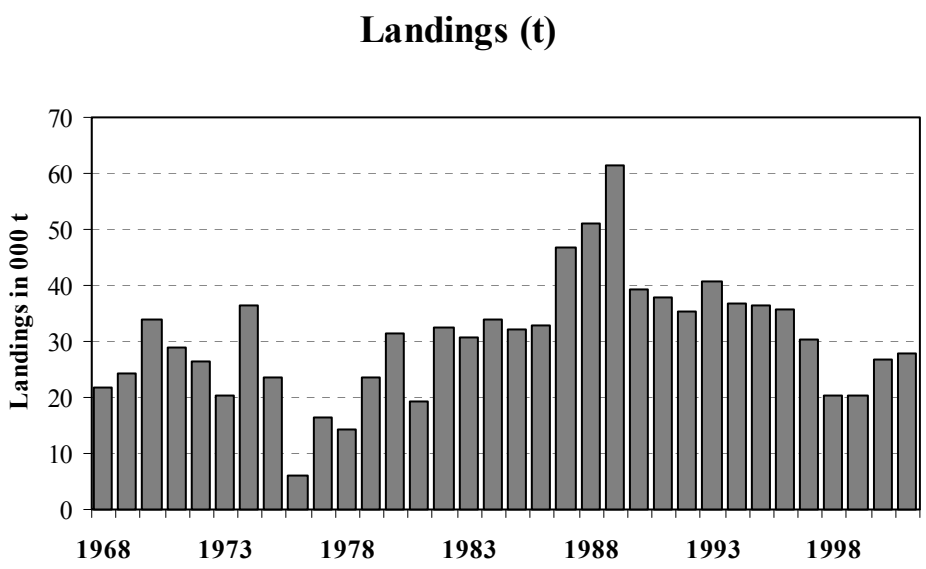


Table 3.2.5.1 Greenland halibut. Nominal catches (tonnes) by countries, in Subareas V, XII, and XIV 1981 – 2001, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	-	-	6	+	-
Faroe Islands	767	1,532	1,146	2,502	1,052	853	1,096	1,378	2,319
France	8	27	236	489	845	52	19	25	-
Germany	3,007	2,581	1,142	936	863	858	565	637	493
Greenland	+	1	5	15	81	177	154	37	11
Iceland	15,457	28,300	28,360	30,080	29,231	31,044	44,780	49,040	58,330
Norway	-	-	2	2	3	+	2	1	3
Russia	-	-	-	-	-	-	-	-	-
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	19,239	32,441	30,891	34,024	32,075	32,984	46,622	51,118	61,156
Working Group estimate	-	-	-	-	-	-	-	-	61,396

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998 [1]
Denmark	-	-	-	-	-	-	1	-	
Faroe Islands	1,803	1,566	2,128	4,405	6,241	3,763	6,148	4,971	3,817
France	-	-	3	2	-	-	29	11	8
Germany	336	303	382	415	648	811	3,368	3,342	3,056
Greenland	40	66	437	288	867	533	1,162	1,129	747
Iceland	36,557	34,883	31,955	33,987	27,778	27,383	22,055	18,569	10,728
Norway	50	34	221	846	1,173 [1]	1,810	2,164	1,986	1,367
Russia	-	-	5	-	-	10	424	37	52
UK (Engl. and Wales)	27	38	109	811	513	1,436	386	218	190
UK (Scotland)	-	-	19	26	84	232	25	26	43
United Kingdom									
Total	38,813	36,890	35,259	40,780	37,305	36,006	35,762	30,289	20,360
Working Group estimate	39,326	37,950	35,423	40,817	36,958	36,300	35,825	30,267	-

Country	1999 [1]	2000 [1]	2001 [1]
Denmark		-	-
Faroe Islands	3,884	4,812	-
France	-	-	-
Germany	3,082	3,271	2,810
Greenland	200	-	-
Iceland	11,180	14,537	16,590
Norway	1,187	1,272	1,510
Russia	138	183	186
UK (Engl. and Wales)	261	370	-
UK (Scotland)	69	121	-
United Kingdom	-	-	324
Total	20,001	24,566	21,420
Working Group estimate	20,371	26,839	28,021

1) Provisional data

Table 3.2.5.2 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea Va 1981 – 2001, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	325	669	33	46			15	379	719
Germany									
Greenland									
Iceland	15,455	28,300	28,359	30,078	29,195	31,027	44,644	49,000	58,330
Norway			+	+	2				
Total	15,780	28,969	28,392	30,124	29,197	31,027	44,659	49,379	59,049
Working Group estimate									59,272 [2]

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Faroe Islands	739	273	23	166	910	13	14	26	6
Germany					1	2	4		9
Greenland					1				[1]
Iceland	36,557	34,883	31,955	33,968	27,696	27,376	22,055	16,766	10,580
Norway									
Total	37,296	35,156	31,978	34,134	28,608	27,391	22,073	16,792	10,595
Working Group estimate	37,308 [2]	35,413 [2]							

Country	1999	2000 [1]	2001 [1]
Faroe Islands	9		
Germany	13	22	50
Greenland	[1]		
Iceland	11,087	14,507	16,590
Norway			6
UK (E/W/I)	26	73	
UK Scottland	3	5	
UK			59
Total	11,138	14,607	16,705
Working Group estimate		14,519 [3]	16,752

1) Provisional data

2) WG estimate inclueds additional catches as described in Working group report for each year and in the report from 2001.

3) Includes additional 125 t by Iceland

Table 3.2.5.3 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea Vb 1981 – 2001, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Denmark	-	-	-	-	-	-	6	+	-
Faroe Islands	442	863	1,112	2,456	1,052	775	907	901	1,513
France	8	27	236	489	845	52	19	25	...
Germany	114	142	86	118	227	113	109	42	73
Greenland	-	-	-	-	-	-	-	-	-
Norway	2	+	2	2	2	+	2	1	3
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	566	1,032	1,436	3,065	2,126	940	1,043	969	1,589
Working Group estimate	-	-	-	-	-	-	-	-	1,606 [2]

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	-	-	
Faroe Islands	1,064	1,293	2,105	4,058	5,163	3,603	6,004	4750	3660
France [6]	...	...	3 [1]	2	1	28	29	11	8 [1]
Germany	43	24	71	24	8	1	21	41	
Greenland	-	-	-	-	-	-	-	-	
Norway	42	16	25	335	53	142	281	42	114
UK (Engl. and Wales)	-	-	1	15	-	31	122		
UK (Scotland)	-	-	1	-	-	27	12	26	43
United Kingdom	-	-	-	-	-				
Total	1,149	1,333	2,206	4,434	5,225	3,832	6,469	4,870	3825
Working Group estimate	1,282 [2]	1,662 [2]	2,269 [2]	-	-	-	-	-	-

Country	1999	2000 [1]	2001 [1]
Denmark			
Faroe Islands	3873	4812	
France			
Germany	22	6	7
Greenland			
Norway	87	110 [1]	53
UK (Engl. and Wales)	9	35	
UK (Scotland)	66	116	
United Kingdom			195
Total	4057	5079	255
Working Group estimate	4265 [2]		3,951

1) Provisional data.
2) WG estimate includes additional catches as described in Working Group reports for each year and in the report from 2001

1) Provisional data.
2) WG estimate includes additional catches as described in Working group report for each year and in the report from 2001.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989
Faroe Islands	-	-	-	-	-	78	74	98	87
Germany	2,893	2,439	1,054	818	636	745	456	595	420
Greenland	+	1	5	15	81	177	154	37	11
Iceland	-	-	1	2	36	17	136	40	+
Norway	-	-	-	+	-	-	-	-	-
Russia	-	-	-	-	-	-	-	-	+
UK (Engl. and Wales)	-	-	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-
Total	2,893	2,440	1,060	835	753	1,017	820	770	518
Working Group estimate	-	-	-	-	-	-	-	-	-

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	-	-	-	-	-	-	1	+	+
Faroe Islands	-	-	-	181	168	147	130	148	151
Germany	293	279	311	391	639	808	3,343	3,301	3,399
Greenland	40	66	437	288	866	533	1,162	1,129	747 [1,10]
Iceland	-	-	-	19	82	7	-	1,803	148
Norway	8	18	196	511	1,120	1,668	1,881	1,944	1,253
Russia	-	-	5	-	-	10	424	37	52
UK (Engl. and Wales)	27	38	108	796	513	1405	264	218	190
UK (Scotland)	-	-	18	26	84	205	13		
United Kingdom	-	-	-	-	-	-	-		
Total	368	401	1,075	2,212	3,472	4,783	7,218	8,580	5940
Working Group estimate	736 [2]	875 [2]	1,176 [2]	2,249 [2]	3,125 [2]	5,077 [2]	7,283 [2]	8,558 [2]	

Country	1999	2000	2,001 [1]
Denmark			
Faroe Islands	2		
Germany	3047	3243	2,753
Greenland	200 [1,4]		
Iceland	93	30	
Norway	1100	1162 [1]	1,451
Russia	138	183	186
UK (Engl. and Wales)	226	262	
UK (Scotland)			
United Kingdom			70
Total	4806	4880	4,460
Working Group estimate	5376 [3]	6958 [5]	7,216 [6]

Table 3.2.5.5 Greenland halibut. Nominal catches (tonnes) by countries, in Subarea XII 1981 – 2001, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001
Faroe Islands		47				
Norway	2					
Total	2	47	-	-	-	-
WG estimate						102 [1]

[1] 102 t by Faroe Islands as reported to Faroe Island authorities

Table 3.2.5.6 Greenland halibut in Subareas V and XIV

Year	Landings (t)
1968	21872
1969	24237
1970	33823
1971	28973
1972	26473
1973	20463
1974	36280
1975	23494
1976	6045
1977	16578
1978	14349
1979	23616
1980	31252
1981	19239
1982	32441
1983	30891
1984	34024
1985	32075
1986	32984
1987	46622
1988	51118
1989	61396
1990	39326
1991	37950
1992	35423
1993	40817
1994	36958
1995	36300
1996	35825
1997	30267
1998	20360
1999	20371
2000	26839
2001	28021
Average	30491

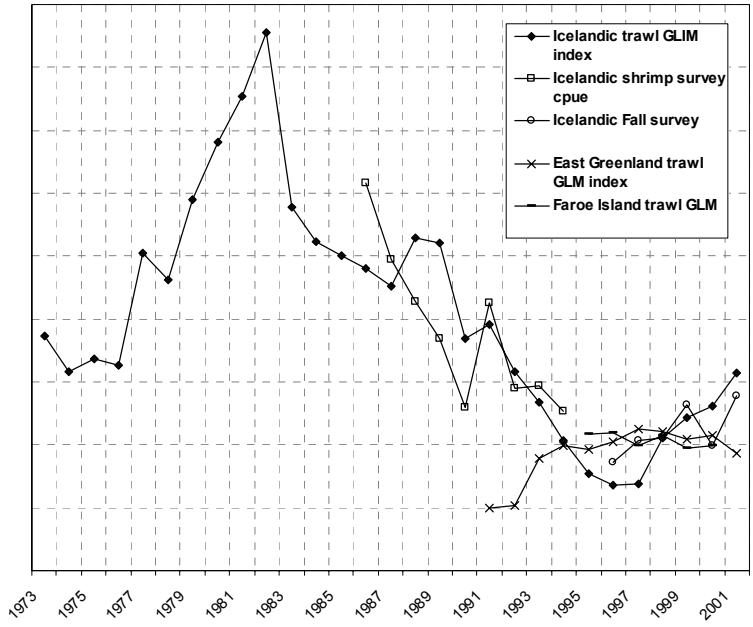


Figure 3.2.5.1 Various commercial and survey indices of Greenland halibut.

Figure 3.2.5.2 Output from ASPIC (Table 6.7.2.1.) with B/$\mathbf{B}_{MSY}$ and F/$\mathbf{F}_{MSY}$.

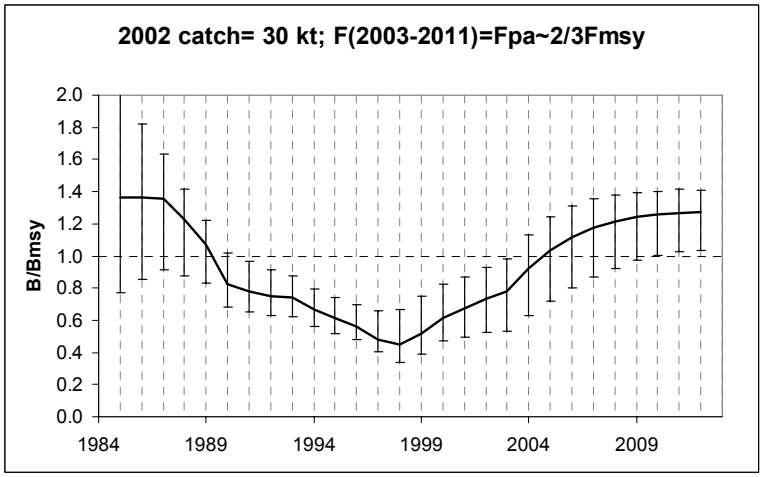
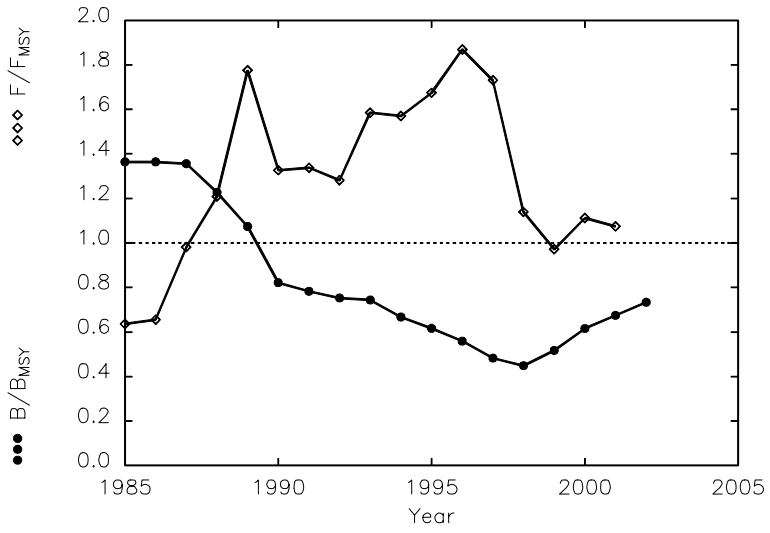


Figure 3.2.5.3 Projected B/$\mathbf{B}_{MSY}$ trajectory with approximately 80% confidence interval from bootstrapping ASPIC output.



3.2.6 Redfish in Subareas V, VI, XII and XIV

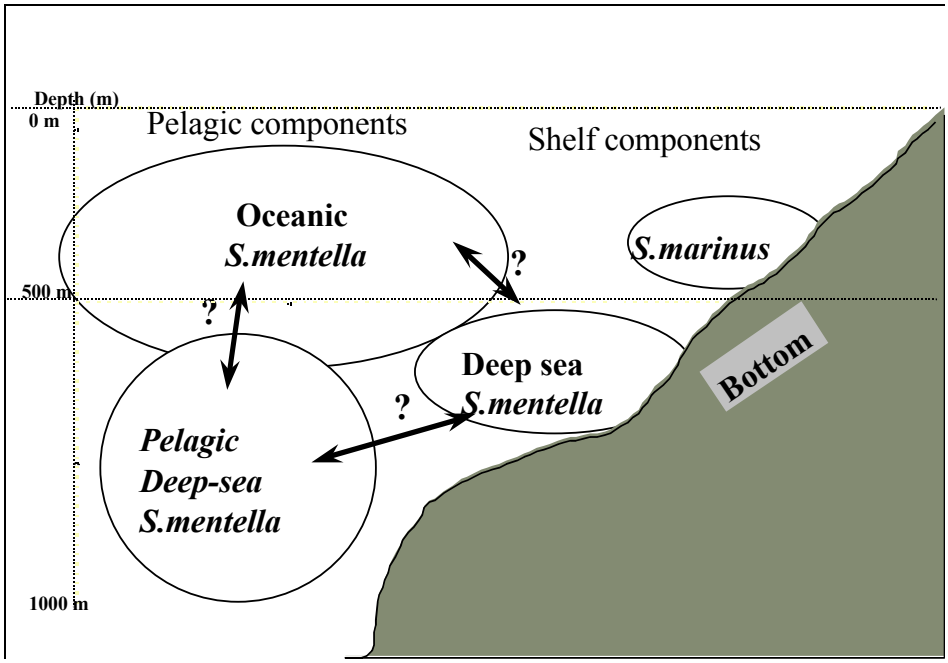
3.2.6.a Overview

Stocks: There are two main commercial species of redfish in Subareas V, XII, and XIV, *Sebastes marinus* and *S. mentella*. In Division Va a small fishery has recently developed on the third redfish species, *S. viviparus*. There are indications that *S. marinus* includes a genetically distinct component "giant" *S. marinus*, with a different depth distribution than typical *S. marinus*. The stock structure of *S. mentella* is complex and uncertain, but there are indications that there may be at least "oceanic", "pelagic deep-sea", and "deep-sea" stocks or stock components. Both the "oceanic" and "pelagic deep-sea" forms in the Irminger Sea are sometimes referred to as pelagic redfish, to differentiate them from the redfish associated with the slope and shelf areas. Thus the redfish fisheries in Subareas V, XII, and XIV operate on several stocks.

Of these stocks, typical *S. marinus* is mainly distributed in the shallower shelf areas, down to about 500 m depth.

The relationships of the various forms of *S. mentella* are complex, and not clearly differentiated. "Oceanic" and "pelagic deep-sea" forms of *S. mentella* both have pelagic distributions in the open Irminger Sea, and both can be found in depths from 100 to 1000 m. The "pelagic deep-sea" form is much more common than the "oceanic" form at depths greater than 500 m, and is exploited primarily by pelagic trawls. The "oceanic" form has its highest concentrations at depths less than 500 m, where it is exploited by the same fishing gears as the "pelagic deep-sea" form. The "deep-sea" form has a distribution more closely associated with the continental shelf than either of the other forms, with a depth distribution from below 1000 m up to above 500 m, where it overlaps with typical *S. marinus*. The "deep-sea" form is exploited primarily by otter board trawls, although other gears are also used.

Published genetic studies are inconclusive on whether these three forms of *S. mentella* are genetically distinct. Some types may even have additional substructure. However, in terms of distribution in the sea, there is substantial overlap of "pelagic deep-sea" and "oceanic" forms in the open sea. The distribution of the "pelagic deep-sea" form extends northward close enough to the continental shelf to overlap with the "deep-sea" form, and there may be exchange between the "oceanic" form and the "deep-sea" form at depths around 500 m near the continental slope as well. The figure below illustrates the complexities and uncertainties of the distributions of the species and forms of *Sebaste*s in the Northwest area. Research continues to clarify the genetic relationships among the various forms, but regardless of future advances in that area, the morphological similarities among species and forms, and the overlapping distributions among them will continue to present difficulties for assessment and management of these resources.



Historic development of the fishery: Redfish in Division Va are mainly caught by trawlers using demersal and pelagic trawl. *S. marinus* is the predominant species down to depths of about 500 m, whereas deep-sea *S. mentella* contributes mostly to the catches at greater depths. The Icelandic fleet takes the major part of the catches, but vessels from Germany, UK, and Faroe Islands also fish in Division Va. In recent years the Icelandic fleet has also caught pelagic *S. mentella* in the deeper parts of Division Va using pelagic trawl.

In Division Vb**,** redfish are mainly caught by trawlers using demersal trawls. Down to about 500 m, *S. marinus* is the most important redfish species, and pair-trawlers are the most important fleet. Deeper than about 500 m, redfish catches consist almost exclusively of deep-sea *S. mentella* taken mostly by otter-board trawlers larger than 1 000 HP. The Faroese catches constitute more than 90% of the redfish catches in this division. Otter-board trawlers from Germany and France occasionally target these stocks. The remainder of the total catches is mainly by-catch in other demersal fisheries.

Redfish catches taken by several countries in Subarea V**I** are considered to be mainly by-catch in demersal fisheries**.** These catches are negligible in comparison with redfish catches in Subareas V, XII, and XIV.

Catches in Subarea XII are mainly pelagic *S. mentella* and are taken by trawlers using pelagic trawls. At least 13 fleets have joined this fishery mainly from Russia, Germany, Iceland, Faroe Islands, and Norway.

In Subarea XIV both *S. marinus* and all *S. mentella* stocks are exploited. On the Greenland shelf and slopes, *S. marinus* dominates the trawl catches above 500 m, whereas deep-sea *S. mentella* dominates below 500 m. Most of the catches are taken by German freezer trawlers. In 1982 a pelagic trawl fishery started exploiting the oceanic *S. mentella* in the deeper parts of Subarea XIV. Since 1990 the main fleets are from Russia, Norway, Iceland, and Germany. In recent years, vessels from several other countries have joined this fishery, mainly outside the EEZs of Iceland and Greenland.

In Subareas Va, XII, and XIV, a pelagic fishery has developed at depths greater than 500 m to target *S. mentella*. In recent years, a substantial proportion of the pelagic *S. mentella* catch was taken below 500 m depth. For the first time, there was significant fishing effort extended from ICES Division XII into the NAFO Convention Area in the autumn of 2000 and 2001.

Landings: The total landings from the redfish stock complex (i.e. redfish in all Subareas) are given in Tables 3.2.6.a.1–5.

Table 3.2.6.a.1 REDFISH. Nominal catches (tonnes) by countries, in Division Va 1995-2001, as officially reported to ICES

Country	1995	1996	1997	1998	1999	2000	2001*
Faroe Islands	521	309	242	280	255		
Germany	229	233	-	284	428	513	844
Iceland	89,474	67,757	73,976	108,380	81,430	95,118	64,889
Norway	-	134	-	-	18	36*	26
UK (E/W/NI)	-	-	-	-	542	734	…
UK (Scotland)	-	-	-	-	149	70	…
United Kingdom							1,144
Total	90,224	68,433	74,218	108,944	82,822		

*Preliminary.

Table 3.2.6.a.2 REDFISH. Nominal catches (tonnes) by countries, in Division Vb 1995-2001, as officially reported to ICES.

Country	1995	1996	1997	1998	1999	2000	2001*
Faroe Islands	7,978	7,286	7,199	6,484	6,191		
France	111	62	98	110*			
Germany	91	189	36	-	207	79	88
Ireland	-	-	-	-	-	-	1
Norway	36	33	25	39	37	42*	25
Russia	-	-	-	-	-	12	54
UK (E/W/NI)	2	40	+	4	15	111	…
UK (Scotland)	24	43	36	27	46	142	…
United Kingdom							208
Total	8,242	7,653	7,394	6,664			

*Preliminary.

Table 3.2.6.a.3 REDFISH. Nominal catches (tonnes) by countries, in Subarea VI 1995-2001, as officially reported to ICES.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	-	-	-	-	-	-	+
Faroe Islands	2	-	12	-	44		
France[1]	529	489	395	297*			
Germany	5	9	1	1	+	+	1
Ireland	4	-	10	10	34	54	-
Norway	1	7	6	3	8	11*	5
Portugal	-	-	-	1	-	-	-
Russia	-	-	-	-	243	461	33
Spain	-	-	-	-	38	4	
UK (E/W/NI)	105	54	19	12	4	20	…
UK (Scotland)	500	603	518	364	762	405	…
United Kingdom							530
Total	1,146	1,162	961	688			

*Preliminary.

Table 3.2.6.a.4 REDFISH. Nominal catches (tonnes) by countries, in Subarea XII 1995-2001, as officially reported to ICES and/or FAO.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	16,854	7,092	3,720	3,968	2,108	4,000	-
Faroe Islands	3,467	3,127	3,822	1,793	528		
France	-	-	-	3*	-*		
Germany	9,673	4,391	8,866	9,746	8,204	1,128	3,877
Greenland	1,856	3,537	…	1,180*	1,188*		
Iceland	19,577	3,613	3,856	1,311	5,072	3,121	-
Latvia	5,003	1,084	-	-	-	-	
Netherlands	13	-	-	-	-	-	-
Norway	3,893	1,013	31	602	2,040	2,158*	879
Poland	-	-	662	-	-	-	-
Russia	34,730	606	-	89	7,698	9,243	4,509
Spain	20	410	1,155	2,231	1,723	576	
UK (E/W/NI)	-	33	-	+	187	-	…
UK (Scotland)	-	13	-	-	1	+	…
United Kingdom						-	-
Total	95,086	24,919	22,112	20,923	28,749		

*Preliminary.

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Table 3.2.6.a.5 REDFISH. Nominal catches (tonnes) by countries, in Subarea XIV 1995-2001, as officially reported to ICES and/or FAO.

Country	1995	1996	1997	1998	1999	2000	2001*
Estonia	-	-	-	-	-	3,811	598
Faroe Islands	8	298	123	47	2		
Germany	9,702	16,996	11,610	9,709	8,935	7,840	6,760
Greenland	2,936	2,699	193	296*	3,152*		
Iceland	8,947	49,381	33,820	6,441	23,770[1]	17,999	27,744
Norway	2,890	6,453	3,187	525	3,253	3,803*	4,258
Poland	-	-	114	-	-	-	-
Portugal	5,125	2,379	3,674	4,133	4,302	4,154	2,514[2]
Russia	9,439	45,142	36,930	25,748	16,652	14,851	23,851
Spain	4,534	3,897	7,552	4,660	4,175	2,657	
UK (E/W/NI)	48	247	28	43	68	45	…
UK (Scotland)	10	6	-	-	-	-	…
United Kingdom							167
Total	43,639	127,498	97,231	51,602	64,309		

*Preliminary. [1]Note Excluding 58 t reported as area unknown. [2]Reported as V/XII/XIV.

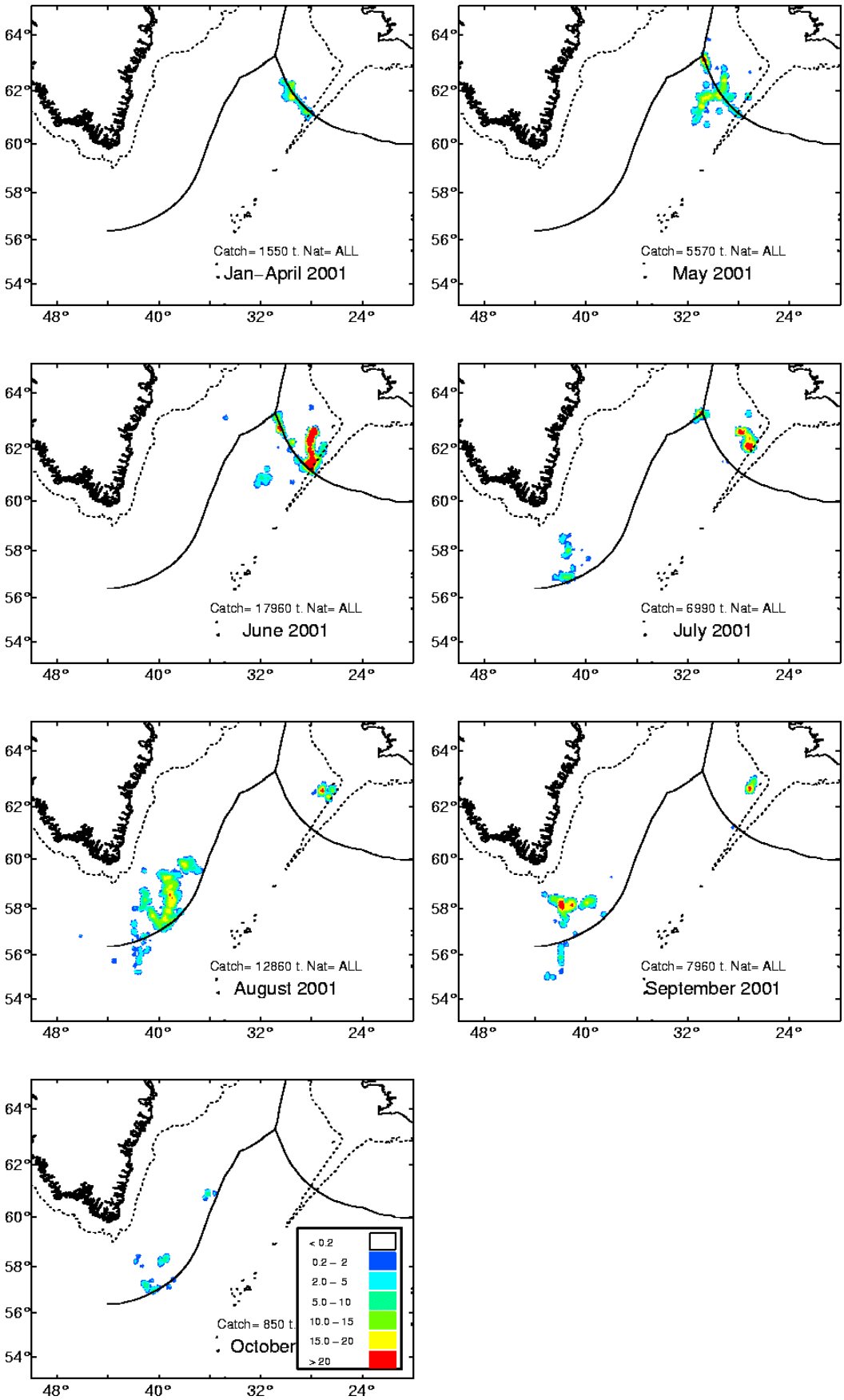

Figure 3.2.6.a.1 Fishing areas of the pelagic redfish by periods in 2001, including data from Germany, Norway, Iceland, and Greenland. The scale given on the pictures indicates the catches in tonnes per square nautical mile. Total catch registered for each period is also shown on the figures.

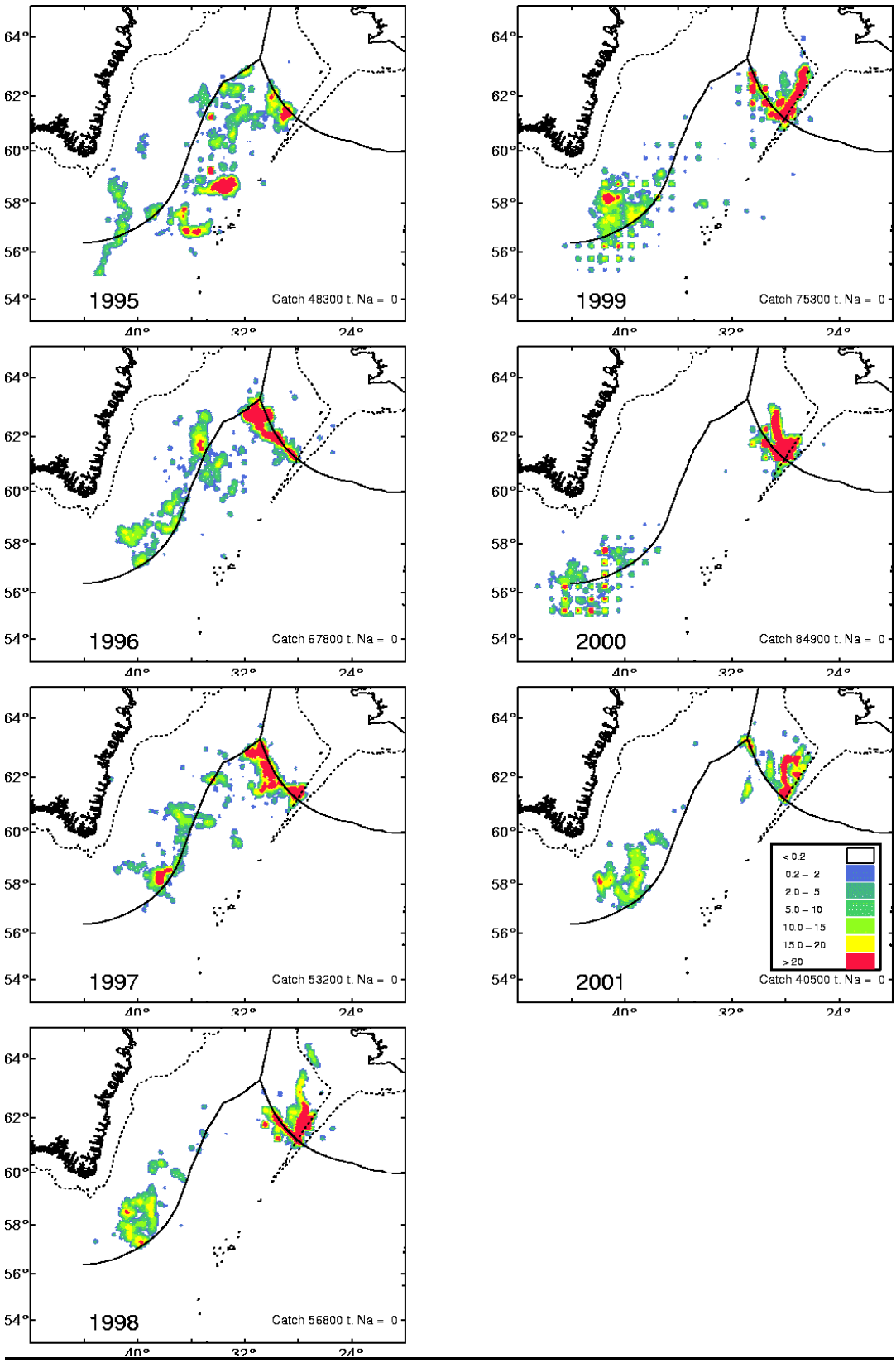

Figure 3.2.6.a.2 Fishing areas of the pelagic redfish by year from 1995-2001. Data from Germany (1995-2001), Iceland (1989-2001), Norway (1995-2001). Greenland (1999-2001), and Russia (1999-2000). The scale given on the pictures indicates the catches in tonnes per square nautical mile.

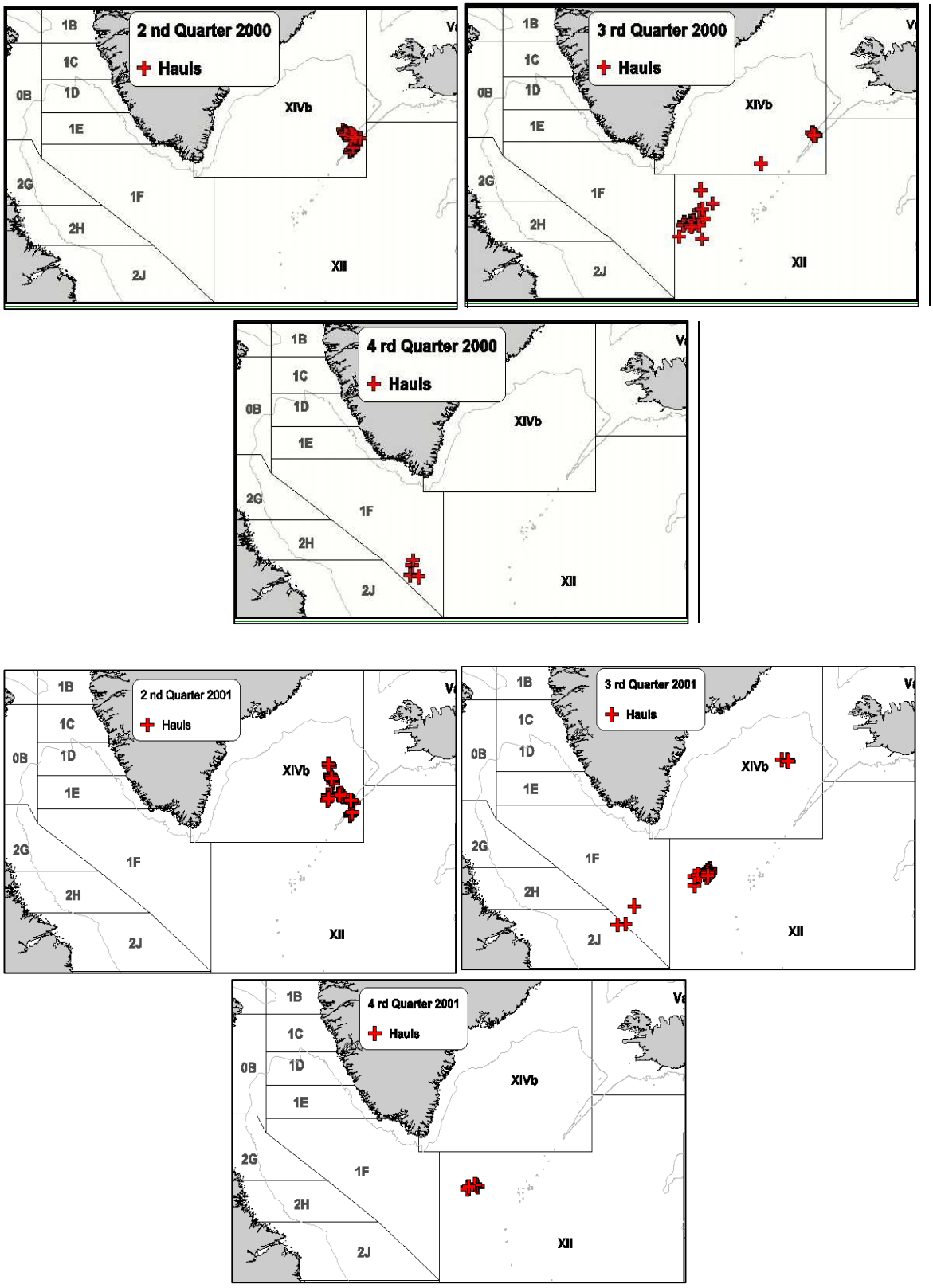

Figure 3.2.6.a.3 Fishing effort distribution of the Spanish oceanic redfish fishery in 2000-2001 by Divisions by quarter.

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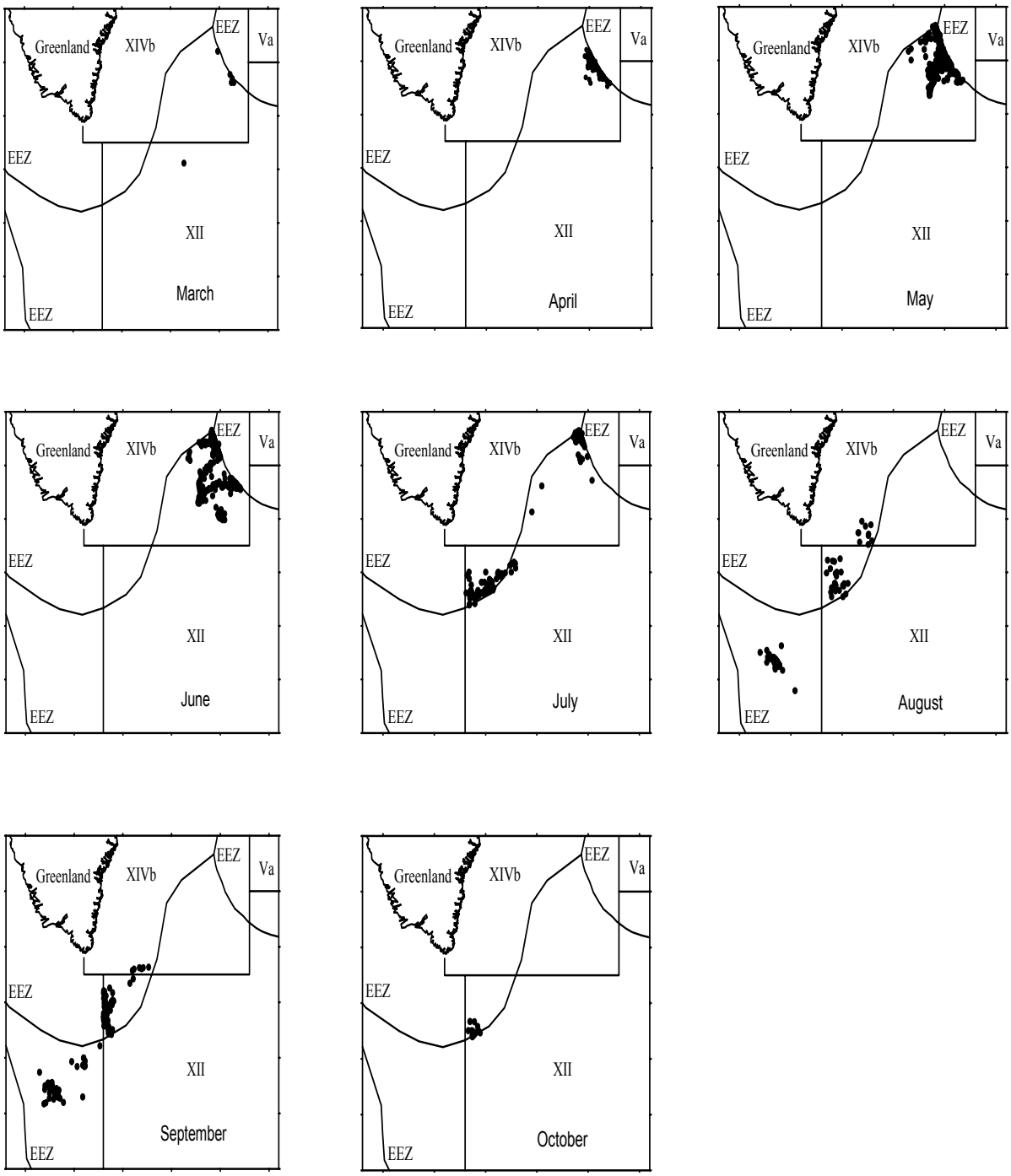
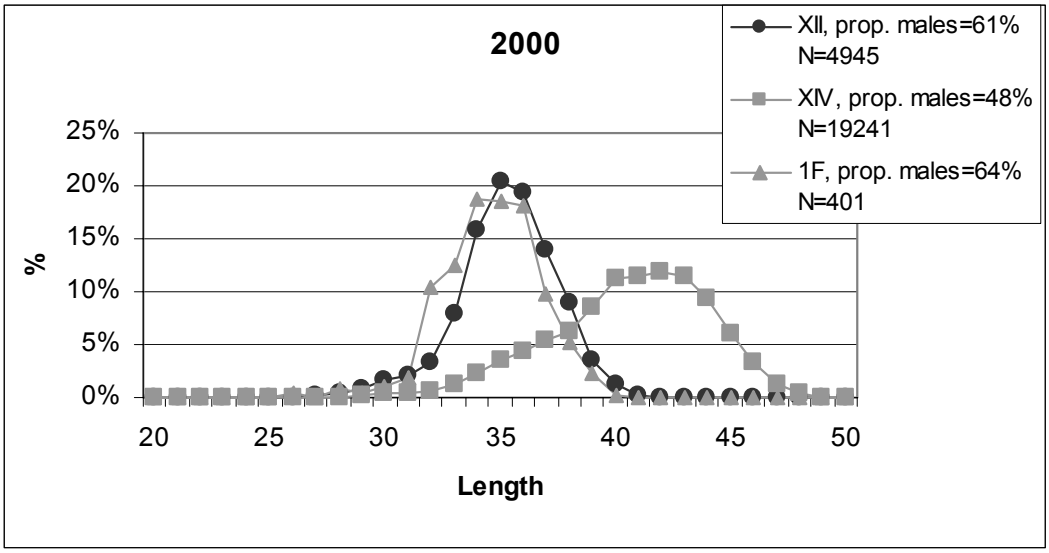


Figure 3.2.6.a.4 Russian fleet monthly position in the Irminger Sea in 2000.



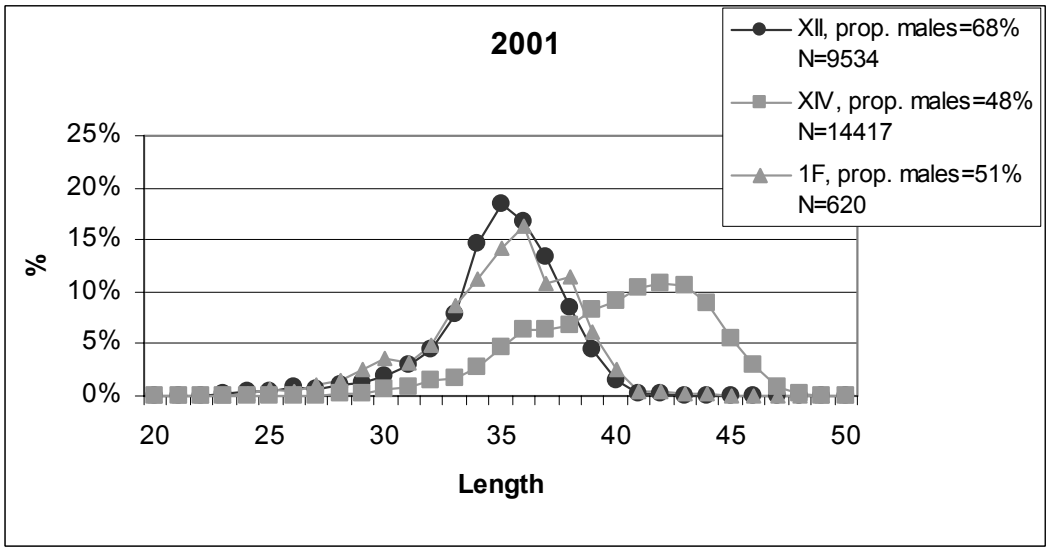


Figure 3.2.6.a.5 Length distribution of the Spanish oceanic redfish fishery in ICES Divisions XII, XIV, and in NAFO Division 1F in the year 2000 and 2001. The proportion of males is also given.

3.2.6.b *Sebastes marinus* in Subareas V, VI, XII, and XIV

State of stock/exploitation: The stock is considered to be outside safe biological limits. According to survey information, the stock in Division Va has fluctuated between $\mathbf{U}_{pa}$ and $\mathbf{U}_{lim}$ since 1990 (Figure 3.2.6.b.1) and is presently slightly below $\mathbf{U}_{pa}$. In Subarea XIV the German groundfish survey has shown an almost continuous decrease in biomass indices by more than 90% since 1986, and *S. marinus* at East-Greenland has been nearly depleted in the last decade (Figure 3.2.6.b.2). In Division Vb catches have declined since 1985 to a low level in recent years, which is also reflected in the Faroes summer survey (Figure 3.2.6.b.3). The strong 1990 year class has started to recruit to the fishery and should sustain the stock in the short to medium term. The surveys do no not indicate further strong year classes.

Management objectives: There is no explicit management objective for this stock.

Precautionary Approach reference points (unchanged since 1999):
ICES suggests that the relative state of the stock be assessed through survey CPUE index series (U).

ICES considers that:	ICES proposes that:
$\mathbf{U}_{lim}$ = 20% of highest observed survey index.	$\mathbf{U}_{pa}$ be set at 60% of highest observed survey index.

Technical basis:

The basis for the calculation of the $\mathbf{U}_{pa}$ is a survey index series starting in 1985 (Figure 3.2.6.b.1). Since 1990 the average **U** has been around half of $\mathbf{U}_{max}$. This has not resulted in any strong year classes compared to higher U's. A precautionary $\mathbf{U}_{pa}$ is therefore proposed at $\mathbf{U}_{max}$*0.6, corresponding to the U's associated with the most recent strong year class.

Advice on management: ICES advises that effort should be reduced by 25%, corresponding to catches not exceeding a total of 31 000 t in ICES Divisions Va and Vb. As the fishable stock of *S. marinus* in Subarea XIV is depleted, ICES advises that there be no direct fishery for *S. marinus* in that Subarea. In order to rebuild the stock further in the near future fishing effort should not be allowed to expand on the incoming 1990 year class.

Relevant factors to be considered in management: Apart from the 1990 year class, no strong recruitment is expected for the stock for several years. The 1990 year class will have to support the fishery for several years and management must distribute the potential yield over many years.

Catch forecast for 2003: Catch in 2003 was estimated as a function of an average standardised CPUE series 1999-2001 and the estimated effort in 2001.

Comparison with previous assessment and advice: The survey index for 2001 is higher than that of 2000 due to the strong incoming 1990 year class. The advice is the same as last year.

Elaboration and special comment: *S. marinus* are mainly taken by trawlers in depths down to 500 m. In Division Va the catch is mainly taken by Icelandic trawlers, while in Division Vb Faroese trawlers predominate. In Subarea XIV the catches are mainly by-catch in shrimp fisheries. Total catches decreased almost continuously from 1983–1996, but have increased slightly since then. The decline occurred in all subareas. In order to reduce the catches of *S. marinus* in Division Va, an area closure was imposed in 1994 and the quotas have been reduced in the most recent years.

Icelandic survey data in Subarea Va, data from a German groundfish survey in Subarea XIV, and from the Faroes groundfish survey in Division Vb are used as indicators of the stock size in the respective areas.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Table 3.2.6.b.1):

Year	ICES Advice	Predicted catch Corresp. to advice	*S. marinus* ACFM catch
1987	No increase in F	83	77
1988	No increase in F	84	90
1989	TAC[1]	117[1]	57
1990	TAC[1]	116[1]	67
1991	Precautionary TAC	77(117[1])	56
1992	Precautionary TAC	76(116[1])	56
1993	Precautionary TAC[1]	120[1]	50
1994	Precautionary TAC, if required	100[1]	43
1995	TAC	90[1]	45
1996	TAC for Va (28); precautionary TAC for Vb and XIV (4)	32[2]	37
1997	Effort 75% of 1995 value	32[2]	40
1998	Effort reduced in steps of 25% from the 1995 level	37.2[2]	39
1999	Effort not increased compared to 1997	35[2]	42
2000	Catch not increased compared to 1998	35[2]	44
2001	Effort not increased compared to 1999	33[2,3]	37
2002	25% reduction in effort	29[4]	
2003	25% reduction in effort(2001)	31[4]	

Weights in '000 t. [1] Deep-sea *S. mentella* and *S. marinus* combined. [2]*S. marinus* only. [3] In Va only. [4]Both Va and Vb and XIV.

Sebastes marinus in Subareas V, VI, XII and XIV.

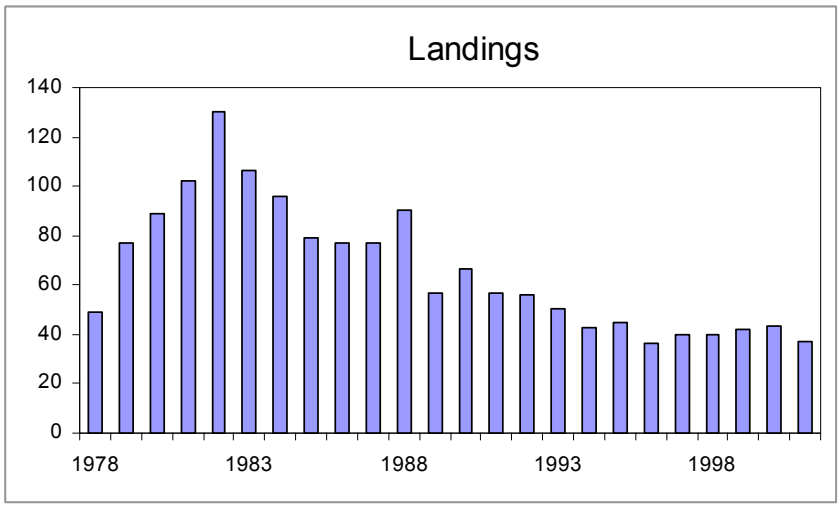


Table 3.2.6.b.1 *S. marinus*. Landings (in tonnes) by area used by the Working Group.

Year	Va	Vb	VI	XII	XIV	Total
1978	31,300	2,039	313	0	15,477	49,129
1979	56,616	4,805	6	0	15,787	77,214
1980	62,052	4,920	2	0	22,203	89,177
1981	75,828	2,538	3	0	23,608	101,977
1982	97,899	1,810	28	0	30,692	130,429
1983	87,412	3,394	60	0	15,636	106,502
1984	84,766	6,228	86	0	5,040	96,120
1985	67,312	9,194	245	0	2,117	78,868
1986	67,772	6,300	288	0	2,988	77,348
1987	69,212	6,143	576	0	1,196	77,127
1988	80,472	5,020	533	0	3,964	89,989
1989	51,852	4,140	373	0	685	57,050
1990	63,156	2,407	382	0	687	66,632
1991	49,677	2,140	292	0	4,255	56,364
1992	51,464	3,460	40	0	746	55,710
1993	45,890	2,621	101	0	1,738	50,350
1994	38,669	2,274	129	0	1,443	42,515
1995	41,516	2,581	606	0	62	44,765
1996	33,558	2,316	664	0	59	36,597
1997	36,342	2,839	542	0	37	39,761
1998	36,771	2,565	379	0	109	39,825
1999	39,824	1,436	773	0	7	42,040
2000	41,110	1,498	776	0	89	43,473
2001	34,940	1,513	530	0	88	37,071

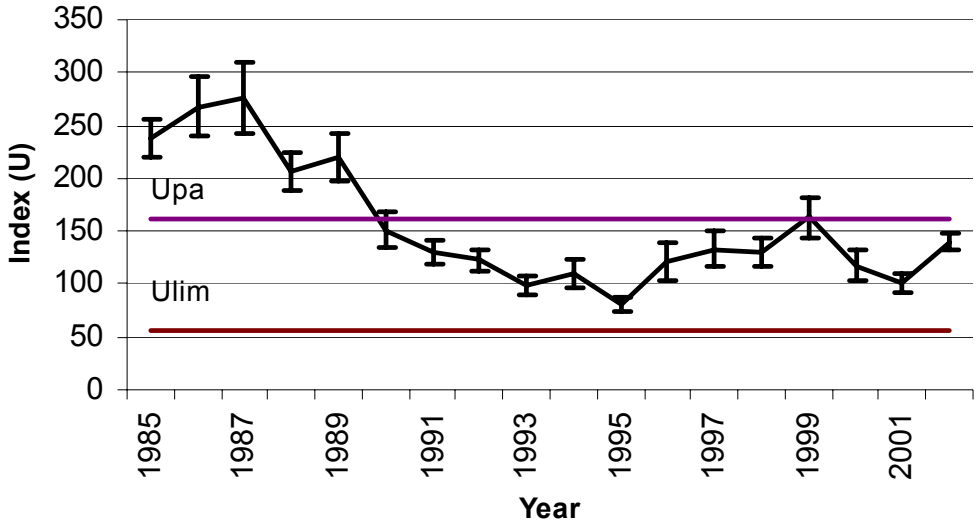


Figure 3.2.6.b.1 Index on fishable stock of *S. marinus* from Icelandic groundfish survey and 95% confidence intervals. The index is based on all strata at depths from 0-400 m.

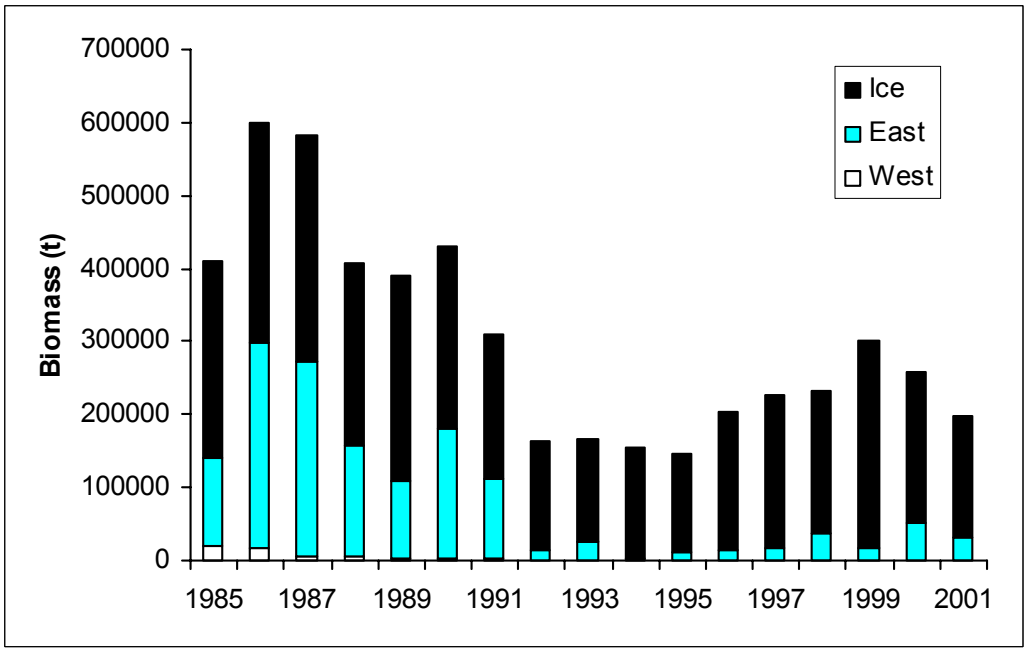


Figure 3.2.6.b.2 *S. marinus* (≥17 cm). Survey biomass indices for East and West Greenland and Iceland, 1985-2001.

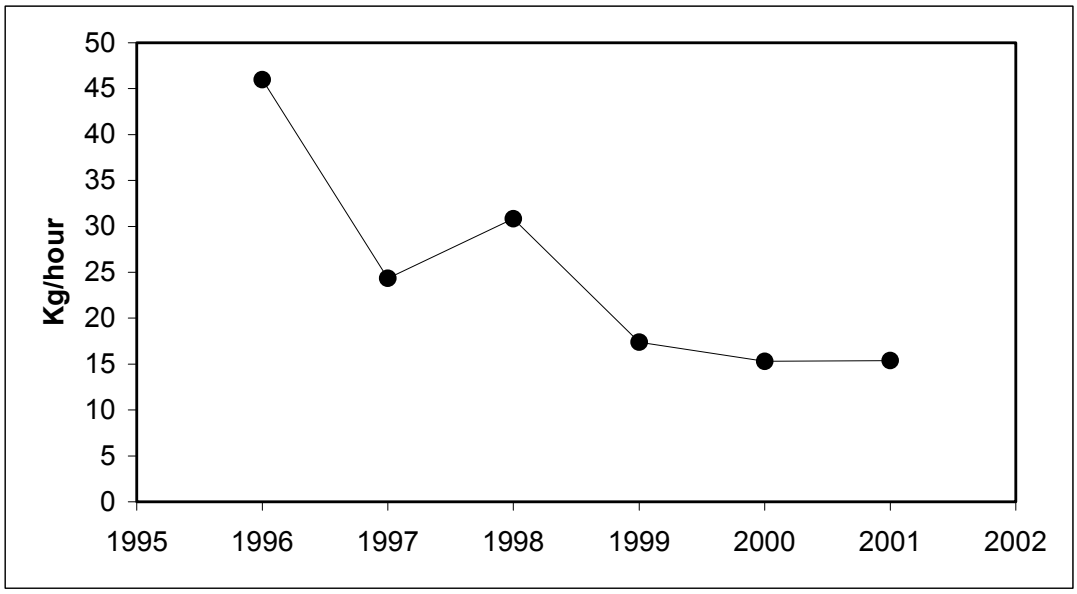


Figure 3.2.6.b.3 CPUE of *S. marinus* in the Faroes summer survey in Division Vb1 from 1996-2001.

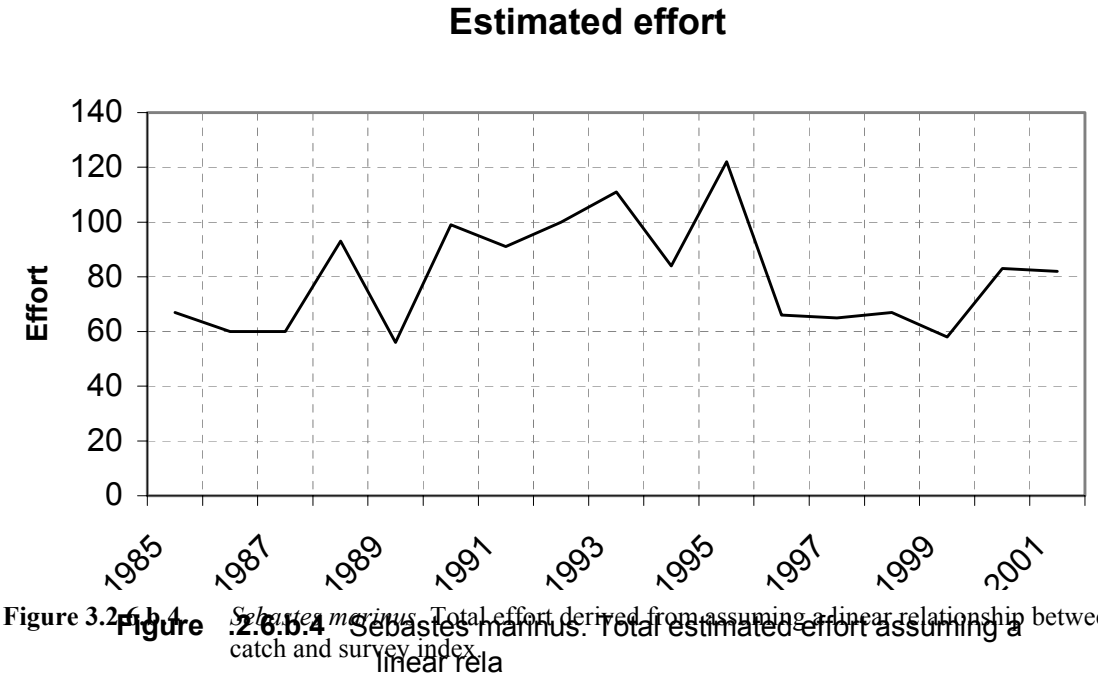


Figure 3.2.6.b.4 *Sebastes marinus*. Total effort derived from assuming a linear relationship between catch and survey index.

3.2.6.c Deep-sea *Sebastes mentella* on the continental shelf in Subareas V, VI, and XIV

State of stock/exploitation: The stock as a whole is considered to be inside safe biological limits although status varies among regions. All CPUE indices show a substantial reduction from a high in the late 1980s, but from the mid-1990s the CPUE index from the Icelandic demersal fishery has remained relatively stable, slightly above $\mathbf{U}_{pa}$. Since 1994 total catches have declined by over 50%, although the decline is not completely the consequence of declining stock status. The catch in 2001 was the lowest catch since 1979. Some of the decline is due to catch restrictions which have substantially reduced effort since 1994.

Based on survey results the SSB of deep-sea *S. mentella* on the continental shelf in Subarea XIV remains severely depleted (Figure 3.2.6.c.2).

Management objectives: There is no explicit management objective for this stock. However, for any management objectives to meet precautionary criteria U should be greater than $\mathbf{U}_{pa}$.

Precautionary Approach reference points: (established in 1999)

ICES considers that:	ICES proposes that:
The maximum index in the CPUE series from the Icelandic commercial bottom trawl fishery be set as $\mathbf{U}_{max}$.	$\mathbf{U}_{pa}=\mathbf{U}_{max}/2$. $\mathbf{U}_{lim}=\mathbf{U}_{max}/5$.

Technical basis:

The basis for the calculation of the $\mathbf{U}_{pa}$ is a CPUE data series from the commercial fishery in Division Va starting in 1985 (Figure 3.2.6.c.1).

Advice on management: ICES advises that the effort should be kept low and no higher than the recent average. Accordingly, the catch for the total stock should be less than 30 000 t. As the fishable stock of *S. mentella* in Subarea XIV is depleted ICES advises that there should be no direct fishery for *S. mentella* in that Subarea.

Relevant factors to be considered in management: The German surveys in East Greenland cover nursery grounds for *S. mentella*. A strong cohort from 1989 was observed in the survey in 1995 to 1998. That cohort has emigrated from the survey area and has started to contribute to the fisheries. There are no indications in the survey of more recent strong year classes.

The nursery grounds of *S. mentella* on the continental shelf in Subarea XIV probably supply recruits to both the pelagic redfish stocks in the Irminger Sea and the shelf stock in Divisions Va and Vb.

Catch forecast for 2003: Catch in 2003 was estimated as a function of an average standardised CPUE for 1999-2001 and the average effort in 1999-2001.

Comparison with previous assessment and advice: The CPUE series, which is the basis for the advice has been revised. The revision did not alter the perception of the stock situation from last year's assessment. The effort in 2001 was about 40% lower than in previous years.

Elaboration and special comment: In Division Va deep-sea *S. mentella* are taken mainly by Icelandic trawlers in depths greater than 500 m. In Division Vb the fishery is carried out mainly by Faroese trawlers, though some by-catch is taken by other countries fishing demersal species. In Subarea XIV the catch is taken largely by German freezer trawlers. The annual catches almost doubled in the early 1990s, but since then have decreased to the level of the 1980s. The increase was mainly caused by an increase in Division Va, both in the demersal and in a temporarily developed pelagic fishery, and by an increase in Subarea XIV in 1993–1994.

The advice for 2003 (of less than 30 000 t) is for the entire stock.

Data and assessment: No data were available to make an analytical assessment. CPUE data are available from Icelandic trawlers in Division Va (1986–2001), the Faroese fishery in Division Vb (1985-2001), and from the German groundfish survey in Subarea XIV (1982–2001).

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data (Table 3.2.6.c.1):

Year	ICES Advice	Predicted catch corresponding to advice	Deep-sea *S. mentella* ACFM catch
1987	Precautionary TAC	41–58	38
1988	Precautionary TAC	41–58	31
1989	TAC[1]	117[1]	54
1990	TAC[1]	116[1]	44
1991	Precautionary TAC	(40) 117[1]	68
1992	Precautionary TAC	(40) 116[1]	63
1993	Precautionary TAC[1]	120[1]	74
1994	Precautionary TAC, if required	100[1]	84
1995	TAC	90[1]	56
1996	Precautionary TAC (45 in Va; 23 in VI and XIV)	68[2]	42
1997	Effort 75% of 95-value	39[2]	43
1998	Fishing mortality be further reduced towards the 86-90 levels		38
1999	Fishing mortality be further reduced towards the 86-90 levels		35
2000	Fishing effort be further reduced by 25%		37
2001	Fishing effort be reduced by 25% from 1998 level	22[3]	23
2002	*Status quo* fishing effort	36[4]	
2003	Not higher fishing effort than recent average	30[4]	

Weights in '000 t. [1] Deep-sea *S. mentella* and *S. marinus* combined. [2]Deep-sea *S. mentella* only. [3]In Va only. [4] For entire Subarea V.

Deep-sea *Sebastes mentella* Subareas V, VI, and XIV

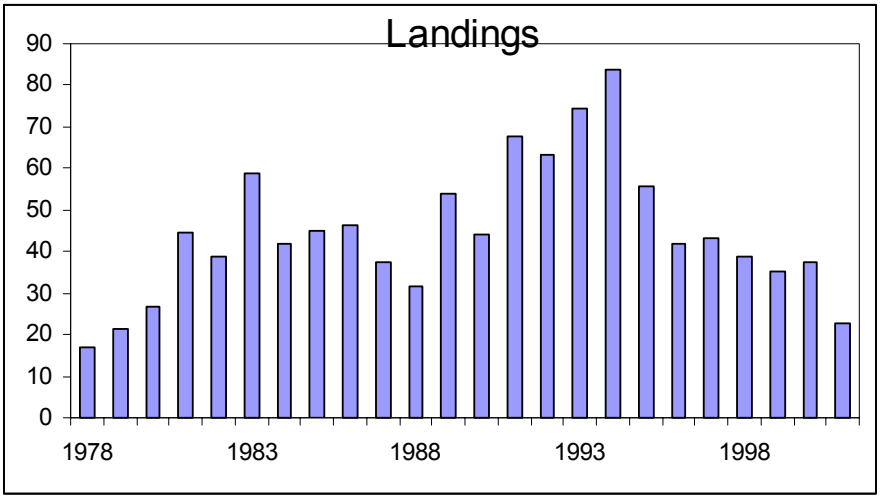


Table 3.2.6.c.1 Deep-sea *S. mentella* on the continental shelf. Landings (in tonnes) by area used by the Working Group.

Year	Va	Vb	VI	XII	XIV	Total
1978	3,902	7,767	18	0	5,403	17,090
1979	7,694	7,869	819	0	5,131	21,513
1980	10,197	5,119	1,109	0	10,406	26,831
1981	19,689	4,607	1,008	0	19,391	44,695
1982	18,492	7,631	626	0	12,140	38,889
1983	37,115	5,990	396	0	15,207	58,708
1984	24,493	7,704	609	0	9,126	41,932
1985	24,768	10,560	247	0	9,376	44,951
1986	18,898	15,176	242	0	12,138	46,454
1987	19,293	11,395	478	0	6,407	37,573
1988	14,290	10,488	590	0	6,065	31,433
1989	40,269	10,928	424	0	2,284	53,905
1990	28,429	9,330	348	0	6,097	44,204
1991	47,651	12,897	273	0	7,057	67,879
1992	43,414	12,533	134	0	7,022	63,103
1993	51,221	7,801	346	0	14,828	74,196
1994	56,720	6,899	642	0	19,305	83,566
1995	48,708	5,670	536	0	819	55,733
1996	34,741	5,337	1,048	0	730	41,856
1997	37,876	4,558	419	0	199	43,051
1998	33,125	4,089	298	3	1,376	38,890
1999	28,590	5,294	243	0	865	34,992
2000	30,696	4,841	885	0	986	37,408
2001	17,313	4,339	39	0	866	22,567

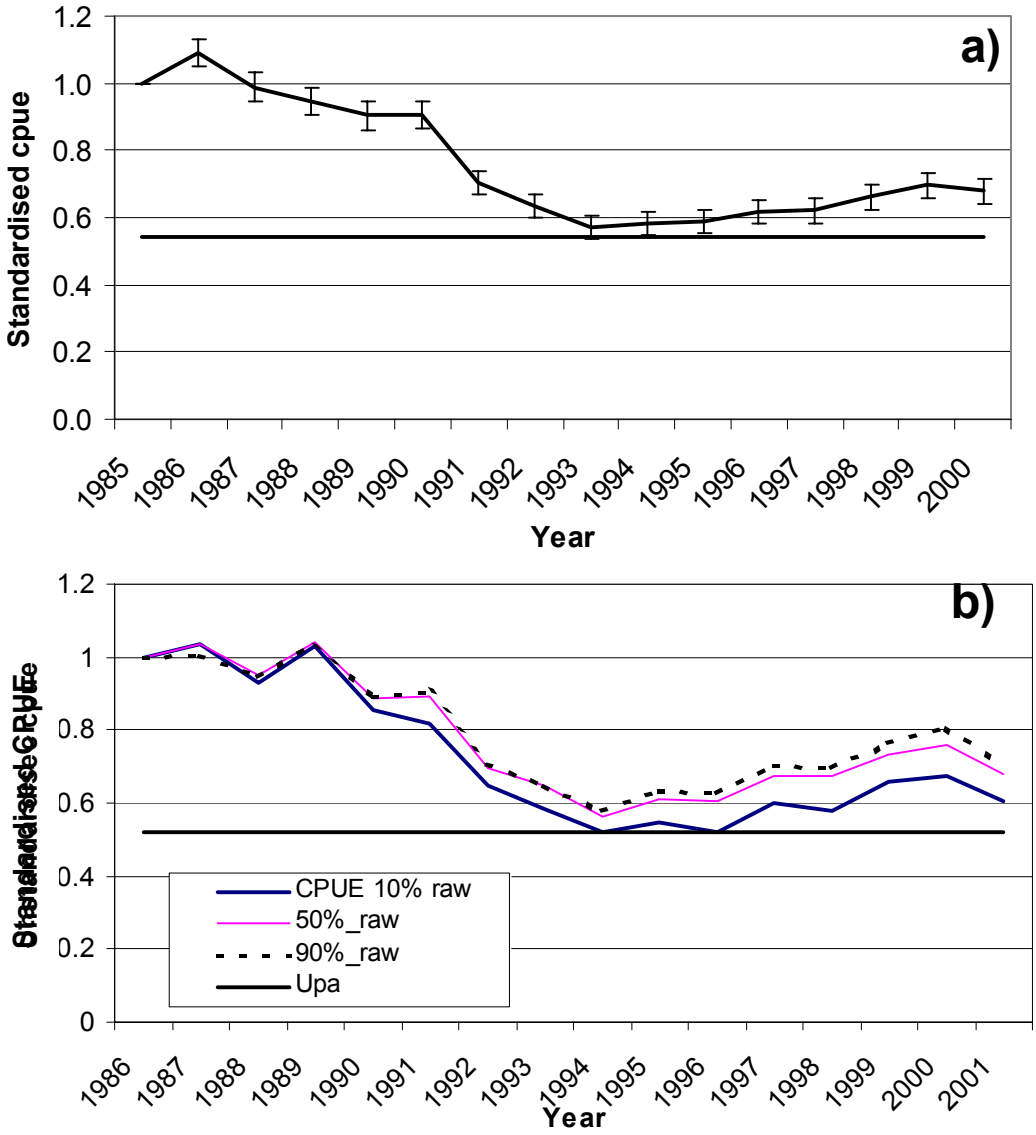


Figure 3.2.6.c.1 CPUE, relative to 1986, from the Icelandic bottom trawl fishery for deep-sea *S. mentella* on the continental shelf, based on a GLIM model (a), which is the basis for the advice, and based on simple mean (b). The GLIM model shows the modelled development using GLIM including hauls where redfish deeper than 500 m compose 50% or more of the total catch in each haul. Simple mean means CPUE calculated on hauls where redfish deeper than 500 m compose 10% (50, 70 and 90% lines are also shown) or more of the total catch in each haul. The horizontal line indicates 50% of $\mathbf{U}_{max}$.

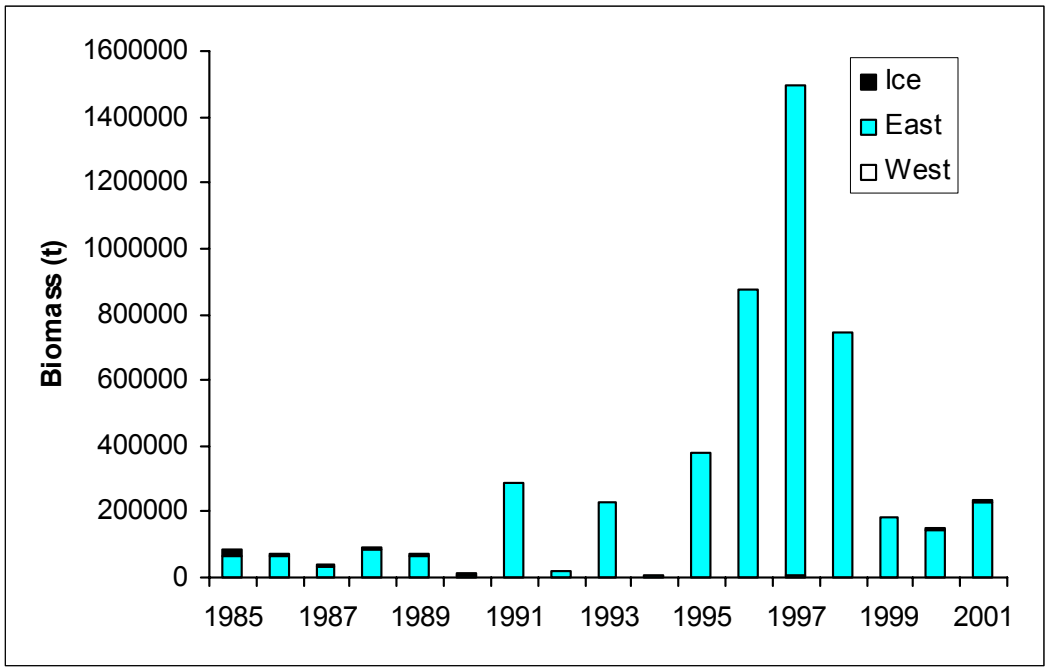


Figure 3.2.6.c.2 Deep-sea *S. mentella* (>=17 cm) on the continental shelf. Survey biomass indices for East and West Greenland and Iceland, as derived from the German and Icelandic groundfish surveys, 1985-2001.

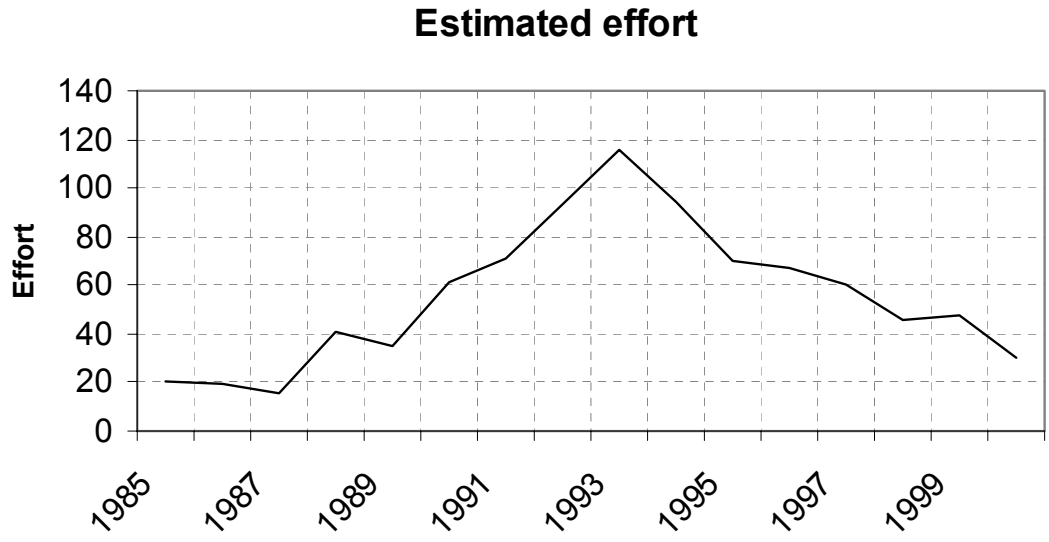


Figure 3.2.6.c.3 *Sebastes mentella*. Total standardised effort derived from a multiplicative model.

3.2.6.d Pelagic fishery for *Sebastes mentella* in the Irminger Sea

The stock structure of pelagic redfish *S. mentella* in Subarea XII, Division Va, and Subarea XIV, and in the NAFO Convention Area remains generally uncertain. There is a difference in the depth and geographical distribution of the two pelagic redfish types, namely the 'oceanic *S. mentella*', mainly above 500 meters and southwesterly in the Irminger Sea, and the 'pelagic deep-sea *S. mentella*', mainly below 500 meters and northeasterly in the Irminger Sea. There are no indications that the pelagic *S. mentella* in the NAFO Convention Area are distinct from the stock(s) or components in the adjacent Irminger Sea.

State of stock/exploitation: The state of the stock is not precisely known. There are indications from acoustic surveys that the stock may have been larger in the early 1990s. Although variable, CPUE series from the commercial fisheries on both redfish types indicate no trend in the stocks since 1995. Biomass estimates from a survey in 2001 suggest a biomass in the order of 2 million tonnes, but this estimate is highly uncertain. Therefore it is not known if the current exploitation rate is above or below the 5% exploitation rate considered sustainable.

Management objectives: There is no explicit management objective for this stock.

Advice on management: The recent exploitation level seems not to have caused stock size reduction. For 2002 and 2003, ICES advises that TACs do not exceed current catch levels (including the NAFO Convention Area). The average catch in the last 5 years has been 119 thousand tonnes. In addition, ICES advises that management action should be taken to prevent a disproportional exploitation rate of any one component.

Relevant factors to be considered in management: Possible changes in the depth distribution of the two redfish types above and below 500 m combined with the differences in geographic coverage of acoustic surveys in different years ,mean that the acoustic biomass series cannot be interpreted as a consistent series showing relative changes in stock size. The stock structure for pelagic *S. mentella* is unknown. Fishing patterns after 1995 resulted in 2 almost distinct fishing grounds in terms of geographic distribution and trawling depth. In 2000 and 2001, substantial catches were taken from the pelagic *S. mentella* aggregations discovered recently in the NAFO Convention Area. There may be a relationship between the demersal deep-sea *S. mentella* on the continental shelves of the Faroe Islands, Iceland, and Greenland and the pelagic *S. mentella* components in the Irminger Sea. This should be kept in mind in the management of these components.

Since this is a relatively new fishery on a long-lived, slow-growing species, ICES notes that monitoring of the stock is essential in order to keep track of biomass changes as they occur. Similarly, it is important to gather the information needed to evaluate the productivity of the stock. This includes information on recruitment, nursery areas, stock identification, and biomass estimation.

Nursery areas for both of the pelagic stock components are likely to be found at the continental slope off East Greenland. The juvenile redfish in these areas should, therefore, be protected and appropriate measures to reduce the by-catches in the shrimp fishery need to be taken.

Comparison with previous assessment and advice: The decline in the time-series of the acoustic survey has been the basis for the advice in past assessments. Less emphasis on the acoustic survey estimates has resulted in a change in the perception of stock trends. The decline in the acoustic estimators is no longer considered to represent stock decline only, but also changes in the availability of the *S. mentella* to the acoustical instruments. The assessment of the current state of the stock and the advice is based on standardized CPUE indices.

Elaboration and special comment: The pelagic fishery in the Irminger Sea is conducted only on the mature part (approximately 95% mature) of the stock. The fishery started in 1982. After decreasing from 1988–1991, mostly due to a reduction in Russian effort, landings increased. The increase in the catches from 1991–1996 is a direct consequence of increased fishing effort due to new fleets entering the fishery. However, the catches have been significantly lower during the last 5 years; at the same time the fishery has expanded into deeper water and the season has expanded from March to December.

The 2001 trawl-acoustic survey on pelagic redfish (*S. mentella*) in the Irminger Sea and adjacent waters was carried out in June/July. Approximately 420 000 square nautical miles were covered, which is the most extended coverage for acoustic assessment pelagic redfish in the Irminger Sea. The stock size measured with the acoustics was assessed to be about 715 000 t at depths down to the deep-scattering layer or about 350 m. The acoustic survey results (shallower than 500 m) indicate a stable stock situation size compared with the 1999 results. In 2001, as well as in 1999, the stock shallower than 500 m was observed more south-westerly and deeper than it has been during former acoustic surveys in the last decade.

By using information from trawl hauls biomass in the depth layers from 0-500 depth, including the layer

where the redfish that was mixed with the deep-scattering layer, was estimated at about 1.1 mill. t. Such estimates are not directly comparable with the acoustic estimates shallower than 500 m depth and should be interpreted with care, due to their innovate nature. About 1.1 mill. t was estimated by using the information from the trawl hauls deeper than 500 m. At these depths, the densest concentrations were found in the NE part of the area (Figure 3.2.6.d.2). This method is still experimental and needs further development.

New survey information will be available after the June/July 2003 survey has been carried out.

Given the technical, seasonal, geographical, and depth changes of the fishing activities, the relevance of the estimated reduction in CPUE as indicator of stock abundance remains difficult to assess both above and below 500 m.

Data on maturity-at-length, and -at-weight and some age-reading experiments were available from both the survey and from the fishery. CPUE series are available for some fleets and as standardised series (Figures 3.2.6.d.1.a-c).

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Catch data for oceanic and pelagic deep-sea *S. mentella* combined (Tables 3.2.6.d.1-3):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No assessment	-		91
1988	No assessment	-		91
1989	TAC	90–100		39
1990	TAC	90–100		32
1991	TAC	66		27
1992	Preference for no major expansion of the fishery	-		66
1993	TAC	50		116
1994	TAC	100		149
1995	TAC	100		176
1996	No specific advice	-	153[1]	180
1997	No specific advice	-	153–158[1]	123[2]
1998	TAC not over recent (1993-1996) levels of 150 000 t		153[1]	117[2]
1999	TAC to be reduced from recent (1993-1996) levels of 150 000 t		153[1]	110[2]
2000	TAC set lower than recent (1997-1998) catches of 120 000 t	85	120	126
2001	TAC less than 75% of catch 1997-1999	85	95	117
2002	TAC less than 75% of catch 1997-1999 – Revised to be below current catch levels	85	Not agreed NEAFC proposal (120)	
2003	TAC not exceed current catch levels	119		

[1]Set by NEAFC. [2]Preliminary. (Weights in '000 t).

Pelagic fishery for *Sebastes mentella* in the Irminger Sea

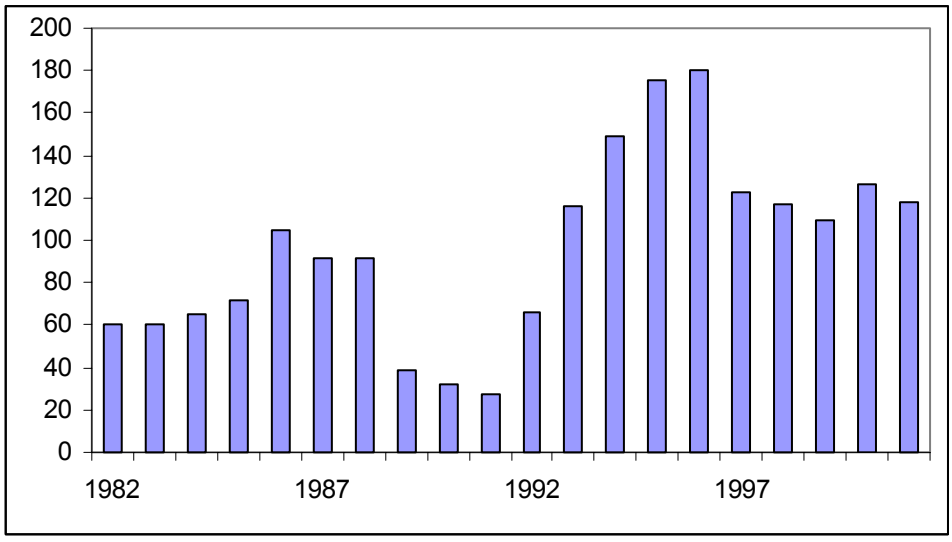


Table 3.2.6.d.1 Results of dividing the Icelandic pelagic redfish catch (t) according to the Icelandic samples from the fishery.

Year	Oceanic	Deep sea	Not classified	Catch Oceanic	Catch Deep sea	Total Catch
1995	72%	27%	0%	25186	9445	34631
1996	45%	52%	3%	29182	33721	62903
1997	36%	64%	0%	14859	26417	41276
1998	10%	85%	4%	5504	46780	52284
1999	15%	85%	0%	6765	37159	43924
2000	5%	95%	0%	2262	42970	45232
2001	34%	66%	0%	14440	28032	42472

Table 3.2.6.d.2 Pelagic *S. mentella*. Landings (in tonnes) by area as used by the Working Group. Due to the lack of area reportings for some countries, the exact share in Subareas XII and XIV is just approximate in the latest years.

Year	Va	Vb	VI	XII	XIV	NAFO 1F	NAFO 2H	NAFO 2J	Total
1982	0	0	0	39,783	20,798				60,581
1983	0	0	0	60,079	155				60,234
1984	0	0	0	60,643	4,189				64,832
1985	0	0	0	17,300	54,371				71,671
1986	0	0	0	24,131	80,976				105,107
1987	0	0	0	2,948	88,221				91,169
1988	0	0	0	9,772	81,647				91,419
1989	0	0	0	17,233	21,551				38,784
1990	0	0	0	7,039	24,477	385			31,901
1991	0	0	0	10,061	17,089	458			27,608
1992	1,968	0	0	23,249	40,745				65,962
1993	2,603	0	0	72,529	40,703				115,835
1994	15,472	0	0	94,189	39,028				148,689
1995	1,543	0	0	132,039	42,260				175,842
1996	4,744	0	0	42,603	132,975				180,322
1997	15,301	0	0	19,822	87,812				122,935
1998	40,612	0	0	22,446	53,910				116,968
1999	36,524	0	0	24,085	48,521	534			109,665
2000	44,677	0	0	19,862	50,722	10,815			126,076
2001[1]	28,139	0	0	28,957	53,753	5,299	208	1,284	117,649

Table 3.2.6.d.3 Pelagic redfish *S. mentella*. Time-series of survey results, areas covered, hydro-acoustic abundance, and biomass estimates shallower and deeper than 500 m (based on standardized trawl catches converted into hydro-acoustic estimates derived from linear regression models).

Year	Area covered (1000 NM^2)	Acoustic estimates < 500 m (10^6 ind.)	Acoustic estimates < 500 m (1000 t)	Trawl estimates < 500 m (10^6 ind.)	Trawl estimates < 500 m (1000 t)	Trawl estimates > 500 m (10^6 ind.)	Trawl estimates > 500 m (1000 t)
1991	105	3498	2235				
1992	190	3404	2165				
1993	121	4186	2556				
1994	190	3496	2190				
1995	168	4091	2481				
1996	253	2594	1576				
1997	158	2380	1225				
1999	296	1165	614			638	497
2001	420	1370	716	1955	1075	1446	1057

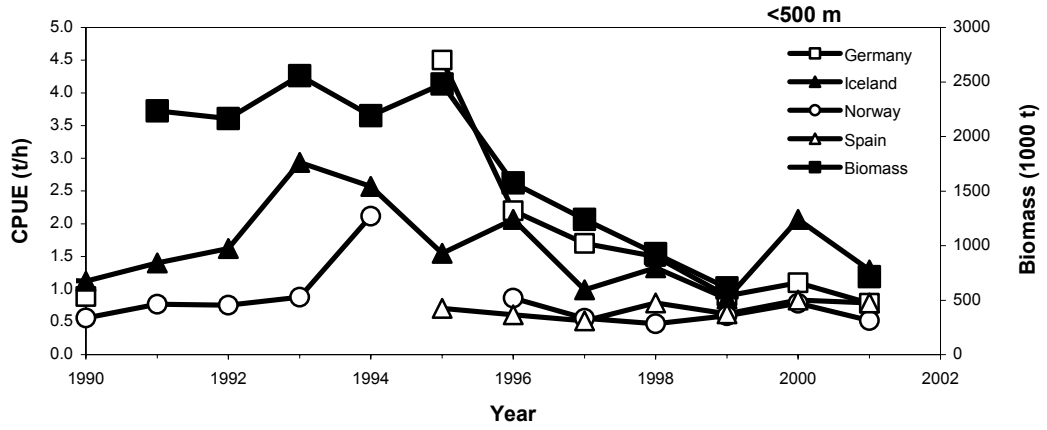


Figure 3.2.6.d.1.a Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, shallower than 500 m, and estimated acoustic biomass from surveys.

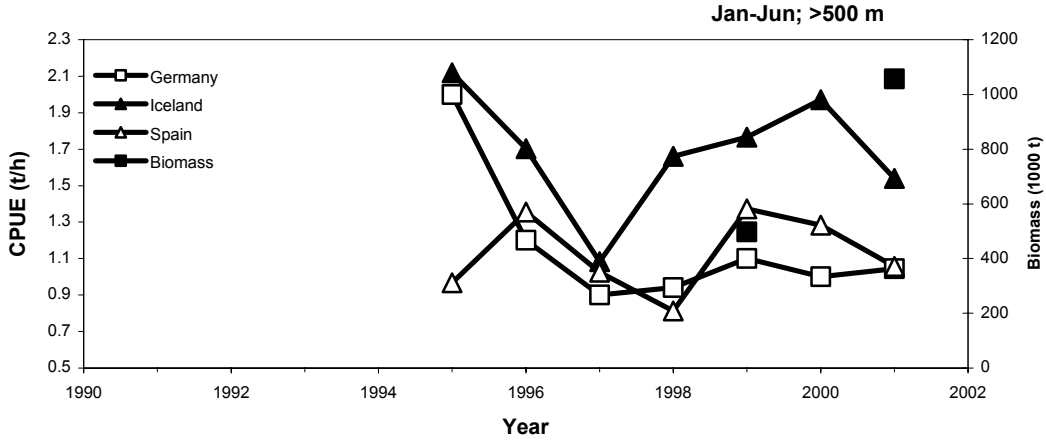


Figure 3.2.6.d.1.b Trends in CPUE of pelagic *S. mentella* fishery in the Irminger Sea, deeper than 500 m, and estimated trawl biomass from surveys.

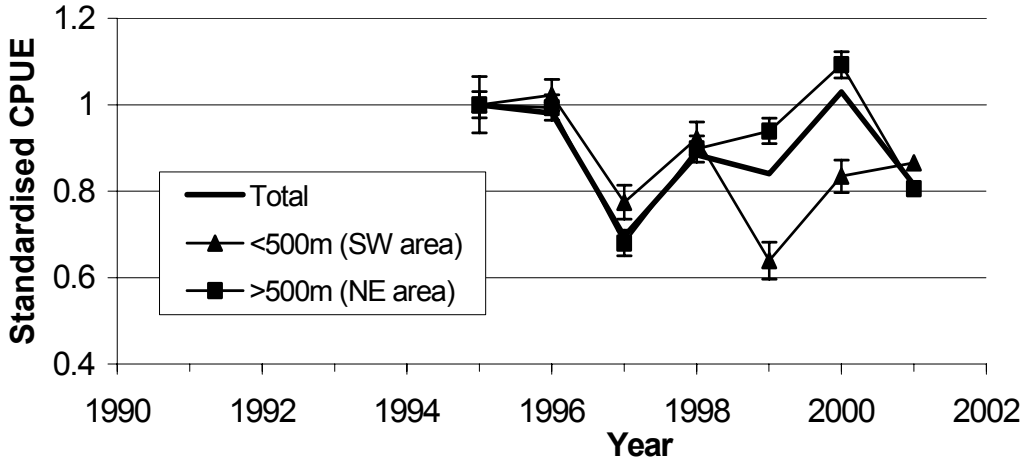


Figure 3.2.6.d.1.c Standardised CPUE, as calculated by using data from Germany (1995-2001), Iceland (1995-2001), Greenland (1999-2001), and Norway (1995-2001) in the GLM model (see chapter 10.2.2.), divided by depths shallower (southwestern area) and deeper than 500 m (northeastern area) and both depth layers (areas) combined (Total).

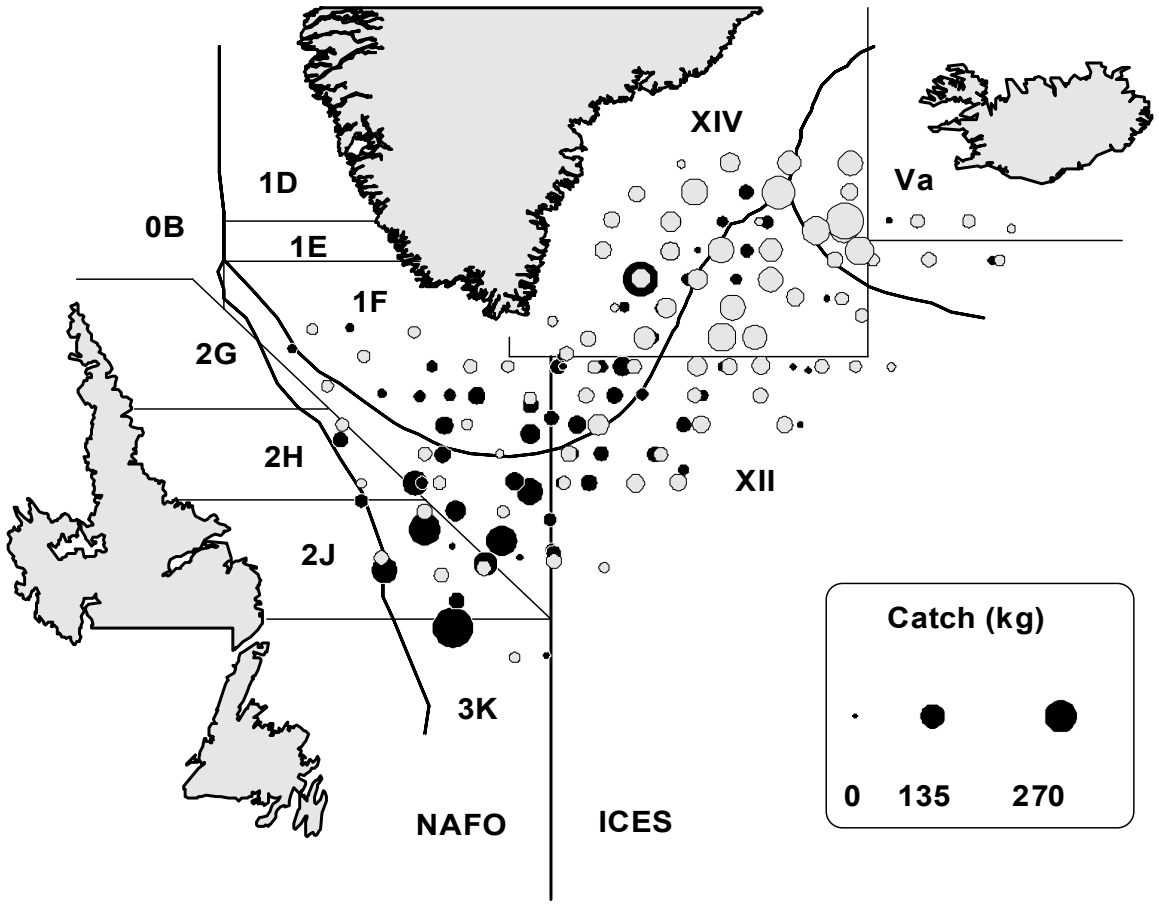


Figure 3.2.6.d.2 Pelagic redfish *S. mentella*. Standardised survey catches in June/July 2001 shallower than 500 m depth (black) and deeper than 500 m depth (grey).

3.2.7 Icelandic summer-spawning herring (Division Va)

State of stock/exploitation: The stock is inside safe biological limits. The spawning stock biomass (SSB) in 2001 is estimated at 540 000 t. The current fishing mortality of 0.2 is below the $\mathbf{F}_{pa}$.

Management objectives: The practice has been to manage this stock at $F=\mathbf{F}_{0.1}=\mathbf{F}_{pa}$ for more than 20 years. However, no formal management strategy has been adopted.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed in 1998 that:
$\mathbf{B}_{lim}$ is 200 000 t	$\mathbf{B}_{pa}$ be set at 300 000 t
$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ be set at 0.22

Technical basis:

$\mathbf{B}_{lim}$: SSB with a high probability of impaired recruitment	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa} = \mathbf{B}_{lim} e^{1.645\,\sigma}$ $\sigma = 0.25$
$\mathbf{F}_{lim}$: -	$\mathbf{F}_{pa}$: $\mathbf{F}_{pa} = \mathbf{F}_{0.1}$=0.22 (based on a weighted average)

Advice on management: ICES recommends that this stock should be continued to be harvested at a maximum of fishing mortality rate $\mathbf{F}_{0.1}$=0.22, corresponding to a maximum catch of 105 000 t in the season 2002/2003.

Relevant factors to be considered in management: Icelandic TACs apply to 1 September to 31 August the following year.

Catch forecast for 2003: No catch options for 2003 are required.

Medium- and long-term projections: Medium-term forecasts in 1995 showed that there was a low probability that the current harvest strategy will reduce the stock to below $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: There has been a general trend to overestimate SSB and underestimate F. VPA results were adjusted based on the retrospective bias.

Elaboration and special comment: The catches of Icelandic summer-spawning herring increased rapidly in the early 1960s due to the development of the purse seine fishery off the south coast of Iceland. This resulted in a rapidly increasing exploitation rate until the stock collapsed in the late 1960s. A fishing ban was enforced during 1972–1975. Thereafter the catches have increased gradually to over 100 000 t. Previously, the fleet consisted of multi-purpose vessels, mostly under 300 GRT, operating purse seines and driftnets. In recent years, larger vessels (up to 1500 GRT) have entered the fishery. These are a combination of purse seiners and pelagic trawlers operating in both the herring and capelin fisheries. In the past five seasons a considerable proportion of the catch has been taken with pelagic trawls.

Data and assessment: Analytical assessment based on catch data and surveys.

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

Yield and spawning biomass per Recruit F-reference points:

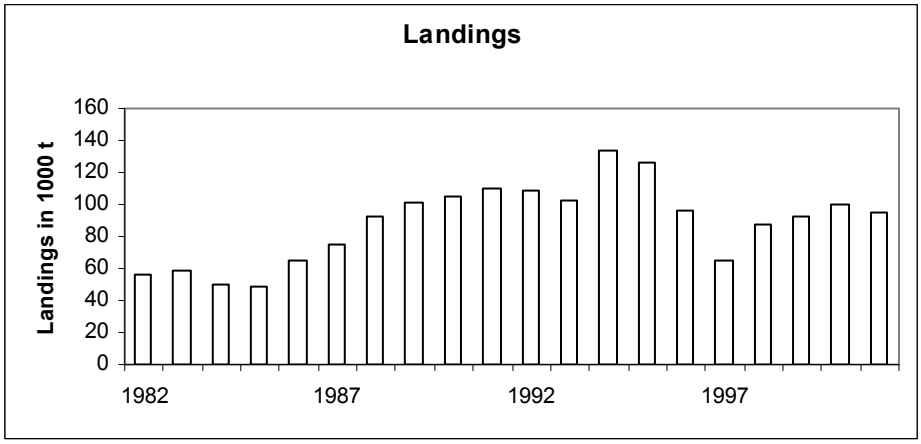
	Fish Mort Ages 5-15	Yield/R	SSB/R
Average Current	0.218	0.151	0.799
$\mathbf{F}_{max}$	0.435	0.158	0.460
$\mathbf{F}_{0.1}$	0.137	0.137	1.091
$\mathbf{F}_{med}$	0.465	0.158	0.436

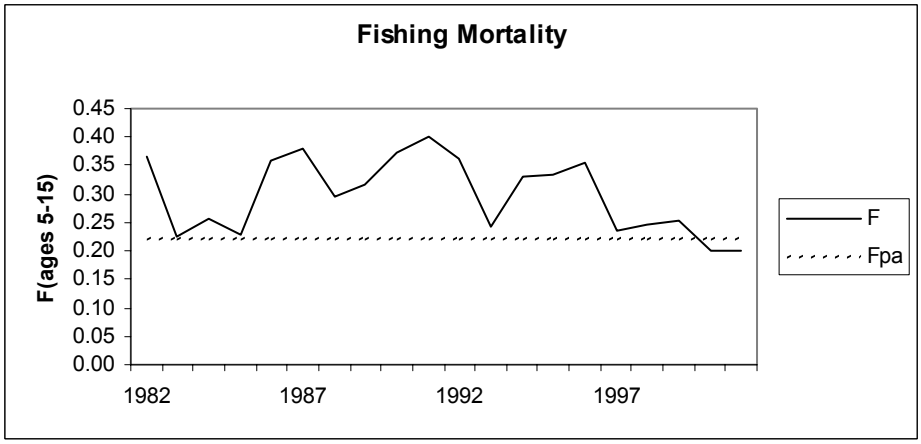
Catch data (Tables 3.2.7.1–2):

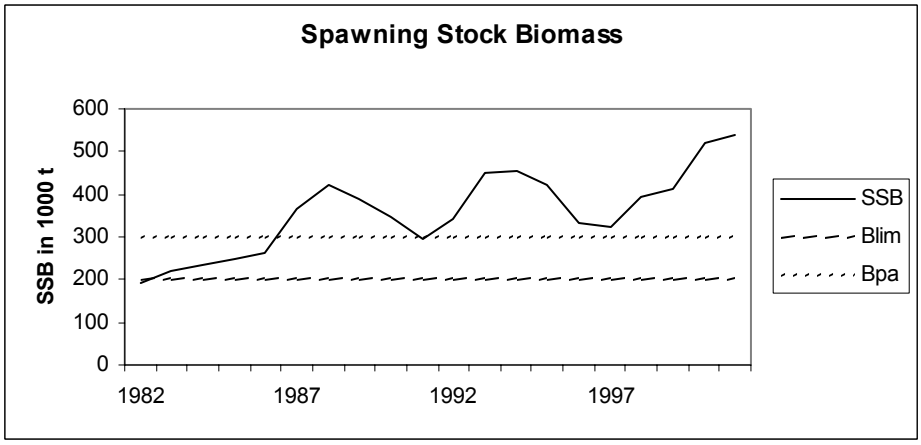
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1984		50	-	50.3
1985		50	-	49.4
1986		65	-	65.5
1987	$\mathbf{F}_{0.1}$	70	72.9	75.4
1988	$\mathbf{F}_{0.1}$	~100	90	92.8
1989	$\mathbf{F}_{0.1}$	95	90	97.3
1990/1991[2]	*Status quo* F	90	100	101.6
1991/1992[2]	$\mathbf{F}_{0.1}$	79	110	98.5
1992/1993[2]	$\mathbf{F}_{0.1}$	86	110	106.7
1993/1994[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	110[1]	110	101.5
1994/1995[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	83[1]	130	132
1995/1996[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	120[1]	110	125
1996/1997[2]	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	97[1]	110	95.9
1997/1998	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	90[1]	100	64.7
1998/1999	No gain in yield by fishing higher than $\mathbf{F}_{0.1}$	90[1]	90	87.0
1999/2000	Current F is sustainable	100[1]	100	92.9
2000/2001	Current F is sustainable	110[1]	110	100.3
2001/2002	Current F is sustainable	125[1]	125	95.3
2002/2003	Current F is sustainable	105[1]		

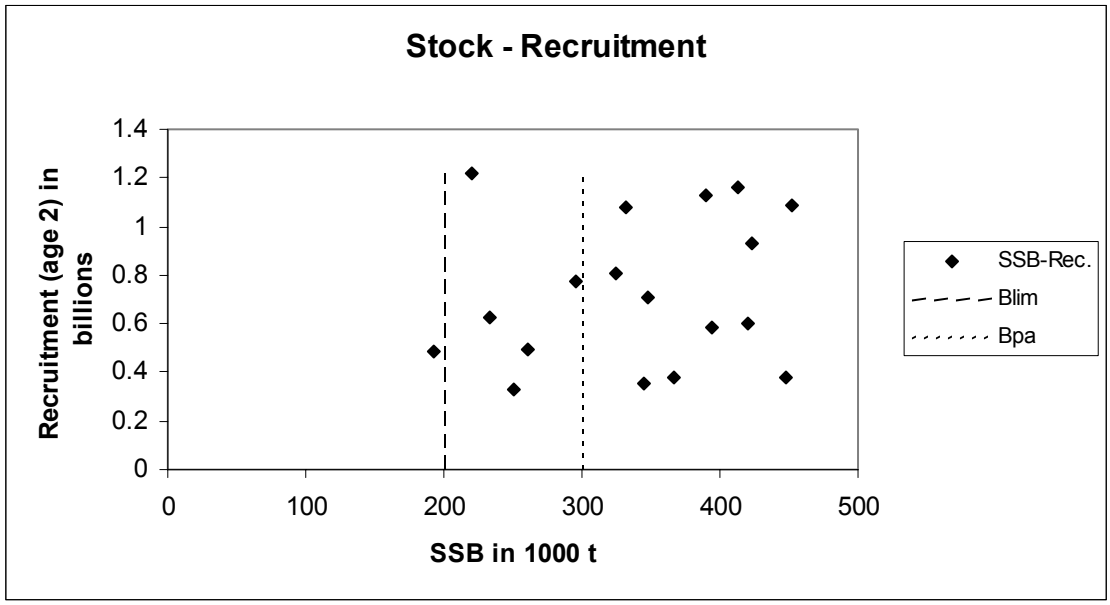
[1] Catch at $\mathbf{F}_{0.1.}$
[2] Season starting in October of first year.
Weights in '000 t.

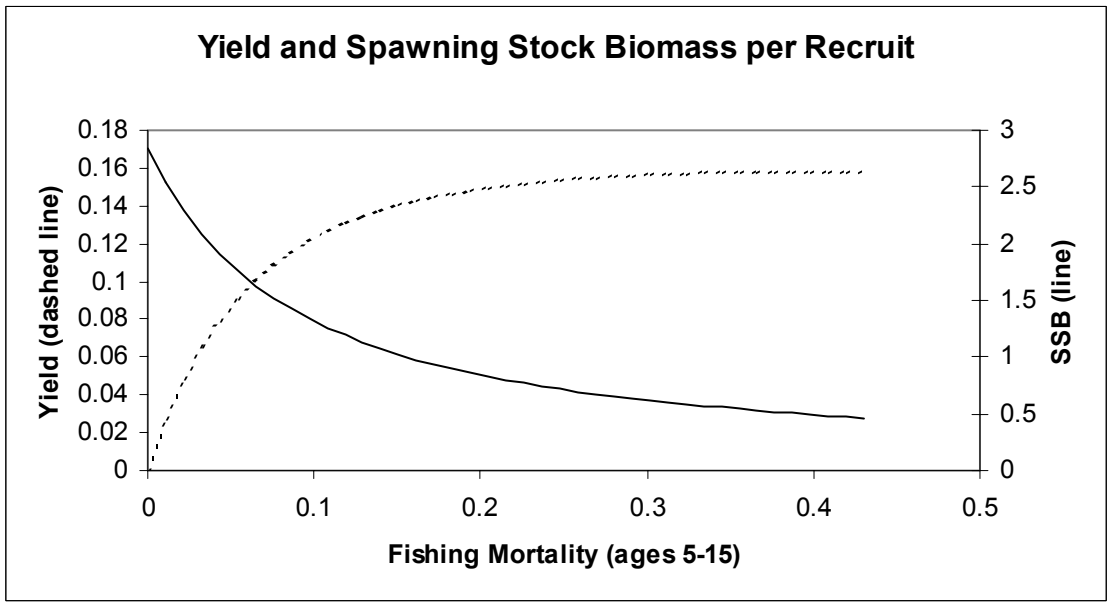
Icelandic summer-spawning herring (Division Va)








Stock - Recruitment
Recruitment (age 2) in billions
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
3
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 5-15)

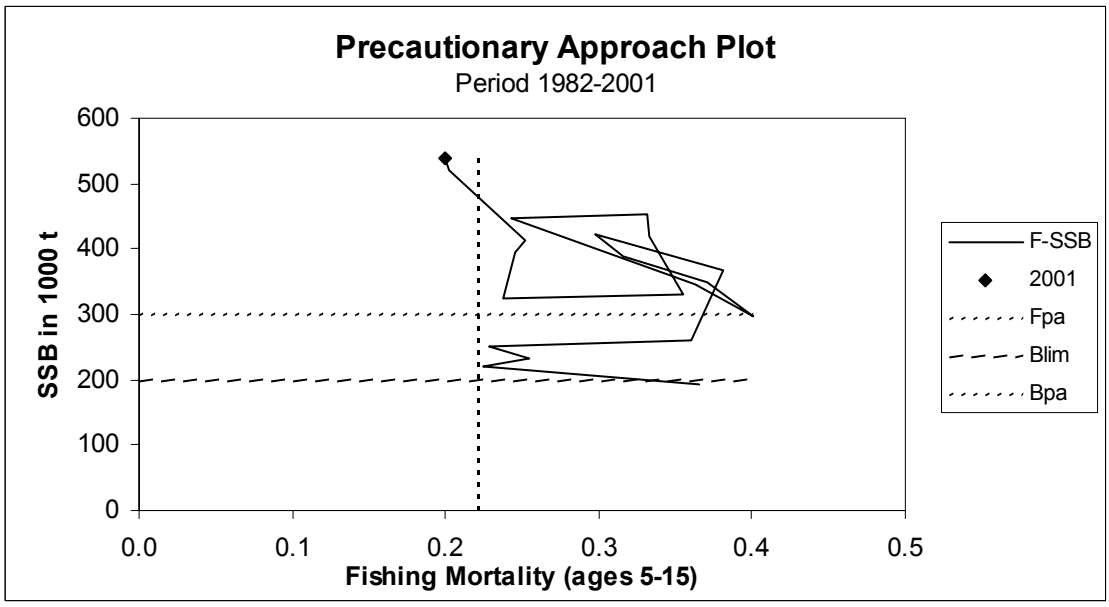

Precautionary Approach Plot
Period 1982-2001
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 5-15)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.2.7.1 Icelandic summer spawners. Landings, catches, and recommended TACs in thousand tonnes.

Year	Landings	Catches	Recommended TACs
1984	50.3	50.3	50.0
1985	49.1	49.1	50.0
1986	65.5	65.5	65.0
1987	73.0	73.0	70.0
1988	92.8	92.8	100.0
1989	97.3	101.0	90.0
1990/1991	101.6	105.1	90.0
1991/1992	98.5	109.5	79.0
1992/1993	106.7	108.5	86.0
1993/1994	101.5	102.7	90.0
1994/1995	132.0	134.0	120.0
1995/1996	125.0	125.9	110.0
1996/1997	95.9	95.9	100.0
1997/1998	64.7	64.7	100.0
1998/1999	87.0	87.0	90.0
1999/2000	92.9	92.9	100.0
2000/2001	100.3	100.3	110.0
2001/2002*	95.3	95.3	125.0

*Preliminary

Table 3.2.7.2 Icelandic summer-spawning herring (Division Va).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 5-15
1982	237907	193256	56528	0.366
1983	219289	219757	58867	0.225
1984	488503	232768	50304	0.255
1985	1220902	250069	49368	0.228
1986	628367	261432	65500	0.360
1987	332913	366223	75439	0.381
1988	490373	423414	92828	0.297
1989	380102	389214	101000	0.316
1990	931883	347835	105097	0.371
1991	1131659	296016	109489	0.401
1992	706140	344506	108504	0.363
1993	770040	447662	102741	0.243
1994	353656	452475	134003	0.332
1995	379286	420688	125851	0.333
1996	1085741	331823	95882	0.355
1997	603625	323968	64682	0.237
1998	1078142	394710	86998	0.246
1999	803000	413497	92896	0.252
2000	588000	521623	100332	0.202
2001	1159000	539483	95278	0.200
Average	679426	358521	88579	0.298

3.2.8 Capelin in the Iceland-East Greenland-Jan Mayen area (Subareas V and XIV and Division IIa west of 5°W)

State of stock/exploitation: The stock is considered to be inside safe biological limits. SSB is highly variable due to dependency on only 2 age groups.

Management objectives: The fishery is managed according to a two-part harvest control rule which allows for a minimum spawning stock biomass of 400 000 t by the end of the fishing season. ICES considers that the two-part harvest control rule is in accordance with the precautionary approach.

Advice on management: In order to ensure a spawning stock biomass of 400 000 t in March 2003, ICES advises, in conformity with the harvest control rule that the preliminary TAC for the first half of the 2002/2003 season should not exceed 690 000 t. This is two thirds of the total catch of 1 040 000 t predicted for the whole season. ICES advises that the data from the surveys in November 2002 and/or January-February 2003 be used when the final TAC is set for the 2002/2003 season. ICES advises that, while the 2002 summer/autumn season could be opened on 20 June, areas of high juvenile abundance should be closed to commercial fishery in order to prevent harvesting a high proportion of juveniles.

Relevant factors to be considered in management: In recent years, large capelin have dominated the catches in July and the first half of August. From the second half of August, the average weight in the catches has often declined drastically due to the presence of juvenile fish and not increased again until late autumn.

The spawning stock fell below the minimum safe level of 400 000 t in the 1989/90 and 1990/91 seasons. The stock recovered quickly due to good recruitment and appears to be fairly strong at present.

Catch forecast for 2003: The basis for the forecast is acoustic surveys and a regression-based prediction model. The model predicts a catch of 77.4 billion maturing 2-group capelin and 18.2 billion maturing 3-group capelin in 2002/2003. When a predicted catch of 1 040 000 t is taken in the 2002/2003 season, it is expected that at least 400 000 t remains to spawn.

Elaboration and special comment: The fishery is mainly an industrial fishery based on maturing capelin, i.e., the 2- and 3-group in the autumn, which spawn at ages 3 and 4 in March of the following year. After being low in the 1989/90 and 1990/91 seasons, catches have increased and have in recent years been more than 1 million t. A record catch of 1 571 000 t was taken during the 1996/97 fishing season.

Preliminary TAC computations are based on a method which involves the use of 1-group (N_1) indices from the October–November survey for predicting the mature 2-group ($N_{2\,mat}$) in the following year. The total 2-group ($N_{2\,tot}$) abundance from the same survey and the relationship between maturation ratios and year class abundance are used for predicting numbers of capelin in the 3-group ($N_{3\,mat}$).

Since 1989, the weight at age shows a significant negative correlation with the adult stock in number. A regression-based predictive model using data from the period 1989–1997 results in predicted mean weights of 16.2 and 22.6 g for age groups 2 and 3 respectively.

The stock size is assessed using trawl/acoustic survey data.

Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

Catch data (Tables 3.2.8.1–2):

Year	ICES Advice	Predicted catch[1] corresp. to advice	Agreed 2 TAC	ACFM Catch[3]
1986	TAC	1,100	1,290	1,333
1987	TAC[1]	500	1,115	1,116
1988	TAC[1]	900	1,065	1,036
1989	TAC[1]	900	*	808
1990	TAC[1]	600	250	314
1991	No fishery pending survey results[1]	0	740	677
1992	Precautionary TAC[1]	500	900	788
1993	TAC[1]	900	1,250	1,179
1994	Apply the harvest control rule	950	850	842
1995	Apply the harvest control rule	800	1,390	930
1996	Apply the harvest control rule	1,100	1,600	1,571
1997	Apply the harvest control rule	850	1,265	1,245
1998	Apply the harvest control rule	950	1,200	1,100
1999	Apply the harvest control rule	866	1,000	934
2000	Apply the harvest control rule	650	1,090	1,052
2001	Apply the harvest control rule	700	1,300	1,250
2002	Apply the harvest control rule	690		

[1)]TAC advised for July–December part of the season. [2)]Final TAC recommended by national scientists for whole season. [3)]July–March of following year. (Weights in '000 t).
*All surveys of fishable stock abundance during the 1989/1990 season were unsuccessful.

Capelin, Iceland-East Greenland-Jan Mayen Area (V XIV Iia west 5ºW)

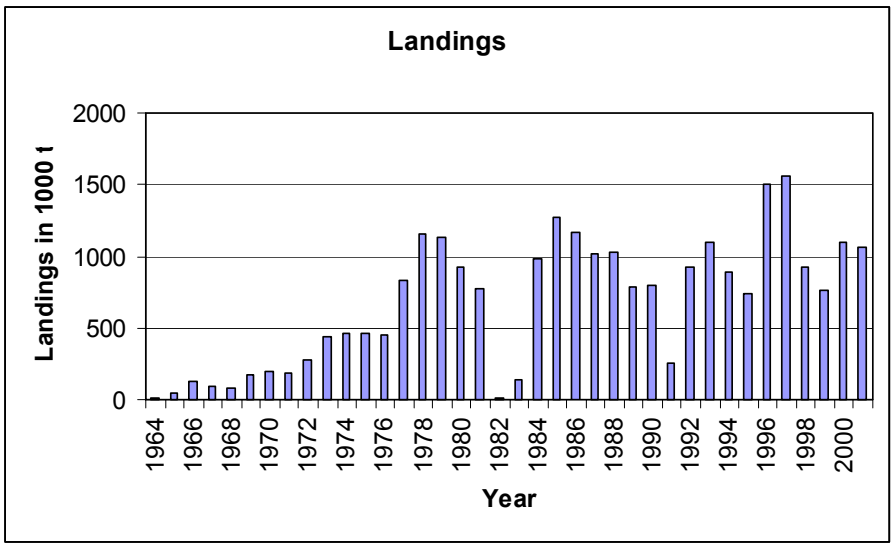


Table 3.2.8.1 The international capelin catch 1964–2002 (thousand tonnes).

Year	Winter season					Summer and autumn season						Total
	Iceland	Nor-way	Faroes	Green-land	Season total	Iceland	Nor-way	Faroes	Green-land	EU	Season total	
1964	8.6	-	-		8.6	-	-	-		-	-	8.6
1965	49.7	-	-		49.7	-	-	-		-	-	49.7
1966	124.5	-	-		124.5	-	-	-		-	-	124.5
1967	97.2	-	-		97.2	-	-	-		-	-	97.2
1968	78.1	-	-		78.1	-	-	-		-	-	78.1
1969	170.6	-	-		170.6	-	-	-		-	-	170.6
1970	190.8	-	-		190.8	-	-	-		-	-	190.8
1971	182.9	-	-		182.9	-	-	-		-	-	182.9
1972	276.5	-	-		276.5		-	-		-	-	276.5
1973	440.9	-	-		440.9	-	-	-		-	-	440.9
1974	461.9	-	-		461.9	-	-	-		-	-	461.9
1975	457.1	-	-		457.1	3.1	-	-		-	3.1	460.2
1976	338.7	-	-		338.7	114.4	-	-		-	114.4	453.1
1977	549.2	-	24.3		573.5	259.7	-	-		-	259.7	833.2
1978	468.4	-	36.2		504.6	497.5	154.1	3.4		-	655.0	1,159.6
1979	521.7	-	18.2		539.9	442.0	124.0	22.0		-	588.0	1,127.9
1980	392.1	-	-		392.1	367.4	118.7	24.2		17.3	527.6	919.7
1981	156.0	-	-		156.0	484.6	91.4	16.2		20.8	613.0	769.0
1982	13.2	-	-		13.2	-	-	-		-	-	13.2
1983	-	-	-		-	133.4	-	-		-	133.4	133.4
1984	439.6	-	-		439.6	425.2	104.6	10.2		8.5	548.5	988.1
1985	348.5	-	-		348.5	644.8	193.0	65.9		16.0	919.7	1,268.2
1986	341.8	50.0	-		391.8	552.5	149.7	65.4		5.3	772.9	1,164.7
1987	500.6	59.9	-		560.5	311.3	82.1	65.2		-	458.6	1,019.1
1988	600.6	56.6	-		657.2	311.4	11.5	48.5		-	371.4	1,028.6
1989	609.1	56.0	-		665.1	53.9	52.7	14.4		-	121.0	786,1
1990	612.0	62.5	12.3		686,8	83.7	21.9	5.6		-	111.2	798.0
1991	202.4	-	-		202.4	56.0	-	-		-	56.0	258.4
1992	573.5	47.6	-		621.1	213.4	65.3	18.9	0.5		298.1	919.2
1993	489.1	-	-	0.5	489.6	450.0	127.5	23.9	10.2		611.6	1,101.2
1994	550.3	15.0	-	1.8	567.1	210.7	99.0	12.3	2.1		324.1	891.2
1995	539.4	-	-	0.4	539.8	175.5	28.0	-	2.2		205.7	745.5
1996	707.9	-	10.0	5.7	723.6	474.3	206.0	17.6	15.0	60.9	773.8	1,497.4
1997	774.9	-	16.1	6.1	797.1	536.0	153.6	20.5	6.5	47.1	763.6	1,561.5
1998	457.0	-	14.7	9.6	481.3	290.8	72.9	26.9	8.0	41.9	440.5	921.8
1999	607.8	14.8	13.8	22.5	658.9	83.0	11.4	6.0	2.0		102.4	761.3
2000	761.4	14.9	32.0	22.0	830.3	126.5	80.1	30.0	7.5	21.0	265.1	1,095.4
2001	767.2	-	10.0	29.0	806.2	150.0	106.0	12.0	9.0	17.0	294.0	1,061.2
2002	901.0	-	28.0	26.0	955.0							

Table 3.2.8.2 Capelin in the Iceland-East Greenland-Jan Mayen area. Recruitment of 1-year-old fish (unit 10^9) and total stock biomass ('000 t) are given for 1 August. Spawning stock biomass ('000 t) is given at the time of spawning (March next year). Landings ('000 t) are the sum of the total landings in the season starting in the summer/autumn of the year indicated and ending in March of the following year.

Year	Recruitment	Total Stock biomass	Landings	Spawning stock biomass
1978	164	2832	1195	600
1979	60	2135	980	300
1980	66	1130	684	170
1981	49	1038	626	140
1982	146	1020	0	260
1983	124	2070	573	440
1984	251	2427	897	460
1985	99	2811	1312	460
1986	156	3106	1333	420
1987	144	2639	1116	400
1988	81	2101	1037	440
1989	64	1482	808	115
1990	118	1293	314	330
1991	133	1975	677	475
1992	163	2058	788	499
1993	144	2363	1179	460
1994	224	2287	864	420
1995	197	3174	929	830
1996	191	3310	1571	430
1997	165	3014	1245	492
1998	168	2197	1100	500
1999	138	2314	934	650
2000	*174	*2233	1071	450
2001	*122	*2260	1249	475

*Preliminary

3.2.9 Answer to Special Request on Redfish

NEAFC requested information on:

a) Review the stock situation and its advice for pelagic redfish in the Irminger Sea for 2002 at the May 2002 ACFM meeting.

b) submit new information on stock identity of the components of redfish such as "pelagic deep-sea" *Sebastes ment*ella, "oceanic" *Sebastes mentella* fished in the pelagic fisheries, and the "deep-sea" *Sebastes mentella* fished in demersal fisheries on the continental shelf and slope;

c) provide information on the horizontal and vertical distribution of pelagic redfish stock components and fisheries in the Irminger Sea and adjacent waters as well as seasonal and interannual changes in distribution. Information on the vertical distribution should allow NEAFC to further consider the appropriateness of separate management measures for different geographical areas/seasons.

The request a) is addressed in the ACFM report, Section 3.2.6.d.

Request b): On further information on stock identity of redfish

An extensive discussion of the problem was made at NEAFC's request last year (Section 3.2.9 in the 2001 ACFM report). The request is also addressed as part of the introduction section 3.2.6.a in this year's report.

Some recent studies on genetics, biological markers, and fish distribution were presented to the Working Group in 2002. ICES considers that interpretations of the evidence on stock structure are still diverging and that individual indicators are inconclusive. Therefore the stock structure remains uncertain. Further studies are in progress.

Request c): Update information on the development of the pelagic fishery for redfish with respect to seasonal and area distribution to allow NEAFC to further consider the appropriateness of separate management measures for different geographical areas/seasons.

Observations indicate that since 1996 a) the fisheries in the Northeastern area in the first half of the year are occurring at depths deeper than 500 m and catching larger fish, and b) the fisheries in the Southwestern area in the second half of the year are mainly occurring at depths shallower than 500 m catching smaller fish. In last year's report there was a detailed description of the fishery. Below is an update to this information.

The geographical distribution of the catches by periods and years since 1995 is given in Figure 3.2.6.a.2. The fishery of these four nations (Germany (1995–2001), Iceland (1989–2001), Norway (1995–2001), Russia (1999-2000), and Greenland (1999–2001)) indicate that there was a similar pattern in the fishery since 1996. Fishing usually started in early April and up to the end of June it was prosecuted in areas east of 32°W and north of 61°N. In July and August, the fleet moves about 400–500 nautical miles to areas south of 60°N and west of about 34°W, where the fishery continues until October. There is very little fishing activity from November until late March. Figure 3.2.6.a.3 gives the locations of part of the Spanish activity in the Irminger Sea, and it shows that they had a similar pattern in 2000 and 2001 as the above-mentioned fleets. The same applies for the Russian fleet in 2001 (Figure 3.2.6.a.4). In the third quarter of the year the fishing has, in general, moved towards the southern part of the area, fishing mostly at depths shallower than 500 m, within Subarea XII as well as in the NAFO convention area, both outside and inside the Greenlandic EEZ. However, it is important to note that the described fishing pattern of the fleet changed significantly around 1995, mainly in terms of area and depth expansion. The changes in the fishing pattern as described above does not necessarily reflect changes in stock distribution, maybe due to commercial reasons.

Although the information on fishing depth is incomplete, except for the Icelandic, Faroese, and the Greenlandic fisheries, the general pattern is that the fishing in the first and second quarter of the year is mostly conducted deeper than 500 m. Further, although there are no haul-by-haul data available for the German catches, the available information shows that the fishery in the first two quarters was characterised by a fishery deeper than 450 m, and at shallower depths during the third and fourth quarters in 1995–2001. There is a similar pattern in the Spanish fishery. They were fishing deeper than 500 m in the second quarter of the year, and in the third quarter fishery continued at depths shallower than 500 m. The Greenland vessel participating in this fishery also reported all its catches taken above 400 m after July, and showed the same pattern as the Icelandic fleet in the first 2 quarters of the year.

Over 95% of all the fish caught in the pelagic redfish fishery are mature. The redfish caught in the Southwestern area are generally smaller than the fish caught in the Northeastern area (Figure 3.2.6.a.5), the dominant length classes being 33-38 cm in the Southwestern area, and 35 – 45 cm in the Northeastern area.

As has been reported in earlier reports of the Working Group, Iceland has classified its pelagic catches between oceanic and pelagic deep-sea redfish according to a contentious method. The results of this

classification have shown that the proportion of fish classified as oceanic-type redfish has been very low during recent years, and only about 5% of the Icelandic catches were classified as oceanic type. The Icelandic fishery prior to 2001 was mostly concentrated on the pelagic deepsea fishery in the first half of the year in the Northeastern area. In 2001, the percentage of the oceanic type increased to about 1/3 of its quota, this being largely a result of increased effort in the Southwestern fishing area at depths shallower than 400 m. The increase in 2001 is due to the effort regulations in the fishery. Based on the samples, the results also indicate that shallower than 500–600 m depth, the proportion "oceanic" is between 85–100%, as the proportion deeper than 600 m is usually between 0–20%.

ICES recommends that NEAFC requests all nations participating in the pelagic redfish fishery to provide ICES with information on the trawling depth (headline depth for each haul as a log-book data), so ICES can have more detailed description of the fishery by season and areas as a basis for giving its advice on the resource.

3.3 Demersal stocks at the Faroe Islands (Division Vb)

3.3.1 Overview

The fisheries and management measures: In 1977 an EEZ was introduced in the Faroe area. The demersal fishery by foreign nations has since decreased and Faroese vessels now take most of the catches. The fishery may be considered a multi-fleet and multi-species fishery. The longliners fish mainly cod and haddock; in addition, some longliners fish in deep water for ling and tusk. Most of the trawlers fish cod, haddock, and saithe, while some large trawlers fish in deeper waters for redfish, blue ling, Greenland halibut, and occasionally grenadier and black scabbardfish. The jiggers fish mainly saithe and cod. Recently, gill net fisheries for Greenland halibut and anglerfish and a directed pair trawler fishery for Argentines have been introduced. The total demersal catches decreased from 120 000 t in 1985 to 65 000 t in 1993, but have since increased again to about 100 000 t in 1997–1999; the 2001 demersal catch was above 120 000 t. The decrease was mainly due to lower catches of cod, haddock, and saithe. The cod catches (Faroe Plateau cod and Faroe Bank cod combined) increased considerably from 6 000 t in 1993 to more than 42 000 t in 1996, but declined thereafter to around 20 000 t in 1999; the 2001 catches were 31 000 t. The catches of haddock also increased considerably from 4 000 t in 1993 to 22 000 t in 1998, but have since decreased to 16 000 t in 2001. The catches of saithe decreased from 33 000 t in 1993–1994 to 20 000 t in 1996, but have since increased again to 52 000 t in 2001.

During the 1980s and 1990s the Faroese authorities have regulated the fishery and the investment in fishing vessels. In 1987 a system of fishing licences was introduced. The demersal fishery at the Faroe Islands has been regulated by technical measures (minimum mesh sizes and closed areas). In order to protect juveniles and young fish, fishing is temporarily prohibited in areas where the number of small cod, haddock, and saithe exceeds 30% in the catches; after 1–2 weeks the areas are again opened for fishing. A reduction of effort has been attempted through banning of new licences and buy-back of old licences.

A new quota system, based on individual quotas, was introduced in 1994. The fishing year started on 1 September and ended on 31 August the following year. The aim of the quota system was, through restrictive TACs for the period 1994–1998, to increase the SSBs of Faroe Plateau cod and haddock to 52 000 t and 40 000 t, respectively. The TAC for saithe was set higher than recommended scientifically. It should be noted that cod, haddock and saithe are caught in a mixed fishery and any management measure should account for this. Species under the quota system were Faroe Plateau cod, haddock, saithe, redfish, and Faroe Bank cod.

The catch quota management system introduced in the Faroese fisheries in 1994 was met with considerable criticism and resulted in discarding and in misreportings of substantial portions of the catches. Reorganisation of enforcement and control did not solve the problems. As a result of the dissatisfaction with the catch quota management system, the Faroese Parliament discontinued the system as from 31 May 1996. In close cooperation with the fishing industry, the Faroese government has developed a new system based on individual transferable effort quotas in days within fleet categories. The new system entered into force on 1 June 1996. The fishing year from 1 September to 31 August, as introduced under the catch quota system, has been maintained.

The individual transferable effort quotas apply to: 1) the longliners less than 100 GRT, the jiggers, and the single trawlers less than 400 HP, 2) the pair trawlers and 3) the longliners greater than 100 GRT. The single trawlers greater than 400 HP do not have effort limitations, but they are not allowed to fish within the 12 nautical mile limit, and the areas closed to them, as well as to the pair trawlers, have increased in area and time. Their catch of cod and haddock is limited by maximum by-catch allocation. The single trawlers less than 400 HP are given special licences to fish inside 12 nautical miles with a by-catch allocation of 30% cod and 10% haddock. In addition, they are obliged to use sorting devices in their trawls. One fishing day by longliners less than 100 GRT is considered equivalent to two fishing days for jiggers in the same gear category. Longliners less than 100 GRT could therefore double their allocation by converting to jigging. Table 3.3.1.1 shows the number of fishing days used by fleet category for 1985–1995 and 1998–2001 and Table 3.3.1.2 shows the number of allocated days inside the outer thick line in Figure 3.3.1.1. Holders of individual transferable effort quotas who fish outside this line can fish for 3 days for each day allocated inside the line. Trawlers are generally not allowed to fish inside the 12 nautical mile limit. Inside the innermost thick line only longliners less than 100 GRT and jiggers less than 100 GRT are allowed to fish. The Faroe Bank shallower than 200 m is closed to trawling.

The effort quotas are transferable within gear categories. The allocations of number of fishing days by fleet categories was made such that together with other regulations of the fishery they should result in average fishing mortalities on each of the 3 stocks of 0.45, corresponding to average annual catches of 33% of the exploitable stocks in numbers. Built into the system is also an assumption that the day system is self-regulatory, because the fishery will move between stocks according to the relative availability of each of them and no stock will be overexploited.

In addition to the number of days allocated in the law, it is also stated in the law what percentage of total catches of cod, haddock, saithe, and redfish each fleet category on average is allowed to fish. These percentages are as follows:

Fleet category	Cod	Haddock	Saithe	Redfish
Longliners < 110GRT, jiggers, single trawl. < 400HP	51 %	58 %	17.5 %	1 %
Longliners > 110GRT	23 %	28 %		
Pairtrawlers	21 %	10.25 %	69 %	8.5 %
Single trawlers > 400 HP	4 %	1.75 %	13 %	90.5 %
Others	1 %	2 %	0.5 %	0.5 %

Technical measures such as area closures during the spawning periods, to protect juveniles and young fish, and mesh size regulations as mentioned above are still in effect.

The marine environment: The waters around the Faroe Islands are in the upper 500 m dominated by the North Atlantic current, which to the north of the islands meets the East Icelandic current. Clockwise current systems create retention areas on the Faroe Plateau (Faroe shelf) and on the Faroe Bank. In deeper waters to the north and east is deep Norwegian Sea water, and to the south and west is Atlantic water. From the late 1980s the intensity of the North Atlantic current passing the Faroe area decreased, but it has increased again in the most recent years. The productivity of the Faroese waters was very low in the late 1980s and early 1990s. This applies also to the recruitment of many fish stocks, and the growth of the fish was poor as well. From 1992 onwards the conditions have returned to more normal values, which is also reflected in the fish landings. There has been observed a very clear relationship, from primary production to the higher trophic levels (including fish and seabirds), in the Faroe shelf ecosystem, and all trophic levels seem to respond quickly to variability in primary production in the ecosystem.

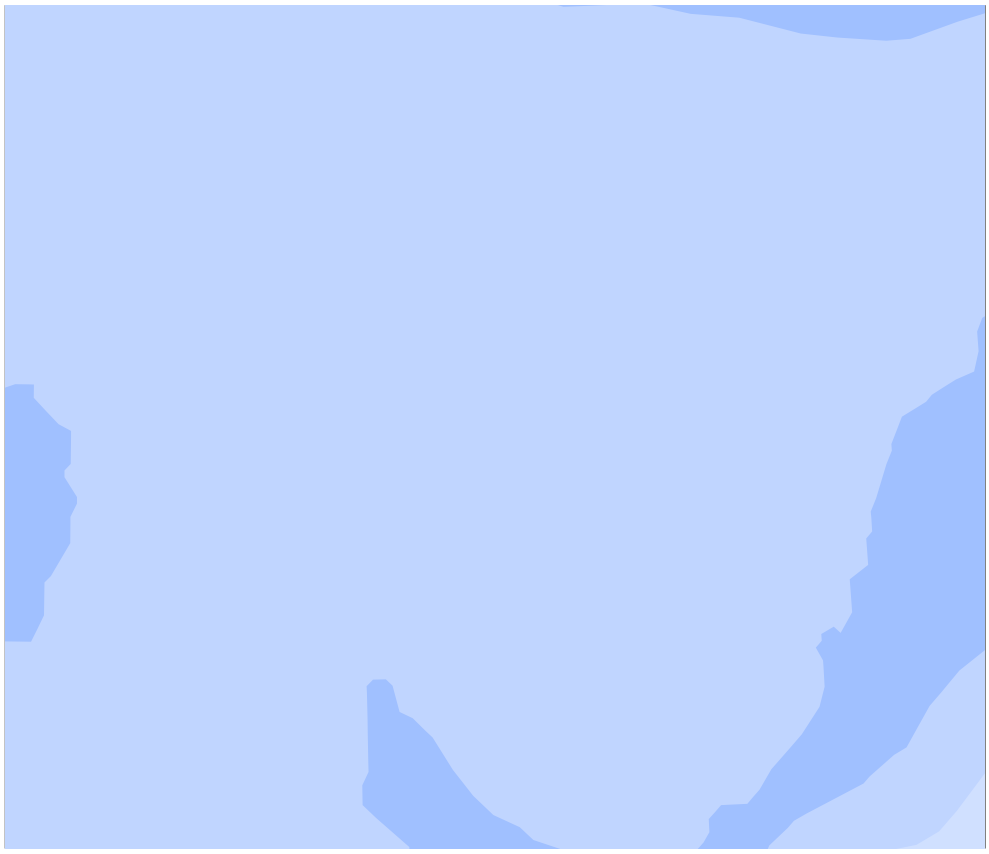
State of stocks: As a result of the combined effect of poor recruitment in the last decade and high fishing effort, the SSBs of Faroe Plateau cod and Faroe haddock were reduced to low levels. In the period 1993–1995 ICES considered them to be well below minimum biologically acceptable levels and consequently advised no fishing. Both stocks have since increased due to improved recruitment and growth with SSB above the precautionary SSB levels ($\mathbf{B}_{pa}$). The fishing mortality on both Faroe Plateau cod and Faroe haddock has been estimated to be above the precautionary level ($\mathbf{F}_{pa}$) since 1996. The Faroe Bank cod stock seems to be at or slightly above average. The SSB of Faroe saithe has been increasing from the record low in 1992 to above the $\mathbf{B}_{pa}$ in 1998–2001. The fishing mortality is above the precautionary level ($\mathbf{F}_{pa}$).

Table 3.3.1.1 Number of fishing days used by various fleet groups in Vb1 1985-1995 and 1998-2001. For other fleets there are no effort limitations. Catches of saithe and redfish are regulated by by-catch percentages given in the text. In addition there are special fisheries regulated by licenses. (This is the real number of days fishing not affected by doubling or tripling of days by changing areas/gears).

Year	Longliner 0-110 GRT, jiggers, trawlers < 400 HP	Longliners > 110 GRT	Pairtrawlers > 400 HP
1985	13449	2973	8582
1986	11399	2176	11006
1987	11554	2915	11860
1988	20736	3203	12060
1989	28750	3369	10302
1990	28373	3521	12935
1991	29420	3573	13703
1992	23762	2892	11228
1993	19170	2046	9186
1994	25291	2925	8347
1995	33760	3659	9346
Average(85-95)	22333	3023	10778
1998	23971	2519	6209
1999	21040	2428	7135
2000	24820	2414	7167
2001	29560	2512	6771
Average(98-01)	24848	2468	6821

Table 3.3.1.2 Number of allocated days for each fleet group since the new management scheme was adopted and number of licenses per fleet.

	Fleets	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	No. of licenses
Group 1	Single trawlers > 400 HP	Regulated by area and by-catch limitations						13
Group 2	Pair trawlers > 400 HP	8225	7199	6839	6839	6839	6839	31
Group 3	Longliners > 110 GRT	3040	2660	2527	2527	2527	2527	19
Group 4	Longliners and jiggers 15-110 GRT, single trawlers < 400 HP	9320	9328	8861	8861	8861	8861	106
Group 5	Longliners and jiggers < 15 GRT	22000	23625	22444	22444	22444	22444	696



Closed areas to trawlings

Areas inside the 12 nm zone closed year round

Area	Period
a	1 jan- 31 des
aa	1 jun – 31 aug
b	20 jan- 1 mar
c	1 jan- 31 des
d	1 jan- 31 des
e	1 apr- 31 jan
f	1 jan- 31 des
g	1 jan- 31 des
h	1 jan- 31 des
i	1 jan- 31 des
j	1 jan- 31 des
k	1 jan- 31 des
l	1 jan- 31 des
m	1 feb- 1 jun
n	31 jan- 1 apr
o	1 jan- 31 des
p	1 jan- 31 des
r	1 jan- 31 des
s	1 jan- 31 des

Spawning area closures

Area	Period
1	15 feb-31 mar
2	15 feb- 15 apr
3	1 feb- 1 apr
4	15 jan- 15 mai
5	15 feb- 15 apr
6	15 feb- 15 apr
7	15 jan- 1 apr

Figure 3.3.1.1 Fishing area regulations in Division Vb. Allocation of fishing days applies to the area inside the outer thick line on the Faroe Plateau. Holders of effort quotas who fish outside this line can triple their numbers of days. Longliners larger than 110 GRT are not allowed to fish inside the inner thick line on the Faroe Plateau. If longliners change from longline to jigging, they can double their number of days. The Faroe Bank shallower than 200 m depths (a, aa) is regulated separate from the Faroe Plateau. It is closed to trawling and the longline fishery is regulated by individual day quotas.

3.3.2 Cod

3.3.2.a Faroe Plateau cod (Subdivision Vb_1)

State of stock/exploitation: The stock is harvested outside safe biological limits. The spawning biomass in 2001 is estimated to be above $\mathbf{B}_{pa}$, but the 2001 fishing mortality is well above $\mathbf{F}_{pa}$ and above $\mathbf{F}_{lim}$. The 1998 year class is of average strength and the 1999 year class appears to be very strong.

Management objectives: The effort management system implemented in the Faroese demersal fisheries in Division Vb since 1996 aims at harvesting on average 33% in numbers of the cod exploitable stock. This translates into an average F of 0.45. This is inconsistent with the precautionary approach with the $\mathbf{F}_{pa}$ of 0.35.

Precautionary Approach reference points (established in 1998).

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 21 000 t, the lowest observed biomass	$\mathbf{B}_{pa}$ be set at 40 000 t
$\mathbf{F}_{lim}$ is 0.68	$\mathbf{F}_{pa}$ be set at 0.35

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{lim} = \mathbf{B}_{loss}$ (98)	$\mathbf{B}_{pa}$: $\mathbf{B}_{pa} = \mathbf{B}_{lim}e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment
$\mathbf{F}_{lim}$: $\mathbf{F}_{lim} = \mathbf{F}_{pa}e^{1.645\sigma}$, assuming a σ of about 0.40 to account for the relatively large uncertainties in the assessment	$\mathbf{F}_{pa}$: Close to $\mathbf{F}_{max}$ (0.34) and $\mathbf{F}_{med}$ (0.38) values from 1998 assessment

Advice on management: ICES advises a reduction in fishing mortality to below $\mathbf{F}_{pa}$(0.35), corresponding to an effort reduction of 50%. If this cannot be done in one year then as a first step, the fishing mortality in 2003 should be reduced by at least 35% in accordance with the fishing mortality advised (0.46) in 2001.

Relevant factors to be considered in management: Current fishing mortality is far above the $\mathbf{F}_{pa,}$ but the basis for $\mathbf{F}_{pa}$ is under revision. A reduction in fishing mortality to $\mathbf{F}_{pa}$ corresponds to landings of less than 23 000 t, and a 35% reduction in fishing mortality in 2003 corresponds to landings of less than 28 000 t.

Close monitoring should be carried out in order to evaluate the effect of the effort regulation, in particular the possible changes in catchability and target species. Effort regulation systems may lead to investment aimed at increasing fishing efficiency in order to obtain the greatest benefits from the effort allocated. Management authorities should monitor vessel characteristics in order to evaluate potential increases in capacity as a result of technological changes.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ =F(2001) = 0.71; Landings (2002) = 41.9; SSB(2002) = 64; SSB(2003) = 74

F(2003)	Basis	Landings (2003)	SSB (2004)
0.35	$0.5*\mathbf{F}_{sq} = \mathbf{F}_{pa}$	22.8	82
0.43	$0.6*\mathbf{F}_{sq}$	26.6	78
0.46	$0.65*\mathbf{F}_{sq}$	28.5	76
0.49	$0.7*\mathbf{F}_{sq}$	30.3	74
0.53	$0.75*\mathbf{F}_{sq}$	32.1	72
0.57	$0.8*\mathbf{F}_{sq}$	33.8	71
0.71	$\mathbf{F}_{sq}$	40.3	64
0.85	$1.2*\mathbf{F}_{sq}$	46.1	58

(Weights in '000 t)
Shaded scenarios considered inconsistent with the precautionary approach.
The *status quo* F assumes the same fleet allocation as in 2001.

Medium- and long-term projections: No medium-term projection was made in current assessment.

Comparison with previous assessment and advice: A summer groundfish survey was used as the only tuning series in this year's assessment, i.e. the commercial tuning series used last year were not used. The estimates of the 1997 and 1998 year classes in the current assessment are lower than in last year's assessment, The 1999 year class appears to be very strong. No major changes have occurred in the perception of the spawning stock biomass. The fishing mortalities 1997-1999 are estimated to be higher, and the 2000 fishing mortality lower, compared to last year's assessment.

Elaboration and special comment: There are indications that environmental conditions (food availability) are determining cod production. The growth rate of fish in the stock has shown a declining trend over the last three decades, with a short-term increase in the mid-1990s. After a drop in 1998 the growth rate has increased again.

Cod are taken in a mixed demersal fishery which was initially international. Following the declaration of EEZs in 1977, the fishery became largely Faroese. Most of the vessels involved are trawlers and longliners.

The survey database is being re-constructed and one summer groundfish survey was available this year. Next year it is expected that a part of the spring groundfish survey will be available, and the two survey indices will be evaluated for inclusion in the assessment next year.

Previous medium-term projections and spawners per recruit calculations suggest that the proposed $\mathbf{F}_{pa}$ may be too conservative. This will be more thoroughly evaluated in the 2003 assessment.

Data and assessment: In this analytical assessment catch-at-age data are tuned with a summer groundfish series.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

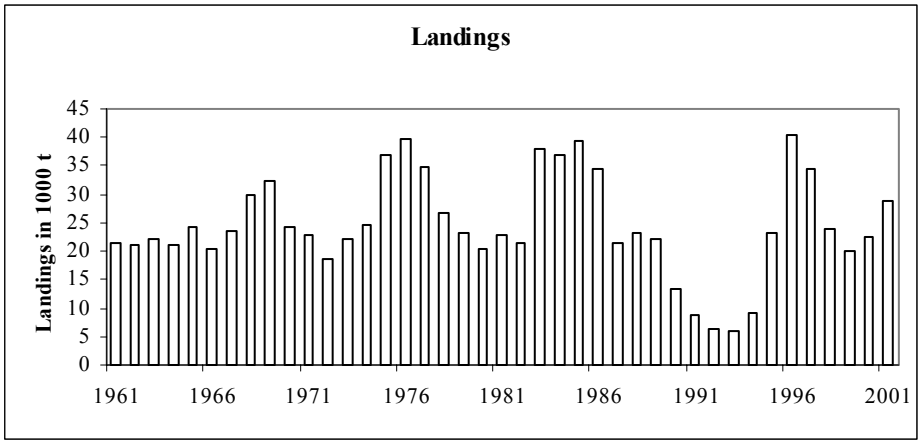
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.709	1.494	2.833
$\mathbf{F}_{max}$	0.362	1.566	5.011
$\mathbf{F}_{0.1}$	0.168	1.422	8.740
$\mathbf{F}_{med}$	0.422	1.562	4.423

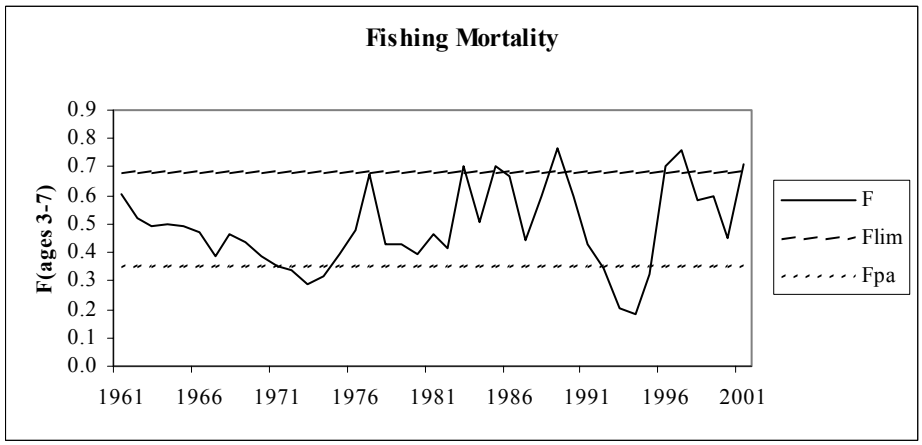
Catch data (Tables 3.3.2.a.1–3):

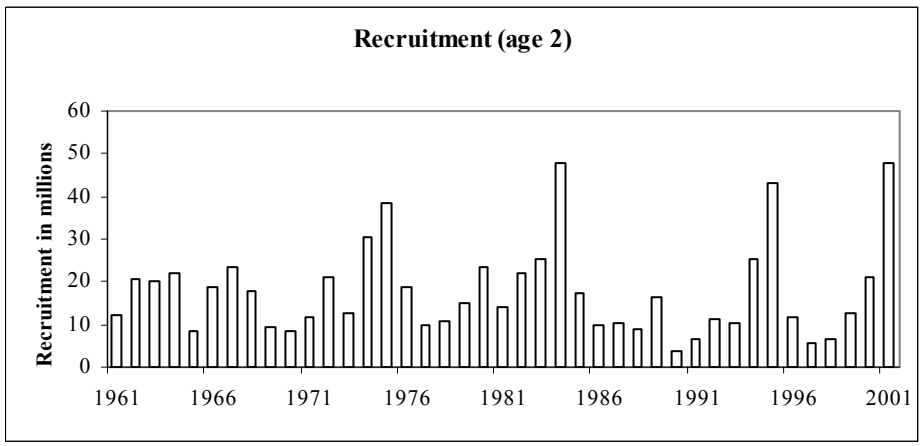
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	31		21.4
1988	No increase in F (Revised estimate)	29 (23)		23.2
1989	No increase in F	19		22.1
1990	No increase in F	20		13.5
1991	TAC	16		8.7
1992	No increase in F	20		6.4
1993	No fishing	0		6.1
1994	No fishing	0	8.5/12.5[1,2]	9.0
1995	No fishing	0	12.5[1]	23.0
1996	F at lowest possible level	-	20[2]	40.4
1997	80% of F(95)	24	-	34.3
1998	30% reduction in effort from 1996/97	-	-	24.0
1999	F less than proposed $\mathbf{F}_{pa}$ (0.35)	19		19.9
2000	F less than proposed $\mathbf{F}_{pa}$ (0.35)	20		22.4
2001	F less than proposed $\mathbf{F}_{pa}$ (0.35)	16		29.0
2002	75% of F(2000)	22		
2003	75% of F(2001)	32		

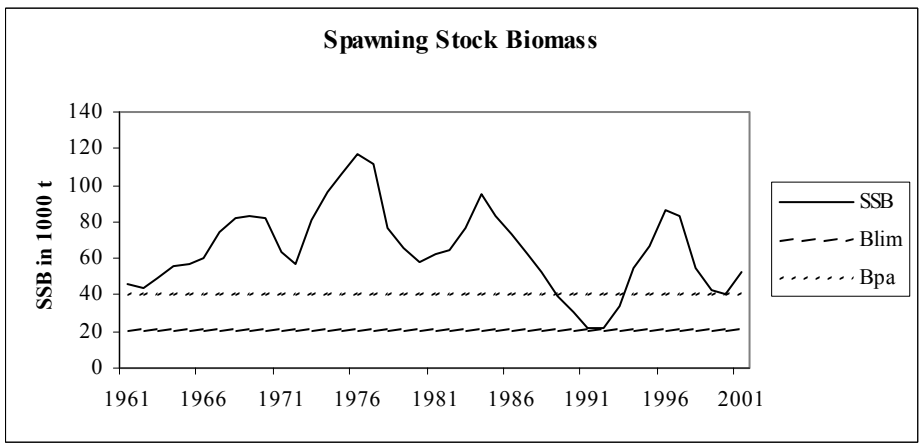
[1]In the quota year 1 September–31 August the following year. [2] The TAC was increased during the quota year. Weights in '000 t.

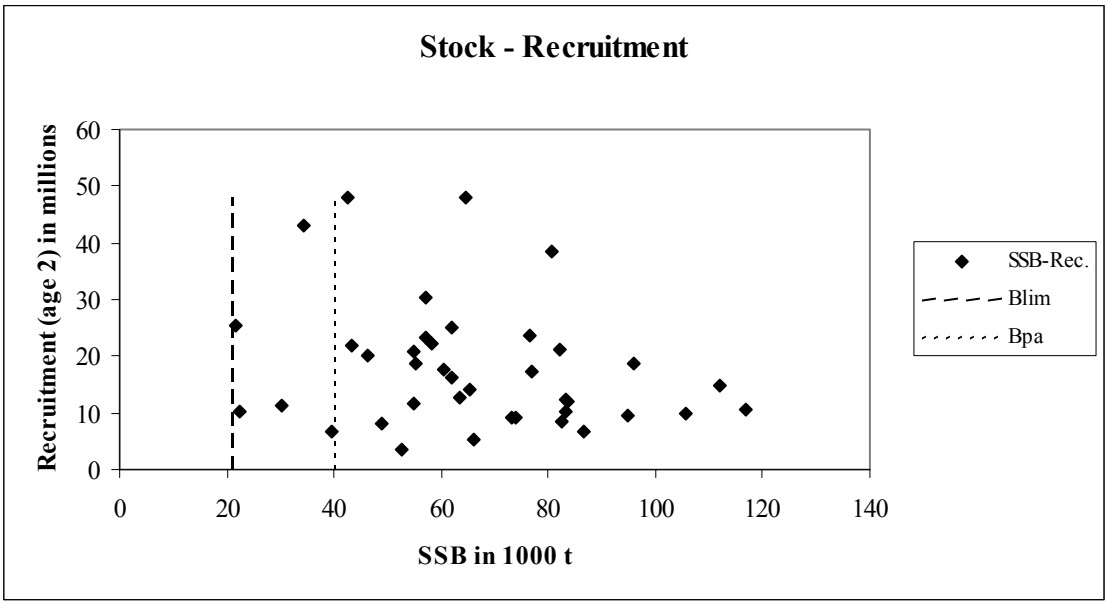
Faroe Plateau cod (Subdivision Vb_1)

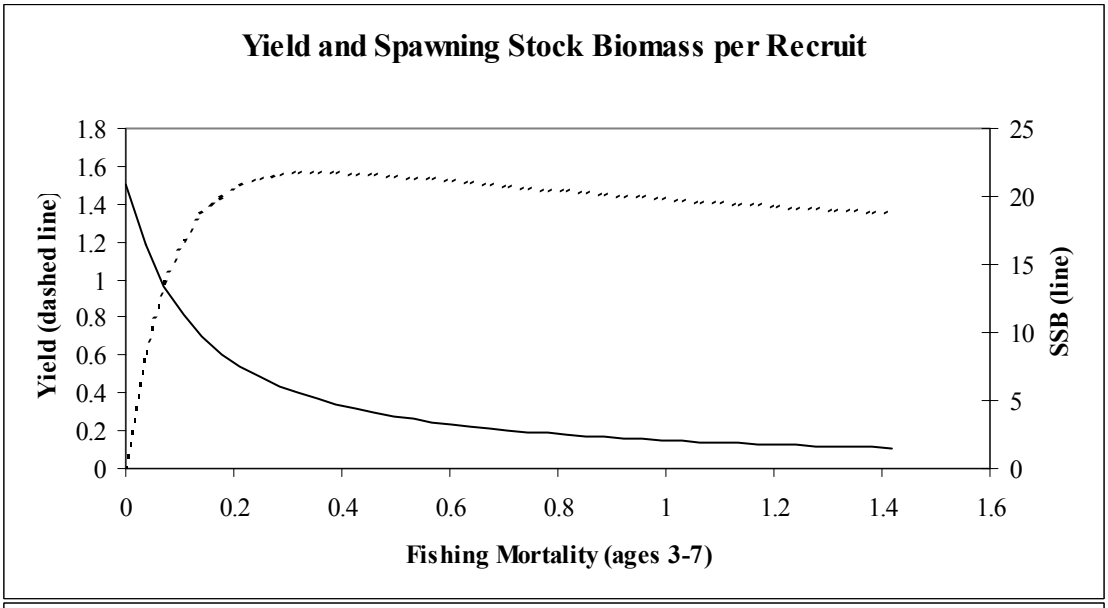









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)

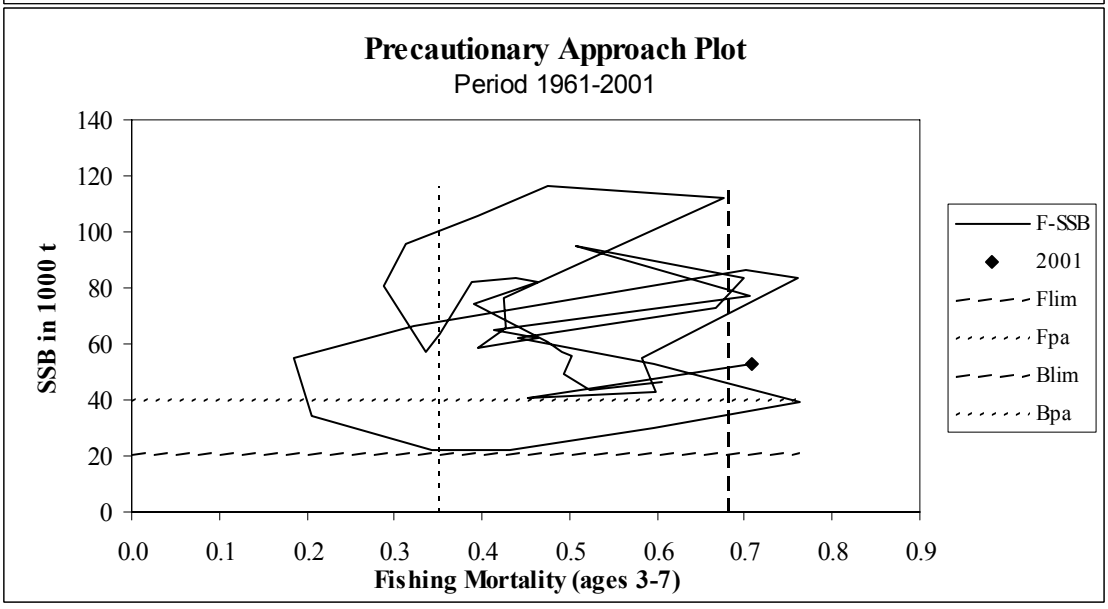

Precautionary Approach Plot
Period 1961-2001
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.3.2.a.1 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catches (tonnes) by countries, 1986–2001, as officially reported to ICES

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Denmark	8	30	10	-	-	-	-	-	-	-	-	-	-
Faroe Islands	34,492	21,303	22,272	20,535	12,232	8,203	5,938	5,744	8,724	19,079	39,406	33,556	23,308
France	4	17	17	-	-	- [1]	3 [2]	1 [2]	-	2 [2]	1 [2]	-	- *
Germany	8	12	5	7	24	16	12	+	2 [2]	2	+	+	-
Norway	83	21	163	285	124	89	39	57	36	38	507	410	405
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (Engl. and Wales)	-	8	-	-	-	1	74	186	56	43	126	61 [2]	27 [2]
UK (Scotland)	-	-	-	-	-	-	-	-	-	-	-	-	-
United Kingdom	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740

	1999	2000	2001 *
Denmark	-		
Faroe Islands	19,156		
France [1]	- *		
Germany	39	2	9 [2]
Norway	450	374 *	544
Greenland			
UK (Engl. and Wales)	51 [2]	18 [2]	
UK (Scotland)	-		
United Kingdom			338 [2]
Total	19,696	394	891

* Preliminary

[1] Included in Vb2.

[2] Reported as Vb.

Table 3.3.2.a.2 Faroe Plateau (Subdivision Vb_1) Cod. Nominal catch (tonnes) 1986–2001, as used in the assessment.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Officially reported	34,595	21,391	22,467	20,827	12,380	8,309	6,066	5,988	8,818	19,164	40,040	34,027	23,740
Faroese catches in IIA within Faroe area jurisdiction			715	1,229	1,090	351	154						
Expected misreporting/discard										3330			
French catches as reported to Faroese authorities				12	17								
Catches reported as Vb2:													
UK (E/W/NI)					-	-	+	1	1	-	-	-	-
UK (Scotland)					205	90	176	118	227	551	382	277	265
Used in the assessment	34,595	21,391	23,182	22,068	13,487	8,750	6,396	6,107	9,046	23,045	40,422	34,304	24,005

	1999	2000	2001 *
Officially reported	19,696	394	891
Faroese catches in Vb1		21,793 *	28,099 *
Expected misreporting/discard			
Catches reported as Vb2:			
UK (E/W/NI)	-	-	-
UK (Scotland)	210	245	-
Used in the assessment	19,906	22,432	28,990

*) Preliminary

Table 3.3.2.a.3 Faroe Plateau cod (Subdivision Vb_1)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1961	12019	46439	21598	0.6059
1962	20654	43326	20967	0.5226
1963	20290	49054	22215	0.4944
1964	21834	55362	21078	0.5017
1965	8269	57057	24212	0.4909
1966	18566	60629	20418	0.4743
1967	23451	73934	23562	0.3900
1968	17582	82484	29930	0.4642
1969	9325	83487	32371	0.4375
1970	8608	82035	24183	0.3882
1971	11928	63308	23010	0.3526
1972	21320	57180	18727	0.3358
1973	12573	80516	22228	0.2886
1974	30480	95831	24581	0.3139
1975	38320	105677	36775	0.3947
1976	18575	116737	39799	0.4748
1977	9995	111864	34927	0.6757
1978	10749	76610	26585	0.4259
1979	14999	65382	23112	0.4273
1980	23587	58390	20513	0.3945
1981	14003	62066	22963	0.4647
1982	22139	64710	21489	0.4137
1983	25185	76963	38133	0.7053
1984	47829	94937	36979	0.5077
1985	17400	83298	39484	0.7001
1986	9638	73164	34595	0.6665
1987	10300	61945	21391	0.4417
1988	9008	52541	23182	0.5966
1989	16373	39489	22068	0.7632
1990	3632	30285	13487	0.5959
1991	6646	22358	8750	0.4322
1992	11399	21824	6396	0.3416
1993	10161	34196	6107	0.2060
1994	25258	54977	9046	0.1848
1995	42962	66197	23045	0.3210
1996	11678	86473	40422	0.7004
1997	5403	83351	34304	0.7609
1998	6622	54988	24005	0.5822
1999	12518	42578	19906	0.5981
2000	20881	40642	22432	0.4531
2001	47829	52537	28990	0.7091
Average	17805	64996	24585	0.4878

3.3.2.b Faroe Bank cod (Subdivision Vb_2)

State of stock/exploitation: Although the stock biomass is not known, it appears to be above average based on survey indices. The surveys indicate a steep increase of the stock in 1996-1998 compared with previous years, followed by a decline to average biomass in 1999-2000 (Figure 3.3.2.b.1). In 2001, the stock seems to have increased again and length distributions suggest strong incoming year classes. The 2002 survey estimate remained high, although slightly lower than in 2001. The ratio of landings to the survey CPUE index provides an exploitation ratio (Figure 3.3.2.b.2), which can be used as a proxy to relative changes in fishing mortality. The results suggest that fishing mortality has decreased over time and is now close to the lowest observed.

Management objectives: There are no explicit management objectives for this stock and biological reference points have not been established.

Advice on management: ICES advises that fishing effort on the Faroe Bank should not exceed that exerted annually since 1996.

Comparison with previous assessment and advice: The advice is similar to last year's.

Relevant factors to be considered in management: The landing estimates are uncertain because since 1996 the vessels are allowed to fish both on the Plateau and on Faroe Bank during the same trip, making it difficult to assign landings to area. Given the relative size of the two fisheries, this causes greater uncertainty regarding catches for Faroe Bank cod than for Faroe Plateau cod, but the magnitude remains unquantified for both. The ability to provide advice depends on the reliability of input data. Because the cod landings from Faroe Bank are not known, it is not possible to provide catch advice on management. If the fishery management agency intends to manage the two fisheries to protect the productive capacity of each individual unit, then it is necessary to monitor and regulate the catch removed from each stock.

Elaboration and special comment: An analytic assessment was attempted at the 2000 Working Group meeting. ACFM concluded that analytic assessment is not considered appropriate until reliable coverage of the total catch-at-age can be obtained. Survey indices in the spring 2001 may be misleading, since the total catch was dominated by one very large catch.

Source of information: Report of the Northwestern Working Group, 29 April - 8 May 2002 (ICES CM 2000/ACFM:20).

Catch data (Tables 3.3.2.b.1):

Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC	Official Landings
1987	No assessment	-		3.5
1988	No assessment	-		3.1
1989	Addition to Faroe Plateau TAC	~2.0		1.4
1990	Access limitation may be required	-		0.6
1991	Access limitation may be required	-		0.4
1992	No fishing	0.3		0.3
1993	TAC	0.5		0.4
1994	TAC	0.5		1.0
1995	Precautionary TAC	0.5		1.2
1996	Precautionary TAC	0.5	1.0	2.5
1997	Effort at present levels	0.7		3.9
1998	Effort at present levels	-		3.5
1999	Effort not to exceed that exerted in 1996–1997	-		1.3
2000	Effort not to exceed that of 1996–1998	-		1.2
2001	Effort not to exceed that of 1996–1999	-		1.8
2002	Effort not to exceed that of 1996-2000	-		
2003	Effort not to exceed that of 1996-2001	-		

Weights in '000 t.

Faroe Bank cod (Subdivision Vb_2)

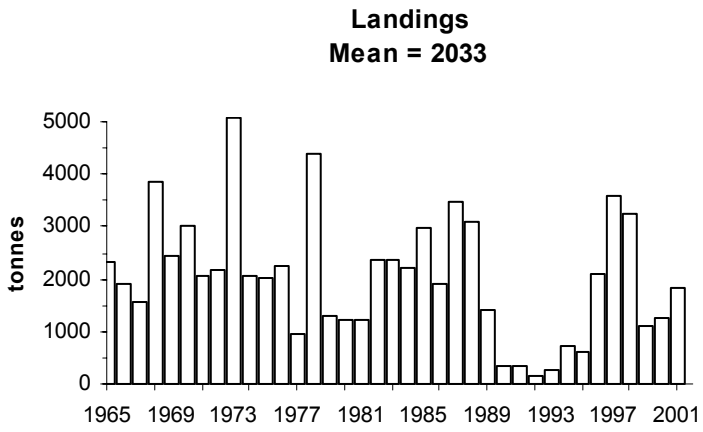


Table 3.3.2.b.1 Faroe Bank (Subdivision Vb_2) Cod. Nominal catches (tonnes) by countries, 1986–2001. As officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	1,836	3,409	2,960	1,270	289	297	122	264	717	561
Norway	6	23	94	128	72	38	32	2	8	40
UK (E.W.N.)	-	-	-	-	-	-	+	1	1	-
UK (Scotland)[1]	63	47	37	14	205	90	176	118	227	551
United Kingdom										
Total	1,905	3,479	3,091	1,412	566	425	330	385	953	1,152
Used in the assessment	-	-	-	-	361	335	154	266	725	601

Country	1996	1997	1998	1999	2000*	2001*
Faroe Islands	2,051	3,459	3,092	1,001		
Norway	55	135*	147*	88*	49	200
UK (E.W.N.)	-[2]	-[2]	-[2]	-[2]	-[2]	
UK (Scotland)	382	277	265	210		
United Kingdom					-[2]	
Total	2,488	3,871	3,504	1,299	49	200
Used in the assessment	2,106	3,594	3,239	1,089	1,243	1,813

* Preliminary.
[1] Includes Vb_1.
[2] Included in Vb_1.

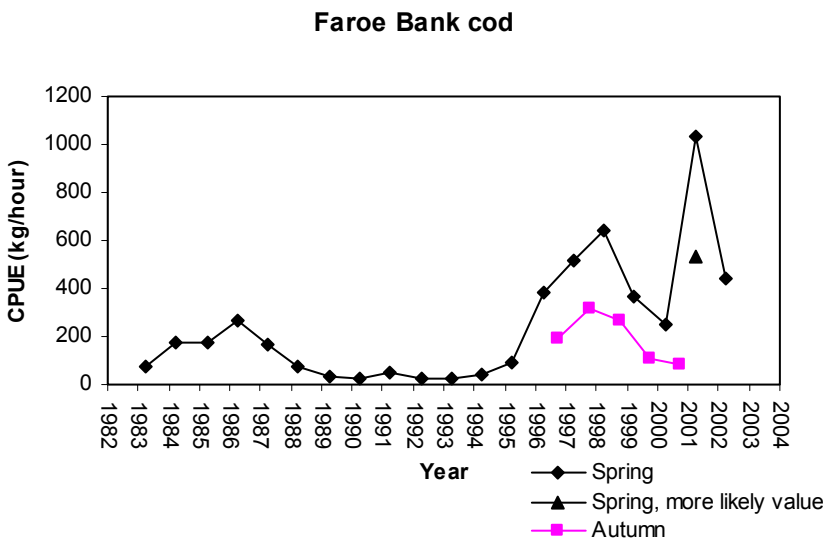


Figure 3.3.2.b.1 Faroe Bank (Subdivision Vb2) COD. Catch per unit effort in the spring and autumn groundfish survey.

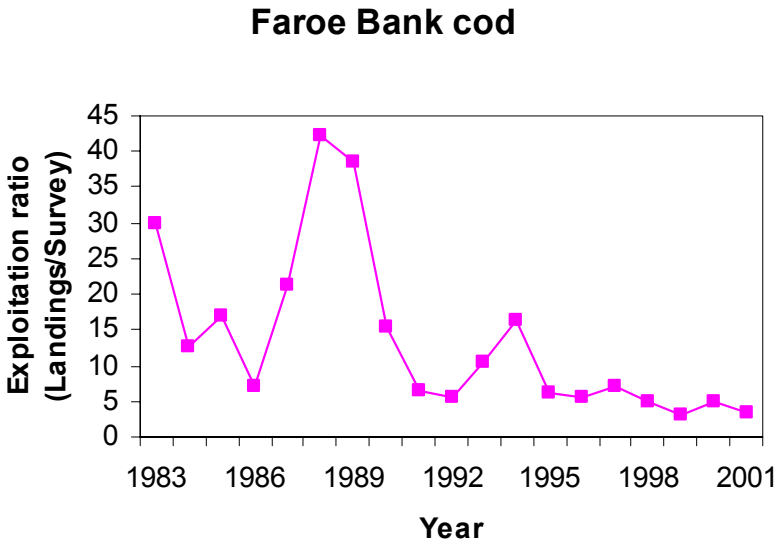


Figure 3.3.2.b.2 Faroe Bank (Subdivision Vb2) COD. Exploitation ratio.

3.3.3 Faroe haddock (Division Vb)

State of stock/exploitation: The stock is harvested outside safe biological limits. SSB in 2002 is estimated to be slightly above $\mathbf{B}_{pa}$. Fishing mortality in 2001 is estimated to be above $\mathbf{F}_{pa}$. The SSB increased significantly in 1996–1998 due to the recruitment of two strong year classes. The subsequent year classes have been below average except for the 1999 year class, which is estimated to be above average.

Management objectives: The effort management system implemented in the Faroese demersal fisheries in Division Vb since 1996 aims at harvesting on average 33% of the haddock exploitable stock. This translates into an average F of 0.45, higher than the proposed $\mathbf{F}_{pa}$ of 0.25 and higher than the $\mathbf{F}_{lim} = 0.40$. The harvest regime is therefore expected to maintain fishing mortalities in excess of $\mathbf{F}_{lim}$. ICES considers this regime as inconsistent with the Precautionary Approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed that:
$\mathbf{B}_{lim}$ is 40 000 t	$\mathbf{B}_{pa}$ be set at 55 000 t
$\mathbf{F}_{lim}$ is 0.40	$\mathbf{F}_{pa}$ be set at 0.25

Technical basis:

$\mathbf{B}_{lim}$: Former MBAL	$\mathbf{B}_{pa}$: 2 st. dev. above $\mathbf{B}_{lim}$, but reduced based on inspection of the SSB-R scatter plot
$\mathbf{F}_{lim}$: 2 *std. dev. above $\mathbf{F}_{pa}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}(1998) = 0.25$

Advice on management: ICES advises a reduction in fishing mortality to below $\mathbf{F}_{pa}$(0.25), corresponding to an effort reduction of about 35%.

Relevant factors to be considered in management: A 35% percent reduction in fishing mortality in 2003 corresponds to landings of no more than 12 000 t. Under the present management regime this can be achieved by reducing the overall directed effort at haddock and/or by establishing area closures for all gears capable of catching haddock. The effect of the effort regulation should be closely monitored, in particular the possible changes in catchability and target species. Haddock are taken in a mixed fishery together with saithe and cod.

Catch forecast for 2003:
Basis: F(2002) =F_{sq}=F(2001) = 0.38; Landings (2002) = 21; SSB(2003) = 57 .

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0.19	$0.5*F_{sq}$	9	58
0.25	$\mathbf{F}_{pa}$ ($0.66F_{sq}$	12	55
0,29	$0.75F_{sq}$	14	54
0.30	$0.8F_{sq}$	14	53
0.38	$1.0F_{sq}$	18	50
0.45	$\mathbf{F}_{lim}$	20	46

Weights in'000t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment is highly uncertain, to a large extent because of conflicting signals in the various sources of information. The stock is now estimated above $\mathbf{B}_{pa}$ due to a combination of lower estimates of fishing mortality and the strong incoming 1999 year class. In 2001, due to lack of reliable recruitment estimates, geometric mean recruitment was assumed for age 2 in the assessment year and in the projections. Those year classes are presently estimated to be considerably higher. The assessment this year was tuned with a survey as opposed to the commercial CPUE indices last year.

Elaboration and special comment: The estimate of the recruiting year classes has improved, as survey indices now are available in the assessment.

The mean weights-at-age, which have been decreasing since the middle of the 1990s, have now increased again for most ages.

Haddock is mainly fished by longliners and pair-trawlers. At present there are closed areas to trawling, and this combined with the large minimum mesh size in the codend (145 mm) effectively reduces catches of juvenile and young haddock in trawl fisheries, whereas this is not the case for longliners.

Data and Assessment: The analytical assessment was performed using a survey index. Recruitment estimates were available from survey.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

Yield and spawning biomass per Recruit F-reference points:

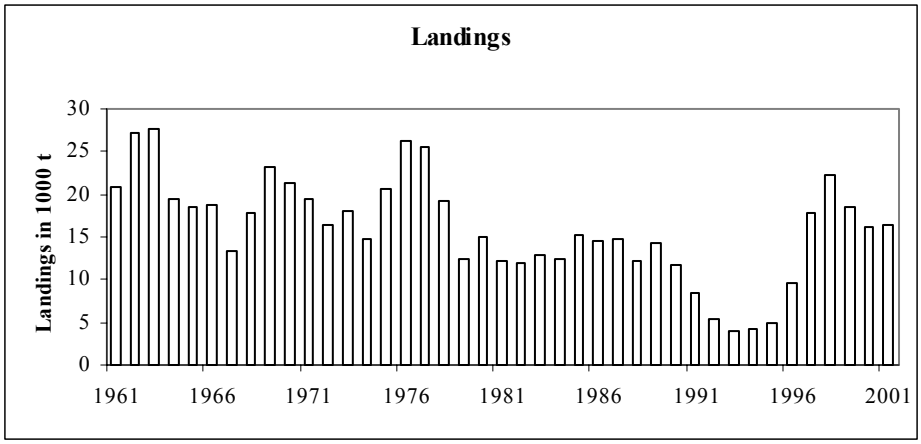
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.380	0.640	1.885
$\mathbf{F}_{max}$	0.509	0.645	1.478
$\mathbf{F}_{0.1}$	0.186	0.571	3.156
$\mathbf{F}_{med}$	0.241	0.606	2.655

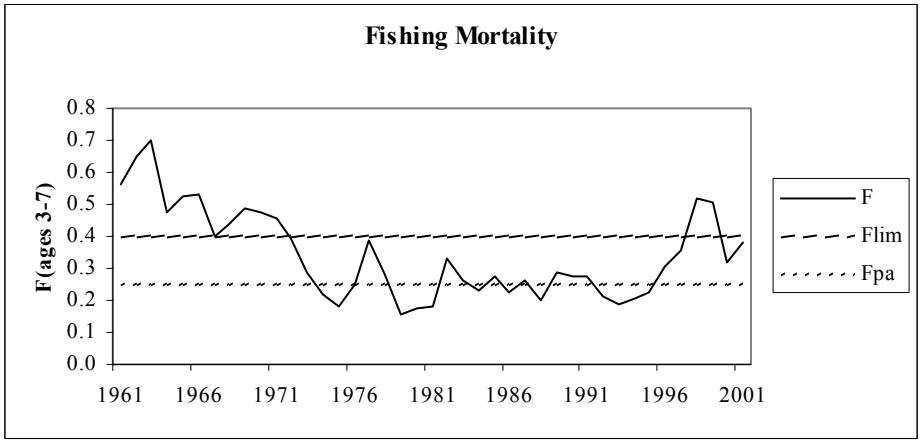
Catch data (Tables 3.3.3.1– 3):

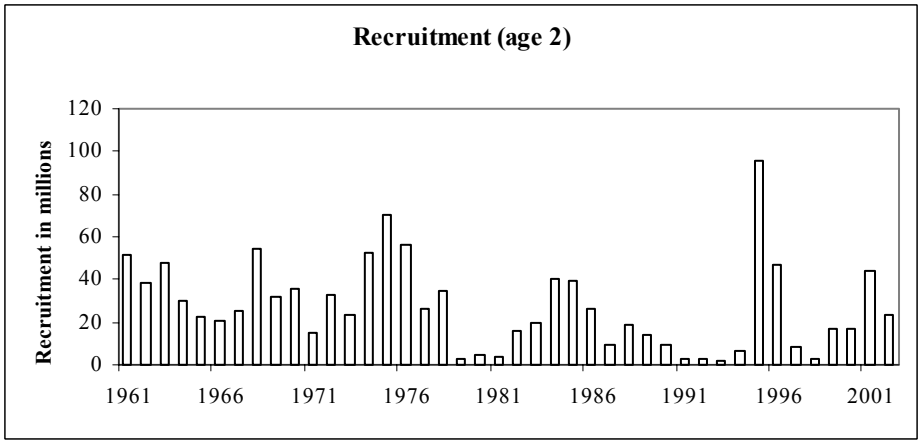
Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC	ACFM Catch
1987	No increase in F	17		14.9
1988	No increase in F	18		12.2
1989	No increase in F	11		14.3
1990	No increase in F	11		11.7
1991	TAC	11		8.4
1992	TAC	13-15		5.5
1993	Reduction in F	8		4.0
1994	No fishing	0	6.2	4.3
1995	No fishing	0	6.2	4.9
1996	TAC	8.3	12.6[1]	9.6
1997	F= F(95)	9.3		17.9
1998	F =F(96)	16		22.2
1999	F < proposed $\mathbf{F}_{pa}$ (0.25)	9		18.5
2000	F < proposed $\mathbf{F}_{pa}$ (0.25)	22		16.1
2001	F < proposed $\mathbf{F}_{pa}$ (0.25)	20		16.3
2002	No fishing	0		
2003	F < proposed $\mathbf{F}_{pa}$ (0.25)	9		

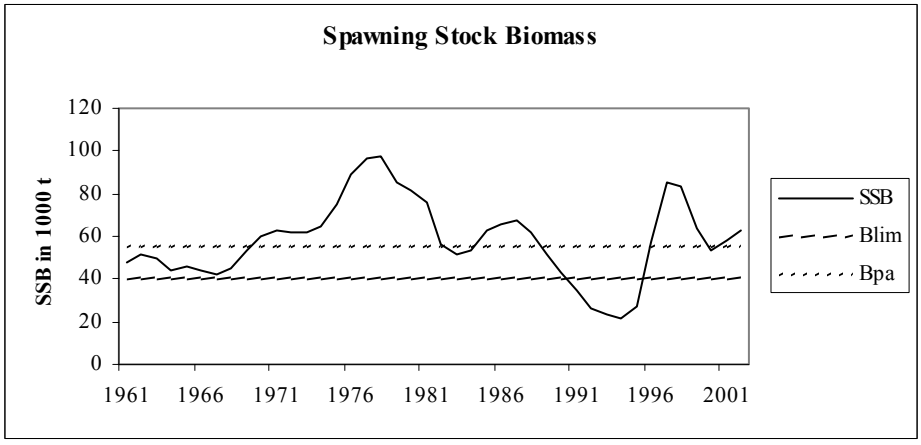
[1]For the period 1 September 1995 to 31 May 1996. Weights in '000 t.

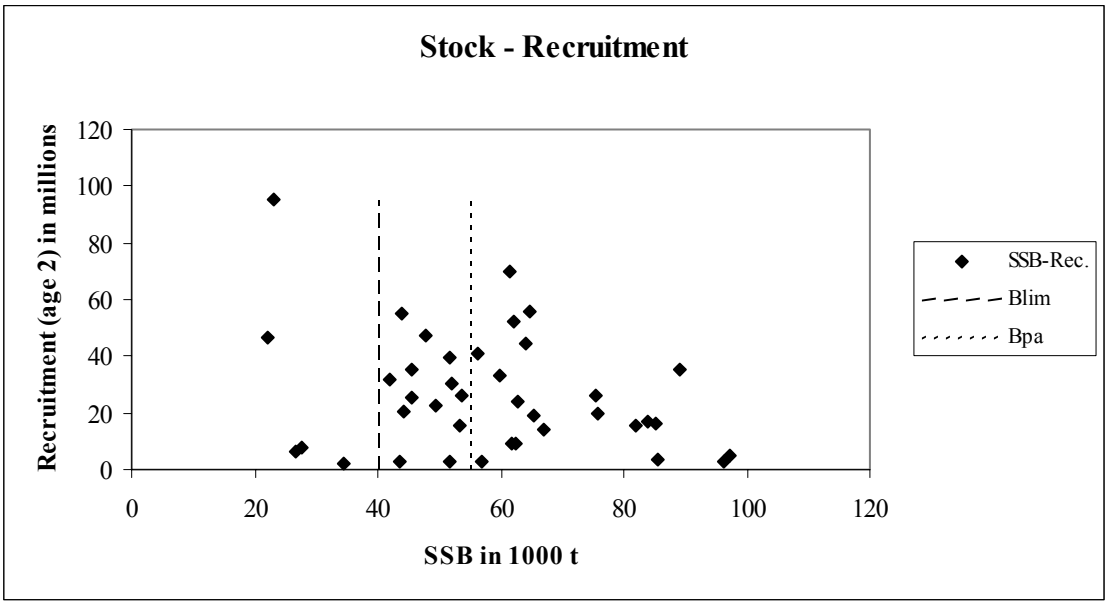
Faroe haddock (Division Vb)

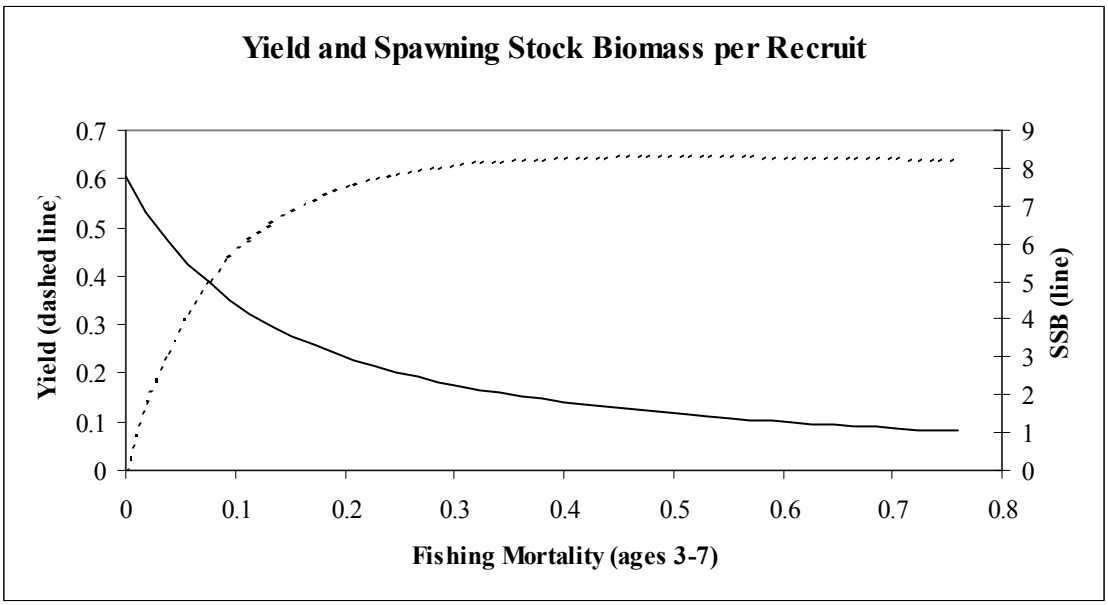


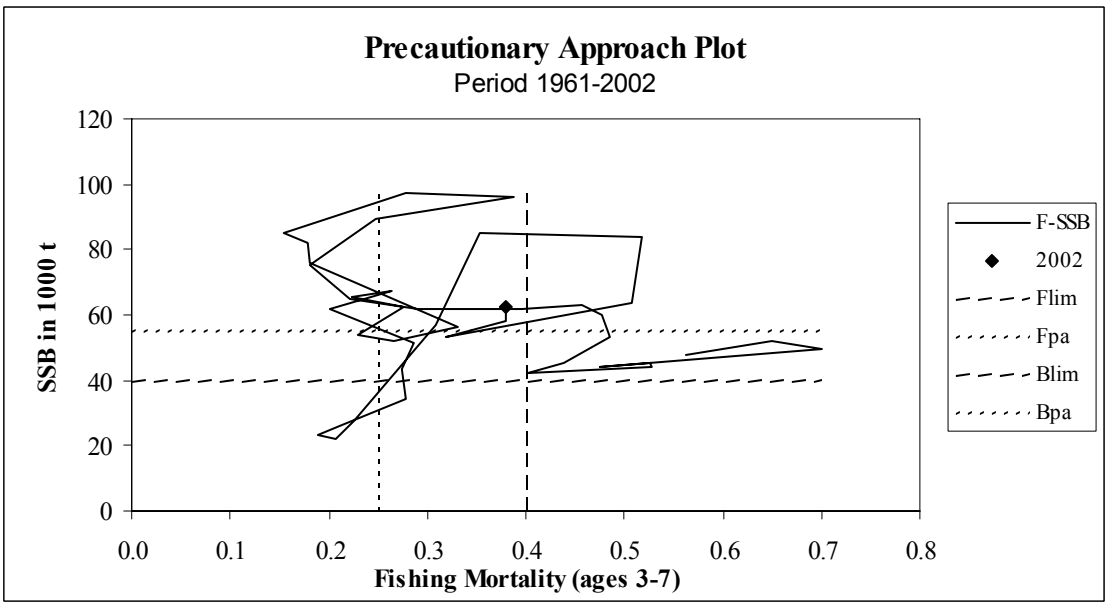







Stock - Recruitment
Recruitment (age 2) in millions
120
100
80
60
40
20
0
0
20
40
60
80
100
120
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-7)


Precautionary Approach Plot
Period 1961-2002
SSB in 1000 t
120
100
80
60
40
20
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Denmark	-	-	-	-	1	8	4	-	-	-
Faroe Island	10,319	11,898	11,418	13,597	13,359	13,954	10,867	13,506	11,106	8,074
France[1]	2	2	20	23	8	22	14	-	-	-
Germany	1	+	+	+	1	1	-	+	+	+
Norway	12	12	10	21	22	13	54	111	94	125
UK (Engl. a	-	-	-	-	-	2	-	-	7	-
UK (Scotla	1	-	-	-	-	-	-	-	-	-
United Kingdom										
Total	10,335	11,912	11,448	13,641	13,391	14,000	10,939	13,617	11,207	8,199
Working Gr	11,937	12,894	12,378	15,143	14,477	14,882	12,178	14,325	11,726	8,429

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 [2]
Faroe Island	4,655	3,622	3,675	4,549	9,152	16,585	19,135	16,643		
France[1]	164	-					2 [2,7]	0		
Germany	-	-		5	-	-				
Greenland								30 [6]	22 [6]	0 [6]
Norway	71	28	22	28	45	45 [2]	71 [2]	411 [2]	355 [2]	259
UK (Engl. a	54	81	31	23	5	22 [1]	30 [1]	59 [7]	19 [7]	
UK (Scotla	-	-	-	-	…	…	…			
United Kingdom										152 [6]
Total	4,944	3,731	3,728	4,605	9,202	16,652	19,238	17,143	396	411
Working Gr	5,476	4,026	4,252	4,948	9,642	17,924	22,210	18,482	16,084	16,296

1) Including catches from Sub-division Vb2. Quantity unknown 1989-1991, 1993 and 1995-2001.

2) Provisional data

3)From 1983 to 1996 catches included in Sub-division Vb2.

4) Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

5)Includes French and Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service

6) Reported as Division Vb, to the Faroese coastal guard service.

7) Reported as Division Vb.

8) Includes Faroese landings reported to the NWWG by the Faroese Fisheries Laboratory

Country	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Faroe Island	1,533	967	925	1,474	1,050	832	1,160	659	325	217
France[1]	-	-	-	-	-	-	-	-	-	-
Norway	1	2	5	3	10	5	43	16	97	4
UK (Engl. a	-	-	-	-	-	-	-	-	-	-
UK (Scotla	48	13	+	25	26	45	15	30	725	287
Total	1,582	982	930	1,502	1,086	882	1,218	705	1,147	508

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001 [2]
Faroe Island	338	185	353	303	338	1,133	2,810	1,110		
France[1]	-	-	-	-	-	-				
Norway	23	8	1	1 [2]	40 [2]	4 [2]	60 [2]	3 [2]	48	64
UK (Engl. a	+	+	+	... [1]	… [1]	… [1]	… [1]	[1]	[1]	[1]
UK (Scotla	869	102	170	39	62	135 [1]	102	193	[1]	[1]
Total	1,230	295	524	343	440	1,272	2,972	1,306	48	64
Working Group estimate 4)									1,648	1,750

1) Catches included in Sub-division Vb1.

2) Provisional data

3)From 1983 to 1996 includes also catches taken in Sub-division Vb1 (see Table 2.4.1)

4) Includes Faroese landings reported to the NWWG by the Faroese Fisheries Laboratory

Table 3.3.3.3 Faroe haddock (Division Vb).

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1961	51279	47797	20833	0.5624
1962	38537	51875	27151	0.6506
1963	47362	49547	27571	0.7002
1964	30110	44128	19490	0.4753
1965	22644	45555	18479	0.5260
1966	20206	43953	18766	0.5288
1967	25356	41959	13381	0.4030
1968	54842	45379	17852	0.4377
1969	31968	53421	23272	0.4853
1970	35581	59858	21361	0.4762
1971	15450	62906	19393	0.4564
1972	33175	61974	16485	0.3964
1973	23690	61576	17976	0.2894
1974	52332	64629	14773	0.2206
1975	70044	75402	20715	0.1799
1976	55961	89213	26211	0.2476
1977	26187	96362	25555	0.3874
1978	35091	97210	19200	0.2782
1979	2783	85376	12418	0.1551
1980	4943	81881	15016	0.1780
1981	3490	75822	12233	0.1814
1982	15829	56391	11937	0.3310
1983	19599	51787	12894	0.2655
1984	40732	53785	12378	0.2286
1985	39319	62541	15143	0.2763
1986	26410	65503	14477	0.2241
1987	9422	67150	14882	0.2649
1988	18755	61726	12178	0.2015
1989	14022	51557	14325	0.2863
1990	8976	43506	11726	0.2743
1991	3033	34322	8429	0.2780
1992	2785	26588	5476	0.2135
1993	1837	23221	4026	0.1887
1994	6449	21972	4252	0.2071
1995	95646	27507	4948	0.2257
1996	46666	56856	9642	0.3083
1997	8000	85262	17924	0.3532
1998	2855	83783	22210	0.5179
1999	16570	63921	18482	0.5072
2000	17236	53395	16084	0.3186
2001	44235	58108	16296	0.3802
2002	23357	62537		
Average	27209	58268	16164	0.3440

3.3.4 Faroe saithe (Division Vb)

State of stock/exploitation: The stock is harvested outside safe biological limits. SSB is above $\mathbf{B}_{pa}$. The 1996 year class is the highest on record. Also the 1997 year class is good.

Management objectives: The effort management system implemented in the Faeroese demersal fisheries (Division Vb) since 1996 aims at harvesting on average 33% of the saithe stock in numbers. This translates into an average F of 0.45, higher than $\mathbf{F}_{pa}$ of 0.28 and even above $\mathbf{F}_{lim}$ of 0.4. ICES considers this regime to be inconsistent with the precautionary approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 60 000 t	$\mathbf{B}_{pa}$ be set at 85 000 t
$\mathbf{F}_{lim}$ is 0.40	$\mathbf{F}_{pa}$ be set at 0.28

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: former MBAL
$\mathbf{F}_{lim}$: consistent with $\mathbf{B}_{lim}$ of 60 000 t	$\mathbf{F}_{pa}$: consistent with $\mathbf{F}_{lim}$ and $\mathbf{F}_{med}$

Advice on management: ICES advises that fishing effort in 2003 be reduced to correspond to fishing mortality below $\mathbf{F}_{pa}$ = 0.28, corresponding to an effort reduction of about 15%. Current practice under the effort management system, to increase the number of fishing days allowed when moving into deeper waters, should be suspended until fishing mortality has decreased such that saithe is harvested within safe biological limits. The present spawning closures should be maintained.

Relevant factors to be considered in management: In recent years, fishing mortality in the last assessment year has consistently been overestimated, and the SSB underestimated.

The advised reduction in fishing mortality to below $\mathbf{F}_{pa}$ = 0.28 corresponds to landings less than 47 000 t. The effect of the effort regulations should be closely monitored, in particular the possible changes in catchability and target species. In addition, it should be noted that saithe are partly caught in a mixed trawl fishery together with haddock and cod. Hence management measures taken in 2001/2002 for cod and haddock should also ensure protection for the saithe stock.

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$= F(1999-2001) = 0.324; Landings (2002) = 53.3; SSB(2003) = 150.7

F(2003)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.23	0.7 $\mathbf{F}_{sq}$	40	40	150
$\mathbf{F}_{pa}$ (0.28)	0.85 $\mathbf{F}_{sq}$	47	47	142
0.30	0.9 $\mathbf{F}_{sq}$	49	49	140
0.32	1.0 $\mathbf{F}_{sq}$	53	53	136
0.45	1.2 $\mathbf{F}_{sq}$	67	67	122

(Weights in '000 t)
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were included in the 2001 advice.

Comparison with previous assessment and advice: SSB for 2001 is now estimated about 55 % above the estimate provided in 2001. This partly reflects the uncertainty in the assessment and is partly caused by the upward revision of the estimate of the strength of the 1996 year class.

Elaboration and special comment: Saithe are predominantly taken in a mixed trawl fishery although some targeting occurs, in which case by-catches of other demersal species are small. The fishery was originally international, but for all practical purposes saithe has been fished only by Faroese vessels since the introduction of the 200 nm EEZ in 1977. The principal fleet consisting of large pair trawlers with engines larger than 1000 HP accounted for 60% of the catches in 1994–2001. In the same period the smaller pair trawlers (<1000 HP) caught 20%, jiggers 9%, and large single trawlers 9%. All other vessels had only small catches of saithe as by-catch. Growth rates have increased from the low level observed in 1990–1991 to higher values in 1994–1996 and have decreased again since 1997.

The assessment was tuned with commercial pair trawler catch and effort data from logbooks. No recruitment indices are available.

Data and assessment: Catch-at-age and CPUE using same settings as last year.

Source of information: Report of the Northwestern Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:20).

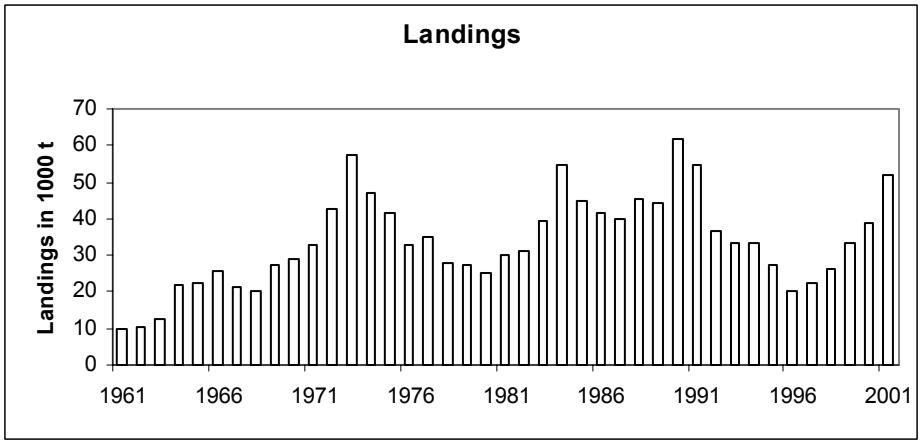
Yield and spawning biomass per Recruit F-reference points:

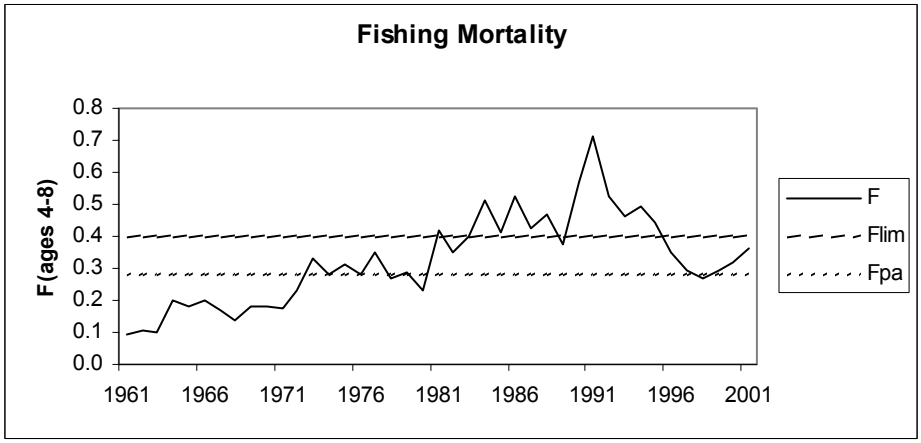
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.324	1.499	3.439
$\mathbf{F}_{max}$	0.422	1.501	3.091
$\mathbf{F}_{0.1}$	0.161	1.337	7.106
$\mathbf{F}_{med}$	0.345	1.495	3.748

Catch data (Tables 3.3.4.1–2):

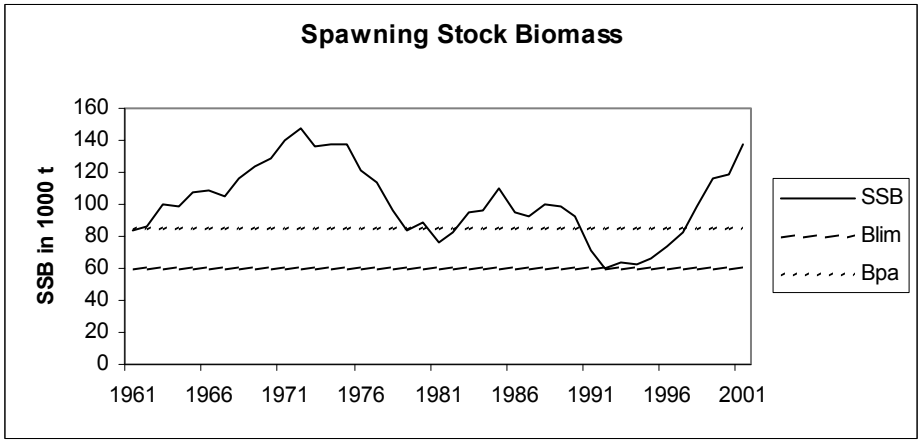
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	No increase in F	32		40
1988	No increase in F	32		45
1989	Reduction in F	<40		44
1990	Reduction in F	41		62
1991	TAC	30		55
1992	Reduction in F	27		36
1993	Reduction in F	<37		34
1994	TAC	26	42[1]	33
1995	TAC	22	39[1]	27
1996	TAC	39	-	20
1997	20% reduction in F from 1995 level	21	-	22
1998	30% reduction in effort from 1996/97 level	-	-	26
1999	F below $\mathbf{F}_{pa}$ (0.28)	14		33
2000	F below than $\mathbf{F}_{pa}$ (0.28)	15		39
2001	Reduce fishing effort to generate F well below $\mathbf{F}_{pa}$ (0.28)	<17		52
2002	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	28		
2003	Reduce fishing effort to generate F below $\mathbf{F}_{pa}$ (0.28)	47		

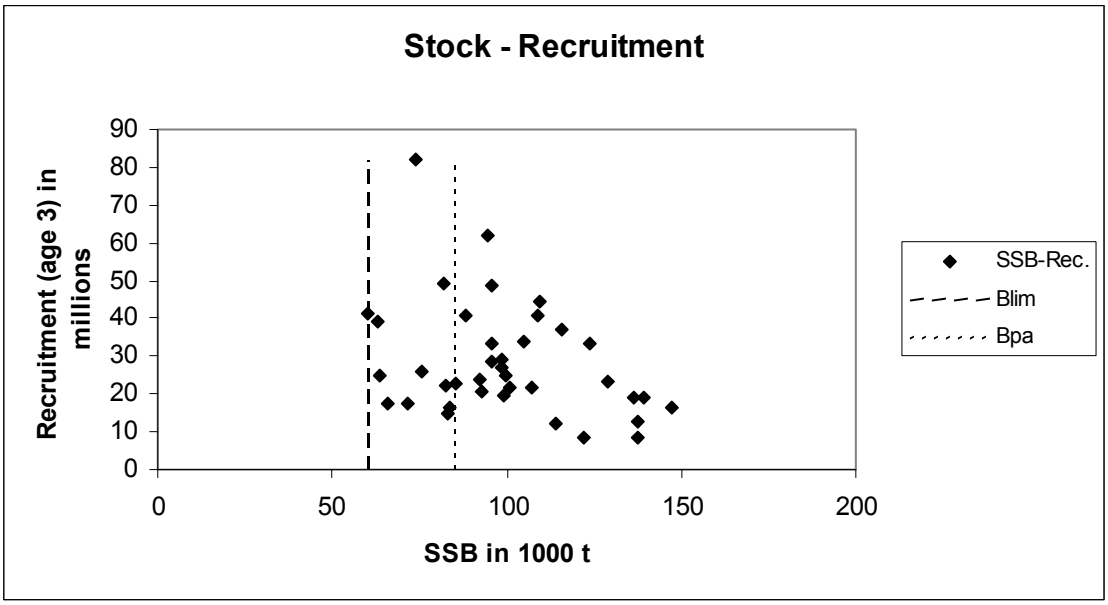
[1]In the quota year 1 September–31 August the following year. Weights in '000 t.

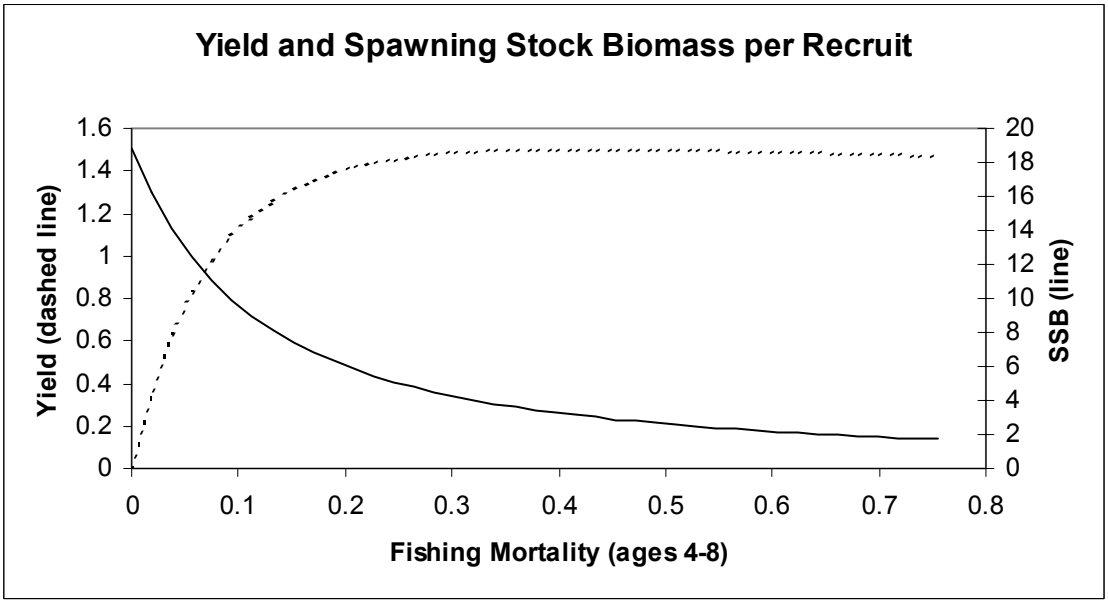

Landings
Landings in 1000 t
0
10
20
30
40
50
60
70
1961
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 4-8)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1961
1966
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa

Recruitment (age 3)
Recruitment in millions
0
10
20
30
40
50
60
70
80
90
1961
1966
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
160
1961
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 3) in millions
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SSB (line)
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 4-8)

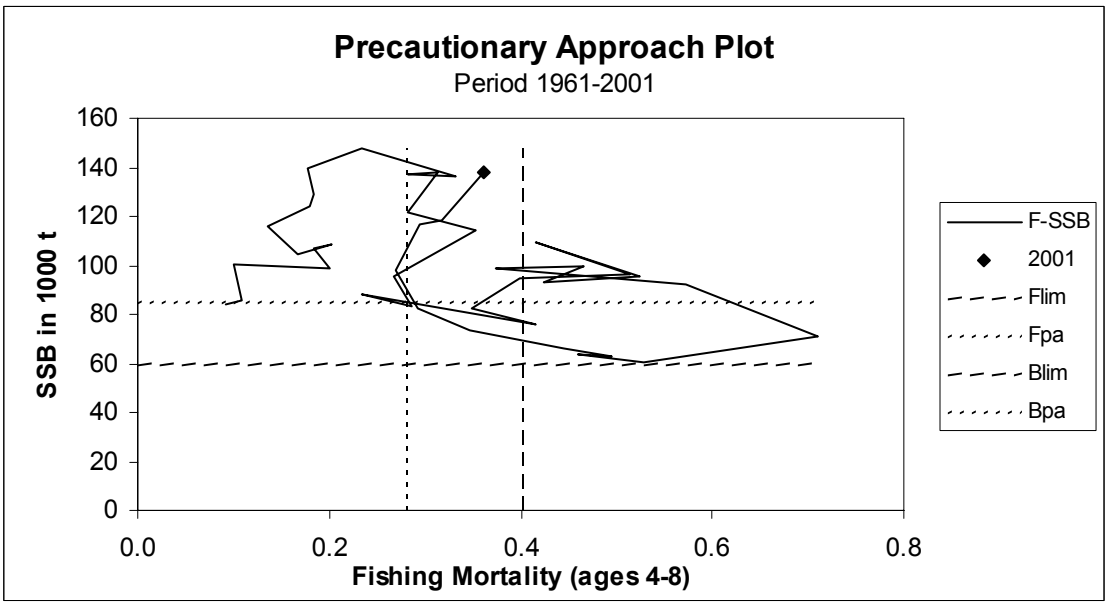

Precautionary Approach Plot
Period 1961-2001
SSB in 1000 t
160
140
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 4-8)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.3.4.1 Saithe in the Faroes (Division Vb). Nominal catches (t) by countries, 1987–2000 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994
Denmark	94	-	2	-	-	-	-
Faroe Islands	44,402	43,624	59,821	53,321	35,979	32,719	32,406
France [3]	313	-	-	-	120	75	19
German Dem.Rep.	-	9	-	-	5	2	1
German Fed. Rep.	74	20	15	32		-	-
Netherlands	-	22	67	65	-	32	156
Norway	52	51	46	103	85	279	151
UK (Eng. & W.)	-	-	-	5	74	425	438
UK (Scotland)	92	9	33	79	98		
USSR/Russia [2]	-	-	30	-	12	-	-
Total	45,027	43,735	60,014	53,605	36,373	33,532	33,171
Working Group estimate [4,5]	45,285	44,477	61,628	54,858	36,487	33,543	33,182

Country	1995	1996	1997	1998	1999	2000 [1]	2001 [1]
Estonia	-	-	16	-	-	-	-
Faroe Islands	26,918	19,297	21,721	25,995	32,439		
France	10	12	9	17	-		
Germany	41	3	5	-	100	230	677
Greenland	-	-	-	-	-		
Norway	10	16	67	53	160	97	80
UK (Eng. & W.)	21	53	-	19	67	32	...
UK (Scotland)	200	580	460	337	441	534	...
United Kingdom							790
Russia	-	18	28	-	-	20	1
Irland							5
Total	27,200	19,979	22,306	26,421	33,207	913	1,553
Working Group estimate [4,5,6]	27,209	20,029	22,306	26,421	33,207	39,045	51,795

[1] Preliminary.

[2] As from 1991.

[3] Quantity unknown 1989-91.

[4] Includes catches from Sub-division Vb2 and Division IIa in Faroese waters.

[5] Includes French, Greenlandic, Russian catches from Division Vb, as reported to the Faroese coastal guard service.

[6] Includes Faroese, French, Greenlandic catches from Division Vb, as reported to the Faroese coastal guard service.

Table 3.3.4.2 Saithe in the Faroes (Division Vb).

Year	Recruitment Age 3 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1961	9046	83791	9592	0.0911
1962	13662	85628	10454	0.1083
1963	22428	100622	12693	0.0996
1964	16188	98372	21893	0.2007
1965	22798	107200	22181	0.1828
1966	21823	108759	25563	0.2029
1967	26868	104609	21319	0.1661
1968	21506	115925	20387	0.1350
1969	40783	123747	27437	0.1791
1970	34118	129081	29110	0.1833
1971	37265	139423	32706	0.1770
1972	33589	147472	42663	0.2331
1973	23274	136569	57431	0.3331
1974	18882	137467	47188	0.2814
1975	16282	137713	41576	0.3131
1976	18882	121831	33065	0.2825
1977	12906	113881	34835	0.3522
1978	8372	95777	28138	0.2665
1979	8595	83261	27246	0.2860
1980	12372	88482	25230	0.2339
1981	33102	75806	30103	0.4160
1982	14641	82498	30964	0.3493
1983	40811	94377	39176	0.3982
1984	25841	95948	54665	0.5133
1985	22054	109447	44605	0.4147
1986	61732	95425	41716	0.5237
1987	48582	92811	40020	0.4249
1988	44557	99575	45285	0.4666
1989	28542	99105	44477	0.3729
1990	20700	92356	61628	0.5714
1991	24871	71352	54858	0.7110
1992	19697	60085	36487	0.5277
1993	23922	63892	33543	0.4601
1994	17572	63068	33182	0.4956
1995	41382	65889	27209	0.4442
1996	24873	73695	20029	0.3472
1997	38978	82085	22306	0.2925
1998	17542	98316	26421	0.2687
1999	81931	116487	33207	0.2950
2000	49270	118699	39045	0.3166
2001	29315	137644	51795	0.3621
Average	27550	101175	33693	0.3239

3.4 Stocks in the Skagerrak and Kattegat (Division IIIa)

3.4.1 Overview

Description of fisheries

The fleets operating in the Skagerrak and Kattegat (Division IIIa) include vessels targeting species for human consumption as well as vessels engaged in fisheries for reduction purposes. The human consumption fleets are diverse, including gillnetters and Danish seiners exploiting flatfish and cod and demersal trawlers involved in various human consumption fisheries (roundfish, flatfish, *Pandalus,* and *Nephrops*). Demersal trawling is also used in the fisheries for Norway pout and sandeel which are landed for reduction purposes. Pelagic trawlers and purse seiners exploit herring, mackerel, horse mackerel, and sprat.

The roundfish, flatfish, and *Nephrops* stocks are mainly exploited by Danish and Swedish fleets consisting of bottom trawlers (*Nephrops* trawls with >70 mm meshes and bottom trawls with >90 mm mesh size), gillnetters, and Danish seiners. The number of vessels operating in Division IIIa has decreased in recent years. This is partly an effect of the EU withdrawal programme which until now has affected the Danish fleets only, but these fleets still dominate the fishery in Division IIIa. *Pandalus* is exploited by Danish, Swedish, and Norwegian shrimp trawlers.

The industrial fisheries are carried out by trawlers mainly of a size above 20 m using small-mesh trawl. The main target species are sandeel, Norway pout, sprat and blue whiting. By-catches in these fisheries have decreased since 1996, mainly due to the enforcement of by-catch regulations. Landings in the industrial fisheries in Division IIIa are given in Table 3.4.1.1.

There are important technical interactions between the fleets.

Misreporting and non-reporting of catches have occurred mainly in the cod fisheries. The amount is, however, not known. There are no discard data available for assessments. The time-series of age samples from landings for industrial purposes is short.

Overview of resources

The Skagerrak-Kattegat area is to a large extent a transition area between the North Sea and the Baltic – both in terms of hydrography and topography and the identity of stocks. The exchange of water between the North Sea and the Baltic is the main hydrographic feature of the area.

When assessed as separate stocks, several of the stocks in the Skagerrak show close affinities to the North Sea stocks, in terms of both population dynamics (similar trends in recruitment and SSB) and biological indicators such as parasites or genetics. Tagging experiments have demonstrated extensive migration between the two areas for several species. Species with no clear stock boundary between the North Sea and Skagerrak include saithe, hake, cod (except for coastal populations in fjords), haddock, whiting, and Norway pout. Sandeel in the North Sea and Skagerrak is probably a complex of several local populations rather than separate populations in the two areas. The landings of sandeel from the Skagerrak area have had a composition of sandeel species different from that in the North Sea.

The main herring stocks exploited in the area are the North Sea autumn spawners and the stock of spring spawners spawning in the western Baltic and the southern part of Division IIIa. Both stocks have important components migrating into Division IIIa at some time during their life cycle. The juvenile herring in Division IIIa are mainly of North Sea stock origin, while the mature fish are predominantly spring spawners. The major part of the Western Baltic spring spawners migrates into Division IIIa outside the spawning season and is found in the Skagerrak in summer.

Cod in the Kattegat and Belt area are also associated with the western Baltic stock. The structure and extent of migrations is, however, not clear.

Most of the species are now assessed in conjunction with the stocks in the neighbouring areas – cod in the Skagerrak, haddock, saithe, Norway pout, and autumn-spawning herring are assessed as part of the North Sea stocks, spring-spawning herring as part of the western Baltic stock. The state of these stocks is considered in the sections concerning the North Sea and the Baltic, respectively.

The cod in Skagerrak is assessed together with cod in the North Sea and the Eastern Channel. The stock is outside safe biological limits (see Section 3.5.2). The landings of cod in the Skagerrak in 2001 were 7 100 t in the human consumption fishery. No by-catch was observed in the small-meshed industrial fisheries. Denmark and Sweden took the majority of catches.

The cod in Kattegat is outside safe biological limits. Landings in 2001 were 3 900 t, which is the lowest in the time-series.

Haddock in Division IIIa is assessed together with haddock in the North Sea. The stock is harvested outside safe biological limits. The landings of haddock in Division IIIa in the human consumption fisheries

amounted to 1 900 t in 2001. By-catches in the industrial fisheries were estimated at 200 t. Most of the catches are taken in the Skagerrak.

Assessment of the state of the whiting in Division IIIa was not possible. The landings of whiting in Division IIIa in 2001 are not yet available but are likely to be amongst the lowest observed. The major part was taken in the industrial fisheries. Most of the landings are taken in the Skagerrak.

The plaice in Division IIIa is harvested outside biological limits, as fishing mortality is higher than $\mathbf{F}_{pa}$. Landings amount to 11 700 t in 2001. About 75% of the landings were taken in the Skagerrak.

Sole in Division IIIa is harvested outside safe biological limits. Landings in 2001 were 560 t, substantially lower than the 1 300 t in 1995.

The industrial fisheries yielded a total catch of 83 000 t in 2001, well below the mean catches of 117 000 t (1989-2001). Most of the catches consisted of sandeel, sprat, and herring with smaller catches of Norway pout and blue whiting (Table 3.4.1.1). By-catches of cod, haddock, and whiting in the industrial fisheries were all much reduced from 1996.

The landings of *Nephrops* and *Pandalus* in 2001 from Division IIIa amounted to 4 000 t and 6 400 t, respectively. The stocks seem to be able to sustain the present fishing mortality.

Table 3.4.1.1 Catches of the most important species in the industrial fisheries in Division IIIa ('000 t), 1974–1999[1].

Year	Sandeel	Sprat[2]	Herring[3]	Norway pout	Blue whiting	Total
1974	8	71	76	13	-	168
1975	17	101	57	19	-	194
1976	22	59	38	42	-	161
1977	7	67	32	21	-	127
1978	23	78	16	25	-	142
1979	34	96	13	25	6	174
1980	39	84	25	26	14	188
1981	59	76	63	30	+	228
1982	25	40	54	44	5	168
1983	29	26	89	30	16	190
1984	26	36	112	46	15	235
1985	6	20	116	9	19	170
1986	73	11	65	6	9	164
1987	5	14	72	3	25	119
1988	23	9	97	8	15	152
1989	18	4	52	5	9	88
1990	16	2	51	27	10	106
1991	24	14	44	39	10	131
1992	39	4	66	45	19	173
1993	45	2	71	8	32	158
1994	55	58	30	7	12	162
1995	12	42	34	50	10	148
1996	53	10	26	36	15	140
1997	82	12	6	32	4	136
1998	11	11	5	15	7	49
1999[4]	13	26	11	7	16	73
2000[4]	17	19	18	10	7	72
2001[4]	25	28	16	9	5	83
Mean 1989–2001	32	18	33	22	12	117

[1] Data from 1974–1984 from Anon. (1986), 1985–2001 provided by Working Group members.
[2] Total landings from all fisheries.
[3] For years 1974–1985, human consumption landings used for reduction are included in these data.
[4] 1999-2001 data provided from Denmark and Sweden. Other years, only data from Denmark is presented.

3.4.2 Cod in the Kattegat

State of the stock/exploitation: The stock is outside safe biological limits. The present fishing mortality is above $\mathbf{F}_{pa}$ and even above $\mathbf{F}_{lim}$. The estimated SSB of 5 400 t in 2002 is below $\mathbf{B}_{lim}$.

The spawning stock declined steadily from about 35 000 t in the early 1970s to about 10 000 t in the 1990s, with a concurrent drop in recruitment from 20–30 millions in the 1970s to around 10 millions in the 1990s. The fishing mortality exceeded 1.0 during most of the 1980s and 1990s. In the present state the fishery is dependent on the strength of incoming year classes. The present assessment indicates that recruitment has been well below average for the five last year classes (1997 to 2001).

Management objectives: There is no long-term management plan for this stock. The European Commission has proposed a recovery plan for the Northern hake stock and the cod stocks in the Kattegat, the Skagerrak, the North Sea and the Eastern Channel, to the west of Scotland, and in the Irish Sea. The objective is to rebuild the stocks to levels greater than $\mathbf{B}_{pa}$. The proposal includes a procedure for setting annual TACs and a system for limiting fishing effort in all fisheries catching cod. It is proposed that each year the TAC be set at a level that will result in an increase in biomass by 30% in the case of cod and 15% in the case of hake. The effort limitation system is based on the idea of reducing fishing effort in relation to the reduction in fishing mortality required to achieve the TACs. It is unclear if and when the proposal will be adopted and implemented.

ICES considers this recovery plan appropriate if it also includes a reduction of cod by-catches in other fisheries.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 400 t	$\mathbf{B}_{pa}$ be set at 10 500 t
$\mathbf{F}_{lim}$ is 1.0	$\mathbf{F}_{pa}$ be set at 0.6

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$*exp(1.645*0.3)
$\mathbf{F}_{lim}$: The spawning stock has declined steadily since the early 1970s at fishing mortality rates averaging F = 1.0. $\mathbf{F}_{lim}$ is tentatively set equal to F = 1.0.	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$*exp(-1.645*0.3)

Advice on management: ICES advises that there should be no fishing on this stock in 2003 unless an effective rebuilding plan is implemented, which aims at rebuilding the SSB to above $\mathbf{B}_{pa}$. The proposed EC recovery plan is expected to be effective if the fishing industry complies with the provisions in this plan.

Rebuilding plan: The fishery should not be re-opened until a rebuilding plan is established. Because a large part of cod is taken as by-catch in fisheries for flatfish and *Nephrops*, the necessary reduction in fishing mortality on cod cannot be achieved by a reduction in TAC alone.

By-catches in the fisheries directed at *Nephrops* and flatfish could be reduced by measures, which improve species selectivity, e.g., escape windows or grids.

Relevant factors to be considered in management: The economically most important species in the Kattegat are cod, *Nephrops,* and sole, which each account for about 25% of the value of the total annual landings. By-catches of cod occur in the mixed sole and *Nephrops* fisheries. Management measures in the Kattegat need to take account of technical interactions in the area. From 1997 to 2001 by-catches in the *Nephrops* fishery on average accounted for 12% of the cod catch in the Kattegat.

Catch forecast for 2003:
Basis: (TAC constraint) Landings (2002) = 2800, F(2002) = 0.55$\mathbf{F}_{sq}$ = 0.64, SSB(2003) = 6313.

F (2003)	Basis	Landings (2003)	SSB (2004)
0	0	0	12132
0.23	0.2 $\mathbf{F}_{sq}$	1432	10146
0.35	0.3 $\mathbf{F}_{sq}$	2045	9305
0.46	0.4 $\mathbf{F}_{sq}$	2600	8550
0.52	30% SSB increase	2856	8203
0.6	$\mathbf{F}_{pa}$=0.52 $\mathbf{F}_{sq}$	3205	7733
0.69	0.6 $\mathbf{F}_{sq}$	3556	7264
0.92	0.8 $\mathbf{F}_{sq}$	4345	6223
1.15	$\mathbf{F}_{sq}$	5000	5377

Weights in t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were carried out. Recruitment is generated from a Ricker stock-recruitment model.

The medium-term projections suggest that fishing at $\mathbf{F}_{pa}$ leads to a more than 75% probability of the stock exceeding $\mathbf{B}_{lim}$ in 2004, and exceeding $\mathbf{B}_{pa}$ in 2009.

Comparison with previous assessment and advice: The present assessment estimates last years SSB to be 2% lower than last year's assessment. The present advice is similar to last year's advice.

Elaboration and special comment: Landings have decreased from 15 000 t in the 1970s to about 7 000 t in the 1990s and less than 5 000 t in the beginning of the 2000s. During the years 1991–1994 an unknown, but probably substantial amount has been either unreported or allocated to other areas. The quality of catch data from 1994 onward has improved, leading to improved reliability of the assessment.

The stock-recruitment plot indicates that strong recruitment requires a large spawning biomass, which will not occur at the present exploitation rates, particularly on younger ages (1–3). There is evidence that the stock interacts with neighbouring cod stocks in the Skagerrak and the Baltic Sea by way of migrations. These interactions add uncertainty to the assessment.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15–24 April 2002 (ICES CM 2002/ACFM:17).

Yield and spawning biomass per Recruit F-reference points:

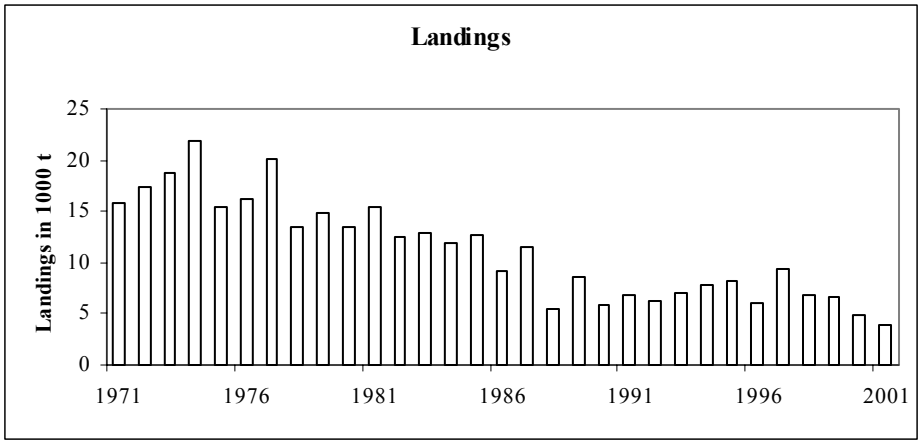
	Fish Mort Ages 3-5	Yield/R	SSB/R
Average Current	1.149	0.625	0.754
$\mathbf{F}_{max}$	0.213	1.017	4.955
$\mathbf{F}_{0.1}$	0.132	0.957	7.226
$\mathbf{F}_{med}$	0.759	0.726	1.224

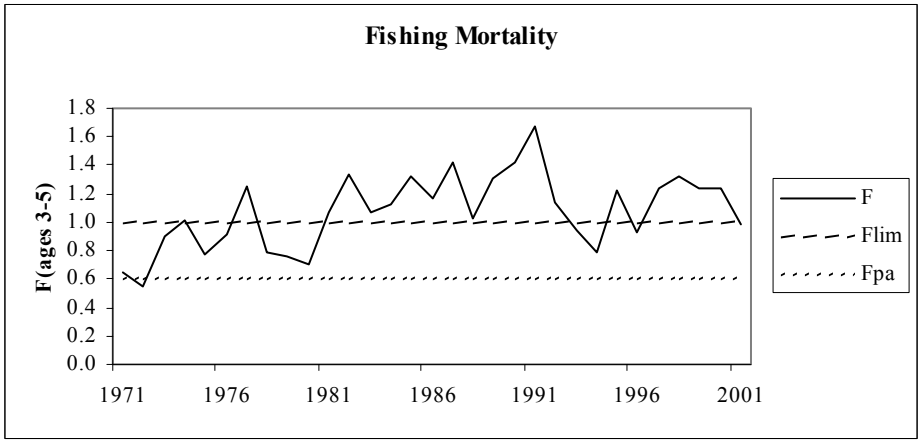
Catch data (Tables 3.4.2.1–2):

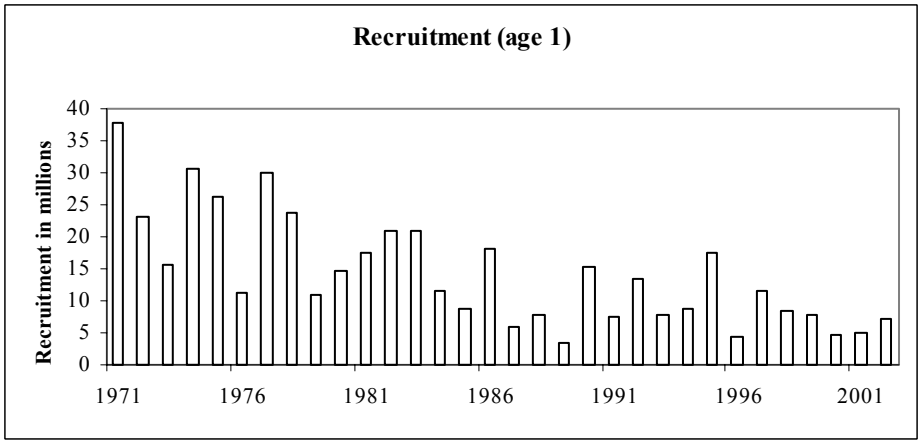
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	Reduction in F	< 13.0	15.5	11.5
1988	Reduction in F	< 15.0	15.0	5.5
1989	TAC	10.0	12.5	8.6
1990	TAC	7.0	8.5	5.9
1991	TAC	6.3	6.65	6.8
1992	30% reduction in fishing effort	-	6.65	6.3
1993	Limit fishing effort to 70% of 1991 effort	-	6.8	7.2
1994	Reduction in catch from 1991–1992	< 6.3–6.8	6.7	7.8
1995	Precautionary TAC based on recent catches	6–7	6.7	8.2
1996	30% Reduction in fishing effort from 1994 level	-	7.7	6.1
1997	Fishing effort should not exceed 70% of the 1994 level	-	8.5	9.5
1998	Fishing effort should not exceed 70% of the 1994 level	-	7.5	6.8
1999	F = 0.6	4.5	6.3	6.6
2000	At least 40% reduction in F	6.4	7.0	4.9
2001	$F = \mathbf{F}_{pa} = 0.6$	4.7	6.2	3.9
2002	No fishery	-	2.8	
2003	No fishery	-		

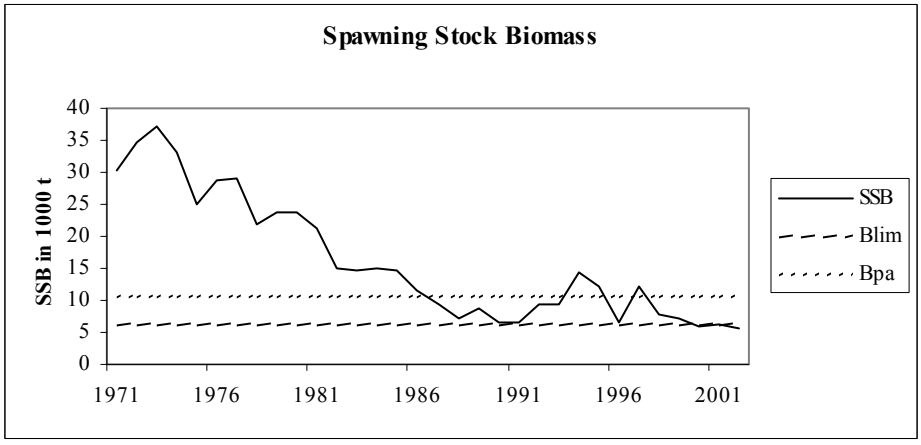
Weights in '000 t.

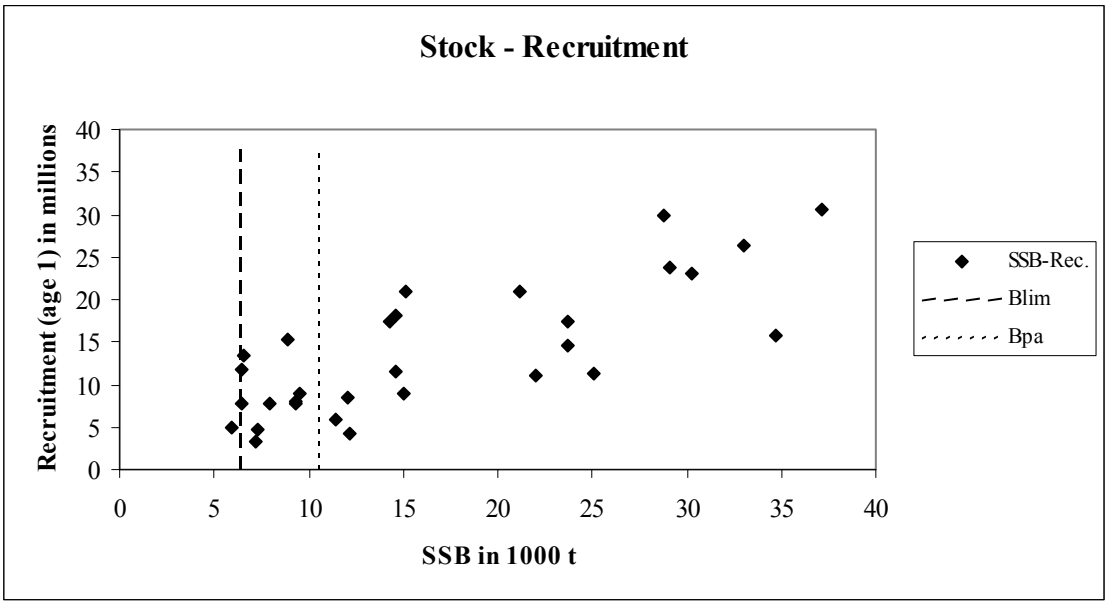
Cod in the Kattegat (part of Division IIIa)

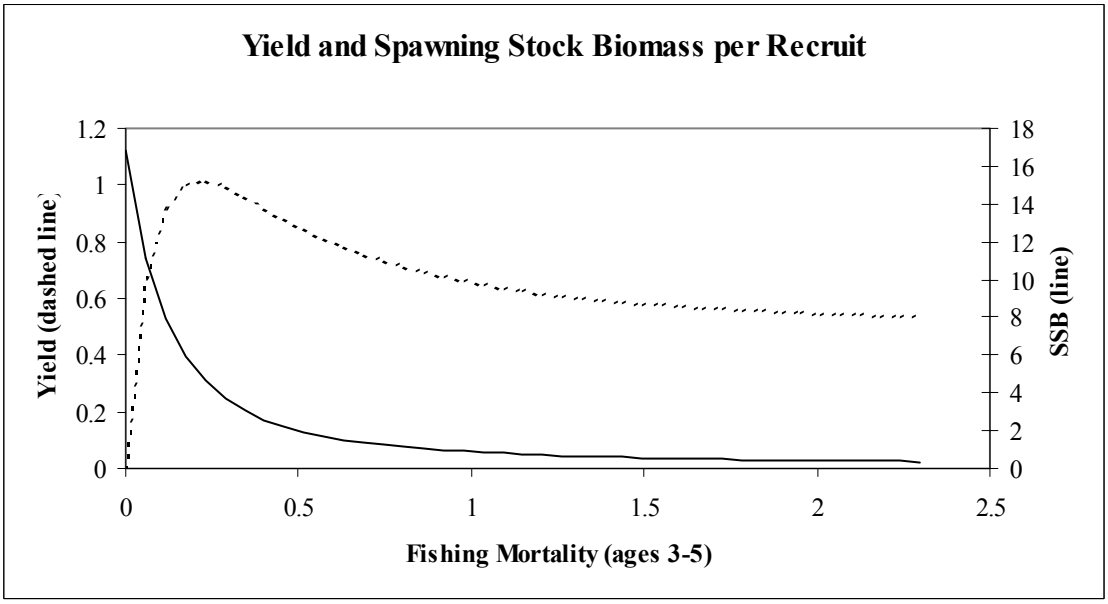


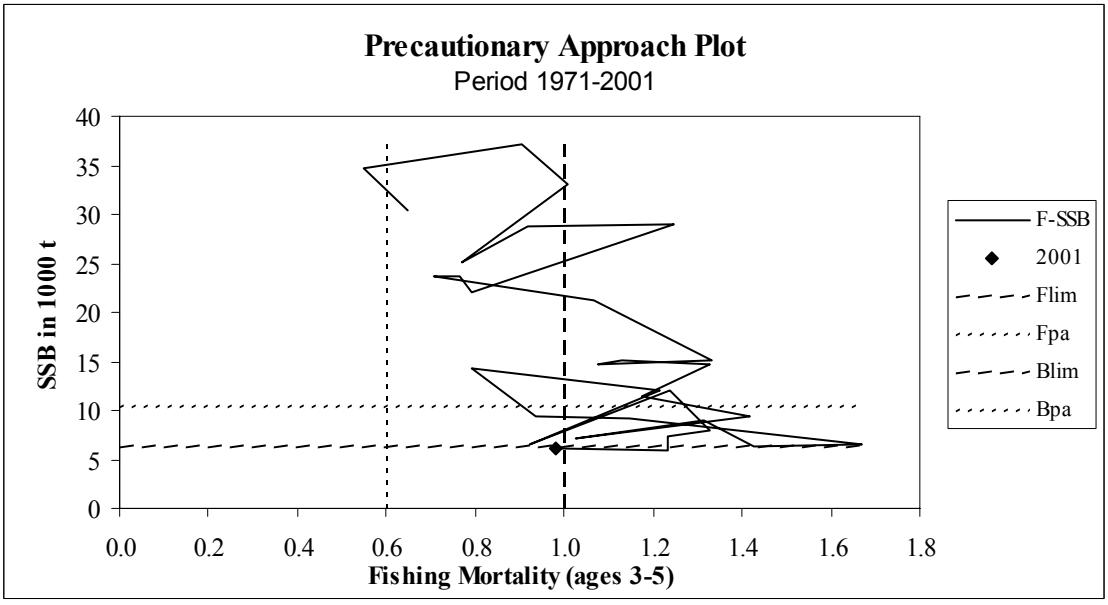







Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-5)


Precautionary Approach Plot
Period 1971-2001
SSB in 1000 t
Fishing Mortality (ages 3-5)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Cod in Kattegat. Medium-term projections of yield, SSB, and recruitment, under the assumption of *status quo* fishing mortality (F =1.15, Fmult =1, top) and precautionary approach fishing mortality (F_{pa} = 0.6, Fmult = 0.52, bottom).

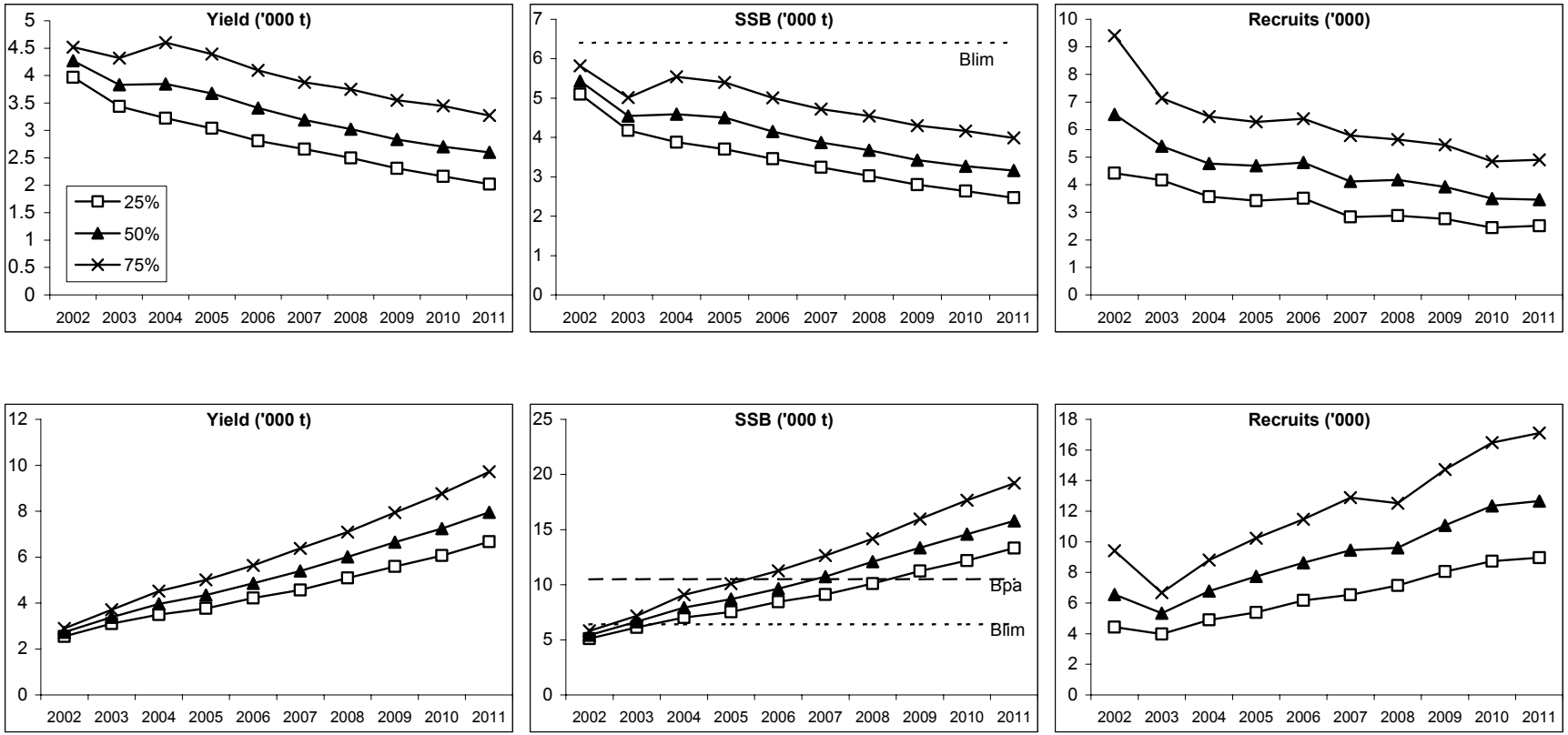


Table 3.4.2.1 Cod landings (in tonnes) from the Kattegat 1971–2001.

Year	Kattegat			Total
	Denmark	Sweden	Gemany[2]	
1971	11,748	3,962	22	15,732
1972	13,451	3,957	34	17,442
1973	14,913	3,850	74	18,837
1974	17,043	4,717	120	21,880
1975	11,749	3,642	94	15,485
1976	12,986	3,242	47	16,725
1977	16,668	3,400	51	20,119
1978	10,293	2,893	204	13,390
1979	11,045	3,763	22	14,830
1980	9,265	4,206	38	13,509
1981	10,693	4,380	284	15,337
1982	9,320	3,087	58	12,465
1983	9,149	3,625	54	12,828
1984	7,590	4,091	205	11,886
1985	9,052	3,640	14	12,706
1986	6,930	2,054	112	9,096
1987	9,396	2,006	89	11,491
1988	4,054	1,359	114	5,527
1989	7,056	1,483	51	8,590
1990	4,715	1,186	35	5,936
1991	4,664	2,006	104	6,834
1992	3,406	2,771	94	6,271
1993	4,464	2,549	157	7,170
1994	3,968	2,836	98	7,802[3]
1995	3,789	2,704	71	8,164[4]
1996	4,028	2,334	64	6,126[5]
1997	6,099	3,303	58	9,460[6]
1998	4,207	2,509	38	6,835
1999	4,029	2,540	39	6,608
2000	3,285	1,568	45	4,897
2001[1]	2,752	1,191	16	3,960

[1]Preliminary.
[2]Landings statistics incompletely split on the Kattegat and Skagerrak.
The figures are estimated by the Working Group members.
[3]Including 900 t reported in Skagerrak.
[4]Including 1,600 t misreported by area.
[5]Excluding 300 t taken in Subdivisions 22–24.
[6]Including 1,700t reported in Subdivision 23.

Table 3.4.2.2 Cod in the Kattegat (part of Division IIIa)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-5
1971	37666	30315	15732	0.6485
1972	23121	34759	17442	0.5482
1973	15763	37176	18837	0.9064
1974	30669	33004	21880	1.0102
1975	26298	25130	15485	0.7677
1976	11215	28733	16275	0.9201
1977	29942	29050	20119	1.2447
1978	23823	21975	13390	0.7932
1979	11042	23750	14830	0.7632
1980	14654	23703	13509	0.7080
1981	17416	21128	15337	1.0660
1982	20913	15111	12465	1.3304
1983	20948	14633	12828	1.0748
1984	11524	15065	11886	1.1303
1985	8906	14648	12706	1.3276
1986	18215	11440	9096	1.1734
1987	5782	9340	11491	1.4183
1988	7904	7166	5527	1.0257
1989	3411	8885	8590	1.3135
1990	15381	6424	5936	1.4268
1991	7648	6520	6834	1.6714
1992	13489	9269	6271	1.1460
1993	7727	9478	7013	0.9357
1994	8856	14259	7802	0.7903
1995	17416	12131	8165	1.2166
1996	4251	6441	6126	0.9214
1997	11667	12074	9461	1.2390
1998	8529	7963	6835	1.3256
1999	7727	7296	6608	1.2310
2000	4670	5960	4897	1.2338
2001	4853	6157	3960	0.9813
2002	6316	5400		
Average	14328	16084	11204	1.0738

3.4.3 Whiting in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the available information it was not possible to assess the state of the stock or identify safe biological limits. It is likely that this stock is linked to the North Sea stock for which the assessment is very uncertain, but which is likely to be outside safe biological limits.

Management objectives: There are no specific management objectives for this stock.

Advice on management: ICES recommends that the landings in 2003 be less than 1 500 t as a precautionary value to restrict the potential for re-expansion of the fishery and misreporting from other regions.

Elaboration and special comment: The major part of the catch is taken as a by-catch in small-mesh fisheries. Total landings in 2001 are not available yet, but are likely to be amongst the lowest observed. The landings value advised for 2003 is consistent with ICES advice provided in 2001, and is based on the average of the catch during 1996-1998.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Catch data (Table 3.4.3.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch[1]
1987	Precautionary TAC	-	17.0	16.7
1988	Precautionary TAC	-	17.0	11.8
1989	Precautionary TAC	-	17.0	13.3
1990	Precautionary TAC	-	17.0	19.4
1991	TAC	-	17.0	14.0
1992	No advice	-	17.0	12.3
1993	Precautionary TAC	-	17.0	4.6
1994	If required, precautionary TAC	-	17.0	6.0
1995	If required, precautionary TAC	-	15.2	9.6
1996	If required, precautionary TAC	-	15.2	2.9
1997	If required, TAC equal to recent catches.	-	15.2	0.7
1998	No advice		15.2	1.0
1999	TAC, average period 1993–1996	6.0	8.0	1.3
2000	TAC, average period 1996–1998	1.5	4.0	0.6
2001	TAC, average period 1996-1998	1.5	2.5	n/a
2002	TAC, average period 1996-1998	1.5	2.0	
2003	TAC, average period 1996-1998	1.5		

[1]Includes by-catch in small-mesh industrial fishery. Weights in '000 t.

Whiting in Division IIIa (Skagerrak - Kattegat)

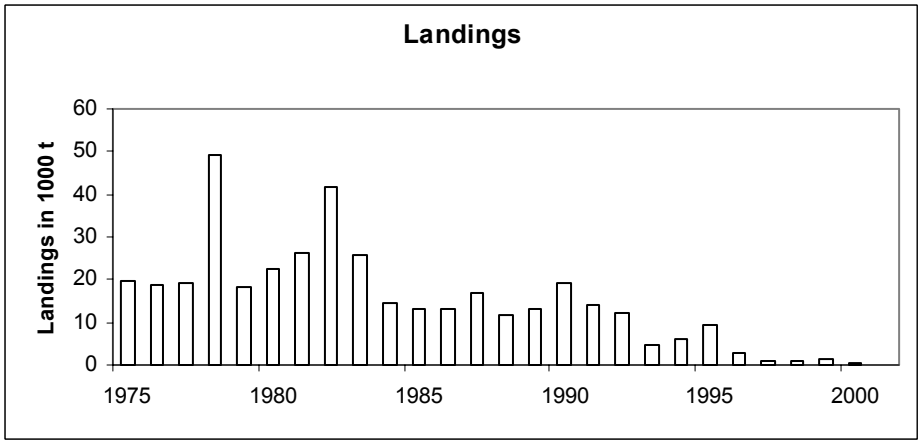


Table 3.4.3.1 Nominal landings (t) of Whiting from Division IIIa as supplied by the Study Group on Division IIIa Demersal Stocks (ICES 1992b) and updated by the Working Group.

Year	Denmark			Norway	Sweden	Others	Total
1975		19,018		57	611	4	19,690
1976		17,870		48	1,002	48	18,968
1977		18,116		46	975	41	19,178
1978		48,102		58	899	32	49,091
1979		16,971		63	1,033	16	18,083
1980		21,070		65	1,516	3	22,654
	Total consumption	Total industrial	Total				
1981	1,027	23,915	24,942	70	1,054	7	26,073
1982	1,183	39,758	40,941	40	670	13	41,664
1983	1,311	23,505	24,816	48	1,061	8	25,933
1984	1,036	12,102	13,138	51	1,168	60	14,417
1985	557	11,967	12,524	45	654	2	13,225
1986	484	11,979	12,463	64	477	1	13,005
1987	443	15,880	16,323	29	262	43	16,657
1988	391	10,872	11,263	42	435	24	11,764
1989	917	11,662	12,579	29	675	-	13,283
1990	1,016	17,829	18,845	49	456	73	19,423
1991	871	12,463	13,334	56	527	97	14,041
1992	555	10,675	11,230	66	959	1	12,256
1993	261	3,581	3,842	42	756	1	4,641
1994	174	5,391	5,565	21	440	1	6,027
1995	85	9,029	9,114	24	431	1	9,570
1996	55	2,668	2,723	21	182	-	2,926
1997	38	568	606	18	94	-	718
1998	35	847	882	16	81	-	979
1999	37	1,199	1,236	15	111	-	1,362
2000	59	386	445	17*	138	1	622
2001*	61	n/a	n/a	27	29	+	n/a

*Preliminary: Norway 1997-1999.

3.4.4 Plaice in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: The stock is harvested outside safe biological limits. The estimated SSB in 2002 is well above $\mathbf{B}_{pa}$, but fishing mortality is above $\mathbf{F}_{pa}$. Recruitment of year classes 1998 and 1999 are the highest in the time-series and this has resulted in a high estimate of recent SSB.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ cannot be accurately defined.	$\mathbf{B}_{pa}$ = 24 000 t.
$\mathbf{F}_{lim}$ cannot be accurately defined.	$\mathbf{F}_{pa}$ = 0.73.

Technical basis:

	$\mathbf{B}_{pa}$ = smoothed $\mathbf{B}_{loss}$ (no sign of impairment).
	$\mathbf{F}_{pa} = \mathbf{F}_{med}$.

Advice on management: ICES recommends a reduction in fishing mortality to less than $\mathbf{F}_{pa}$ (0.73), corresponding to landings in 2003 of less than 18 400 t. This implies a reduction in fishing mortality of at least 15%. Management of fisheries taking plaice must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: Plaice is taken both in a directed fishery and as an important by-catch in a mixed cod-plaice fishery. The North Sea Cod stock area includes the Skagerrak (Division IIIaN). Also, the Kattegat cod is in a precarious state (Division IIIaS). The plaice fisheries take cod as by-catch. The by-catch and discard limits advised for cod and other management measures that may be implemented to promote the recovery of cod need to be respected in the prosecution of the mixed plaice-cod fisheries. By-catch or discards should be quantified.

There is no long-term gain in yield for fishing mortalities above 0.22.

Catch forecast for 2003:

Basis: $\mathbf{F}_{sq}$ = F(99-01) scaled to F(01)=0.86; Landings (2002) =14.2 ; SSB(2003)=73.4.

F (2003)	Basis	Landings (2003)	SSB (2004)
0	0.0*$\mathbf{F}_{sq}$	0.0	82.8
0.09	0.1*$\mathbf{F}_{sq}$	2.7	80.0
0.17	0.2*$\mathbf{F}_{sq}$	5.2	77.4
0.26	0.3*$\mathbf{F}_{sq}$	7.6	74.9
0.34	0.4*$\mathbf{F}_{sq}$	9.8	72.6
0.43	0.5*$\mathbf{F}_{sq}$	11.9	70.4
0.52	0.6*$\mathbf{F}_{sq}$	13.9	68.4
0.60	0.7*$\mathbf{F}_{sq}$	15.7	66.4
0.69	0.8*$\mathbf{F}_{sq}$	17.5	64.6
0.73	$\mathbf{F}_{pa}$=0.85*$\mathbf{F}_{sq}$	18.4	63.7
0.78	0.9*$\mathbf{F}_{sq}$	19.2	62.9
0.86	$\mathbf{F}_{sq}$	20.8	61.3
0.95	1.1*$\mathbf{F}_{sq}$	22.3	59.7
1.03	1.2*$\mathbf{F}_{sq}$	23.8	58.3

Weights in '000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium-term projections have been carried out.

Comparison with previous assessment and advice: The assessment undertaken this year has a very different configuration compared to last year. Due to the addition of three new survey series and the inclusion of the 2001 data, SSB in 2001 is estimated to be 78% higher than last year and fishing mortality in 2000 is estimated 58% higher.

The advice for plaice in IIIa has been revised in May 2002 following a re-evaluation of the available data. The current advice is consistent with the advice provided in May 2002.

Elaboration and special comment: The estimates of fishing mortality and proposed $\mathbf{F}_{pa}$ for plaice in Division IIIa are substantially higher than the corresponding estimates for plaice in the North Sea (Subarea IV). ACFM has previously speculated about the reasons for this difference, but there are no clear explanations. Reference points based on the estimated F will still be appropriate to use with this stock, but the values are not comparable to reference points for other plaice stocks.

The major plaice catches are taken in fisheries using Danish seine, trawl, and gillnet, targeting mixed species for human consumption including cod. The fishery is more directed at older fish than for most other plaice fisheries; however, due to the arrival of the strong 1998 and 1999 year classes, the catches of 2- and 3-year-old plaice was higher in 2001.

The analytical assessment uses information from three Danish commercial fleets and four survey series.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

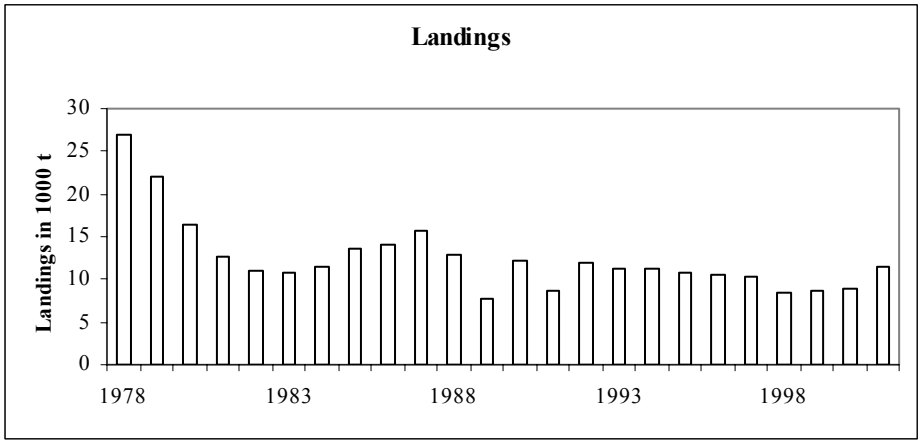
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.854	0.219	0.767
$\mathbf{F}_{max}$	0.221	0.242	1.583
$\mathbf{F}_{0.1}$	0.105	0.220	2.533
$\mathbf{F}_{med}$	1.162	0.218	0.693

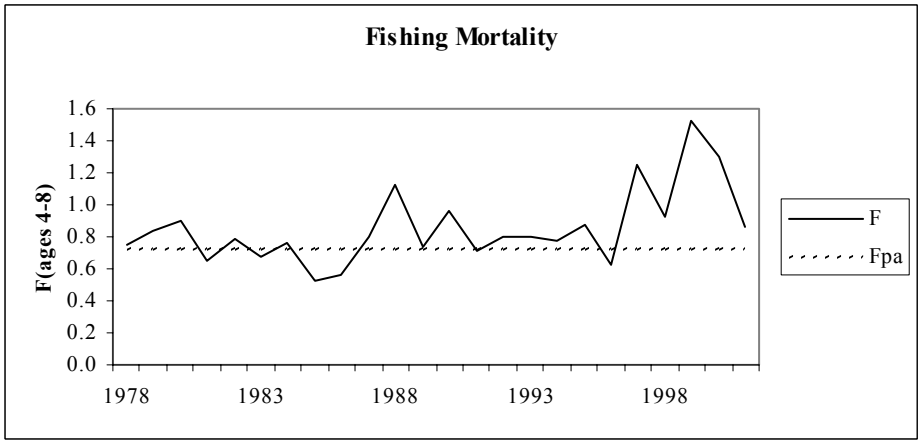
Catch data (Tables 3.4.4.1-2):

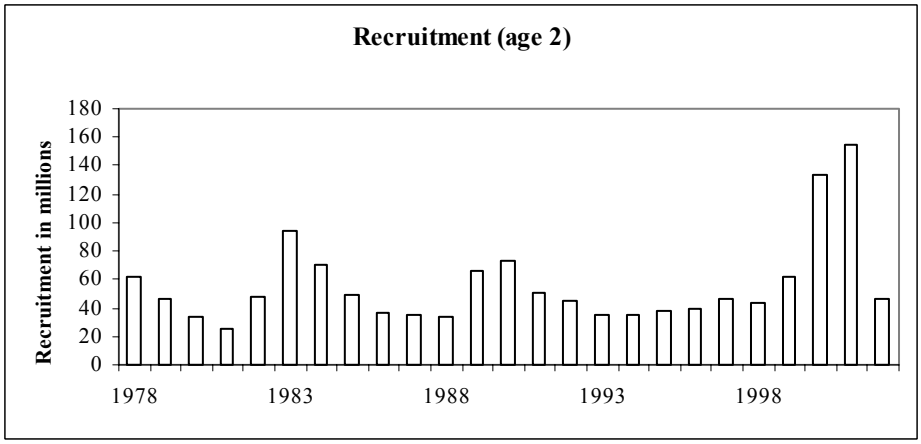
Year	ICES Advice	Predicted landings corresp. to advice[1]		Agreed TAC:		ACFM Landings
		Kattegat	Skagerrak	Kattegat	Skagerrak	
1987	Precautionary TAC	-	-	4.75	14.5	15.7
1988	No increase in F[3] ; precautionary TAC[4]	3.7	-	4.75	15.0	12.9
1989	No increase in F[3] ; precautionary TAC[4]	2.9	-	4.0	15.0	7.7
1990	80% of F(88)[3]; TAC[3]; TAC[4]	1.3	10.0	2.0	11.0	12.1
1991	TAC	1.1[2]	10.0[2]	1.3	10.0	8.7
1992	TAC	14.0		2.8	11.2	11.9
1993	Precautionary TAC	-		2.8	11.2	11.3
1994	If required, precautionary TAC	-		2.8	11.2	11.3
1995	If required, precautionary TAC	-		2.8	11.2	10.8
1996	If required, precautionary TAC	-		2.8	11.2	10.5
1997	No advice	-		2.8	11.2	10.1
1998	No increase in F from the present level	11.9		2.8	11.2	8.4
1999	No increase in F from the present level	11.0		2.8	11.2	8.5
2000	$F < \mathbf{F}_{pa}$	11.8		2.8	11.2	8.8
2001	$F < \mathbf{F}_{pa}$	9.4		2.35	9.4	11.7
2002	$F < \mathbf{F}_{pa}$	8.5[5]		1.6	6.4	
2003	$F < \mathbf{F}_{pa}$	18.4				

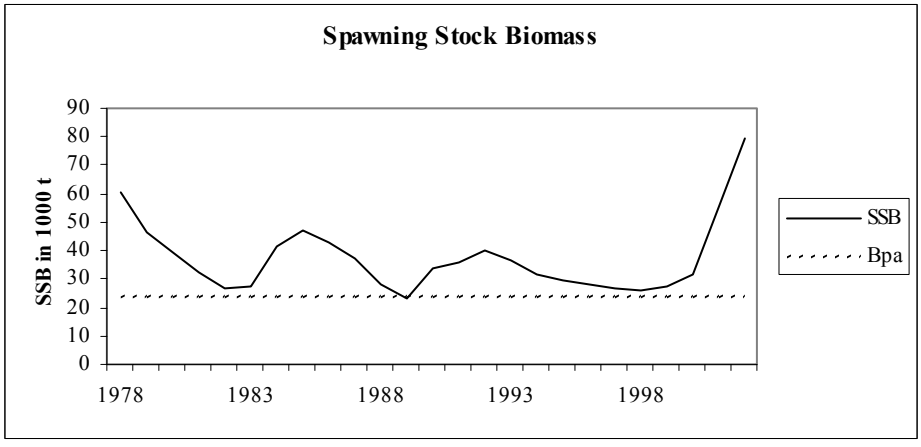
[1]From 1992 onwards predicted landings are for Kattegat and Skagerrak combined. [2]In May l991 ACFM revised its advice to 12.0 for both areas combined. [3]Kattegat. [4]Skagerrak. [5]In March 2002 ACFM revised its advice to 12.0 for both areas combined. Weights in '000 t.

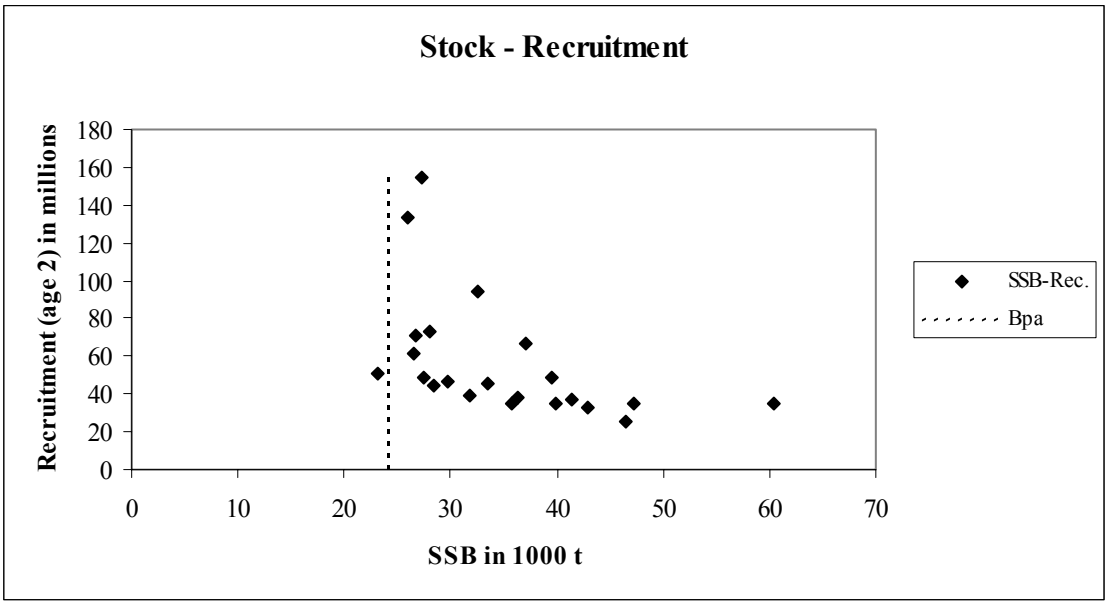
Plaice in Division IIIa (Skagerrak - Kattegat)

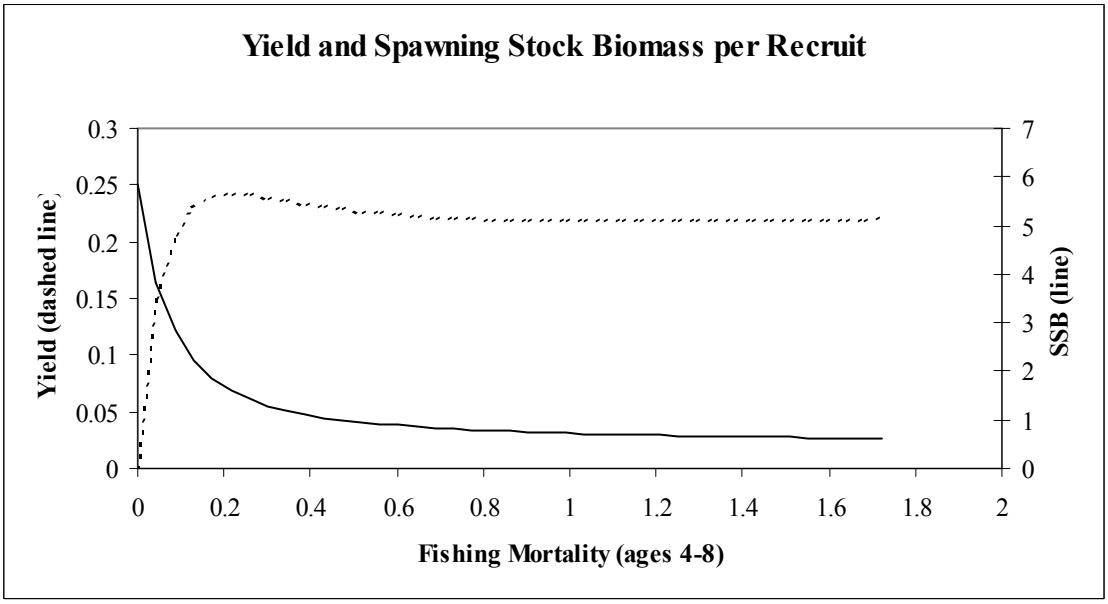









Stock - Recruitment
Recruitment (age 2) in millions
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Fishing Mortality (ages 4-8)

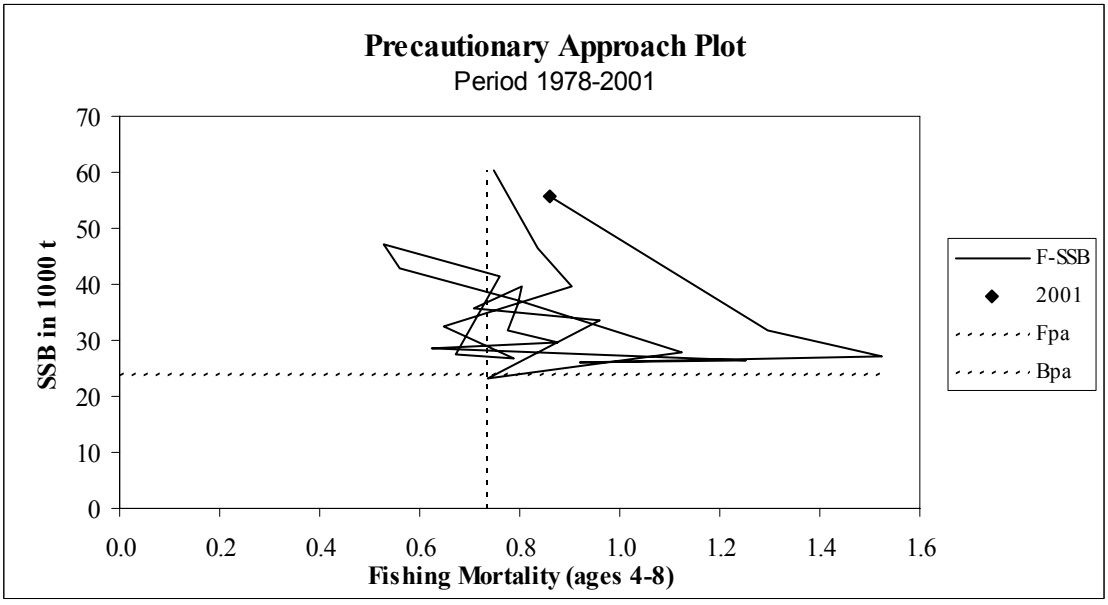

Precautionary Approach Plot
Period 1978-2001
SSB in 1000 t
70
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Fishing Mortality (ages 4-8)
F-SSB
2001
Fpa
Bpa

Table 3.4.4.1 Plaice landings (t) from Division IIIa (Kattegat and Skagerrak) as officially reported to ICES.

Year	Denmark		Sweden		Germany		Belgium	Norway	Total WG		
	Kattegat	Skagerrak	Kattegat	Skagerrak	Kattegat	Skagerrak	Skagerrak	Skagerrak	Kattegat	Skagerrak	Div. IIIa
1972	15,504	5,095	348	70	77			3	15,929	5,168	21,097
1973	10,021	3,871	231	80	48			6	10,300	3,957	14,257
1974	11,401	3,429	255	70	52			5	11,708	3,504	15,212
1975	10,158	4,888	296	77	39			6	10,493	4,971	15,464
1976	9,487	9,251	177	51	32		717	6	9,696	10,025	19,721
1977	11,611	12,855	300	142	32		846	6	11,943	13,849	25,792
1978	12,685	13,383	312	94	100		371	9	13,097	13,857	26,953
1979	9,721	11,045	333	67	38		763	9	10,092	11,884	21,976
1980	5,582	9,514	313	71	40		914	11	5,935	10,510	16,445
1981	3,803	8,115	256	110	42		263	13	4,101	8,501	12,602
1982	2,717	7,789	238	146	19		127	11	2,974	8,073	11,047
1983	3,280	6,828	334	155	36		133	14	3,650	7,130	10,780
1984	3,252	7,560	388	311	31		27	22	3,671	7,920	11,591
1985	2,979	9,646	403	296	4		136	18	3,386	10,096	13,482
1986	2,470	10,645	202	202	2		505	26	2,674	11,378	14,052
1987	2,846	11,327	307	241	3		907	27	3,156	12,502	15,658
1988	1,820	9,782	210	281	0		716	41	2,030	10,820	12,850
1989	1,609	5,414	135	320	0		230	33	1,744	5,997	7,741
1990	1,830	8,729	202	779	2		471	69	2,034	10,048	12,082
1991	1,737	5,809	265	472	19	15	315	68	2,021	6,679	8,700
1992	2,068	8,514	208	381	101	16	537	106	2,377	9,554	11,931
1993	1,294	9,125	175	287	0	37	326	79	1,469	9,854	11,323
1994	1,547	8,783	227	315	0	37	325	91	1,774	9,551	11,325
1995	1,254	8,468	133	337	0	48	302	224	1,387	9,379	10,766
1996	2,337	7,304	205	260	0	11		428	2,542	8,003	10,545
1997	2,198	7,306	255	244	25	14		93	2,478	7,657	10,135
1998	1,786	6,132	185	208	10	11		59	1,981	6,410	8,391
1999	1,510	6,473	161	233	20	7		66	1,691	6,779	8,470
2000	1,644	6,680	184	230	10	5		67	1,838	6,982	8,820
2001	2,069	9,045	260	125	1	0		61	2,329	9,231	11,560

Table 3.4.4.2 Plaice in Division IIIa (Skagerrak and Kattegat)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1978	61661	60329	26953	0.7460
1979	45790	46558	21976	0.8345
1980	34422	39476	16445	0.9044
1981	25729	32575	12602	0.6497
1982	48503	26713	11047	0.7881
1983	94318	27546	10780	0.6724
1984	70514	41491	11591	0.7597
1985	48961	47144	13482	0.5297
1986	37159	42885	14052	0.5586
1987	34607	36996	15658	0.7948
1988	33106	27981	12850	1.1222
1989	66183	23198	7741	0.7379
1990	73274	33576	12082	0.9587
1991	50795	35692	8700	0.7084
1992	45377	39819	11931	0.8022
1993	35303	36301	11323	0.7953
1994	35043	31792	11325	0.7749
1995	38061	29728	10766	0.8740
1996	39649	28453	10545	0.6249
1997	46387	26533	10291	1.2523
1998	44003	26021	8430	0.9207
1999	61863	27248	8740	1.5235
2000	133086	31899	8820	1.2960
2001	154847	55745	11560	0.8617
2002	46318	79256		
Average	56198	37398	12487	0.8538

3.4.5 Sole in Division IIIa

State of the stock/exploitation: The stock is harvested outside safe biological limits. Fishing mortality in 2001 was above $\mathbf{F}_{pa}$ and landings decreased by 27% in 2001 compared to 2000. Spawning biomass (1180 t) is estimated to be slightly above $\mathbf{B}_{pa}$. The stock size was exceptionally high in the period 1992–1996 due to strong recruitment in the period 1989–1993. Recruitment has mostly been well below average since 1994.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the proposed precautionary criteria, F should be less than the proposed $\mathbf{F}_{pa}$ and spawning stock biomass should be maintained above the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 770 t	$\mathbf{B}_{pa}$ be set at 1 060 t
$\mathbf{F}_{lim}$ is 0.47	$\mathbf{F}_{pa}$ be set at 0.30

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{pa}$*exp(-1.645*0.2)	$\mathbf{B}_{pa}$: MBAL
$\mathbf{F}_{lim}$: $\mathbf{F}_{med}$ 98 excluding the abnormal years around 1990	$\mathbf{F}_{pa}$: consistent with $\mathbf{F}_{lim}$

Advice on management: ICES recommends that current fishing mortality should be reduced to below $\mathbf{F}_{pa,}$ corresponding to landings in 2003 of less than 275 t.

Relevant factors to be considered in management: This stock supported catches at 250–450 t for 35 years, prior to the occurrence of strong recruitments in the period of 1989 to 1993. These recruitments led to large increases in SSB and yield. Since 1994, recruitment has returned to the earlier low values.

Regardless of short-term management measures, biomass and yield will decline over the next few years under the lower recruitment regime. Recruitments appear to have periods of generally high or low year classes that are not closely tied to the size of the spawning biomass. This suggests that environmental factors might be important for recruitment and therefore contribute uncertainty to medium-term projections and biological reference points.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$= F(2001) = 0.46; Landings (2002) = 430; SSB(2003)= 1092.

F (2003)	Basis	Landings (2003)	SSB (2004)
0.09	$0.2\mathbf{F}_{sq}$	92	1390
0.19	$0.4\mathbf{F}_{sq}$	178	1298
0.28	$0.6\mathbf{F}_{sq}$	257	1213
0.30	$0.65\mathbf{F}_{sq}$ **(=$\mathbf{F}_{pa}$)**	275	1193
0.37	$0.8\mathbf{F}_{sq}$	330	1135
0.46	$\mathbf{F}_{sq}$	397	1062

Weights in t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment indicates a lower SSB in 2001 (37%) and higher fishing mortality (48%) for year 2000 than last year's assessment. Part of this change is due to data problems connected to a recent change in spatial distribution of catches. This has led to problems in sampling coverage. There has been a tendency of the assessment in recent years to over-estimate SSB and under-estimate F.

Elaboration and special comment: The analytical assessment is based on landings data and commercial CPUE series. The assessment is considered very uncertain. Maturity is not measured but assumed, no age readings are available from Skagerrak for 2001 and catchability has decreased for all age groups in the two commercial tuning series. Official catch statistics are considered unreliable for the early 1990s, but are thought to be fairly accurate since 1994.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15–24 April 2002 (ICES CM 2002/ACFM:17).

Yield and spawning biomass per Recruit
F-reference points:

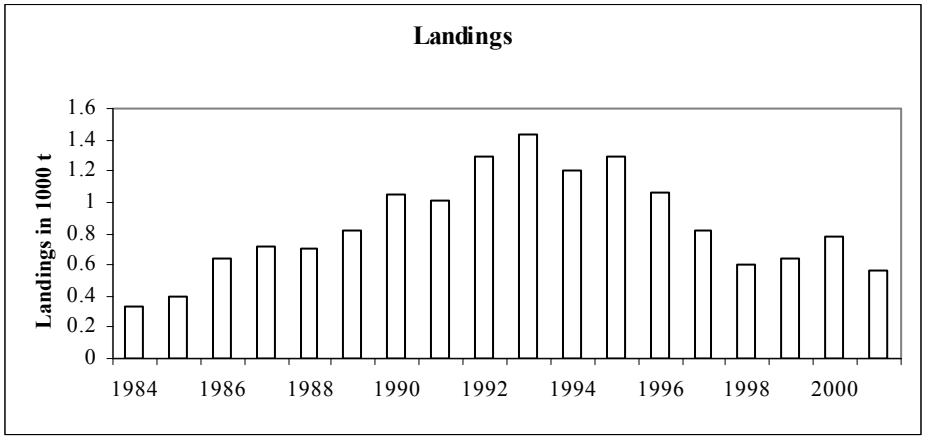
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average current	0.46		
$\mathbf{F}_{max}$	0.59	0.21	0.46
$\mathbf{F}_{0.1}$	0.21	0.18	1.1
$\mathbf{F}_{med}$	0.34	0.20	0.72

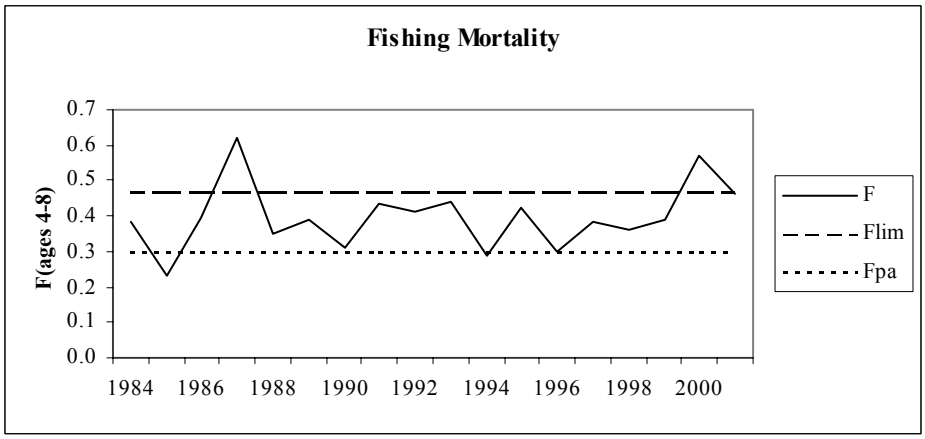
Catch data (Tables 3.4.5.1–2):

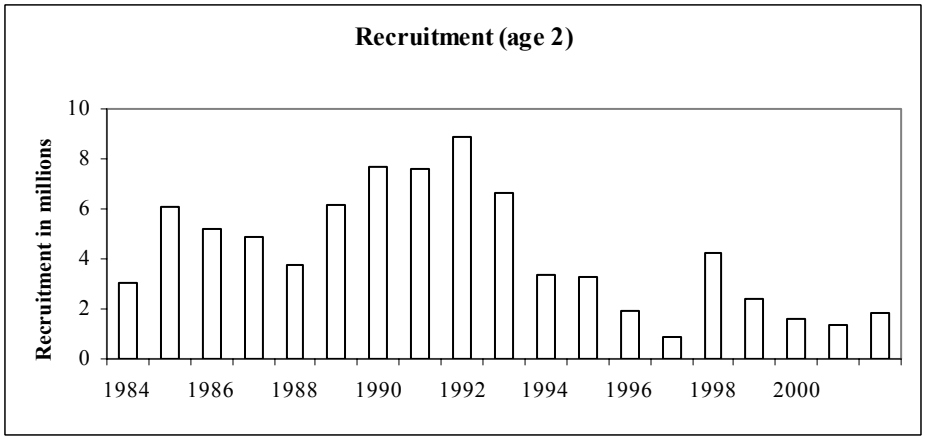
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	-	-	0.85	0.72
1988	-	-	0.95	0.71
1989	TAC	<0.8	0.80	0.82
1990	Precautionary TAC	0.6	0.50	1.05
1991	TAC	1.0	1.00	-[1]
1992	TAC	1.0	1.40	-[1]
1993	TAC at recent catch levels	1.0	1.60	-[1]
1994	No advice due to uncertain catches	-	2.10	1.20
1995	No advice	-	2.25	1.30
1996	No advice	-	2.25	1.10
1997	No advice	-	2.25	0.81
1998	No advice	-	1.80	0.61
1999	No increase in F	0.8	1.35	0.64
2000	No increase in F	0.65	0.95	0.76
2001	No increase in F	0.7	0.70	0.56
2002	F below $\mathbf{F}_{pa}$	0.5	0.50	
2003	F below $\mathbf{F}_{pa}$	0.3		

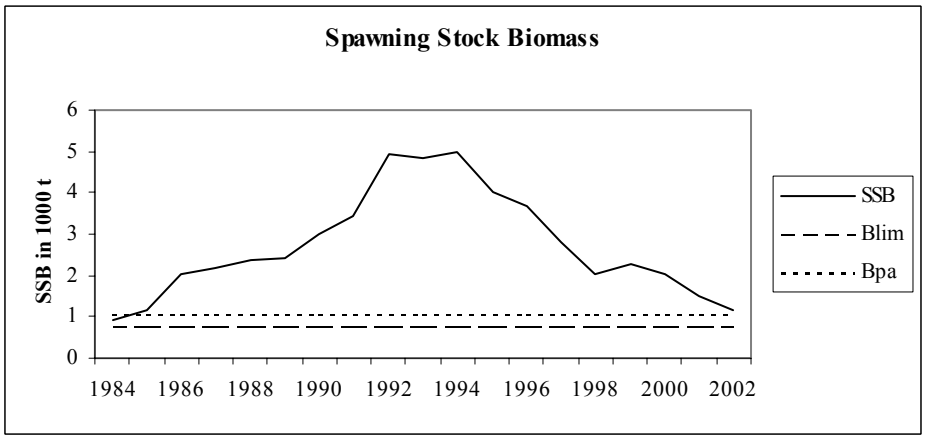
[1]Uncertain. Weights in '000 t.

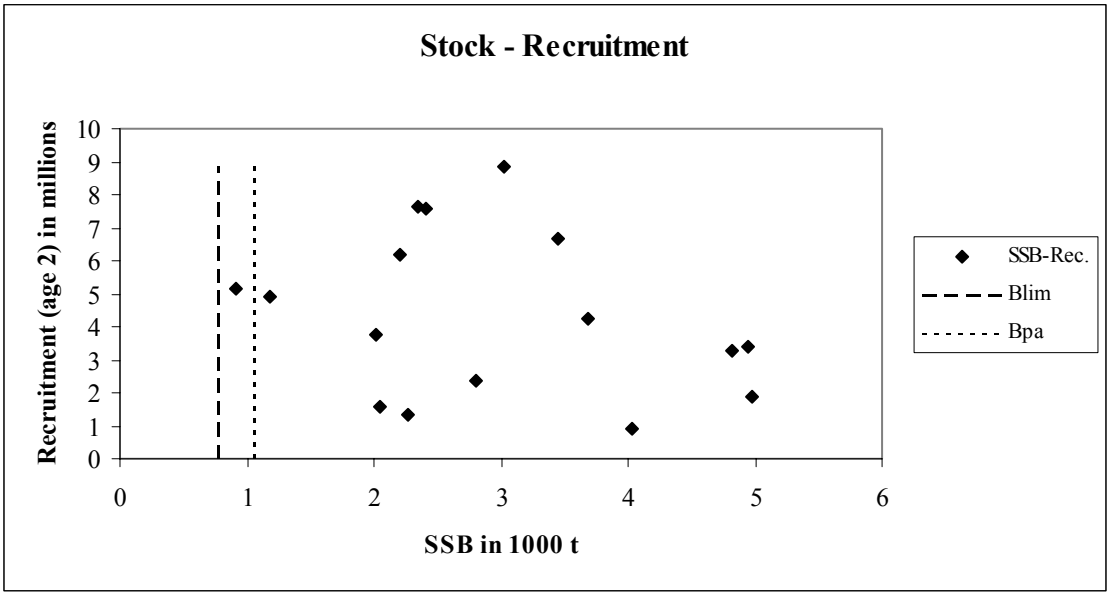
Sole in Division IIIa

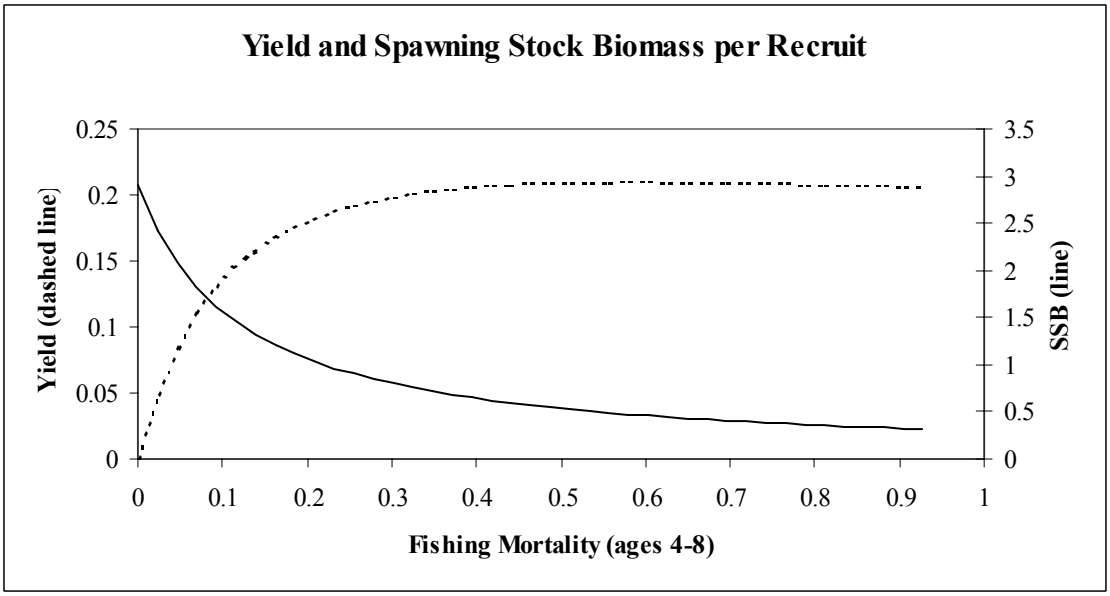









Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

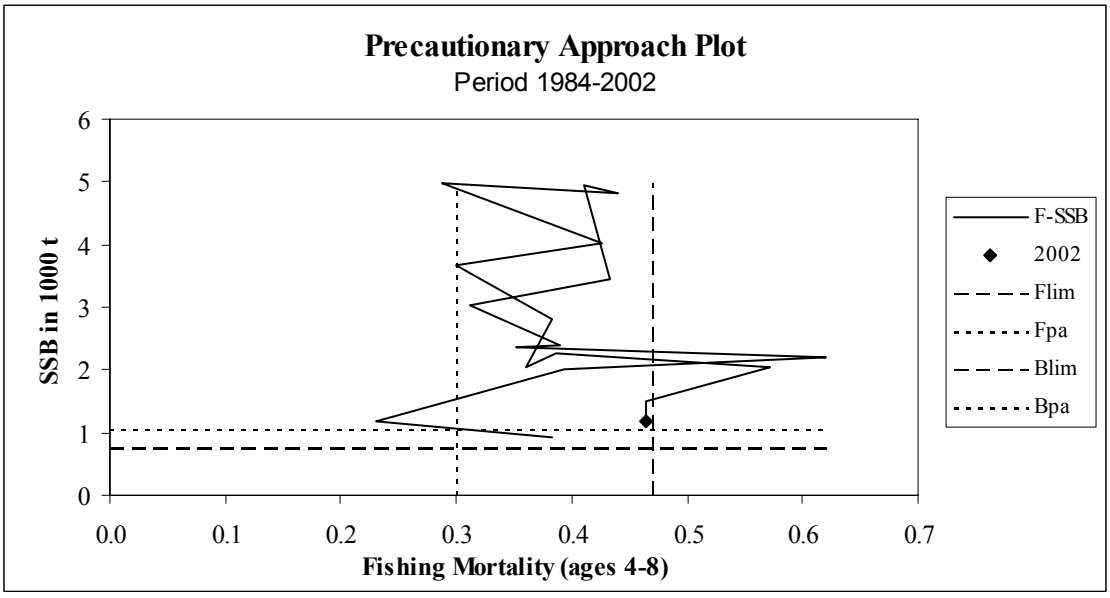

Precautionary Approach Plot
Period 1984-2002
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.4.5.1 Catches of sole in Division IIIa. Kattegat and Skagerrak Sole landings (tonnes) 1952–2001. Official statistics and Working Group corrections. Danish catches are given for Kattegat and Skagerrak combined 1952–1969. For Sweden there is no information 1962–1974.

Year	Denmark		Sweden	Germany	Belgium	Netherlands	Working Group	Total
	Kattegat	Skagerrak	Skag+Kat	Kat+Skag	Skagerrak	Skagerrak	Corrections	
1952	156		51	59				266
1953	159		48	42				249
1954	177		43	34				254
1955	152		36	35				223
1956	168		30	57				255
1957	265		29	53				347
1958	226		35	56				317
1959	222		30	44				296
1960	294		24	83				401
1961	339		30	61				430
1962	356			58				414
1963	338			27				365
1964	376			45				421
1965	324			50				374
1966	312			20				332
1967	429			26				455
1968	290			16				306
1969	261			7				268
1970	158	25						183
1971	242	32		9				283
1972	327	31		12				370
1973	260	52		13				325
1974	388	39		9				436
1975	381	55	16	16		9	-9	468
1976	367	34	11	21	2	155	-155	435
1977	400	91	13	8	1	276	-276	513
1978	336	141	9	9		141	-141	495
1979	301	57	8	6	1	84	-84	373
1980	228	73	9	12	2	5	-5	324
1981	199	59	7	16	1			282
1982	147	52	4	8	1	1	-1	212
1983	180	70	11	15		31	-31	276
1984	235	76	13	13		54	-54	337
1985	275	102	19	1	+	132	-132	397
1986	456	158	26	1	2	109	-109	643
1987	564	137	19		2	70	-70	722
1988	540	138	24		4			706
1989	578	217	21	7	1			824
1990	464	128	29	-	2		+427	1050
1991	746	216	38	+			+11	1011*
1992	856	372	54				+12	1294*
1993	1016	355	68	9			-9	1439*
1994	890	296	12	4			-4	1198
1995	850	382	65	6			-6	1297
1996	784	203	57	612			-597	1059
1997	560	200	52	2				814
1998	367	145	90	3				605
1999	431	158	45	3				637
2000	399	320	34	11				764
2001[1]	249	286	25					560

*Considerable non-reporting assumed for the period 1991–1993.

Table 3.4.5.2 Sole in Division IIIa

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1984	3061	919	337	0.3826
1985	6094	1177	397	0.2307
1986	5165	2021	643	0.3925
1987	4879	2199	722	0.6197
1988	3743	2350	706	0.3509
1989	6167	2407	824	0.3899
1990	7664	3016	1050	0.3113
1991	7591	3452	1011	0.4335
1992	8863	4945	1294	0.4112
1993	6655	4824	1439	0.4393
1994	3385	4974	1198	0.2868
1995	3266	4026	1297	0.4256
1996	1898	3678	1059	0.2997
1997	906	2805	814	0.3821
1998	4218	2050	605	0.3598
1999	2365	2260	638	0.3868
2000	1566	2043	764	0.5712
2001	1352	1492	560	0.4639
2002	1805	1180		0.4639
Average	4244	2727	854	0.4001

3.4.6 *Pandalus borealis* in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps)

State of the stock/exploitation: The state of the stock is not known, relative to precautionary reference points. Stock size is estimated to have increased since the beginning of the 1990s and is above the long-term average since 1995. Fishing effort has declined since 1993 and is currently estimated to be at the lowest observed level. Predator abundance has declined over the last 3 years. Recruitment of the year class 2000 (in 2002) is above average.

Management objectives: There are no explicit management objectives for this stock.

Advice on management: ICES recommends that landings in 2003 should not exceed 14 750 t, based on an estimated increase in stock size of around 20% from 2002 to 2003 and corresponding to the current level of exploitation.

Relevant factors to be considered in management: The perception of the state of the stock in 2002 is based on an assessment that takes predation into account. The assessment shows that predators remove annually about 60% of the stock biomass, while only about 10% is removed by fishing. The exploitable biomass comprises only few age groups (1-3) of which age group 2 and older constitute around 70% in weight of the total catch.

Sorting grids or other means of facilitating the escape of fish should be implemented in this fishery.

Catch forecast for 2003: Not available.

Comparison with previous assessment and advice: In previous years, analytical assessments (XSA) have been applied to assess this stock as a basis for catch forecasts. However, since the natural mortality of this species is most likely to be several times higher than the fishing mortality, cohort analysis methodology is not well suited for this species. The few age groups in the stock further add to uncertainty of the XSA estimates. ICES has investigated alternative assessment models. A stock production model (SPP) taking predation into account has been introduced. For the beginning of the time-series, the SPP model estimates the stock level to be similar to that estimated by XSA, while for the most recent years (since ≈1994) SPP estimates the stock to be at a higher level than estimated by XSA. This is in agreement with the survey results and the commercial LPUE data.

Elaboration and special comments: *Pandalus borealis* is fished by bottom trawls at 150–400 m depth throughout the year by Danish, Norwegian, and Swedish fleets.

Strong fluctuations in the *Pandalus* stocks are frequently observed. Predator pressure as well as the low number of age groups in the stock contributes significantly to such fluctuations. The natural mortality for *Pandalus* is likely to be substantially higher than the fishing mortality and fluctuates considerably according to the abundance of predators.

Because of the potentially large impact of predation on stock dynamics, the biological consequences of any specific fishing mortality rate can be highly variable. At low predator abundance, even a low fishing mortality (F) may be a high proportion of total mortality (Z), whereas at high predator abundance, a higher F may still be a small part of Z. It is not yet possible to identify appropriate precautionary fishing mortality reference points ($\mathbf{F}_{lim}$, $\mathbf{F}_{pa}$) for such circumstances, and reference points based on total mortality may be more sound biologically.

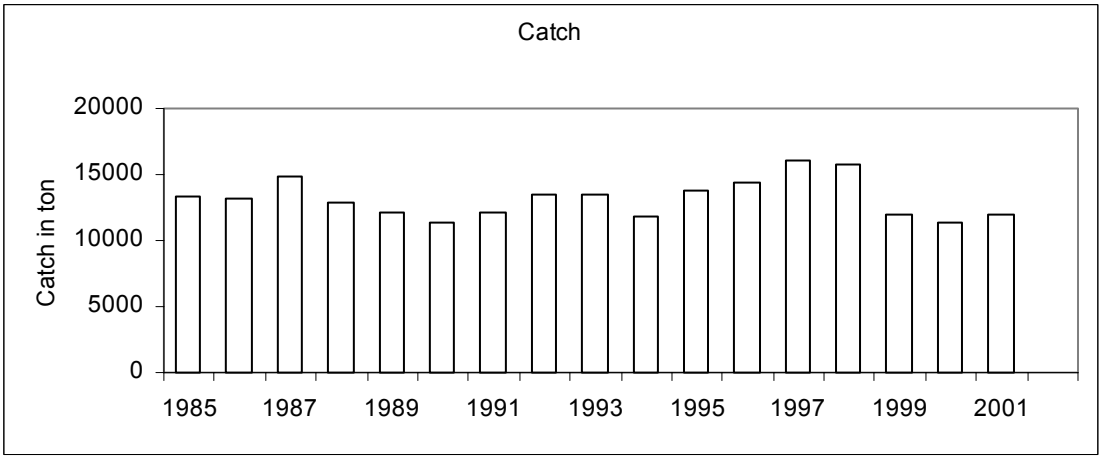
The assessment was based on commercial catches, survey indices of available biomass, recruitment, and amount of predators.

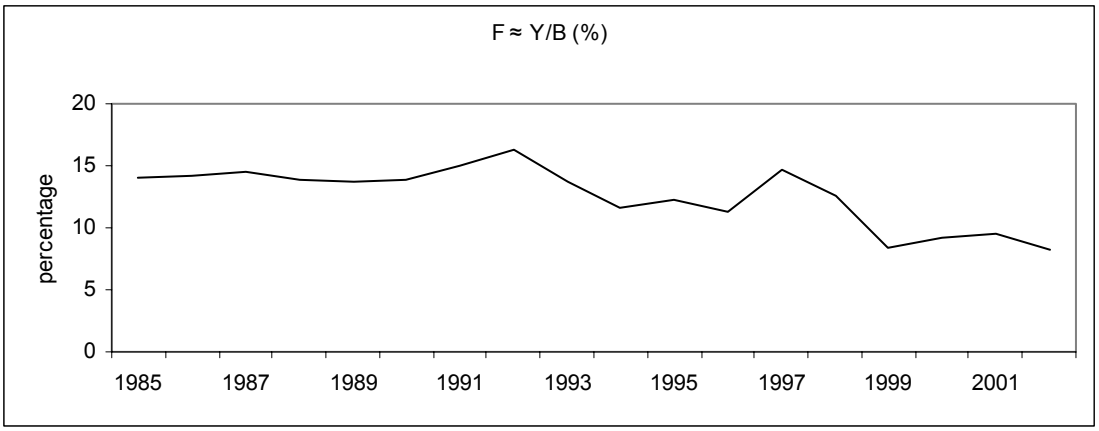
Source of information: Report of the *Pandalus* Assessment Working Group, Flødevigen, Norway, August 2002 (ICES CM 2003/ACFM:05).

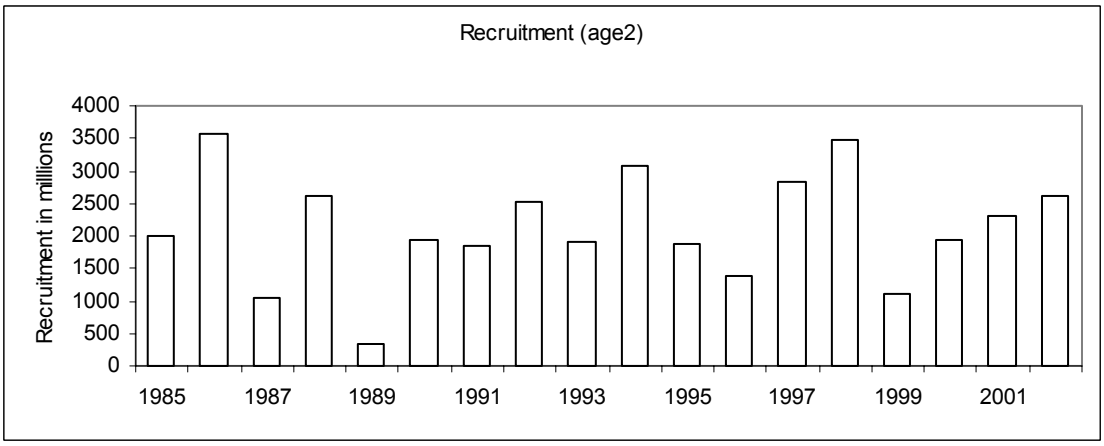
Catch data (Tables 3.4.6.1–2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC Skagerrak	Agreed TAC IIIa + IVaE	Dis-cards	ACFM landings	ACFM catch
1987	Not assessed				0.7	14.2	14.9
1988	Catches significantly below 1985–1986[3]				0.8	12.2	12.9
1989	No advice		3.1[1]		1.1	11.0	12.1
1990	F as F(pre-85)[3]; TAC[3]; No increase in F[4]; TAC[4]	10.0	2.75[1]		1.2	10.2	11.4
1991	No increase in F; TAC	12.0	8.55		0.5	11.6	12.1
1992	Within safe biological limits	15[2]	10.50	15.0	0.5	13.0	13.6
1993	Within safe biological limits	13[2]	10.50	15.0	0.9	12.6	13.5
1994	Within safe biological limits	19[2]	12.60	18.0	0.2	11.5	11.7
1995	Within safe biological limits	13[2]	11.20	16.0	0.3	14.2	14.5
1996	No advice	11[2]	10.50	15.0	0.3	14.2	14.5
1997	No advice	13[2]	10.50	15.0	1.0	15.1	16.1
1998	No increase in F; TAC	19[2]	13.16	18.8	0.4	15.4	15.8
1999	Maintain F	19[2]	13.16	18.8	0.6	11.2	11.9
2000	Maintain F	<11.5[2]	9.10	13.0	0.7	10.8	11.5
2001	Maintain F	13.4	10.15	14.5	0.7	11.3	12.0
2002	Long-term average landings	12.6	10.15	14.5			
2003	Maintain F	14.7					

[1]EU zone only. [2] Catch at *status quo* F. [3] IIIa. [4]Norwegian Deep. Weights in '000 t.


Catch
Catch in ton
20000
15000
10000
5000
0
1985
1987
1989
1991
1993
1995
1997
1999
2001


F ≈ Y/B (%)
percentage
20
15
10
5
0
1985
1987
1989
1991
1993
1995
1997
1999
2001


Recruitment (age2)
Recruitment in millions
4000
3500
3000
2500
2000
1500
1000
500
0
1985
1987
1989
1991
1993
1995
1997
1999
2001

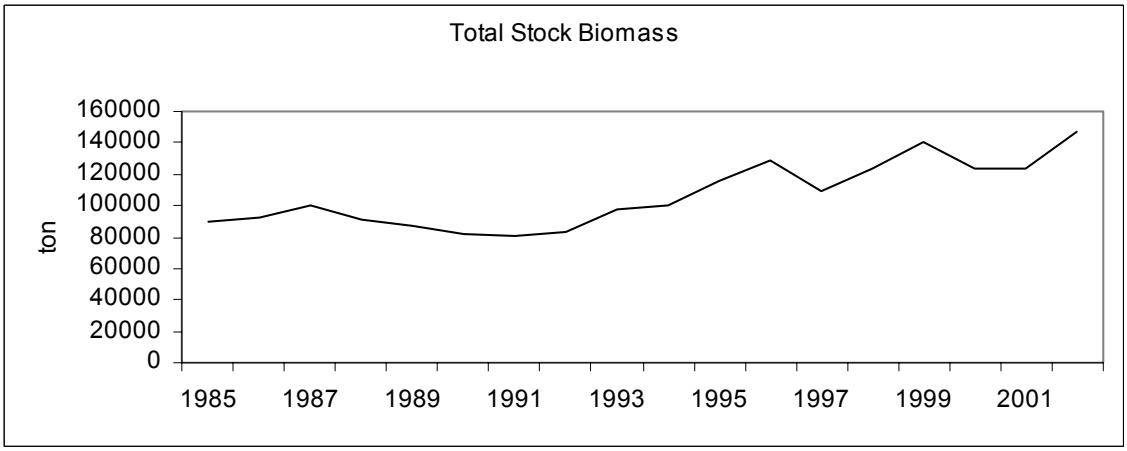

Total Stock Biomass
ton
160000
140000
120000
100000
80000
60000
40000
20000
0
1985
1987
1989
1991
1993
1995
1997
1999
2001

Table 3.4.6.1 Nominal landings (t) of *Pandalus borealis* in ICES Division IIIa and Subarea IV as officially reported to ICES.

	Division IIIa				Sub-area IV					
Year	Denmark	Norway	Sweden†	Total	Denmark	Norway	Sweden	UK (Engl.)*	UK (Scotl.)*	Total
1970	757	982	2740	4479	3460	1107	-	14	100	4681
1971	834	1392	2906	5132	3572	1265	-	-	438	5275
1972	773	1123	2524	4420	2448	1216	-	692	187	4543
1973	716	1415	2130	4261	196	931	-	1021	163	2311
1974	475	1186	2003	3664	337	767	-	50	432	1586
1975	743	1463	1740	3946	1392	604	261	-	525	2782
1976	865	2541	2212	5618	1861	1051	136	186	2006	5240
1977	763	2167	1895	4825	782	960	124	265	1723	3854
1978	757	1841	1529	4127	1592	692	78	98	2044	4504
1979	973	2489	1752	5214	962	594	34	238	309	2137
1980	1679	3498	2121	7298	1273	1140	38	203	406	3060
1981	2593	3753	2210	8556	719	1435	31	1	341	2527
1982	2920	3877	1421	8218	1069	1545	92	-	354	3060
1983	1571	3722	988	6281	5752	1657	112	65	1836	9422
1984	1717	3509	933	6159	4638	1274	120	277	25	6334
1985	4105	4772	1474	10351	4582	1785	128	415	1347	8257
1986	4686	4811	1357	10854	3896	1681	157	458	358	6550
1987	4140	5198	1085	10423	9223	3145	252	526	774	13920
1988	2278	3047	1075	6400	2647	4614	220	489	109	8098
1989	2527	3156	1304	6987	3298	3418	122	364	579	7802
1990	2277	3006	1471	6754	2079	3146	137	305	365	6083
1991	3256	3441	1747	8444	750	2715	161	130	54	3810
1992	3296	4257	2057	9610	1881	2945	147	69	116	5158
1993	2490	4089	2133	8712	1985	3449	167	29	516	6146
1994	1973	4388	2553	8914	1352	2426	176	41	35	4030
1995	2494	5181	2512	10187	4698	2879	166	217	1324	9284
1996	3664	5143	1985	10792	4063	2772	82	97	1899	8913
1997	3617	5460	2281	11358	3117	3112	316	52	365	6962
1998	2941	6519	2086	11546	3273	3092	187	55	1364	7971
1999	1398	3985	2114	7497	1679	2756	182	46	479	5142
2000	1898	3554	1890	7342	1956	2562	184	80	378	5160
2001	1186	3261	1950	6397	2030	3953	158	74	465	6680

* Includes small amounts of other Pandalid shrimp.
† 1970 to 1974 includes Sub-area IV.
Total 1988 - 1990 includes 19, 21 and 51 t by the Netherlands.
2001 figures are preliminary.
Weights in tonnes

Table 3.4.6.2 *Pandalus borealis* landings from Divisions IIIa (Skagerrak) and IVa (eastern part), as estimated by the Working Group.

Year	Denmark	Norway	Sweden	Total	Estimated discards	Catch
1970	1102	1729	2742	5573		
1971	1190	2486	2906	6582		
1972	1017	2477	2524	6018		
1973	755	2333	2130	5218		
1974	530	1809	2003	4342		
1975	817	2339	2003	5159		
1976	1204	3348	2529	7081		
1977	1120	3004	2019	6143		
1978	1459	2440	1609	5508		
1979	1062	3040	1787	5889		
1980	1678	4562	2159	8399		
1981	2593	5183	2241	10017		
1982	3766	5042	1450	10258		
1983	1567	5361	1136	8064		
1984	1800	4783	1022	7605	200	7805
1985	4498	6646	1571	12715	558	13273
1986	4866	6490	1463	12819	414	13233
1987	4488	8343	1322	14153	723	14876
1988	3240	7661	1278	12179	750	12929
1989	3242	6411	1433	11086	1107	12193
1990	2479	6108	1608	10195	1226	11421
1991	3583	6119	1908	11610	497	12107
1992	3725	7136	2154	13015	541	13556
1993	2915	7371	2300	12586	889	13475
1994	2134	6813	2601	11548	214	11761
1995	2460	8095	2882	13437	275	13713
1996	3868	7878	2371	14117	318	14436
1997	3909	8565	2597	15071	1039	16110
1998	3330	9606	2469	15406	348	15753
1999	2072	6739	2445	11256	639	11895
2000	2371	6118	2225	10714	687	11401
2001	1953	7196	2108	11257	705	11962

Weights in t.

Table 3.4.6.3 *Pandalus borealis* in Divisions IIIa (Skagerrak) and IVa (eastern part).

Year	Recruitment Age 2 Millions	Total Biomass Tonnes	Catch Tonnes	F ≈ Y/B %
1985	2000	90001	13273	14.0
1986	3574	92841	13233	14.1
1987	1046	100124	14876	14.6
1988	2600	91532	12929	13.9
1989	337	86955	12193	13.7
1990	1951	81961	11421	13.9
1991	1850	80230	12107	15.1
1992	2521	83259	13556	16.2
1993	1906	97116	13475	13.8
1994	3075	100791	11761	11.5
1995	1862	116055	13713	12.3
1996	1384	128172	14436	11.2
1997	2827	109519	16110	14.6
1998	3474	123094	15753	12.7
1999	1096	139857	11895	8.3
2000	1938	123652	11401	9.2
2001	2319	123970	11962	9.5
2002	2630	146800		8.2
Average	2133	106441	13182	12.6

3.4.7 Herring in Subdivisions 22–24 and Division IIIa (spring spawners)

State of stock/exploitation: SSB has been relatively stable over the last five years, but the stock is being harvested outside of biological limits. Fishing mortality is 0.50 for adults and 0.25 for the juveniles (0- and 1-ringers), which is substantially greater than $\mathbf{F}_{max}$. The age structure in the catch appears to be relatively stable over the last four years.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: Precautionary Approach reference points have not been defined. The continued development of an analytical assessment may allow definition of PA reference points in the near future. Based on a comparison to other herring stocks all likely candidates of $\mathbf{F}_{pa}$ will be less than $\mathbf{F}_{max}$.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{max}$, corresponding to catches in 2003 of less than 84 000 t. According to the recent geographic distribution of catches, approximately half of the total catch should be taken from the Subdivisions 22–24.

Relevant factors to be considered in management: Section (3.5.8) on North Sea herring (autumn spawners) states: "The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring spawning herring", and the North Sea stock is now above $\mathbf{B}_{pa}$. A considerable part of the landings of juvenile herring in Division IIIa originates from the North Sea stock. An abundant 2000 year class of North Sea autumn spawner herring is expected to be present in the area as one-winter-ringers in 2002. The 2001 North Sea autumn spawner year class also appears to be abundant and this year-class will be present in Div. IIIa as 0-ringers in 2002. Recently, this fishery has been managed in a manner consistent with the management of the herring in the North Sea. As the North Sea stock recovers, the need for a separate management of Subdivisions 22–24 + Division IIIa herring stock increases.

In the Baltic the TACs for herring apply to several herring stocks, including the component of this stock in Subdivisions 22–24, and there is no specific instrument that allows control over the exploitation of spring-spawning herring in Division IIIa and Subdivisions 22–24. The herring TAC for the Baltic should be split and individual TACs applied to the stocks, i.e. Subdivisions 22–24, Subdivisions 25–29 + 32 (excluding Gulf of Riga herring), Gulf of Riga herring, Subdivision 30 and Subdivision 31.

Catch forecast for 2003: Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999–2001) = 0.498; Landings (2002) = 107; SSB(2002) = 140.

F(2003 onwards)	Basis	SSB (2003)	Landings (2003)	SSB (2004)
0	$0\mathbf{F}_{sq}$	141	0	224
0.202	$\mathbf{F}_{0.1}$	139	48	183
0.3	$0.6\mathbf{F}_{sq}$	136	69	166
0.372	$\mathbf{F}_{max}$	136	84	154
0.398	$0.8\mathbf{F}_{sq}$	135	89	150
0.448	$0.9\ \mathbf{F}_{sq}$	135	98	143
0.498	$\mathbf{F}_{sq}$	134	107	136
0.547	$1.1\ \mathbf{F}_{sq}$	133	116	129

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The assessment carried out in 2002 is the first accepted analytical assessment. The results are very similar to a provisional assessment provided last year.

Elaboration and special comments: Herring of this stock are taken in the Northeastern part of the North Sea, Division IIIa, and Subdivisions 22–24. Division IIIa has directed fisheries by trawlers and purse seiners (fleet C), while Subdivisions 22–24 have directed trawl, gillnet, and trapnet fisheries (fleet F). The herring by-catches taken in Division IIIa in the small mesh trawl fishery for Norway pout, sandeel, and sprat (fleet D) are mainly autumn spawners from the North Sea stock. After a period of high landings in the early 1980s the combined landings of all fleets have decreased to below the long-term average.

The TACs in Division IIIa in 2001 were: 1) for the directed fishery 80 000 t, and 2) for by-catch in the small mesh fisheries 21 000 t. The TAC comprises both the autumn- and spring-spawning stocks in the area. The spring spawners are also fished in the Baltic, under the overall IBSFC herring TAC of 300 000 t (Subdivisions 22–32). The TACs in Div. IIIa for 2002 are 80 000 t for directed fishery and a total of 21 000 t for by-catches in the small mesh fisheries.

The otolith microstructure method to calculate the proportion of spring and autumn spawners caught in these areas has been implemented, all catch and IBTS data for the period 1991–1999 has been revised. Continued development of the stock identification methods should be applied to explore the importance of local stock components in the area.

Analytical assessment is based on catch data and acoustic and trawl survey results. In order to continue to improve the assessment, a comprehensive survey covering the whole stock is needed.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

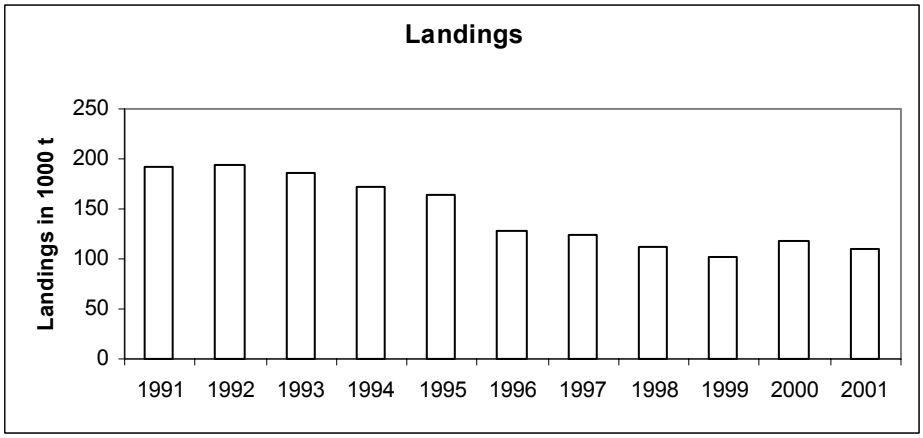
Yield and spawning biomass per Recruit F-reference points:

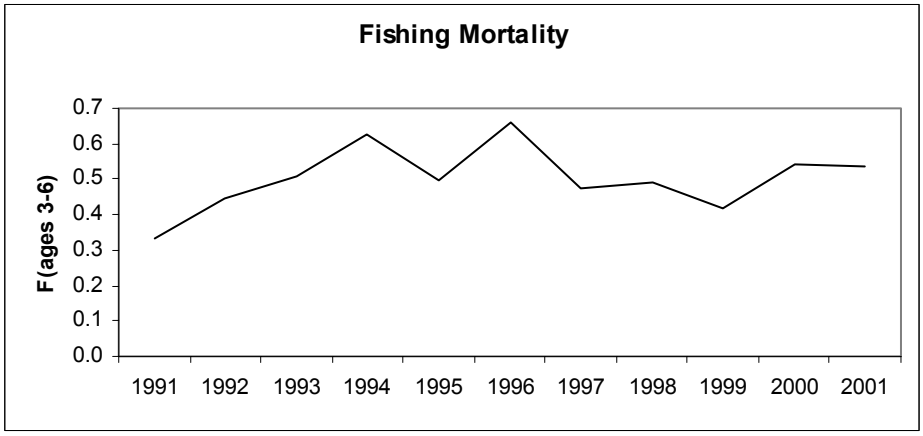
	Fish Mort Ages 3–6	Yield/R	SSB/R
Average Current	0.498	0.024	0.030
$\mathbf{F}_{max}$	0.372	0.024	0.046
$\mathbf{F}_{0.1}$	0.202	0.022	0.089
$\mathbf{F}_{med}$	N/A		

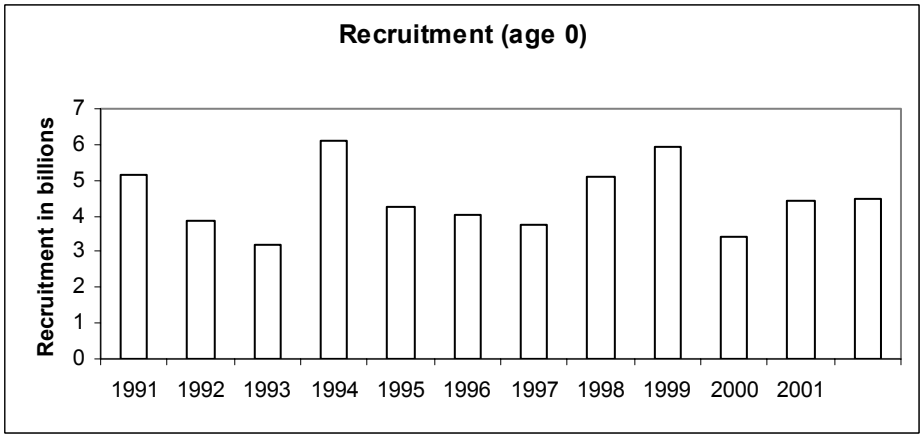
Catch data: (Tables 3.4.7.1–2)

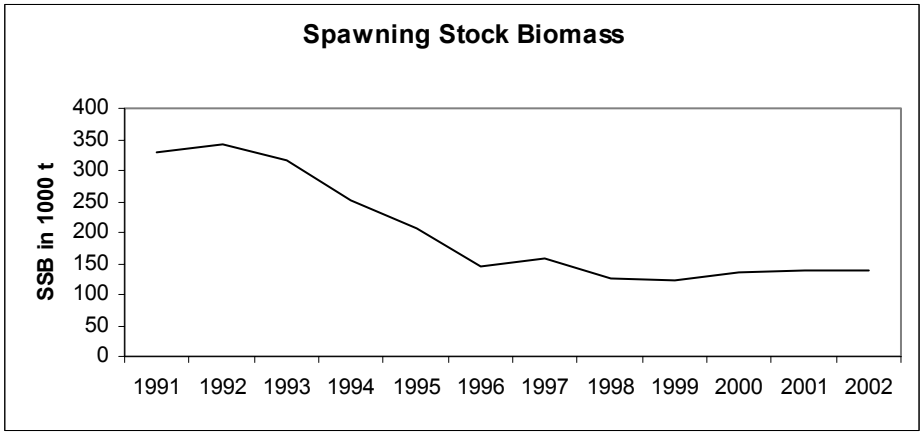
Year	ICES Advice	Pred. Catch Corresp. to advice	Agreed TAC	ACFM catch of Stock			
				22–24	IIIa	IV	Total
1987	Reduction in F	224		102	59	14	175
1988	No increase in F	196		99	129	23	251
1989	TAC	174		95	71	20	186
1990	TAC	131		78	118	8	204
1991	TAC	180		70	112	10	192
1992	TAC	180		85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188		81	95	10	186
1994	TAC	130–180		66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192		74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171		58	71	1	130
1997	IIIa: managed together with autumn-spawners 22–24: if required, TAC not exceeding recent catches	66–85[1]		68	55	1	124
1998	Should be managed in accordance with North Sea autumn spawners	-		51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-		50	43	5	98
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Sub-divs. 22–24		54	57	7	118
2001	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24		62	42	6	110
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24					
2003	Decrease F	<80					

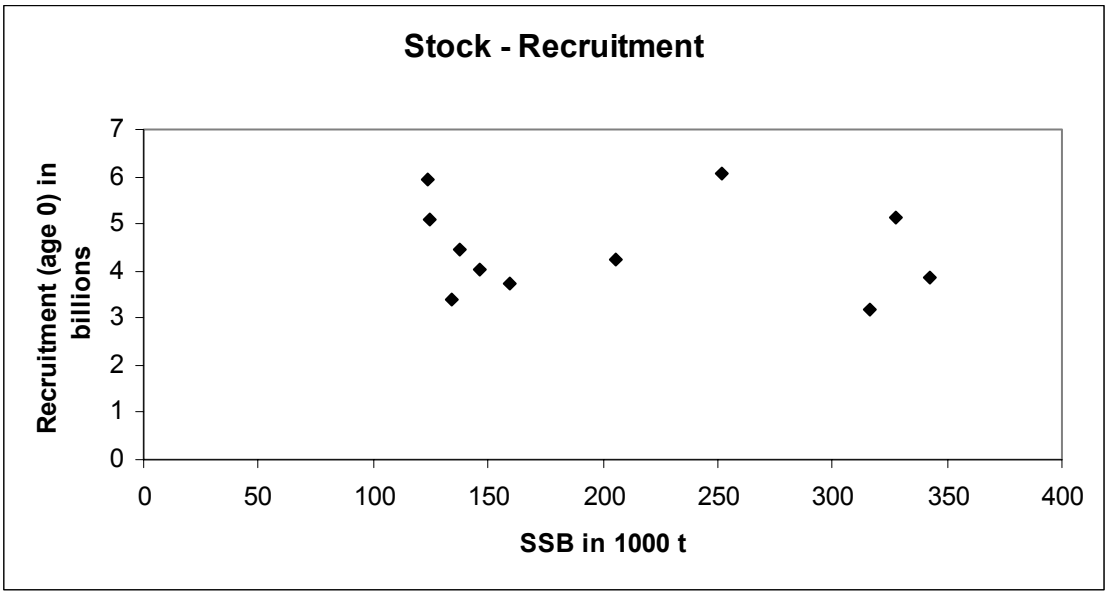
[1]Catch in Subdivisions 22–24. Weights in '000 t.


Landings
Landings in 1000 t
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Fishing Mortality
F (ages 3-6)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Recruitment (age 0)
Recruitment in billions
7
6
5
4
3
2
1
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Spawning Stock Biomass
SSB in 1000 t
400
350
300
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002


Stock - Recruitment
Recruitment (age 0) in billions
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
SSB in 1000 t

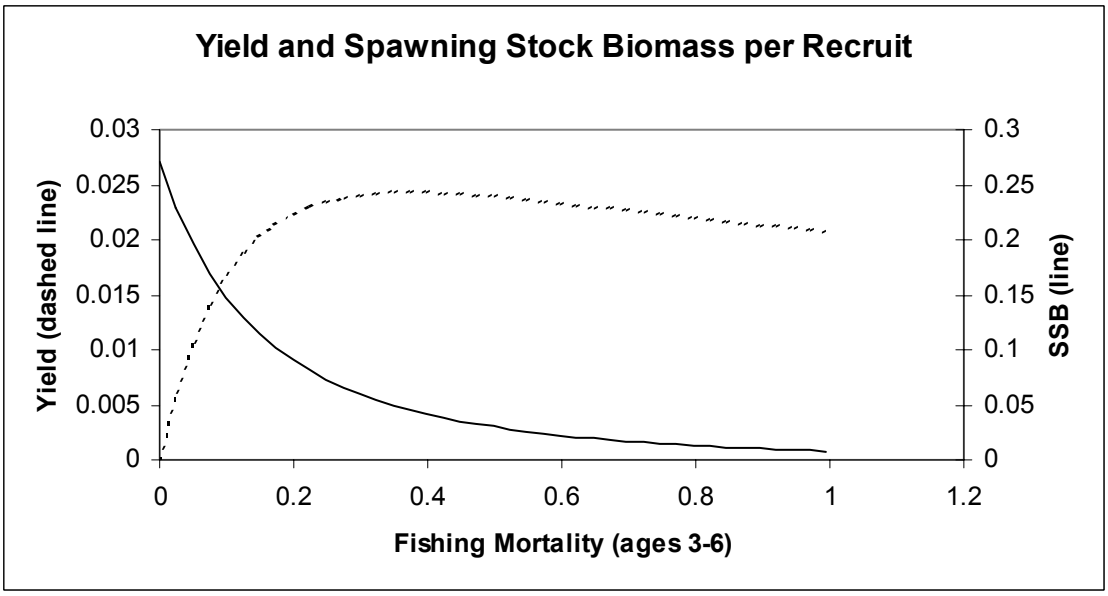

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.005
0.01
0.015
0.02
0.025
0.03
SSB (line)
0
0.05
0.1
0.15
0.2
0.25
0.3
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 3-6)

Table 3.4.7.1 HERRING in Division IIIa and Subdivisions 22–24. 1985–2001. Landings in thousands of tonnes. Autumn and spring spawners in Division IIIa. (Data provided by Working Group members 2001).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Skagerrak										
Denmark	88.2	94.0	105.0	144.4	47.4	62.3	58.7	64.7	87.8	44.9
Faroe Islands	0.5	0.5								
Norway	4.5	1.6	1.2	5.7	1.6	5.6	8.1	13.9	24.2	17.7
Sweden	40.3	43.0	51.2	57.2	47.9	56.5	54.7	88.0	56.4	66.4
Total	133.5	139.1	157.4	207.3	96.9	124.4	121.5	166.6	168.4	129.0
Kattegat										
Denmark	69.2	37.4	46.6	76.2	57.1	32.2	29.7	33.5	28.7	23.6
Sweden	39.8	35.9	29.8	49.7	37.9	45.2	36.7	26.4	16.7	15.4
Total	109.0	73.3	76.4	125.9	95.0	77.4	66.4	59.9	45.4	39.0
Sub. Div. 22+24										
Denmark	15.9	14.0	32.5	33.1	21.7	13.6	25.2	26.9	38.0	39.5
Germany	54.6	60.0	53.1	54.7	56.4	45.5	15.8	15.6	11.1	11.4
Poland	16.7	12.3	8.0	6.6	8.5	9.7	5.6	15.5	11.8	6.3
Sweden	11.4	5.9	7.8	4.6	6.3	8.1	19.3	22.3	16.2	7.4
Total	98.6	92.2	101.4	99.0	92.9	76.9	65.9	80.3	77.1	64.6
Sub. Div. 23										
Denmark	6.8	1.5	0.8	0.1	1.5	1.1	1.7	2.9	3.3	1.5
Sweden	1.1	1.4	0.2	0.1	0.1	0.1	2.3	1.7	0.7	0.3
Total	7.9	2.9	1.0	0.2	1.6	1.2	4.0	4.6	4.0	1.8
Grand Total	349.0	307.5	336.2	432.4	286.4	279.9	257.8	311.4	294.9	234.4

Year	1995	1996	1997	1998	1999	2000	2001[1]
Skagerrak							
Denmark	43.7	28.7	14.3	10.3	10.1	16.0	16.2
Faroe Islands							
Norway	16.7	9.4	8.8	8.0	7.4	9.7	8.3
Sweden	48.5	32.7	32.9	46.9	36.4	45.8	30.8
Total	108.9	70.8	56.0	65.2	53.9	71.5	55.3
Kattegat							
Denmark	16.9	17.2	8.8	23.7	17.9	18.9	18.8
Sweden	30.8	27.0	18.0	29.9	14.6	17.3	16.2
Total	47.7	44.2	26.8	53.6	32.5	36.2	35.0
Sub. Div. 22+24							
Denmark	36.8	34.4	30.5	30.1	32.5	32.6	28.3
Germany	13.4	7.3	12.8	9.0	9.8	9.3	9.9
Poland	7.3	6.0	6.9	6.5	5.3	6.6	9.3
Sweden	15.8	9.0	14.5	4.3	2.6	4.8	13.9
Total	73.3	56.7	64.7	49.9	50.2	53.3	61.4
Sub. Div. 23							
Denmark	0.9	0.7	2.2	0.4	0.5	0.9	0.6
Sweden	0.2	0.3	0.1	0.3	0.1	0.1	0.2
Total	1.1	1.0	2.3	0.7	0.6	1.0	0.8
Grand Total	231.0	172.7	149.8	169.4	137.2	162.0	152.5

[1] Preliminary.

Table 3.4.7.2 Herring in Subdivisions 22–24 and Division IIIa (spring spawners).

Year	Recruitment Age 0 thousands	SSB Tonnes	Landings tonnes	Mean F Ages 3–6
1991	5152960	327477	191573	0.3358
1992	3870880	342905	194411	0.4441
1993	3167210	316405	185010	0.5061
1994	6087790	251977	172438	0.6243
1995	4260820	205460	164284	0.4942
1996	4014880	146638	128243	0.6621
1997	3749770	159142	123199	0.4738
1998	5080980	124774	112386	0.4905
1999	5928180	123367	101573	0.4161
2000	3393080	134518	118278	0.5416
2001	4446510	137931	110192	0.5351
2002	4490961	139690		
Average	4470335	200857	145599	0.5022

3.4.8 Sprat in Division IIIa

State of stock/exploitation: The state of the stock is unknown. Sprat in this area is short-lived with large annual natural fluctuations in stock biomass.

Management objectives: There are no explicit management objectives for this stock.

Advice on management: **As sprat is mainly fished together with juvenile herring the exploitation of sprat will be limited by the restrictions imposed on fisheries for juvenile herring. With the current management regime, where there are by-catch ceilings of herring as well as by-catch percentage limits, the sprat fishery is controlled by these factors.**

Relevant factors to be considered in management: Sprat cannot be fished without significant by-catches of herring except in years with high sprat abundance. The most recent period when this occurred was 1994–1995. The available surveys are not reliable indicators of sprat abundance in Division IIIa. Therefore, fishing possibilities in 2002 cannot be projected.

Management of this stock should consider management advice given in Section 3.5.8 (Herring in Subarea IV, Division VIId, and Division IIIa).

Elaboration and special comment: The directed sprat fishery serves a very small market. Most sprat catches are taken in an industrial fishery where catches are limited by herring by-catch restrictions. This combination of factors has prevented full utilisation of the occasional strong year class. Such year classes emerge and disappear very quickly.

Landings of sprat in Division IIIa averaged about 70 000 t in the 1970s, but since 1982 have typically been around 20 000 t, except in 1994–1995.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Catch data (Table 3.4.8.1):

Year	ICES Advice	Pred. cat. corr. to adv.	Agreed TAC[1]	Official lndgs.[2]	ACFM catch
1987	-	-	80	68	14
1988	TAC for "mixed clupeoid" fishery	80[1]	80	63	9
1989	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	80[1]	80	62	10
1990	Sprat catch lowest possible level; TAC for "mixed clupeoid" fishery	60[1]	65	43	10
1991	Sprat catch lowest possible level; Zero TAC for "mixed clupeoid" fishery	-	50	44	14
1992	No advice for sprat; Zero TAC for "mixed clupeoid" fishery	-	50	40	11
1993	No advice for sprat	-	45	36	9
1994	Separate sprat TAC based on recent catches	10-14	43	67	96
1995	Separate sprat TAC based on recent catches	9-14	43	45	56
1996	No advice	-	43	28	18
1997	Reduce by-catch of herring	-	40	19	16
1998	Limited by restriction on juvenile herring catches	-	40	26	18
1999	Limited by restriction on juvenile herring catches	-	50	35	27
2000	Limited by restriction on juvenile herring catches	-	50	28	20
2001	Limited by restriction on juvenile herring catches	-	50	34	29
2002	Limited by restriction on juvenile herring catches	-	50		
2003	Limited by restriction on juvenile herring catches	-			

[1]TAC applies to all species in "mixed clupeoid" catch. [2]Includes other species in "mixed clupeoid" catches. Weights in '000 t.

Sprat in Division IIIa

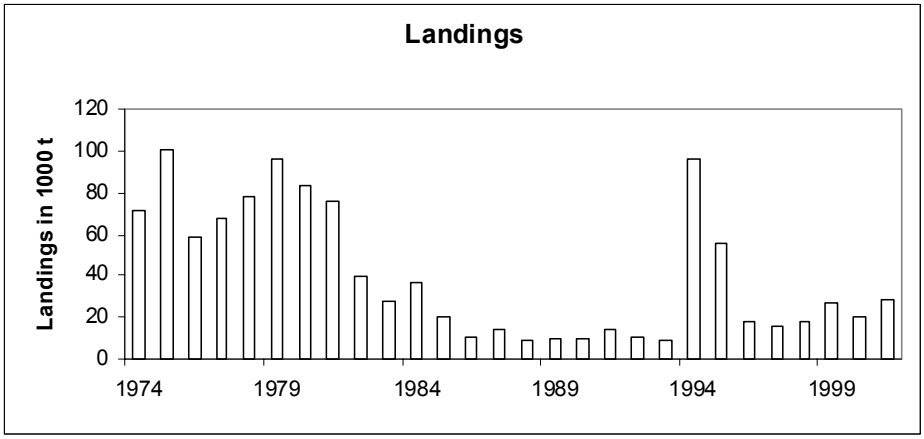


Table 3.4.8.1 Sprat in Division IIIa. Landings in (1000 tonnes) 1974-2001. (Data provided by Working Group members).

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

	Skagerrak				Kattegat			Div. IIIa
Year	Denmark	Sweden	Norway	Total	Denmark	Sweden	Total	total
1974	17.9	2	1.2	21.1	31.6	18.6	50.2	71.3
1975	15	2.1	1.9	19	60.7	20.9	81.6	100.6
1976	12.8	2.6	2	17.4	27.9	13.5	41.4	58.8
1977	7.1	2.2	1.2	10.5	47.1	9.8	56.9	67.4
1978	26.6	2.2	2.7	31.5	37	9.4	46.4	77.9
1979	33.5	8.1	1.8	43.4	45.8	6.4	52.2	95.6
1980	31.7	4	3.4	39.1	35.8	9	44.8	83.9
1981	26.4	6.3	4.6	37.3	23	16	39	76.3

	Skagerrak			Kattegat		Div. IIIa	Division IIIa
Year	Denmark	Sweden	Norway	Denmark	Sweden	Sweden	Total
1982	10.5		1.9	21.4		5.9	39.7
1983	3.4		1.9	9.1		13	27.4
1984	13.2		1.8	10.9		10.2	36.1
1985	1.3		2.5	4.6		11.3	19.7
1986	0.4		1.1	0.9		8.4	10.8
1987	1.4		0.4	1.4		11.2	14.4
1988	1.7		0.3	1.3		5.4	8.7
1989	0.9		1.1	3		4.8	9.8
1990	1.3		1.3	1.1		6	9.7
1991	4.2		1	2.2		6.6	14
1992	1.1		0.6	2.2		6.6	10.5
1993	0.6	4.7	1.3	0.8	1.7		9.1
1994	47.7	32.2	1.8	11.7	2.6		96
1995	29.1	9.7	0.5	11.7	4.6		55.6
1996	7	3.5	1	3.4	3.1		18
1997	7	3.1	0.4	4.6	0.7		15.8
1998	3.9	5.2	1	7.3	1		18.4
1999	6.8	6.4	0.2	10.4	2.9		26.7
2000	5.1	4.3	0.9	7.7	2.1		20.1
2001	5.2	4.5	1.4	14.9	3.0		29.1

3.4.9 Sandeel in Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: Based on the available information it was not possible to assess the state of the stock or identify safe biological limits.

Management objectives: There are no explicit management objectives for this stock.

Elaboration and special comment: ICES notes that this is an unregulated fishery on an important prey species.

The fishery is an extension of the North Sea fishery into Division IIIa, but with smaller vessels working closer inshore, mostly along the coast of Jutland.

The catches in 2001 were 25 500 t, which is an increase compared to the values in 1998-2000, but still below the average of 32 000 t for the period 1989-2001.

The available information suggests that Subarea IV and Division IIIa can be combined to one stock unit. No assessments of sandeel in Division IIIa have been carried out so far. Biological data for this area are sparse and would have to be evaluated before a decision is made about treating sandeels in Subarea IV and Division IIIa as one stock.

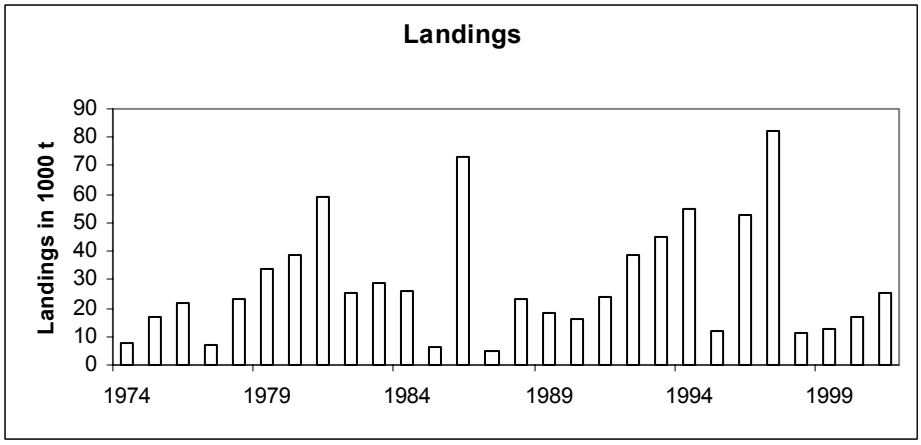
Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Catch data (Table 3.4.1.1):

Year	ICES advice	ACFM Catch
1987	No advice	5
1988	No advice	23
1989	No advice	18
1990	No advice	16
1991	No advice	23
1992	No advice	39
1993	No advice	45
1994	No advice	55
1995	No advice	12
1996	No advice	53
1997	No advice	81
1998	No advice	11
1999	No advice	13
2000	No advice	17
2001	No advice	25
2002	No advice	
2003	No advice	

Weights in '000 t.

Sandeel in Division IIIa (Skagerrak - Kattegat)



3.4.10 Anglerfish in Division IIIa (Skagerrak and Kattegat)

Anglerfish in this area is assessed as part of the complex covering Division IIIa (Skagerrak and Kattegat), Sub-area IV (North Sea) and Division VIa (West of Scotland), see section 3.7.7.

that the results reported in "Analysis of possibilities of limiting the annual fluctuations in TACs" (Reference FISH-2000–02–01) should be interpreted with care and conclusions should be based on comparative patterns rather than on absolute estimates of probability or risk.

2) Targets and limits

The basic management scenarios that were investigated consisted of a target F and a constraint on the annual percentage changes in TAC, which would be permitted. The results from these scenarios were presented in terms of mean yield and the risk of the SSB being below $\mathbf{B}_{pa}$.

In general, ACFM observed a non-linear relationship between risk of SSB being reduced to less than $\mathbf{B}_{pa}$ and the magnitude of TAC constraints. In most short- and medium-term simulations, a TAC constraint of 10% (i.e., restricting annual changes in TAC to 10% or less) had substantially greater risk than a 20% constraint, but the difference in risk of from 20% to 40% constraints was much less. It was also clear that the current state of the stock also had an important effect on the results. For stocks below $\mathbf{B}_{pa}$, imposing a restrictive constraint on the TAC delayed recovery and thus led to an increased risk to the stock. Conversely, for stocks above $\mathbf{B}_{pa}$, such a TAC constraint served to reduce the risk to the stock. For several stocks, the projections indicated a clear optimum target F for minimising risk and maximizing yield in the medium or long term.

Results from the individual stocks are summarized below, together with the current perception of the state of each stock.

Plaice in the Skagerrak (2001 SSB=130%$\mathbf{B}_{pa}$, 2001 F=112%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.73):

A 10% TAC constraint has substantially greater risk than looser constraints, and risk is similar at various levels of F. For example, in the short-term, a target F of 0.4 with a 20% TAC constraint produces approximately one-third of the risk produced with a 10% TAC constraint and also produces some gains in yield. Although simulation results are sensitive to the assumed stock-recruit model, this pattern is similar for all assumed models. In the medium term, a 10% constraint also produces greater risk, and F has slightly more effect on risk, but only affects yield at very low Fs. In the long-term, the TAC constraint has less effect, and risk is much more a function of F, because the stock is fluctuating less and is nearly in equilibrium. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive, because it does not allow a quick response to strong recruitment or poor conditions. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the North Sea (2001 SSB=96%$\mathbf{B}_{pa}$ 2001 F=143%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.30):

In the short-term, risk is more affected by the target F than the level of TAC constraint, because simulations are starting with SSB levels that are less than $\mathbf{B}_{pa}$. Alternative stock-recruit models produced similar results. In the medium-term, yield is similar among all scenarios, but risk is greatly increased at greater target Fs. In the long term, target Fs greater than 0.35 produce less yield and great risk, with TAC constraints also producing less yield. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, there is substantial risk of SSB being below $\mathbf{B}_{pa}$ in the short, medium and long term when the target is $\mathbf{F}_{pa}$, regardless of TAC constraints.

Plaice in the Irish Sea (2001 SSB=179%$\mathbf{B}_{pa}$ 2001 F=69%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than looser constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$ and low Fs, and constraints do not allow F to quickly increase to the target. Risk is lower at low target Fs, but there is substantial loss in yield. A target F of 0.363 produces much less risk than $\mathbf{F}_{pa}$ with no loss of yield for much reduced risk. Yield is much less at target Fs of less than 0.275. In the long-term the 10% TAC constraint produced relatively high risk and low yield. There is substantial risk of equilibrium SSB produced by a target of $\mathbf{F}_{pa}$ being less than $\mathbf{B}_{pa}$. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the Eastern English Channel (2001 SSB=119%$\mathbf{B}_{pa}$ 2001 F=116%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than no constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$. In the medium term, $\mathbf{F}_{pa}$ produces the most yield at low risk. In the long term target Fs greater than $\mathbf{F}_{pa}$ produce much less yield and have much greater risk. The 10% TAC constraint substantially increases risk, particularly at higher target Fs. Simulations at lower Fs produce SSBs that are much greater than the observed maximum. In conclusion, the 10% TAC constraint appears to be too restrictive, but $\mathbf{F}_{pa}$ appears to produce low risk and high yield.

Sole in the North Sea (2001 SSB=113%B_{pa} 2001 F=115%F_{pa}, F_{pa}=0.40):

In the short term, target F and to a lesser extent TAC constraints affect on risk. Target Fs greater than 0.5 produce a very high risk, with or without TAC constraints. At lower target Fs, TAC constraints have more affect on risk. The 10% TAC constraint produces substantially greater risk than looser constraints, irrespective of target Fs, probably resulting from highly variable recruitment. The 10% TAC constraint is also much riskier in the medium term. In the long term, risk is more a function of target F, with losses in yield at Fs greater than 0.4. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% TAC constraint with a target F of $\mathbf{F}_{pa}$ or less has substantially less risk.

Sole in the Eastern English Channel (2001 SSB=158%B_{pa} 2001 F=85%F_{pa}, F_{pa}=0.40):

In the short term, there is a distinct tradeoff between risk and yield in which target Fs greater than $\mathbf{F}_{pa}$ have substantially greater risk, but also produce greater yield. The 10% TAC constraint also has greater risk for the lower target Fs. The target F that produced the greatest yield and least risk in the medium term was 0.3, but the 10% TAC constraint had greater risk at all target Fs. The target F that produced the greatest yield and least risk in the long term was 0.2–0.3, and the 10% TAC constraint was more risky. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% constraint with a target F of between 0.2 and 0.3 has relatively low risk and produces relatively high yields.

3) Recovery Plans

This request could not be completely addressed with the information that was provided, because the proposed rebuilding strategies were not directly simulated. Although ACFM cannot respond to the specific request, the general simulation results show that TAC constraints should be not be applied during rebuilding and TACs should be as responsive as possible to the perceived stock conditions. One technical aspect of a rapid response is that some assessment methods that assume stable F may not perform well for monitoring rebuilding.

3.4.11 Response to the request from DG Fish concerning TACs for 2002 for certain species Plaice in Division IIIa (Skagerrak and Kattegat)

The EC has requested ICES to reconsider its TAC advice for plaice in Division IIIa (Skagerrak and Kattegat) for 2002 taking into account any additional data that may have become available since the assessment was done in 2001.

ICES advised based on its assessment in June 2001 as follows:

Advice on management: ICES recommends that fishing mortality should be less than the proposed F_{pa} (0.73), corresponding to landings in 2002 of less than 8 500 t.

ICES also commented that the assessment was uncertain.

The present document provides an update of the advice for 2002 based on new information now available for 2001. The analysis presented in two background papers is based on incomplete and preliminary data for 2001. These two papers are attached.

ICES Comments

1. The plaice in Division IIIa (Skagerrak and Kattegat) is assessed by the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). This group will meet again in late June 2002 and at that time will have the complete data 2001 set available. Also the Argos 2002 survey data will be available at that time. The assessment made by WGNSSK will be reviewed by the ICES Advisory Committee on Fishery Management (ACFM) in October 2002. Also, ACFM will at that time formulate ICES advice for 2003.

2. The fishery on plaice in Division IIIa is almost entirely Danish and the Danish Institute of Fisheries Research (DIFRES) provides almost all data for the assessment (tuning series and age-length keys). Therefore, ICES asked DIFRES to conduct a study to allow ICES to respond to this request. This study was supplemented by data analysis made by the ICES Secretariat.

3. The provisional total catch is 11,800 t. The expected catch for 2001 under the assumption of unchanged fishing mortality was 8,600 tonnes.

4. The 2001 catch at age distribution differs considerably from the age distribution predicted at the most recent assessment. It contains considerably more age 2 and 3 plaice (year-classes 1999 and 1998) and less of age 6 and older. In the provisional catch fish of age 4 or less account for 57% of the fish, whereas they were predicted to account for 36%.

5. For 2001 the predicted and preliminary data on mean weight-at-age are almost identical.

6. Compared to 2000, the effort has increased by 2, 12 and 10% for trawlers, gill-netters and Danish seiners, respectively, whereas catches have increased by 31, 32 and 26%. The preliminary CPUE data, which are used as the stock abundance indicators, were 12, 3 and 31%, respectively, above the predicted values.

7. Data from three abundance surveys are available; IBTS conducted by the Swedish vessel Argos during the first quarter of each year, and Danish surveys conducted by the vessel Havfisken in the first and fourth quarter of each year.

8. Inter-sessional work after June 2001has been conducted on the two R/V Havfisken survey data and the time series have been both revised and extended. The new indices available thus cover the period 1996-2001 for the spring survey, and 1994-2001 for the fall survey **(Figure 4).** They indicate that all year classes from 1997 and later are above average and that the year classes 1998 and 1999 are large. The Argos survey series including data for spring 2002 similarly show a high level of recruitment in recent years.

9. The re-evaluation is done as follows

- The assessment model (WGNSSK 2001) uses age groups 2-11+. This re-evaluation uses age group 2-6+. This is done to avoid influence of small contributions of old fish

- the age composition of N6+ is taken as estimated by the 2001 assessment

- fishing mortality for 2001 for ages 2 and 3 should resemble $\mathbf{F}_{sq.}$. This is done to mimic the shrinkage used in the June 2001 assessment.

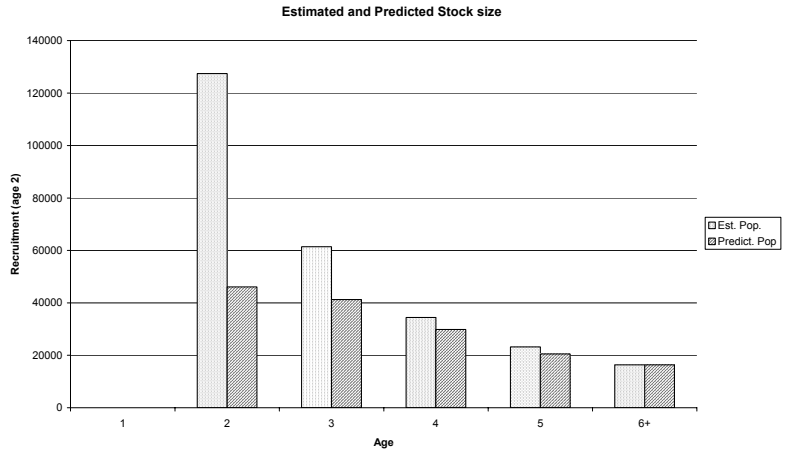
This is not a full assessment but an *ad-hoc* solution for an evaluation of the preliminary data.

The estimated parameters are

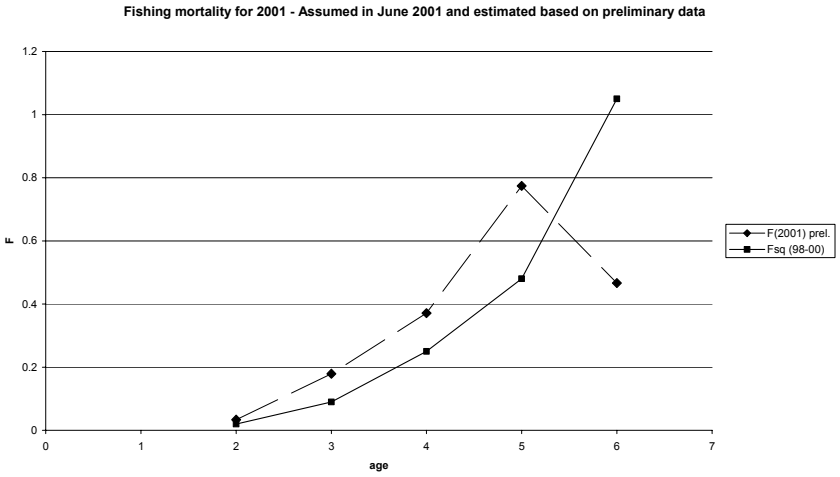
- Fishing mortality for ages 2,3,4,5 and 6+ and

- Stock size as of 1st January 2001 for ages 2,3,4 and 5.

10. The estimated stock size as of 1st January 2001 is compared with the estimate adopted in the June 2001 assessment



11. The estimated fishing mortality is compared with the expected fishing mortality for 2001 on the graph below



12. The catch option table is then revised to be:

Landings 2001= 12,300 t, SSB(2002) = 57,100 t, $F_{2001}(4\text{-}8) = 0.51$.

$F_{2002}/\mathbf{F}_{sq}$	F_{2002}(4-8)	Yield (2002)	SSB(2003)
0	0	No Fishing	59,991
0.4	0.31	5,657	56,411
0.6	0.47	8,046	54,764
0.8	0.62	10,202	53,203
0.9	0.70	11,203	52,453
0.94	0.73	11,590	52,159
1	0.78	12,158	51,723
1.1	0.85	13,070	51,011
1.2	0.93	13,943	50,317
1.3	1.01	14,779	49,640

13. The adopted precautionary reference points ($\mathbf{B}_{pa}$ = 24,000 t and $\mathbf{F}_{pa}$= 0.73) are based on an exploitation pattern that resembles that existing in the 1998-2000 period. This exploitation pattern indicates a substantially higher average age in the catches than what was observed in the preliminary catch compositions for 2001. Should such an exploitation pattern prevail in the fishery then the $\mathbf{F}_{pa}$ reference point would no longer be valid and a lower reference fishing mortality is implied.

14. The 2002 TAC was set taking cod by-catches into consideration. There are no available data on cod by-catches for 2001. The cod-by-catch relates to effort rather than to catch of plaice and effort is related to fishing mortality. The fishing mortality for 2002 should be below the current level if total cod by-catch should be below the level seen in recent years. $\mathbf{F}_{pa}$ is slightly below the average fishing mortality for 1998-2000, but above the (uncertain) 2001 estimate.

15. The re-evaluation is based on preliminary data and the uncertainty on the estimates is larger than in an assessment based on the full dataset. In addition, also due to uncertainty about the exploitation pattern the management option table is only indicative of the change in projections.

16. The 2001 information suggests a 32 % higher status quo prediction for 2002 than presented in 2001, implying that the 2002 TAC could be increased by up to 32% without significant additional risk to the stock.

3.5 Stocks in the North Sea (Subarea IV)

3.5.1 Overview

Description of the fisheries

The fisheries in the North Sea can be grouped into demersal and pelagic human consumption fisheries and into industrial fisheries, which land their catch for industrial purposes. Demersal human consumption fisheries usually target a mixture of roundfish species (cod, haddock, whiting), or a mixture of flatfish species (plaice and sole) with a by-catch of roundfish. A fishery directed at saithe exists along the shelf edge. The catch of these fisheries is landed for human consumption. The pelagic fisheries mainly target herring, mackerel, and horse mackerel. Although most of the landings of these species may be landed for human consumption purposes, part of the landings are used for fishmeal and fishoil. The catch of the industrial fisheries mainly consists of sandeel, Norway pout, and sprat. The industrial catches also contain by-catches of other species, including herring, haddock, and whiting (Table 3.5.1.1). In addition to the finfish fisheries, smaller fleets exist which fish for crustaceans, including *Nephrops*, *Pandalus,* and brown shrimp (*Crangon crangon*).

Each fishery uses a variety of gears. Demersal fisheries: otter trawls, pair trawls, twin trawls, seines, gillnets, beam trawls. Pelagic fisheries: pelagic trawls and purse seines. Industrial fisheries: small-meshed otter trawls, pelagic trawls, and purse seines.

Some major technological developments changed the fisheries in the North Sea during and after the 1960s such as the development of the beam trawl fishery for flatfish, purse seines in the pelagic fishery, and large pelagic trawls to replace driftnets. In recent years twin trawls have been introduced in the fishery for flatfish and roundfish. The introduction of power blocks in the 1960s has enormously increased the possibilities for the purse seiners. Right up to the present time further development of electronic equipment such as satellite navigation, fish finders, and sonar has increased the fishing efficiency of the fleets.

The trends in landings of the most important species landed by these fleets since 1970, together with the total international landings, are shown in Table 3.5.1.2 and in Figure 3.5.1.1. The demersal landings have steadily declined over the period. The pelagic landings, dominated by herring, decreased to a minimum in the late 1970s, when the fishery for herring was closed, but increased again up to over 1 million t in the period 1987-1995. In 1996 they were reduced by about half and have remained stable since then. The landings in the industrial fisheries increased to approximately 1.8 million t in the mid-1970s, and have fluctuated between 1 and 1.5 million t in recent years. These landings show the largest annual variations, due to the short life span of the species. The total landings reached 3 million t in 1974, and have been around 2.5 million t since the 1980s.

Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3. The average landings allow a comparison to be made between different fleet segments. However, the interpretation possibilities of Table 3.5.1.3 are hindered by the fact that discards are not included in the table so that the actual catch of the different fleet segments cannot be evaluated.

Most commercial species are managed by TAC/quota regulations that apply to Subarea IV or a combination of Subarea IV with an adjacent area. The national management measures with regard to the implementation of the quota in the fisheries differ between species and countries. The industrial fisheries are subject to regulations for the by-catches of protected species.

Data

The biological data available from scientific sources for the assessment of roundfish, flatfish, herring, and mackerel are relatively good. The level of biological sampling of most of the commercial landings has been maintained. Discard data are only used directly in assessments for haddock and whiting, but a historical series exists only for one country. Several countries now collect discard data on a recurrent basis, although many of these data have yet to be incorporated in the assessments.

Data on landings, fishing effort, and species composition are available from all industrial fisheries. There are catch and effort data available for many fisheries, but it is uncertain how reliably these data reflect trends in effective effort, i.e. nominal effort after corrections for technological improvements. Restrictive management measures (TAC's) have also resulted in changes in the fishing practice of some fleets and redirected their effort to other species. In a number of cases this has lead to abandoning the use of time-series of commercial CPUE data in the assessments (cod, haddock, whiting, plaice). In some recent years there was misreporting of roundfish landings associated with restrictive quotas. Substantial underreporting of cod landings occurred in 1998 and 2001.

Several series of research vessel survey indices are available for most species. Quarterly data were available from the International Bottom Trawl Survey for a period of 6 years (1991-1996) and these were used in the assessment of some stocks. This survey covers quarters 1 and 3 since then. For herring and mackerel the

spawning stock sizes are estimated by annual larvae- and acoustic surveys (herring) or intermittent egg surveys (mackerel).

Analytical assessments were performed on cod, haddock, whiting, saithe, herring, mackerel, plaice, sole, sandeel, and Norway pout.

Multispecies considerations are not incorporated in the assessments or the forecasts for the North Sea stocks. However, average natural mortalities estimated by multispecies assessments are incorporated in the assessments of cod, haddock, whiting, herring, sprat, sandeel, and Norway pout.

Overview of resources

In the past 10 years the state of the stock for most roundfish and flatfish species in the North has further deteriorated. Some of these stocks have reached a historical low within this period. One of the major causes of this deterioration is the continuous very high level of exploitation. This exploitation has lead to a reduction in the number of age groups in the stocks and fishing opportunities have consequently become more dependent on the success of recruitment. Recruitment for most stocks is, however, very variable. For a number of species (cod, whiting, plaice) recruitment in most years has been lower than in previous decades. At the same time it is observed that a number of species (cod, haddock, whiting, sole, plaice) simultaneously show a reduction of growth. On the contrary, other (southern) species like sea bass and red mullet have increased and in some times attracted a fishery. There is considerable speculation on the reasons for the observed changes. The reduction in recruitment can be explained by a reduction in the production of eggs by the reduced spawning stocks, but it cannot be excluded that changes in the environment play a role. In the last 10 years the climate has changed not only on land but also in the sea, and mean temperatures in the sea have increased. Changes in the sea currents have also been observed. The changes in environmental conditions may be responsible as well for changes in the distribution and abundance of the different species.

In the North Sea all stocks of roundfish and flatfish species have been exposed to high levels of exploitation. The present assessments indicate that the fishing mortality in the last three years has been reduced for whiting and saithe, but not for cod and haddock. The cod stock is at a very low level. The stock of whiting has shown a continued decline over time but appears to be increasing again due to the reduction in fishing mortality. However, it is considered likely that the whiting stock is still outside safe biological limits. The saithe stock is now considered to be within safe biological limits. The stock of haddock presently profits from a good year class recruiting into the spawning stock, but the exploitation rate is still too high and the spawning stock is expected to decrease rapidly due to the very low recruitments, which followed the strong 1999 year class. Plaice and sole are outside safe biological limits and fishing mortality on both plaice and sole are high and unsustainable in the longer term. Norway pout and sandeel are short-lived species and their biomasses show large fluctuations in accordance with large variability of recruitment. The biomasses of Norway pout and sandeel in 2001 were high and these stocks are both considered within safe biological limits.

The herring stock in the North Sea collapsed in the mid-1970s due to heavy exploitation, but has recovered after a closure of the fisheries between 1977 and 1981. In the mid-1990s it declined again. In 1996, effective management measures have been implemented to reduce the catches in both the human consumption and industrial fishery. These measures resulted in a considerable reduction in the fishing mortality in 1996-2001. Additionally, the North Sea autumn-spawning herring showed a very high recruitment over the last years. The stock has been outside safe biological limits for a number of years, but has recovered to above $\mathbf{B}_{pa}$ and is expected to increase further. The herring stock is exploited in the North Sea and the Channel (Downs herring) by human consumption fisheries. By-catches of juvenile North Sea herring are taken in the industrial fishery for sprat in the North Sea and Division IIIa (Skagerrak/Kattegat). The sprat stock fluctuates considerably between years. The actual state of the sprat stock is not precisely known, but the biomass is thought to be high at present. The North Sea component of the North-East Atlantic mackerel stock collapsed in the early 1970s and shows no signs of recovery. Most of the mackerel catches taken in the northern North Sea in recent years originate from the western component.

Landings of **cod** in 2001 were 50 000 t. The spawning stock in 2002 has been estimated at 38 000 t, and has been decreasing rapidly over the last years. Recruitment has been below average since 1985 in all years, with the exception of the 1996 year class. The present assessment indicates a constant high fishing mortality in recent years. A recovery plan is urgently required to rebuild the stock.

The spawning stock of **saithe** (assessed for the North Sea and West of Scotland combined) is at a low level compared to the 1970s when it was more lightly exploited and recruitment was higher. In recent years it has increased slightly. Landings in 2001 in the North Sea were 95 000 t. Fishing mortality has almost continuously declined from the 1980s. The proportion of the stock available in area VI has been reduced from the 1980s.

Human consumption landings of **haddock** in 2001 were 39 000 t. Historically, the stock size has shown large variations due to the occasional occurrence of a very strong year class. The spawning stock size in 2001 has increased due to a large 1999 year class, but is expected to decrease rapidly due to a sequence of low recruitments after the strong 1999 year class. Fishing mortality remains too high.

The assessment of **whiting** has a lower precision than the assessment of some other stocks. Total landings have been gradually decreasing since 1976 and the landings in 2001, at 25 000 t, are the lowest observed in the time-series. There are indications that the stock has increased in recent years but that it is likely still outside safe biological limits.

The spawning stock of **plaice** decreased in the early 1990s and in 1997 was at the lowest observed level historically. Landings have decreased since 1990 and were 82 000 t in 2001. Fishing mortality has decreased but remains too high. At its present exploitation rate there is a high probability that the stock will remain below the levels observed in the 1970s and 1980s. The abundant 1996 year class was expected to increase the spawning stock, but a slower growth of this year class and increased discarding has reduced its contribution to the spawning stock.

Landings of **sole** were 20 000 t in 2001. The spawning stock is decreasing. The spawning stock in recent years mainly consisted of a large 1996 year class which has now mostly passed the fishery. Fishing mortality has reduced in recent years but is still too high.

Landings of **Norway pout** have been low in 2001 at 66 000 t. The spawning stock in 2001 was amongst the highest in the time-series, due to the large 1999 year class. The 2000 year class, however, was poor and the stock is expected to decline fast. Fishing mortality has generally decreased between 1974-1995 and has fluctuated around a low level since.

Landings of **sandeel** in 2001 were 862 000 t. Over the years, the spawning stock has been fluctuating without a trend. The spawning stock in 2001 was also around the long-term average. There is insufficient information to forecast the development of the stock in the short term.

The **herring** has recently recovered from a low and is currently considered to be above $\mathbf{B}_{pa}$. The stock is expected to increase further in the short term due to the large 1998 year class which matures in 2002. Catches in the human consumption and industrial fisheries in the North Sea remained stable in the last three years and were 323 000 t in 2001.

Landings of **sprat** in 2001 were 170 000 t. The state of the sprat stock is not precisely known but appears to be high.

The spawning stock of **mackerel** in the North Sea remains small. Recruitment to this stock component has been very low for many years. An egg survey in 2002 estimated a slightly increasing spawning stock size. The fisheries for mackerel in the North Sea rely on a much larger stock component, the western mackerel, which spawns outside the North Sea and which is present in the northern North Sea in the second half of the year.

The present state of the North Sea **horse mackerel** stock is not known. The last estimate from egg surveys in 1989–1991 indicates an SSB of about 240 000 t. The age composition of the relatively small catches suggests that the exploitation rate of juvenile fish may have increased in recent years.

The stock of ***Pandalus borealis*** in Division IVa (Norwegian Deep) and Division IIIa remains stable. The state of the stocks in Division IVa (Fladen Ground) and Division IVb (Farn Deep) is not known, as only insufficient data for assessments were available. The fishery in the latter two areas is opportunistic, strongly influenced by stock abundance and market prices.

Management advice

Reductions in fishing mortalities have been advised for several stocks, which are outside safe biological levels. Fishing mortality is generally high and reached for most stocks the highest historical values in recent decades. This is in itself a clear indication of excessive effort.

This, and the poor performance of TACs, as implemented, in reducing fishing mortality, leads ICES to reiterate that the required reductions in fishing mortality can only be achieved if reductions in effort are included in management.

Most fisheries on roundfish and flatfish in the North Sea are characterised by extensive discarding. Discarding and high-grading also take place in pelagic fisheries, but little and incomplete information on discarding practices in these fisheries is available. Management measures, which reduce the amount of juveniles caught, would contribute to the recovery of spawning stocks and benefit yields.

Specific advice is presented in the respective stock sections.

Mixed fisheries considerations

Many of the fleets in the North Sea operate on mixed aggregations of cod, haddock, and whiting, or mixed aggregations of sole, plaice, and cod (Table 3.5.1.3a). As trends in stocks of various species are generally not in synchrony, advice provided independently of the linkages between species may result in advised fishing mortalities that cannot be realized simultaneously within the context of mixed fisheries. This raises some concerns for stocks in need of special conservation efforts, such as those affected by recovery plans. For instance. If the reduction of fishing mortality (and effort) required for cod is used as a minimum reduction for the other species taken in a mixed fishery, TACs would have to be adjusted downward for some of the species in the mix. An alternative would be to adjust effort, perhaps on a fleet-by-fleet basis as per the proposed recovery plan, so as to meet the objectives of recovery efforts on cod.

North Sea Commission Fisheries Partnership Assessment Consultations

In August 2002, the results of a number of assessments of stocks in the North Sea (cod, saithe, and plaice) were presented at assessment consultations with the North Sea Commission Fisheries Partnership. The meeting was held at ICES HQ. The chair of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) presented the results of the assessments. Three independent scientific experts from the USA and Canada provided a scientific review of the assessments and representatives from a number of fishing organisations around the North Sea had the opportunity to exchange views with the ICES scientists about the state of the stocks and the development in the fisheries. The fishermen's representatives expressed general agreement with the assessment results for cod and saithe, but they had different views on the state of the plaice stock.

The Consultation Meeting met its main objectives of making the assessments more open and transparent, and identifying additional data that might improve the assessments. The presence of the independent experts reassured fishermen of the quality of the assessments and enabled all aspects of them to be explored. Fishermen opined that if the assessments were to become fully transparent then the format, presentation, and language of the assessment report would need to be modified. They also emphasised the need for care in describing the state of fish stocks.

Fishermen were prepared to assist with the provision of additional and improved information. Both they and the scientists saw advantages in fishermen being present at an early stage in the assessments to provide supporting information on the fisheries. Fishermen also pointed to the valuable information held in their log books, and urged that it be used. Scientists too benefited from the meeting and recognised the value of engaging with fishermen in the joint collection of data and in cooperative research. This initiative could be taken further through a Joint Partnership/ICES Study Group on Fishers' Information.

Results of a survey among fishermen around the North Sea

The North Sea Commission Fisheries Partnership (NSC-FP) has initiated a survey among fishermen fishing in the North Sea and in the waters west of Scotland. The fishermen were asked to compare the state of their catch in January to June 2002 with a similar period last year. Findings were based on the catch, not on the landings. The results are based on questions relating to the principal commercial species of the North Sea (cod, haddock, whiting, saithe, monkfish, *Nephrops*, plaice, and sole). For the purpose of the survey, the North Sea was subdivided into zones based upon ICES rectangles and consistent with the areas used for the International Bottom Trawl Survey (IBTS). The survey represents the views of 778 fishermen operating across the North Sea. Results were presented graphically and in numbers, arranged by species. The results were both presented for the North Sea as a whole and by different areas in the North Sea.

ACFM drew the following observations from the data presented:

- **Cod in the North Sea.** The overall abundance of cod in the North Sea is unclear, with almost equal numbers of fishermen reporting more and less abundance of cod. The northern areas (1, 7, and 8) were noted to have more or much more cod, whereas in the southern areas most fishermen indicated that there was less or much less cod. This confirms the information from the research vessel surveys that indicated the same trends in distribution. The results are also similar to the results presented last year by the fisheries organizations.

- **Haddock in the North Sea.** The fishermen noted the abundance of the strong 1999 year class and reported having observed more or much more haddock in the North Sea. This trend is most obvious in the northern areas of the North Sea. The size range of the fish is mostly small fish, which is consistent with the strong year class.

- **Whiting in the North Sea.** Most responses in the southern and eastern areas of the North Sea indicated a higher stock size of whiting, whereas in the northern and western areas the fishermen experienced either the same or less whiting. This is consistent with the observations from the research surveys.

- **Saithe in the North Sea.** The abundance trend for saithe is not clear. Around 38% of the fishermen reported more or much more saithe, while 21% reported less or much less. According to the fishermen, saithe is mostly to be found in the northern-most areas, which is consistent with the results of the commercial CPUE series and the Norwegian acoustic survey.

- **Plaice in the North Sea.** According to the fishermen, catches in the southern areas of the North Sea have been more or much more according to 65% of the fishermen. 31% of the fishermen reported mostly small plaice. The perception of the fishermen is broadly consistent with the results of the research surveys and the assessment, although the absolute level of increase in the spawning stock that is indicated by the assessment may be less than can be derived from the fishermen's survey.

- **Sole in the North Sea.** Around 55% of the fishermen indicated having seen either more or much more sole in the southern areas of the North Sea, which is the main area of distribution for this species. ACFM finds it difficult to match this with the results of the assessments, which indicates a slightly decreasing SSB. The difference may be caused by the fact that fishermen observe the catchable fish (total biomass), whereas the assessment concentrates on the mature fish (spawning stock).

ACFM comments

ACFM welcomed the information presented by the NSC-FP and found the information useful. The spatial disaggregation provided makes it possible to track changes in the distribution of the fish stocks to the observations from the research surveys.

It is the policy of ICES to encourage and facilitate this sort of dialogue between scientists and the fishing industry. The documentation at this ACFM meeting is a very encouraging start to that process.

The enquiry indicates some diversity of opinions. Impressions of stocks vary between individual fishermen, but also between countries and areas.

The information on the status of fish stocks from the fishermen deals with abundance (in weight?) and with the size distribution in the catches. Comparisons are short term, i.e. 1-3 years. There is only rarely a reference to the fishing mortality or a proxy thereof. The ICES assessment information is expressed in different ways, the SSB is often compared to $\mathbf{B}_{pa}$ or $\mathbf{B}_{lim}$, while the short-term trend is mostly not referred to. In order to compare the information these short-term trends have been inferred, based on the graphs of SSB presented in the advisory report.

The material provided by the industry will be sent to the relevant ICES assessment Working Groups for their consideration in the 2003 round of meetings.

In 2001 results of a similar survey were presented. Compared to that survey the 2002 exercise represents a significant improvement with respect to homogeneity of the questionaire and analysis. In analysing the results care should be taken that responses are biased towards the bigger vessels having a much higher response rate than smaller vessels, e.g. only 4% of the responses from the North Sea/Skagerrak/Kattegat are from vessels < 15m. Also, the responses rate differs significantly between countries.

At present, the nature of the data provided means that they cannot be handled in a quantitative way, but the collection and reporting of quantitative data is a goal that both sides should work towards achieving. ICES and NSCFP has agreed to establish a joint study group that will work with the problems in such surveys. This group will consider and develop appropriate methods of collecting and reporting data.

Table 3.5.1.1 Species composition in the Danish and Norwegian small-meshed fisheries in the North Sea ('000t). (Data provided by Working Group members).

Year	Sandeel	Sprat	Herring	Norway pout	Blue whiting	Haddock	Whiting	Saithe	Other	Total
1974	525	314	-	736	62	48	130	42		1857
1975	428	641	-	560	42	41	86	38		1836
1976	488	622	12	435	36	48	150	67		1858
1977	786	304	10	390	38	35	106	6		1675
1978	787	378	8	270	100	11	55	3		1612
1979	578	380	15	320	64	16	59	2		1434
1980	729	323	7	471	76	22	46	-		1674
1981	569	209	84	236	62	17	67	1		1245
1982	611	153	153	360	118	19	33	5	24	1476
1983	537	88	155	423	118	13	24	1	42	1401
1984	669	77	35	355	79	10	19	6	48	1298
1985	622	50	63	197	73	6	15	8	66	1100
1986	848	16	40	174	37	3	18	1	33	1170
1987	825	33	47	147	30	4	16	4	73	1179
1988	893	87	179	102	28	4	49	1	45	1388
1989	1039	63	146	162	28	2	36	1	59	1536
1990	591	71	115	140	22	3	50	8	40	1040
1991	843	110	131	155	28	5	38	1	38	1349
1992	854	214	128	252	45	11	27	-	30	1561
1993	578	153	102	174	17	11	20	1	27	1083
1994	769	281	40	172	11	5	10	-	19	1307
1995	911	278	66	181	64	8	27	1	15	1551
1996	761	81	39	122	93	5	5	0	13	1119
1997	1091	99	15	126	46	7	7	3	21	1415
1998	956	131	16	72	72	5	3	3	24	1282
1999	678	166	23	97	89	4	5	2	40	1104
2000	655	191	24	176	98	8	8	6	21	1187
2001	810	156	21	59	76	6	7	3	14	1152
Avg	730	202	64	252	59	13	40	9	35	1389

Year	Sandeel	Sprat	Herring	Norway pout	Blue whiting	Haddock	Whiting	Saithe	Other	Total
1997 q1	37	7	1	11	4	0	1	0	2	65
1997 q2	802	1	2	7	11	3	2	0	4	833
1997 q3	238	28	5	59	16	3	2	2	11	363
1997 q4	13	63	7	49	14	1	1	0	5	155
1998 q1	37	7	7	13	11	1	0	0	5	80
1998 q2	754	1	2	8	12	2	1	0	4	784
1998 q3	153	60	4	29	38	2	1	2	9	298
1998 q4	12	63	4	23	12	0	0	0	6	121
1999 q1	14	14	4	8	23	1	1	1	8	74
1999 q2	507	2	4	22	30	1	2	1	8	577
1999 q3	139	129	10	41	18	1	2	0	7	347
1999 q4	17	21	6	25	17	1	1	0	18	106
2000 q1	10	42	1	9	13	1	0	0	5	82
2000 q2	581	2	4	17	32	3	2	0	4	646
2000 q3	63	133	10	30	39	2	3	6	5	291
2000 q4	0	15	8	119	14	2	3	0	8	169
2001 q1	12	40	2	20	15	1	1	0	3	94
2001 q2	462	1	2	10	32	3	1	2	4	517
2001 q3	314	44	4	4	12	1	2	0	5	386
2001 q4	22	72	13	24	16	1	2	0	2	152

Table 3.5.1.2 Landings of demersal, pelagic, and industrial species from the North Sea. For some species Divisions IIIa, Iva, and/or VIId have been included.

Species	Cod	Haddock		Whiting		Saithe		Sole	Plaice	N pout	Sandeel	Sprat	Herring	Mackerel	Horse Mack.	Demersal	Pelagic	Industrial	Total
Type		hc	ib	hc	ib	hc	ib			i	i	i	p	p	p	Total	Total	Total	
Area	3a,4,7d	4	4	4,7d	4,7d	3a,4	3a,4	4	4	3a,4	4	4	3a,4,7d	3a,4	4				
1970	226	525	180	83	115	163	59	20	130	238	191	51	563	323	12	1147	898	834	2879
1971	328	235	32	61	72	218	35	24	114	305	382	95	520	243	32	980	795	921	2696
1972	354	193	30	64	61	218	28	21	123	445	359	92	498	189	8	973	695	1015	2683
1973	239	179	11	71	90	195	31	19	130	346	297	228	484	327	42	833	853	1003	2689
1974	214	150	48	81	130	231	42	18	113	736	524	314	275	298	31	807	604	1794	3205
1975	205	147	41	84	86	240	38	21	108	560	428	641	313	263	10	805	586	1794	3185
1976	234	166	48	83	150	253	67	17	114	435	488	622	175	304	9	867	488	1810	3165
1977	209	137	35	78	106	190	6	18	119	390	786	304	46	258	1	751	305	1627	2683
1978	297	86	11	97	55	132	3	20	114	270	787	398	11	149	5	746	165	1524	2435
1979	270	83	16	107	59	113	2	23	145	329	578	380	25	152	1	741	178	1364	2283
1980	294	99	22	101	46	120	0	16	140	483	729	323	71	87	2	770	160	1603	2533
1981	335	130	17	90	67	121	1	15	140	239	569	209	175	64	7	831	246	1102	2179
1982	303	166	19	81	33	161	5	22	155	396	612	153	275	35	3	888	313	1218	2419
1983	259	159	13	88	24	167	1	25	144	452	537	88	387	41	4	842	432	1115	2389
1984	228	128	10	86	19	192	6	27	156	393	669	77	429	39	25	817	493	1174	2484
1985	213	159	6	62	15	192	8	24	160	206	623	50	614	47	24	810	685	908	2403
1986	196	166	3	64	18	163	1	18	165	178	848	16	671	236	21	772	928	1064	2764
1987	210	108	4	68	16	145	4	17	154	149	825	32	792	291	21	702	1104	1030	2836
1988	176	105	4	56	49	106	1	22	154	110	893	87	888	309	62	619	1259	1144	3022
1989	140	76	2	45	43	92	2	22	170	172	1039	63	788	279	112	545	1179	1321	3045
1990	125	52	3	47	51	88	2	35	156	152	591	73	645	301	145	503	1091	872	2466
1991	102	45	5	53	38	98	1	34	148	193	843	112	658	359	78	480	1095	1192	2767
1992	114	70	11	52	27	92	0	29	125	300	855	124	717	364	114	482	1195	1317	2994
1993	122	80	11	53	20	105	1	31	117	184	579	200	671	388	140	508	1199	995	2702
1994	111	81	4	49	10	102	0	33	110	183	766	320	568	475	113	486	1156	1283	2925
1995	136	75	8	46	27	113	0	30	98	241	918	357	639	323	98	498	1060	1551	3109
1996	126	76	5	41	5	110	0	23	82	166	777	137	306	211	26	458	543	1090	2091
1997	124	79	7	36	6	103	0	15	83	169	1140	103	273	225	79	440	577	1425	2442
1998	146	77	5	28	3	100	0	21	71	80	1004	164	380	265	31	443	676	1256	2375
1999	96	64	4	30	5	107	0	23	81	92	735	188	372	300	65	401	737	1024	2162
2000	71	46	8	28	9	87	0	23	81	184	699	196	372	272	32	336	676	1096	2108
2001	50	39	8	25	7	95	3	20	82	66	862	170	364	312	20	311	696	1116	2123
avg	*195*	*124*	*20*	*64*	*46*	*144*	*11*	*23*	*124*	*276*	*685*	*199*	*436*	*242*	*43*	*675*	*721*	*1237*	*2633*

hc = human consumption, ib = industrial by-catch, i = industrial, p = pelagic

Table 3.5.1.3a Human consumption landings (t) in demersal fisheries by fleet and by species according to national EU logbook databases averaged over the years 1999-2001 (see Table 3.5.1.3b for explanation of fleet codes).

Fleet	cod	haddock	plaice	saithe	sole	whiting	total	%cod	%had	%ple	%sai	%sol	%whg
B_MIS	253	22	267	1	101	156	799	0.3%	0.0%	0.3%	0.0%	0.5%	0.6%
B_OTB	472	35	333	89	70	170	1170	0.6%	0.1%	0.4%	0.1%	0.3%	0.6%
B_TBB	2490	432	5924	25	1839	180	10889	3.4%	0.8%	7.3%	0.0%	8.4%	0.6%
DK_GN	7359	167	2366	412	695	4	11003	10.1%	0.3%	2.9%	0.4%	3.2%	0.0%
DK_MIS	1354	283	1447	732	13	41	3869	1.9%	0.6%	1.8%	0.7%	0.1%	0.1%
DK_OTB1	216	14	1349	9	7	1	1595	0.3%	0.0%	1.7%	0.0%	0.0%	0.0%
DK_OTB2	661	123	1639	512	14	19	2967	0.9%	0.2%	2.0%	0.5%	0.1%	0.1%
DK_PTB1	130	34	14	16	0	0	194	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
DK_PTB2	844	869	74	199	0	2	1987	1.2%	1.7%	0.1%	0.2%	0.0%	0.0%
DK_SDN1	996	78	3216	21	0	0	4311	1.4%	0.2%	4.0%	0.0%	0.0%	0.0%
DK_SDN2	996	280	475	112	0	2	1865	1.4%	0.5%	0.6%	0.1%	0.0%	0.0%
DK_TBB1	15	1	220	0	1	0	237	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%
DK_TBB2	118	9	1887	5	7	0	2026	0.2%	0.0%	2.3%	0.0%	0.0%	0.0%
EW_GN	1457	21	21	3	98	40	1639	2.0%	0.0%	0.0%	0.0%	0.4%	0.1%
EW_MIS	1217	152	13	1	17	48	1447	1.7%	0.3%	0.0%	0.0%	0.1%	0.2%
EW_OTB1	1176	546	235	212	130	639	2938	1.6%	1.1%	0.3%	0.2%	0.6%	2.3%
EW_OTB2	2657	1756	421	1544	11	1042	7433	3.7%	3.4%	0.5%	1.5%	0.1%	3.7%
EW_SDN1	24	2	493	0	0	0	518	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%
EW_SDN2							0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EW_TBB1	34	2	222	0	41	3	302	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%
EW_TBB2	427	57	9306	3	317	12	10123	0.6%	0.1%	11.4%	0.0%	1.4%	0.0%
FR_GN	225	0	186	0	606	0	1018	0.3%	0.0%	0.2%	0.0%	2.8%	0.0%
FR_MIS	8	0	4	0	2	0	14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
FR_OTB1	900	82	188	0	33	3076	4278	1.2%	0.2%	0.2%	0.0%	0.1%	11.0%
FR_OTB2	148	536	1	21984	0	179	22848	0.2%	1.0%	0.0%	21.5%	0.0%	0.6%
FR_TBB	27	0	123	0	67	0	217	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%
GER_GN	26	0	2	4	33	0	66	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%
GER_MIS	3	1	1		0	0	5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
GER_OTB	379	21	1550	0	17	220	2187	0.5%	0.0%	1.9%	0.0%	0.1%	0.8%
GER_OTB	618	237	168	9564	1	33	10622	0.9%	0.5%	0.2%	9.4%	0.0%	0.1%
GER_PTB	239	39	7	1	0	6	291	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%
GER_PTB	375	153	8	1	0	14	550	0.5%	0.3%	0.0%	0.0%	0.0%	0.0%
GER_SDN	259	28	143	1	0	16	446	0.4%	0.1%	0.2%	0.0%	0.0%	0.1%
GER_SDN	404	72	5	173	0	2	656	0.6%	0.1%	0.0%	0.2%	0.0%	0.0%
GER_TBB	82	1	1008	0	772	23	1884	0.1%	0.0%	1.2%	0.0%	3.5%	0.1%
GER_TBB	101	2	1227	0	413	28	1772	0.1%	0.0%	1.5%	0.0%	1.9%	0.1%
N _OTB1	288	269	4	10919	0	1	11481	0.4%	0.5%	0.0%	10.7%	0.0%	0.0%
N _OTB2	200	166	5	14613	2	0	14984	0.3%	0.3%	0.0%	14.3%	0.0%	0.0%
N _TBB1	4	4	58	0	0	2	69	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
N _TBB2	49	3	692	0	183	3	930	0.1%	0.0%	0.9%	0.0%	0.8%	0.0%
NL_GN	134	0	1	0	19	2	156	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%
NL_MIS	125	4	92	0	12	104	337	0.2%	0.0%	0.1%	0.0%	0.1%	0.4%
NL_OTB	24	0	0	0	0	2	27	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL_OTB1	1128	2	209	0	19	358	1716	1.6%	0.0%	0.3%	0.0%	0.1%	1.3%
NL_OTB2	381	24	516	0	4	255	1179	0.5%	0.0%	0.6%	0.0%	0.0%	0.9%
NL_PTB	31	3	1	0	0	0	35	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NL_PTB1	287	15	5	0	1	50	357	0.4%	0.0%	0.0%	0.0%	0.0%	0.2%
NL_PTB2	771	42	33	0	1	346	1192	1.1%	0.1%	0.0%	0.0%	0.0%	1.2%
NL_TBB	29	2	386	0	177	12	604	0.0%	0.0%	0.5%	0.0%	0.8%	0.0%
NL_TBB1	220	3	1849	0	1426	90	3587	0.3%	0.0%	2.3%	0.0%	6.5%	0.3%
NL_TBB2	3066	88	32274	0	13441	906	49774	4.2%	0.2%	39.7%	0.0%	61.2%	3.2%
SC_OTB1	6665	12251	691	1653	0	4950	26210	9.2%	24.0%	0.8%	1.6%	0.0%	17.7%
SC_OTB2	436	746	82	47	0	599	1909	0.6%	1.5%	0.1%	0.0%	0.0%	2.1%
SC_OTB3	1401	2570	60	1036	0	353	5420	1.9%	5.0%	0.1%	1.0%	0.0%	1.3%
SC_PTB	4326	8853	326	920	0	3984	18410	6.0%	17.3%	0.4%	0.9%	0.0%	14.2%
SC_SDN	3539	9876	372	774	0	3192	17753	4.9%	19.3%	0.5%	0.8%	0.0%	11.4%
ZZ	22835	10141	9113	36503	1361	6838	86792	31.4%	19.8%	11.2%	35.8%	6.2%	24.4%
TOTAL	**72627**	**51115**	**81309**	**102089**	**21953**	**27999**	**357092**	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 3.5.1.3b Legend to Table 3.5.1.3a.

Code	Country	Gear	HP	Features
B_MIS	Belgium	Miscelleneous		
B_OTB	Belgium	Bottom Otter Trawl		
B_TBB	Belgium	Bottom Beam Trawl		
DK_GN	Denmark	Gill Net		
DK_MIS	Denmark	Miscelleneous		
DK_OTB1	Denmark	Bottom Otter Trawl	< 300	
DK_OTB2	Denmark	Bottom Otter Trawl	> 300	
DK_PTB1	Denmark	Bottom Pair Trawl	< 300	
DK_PTB2	Denmark	Bottom Pair Trawl	> 300	
DK_SDN1	Denmark	Seine	< 300	
DK_SDN2	Denmark	Seine	> 300	
DK_TBB1	Denmark	Bottom Beam Trawl	< 300	
DK_TBB2	Denmark	Bottom Beam Trawl	> 300	
EW_GN	England & Wales	Gill Net		
EW_MIS	England & Wales	Miscelleneous		
EW_OTB1	England & Wales	Bottom Otter Trawl	< 300	
EW_OTB2	England & Wales	Bottom Otter Trawl	> 300	
EW_SDN1	England & Wales	Seine	< 300	
EW_SDN2	England & Wales	Seine	> 300	
EW_TBB1	England & Wales	Bottom Beam Trawl	< 300	
EW_TBB2	England & Wales	Bottom Beam Trawl	> 300	
FR_GN	France	Gill Net		
FR_MIS	France	Miscelleneous		
FR_OTB1	France	Bottom Otter Trawl		Coastal trawlers
FR_OTB2	France	Bottom Otter Trawl		Offshore trawlers
FR_TBB	France	Bottom Beam Trawl		
GER_GN	Germany	Gill Net		
GER_MIS	Germany	Miscelleneous		
GER_OTB1	Germany	Bottom Otter Trawl	< 300	
GER_OTB2	Germany	Bottom Otter Trawl	> 300	
GER_PTB1	Germany	Bottom Pair Trawl	< 300	
GER_PTB2	Germany	Bottom Pair Trawl	> 300	
GER_SDN1	Germany	Seine	< 300	
GER_SDN2	Germany	Seine	> 300	
GER_TBB1	Germany	Bottom Beam Trawl	< 300	
GER_TBB2	Germany	Bottom Beam Trawl	> 300	
N_OTB1	Norway	Bottom Otter Trawl	< 2000	
N_OTB2	Norway	Bottom Otter Trawl	> 2000	
N_TBB1	Norway	Bottom Beam Trawl	< 2000	
N_TBB2	Norway	Bottom Beam Trawl	> 2000	
NL_GN	Netherlands	Gill Net		
NL_MIS	Netherlands	Miscelleneous		
NL_OTB	Netherlands	Bottom Otter Trawl	unspec	
NL_OTB1	Netherlands	Bottom Otter Trawl	< 300	
NL_OTB2	Netherlands	Bottom Otter Trawl	> 300	
NL_PTB	Netherlands	Bottom Pair Trawl	unspec	
NL_PTB1	Netherlands	Bottom Pair Trawl	< 300	
NL_PTB2	Netherlands	Bottom Pair Trawl	> 300	
NL_TBB	Netherlands	Bottom Beam Trawl	unspec	
NL_TBB1	Netherlands	Bottom Beam Trawl	< 300	
NL_TBB2	Netherlands	Bottom Beam Trawl	> 300	
SC_OTB1	Scotland	Bottom Otter Trawl		Nephrops fis
SC_OTB2	Scotland	Bottom Otter Trawl		Light trawlers
SC_OTB3	Scotland	Bottom Otter Trawl		Heavy trawlerd
SC_PTB	Scotland	Bottom Pair Trawl		
SC_SDN	Scotland	Seine		
ZZ	UNSPECIFIED			

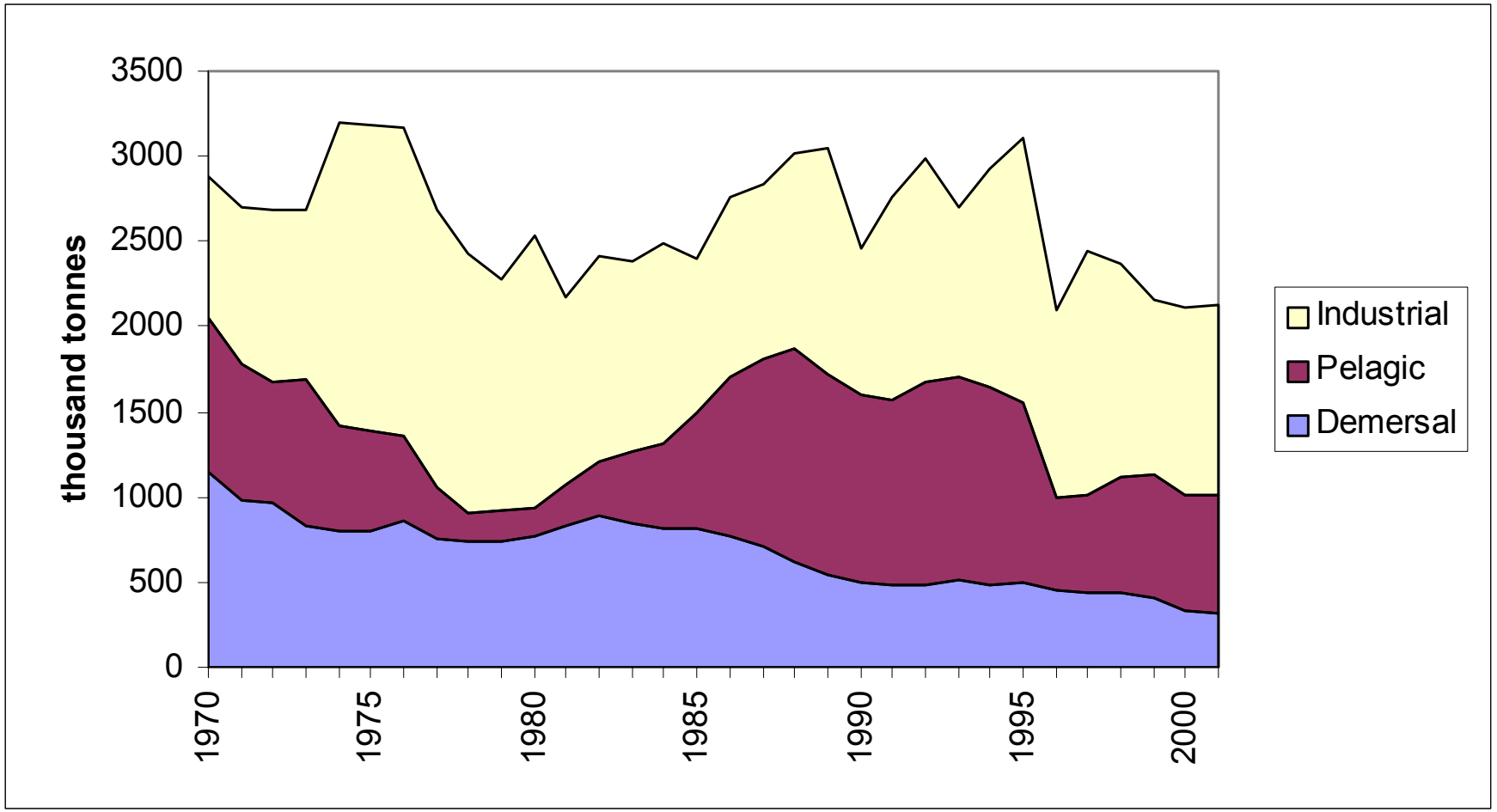


Figure 3.5.1.1 Landings from North Sea. Data from Table 3.5.1.2.

3.5.2 Cod in Subarea IV (North Sea), Division VIId (Eastern Channel), and Division IIIa (Skagerrak)

State of stock/exploitation: The stock is outside safe biological limits. The spawning stock is estimated to have been below $\mathbf{B}_{pa}$ since 1984 and in the region of $\mathbf{B}_{lim}$ since 1990. SSB in 2001 is estimated at a new historic low at about 30 000 t and is now estimated 50% lower than last year. The SSB in 2002 is estimated around 38 000 t. Fishing mortality has remained at about the historic high and above $\mathbf{F}_{pa}$ since the early 1980s and F in 2001 is estimated to be above $\mathbf{F}_{lim}$. Except for the 1996 year class, recruitment has been below average in all years since 1987. The 1997 and 2000 year classes are estimated to be the poorest on record.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the cod stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 70 000 t ($\boldsymbol{B}_{lim}$).*
2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.65 for appropriate age groups as defined by ICES.*
3. *Should the SSB fall below a reference point of 150 000 t ($\boldsymbol{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 150 000 t.*
4. *In order to reduce discarding and to enhance the spawning biomass of cod, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*
5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 70 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 150 000 t. This is the previously agreed MBAL and affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 0.86, the fishing mortality estimated to lead to impaired recruitment	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to have a 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of assessments.

Technical basis:

$\mathbf{B}_{lim}$ = Rounded $\mathbf{B}_{loss}$ = 70 000 t.	$\mathbf{B}_{pa}$ = Previous MBAL and signs of impaired recruitment below: 150 000 t.
$\mathbf{F}_{lim} = \mathbf{F}_{loss} = 0.86$.	$\mathbf{F}_{pa}$ = Approx. 5th percentile of $\mathbf{F}_{loss}$; implies an equilibrium biomass >$\mathbf{B}_{pa}$ and a less than 10% probability that (SSBMT<$\mathbf{B}_{pa}$).

Advice on management: Given the very low stock size, the recent poor recruitments, and continued high fishing mortality despite management efforts to promote stock recovery, ICES recommends a closure of all fisheries for cod as a targeted species or by-catch. In fisheries where cod comprises solely an incidental catch there should be stringent restrictions on the catch and discard rates of cod, with effective monitoring of compliance with those restrictions.

These and other measures that may be implemented to promote stock recovery should be kept in place until there is clear evidence of the recovery of the stock to a size associated with a reasonable probability of good recruitment and there is evidence that productivity has improved. The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the behavior of the fleets are unknown, and therefore historic experience and data are not considered a reliable basis for medium-

term forecasts of stock dynamics under various rebuilding scenarios.

Relevant factors to be considered in management: Although large short-term losses will be incurred in many North Sea fisheries, the advised measures are required if the cod stock is to reach a level where it can regain historic productivity. The advice will likely result in greatly reduced harvesting of other stocks where the fisheries take cod as part of a mixed-species fisheries, particularly haddock, whiting. Harvesting of other stocks such as plaice, sole, and *Nephrops* may also require substantial reductions and/or changes in times, areas or methods fished, if it is shown that, in recent years, a significant proportion of the annual cod catch has been caught in the fisheries for them. However, the current state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that more stringent action is required.

Time and area closures for particular fisheries may be a tool in rebuilding this stock, and their effect can be considered in evaluating harvest opportunities for other species.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for other species down to near zero, then these programs could be considered in management of such fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include fully transparent method for ensuring that their catches of cod are fully and credibly reported.

The newly agreed increases in minimum mesh size for North Sea fisheries, if implemented fully, would have a positive effect on the exploitation pattern of North Sea cod when fisheries taking cod eventually reopen. However, the implementation and enforcement of these measures has not been evaluated yet.

North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001. Results are expressed as the percentage deviation from baseline simulations, which assume that no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures, i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial by-catch	Spawning stock biomass
2002	<1%	-	-	
2003	<1%	-	-	<1%
Long Term	7%	-	-	5%

The absence of information on discards in the cod assessment and forecasts means that the effect of increased selectivity at the youngest ages is not accounted for in the above table.

The effects of the emergency closure implemented in 2001 has not been evaluated by ICES, but that closure was likely to have contributed little to the recovery of the stock.

In recent years the growth rate of North Sea cod has declined. The reasons for this are not known, but if growth remains slow, the rate of recovery of SSB will be delayed. Slower growth may also expose juveniles longer to discarding.

The catches of this stock in Division VIId is managed by TAC covering Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1. Managers should take this into account when setting a TAC for Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1.

Catch forecast for 2003:
Basis: F(sq) = F(99–01) = 1.11; Landings (2002) = 76.6; SSB(2003) = 35.4.

F(2003)	Basis	Landings in combined area (2003)	Lndgs in IIIa (2003) Skagerrak	Lndgs in IV (2003)	Lndgs in VIId (2003)	SSB (2004)
0	$0*\mathbf{F}_{sq}$	0	0	0	0	87.1
0.11	$0.1*\mathbf{F}_{sq}$	10.3	1.3	8.8	0.3	78.6
0.22	$0.2*\mathbf{F}_{sq}$	19.7	2.4	16.8	0.5	71.0
0.33	$0.3*\mathbf{F}_{sq}$	28.2	3.4	24.0	0.8	64.2
0.44	$0.4*\mathbf{F}_{sq}$	36	4.4	30.6	1.0	58.1
0.55	$0.5*\mathbf{F}_{sq}$	43.1	5.3	36.7	1.2	52.7
0.65	$\mathbf{F}_{pa}=0.59*\mathbf{F}_{sq}$	49	6.0	41.7	1.3	48.3
0.78	$0.7*\mathbf{F}_{sq}$	55.7	6.8	47.4	1.5	43.5
0.89	$0.8*\mathbf{F}_{sq}$	61.2	7.5	52.1	1.7	39.6
1	$0.9*\mathbf{F}_{sq}$	66.2	8.1	56.3	1.8	36.1
1.11	$1*\mathbf{F}_{sq}$	70.9	8.6	60.3	1.9	33.0

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Landings by Division or Subarea are obtained by pro-rating the combined area catch by 0.122 for Division IIIa, 0.851 for Subarea IV, and 0.027 for Division VIId. These factors are the ratio of the mean catches by area to the combined area for the period 1992–1996.

Rebuilding plan: A rebuilding plan for the cod stock in the North Sea has recently been proposed by the European Commission. Although ICES advises a closure and not a rebuilding plan with lowered fishing on cod, it did conduct a review of the proposed plan. The proposal consists of a set of measures that aim at increasing the spawning stock biomass by 30% per year. This is to be achieved by reductions in fishing mortalities and maximum allowed changes in TACs. The reductions in fishing mortalities are to be accompanied by reductions in fishing effort.

The rebuilding plan has been evaluated by the Scientific, Technical and Economic Committee on Fisheries (STECF) and by the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK). The evaluations indicate that the proposed recovery plan is likely to lead to a recovery period of at least 8 years. It was further noted that evaluations were sensitive to the assumptions used so that the actual number of years required for recovery cannot be estimated precisely. Notably, the bias in the assessment may seriously alter the perception of recovery to a period in the order of 12 years. Discards have not been included in the evaluation, which limits the generality of the results. ICES also notes that the current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the behavior of the fleets are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios. On the basis of this evaluation ICES concludes that the proposed rebuilding plan cannot be accepted as likely to lead to safe and rapid rebuilding of this cod stock.

Comparison with previous assessment and advice: Fishing mortality has consistently been underestimated and stock size overestimated in previous assessments, and the current assessment suffers from the same problem. The quality of the assessment improved in 2000 and 2001 due to the exclusion of commercial CPUE data. This year the assessment again showed retrospective bias, possibly because of a decrease in the quality of the landings data in 2001.

Elaboration and special comment: Cod are taken by towed gears in mixed roundfish fisheries, which include haddock and whiting. They are also taken in directed fisheries using fixed gears. By-catches of cod occur in flatfish and shrimp fisheries especially in the Southern North Sea and in *Nephrops* fisheries. Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the interpretation of Table 3.5.1.3 is hindered by the fact that discards are not included in the table so that the actual catch of the different fleet segments cannot be evaluated. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

It was apparent that commercial CPUE data used in calibrating previous assessments had a strong tendency to give a more optimistic estimate of the state of the stock than research vessel survey data. There are a number of reasons for believing that the commercial CPUE data may be biased. For example, there have been substantial changes in the distribution of commercial fleet effort and the nature of vessels in the fleet, which may affect abundance indices derived from these sources. In addition, commercial fleets may target areas of high cod abundance leading to artificially higher abundance estimates. It should be noted that

differing signals between commercial CPUE data and survey data affected assessments of some Canadian cod stocks, resulting in an over-optimistic decision on the management of these stocks before they collapsed. In view of these problems, no commercial CPUE data are used in the assessment of North Sea cod.

A number of analyses were performed using a variety of different assessment models. All these approaches gave very similar results. While no method is without uncertainty, the fact that a variety of methods give comparable results increases confidence in the current assessment.

There is reason to suspect that the landings for 2001 were under-reported. The TAC implied a reduction in fishing mortality to the order of 50%, and the reported landings were less than the TAC. The results of a time-series analysis indicated predicted removals in 2001 almost double the reported landings.

The North Sea Commission Fisheries Partnership has reviewed the assessment for North Sea cod in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the review was that the assessment was carried out according to appropriate standards. The fishermen broadly shared the perception on the development in the stock.

Following the review by the North Sea Commission Fisheries Partnership a survey has been conducted among fishermen in order to evaluate their perceptions of the stock and catches in 2002 in relation to 2001. The results of that survey were made available to ACFM and indicated that fishermen differ in their perception of stock abundance. Fishermen in the North tend to see more fish than last year, and fishermen in the South tend to see fewer fish.

The assessment is based on analysis of catch-at-age data calibrated with data from three research vessel surveys.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM:02).

EC (2001). Proposal for a council regulation establishing measures for the recovery of cod and hake stocks. COM(2001) 724.

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-8	Yield/R	SSB/R
Average Current	1.107	0.514	0.238
$\mathbf{F}_{max}$	0.248	0.731	2.564
$\mathbf{F}_{0.1}$	0.148	0.685	4.244
$\mathbf{F}_{med}$	0.823	0.563	0.410

Landings for each of the three parts of this combined assessment area and for the combined area are given in Tables 3.5.2.1-2.

North Sea (Subarea IV)

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	SSB recovery; TAC	100–125	175	167	182
1988	70% of F(86); TAC	148	160	142	157
1989	Halt SSB decline; protect juveniles; TAC	124	124	110	116
1990	80% of F (88); TAC	113	105	99	105
1991	70% of effort (89)		100	87	89
1992	70% of effort (89)		100	98	97
1993	70% of effort (89)		101	94	105
1994	Significant effort reduction		102	87	95
1995	Significant effort reduction		120	112	120
1996	80% of F(94) = 0.7	141	130	104	107
1997	80% of F(95) = 0.65	135	115	100	102
1998	F(98) should not exceed F(96)	153	140	114	122
1999	F = 0.60 to rebuild SSB	125	132	80	78
2000	F less than 0.55	<79	81	62	59
2001	lowest possible catch	0	48.6	42.3	41
2002	lowest possible catch	0	49.3		
2003	Closure	0			

Skagerrak (Division IIIa)

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings[1]
1987	F = $\mathbf{F}_{max}$	<21	22.5	20.9
1988	Reduce F		21.5	16.9
1989	F at $\mathbf{F}_{med}$	<23	20.5	19.6

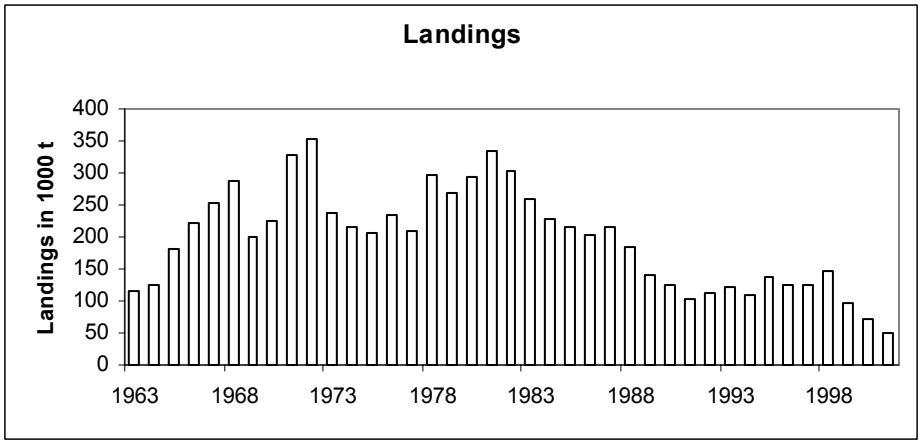
1990	F at $\mathbf{F}_{med}$; TAC	21.0	21.0	18.6
1991	TAC	15.0	15.0	12.4
1992	70% of F(90)		15.0	14.8
1993	Precautionary TAC		15.0	15.3
1994	No long-term gain in increased F + precautionary TAC		15.5	13.9
1995	If required precautionary TAC; link to North Sea		20.0	12.1
1996	If required precautionary TAC; link to North Sea		23.0	16.4
1997	If required precautionary TAC; link to North Sea		16.1	14.9
1998	If required precautionary TAC; link to North Sea	21.9	20.0	15.3
1999	F = 0.60 to rebuild SSB	17.9	19.0	11.0
2000	F less than 0.55	<11.3	11.6	9.3
2001	lowest possible catch	0	7.0	7.1
2002	lowest possible catch	0	7.1	
2003	Closure	0		

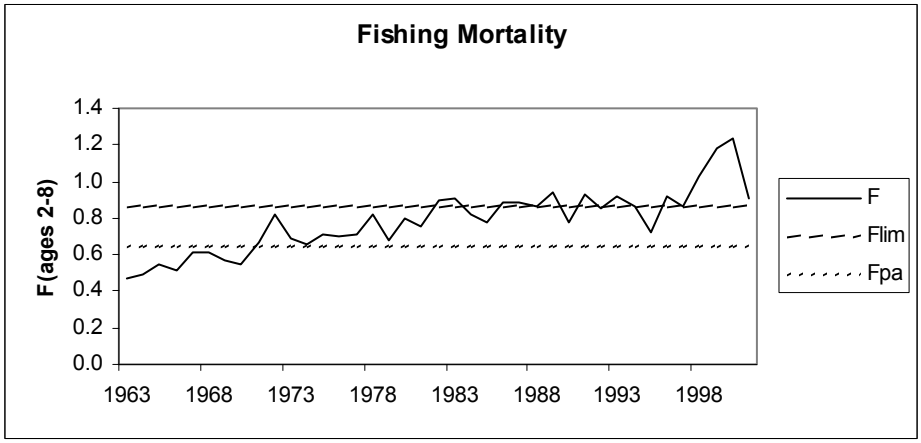
[1] Norwegian fjords not included. Weights in '000 t.

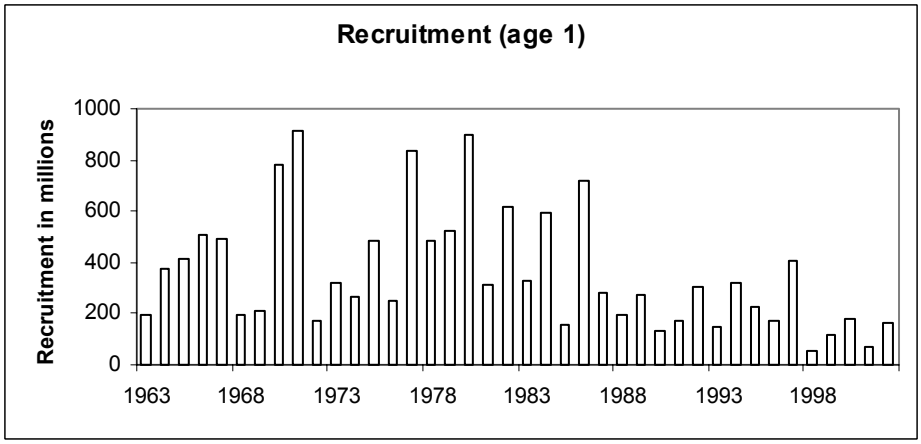
Eastern Channel (Division VIId)

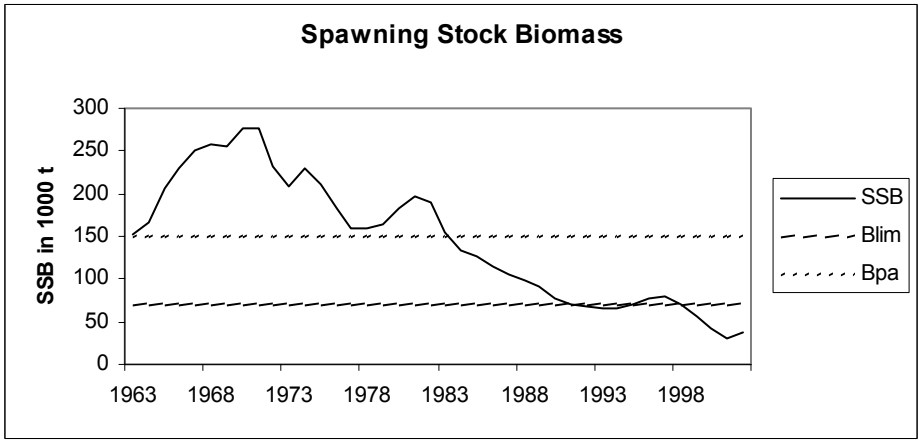
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings
1987	Not assessed	-	-	9.4	14.2
1988	Precautionary TAC	-	-	10.1	10.7
1989	No increase in F; TAC	10.0[2]	-	n/a	5.5
1990	No increase in F; TAC	9.0[2]	-	n/a	2.8
1991	Precautionary TAC	3.0[2]	-	n/a	1.9
1992	If required, precautionary TAC	5.5[2]	-	2.7	2.7
1993	If TAC required, consider SSB decline	-	-	2.5	2.4
1994	Reduce F+ precautionary TAC		-	2.9	2.9
1995	Significant effort reduction; link to North Sea		-	4.0	4.0
1996	Reference made to North Sea advice		-	3.5	3.5
1997	No advice		-	7.2	7.0
1998	Link to North Sea	4.9	-	8.7	8.6
1999	F = 0.60 to rebuild SSB	4.0	-	n/a	6.9
2000	F less than 0.55	<2.5	-	n/a	2.3
2001	lowest possible catch	0	-	n/a	1.6
2002	lowest possible catch	0	-		
2003	Closure	0			

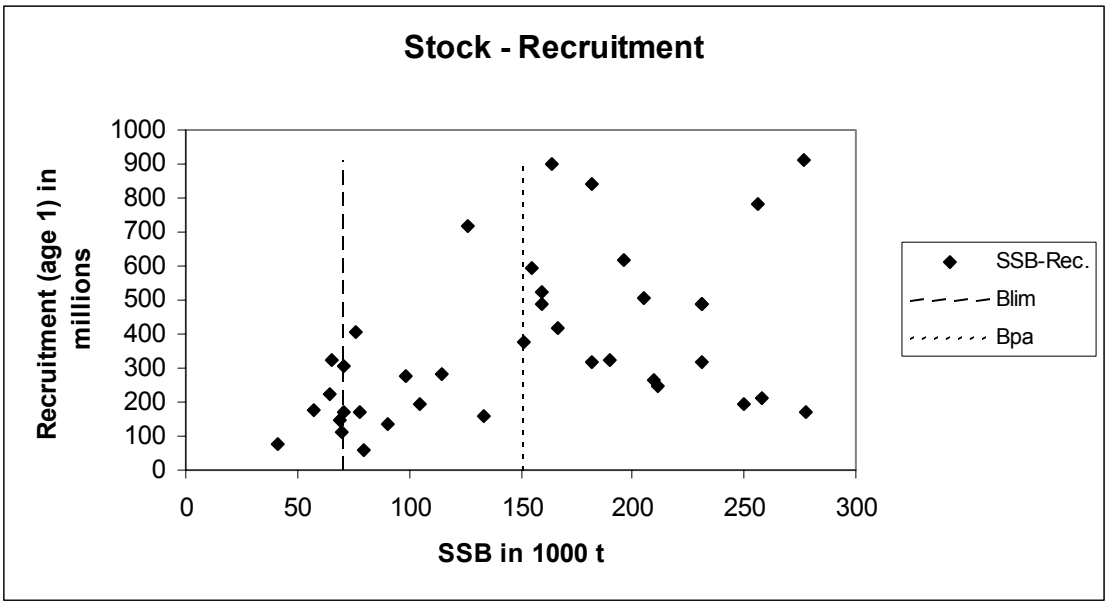
[1] Included in TAC for Sub-area VII (except Division VIIa). [2]Including VIIe. Weights in '000 t.

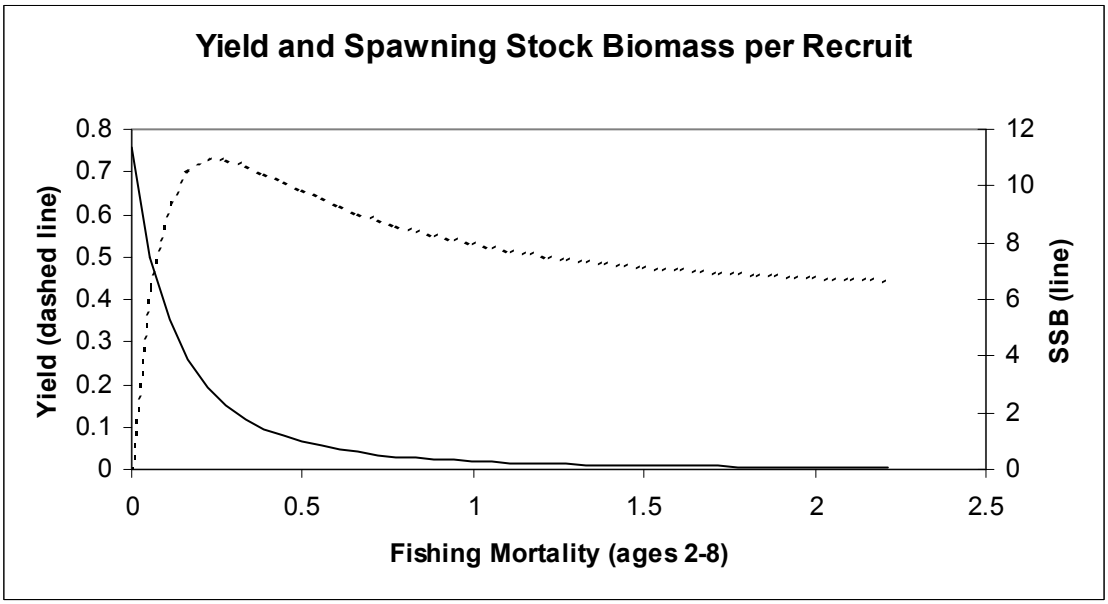

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1963
1968
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-8)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1963
1968
1973
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
1000
800
600
400
200
0
1963
1968
1973
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
300
250
200
150
100
50
0
1963
1968
1973
1978
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
1000
900
800
700
600
500
400
300
200
100
0
0
50
100
150
200
250
300
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
Fishing Mortality (ages 2-8)

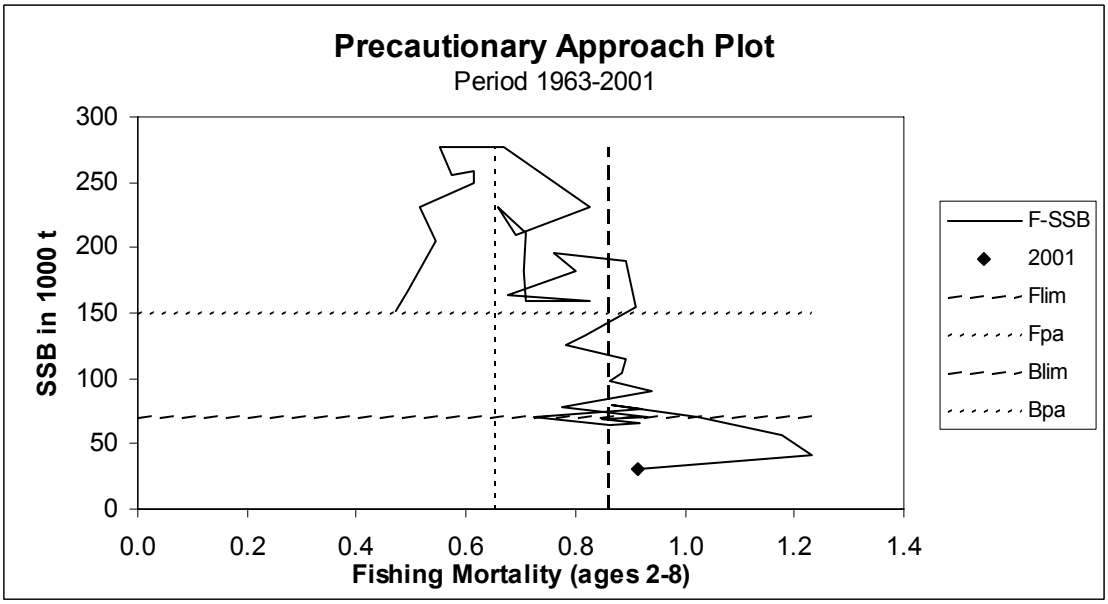

Precautionary Approach Plot
Period 1963-2001
SSB in 1000 t
300
250
200
150
100
50
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Fishing Mortality (ages 2-8)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.2.1 Nominal landings (in tonnes) of COD in IIIa (Skagerrak), IV, and VIId, as officially reported to ICES and as used by the Working Group.

Sub-area IV

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001****
Belgium	3,356	3,374	2,648	4,827	3,458	4,642	5,799	3,882	3,304	2,470
Denmark	18,479	19,547	19,243	24,067	23,573	21,870	23,002	19,697	14,000	8,358
Faroe Islands	109	46	80	219	44	40	102	96		
France	2,146	1,868	1,868	3,040	1,934	3,451	2,934	1,750	2,348	1,350
Germany	8,446	6,800	5,974	9,457	8,344	5,179	8,045	3,386	1,740	1,810
Netherlands	11,133	10,220	6,512	11,199	9,271	11,807	14,676	9,068	5,995	3,574
Norway	10,476	8,742	7,707	7,111	5,869	5,814	5,823	7,432	6,353	4,369
Poland	-	-	-	-	18	31	25	19	18	18
Sweden	823	646	630	709	617	832	540	625	640	626
UK (E/W/NI)	14,462	14,940	13,941	14,991	15,930	13,413	17,745	10,344	6,543	
UK (Scotland)	28,677	28,197	28,854	35,848	35,349	32,344	35,633	23,017	21,009	
United Kindom										19,683
Total Nominal Catch	98,107	94,380	87,457	111,468	104,407	99,423	114,324	79,316	61,950	42,258
Unallocated landings	-758	10,200	7,066	8,555	2,161	2,746	7,779	-924	-2,865	-1,224
WG estimate of total landings	**97,349**	**104,580**	**94,523**	**120,023**	**106,568**	**102,169**	**122,103**	**78,392**	**59,085**	**41,034**
Agreed TAC	*100,000*	*101,000*	*102,000*	*120,000*	*130,000*	*115,000*	*140,000*	*132,400*	*81,000*	*49,300*

Division VIId

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Belgium	187	157	228	377	321	310	239	172	110	93
Denmark	1	1	9	-	-	-	-	-		
France	2,079	1,771	2,338	3,261	2,808	6,387	7,788			
Netherlands	2	-	-	-	+	-	19	3	4	17
UK (E/W/NI)	443	530	312	336	414	478	618	454	385	
UK (Scotland)	22	2	+	+	4	3	1	-		
United Kingdom										248
Total Nominal Catch	2,734	2,461	2,887	3,974	3,547	7,178	8,665	629	499	358
Unallocated landings	-65	-29	-37	-10	-44	-135	-85	6,229	1,826	1,215
WG estimate of total landings	**2,669**	**2,432**	**2,850**	**3,964**	**3,503**	**7,043**	**8,580**	**6,858**	**2,325**	**1,573**

Division IIIa (Skagerrak)

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Denmark	11,194	11,997	11,953	8,948	13,573	12,164	12,340	8,734	7,683	8,650
Sweden	2,436	2,574	1,821	2,658	2,208	2,303	1608	1,909	1,350	2,201
Norway	270	75	60	169	265	348	303	345	301	757
Germany	-	-	301	200	203	81	16	54	9	32
Others	102	91	25	134	-	-	-	-	-	-
Total Nominal Catch	14002	14737	14160	12109	16249	14896	14267	11042	9343	11,640
Unallocated landings	0	0	-899	0	0	50	1,064	-68	-66	-4,554
WG estimate of total landings	**14,002**	**14,737**	**13,261**	**12,109**	**16,249**	**14,946**	**15,331**	**10,974**	**9,277**	**7,086**
Agreed TAC	*15,000*	*15,000*	*15,500*	*20,000*	*23,000*	*16,100*	*20,000*	*19,000*	*11,600*	*7,000*

Sub-area IV, Divisions VIId and IIIa (Skagerrak) combined

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Total Nominal Catch	114,843	111,578	104,504	127,551	124,203	121,497	137,256	90,987	71,792	54,256
Unallocated landings	-823	10,171	6,130	8,545	2,117	2,661	8,758	5,238	-1,105	-4,563
WG estimate of total landings	**114,020**	**121,749**	**110,634**	**136,096**	**126,320**	**124,158**	**146,014**	**96,225**	**70,687**	**49,693**

n/a not available
** provisional

Division IIIa (Skagerrak) landings not included in the assessment

Country	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000****	**2001****
Norwegian coast *	923	909	760	846	748	911	976	788	624	846
Danish industrial by-catch	1,360	511	666	749	676	205	97	62	58	46
Total	**2,283**	**1,420**	**1,426**	**1,595**	**1,424**	**1,116**	**1,073**	**850**	**682**	892

Table 3.5.2.2 Cod in Subarea IV, Divison VIId & Division IIIa (Skagerrak)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-8
1963	195099	151521	116457	0.4732
1964	374080	166150	126041	0.4928
1965	415425	205425	181036	0.5458
1966	506863	230759	221336	0.5145
1967	488789	250046	252977	0.6124
1968	194587	258219	288368	0.6158
1969	209061	255921	200760	0.5742
1970	782003	276848	226124	0.5514
1971	910808	277216	328098	0.6695
1972	173496	231011	353976	0.8246
1973	319648	209145	239051	0.6919
1974	263657	230838	214279	0.6589
1975	486359	211636	205245	0.7084
1976	246421	182050	234169	0.7045
1977	839198	159349	209154	0.7107
1978	488156	159354	297022	0.8247
1979	525424	164266	269973	0.6765
1980	899522	181875	293644	0.8020
1981	314766	195731	335497	0.7597
1982	618498	190226	303251	0.8931
1983	324685	154987	259287	0.9107
1984	596292	133414	228286	0.8173
1985	158611	126206	214629	0.7815
1986	716254	114213	204053	0.8909
1987	281821	104722	216212	0.8842
1988	197054	98642	184240	0.8634
1989	274077	90604	139936	0.9391
1990	133933	78044	125314	0.7748
1991	168552	71117	102478	0.9315
1992	305284	68898	114020	0.8484
1993	147360	65087	121749	0.9181
1994	323413	64800	110634	0.8626
1995	226023	70953	136096	0.7246
1996	170710	76252	126320	0.9207
1997	407921	79738	124158	0.8655
1998	57961	70151	146014	1.0249
1999	113291	56902	96225	1.1773
2000	177149	41110	71371	1.2317
2001	73747	30278	49694	0.9123
2002	167000	37600		
Average	356825	145533	196594	0.7842

3.5.3 Haddock in Subarea IV (North Sea) and Division IIIa (Skagerrak – Kattegat)

State of stock/exploitation: The stock is being harvested outside safe biological limits. SSB in 2002 is estimated to be above the $\mathbf{B}_{pa}$, and fishing mortality in 2001 is estimated to be above the $\mathbf{F}_{pa}$. The 1999 year class is estimated to be strong and has led to the current increase of SSB, but it is the only year class above average size for a number of years and dominates both the stock biomass and the catches. The 2001 year class is the lowest on record and the 2002 year class also appears to be well below average. The SSB is expected to decrease to below $\mathbf{B}_{pa}$ in the short term at the present fishing mortality rates.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the haddock stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 100 000 t ($\boldsymbol{B}_{lim}$).*
2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.70 for appropriate age groups as defined by ICES.*
3. *Should the SSB fall below a reference point of 140 000 t ($\boldsymbol{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 140 000 t.*
4. *In order to reduce discarding and to enhance the spawning biomass of haddock, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*
5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 100 000 t, the bootstrapped median estimate of the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 140 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessments.
$\mathbf{F}_{lim}$ is 1.0, a fishing mortality historically associated with stock decline.	$\mathbf{F}_{pa}$ be set at 0.7. This F is considered to provide approximately 90% probability of avoiding a fishing mortality associated with stock collapse.

Technical basis:

$\mathbf{B}_{lim}$ = Smoothed $\mathbf{B}_{loss.}$	$\mathbf{B}_{pa} = 1.4*\mathbf{B}_{lim.}$
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ poorly defined; 1.4 $\mathbf{F}_{pa}$ which has historically led to decline: 1.0.	$\mathbf{F}_{pa} = F_{lpg}$[1] implies an equilibrium biomass > $\mathbf{B}_{pa}$ and a less than 10% probability that ($SSB_{MT} < \mathbf{B}_{pa}$).

[1] F_{lpg} is defined as the F value having a 10% probability of giving a replacement line above G_{loss}, which is the slope in the stock-recruitment plot associated with the lowest observed SSB.

Advice on management: Since haddock is mostly taken in demersal fisheries with cod and whiting, the advice for cod determines the advice for haddock. Unless ways to harvest haddock without by-catch or discards of cod can be demonstrated fishing for haddock should not be permitted.

Relevant factors to be considered in management: On the basis of the status of haddock alone, ICES would recommend that the fishing mortality be less than F = 0.52 to ensure that the stock remains above $\mathbf{B}_{pa}$ in 2004 and 2005. This would correspond to landings of less than 84 000 t in 2003 and a reduction of fishing mortality by at least 40%. If any fisheries on haddock are permitted, despite the advice on cod, then total catches should not exceed these values.

The extent to which the cod-haddock-whiting fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and probably variable. It is possible for fishing vessels to increase their targeting of individual species within the demersal fish complex, but

there will always be a significant by-catch of other roundfish.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for haddock down to near zero, then these programs could be considered in management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent method for ensuring that their catches of cod are fully and credibly reported.

Recruitment of haddock has been well below average for all year classes after the strong 1999 year class. This will have a strong negative impact on the development of the spawning stock biomass in the near future. These weak year classes mean that a reduction of fishing mortality to 0.52 would be necessary in order to ensure that the stock remains above $\mathbf{B}_{pa}$ in the short and medium term.

Fisheries targeting *Nephrops* may take a by-catch of haddock. In this case ICES notes that haddock may continue to be caught subject to existing EU regulations applying to *Nephrops* fisheries, and providing the catch of cod complies with the advice on cod.

Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the interpretation of Table 3.5.1.3 is hindered by the fact that discards are not included in the table so that the actual catch of the different fleet segments cannot be evaluated. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery, and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

Haddock, while a principal target for some fleets, are taken in a mixed roundfish fishery. This means it is important to take into account the impact of management of haddock on other stocks, notably cod and whiting. The reverse is, of course, also true. Recent measures to protect North Sea cod, such as the closed area, and agreements to increase mesh size, will affect the haddock fishery. Improvements in selectivity related to measures to protect cod should, if effectively implemented, benefit the haddock fishery by reducing discards and increasing landings in the long term.

Several technical conservation measures have been or will be implemented from 2000 onwards. The effects of these measures have not yet been demonstrated in the available data. North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001, and SSI 649/2001. Results are expressed as the percentage deviation from baseline simulations that assume no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures , i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial by-catch	Spawning stock biomass
2002	-11%	-64%	10%	
2003	9%	-70%	29%	28%
Long Term	120%	-77%	113%	160%

Catch forecast for 2003*:

Basis: F_{2002}=$\mathbf{F}_{sq}$ = F(1999–2001-scaled) = 0.83; Catch (2002) = 271; Landings[1] (2002) = 198; SSB(2003) = 221.

F (2003 onwards)	Basis[2]	Total catch (2003)	HC Lndgs (2003)	Discards (2003)	Industrial By-catch (2003)	HC Lndgs (2003) IV	HC Lndgs (2003) IIIa	SSB (2004)
0.05	0*$\mathbf{F}_{sq}$	8	0	0	8	0	0	250
0.13	0.1*$\mathbf{F}_{sq}$	27	17	2	7	16	1	231
0.21	0.2*$\mathbf{F}_{sq}$	44	33	4	7	32	1	214
0.29	0.3*$\mathbf{F}_{sq}$	60	47	6	7	45	2	197
0.36	0.4*$\mathbf{F}_{sq}$	76	60	8	7	58	2	182
0.44	0.5*$\mathbf{F}_{sq}$	89	73	10	7	71	2	169
0.52	0.6*$\mathbf{F}_{sq}$	102	84	12	7	81	3	156
0.6	0.7*$\mathbf{F}_{sq}$	114	95	13	6	92	3	144
0.68	0.8*$\mathbf{F}_{sq}$	125	104	15	6	101	3	134
0.7	$\mathbf{F}_{pa}$=0.83*$\mathbf{F}_{sq}$	128	107	15	6	103	4	131
0.76	0.9*$\mathbf{F}_{sq}$	135	113	16	6	109	4	124
0.83	1*$\mathbf{F}_{sq}$	145	122	17	6	118	4	115
0.91	1.1*$\mathbf{F}_{sq}$	154	129	18	6	125	4	106

Weights in '000 t. [1] North Sea + IIIa human consumption. [2]Multipliers on $\mathbf{F}_{sq}$ refer to human consumption and discard partial fishing mortality only. By-catch F is assumed constant at 0.05. The landings in Division IIIa are calculated as 3.3% of the combined area total. The figure 3.3% is the long-term average of the Division IIIa (human consumption) landings expressed as a percentage of the combined IIIa–IV (human consumption) landings.

* The shading is presented solely with regard to a precautionary approach to haddock. It is the requirement for the recovery of cod that leads to the advice of no harvesting of haddock.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: The medium-term analysis indicate that the stock is expected to decline rapidly at the current fishing mortality (F(2001) = 0.83) due to the very low recruitments since 1999.

Comparison with previous assessment and advice: Assessments carried out since 1997 showed a strong tendency to overestimate SSB and underestimate fishing mortality. The retrospective analysis of the current assessment indicates that this problem has been reduced.

Elaboration and special comment: The large majority of the catch is taken by Scottish trawlers, seiners, and pair trawlers. Smaller quantities of haddock are taken by other vessels, including *Nephrops* trawlers. In Division IIIa, catches are taken by trawl, seine, and gillnet in mixed fisheries.

In the early 1990s the industrial by-catch of haddock has frequently been overestimated in the short-term predictions. Three potential sources could lead to overestimating the industrial by-catch in the catch predictions: population size at the start of the prediction, mean weight-at-age, and partial fishing mortality. These sources of bias have been evaluated and indicate that none of these sources can be identified uniquely as the source of bias. The problem of overestimating industrial by-catch of haddock appears to be relatively small in relation to the uncertainty of the assessment.

The analytical assessment is based on a long time-series of catch-at-age data using CPUE from survey fleets for calibration.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	1.059	0.003	0.005
$\mathbf{F}_{max}$	0.251	0.004	0.019
$\mathbf{F}_{0.1}$	0.163	0.004	0.029
$\mathbf{F}_{med}$	0.494	0.004	0.010

Catch data (Tables 3.5.3.1–3):
Subarea IV

Year	ICES Advice	Predicted lndgs corresp. to advice[1]	Agreed TAC	Off. lndgs.	ACFM catches Hum. Cons.	Disc slip.	Indust. by-catch	Total
1987	80% of F(85)	105	140	109	108	59	4	172
1988	77% of F(86); TAC	185	185	105	105	62	4	171
1989	Reduce decline in SSB; TAC; protect juveniles	68	68	64	76	26	2	104
1990	80% of F(88); TAC	50	50	43	51	33	3	87
1991	70% of effort (89)		50	45	45	40	5	90
1992	70% of effort (89)		60	51	70	48	11	129
1993	70% of effort (89)		133	80	80	80	11	170
1994	Significant reduction in effort; mixed fishery		160	87	81	65	4	150
1995	Significant reduction in effort; mixed fishery		120	75	75	57	8	140
1996	Mixed fishery to be taken into account		120	75	76	73	5	154
1997	Mixed fishery to be taken into account		114	73	79	52	7	138
1998	No increase in F	100.3	115	72	77	45	5	128
1999	Reduction of 10% F(95–97)	72	88.6	64	64	43	4	111
2000	F less than $\mathbf{F}_{pa}$	<51.7	73.0	47	45	47	8	100
2001	F less than $\mathbf{F}_{pa}$	<58.0	61	40	39	118	8	165
2002	F less than $\mathbf{F}_{pa}$	<94.0	104.0					
2003	No cod catches	-						

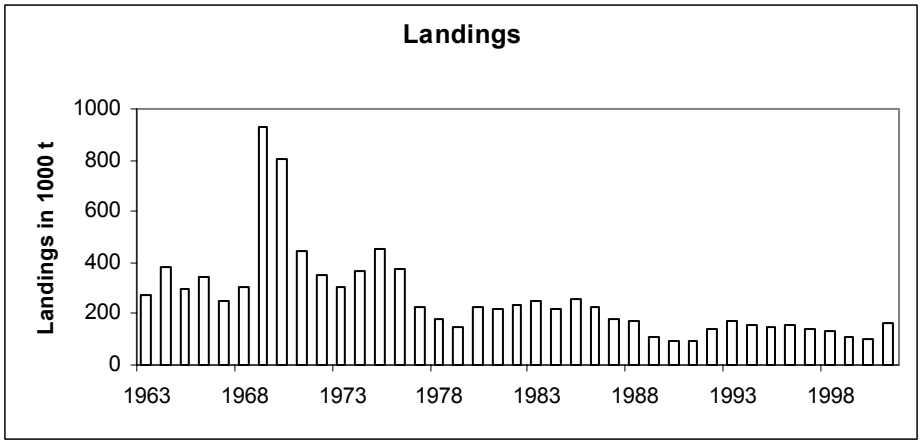
[1]Only pertaining to the North Sea. Weights in '000 t.

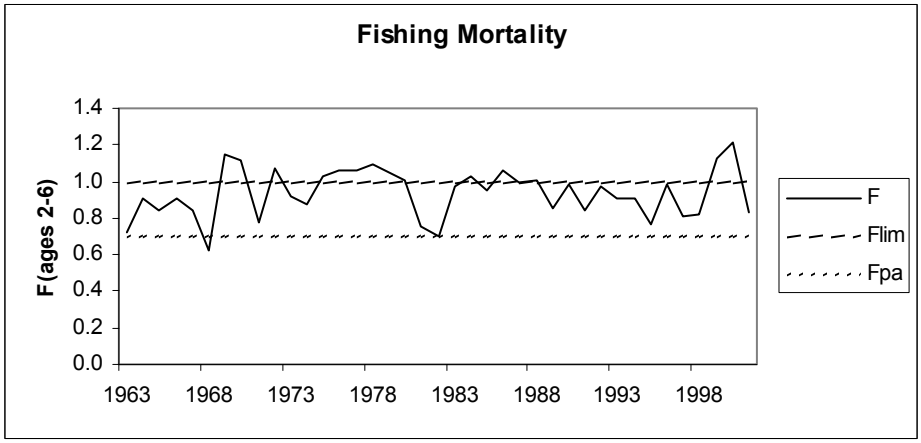
Division IIIa

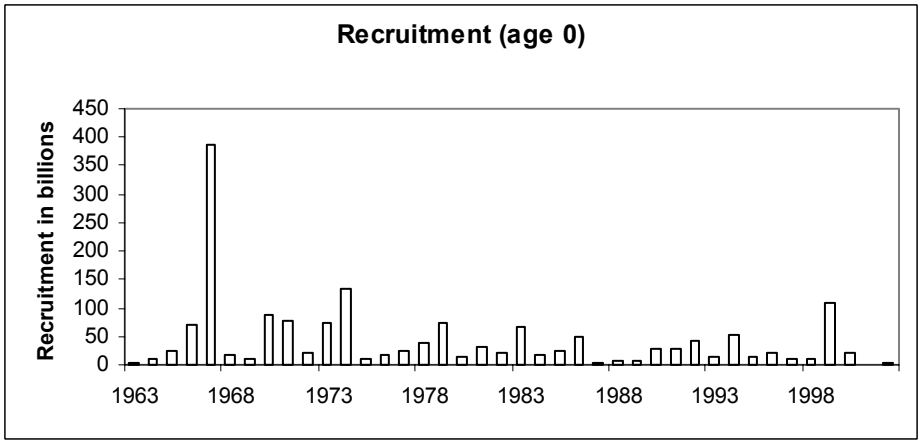
Year	ICES Advice	Predicted lndgs corresp. to advice	Agreed TAC	ACFM landings Hum. Cons.	Indust. bycatch	Total
1987	Precautionary TAC	-	11.5	3.8	1.4	5.3
1988	Precautionary TAC	-	10.0	2.9	1.5	4.3
1989	Precautionary TAC	-	10.0	4.1	0.4	4.5
1990	Precautionary TAC	-	10.0	4.1	2.0	6.1
1991	Precautionary TAC	4.6	4.6	4.1	2.6	6.7
1992	TAC	4.6	4.6	4.4	4.6	9.0
1993	Precautionary TAC	-	4.6	2.0	2.4	4.4
1994	Precautionary TAC	-	10.0	1.8	2.2	4.0
1995	If required, precautionary TAC; link to North Sea	-	10.0	2.2	2.2	4.4
1996	If required, precautionary TAC; link to North Sea	-	10.0	3.1	2.9	6.1
1997	Combined advice with North Sea	-	7.0	3.4	0.6	4.0
1998	Combined advice with North Sea	4.7	7.0	3.8	0.3	4.0
1999	Combined advice with North Sea	3.4	5.4	1.4	0.3	1.7
2000	Combined advice with North Sea	<1.8	4.5	1.5	0.6	2.1
2001	Combined advice with North Sea	<2.0	4.0	1.9	0.2	2.1
2002	Combined advice with North Sea	<3.0	6.3			
2003	Combined advice with North Sea	-				

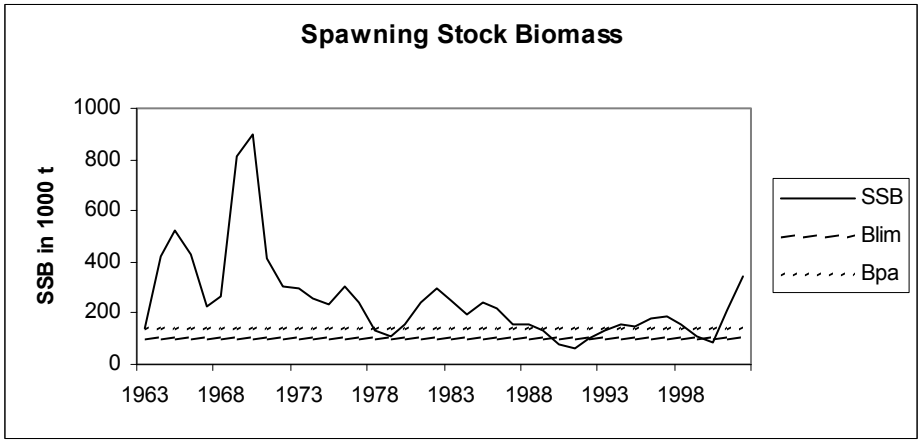
Weights in '000 t.

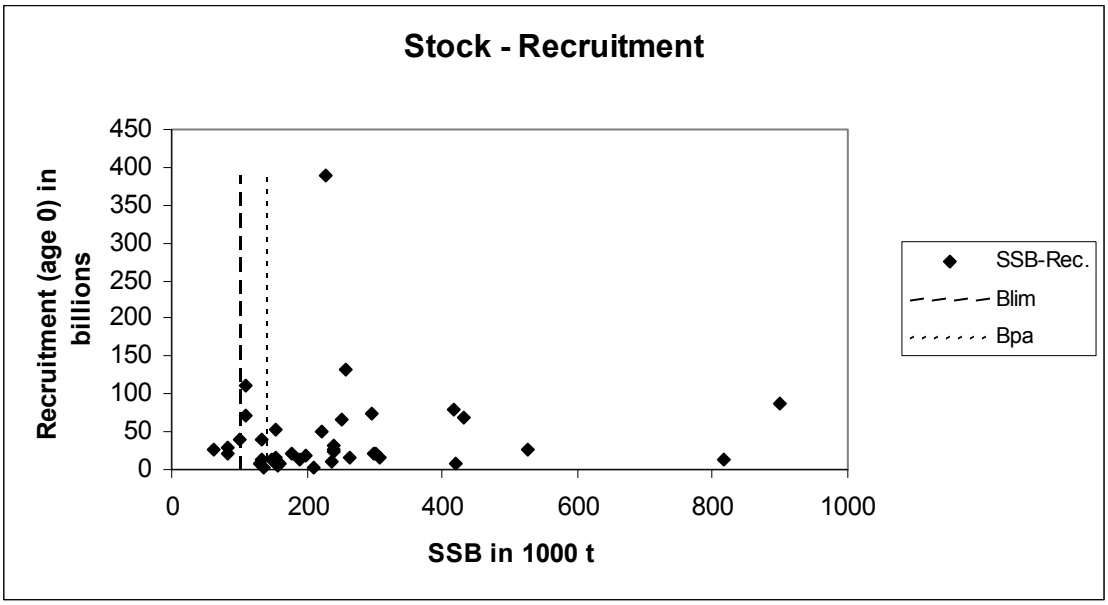
Haddock in Subarea IV (North Sea) and Division IIIa.

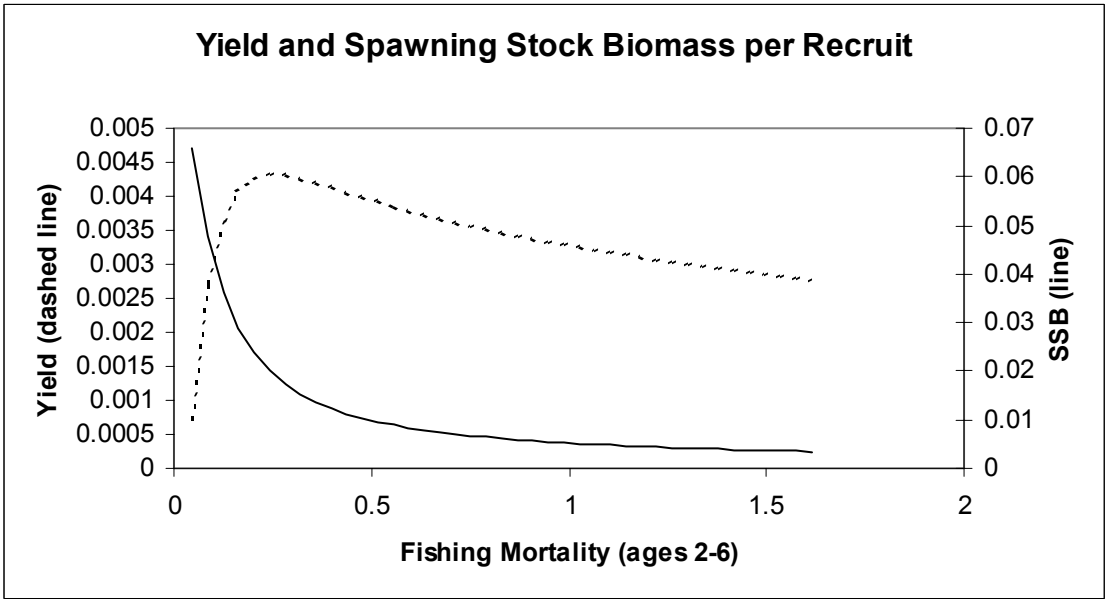









Stock - Recruitment
Recruitment (age 0) in billions
450
400
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
SSB (line)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
0.5
1
1.5
2
Fishing Mortality (ages 2-6)

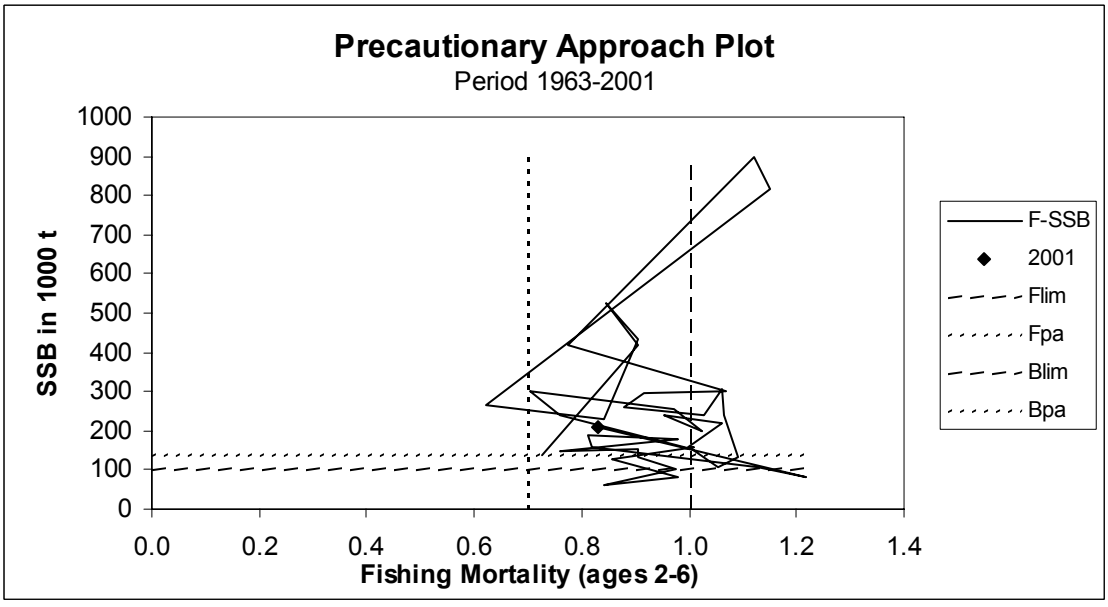

Precautionary Approach Plot
Period 1963-2001
SSB in 1000 t
1000
900
800
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Fishing Mortality (ages 2-6)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.3.1 Nominal catch (t) of Haddock from Division IIIa and the North Sea 1990-2000, as officially reported to ICES and estimated by ACFM.

Division IIIa

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	14	9	4	18	-	-	-	-	-	
Denmark	3,812	1,600	1,458	1,576	2,523	2,501	3,168	1,012	1,033	1,590
Germany	-	-	1	1	5	5	11	3	1	128
Norway	184	153	142	135	115	188	188	168	126*	148
Sweden	744	436	408	498	536	835	529	26	377	285
Total reported	4,754	2,198	2,013	2,228	3,179	3,529	3,896	1,389	1,527	2,158
Unallocated	-358	-239	-180	-37	-37	-128	-137	-29	-42	-255
WG estimate of H.cons. landings	4,396	1,959	1,833	2,191	3,142	3,401	3,759	1,360	1,485	1,903
WG estimate of industrial bycatch	4,604	2,415	2,180	2,162	2,925	610	275	334	617	218
WG estimate of total catch	9,000	4,374	4,013	4,353	6,067	4,011	4,034	1,694	2,102	2,121

* Preliminary

Subarea IV

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	415	292	306	407	215	436	724	462	399	606
Denmark	1,476	3,582	3,208	2,902	2,520	2,722	2,608	2,104	1,670	2,407
Faroe Islands	13	25	43	49	13	9	43	55	-	-
France	508	960	587	441	369	548	427*	742[1*]	1,152[1*]	576[1]
Germany	764	348	1,829	1,284	1,769	1,462	1,314	565	342	681
Netherlands	148	192	96	147	110	480	275	110	119	274[2]
Norway	3,273	2,655	2,355	2,461	2,295	2,354	3,262	3,830	3,118*	1,877
Poland	-	-	-	-	18	8	7	17	13	12
Sweden	1,289	908	551	722	689	655	472	686	596	812
UK (Engl. & Wales)	2,926	4,259	4,043	3,616	3,379	3,330	3,280	2,398	1,876	
UK (Isle of Man)	11	-	-	-	-	-	-	-	-	-
UK (N. Ireland)	73	18	9	-	-	-	-	-	-	-
UK (Scotland)	39,896	66,799	73,793	63,411	63,542	61,098	60,3234	53,628	37,772	
UK(all)										32,544
Total reported	50,792	80,038	86,820	75,440	74,919	73,102	72,736	64,597	47,057	39,789
Unallocated landings	19,426	-458	-5923	-127	1,115	5,993	4,665	-388	-973	-831
WG estimate of H.cons. landings	70,218	79,580	80,897	75,313	76,034	79,095	77,311	64,209	46,084	38,958
WG estimate of discards	47,967	79,601	65,392	57,360	72,522	52,105	45,175	42,562	48,841	118,320
WG estimate of industrial bycatch	10,816	10,741	3,561	7,747	5,048	6,689	5,101	3,834	8,133	7,879
WG estimate of total catch	129,001	169,922	149,850	140,420	153,604	137,889	127,587	110,605	103,058	165,157

* Preliminary. [1] Includes IIa(EC). [2] Note: Not included here 21 t of haddock reported in area unknown.

Division IIIa and Subarea IV

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
WG estimate of Total Catch	138,001	174,296	153,863	144,773	159,671	141,900	131,621	112,299	105,160	167,278

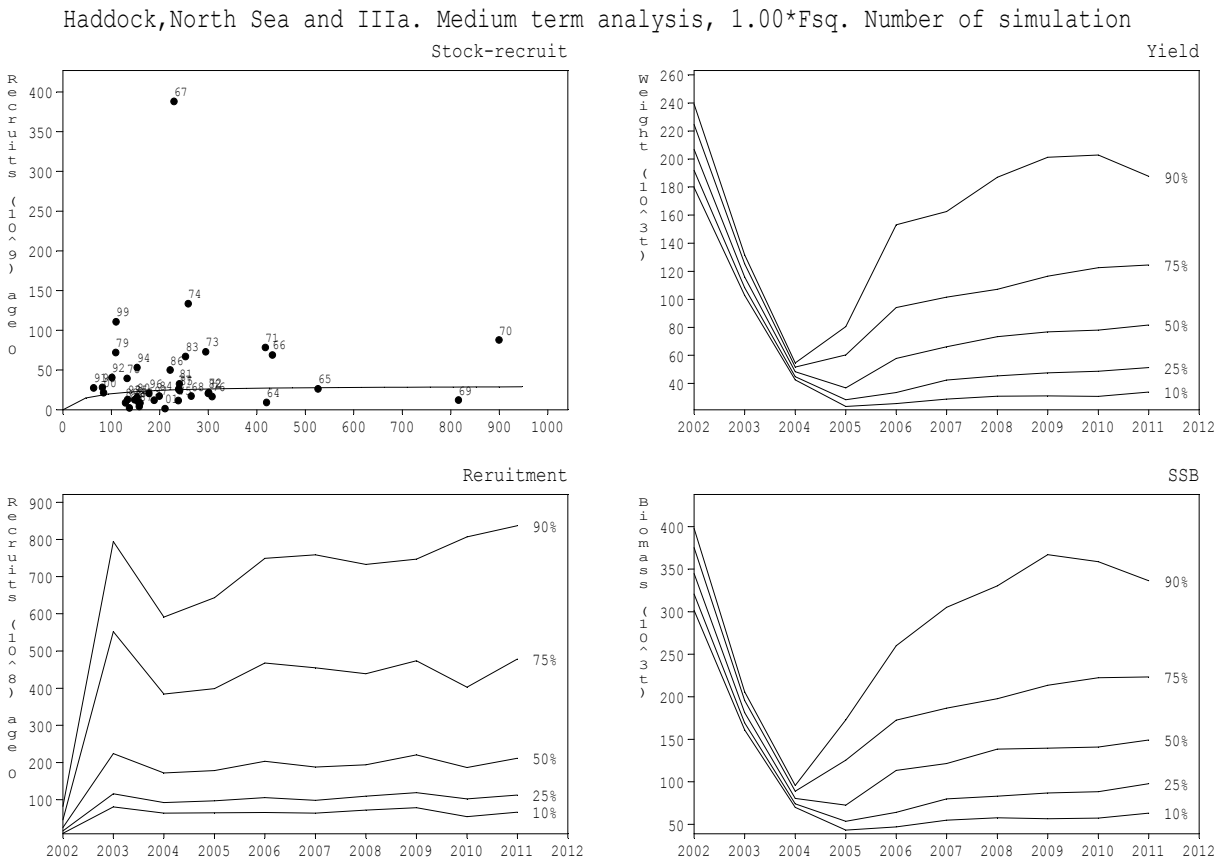
Table 3.5.3.2 Catches (‘000 t) of Haddock from the North Sea and Division IIIa, 1963–2001. Figures are Working Group estimates.

	North Sea				Division IIIa			Total
Year	H.cons	Disc	Ind. BC	Total	H. cons.	Ind. BC	Total	
1963	68.4	189.0	13.7	271.1	0.4	0.1	0.5	271.6
1964	130.5	160.3	88.6	379.4	0.4	0.3	0.7	380.1
1965	161.6	62.2	74.6	298.4	0.7	0.3	1.0	299.4
1966	225.8	73.6	46.7	346.1	0.6	0.1	0.7	346.8
1967	147.4	78.1	20.7	246.2	0.4	0.1	0.5	246.7
1968	105.4	161.9	34.2	301.5	0.4	0.1	0.5	302.0
1969	330.9	260.2	338.4	929.5	0.5	0.5	1.0	930.5
1970	524.6	101.4	179.7	805.7	0.7	0.2	0.9	806.6
1971	235.4	177.5	31.5	444.4	2.0	0.3	2.3	446.7
1972	192.9	128.1	29.6	350.6	2.6	0.4	3.0	353.6
1973	178.6	114.7	11.3	304.6	2.9	0.2	3.1	307.7
1974	149.6	166.8	47.8	364.2	3.5	1.1	4.6	368.8
1975	146.6	260.4	41.4	448.4	4.8	1.3	6.1	454.5
1976	165.6	154.3	48.2	368.1	7.0	2.0	9.0	377.1
1977	137.3	44.3	35.0	216.6	7.8	2.0	9.8	226.4
1978	85.8	76.9	10.8	173.5	5.9	0.7	6.6	180.1
1979	83.1	41.7	16.4	141.2	4.0	0.8	4.8	146.0
1980	98.6	94.7	22.3	215.6	6.4	1.5	7.9	223.5
1981	129.6	60.1	17.1	206.8	9.1	1.2	10.3	217.1
1982	165.8	40.5	19.4	225.7	10.8	1.3	12.1	237.8
1983	159.3	65.9	13.1	238.3	8.0	7.2	15.2	253.5
1984	128.1	75.3	10.1	213.5	6.4	2.7	9.1	222.6
1985	158.5	85.4	6.0	249.9	7.2	1.0	8.2	258.1
1986	165.5	52.2	2.6	220.3	3.6	1.7	5.3	225.6
1987	108.0	59.2	4.4	171.6	3.8	1.4	5.2	176.8
1988	105.1	62.1	4.0	171.2	2.9	1.5	4.4	175.6
1989	76.2	25.7	2.4	104.3	4.1	0.4	4.5	108.8
1990	51.5	32.6	2.6	86.7	4.1	2.0	6.1	92.8
1991	44.6	40.3	5.4	90.3	4.1	2.6	6.7	97.0
1992	70.2	48.0	10.8	129.0	4.4	4.6	9.0	138.0
1993	79.6	79.6	10.7	169.9	2.0	2.4	4.4	174.3
1994	80.9	65.4	3.6	149.9	1.8	2.2	4.0	153.9
1995	75.3	57.4	7.7	140.4	2.2	2.2	4.4	144.8
1996	76.0	72.5	5.0	153.6	3.1	2.9	6.1	159.7
1997	79.1	52.1	6.7	137.9	3.4	0.6	4.0	141.9
1998	77.3	45.2	5.1	127.6	3.8	0.3	4.0	131.6
1999	64.2	42.6	3.8	110.6	1.4	0.3	1.7	112.3
2000	46.1	48.8	8.1	103.1	1.5	0.6	2.1	105.2
2001	39.0	118.3	7.9	165.2	1.9	0.2	2.1	167.3
Min	39.0	25.7	2.4	86.7	0.4	0.1	0.5	92.8
Mean	132.0	91.7	32.0	255.7	3.6	1.3	4.9	260.6
Max	524.6	260.4	338.4	929.5	10.8	7.2	15.2	930.5

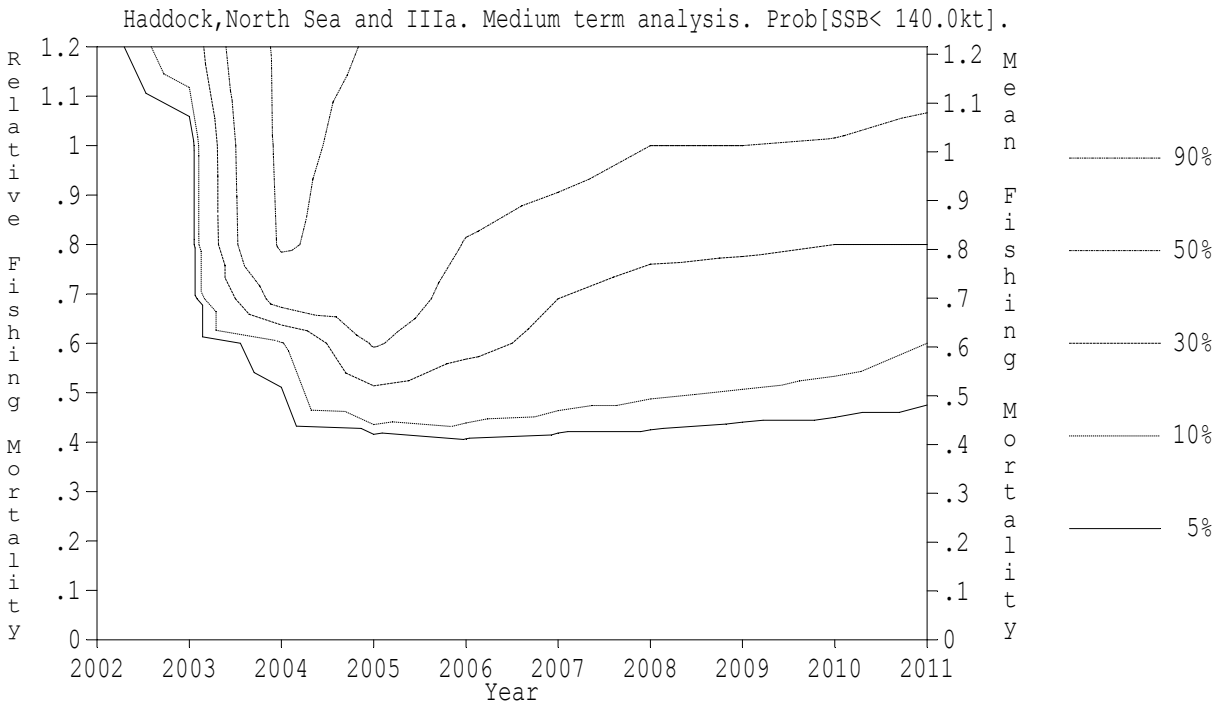
Table 3.5.3.3 Haddock in Subarea IV (North Sea) and Division IIIa

Year	Recruitment Age 0 thousands	SSB tonnes	Catches tonnes	Mean F Ages 2-6
1963	2338000	137200	271500	0.725
1964	9172000	420000	380200	0.906
1965	26336000	526100	299500	0.846
1966	68992000	432200	346700	0.904
1967	388112000	229100	246600	0.841
1968	17103000	264600	302000	0.620
1969	12196000	815800	930500	1.152
1970	87764000	899500	806700	1.121
1971	78285000	417800	446600	0.776
1972	21539000	301000	353600	1.070
1973	72899000	294500	307700	0.915
1974	133492000	258400	368800	0.879
1975	11543000	238100	454500	1.027
1976	16484000	307800	377100	1.060
1977	25757000	238600	226400	1.065
1978	39547000	132300	180100	1.092
1979	72151000	109200	146000	1.055
1980	15653000	153000	223600	1.004
1981	32480000	240200	217200	0.758
1982	20625000	299800	237800	0.703
1983	66982000	252900	253600	0.971
1984	17274000	199000	222600	1.024
1985	24053000	240900	258100	0.955
1986	49885000	221500	225700	1.062
1987	4202000	157500	176900	0.999
1988	8442000	159300	175500	1.010
1989	8706000	129100	108800	0.857
1990	28141000	81400	92700	0.981
1991	27424000	63500	97000	0.841
1992	40616000	101200	138000	0.975
1993	12720000	133300	174300	0.905
1994	53185000	153000	153900	0.906
1995	12518000	148400	144800	0.761
1996	20666000	177700	159700	0.980
1997	11933000	188200	141900	0.813
1998	9409000	156100	131600	0.820
1999	110671000	109600	112300	1.130
2000	21334000	83800	105200	1.217
2001	1448000	210700	167300	0.829
2002	2821000	347000		
Average	42122450	250733	260590	0.937

Medium-term analysis at F_{sq} = 0.83.



Probability of SSB falling below $\mathbf{B}_{pa}$ (140 thousand tonnes) at different levels of fishing mortality, held constant over the 10 year period.



3.5.4 Whiting in Subarea IV (North Sea) and Division VIId (Eastern Channel)

State of stock/exploitation: The stock is outside safe biological limits. SSB has declined over the last 20 years, reaching a historic low in 1998. Fishing mortality has decreased and is below $\mathbf{F}_{pa}$. Recruitment has fluctuated below the average (1980-2001) level since 1990, with the exception of the 1998 year class.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 225 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 315 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 0.90, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}=\mathbf{B}_{loss}=225\,000$ t.	$\mathbf{B}_{pa}=1.4*\mathbf{B}_{lim}$, apparent impaired recruitment below this value: 315 000 t.
$\mathbf{F}_{lim}=\mathbf{F}_{loss}=0.9$.	$\mathbf{F}_{pa} \sim 0.7\ \mathbf{F}_{lim}=0.65$.

Advice on management: Since whiting is mostly taken in demersal fisheries with cod and haddock, the advice for cod determines the advice for whiting. Except where it can be demonstrated that whiting can be harvested without by-catch or discards of cod, fishing for whiting should not be permitted.

Relevant factors to be considered in management: Demonstration that whiting can be taken without cod should be based on a high rate of independent observer coverage, or other fully transparent methods for ensuring that their catches of cod are fully and credibly reported.

On the basis of the status of whiting alone, in order to bring SSB above $\mathbf{B}_{pa}$ in 2004, ICES would recommend that fishing mortality in 2002 should be below 0.27, corresponding to human consumption landings of less than 26| 000 t. This implies a reduction in fishing mortality of at least 40%. If fishing on whiting is permitted consistent with the advice on cod then total catches should not exceed these values.

The recommended reduction in fishing mortality cannot be achieved by TAC management alone, because whiting is caught in a mixed demersal fisheries, where discarding of whiting is sometimes high (commonly 60% by weight). In *Nephrops*, shrimp, and flatfish fisheries nearly all whiting caught are discarded. Average landings by fleet segment in the North Sea demersal fisheries are shown in Table 3.5.1.3 (see overview Section 3.5.1). The average landings allow a comparison to be made between different fleet segments. However, the interpretation of Table 3.5.1.3 is hindered by the fact that discards are not included in the table so that the actual catch of the different fleet segments cannot be evaluated. A STECF subgroup will meet shortly after ACFM to address the issue of linkage in the cod-haddock-whiting fishery, and ICES working groups are expected to deliver data to this group. The issue of linkage will also be an explicit term of reference for an ICES study group, which is expected to meet next year.

A reduction in TAC without a reduction in effort is likely to result in increased discarding, which may counteract the desired reduction in fishing mortality. For mixed demersal fisheries improvements to gear selectivity, such as increased mesh size or inclusion of square mesh panels, would contribute to this goal.

North Sea demersal fisheries have been subjected to a number of EU and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001. Results are expressed as the percentage deviation from baseline simulations, which assume that no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures, i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply.

Year	Landings for human consumption	Discards	Industrial bycatch	Spawning stock biomass
2002	-66%	-88%	6%	
2003	-72%	-93%	16%	13%
Long Term	-42%	-91%	26%	57%

ICES notes that improvement in SSB whiting may be achieved through implementation of technical conservation measures for cod, because whiting are taken in a mixed fishery with cod. Hence, the rebuilding of whiting SSB could be somewhat greater if the advice on North Sea cod and measures to reduce discarding are implemented effectively.

Catch forecast for 2003*:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(01) = 0.43; HC landings IV (2002) = 31.7; HC landings VIId (2002) = 4.1; Discards (2002) = 18.4; Industrial by-catch (2002) = 6.1; SSB(2003) = 270.

F (2003)	Basis	Catch (2003)	HC (2003)	Discards (2003)	Industrial By-catch (2003)	HC IV (2003)	HC VIId (2003)	SSB (2004)
0.10	0.2 * $\mathbf{F}_{sq}$	21	9	5	7	8	1	337
0.19	0.4 * $\mathbf{F}_{sq}$	34	18	9	7	16	2	325
0.27	0.6 * $\mathbf{F}_{sq}$	46	26	13	7	23	3	314
0.35	0.8 * $\mathbf{F}_{sq}$	58	34	17	7	30	4	304
0.43	1.0 * $\mathbf{F}_{sq}$	69	41	21	7	36	5	294
0.52	1.2 * $\mathbf{F}_{sq}$	79	48	24	7	42	6	285
0.65	$\mathbf{F}_{pa}$ = 1.52 * $\mathbf{F}_{sq}$	94	58	30	7	51	7	272

Weights in '000 tonnes. The HC landings in Division VIId are calculated as 11.5% of the HC landings forecast for the area combined, 11.5% being the average of the VIId HC landings relative to the HC landings from the combined area for the years 1992–1996.
* The shading is presented solely with regard to a precautionary approach to whiting. It is the requirement for the recovery of cod that leads to the advice of no harvesting of whiting.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium- or long-term projections have been carried out.

Comparison with previous assessment and advice: The results of the current assessment are broadly consistent with last year's assessment, although fishing mortality has been revised upwards for a number of years. The reason for this revision is the addition of the 2001 data.

Elaboration and special comment: At very low stock sizes, as experienced in recent years, catch opportunities in the short term are very dependent on the strength of incoming year classes. However, the estimates of year class strength for whiting are very imprecise.

The SSB is estimated to have increased since 1998, mainly due to lower fishing mortality, not increased recruitment.

There are inconsistencies between information from commercial catch data and survey data. There are also inconsistencies between information from different surveys which may reflect different abundance trends between areas. Discard data are available for about 50% of the catch since 1975, but the discard estimates are relatively imprecise due to low sampling effort.

In the early 1990s the industrial by-catch of whiting has frequently been overestimated in the short-term predictions. Three potential sources could lead to overestimating the industrial by-catch in the catch predictions: population size at the start of the prediction, mean weight-at-age, and partial fishing mortality. These sources of bias have been evaluated and indicate that both the mean weight-at-age and the fishing mortality on the industrial by-catch components have been overestimated in those years. The problem of overestimating industrial by-catch appears to have decreased in the second half of the 1990s.

Analytical assessment (time-series analysis) based on landings, discards, and industrial by-catch data-at-age data. No calibration data included in the assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.522	0.031	0.148
Fmax	0.915	0.032	0.118
F0.1	0.270	0.028	0.188
Fmed	0.671	0.032	0.134

Catch data (Tables 3.5.4.1–2):
North Sea (Subarea IV)

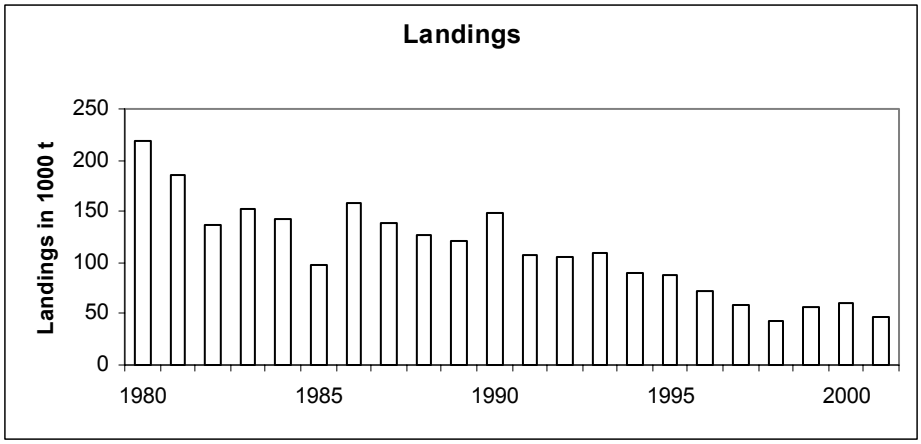
Year	ICES Advice	Predicted Landings Corresp. To advice	Agreed TAC	Off. Lndgs.	ACFM figures			
					Hum. Cons.	Indust. by-catch	Disc. slip.	Total catch
1987	Reduce F towards $\mathbf{F}_{max}$	120	135	65	64	16	54	134
1988	No increase in F; TAC	134	120	66	52	49	28	129
1989	Protect juveniles	-	115	40	41	43	36	120
1990	80% of F(88); TAC	130	125	41	43	51	56	150
1991	70% of effort (89)	-	141	47	47	38	34	119
1992	70% of effort (89)	-	135	47	46	27	31	104
1993	70% of effort (89)	-	120	47	48	20	43	111
1994	Significant reduction in effort; mixed fishery	-	100	42	43	10	33	86
1995	Significant reduction in effort; mixed fishery	-	81	41	41	27	30	98
1996	Mixed fishery; take into account cod advice	-	67	35	36	5	28	69
1997	Mixed fishery; take into account cod advice	-	74	32	31	6	17	54
1998	No increase from 1996 level	54	60	24	24	3	13	40
1999	at least 20% reduction of F(95–97)	40.4	44	25	26	5	24	55
2000	lowest possible catch	0	30	24	24	9	22	55
2001	60% reduction of F(97–99)	19.4	30	19	19	7	16	43
2002	F not larger than 0.37	<=33	32					
2003	No cod catches	-						

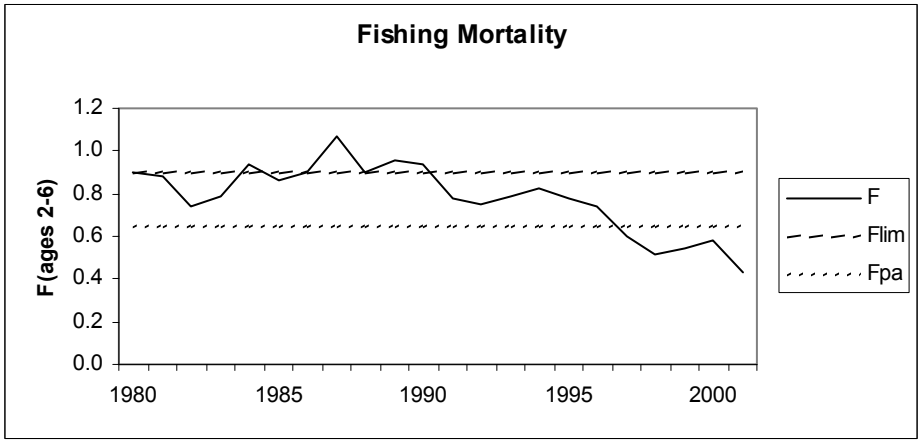
Weights in ‘000 t.

Eastern Channel (Division VIId)

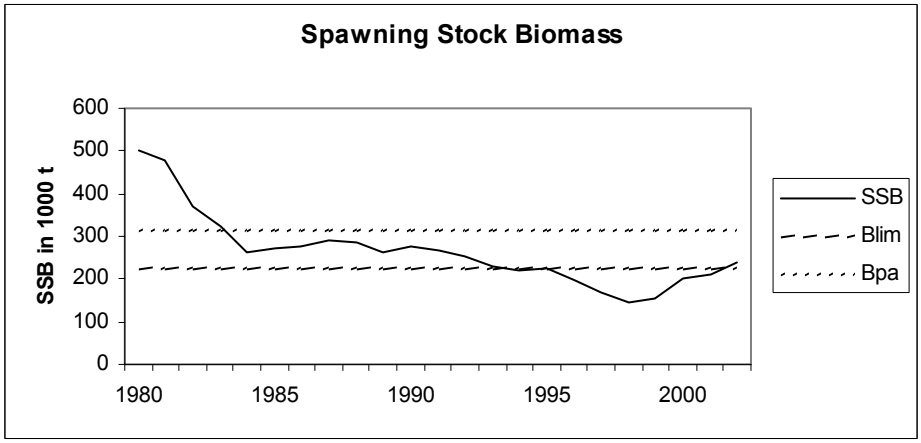
Year	ICES Advice	Predicted catch corresp. To advice	Agreed TAC[1]	Official landings	ACFM Catch
1987	Not assessed	-	-	7.2	4.7
1988	Precautionary TAC	-	-	7.8	4.4
1989	Precautionary TAC	-	-	n/a	4.2
1990	No increase in F; TAC	8.0[2]	-	n/a	3.5
1991	$\mathbf{F}_{sq}$;TAC	5.1	-	n/a	5.7
1992	If required, precautionary TAC	6.0[2]	-	5.9	5.7
1993	No basis for advice	-	-	5.4	5.2
1994	No long-term gains in increasing F	-	-	7.1	6.6
1995	Significant reduction in effort; link to North Sea	-	-	5.6	5.4
1996	Reference made to North Sea advice	-	-	5.1	5.0
1997	Reference made to North Sea advice	-	-	4.8	4.6
1998	Reference made to North Sea advice	5.8	-	4.8	4.6
1999	Reference made to North Sea advice	3.9	-	n/a	4.4
2000	Lowest possible catch	0	-	n/a	4.3
2001	60% reduction of $\mathbf{F}_{sq}$	2.5	-	n/a	5.8
2002	F not larger than 0.37	<=4	-		
2003	No cod catches	-			

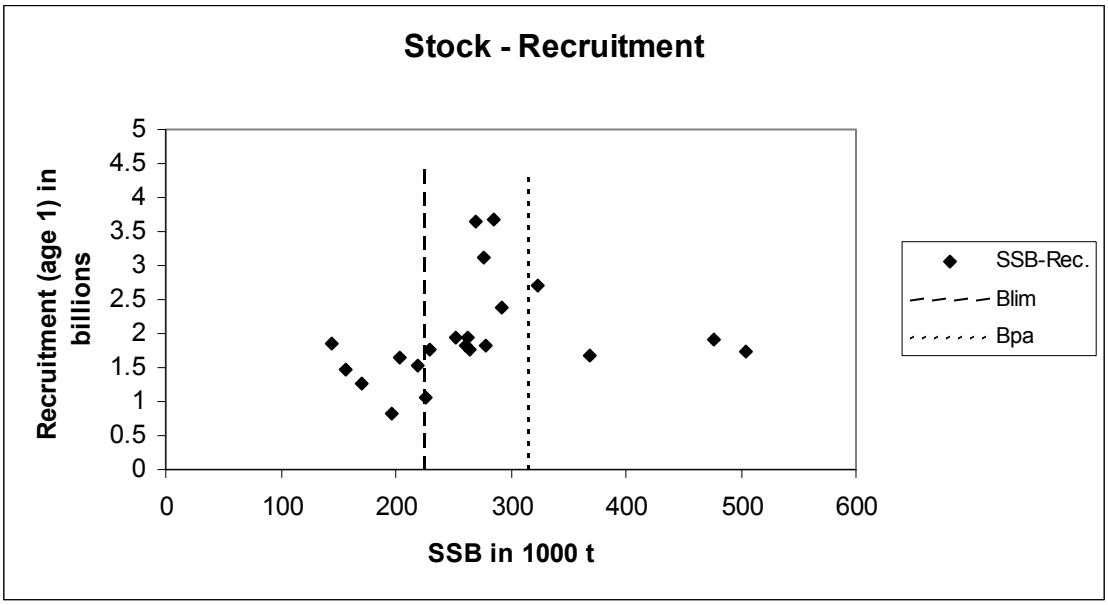
[1] Included in TAC for Subarea VII (except Division VIIa). [2]Including VIIe. Weights in ‘000 t. n/a=Not available.

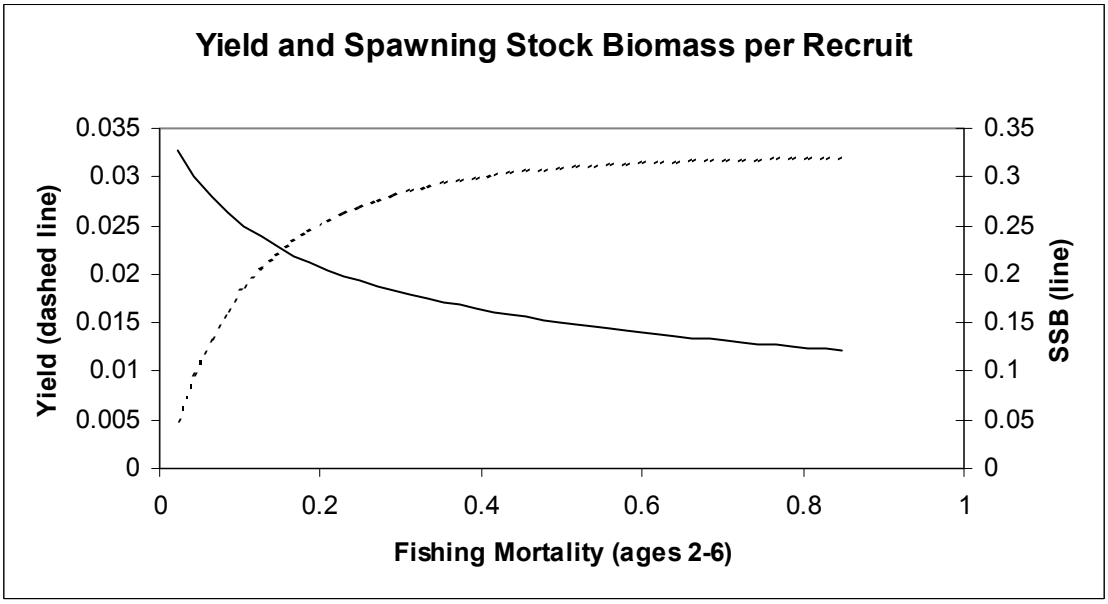

Landings
Landings in 1000 t
250
200
150
100
50
0
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 2-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1980
1985
1990
1995
2000
F
Flim
Fpa

Recruitment (age 1)
Recruitment in billions
5
4
3
2
1
0
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-6)

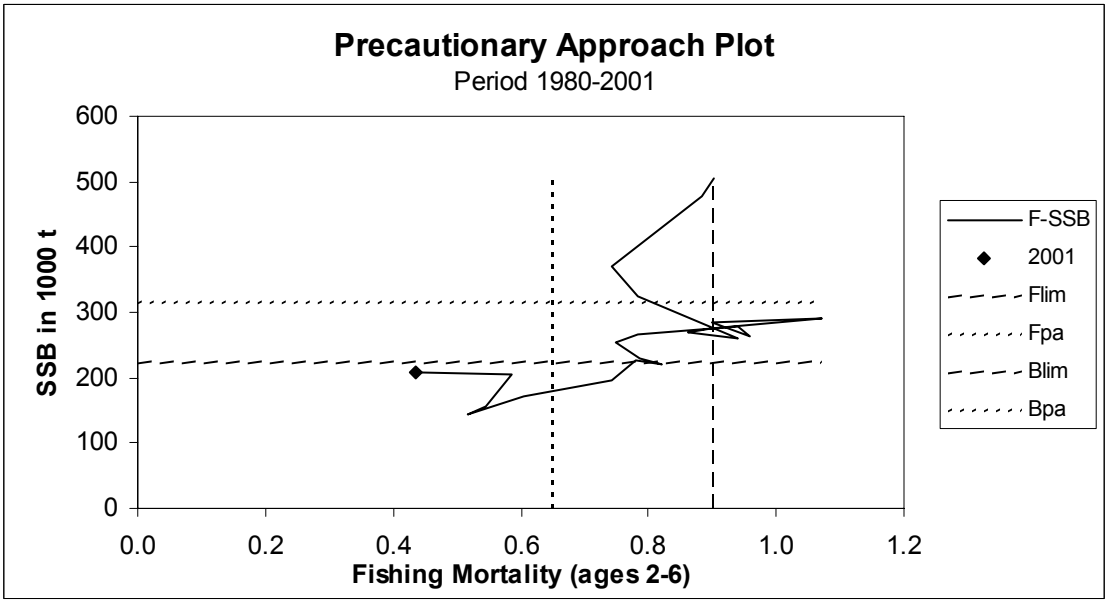

Precautionary Approach Plot
Period 1980-2001
SSB in 1000 t
Fishing Mortality (ages 2-6)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.4.1 Nominal catch (in tonnes) of Whiting in Subarea IV and Division VIId, as officially reported to ICES.

Subarea IV

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	1,030	944	1,042	880	843	391	268	529	536	454
Denmark	1,377	1,418	549	368	189	103	46	58	105	105
Faroe Islands	16	7	2	21	-	6	1	1	-	-
France	5,071	5,502	4,735	5,963	4,704	3,526	1,908*	4,292*[1]	2,529*[1]	3,460*[1]
Germany, Fed.Rep.	511	441	239	124	187	196	103	176	424	402
Netherlands	5,390	4,799	3,864	3,640	3,388	2,539	1,941	1,795	1,884	2,478[2]
Norway	232	130	79	115	66	75	64	68	33	44
Poland	-	-	-	-	-	-	1	-	-	-
Sweden	22	18	10	1	1	1	1	9	4	1
UK (E.&W)[3]	2,528	2,774	2,722	2,477	2,329	2,638	2,909	2,268	1,782	…
UK (Scotland)	30,821	31,268	28,974	27,811	23,409	22,098	16,696	17,206	17,158	…
United Kingdom										11,876
Total	46,998	47,301	42,216	41,400	35,116	31,573	23,938	26,402	24,455	18,820
Unallocated landings	-554	680	401	-348	1,006	-276	-72	-421	-412	592
WG estimate of H.Cons. landings	46,444	47,981	42,617	41,052	36,122	31,297	23,866	25,981	24,044	19,412
WG estimate of discards	30,615	42,871	33,010	30,264	28,181	17,217	12,708	23,584	22,360	16,488
WG estimate of Ind. By-catch	26,901	20,099	10,354	26,561	4,702	5,965	3,141	5,183	8,886	7,357
WG estimate of total catch	103,960	110,951	85,981	97,877	69,005	54,479	39,715	54,748	55,290	43,258

*Preliminary: year 2001, France 1998–2001.
[1]Includes Division IIa (EC).
[2]Not included here are 68 t reported into an unknown area.
[3]1989-1994 revised. N. Ireland included with England and Wales.

Division VIId

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	66	74	61	68	84	98	53	48	65	75
France	5,414	5,032	6,734	5,202	4,771	4,532	4,495*	-	-	-
Netherlands	-	-	-	-	1	1	32	6	14	67
UK (E.&W)	419	321	293	280	199	147	185	135	118	…
UK (Scotland)	24	2	-	1	1	1	+	-	-	…
United Kingdom									110	133
Total	5,923	5,429	7,088	5,551	5,056	4,779	4,765	189	197	142
Unallocated	-178	-214	-463	-161	-104	-156	-167	4242	4101	5662
W.G. estimate	5,745	5,215	6,625	5,390	4,952	4,623	4,598	4,431	4,298	5,804

*Preliminary.

Subarea IV and Division VIId

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W.G. estimate	109,705	116,166	92,606	103,267	73,957	59,102	44,313	59,179	60,907	49,062

Table 3.5.4.2 Whiting Subarea IV (North Sea) & Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Catches tonnes	Mean F Ages 2-6
1980	4422380	503730	218710	0.9037
1981	1732840	476600	186430	0.8821
1982	1914270	369100	137310	0.7421
1983	1665680	322980	151660	0.7829
1984	2711130	261500	142380	0.9391
1985	1820960	269540	97610	0.8624
1986	3652930	275870	158090	0.9000
1987	3112170	291920	137800	1.0718
1988	2370560	285180	127590	0.8981
1989	3673340	261990	121520	0.9592
1990	1953020	277840	149060	0.9384
1991	1838150	264900	107260	0.7821
1992	1764110	252630	106440	0.7483
1993	1951410	229810	108840	0.7878
1994	1758800	219870	89870	0.8224
1995	1535410	225990	88280	0.7799
1996	1064430	196590	72140	0.7414
1997	814400	170810	58680	0.6046
1998	1252790	144700	43250	0.5157
1999	1851930	156070	57280	0.5437
2000	1464810	203720	60820	0.5857
2001	1644820	209200	46640	0.4356
2002	1948630	237080		
Average	2083433	265549	112166	0.7830

3.5.5 Saithe in Subarea IV (North Sea), Division IIIa (Skagerrak), and Subarea VI (West of Scotland and Rockall)

State of stock/exploitation: The stock is within safe biological limits. Fishing mortality has declined from 1986 to 2001, and is estimated below $\mathbf{F}_{pa}$ in 2001. SSB has remained near or below $\mathbf{B}_{pa}$ since 1984, but it has increased in the late 1990s and is estimated to be above $\mathbf{B}_{pa}$ since 1999.

Management objectives: In 1999 the EU and Norway have *"agreed to implement a long-term management plan for the saithe stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 106 000 t ($\boldsymbol{B}_{lim}$).*

2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of 0.40 for appropriate age groups as defined by ICES.*

3. *Should the SSB fall below a reference point of 200 000 t ($\boldsymbol{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 200 000 t.*

4. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."*

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 106 000 t.	$\mathbf{B}_{pa}$ be set at 200 000 t.
$\mathbf{F}_{lim}$ is 0.60.	$\mathbf{F}_{pa}$ be set at 0.40.

Technical basis:

$\mathbf{B}_{lim}=\mathbf{B}_{loss}$=106 000 t.	$\mathbf{B}_{pa}$ Impaired recruitment at SSB less than 200 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}=\mathbf{F}_{loss}$=0.6, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}=5^{th}$ percentile of $\mathbf{F}_{loss}$ (0.45) implies that $B_{eq} < \mathbf{B}_{pa}$. F = 0.4 implies that $B_{eq} > \mathbf{B}_{pa}$ and $P(SSB_{MT} < \mathbf{B}_{pa}) < 10\%$. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Advice on management: ICES advises that fishing mortality in 2003 should be less than $\mathbf{F}_{pa}$, corresponding to landings in 2003 of less than 193 000 t.

Relevant factors to be considered in management: There is no long-term gain in yield by increasing current fishing mortality. Restricting landings to 132 000 t would maintain *status quo* fishing mortality and would increase stability of catches in the medium term.

Before 1999, saithe in Subarea VI and saithe in Sub-rea IV and Division IIIa were assessed as two separate stocks. The ICES advice applies to the combined areas IIIa, IV, and VI.

The assessment is considered to be uncertain because there are few survey data to confirm the stock trends as calibrated by commercial CPUE. The catch forecast is mainly driven by the assumption of average recruitment, with about one quarter of the forecast 2003 landings and 2004 SSB originating from this assumption. This means that the forecasts may not track fluctuations in the stock particularly well. Medium-term considerations indicate that continued fishing at $\mathbf{F}_{sq}$ implies low probability of falling below $\mathbf{B}_{pa}$.

Catch forecast for 2003:
Basis: TAC(2002)=Landings(2002)=149; F(2002)= 0.29; SSB(2003) = 325.

F(2003 onwards)	Basis	Total Landings	Landings IIIa & IV*) (2003)	Landings VI*) (2003)	SSB(2004)
0.15	$0.6*\mathbf{F}_{sq}$	84	76.4	7.6	386
0.20	$0.8*\mathbf{F}_{sq}$	109	99.2	9.8	361
0.25	$1.0*\mathbf{F}_{sq}$	132	120.1	11.9	338
0.30	$1.2*\mathbf{F}_{sq}$	153	139.2	13.8	317
0.34	$1.4*\mathbf{F}_{sq}$	173	157.4	15.6	297
0.40	$1.61*\mathbf{F}_{sq}(=\mathbf{F}_{pa})$	193	175.6	17.4	277
0.44	$1.8*\mathbf{F}_{sq}$	211	192.0	19.0	261

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.
*Landings split according to average in 1993-1998.

Medium- and long-term projections: Results of the medium-term analysis indicate that under the *status quo* fishing mortality there is a low probability of falling below $\mathbf{B}_{pa}$ in the medium-term.

Comparison with previous assessment and advice: This assessment gives a new estimate of fishing mortality in 2000 which is 11% lower than the estimate from last year, and estimates of SSB in 2000 and 2001 which are respectively 6% lower and higher compared to the estimates from last year. The general tendency of this assessment to overestimate F and underestimate SSB appears to be reduced.

Elaboration and special comment: Saithe in the North Sea are mainly taken in a direct trawl fishery in deep water near the Northern Shelf edge and the Norwegian deeps. Norwegian, French, and German trawlers take the majority of the catches. In the first half of the year the fishery is directed towards mature fish, while immature fish dominate in the catches the rest of the year. The main fishery was developed in the beginning of 1970s. In later years, the trawlers have also exploited deep-water fish.

The fishery in Subarea VI consists largely of a directed French, German, and Norwegian deep-water fishery operating on the shelf edge, and a Scottish fishery operating inshore.

The proportional contribution of saithe landings by area over different periods is as follows:

Period	Area IIIa & IV	Area VI
1982-1998	86%	14%
1988-1998	87%	13%
1993-1998	91%	9%

The assessment of saithe in the North Sea and area VIa was reviewed by the North Sea Commission Fisheries Partnership in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the review was that the assessment was carried out according to appropriate standards although there was concern about the reliance on commercial CPUE data for the calibration of the assessment. The fishermen broadly shared the perception on the development in the stock.

Analytical assessment is based on catch-at-age analysis using CPUE information from commercial fisheries. Lack of recruitment indices for recent and incoming year classes makes catch predictions imprecise.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.280	0.632	1.401
$\mathbf{F}_{max}$	0.170	0.654	2.409
$\mathbf{F}_{0.1}$	0.090	0.604	4.108
$\mathbf{F}_{med}$	0.412	0.600	0.857

Catch data (Tables 3.5.5.1-2):

Saithe in IV and IIIa

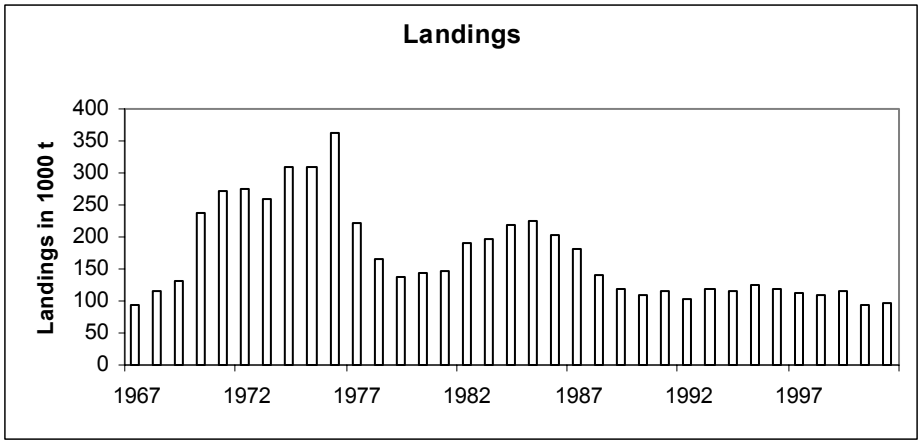
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Reduce F	<198	173	154	149
1988	60% of F(86); TAC	156	165	113	107
1989	No increase in F; TAC	170	170	92	92
1990	No increase in F; TAC	120	120	85	88
1991	No increase in F; TAC	125	125	93	99
1992	No increase in F; TAC	102	110	92	92
1993	70% of F(91) ~ 93 000 t	93	93	99	105
1994	Reduce F by 30%	72	97	90	102
1995	No increase in F	107	107	97	113
1996	No increase in F	111	111	96	110
1997	No increase in F	113	115	86	103
1998	Reduce F by 20%	97	97	88	100
1999	Reduce F to $\mathbf{F}_{pa}$	104	110	108	107
2000	Reduce F by 30 %	75	85	85	87
2001	Reduce F by 20 %	87	87	86	90
2002	F < $\mathbf{F}_{pa}$	<135	135		
2003	F < $\mathbf{F}_{pa}$	<176			

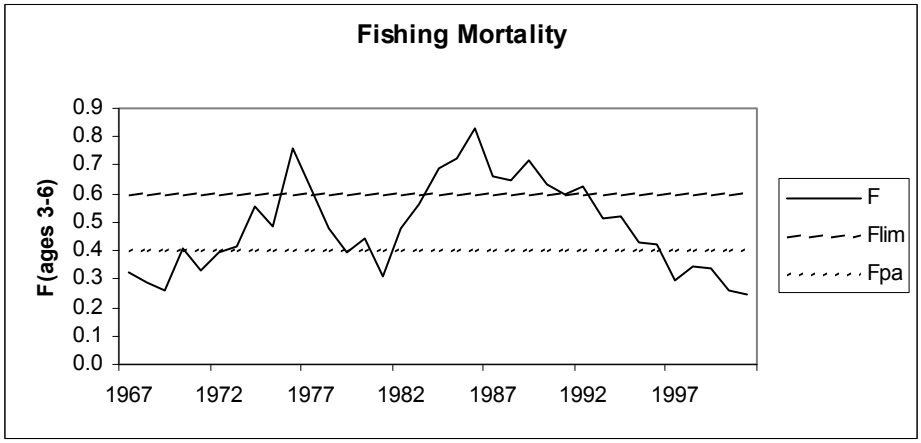
Weights in '000 t.

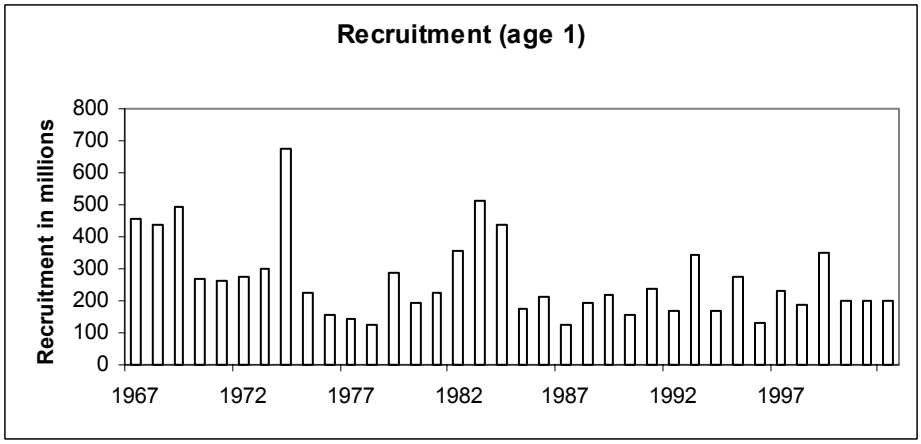
Saithe in VI

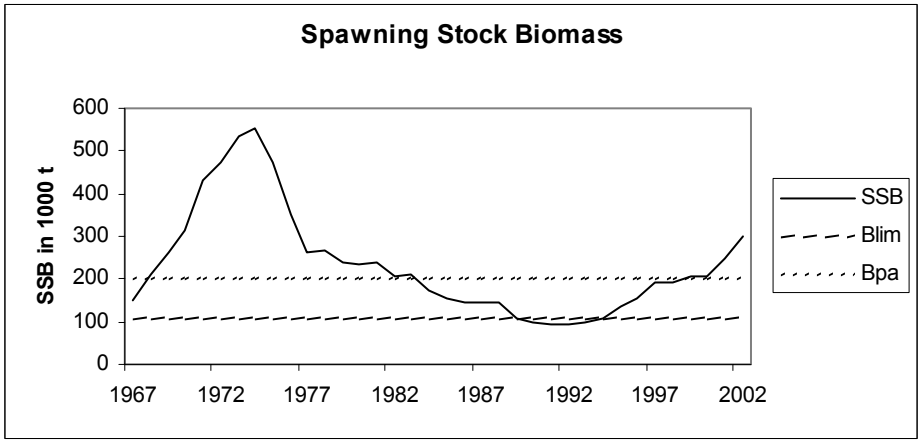
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	F reduced towards $\mathbf{F}_{max}$	19	27.8	32.5	31.4
1988	80% of F(86); TAC	35	35	32.8	34.2
1989	F < 0.3; TAC	20	30	22.4	25.6
1990	80% of F(88); TAC	24	29	18.0	19.9
1991	Stop SSB decline; TAC	21	22	17.9	17.0
1992	Avoid further reduction in SSB	<19	17	10.8	11.8
1993	F = 0.21	6.3	14	14.5	13.9
1994	Lowest possible F		14	13.0[2]	12.8
1995	Significant reduction in effort	-	16	10.6[2]	11.8
1996	No increase in F	10.2[1]	13	9.4[2]	9.4
1997	Significant reduction in F		12	8.6[2]	9.4
1998	60% Reduction in F	4.8	10.9	7.4[2]	8.4
1999	60% reduction in F	4.8	7.5	6.8	7.3
2000	Reduce F by 30 %	6.0	7	6.4	5.9
2001	Reduce F by 20 %	9.0	9	8.7	8.4
2002	F< $\mathbf{F}_{pa}$	<13	14		
2003	F<$\mathbf{F}_{pa}$	<17			

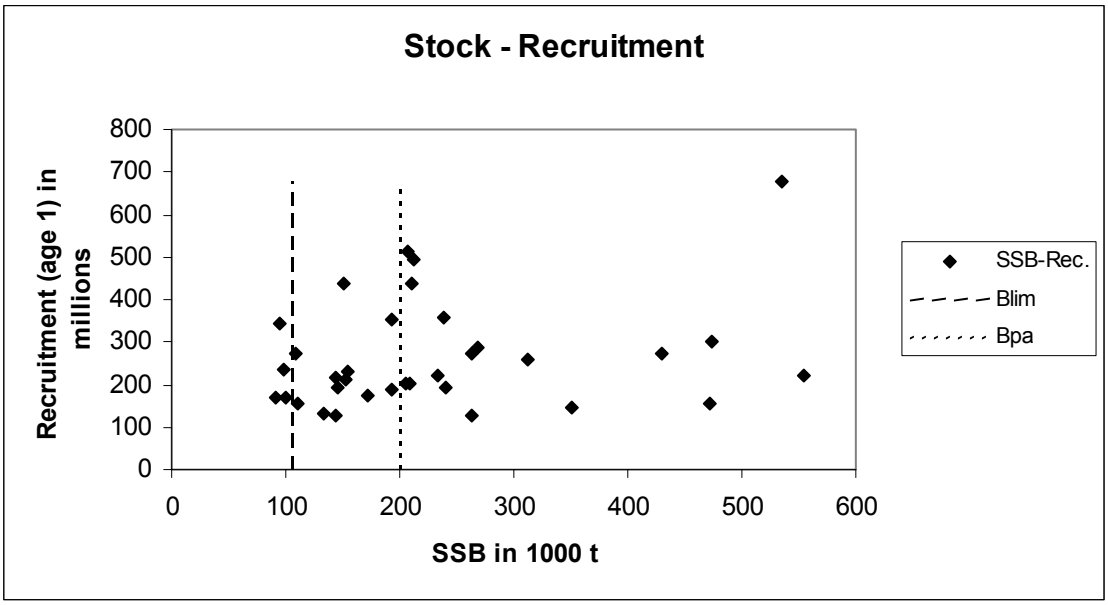
[1]*Status quo* catch. [2] Incomplete data. Weights in '000 t.

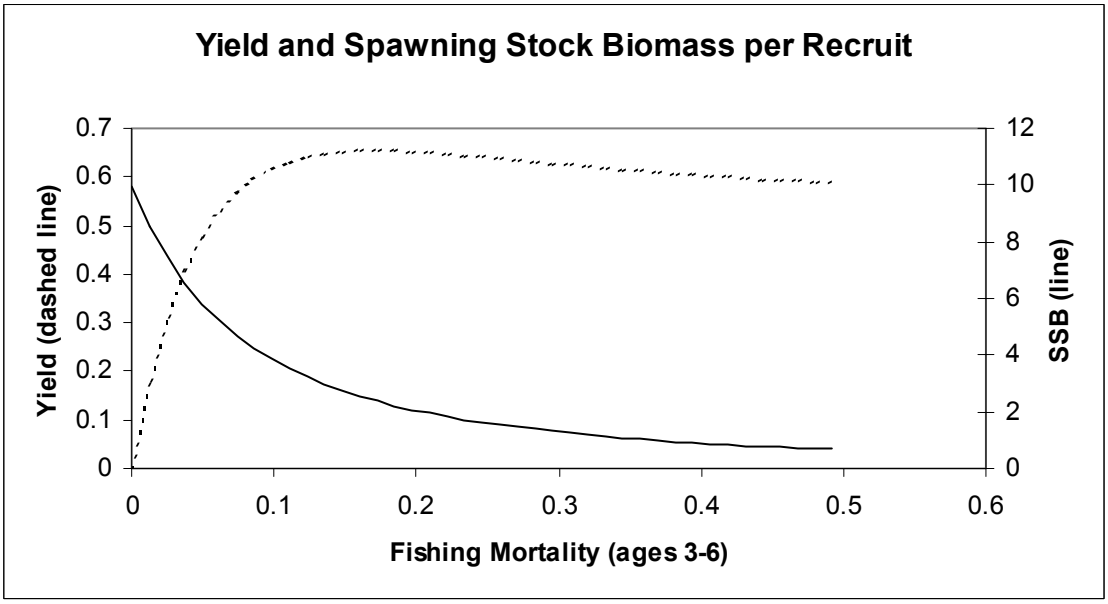

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 3-6)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1967
1972
1977
1982
1987
1992
1997
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
800
700
600
500
400
300
200
100
0
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 3-6)

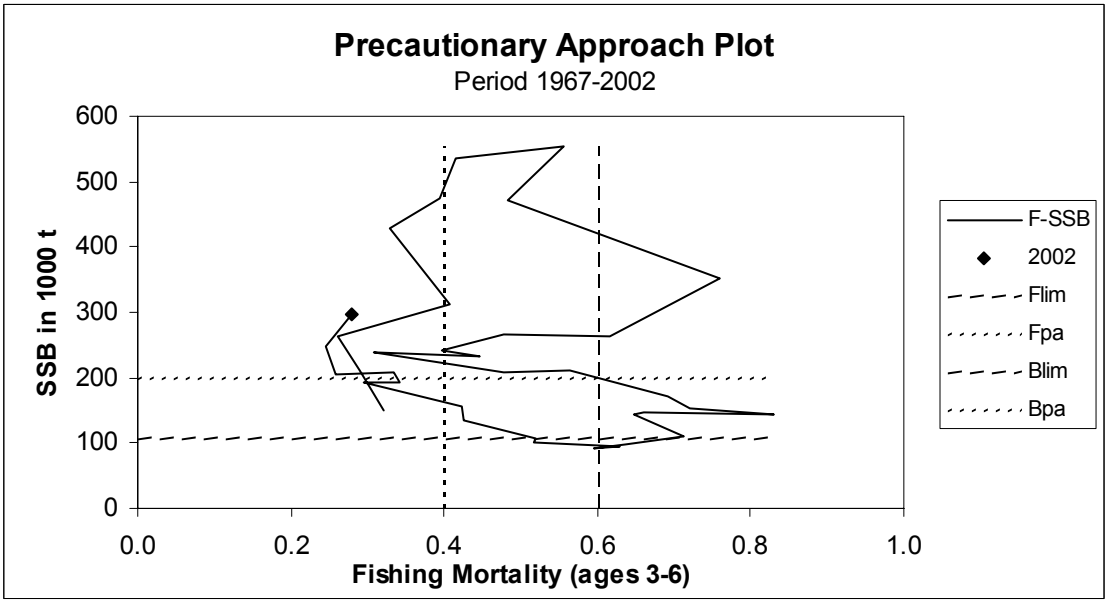

Precautionary Approach Plot
Period 1967-2002
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.5.5.1 Nominal catch (in tonnes) of Saithe in Subarea IV and Division IIIa and Subarea VI, 1992-2001, as officially reported to ICES.

Subarea IV and Division IIIa

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	70	113	130	228	157	254	249	200	122	24
Denmark	4,669	4,232	4,305	4,388	4,705	4,513	3,967	4,494	3,529	3,575
Faroe Islands	2,480	2,875	1,780	3,808	617	158	1,298	1,101	-	
France	9,061	15,258	13,612	11,224	12,336	10,932	11,786[1]	24,305[12]	20,399[12]	21,247[2]
Germany	13,177	14,814	10,013	12,093	11,567	12,581	10,117	10,481	9,273	9,479
Netherlands	180	79	18	9	17	40	7	7	11	20
Norway	48,205	47,669	47,042	53,793	55,531	46,424	50,254	56,150	42,735[1]	43,504
Poland	1,238	937	151	592	365	822	813	862	747	727
Sweden	3,302	4,955	5,366	1,891	1,771	1,647	1,857	1,929	1,421	1,510
UK (E. & W.)	2,893	2,429	2,354	2,522	2,864	2,556	2,293	2,874	1,227	
UK (Scotland)	6,881	5,929	5,566	6,341	5,848	6,329	5,353	5,420	5,484	
United Kingdom										6,282
U.S.S.R.	-	-	-	-	-	-	-	-	67	
Total reported	92,156	99,290	90,337	96,889	95,778	86,256	87,994	107,823	85,080	86,368
Unallocated	187	5,840	12,098	16,525	14,458	17,006	12,983	-175	1,945	3,305
W.G. estimate	92,343	105,130	102,435	113,414	110,236	103,322	100,263	107,314	87,449	89,673
TAC	110,000	93,000	97,000	107,000	111,000	115,000	97,000	110,000	85,000	87,000

Preliminary values for France (1989-1995, 1998-2000), Norway (1995, 1997-2000), Sweden (1999).
Includes IIa (EC), IIIa-d (EC) and IV: France (1989-1991, 1994, 1999-2000).
Includes Estonia: USSR (1991).

Subarea VI

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	2	2	-	-	-	-	-	-	-	-
Denmark	1	2	-	-	1	-	-	-	-	-
Faroe Islands	1	-	-	-	3	1	-	-		
France	6,534	10,216	8,423	6,145	4,781	4,662	3,635[1]	3,467[13]	3,314[13]	5,176[1]
Germany	685	222	524	321	1,012	492	506	250	305	466
Ireland	278	317	438	530	419	411	216	320	449	422
Norway	67	59	74	35	34	26	41	126	58[1]	92
Spain	-	-	-	-	-	13	54	23	3	
Portugal	-	-	-	-	-	1	-	-	-	
UK (E. & W. & N.I.)	540	799	744	317	708	294	526	503	276	
UK (Scotland)	2,708	2,903	2,828	3,279	2,435	2,659	2,402	2,084	2,463	
United Kingdom										2,522
Russia	-	-	-	-	-	-	-	3	25	
Total reported	10,816	14,520	13,031	10,627	9,393	8,559	7,380	6,776	6,423	8,678
Unallocated	988	-577	-210	1,143	40	859	1,054	566	-533	-306
W.G. estimate	11,804	13,943	12,821	11,770	9,433	9,418	8,434	7,342	5,890	8,372
TAC	17,000	14,000	14,000	16,000	13,000	12,000	10,900	7,500	7,000	9,000

[1]Preliminary values: France (1998-2000), Norway (1994, 1997-1999).
[2]Includes Division Vb (EC): France (1991).
[3]Reported by TAC area, Vb (EC), VI, XII and XIV: France (1999-2000).

Subareas IV and VI and Division IIIa

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
W.G. estimate	104,147	119,073	115,256	125,184	119,669	112,740	108,697	114,656	93,600	98,000

Table 3.5.5.2 Saithe in Subarea IV, Division IIIa (Skagerrak) and Subarea VI

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1967	454000	150800	94500	0.322
1968	438000	211700	116800	0.291
1969	492000	264000	131900	0.262
1970	271000	312000	236600	0.408
1971	261000	429500	272500	0.329
1972	273000	474000	275100	0.395
1973	301000	534400	259600	0.416
1974	678000	554800	309400	0.557
1975	222000	471900	308900	0.482
1976	157000	351400	361700	0.761
1977	145000	262900	223400	0.616
1978	125000	267600	166200	0.478
1979	289000	240400	136000	0.397
1980	192000	234100	142400	0.446
1981	222000	239200	146100	0.309
1982	358000	207500	189900	0.477
1983	515000	210000	197800	0.563
1984	440000	171300	219600	0.691
1985	176000	153300	226100	0.721
1986	212000	143800	202800	0.829
1987	128000	145500	180800	0.660
1988	192000	143000	140800	0.648
1989	218000	110100	117600	0.714
1990	156000	97400	107900	0.636
1991	235000	91900	115600	0.595
1992	168000	93900	104100	0.629
1993	343000	100300	119100	0.516
1994	171000	108300	115300	0.519
1995	275000	133800	125200	0.426
1996	134000	154700	119700	0.422
1997	229000	192700	112700	0.294
1998	187000	192800	108700	0.343
1999	351000	208500	114700	0.335
2000	203000*	205200	93600	0.258
2001	203000*	247000	98000	0.246
2002	203000*	298000		0.280
Average	267139	233547	171174	0.480

* GM mean

3.5.6 Plaice in Subarea IV (North Sea)

State of stock/exploitation: The stock is outside safe biological limits. SSB in 2002 is below $\mathbf{B}_{pa}$ and fishing mortality in 2001 was above $\mathbf{F}_{pa}$. Spawning stock biomass has declined from 1989 to 1997, where it reached its historical minimum, but has increased in recent years due to the strong 1996 year class. Fishing mortality increased from the 1960s to the 1990s, reaching a record high in 1997 and has declined since then. Except for the 1996 year class, recruitment since 1993 has been below average. Surveys indicate that the 2001 year class is strong.

Management objectives: In 1999, the EU and Norway have *"agreed to implement a long-term management plan for the plaice stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:*

1. *Every effort shall be made to maintain a minimum level of SSB greater than 210 000 t ($\boldsymbol{B}_{lim}$).*

2. *For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality of 0.3 for appropriate age groups as defined by ICES.*

3. *Should the SSB fall below a reference point of 300 000 t ($\boldsymbol{B}_{pa}$), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of 300 000 t.*

4. *In order to reduce discarding and to enhance the spawning biomass of plaice, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, inter alia, ICES.*

The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."

ICES considers that the agreed Precautionary Approach reference points in the management plan are consistent with the precautionary approach, provided they are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary approach reference points (unchanged since 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 210 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 300 000 t. This is the previously agreed MBAL and affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.6.	$\mathbf{F}_{pa}$ be set at 0.30. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=210 000 t.	$\mathbf{B}_{pa}$ Approximately 1.4 $\mathbf{B}_{lim}$, previous MBAL.
$\mathbf{F}_{lim}$=$\mathbf{F}_{loss}$=0.6.	$\mathbf{F}_{pa}$ = 5th % of $\mathbf{F}_{loss}$ (0.6) is 0.36, which implies that $\mathbf{B}_{eq}$< $\mathbf{B}_{pa}$. Therefore a lower value is required. F = 0.3 implies $\mathbf{B}_{eq}$ > $\mathbf{B}_{pa}$ and a less than 10 % probability that $\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$.

NB: As F increases above 0.3, P($\mathbf{SSB}_{MT}$ < $\mathbf{B}_{pa}$) increases rapidly.

Advice on management: ICES recommends that the fishing mortality be less than F = 0.23 in order to bring SSB above $\mathbf{B}_{pa}$ in 2004. This corresponds to landings of less than 60 000 t in 2003. This implies a reduction in fishing mortality of at least 40%. Management of fisheries taking plaice must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: Although there is some by-catch of cod in the plaice fisheries the impact of the agreed technical measures as outlined in EU regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001 that will be implemented from 2002 onwards are not likely to impact the plaice fishery and stock substantially.

The assessment is considered to be uncertain. One major source of uncertainty is the absence of discard data from the analysis when discarding is high and increasing. The surveys used for calibrating the assessment may only cover part of the stock. There are conflicting signals about the trends in the stock from the fishermen and from the assessment.

There is evidence from the surveys, sampling, and assessment that the strong 1996 year class suffered extensive discarding and a substantial portion of its potential contribution to yields and SSB was wasted. With the 2001 year class appearing strong at this time, extra measures to reduce captures prior to attaining marketable size would be appropriate and beneficial to development of fisheries and SSB in the next few years.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01) scaled = 0.38; Landings(2002) = 97; SSB(2003) = 269.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	$0.0*\mathbf{F}_{sq}$	0	361
0.04	$0.1*\mathbf{F}_{sq}$	11.1	350
0.08	$0.2*\mathbf{F}_{sq}$	21.7	339
0.11	$0.3*\mathbf{F}_{sq}$	31.9	329
0.15	$0.4*\mathbf{F}_{sq}$	41.7	319
0.19	$0.5*\mathbf{F}_{sq}$	51.2	310
0.23	$0.6*\mathbf{F}_{sq}$	60.3	301
0.27	$0.7*\mathbf{F}_{sq}$	69	292
0.3	$\mathbf{F}_{pa}=0.8*\mathbf{F}_{sq}$	77.5	284
0.34	$0.9*\mathbf{F}_{sq}$	85.6	276
0.38	$1.0*\mathbf{F}_{sq}$	93.4	269

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessments: Contrary to previous assessments the current retrospective analysis does not show a retrospective bias of consistent overestimation of SSB. The current assessment is generally consistent with last year's assessment, although the 2001 data on age compositions has introduced a revision in the perception of both fishing mortality and SSB.

Elaboration and special comment: North Sea plaice is taken mainly in a mixed flatfish fishery by beam trawlers in the southern and southeastern North Sea. Directed fisheries are also carried out with seine and gillnet, and by beam trawlers in the central North Sea.

Since 1989, an area with high concentrations of small plaice ("Plaice Box") was closed to beam trawl fisheries with vessels > 300 hp during the second and third quarter and, since 1994, during the fourth quarter as well. Since 1995, the plaice box has been closed for the whole year. Beam trawlers < 300 hp are allowed to fish inside the box. Effort reductions have mainly been effective since 1994 when the fourth quarter was closed and when effort levels in the box decreased to around 10% of the pre-box level.

Due to the minimum mesh size (80 mm) in the mixed beam trawl fishery, south of 55°N, or 56°N east of 5°E, large numbers of (undersized) plaice are discarded. The 80 mm mesh size is obviously not matched to the minimum landing size of plaice. Estimates of discards are not included in the assessment since time-series of discards are not available. Ongoing sampling programmes indicate that discarding in recent years has increased from about 50% in numbers historically to 70-80% in 2000 and 2001. The high estimates of discards in recent years may be caused by a reduction in growth, which extends the time the fish is undersized and subject to discarding. There is a need for continuous monitoring of discards and special attention should be given to reconstructing recent discard trends so as to improve the assessment of this stock.

The stock-recruitment plot suggests that in recent years recruitment has declined at lower SSB. However, recruitment surveys at age zero do not indicate such a reduction, and it is possible that the lower estimated recruitment in the assessment may be explained by an increase in discarding.

The North Sea Commission Fisheries Partnership reviewed the assessment for North Sea plaice in August 2002. The review consisted of a scientific review by three independent scientific experts and a public review with the participation of fishermen organizations. The general conclusion of the scientific review was that the assessment was carried out according to appropriate standards although it was acknowledged that the assessment was uncertain. The fishermen expressed a different perception on the development in the stock compared to the stock assessment.

Preliminary simulations have been carried out to evaluate the potential effects of the technical

interactions between fleets harvesting plaice and sole. Although the linkage between plaice and sole has not quantified, the results indicate that the required reduction in fishing mortality for plaice and sole based on single species considerations may be incompatible.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Analytical assessment uses data from two research surveys for calibration. Forecasts use survey indices up to and including 2002. No discard datas are used in the assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

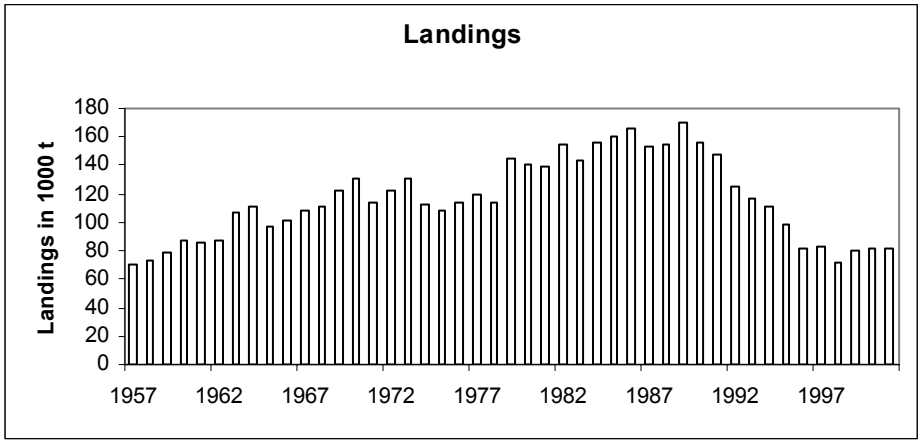
Yield and spawning biomass per Recruit F-reference points:

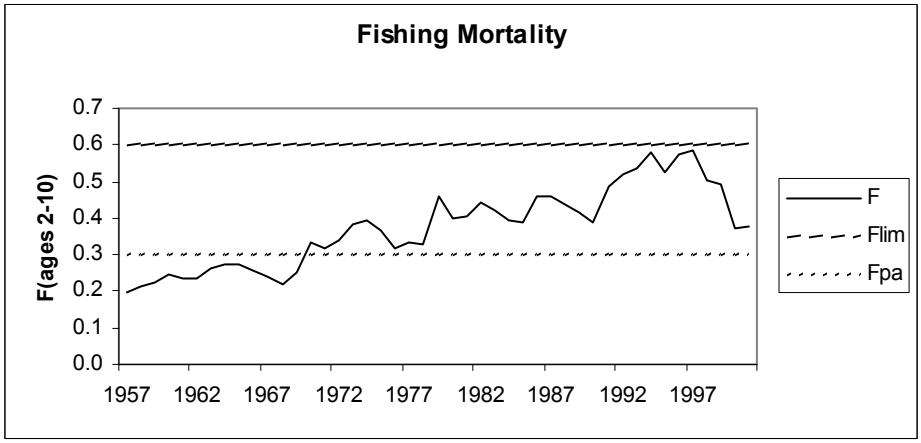
	Fish Mort Ages 2-10	Yield/R	SSB/R
Average Current	0.414	0.254	0.656
$\mathbf{F}_{max}$	0.250	0.261	1.069
$\mathbf{F}_{0.1}$	0.118	0.238	2.120
$\mathbf{F}_{med}$	0.337	0.258	0.798

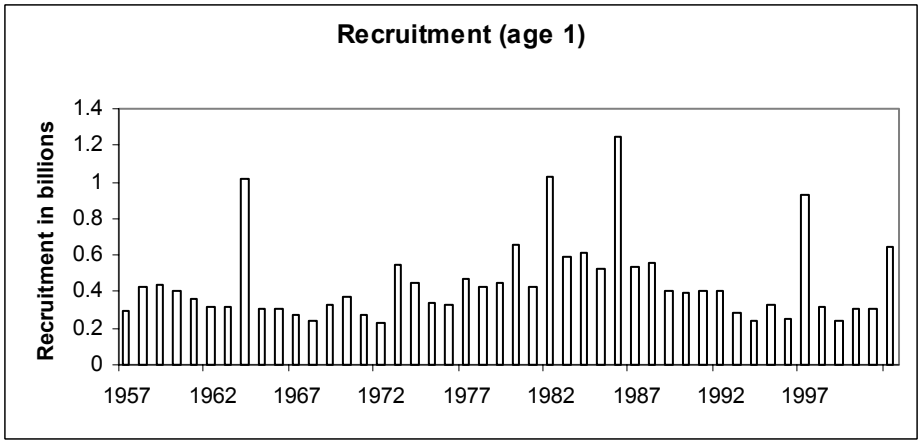
Catch data (Tables 3.5.6.1–2):

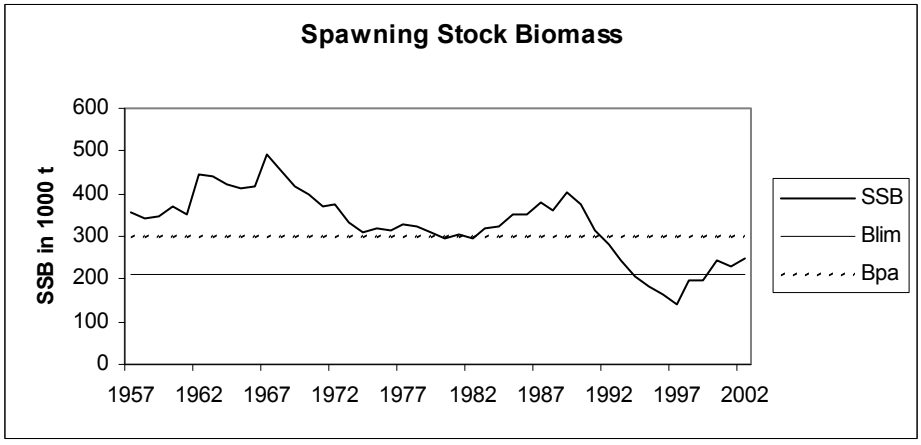
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	F < F(84); TAC	120	150	131	154
1988	70% of F(85); TAC	150	175	138	154
1989	Reduce F; buffer SSB	<175	185	152	170
1990	*Status quo* F; TAC	171	180	156	156
1991	No increase in F; TAC	169	175	144	148
1992	No long-term gains in increasing F	-[1]	175	123	125
1993	No long-term gains in increasing F	170[1]	175	115	117
1994	No long-term gains in increasing F	-[1]	165	110	110
1995	Significant reduction in F	87[2]	115	96	98
1996	Reduction in F of 40%	61	81	80	82
1997	Reduction in F of 20%	80	91[3]	82	83
1998	Fish at F = 0.3	82	87	70	72
1999	Fish at F = 0.3	106	102	79	81
2000	Fish at F = 0.3	95	97	84	81
2001	Fish at F = 0.26	78	78	80	82
2002	F<$\mathbf{F}_{pa}$	<77	77		
2003	Fish at F=0.23	60			

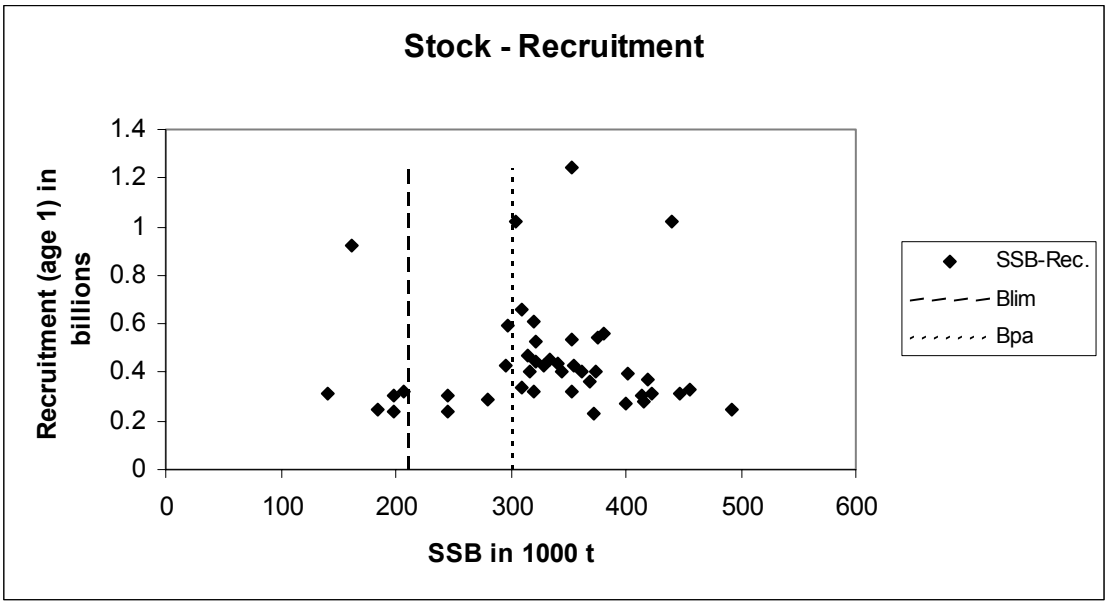
[1] Catch at *status quo* F. [2]Catch at 20% reduction in F. [3] After revision from 77 000 t. Weights in '000 t.

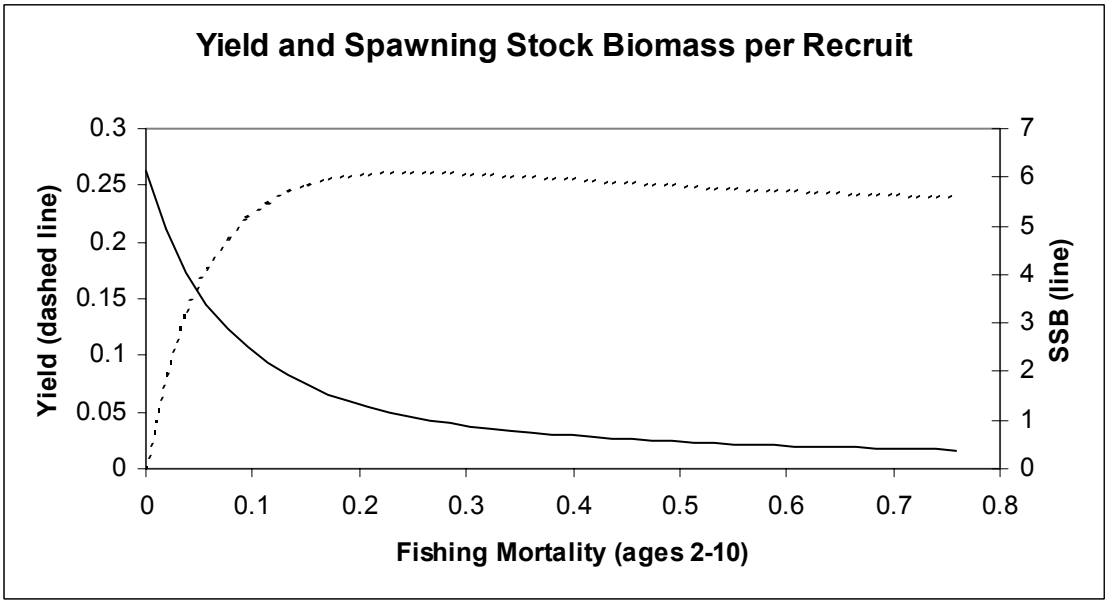

Landings
Landings in 1000 t
180
160
140
120
100
80
60
40
20
0
1957
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 2-10)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1957
1962
1967
1972
1977
1982
1987
1992
1997
F
Flim
Fpa


Recruitment (age 1)
Recruitment in billions
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1957
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 2-10)

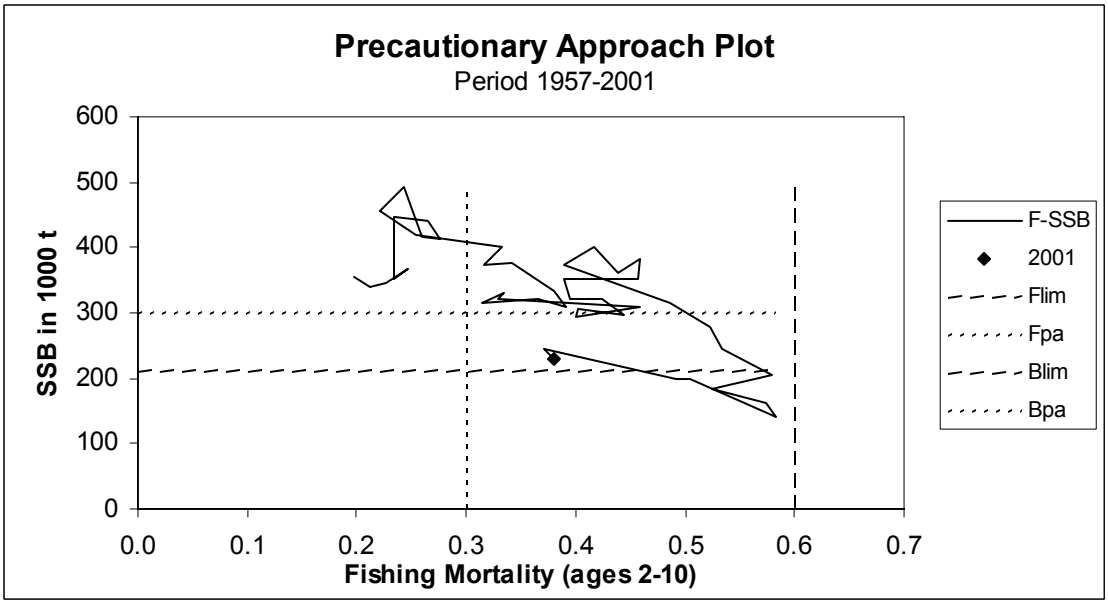

Precautionary Approach Plot
Period 1957-2001
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 2-10)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.5.6.1 North Sea Plaice. Nominal landings (tonnes) in Subarea IV as officially reported to ICES.

Country	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	7,951	7,093	5,765	5,223	5,592	6,160	7,620	6,369
Denmark	17,056	13,358	11,776	13,940	10,087	13,468	13,408	13,797
France	407	442	379	254	489	624	836	429
Germany	5,697	6,329	4,780	4,159	2,773	3,144	4,310	4,739
Netherlands	50,289	44,263	35,419	34,143	30,541	37,513	35,030	33,290*
Norway	524	527	917	1,775	1,004	913	835	1,926
Sweden	6	3	5	10	2	4	3	3
UK (E/W/NI)	17,806	15,801	13,541	13,789	11,473	9,743	…	
UK (Scotland)	9,943	8,594	7,451	8,345	8,442	7,318	…	
United Kingdom							20,711	19,111
Others					1			
Total	109,679	96,410	80,033	81,638	70,404	78,887	82,753	79,668
Unallocated	713	1,946	1,640	1,410	1,130	1,775	0	2,183
WG estimate	110,392	98,356	81,673	83,048	71,534	80,662	81,148[1]	81,847
TAC	165,000	115,000	81,000	91,000	87,000	102,000	97,000	78,000

[1]Revised in 2002 *not including 544t reported in unknown area.

Table 3.5.6.2 Plaice Subarea IV (North Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-10
1957	296163	354624	70563	0.1973
1958	429984	340635	73354	0.2118
1959	433436	345186	79300	0.2266
1960	405322	368310	87541	0.2469
1961	359381	352877	85984	0.2331
1962	318799	446570	87472	0.2345
1963	315180	439974	107118	0.2645
1964	1021876	422932	110540	0.2732
1965	309564	414351	97143	0.2761
1966	305368	416384	101834	0.2594
1967	277223	493003	108819	0.2427
1968	245500	456098	111534	0.2210
1969	327470	418273	121651	0.2538
1970	370435	399568	130342	0.3330
1971	275472	372346	113944	0.3156
1972	234574	375795	122843	0.3410
1973	541864	334716	130429	0.3807
1974	451917	308810	112540	0.3915
1975	335705	320025	108536	0.3657
1976	324555	314499	113670	0.3151
1977	471281	329206	119188	0.3349
1978	429861	322583	113984	0.3290
1979	444315	309301	145347	0.4585
1980	659486	295023	139951	0.3995
1981	424278	305108	139747	0.4024
1982	1024429	297558	154547	0.4439
1983	589588	320724	144038	0.4236
1984	607625	321214	156147	0.3948
1985	527444	353101	159838	0.3892
1986	1244422	353138	165347	0.4578
1987	538723	381332	153670	0.4595
1988	562781	362315	154475	0.4381
1989	406684	401635	169818	0.4160
1990	396763	373504	156240	0.3887
1991	401395	315671	148004	0.4861
1992	403264	279556	125190	0.5219
1993	284693	245697	117113	0.5345
1994	238459	206567	110392	0.5788
1995	323671	183541	98356	0.5244
1996	250311	162560	81673	0.5744
1997	926430	140553	83048	0.5839
1998	312257	198560	71534	0.5046
1999	240475	198719	80662	0.4918
2000	306314	244434	81148	0.3707
2001	301655	230644	81847	0.3796
2002	650000	250000		
Average	446661	327766	116144	0.3749

3.5.7 Sole in Subarea IV (North Sea)

State of stock/exploitation: The stock is outside safe biological limits. SSB in 2002 is below the proposed $\mathbf{B}_{pa}$, and fishing mortality in 2001 remains above $\mathbf{F}_{pa}$. The spawning stock reached an historic low in 1998 below $\mathbf{B}_{lim}$. It increased sharply following recruitment of the strong 1996 year class. The 2001 year class is above average.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 25 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 35 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is undefined.	$\mathbf{F}_{pa}$ be set at 0.4. This F is considered to provide a greater than 95% probability of avoiding $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$=$\mathbf{B}_{loss}$=25 000 t.	$\mathbf{B}_{pa}$ = 1.4 *$\mathbf{B}_{lim}$.
	$\mathbf{F}_{pa}$ = 5th percentile (0.49) of $\mathbf{F}_{loss}$ implies $B_{eq} < \sim \mathbf{B}_{pa}$, F = 0.4 implies $\mathbf{B}_{eq} > \mathbf{B}_{pa}$ and P($\mathbf{SSB}_{MT} < \mathbf{B}_{pa}$) < 10%.

Advice on management: ICES recommends that the fishing mortality be less than $\mathbf{F}_{pa}$ = 0.4, corresponding to landings of less than 14 600 t in 2003. This implies a reduction in fishing mortality of at least 23%. Management of fisheries taking sole must respect the stringent restrictions on the catch and discard rates advised for cod, with effective monitoring of compliance with those restrictions.

Relevant factors to be considered in management: The peaks in SSB of this stock are heavily dependent on the occasional occurrence of strong year classes. The SSB and landings in recent years have been dominated by the abundant 1996 year class. The stock is expected to decrease in 2003 just above $\mathbf{B}_{lim}$, but well below $\mathbf{B}_{pa}$. However, because of a strong 2001 year class, the stock is expected to increase above $\mathbf{B}_{pa}$ in 2004. TACs in recent years have been agreed above the recommended $\mathbf{F}_{pa}$.

Sole is mainly caught in a mixed beam trawl fishery with plaice using 80 mm mesh in the southern North Sea. This means it is important to take into account the impact of management measures for plaice when considering sole. There is not a simple one-to-one link between the catch of sole and plaice when considering effort reduction. The proposed reduction in fishing mortality for plaice is 40%, while the advice given for sole implies a reduction of at least 23 %.

Management measures, which result in a reduction in the mortality on juvenile sole would benefit the stock. The continued use of 80 mm mesh together with the minimum landing size of 24 cm results in a high proportion of sole being landed which are immature.

The impact of the agreed technical measures that will be implemented from 2002 onwards are not likely to impact the sole stock. Technical measures introduced in January 2000 have extended the area where fishing with 80 mm is allowed from 55ºN to 56ºN east of 5ºE. ICES is not able to assess the impact of this measure, but it is considered unlikely to have a substantial impact on the sole stock as long as it represents the northern limit of the distribution of sole.

The by-catch and discard limits advised for cod and other management measures that may be implemented to promote the recovery of cod need to be respected in the prosecution of the mixed plaice-sole fisheries. By-catch or discards should be quantified.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999-2001, scaled) = 0.52; Landings (2002) = 16.8; SSB(2003)= 25.7.

F (2003)	Basis	Landings (2003)	SSB (2004)
0.31	$\mathbf{F}_{sq}$*0.60	11.8	44.9
0.37	$\mathbf{F}_{sq}$*0.70	13.5	43.3
0.40	$\mathbf{F}_{sq}$*0.77 = $\mathbf{F}_{pa}$	14.6	42.2
0.42	$\mathbf{F}_{sq}$*0.80	15.1	41.7
0.52	$\mathbf{F}_{sq}$*1.00	18.1	38.8
0.63	$\mathbf{F}_{sq}$*1.20	20.8	36.1

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term analyses (Figures 3.5.7.1 and 3.5.7.2) indicate that yield and SSB are expected to decrease at the current fishing mortality (F=0.52). SSB will fall below $\mathbf{B}_{pa}$. Fishing at $\mathbf{F}_{pa}$ is expected to give a high probability of SSB being above $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: The main change in the assessment compared with last year is a change in the calibration data used for the assessment and a revision of the catch data. The stock is now assessed to be outside safe biological limits.

Elaboration and special comment: Sole is mainly taken by beam trawl fleets in a mixed fishery for sole and plaice in the southern part of the North Sea. The minimum mesh size permitted when fishing for sole is 80 mm. Beam trawl fleets started to develop in the mid-1960s, and have expanded up to the 1990s. A relatively small part of the catch is taken in a directed fishery by gillnetters in coastal areas, mostly in the 2nd quarter of the year. Since 1989, the distribution pattern of the beam trawl fleets > 300 HP has changed due to the introduction of the 'Plaice Box' in the southeastern part of the North Sea.

A knife-edged maturity ogive is used for sole, implying maturity at age 3. There is evidence from previous working documents that this may substantially overestimate the proportion of mature sole in some years.

Preliminary simulations have been carried out to evaluate the potential effects of the technical interactions between fleets harvesting plaice and sole. Although the linkage between plaice and sole has not quantified, the results indicate that the required reduction in fishing mortality for plaice and sole based on single species considerations may be incompatible.

Analytical assessment (XSA) uses data from two research surveys and two commercial CPUE series for calibration. Forecasts use survey indices up to and including 2002. No discard data are used in the assessment.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

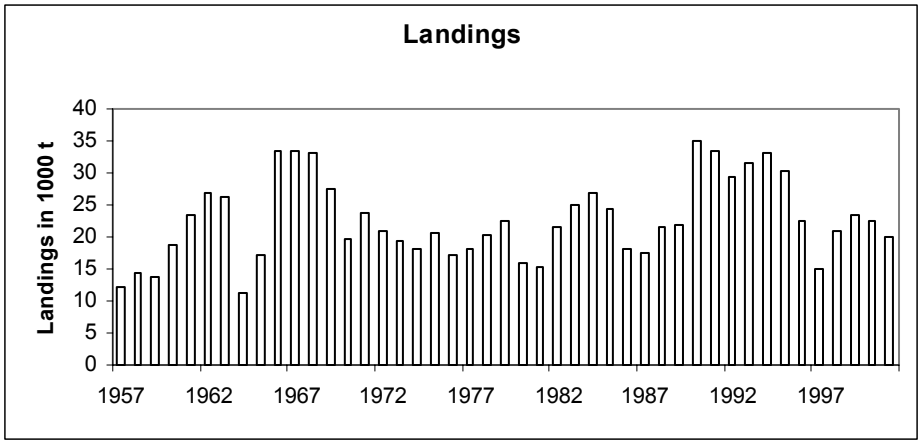
Yield and spawning biomass per Recruit F-reference points:

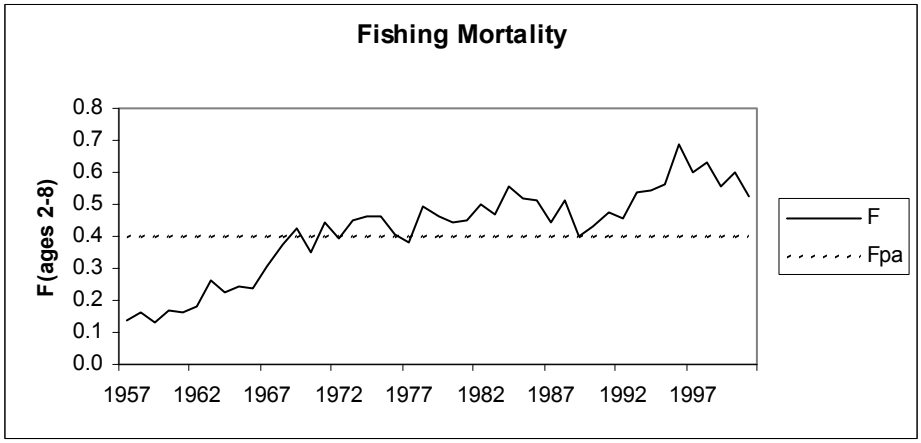
	Fish Mort Ages 2-8	Yield/R	SSB/R
Average Current	0.560	0.167	0.276
$\mathbf{F}_{max}$	0.279	0.170	0.553
$\mathbf{F}_{0.1}$	0.092	0.151	1.472
$\mathbf{F}_{med}$	0.300	0.170	0.515

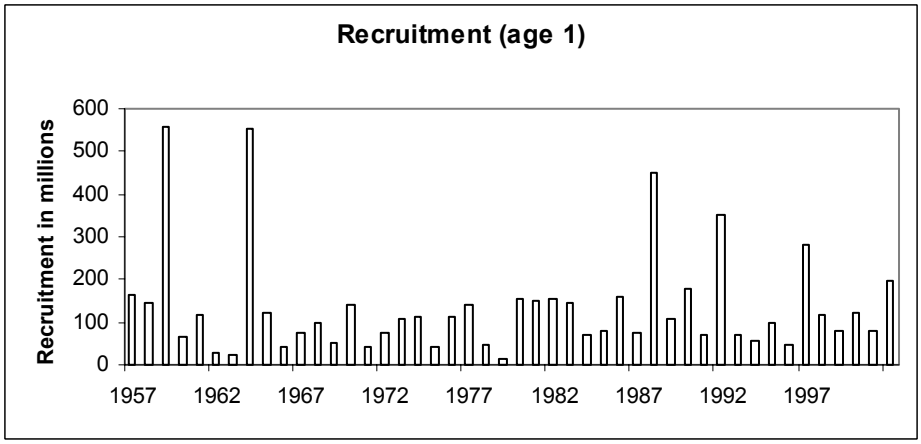
Catch data (Tables 3.5.7.1–2):

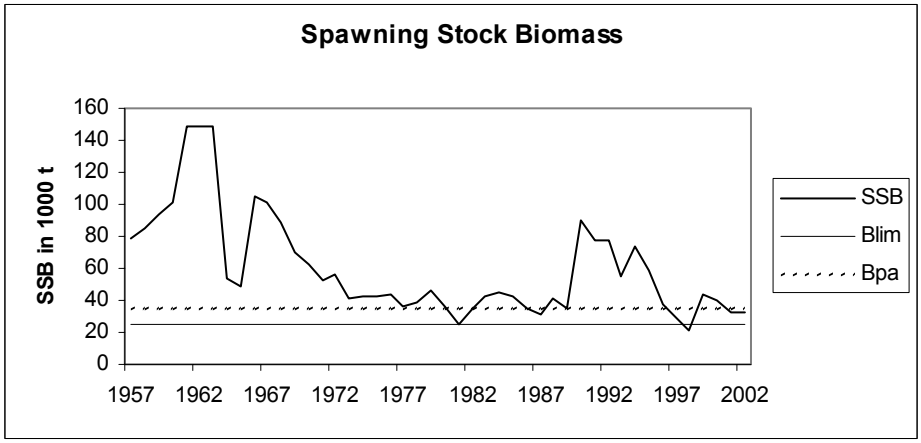
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	Rebuild SSB to 40 000 t; TAC	11.0	14.0	13.8	17.4
1988	Increase SSB towards 50 000 t; TAC	11.0	14.0	13.4	21.6
1989	Increase SSB towards 50 000 t; TAC	14.0	14.0	14.5	21.8
1990	80% of F(88); TAC	25.0	25.0	26.5	35.1
1991	SSB>50 000 t; TAC	27.0	27.0	27.6	33.5
1992	TAC	21.0	25.0	26.0	29.3
1993	No long-term gains in increased F	29.0[1]	32.0	29.8	31.5
1994	No long-term gains in increased F	31.0[1]	32.0	31.3	33.0
1995	No long-term gains in increased F; link to plaice	28.0[1]	28.0	28.8	30.5
1996	Mixed fishery, link plaice advice into account	23.0[1]	23.0	20.4	22.7
1997	<80% of F(95)	14.6	18.0	13.7	15.0
1998	75% of F(96)	18.1	19.1	19.7	20.9
1999	$F < \mathbf{F}_{pa}$ (80% of F(97))	20.3	22.0	22.0	23.5
2000	$F < \mathbf{F}_{pa}$	<19.8	22.0	20.7	22.5
2001	$F < \mathbf{F}_{pa}$	<17.7	19.0	16.4	19.8
2002	F<0.37	<14.3	16.0		
2003	$F<\mathbf{F}_{pa}$	<14.6			

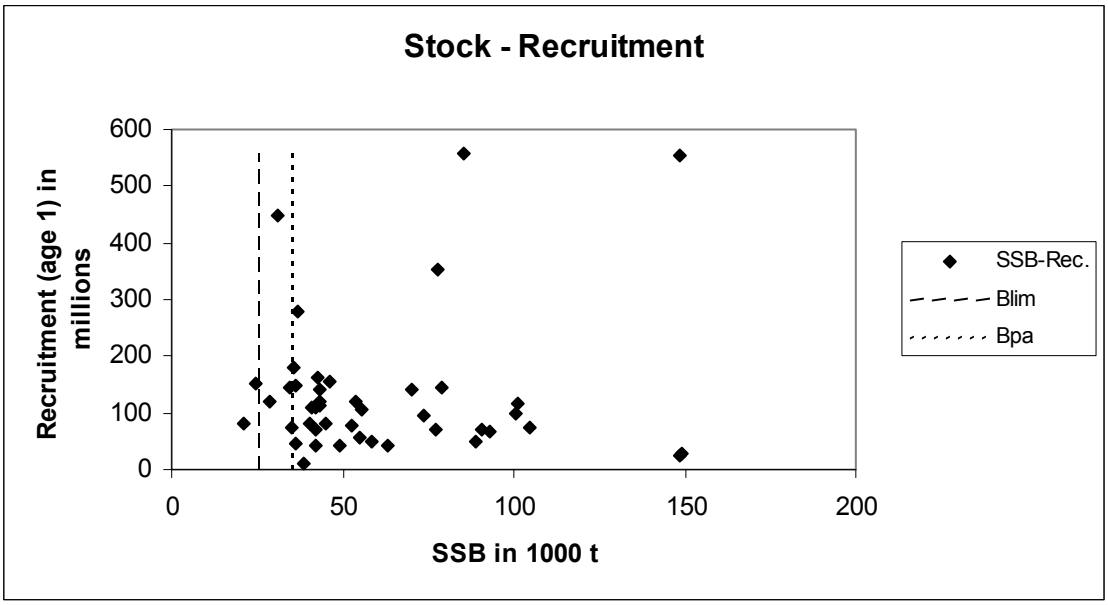
[1]Catch *status quo* F. Weights in '000 t.

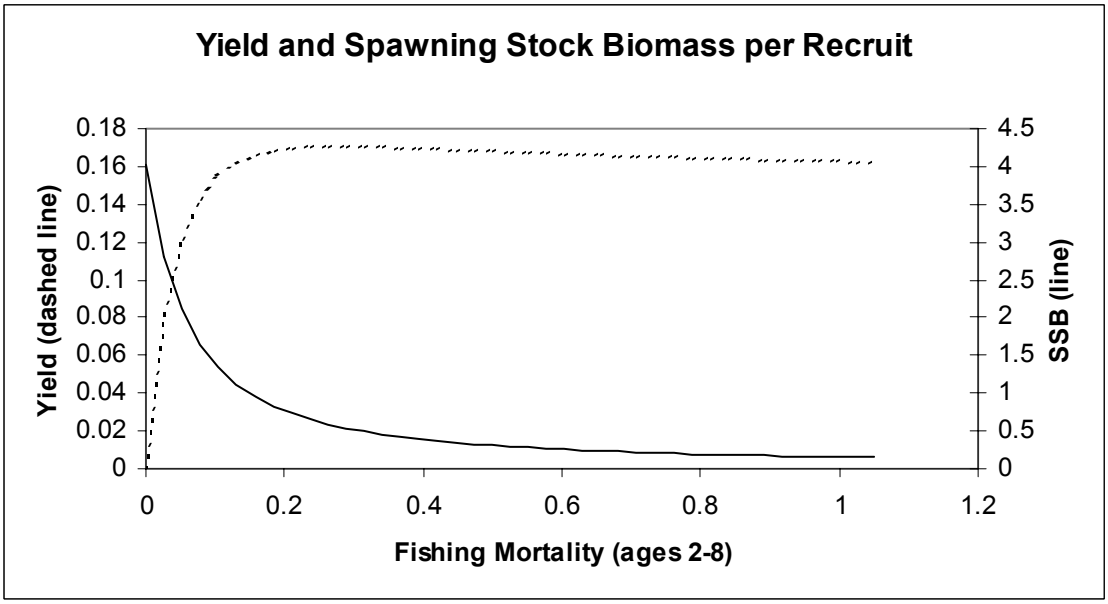

Landings
Landings in 1000 t
0
5
10
15
20
25
30
35
40
1957
1962
1967
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 2-8)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1957
1962
1967
1972
1977
1982
1987
1992
1997
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
100
200
300
400
500
600
1957
1962
1967
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
160
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
600
500
400
300
200
100
0
0
50
100
150
200
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 2-8)

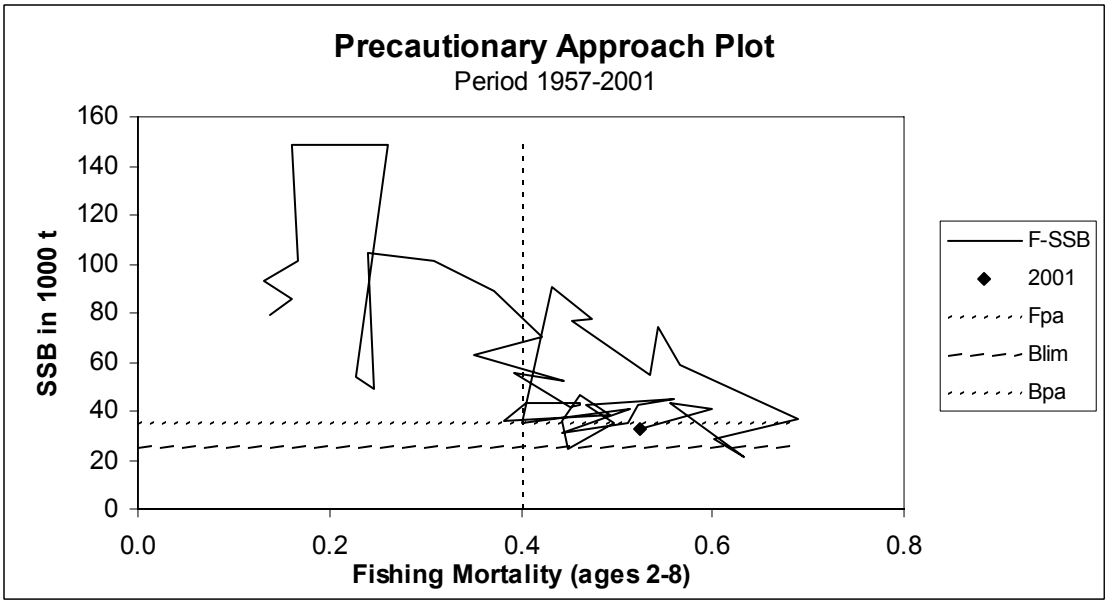

Precautionary Approach Plot
Period 1957-2001
SSB in 1000 t
160
140
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-8)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.5.7.1 Nominal catch (tonnes) of Sole in Subarea IV and landings as estimated by the Working Group.

Year	Belgium	Denmark	France	Germany Fed. Rep.	Netherlands	UK (Engl. Wales)	Other countries	Total reported	Unallocated landings	WG Total	TAC
1982	1,927	522	686	290	17,749	403		21,577	2	21,579	20,000
1983	1,740	730	332	619	16,101	435		19,957	4,970	24,927	20,000
1984	1,771	818	400	1,034	14,330	586	1	18,940	7,899	26,839	20,000
1985	2,390	692	875	303	14,897	774	3	19,934	4,314	24,248	22,000
1986	1,833	443	296	155	9,558	647	2	12,934	5,266	18,200	20,000
1987	1,644	342	318	210	10,635	676	4	13,829	3,539	17,368	14,000
1988	1,199	616	487	452	9,841	740	28	13,363	8,227	21,590	14,000
1989	1,596	1,020	312	864	9,620	1,033	50	14,495	7,311	21,806	14,000
1990	2,389	1,428	352	2,296	18,202	1,614	263	26,544	8,576	35,120	25,000
1991	2,977	1,307	465	2,107	18,758	1,723	271	27,608	5,905	33,513	27,000
1992	2,058	1,359	548	1,880	18,601	1,281	277	26,004	3,337	29,341	25,000
1993	2,783	1,661	490	1,379	22,015	1,149	298	29,775	1,716	31,491	32,000
1994	2,935	1,804	499	1,744	22,874	1,137	298	31,291	1,711	33,002	32,000
1995	2,624	1,673	640	1,564	20,927	1,040	312	28,780	1,687	30,467	28,000
1996	2,555	1,018	535	670	15,344	848	229	20,351	2,300	22,651	23,000
1997	1,519	689	99	510	10,241	479	204	13,741	1,160	14,901	18,000
1998	1,844	520	510	782	15,198	549	338	19,739	1,129	20,868	19,100
1999	1,919	828	357	1,458	16,283	645	501	21,991	1,484	23,475	22,000
2000	1,806	1,069	362	1,280	15,273	600	346	20,736	1,796	22,532	22,000
2001	1,874	773	370	958	11,547	596	310	16,428	3,421	19,849	19,000

Table 3.5.7.2 Sole in Subarea IV (North Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-8
1957	165503	78903	12067	0.1369
1958	144953	85570	14287	0.1599
1959	559006	93191	13832	0.1324
1960	66859	101245	18620	0.1669
1961	115734	148954	23566	0.1599
1962	28345	148786	26877	0.1806
1963	23008	148403	26164	0.2612
1964	554353	53583	11342	0.2277
1965	121486	48953	17043	0.2464
1966	41181	104785	33340	0.2398
1967	75332	100874	33439	0.3081
1968	100099	88922	33179	0.3726
1969	50588	70373	27559	0.4229
1970	141484	62942	19685	0.3506
1971	41937	52377	23652	0.4439
1972	76954	55733	21086	0.3930
1973	106419	41867	19309	0.4519
1974	110814	42280	17989	0.4624
1975	41910	43020	20773	0.4617
1976	114341	43477	17326	0.4046
1977	140464	36044	18003	0.3817
1978	47052	38588	20280	0.4934
1979	11817	46183	22598	0.4609
1980	154662	36021	15807	0.4427
1981	149248	24712	15403	0.4483
1982	153150	34734	21579	0.4971
1983	144182	42056	24927	0.4676
1984	71321	45237	26839	0.5592
1985	81485	42417	24248	0.5217
1986	160722	35359	18201	0.5116
1987	73053	30712	17368	0.4426
1988	448821	40855	21590	0.5132
1989	108878	35438	21805	0.4020
1990	178585	90485	35120	0.4329
1991	71371	77951	33513	0.4735
1992	352279	77076	29341	0.4532
1993	69422	54977	31491	0.5348
1994	57347	73922	33002	0.5432
1995	96501	58674	30467	0.5655
1996	48961	36917	22651	0.6899
1997	279247	28516	14901	0.6012
1998	119390	21053	20868	0.6324
1999	81109	43281	23475	0.5561
2000	121251	40621	22532	0.5986
2001	80305	32829	19849	0.5244
2002	197033	32300		
Average	134304	60243	22600	0.4162

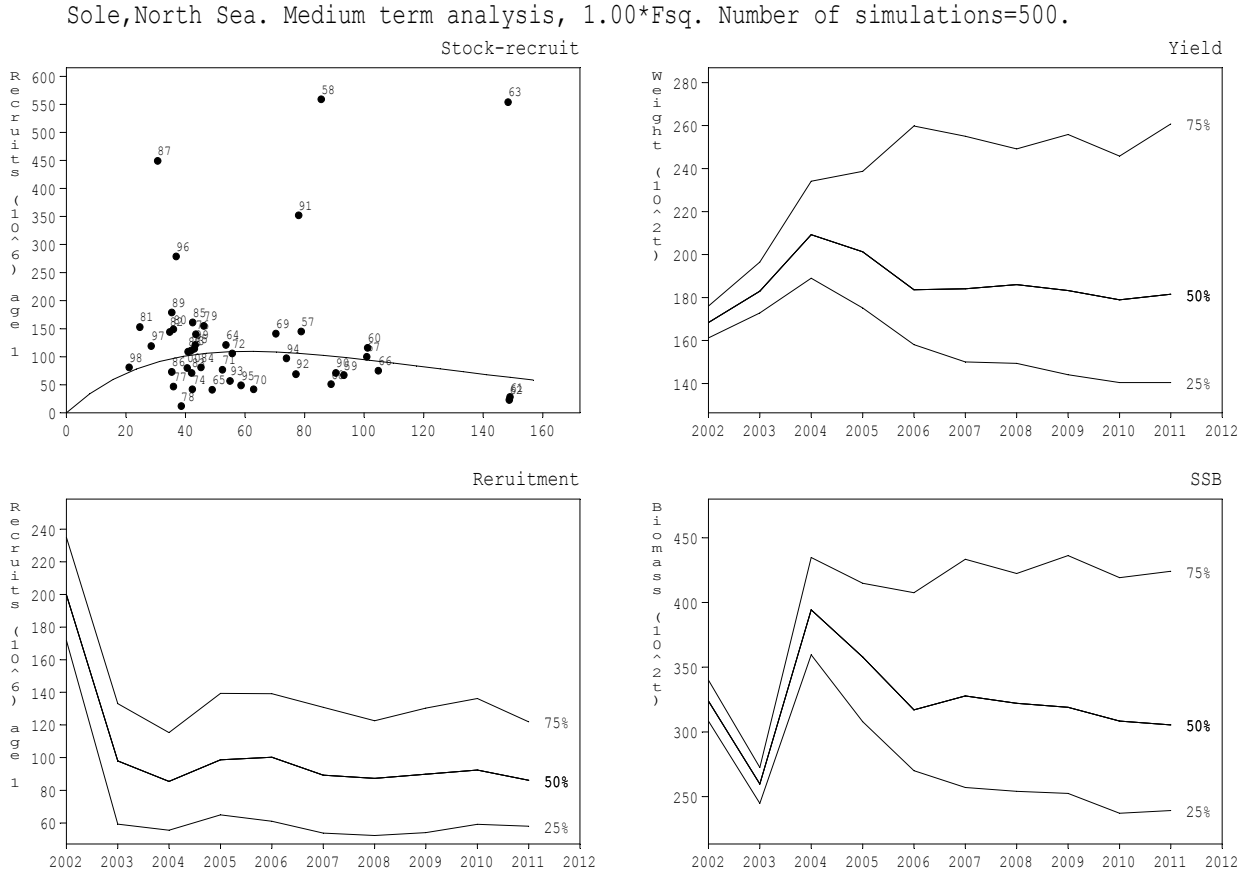


Figure 3.5.7.1

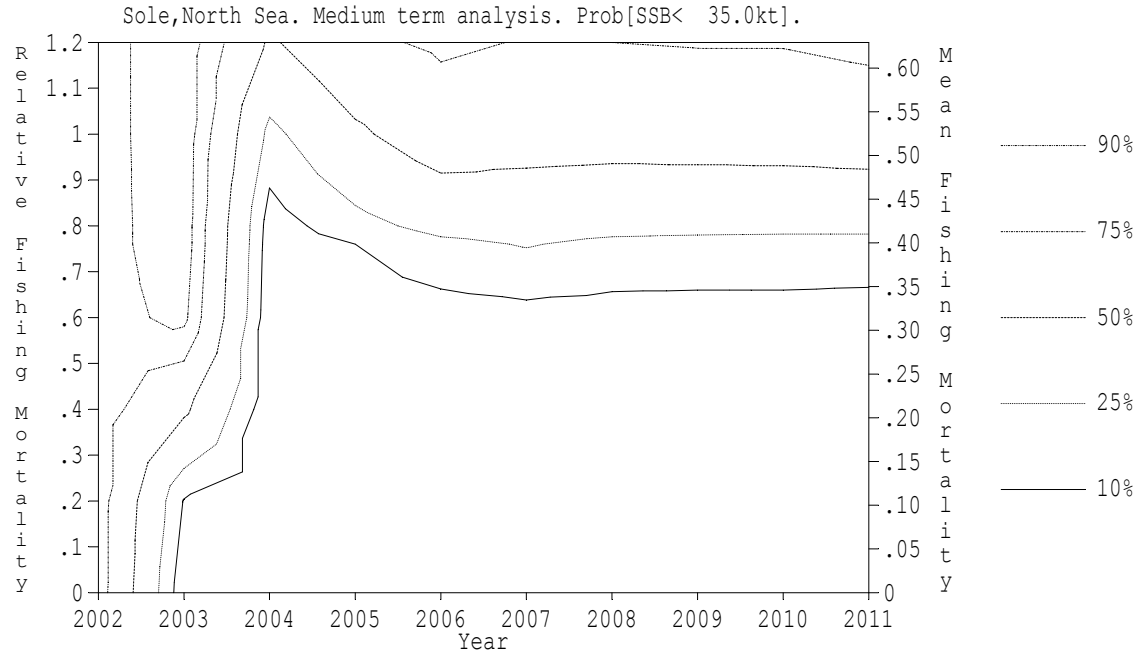


Figure 3.5.7.2

3.5.8 Herring in Subarea IV, Division VIId and Division IIIa (autumn-spawners)

State of stock/exploitation: The stock is inside safe biological limits. SSB in 2001 was estimated at 1.4 million t and is expected to increase to 1.7 million tons in 2002, which is above the $\mathbf{B}_{pa}$ of 1.3 million t. SSB has increased gradually since the low stock size in the mid 1990s. This in response to reduced catches, strong recruitment and management measures that reduced exploitation both on juveniles and adults. In 1996 the fishing mortality for the adult part of the stock was reduced to 0.43. It has further decreased in subsequent years, being 0.24 in 2001. For juveniles the fishing mortality remained below 0.1 since 1996. Both, the 1998 year class and the 2000 year class appear to be very strong in all the surveys.

Management objectives: According to the EU-Norway agreement (December 1997):

1. *Every effort shall be made to maintain a level of Spawning Stock Biomass (SSB) greater than the Minimum Biological Acceptable level (MBAL) of 800.000 tonnes.*

2. *A medium-term management strategy, by which annual quotas shall be set for the directed fishery and for by-catches in other fisheries as defined by ICES, reflecting a fishing mortality rate of 0.25 for 2-ringers and older and 0.12 for 0–1-ringers, shall be implemented.*

3. *Should the SSB fall below a reference point of 1.3 million tonnes, the fishing mortality rates referred to under paragraph 2, will be adapted in the light of scientific estimates of precise conditions then*

4. *prevailing, to ensure rapid recovery of SSB to levels in excess of 1.3 million tonnes.*

The recovery plan referred to above may, inter alia, include additional limitations on effort in the form of special licensing of vessels, restrictions on fishing days, closing of areas and/or seasons, special reporting requirements or appropriate control measures.

5. *By-catches of herring may only be landed in ports where adequate sampling schemes to effectively monitor the landings have been set up. All catches landed shall be deducted from the respective quotas set, and the fisheries shall be stopped immediately in the event that the quotas are exhausted.*

6. *The allocation of the TAC for the directed fishery for herring shall be 29% to Norway and 71% to the Community. The by-catch quota for herring shall be allocated to the Community.*

7. *The Parties shall, if appropriate, consult and adjust management measures and strategies on the basis of any new advice provided by ICES including that from the assessment of the abundance of the most recent year class.*

8. *A review of this agreement shall take place no later than 31 December 2001.*

9. *This agreement shall enter into force on 1 January 1998.*

ICES considers the agreement to be consistent with the precautionary approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposed that:
$\mathbf{B}_{lim}$ is 800 000 t	$\mathbf{B}_{pa}$ be set at 1.3 mill t
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at $\mathbf{F}_{ages\ 0\text{-}1} = 0.12$; at $\mathbf{F}_{ages\ 2\text{-}6} = 0.25$

Technical basis:

$\mathbf{B}_{lim}$: below this value poor recruitment has been experienced	$\mathbf{B}_{pa}$: part of a harvest control rule based on simulations
$\mathbf{F}_{lim}$: Not defined	$\mathbf{F}_{pa}$: part of a harvest control rule based on simulations

Advice on management: ICES advises that catches in 2003 should be within the constraints on fishing mortality agreed by EC and Norway, i.e. less than $\mathbf{F}_{2\text{-}6} = 0.25$ and $\mathbf{F}_{0\text{-}1} = 0.12$. Several such options are presented in the Management Option table. The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring-spawning herring in Section 3.4.7.

Analyses of survey data suggest that the catches in 2003 in Divisions IVc and VIId (Downs herring) should not exceed the TAC for 2002.

Relevant factors to be considered in management: Catches on adult herring in recent years have consistently exceeded the agreed TAC, mainly due to misreporting

from other ICES areas into and out of the North Sea; this gives rise to overshooting of the TAC.

The 1998 year class is strong and comprises almost 45% of SSB in 2002. In the past large year classes have tended to have a lower maturation rate than the long-term average. So far these signals have not been detected for the 1998 yearclass, as the proportion, which mature, appears to be above average.

The ICES advice is based on the projected SSB in 2003 being above 1.3 million t. SSB in 2003 depends on the fisheries in 2002 and that part in 2003 that takes place before spawning. About 2/3 of the total mortality is expected to be realised before spawning each year. The increase in SSB expected in 2003 depends strongly on the incoming 1998 and 2000 year classes. Observations from different surveys indicate that these year classes are strong. Although the 1998 year class and the 2000 year class appear to be very strong in all the surveys, they have not been well represented in the catches. The reason for this discrepancy is not clear at present. Generally, the surveys provide more reliable indications of year class strength than catches of juveniles do.

Catch Forecast for 2003: Catch options are given for 2003, for limits on the fishing mortality rate, which reflect both the ICES recommendation and the EU-Norway agreement. Catch forecasts assume **F** status quo for all fleets for 2002 (=$\mathbf{F}_{2001}$), because the alternative assumption of a catch constraint produced an unrealistic decrease in F. This implies **F** on adults close to 0.25, but a low fishing mortality on juveniles.

There are many possible permutations of catches by the four fleets that could result in the desired values of $\mathbf{F}_{0\text{-}1}$ and $\mathbf{F}_{2\text{-}6}$. Hence, there is some liberty within the framework set by the fishing mortalities for managers to decide the proportion of the total catch to be allocated to each of the fleets. The following options are provided:

Two options are included where the fishing mortality of the C and D fleets varies in proportion with the B fleet, maintaining the ratios between these fleets as in the status quo fishing mortalities. The examples have $\mathbf{F}_{2\text{-}6}$ close to 0.2, but different fishing mortalities for the 0-1 ringers.

In the remaining options, some combinations of fishing mortalities for the four fleets that give an $\mathbf{F}_{0\text{-}1}$ close to 0.12 and $\mathbf{F}_{2\text{-}6}$ close to 0.25 are shown. The combinations in addition satisfy constrains that the catch by the C fleet shall be close to either 30, 50 or 70 thousand tonnes, and the catch of the D fleet close to either 10, 20 or 30 thousand tonnes.

All scenarios indicate a rapid increase in spawning biomass and in yield. This is mainly caused by the 1998 year class, which is estimated to be strong, and the 2000 year class, which also appears strong in the surveys.

Catch Forecast for 2003

	Assuming F status quo in 2002												
	$\mathbf{F}_{2\text{-}6}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{2\text{-}6}$	**Yield 2002**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2002**
	0.226	0.01	0.017	0.014	0.043	0.243	403	16	52	12	80	483	1699
2003	**F for fleets B-D maintain proportion from 2002**												
	$\mathbf{F}_{2\text{-}6}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{2\text{-}6}$	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
	0.185	0.009	0.015	0.012	0.039	0.2	414.1	13.7	46.9	9.4	70	484.1	2276.4
	0.155	0.026	0.044	0.036	0.108	0.2	346.4	39	132.1	26.2	197	543.7	2269.0
	Combinations of catches by the various fleets that give $\mathbf{F}_{0\text{-}1}$ = 0.12 and $\mathbf{F}_{2\text{-}6}$ = 0.25												
	$\mathbf{F}_{2\text{-}6}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{2\text{-}6}$	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
	0.2	0.096	0.01	0.014	0.123	0.247	438	142	30	10	182	620	2207
	0.205	0.083	0.01	0.027	0.123	0.248	449	123	30	20	172	621	2207
	0.215	0.066	0.011	0.04	0.12	0.252	470	98	33	29	160	629	2201
	0.2	0.085	0.016	0.014	0.118	0.247	438	126	48	10	184	622	2207
	0.205	0.071	0.017	0.028	0.119	0.248	449	105	51	20	176	625	2205
	0.21	0.059	0.017	0.041	0.12	0.249	460	87	51	30	168	627	2204
	0.2	0.078	0.023	0.014	0.118	0.249	438	115	69	10	194	632	2202
	0.205	0.067	0.024	0.028	0.122	0.251	448	99	72	20	191	639	2199
	0.21	0.05	0.024	0.042	0.119	0.25	459	74	72	31	176	635	2201
	F status quo in 2003												
	$\mathbf{F}_{2\text{-}6}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{0\text{-}1}$	$\mathbf{F}_{2\text{-}6}$	**Yield 2003**						SSB
	A	**B**	**C**	**D**			**A**	**B**	**C**	**D**	**B-D**	**Total**	**2003**
	0.226	0.01	0.017	0.014	0.043	0.243	497	14.9	51.1	10.2	76.2	573.2	2216.3

Fleet definitions:

A: Directed herring fisheries with purse seiners and trawlers in the North Sea;

B: All other vessels, which take herring as by-catch in the North Sea;

C: Directed fisheries with purse seiners and trawlers in Division IIIa;

D: Vessels fishing in Division IIIa for herring and sprat and other vessels participating in fisheries where herring is taken as by-catch in Division IIIa.

The following bullet points apply for all options presented above:

- $\mathbf{F}_{2–6}$ is the total F averaged over 2–6-ringers;
- $\mathbf{F}_{0-1}$ is the total F averaged over 0-1-ringers;

Medium- and long-term projections: The medium-term projections are heavily dependent on the stock-recruitment relationship. The currently estimated parameters for the Beverton and Holt stock-recruitment tend to give very optimistic trends in SSB at the current levels of SSB. Medium-term projections are available in the HAWG report, but because of the above concerns are not regarded as useful for management consideration. Medium-term forecasts indicate that a fishing mortality of 0.25 on adult herring, and 0.12 on juvenile herring, will give a high probability of SSB being above $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: As noted above, assessments of this stock show a tendency to overestimate stock size and underestimate fishing mortality. Compared with the 2001 assessment, the 2002 assessment increased the influence of the more precise surveys on results and decreased the influence of juvenile catch. The result of these revised assessment methods is a 22% greater estimate of the 2000 stock size and a lower estimate of the fishing mortality than in the 2001 assessment. Nevertheless, both methods have internal inconsistencies that tend to overestimate stock size.

Elaboration and special comment: Stock depletion in the 1970s resulted in a four-year closure of the directed fishery. The stock recovered during the 1980s. Following the re-opening of the fishery, the fishing mortality rate steadily increased. By the 1990s this rate was no longer sustainable and the SSB fell below the MBAL of 800 000 t. Emergency regulations were introduced to reduce TACs which reduced the fishing mortality rate substantially.

The directed fisheries (fleet A in the North Sea and fleet C in the Skagerrak/Kattegat area) have been managed by TACs since the re-opening of the North Sea herring fisheries in 1981. Fleet D, landing herring as by-catch, has also previously been managed by TAC for mixed clupeoids. It has been managed by a by-catch ceiling since 1996. The catch of fleet A has been higher than the agreed TAC and in 2001 was about 16% above the agreed TAC of 265 000 t. The by-catch of herring in the small mesh fishery has been low since 1997.

The total catch of North Sea autumn-spawners, taken in all areas in 2001, comprises around 60% immature fish (in numbers), which is more than in recent years, but significantly lower than the 80% in 1995 and earlier years.

The harvest control rule, which forms the basis for advice, separates the mortality for adults and juveniles. Fleet A catches adults, fleets B and D catch juveniles, and fleet C catches both. Therefore, the harvest control rule does not determine the catches uniquely, but offers some flexibility to the share of the catch between the fleets.

To obtain catch forecasts, projections by fleet are performed for the whole area. The area split that was used in previous years was shown to add little to the predictive power of the process.

This stock complex also includes Downs herring (herring in Divisions IVc and VIId), which has shown independent trends in exploitation rate and recruitment, but cannot be assessed separately. Abundance indices from larvae and trawl surveys indicate that since 1995 the SSB of the Downs herring has increased. The Downs fishery is concentrated on the spawning aggregations in a restricted area, which makes this stock component particularly vulnerable to excessive fishing pressure. EU splits its share of the total TAC (Subarea IV and Division VIId) into TACs for Divisions IVa+IVb and for Divisions IVc+VIId. In response to ICES advice in May 1996 the IVc+VIId TAC was reduced by 50% in line with reductions for the whole North Sea. The TAC for Downs herring was reduced from 50 000 t to 25 000 t and has remained there until 2001. TACs for this component have been significantly exceeded in all years. The TAC for this component was increased in 2002 (to 42,000 t) following the advice of ICES in 2001. However, the strong increase in SSB in the North Sea stock in 2001 is not mirrored in the Downs component, and therefore the TAC for Downs herring should not increase.

Catches for recent years from Divisions IVc and VIId are found in Table 3.5.8.5.

Age-based assessment is based on landings of North Sea Autumn Spawning herring in Subarea IV, Divisions VIId and IIIa and surveys. Incomplete discard data are available.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Yield and spawning biomass per Recruit F-reference points:

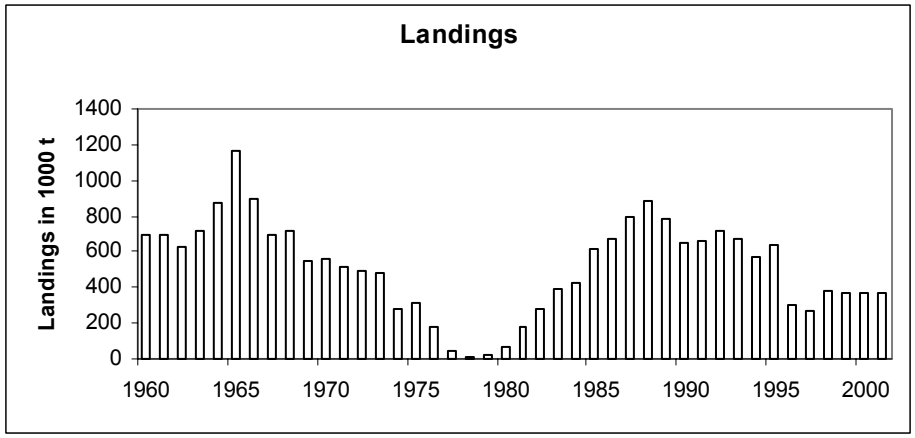
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.243	0.013	0.050
$\mathbf{F}_{max}$	0.381	0.013	0.031
$\mathbf{F}_{0.1}$	0.128	0.012	0.089
$\mathbf{F}_{med}$	N/A		

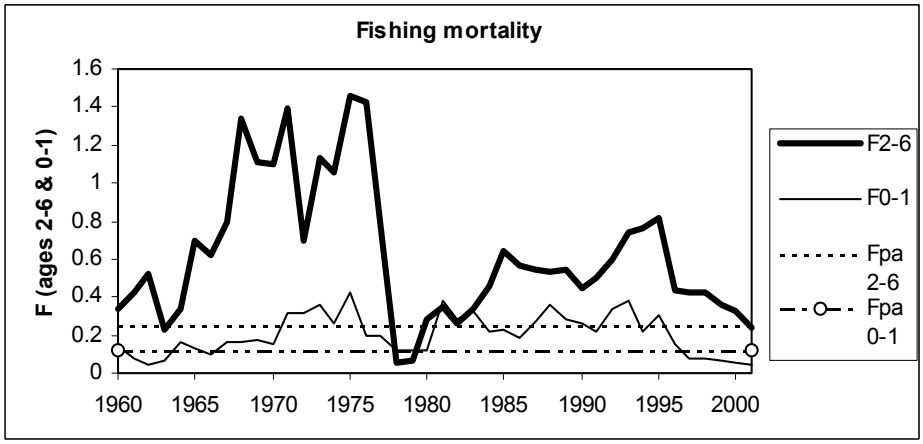
Catch data (Tables 3.5.8.1-7):

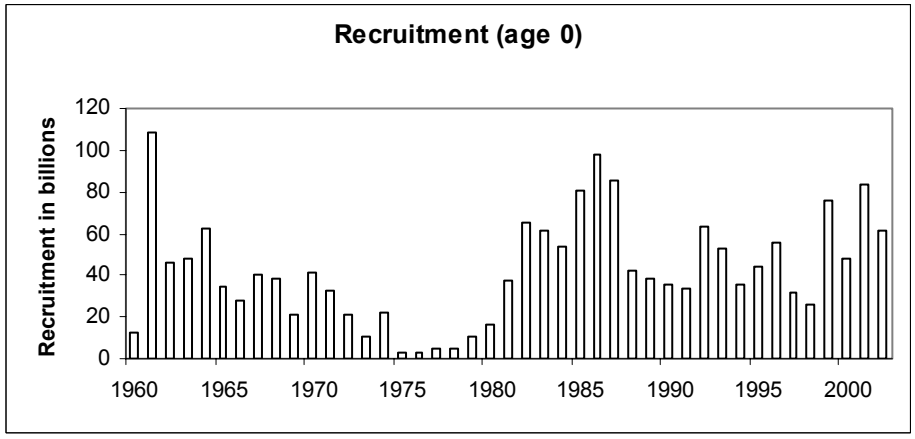
Subarea IV and Division VIId

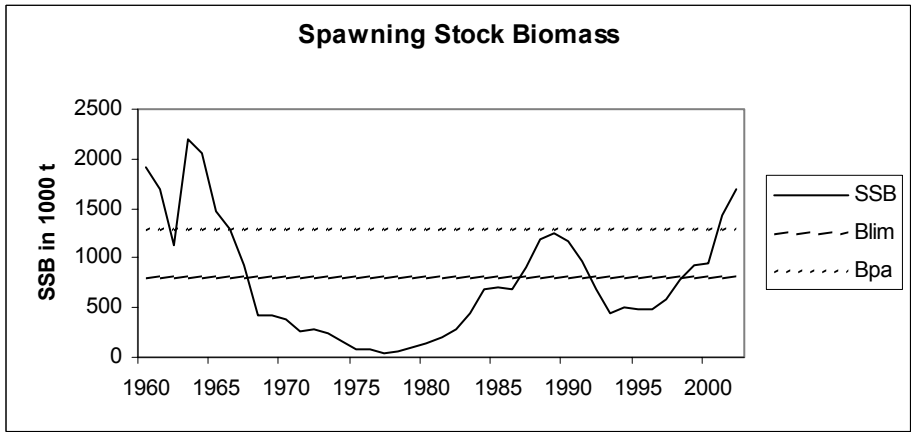
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	By-catch ceiling Fleet B	ACFM Lndgs.[6]	ACFM Catch[6]
1987	TAC	610	600		625	625
1988	TAC	515	530		710	710
1989	TAC	514	514		713	717
1990	TAC	403	415		570	578
1991	TAC	423	420		583	588
1992	TAC	406	430		567	572
1993	No increase in yield at F > 0.3	340[1]	430		545	548
1994	No increase in yield at F > 0.3	346[1]	440		495	498
1995	Long-term gains expected at lower F	429[1]	440		566	566
1996	50% reduction of agreed TAC[2]	156[1]	156[3]	44	263	265
1997	F = 0.2	159[1]	159	24	228[5]	234[5]
1998	F(adult) = 0.2, F(juv)< 0.1	254[1]	254	22	325	329
1999	F(adult) = 0.2, F(juv)< 0.1	265[1]	265	30	331	336
2000	F(adult) = 0.2, F(juv)< 0.1	265[1]	265	36	323	329
2001	F(adult) = 0.2, F(juv)< 0.1	See scenarios	265	36	322	323
2002	F(adult) = 0.2, F(juv)< 0.1	See scenarios	265	36		
2003	F(adult) = 0.25, F(juv)=0.12	See scenarios				

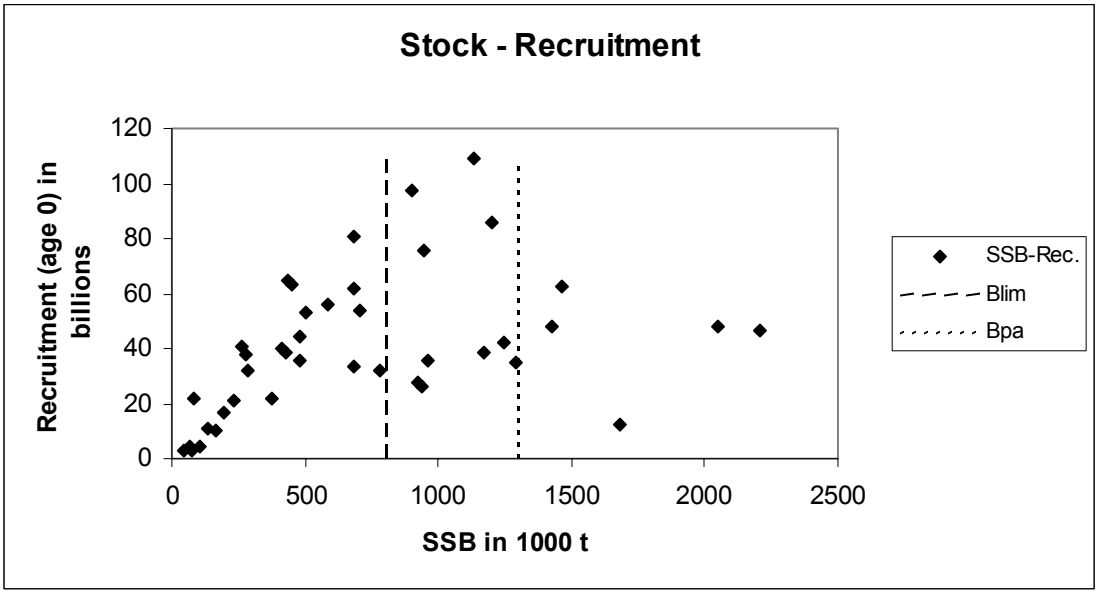
[1]Catch in directed fishery in IV and VIId. [2]Revision of advice given in 1995. [3]Revised in June 1996, down from 263. [4]TAC overshoot not calculated for years prior to 1993. Revised in 2000 [5]Based on revised estimates of misreporting by the WG. [6]Values revised to reflect catches and landings from area IV and Division VIId only. Weights in '000 t.

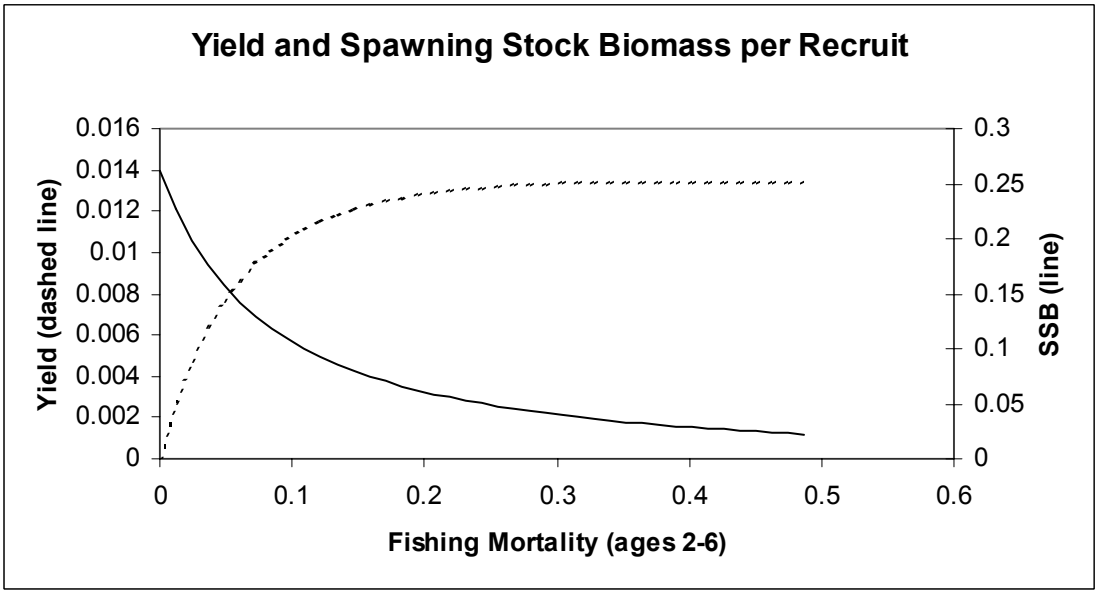

Landings
Landings in 1000 t
1400
1200
1000
800
600
400
200
0
1960
1965
1970
1975
1980
1985
1990
1995
2000


Fishing mortality
F (ages 2-6 & 0-1)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
F2-6
F0-1
Fpa 2-6
Fpa 0-1


Recruitment (age 0)
Recruitment in billions
120
100
80
60
40
20
0
1960
1965
1970
1975
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
120
100
80
60
40
20
0
0
500
1000
1500
2000
2500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
SSB (line)
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 2-6)

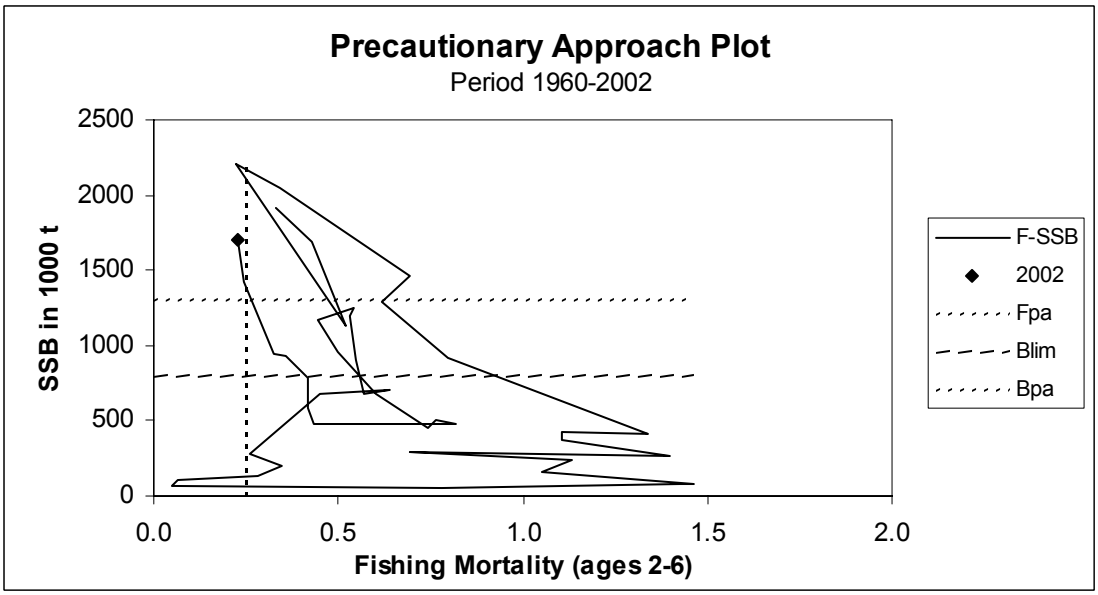

Precautionary Approach Plot
Period 1960-2002
SSB in 1000 t
2500
2000
1500
1000
500
0
0.0
0.5
1.0
1.5
2.0
Fishing Mortality (ages 2-6)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.5.8.1 Herring caught in the North Sea (Subarea IV and Division VIId). Catch in tonnes by country, 1992–2001.

These figures do not an all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Belgium	242	56	144	12	-
Denmark	193968	164817	121559	153363[9]	67496
Faroe Islands	-	-	-	231[9]	-
France	16587	12623	27941	29499[9]	12500
Germany, Fed.Rep	42665	41619[9]	38394	43798	14215
Netherlands	75683	79190	76155	78491	35276
Norway 4	116863	122815	125522	131026	43739
Sweden	4939	5782	5425	5017	3090
USSR/Russia				-	-
UK (England)	11314	12002[10]	14216	14676	6881
UK (Scotland)	56171	55532	49919	44813	17473
UK (N.Ireland)	-	-	-	-	-
Unallocated landings	25867	18410	5749	33584[9]	24475
Misreporting from VIaN	22594	24397	30234	32146	38254
Total landings	566892	537243[9,10]	495258	566656	263399
Discards	4950	3470	2510	-	1469
Total catch	**571842**	**540713**[9,10]	**497768**	**566656**[9]	**264868**
Estimates of the parts of the catches which have been allocated to spring spawning stocks					
IIIa type (WBSS)	7854	8928	13228	10315	855
Thames estuary[5]	202	201	215	203	168

Country	1997	1998	1999	2000[1]	2001[1]
Belgium	1	1	2	1	-
Denmark[7]	38431	58924	61268	64123	67096
Faroe Islands	-	25	1977	915	1082
France	14524	20783	26962	20952	24515
Germany	13381	22259	26764	26687	29779
Netherlands	35129	50654	54318	54382	52390
Norway[4]	38745[13]	68523[13]	70718	72844	75089
Sweden	2253	3221	3241	3046	3695
Russia	1619	-	-	-	-
UK (England)	3421	7635	10598	11179	14582
UK (Scotland)	22914	32403	29911	30033	26719
UK (N.Ireland)	-	-	-	915	1018
Unallocated landings	27583	27722	21653	37707[12]	25849
Misreporting from VIaN	29763[6]	32446	23625	[8]	[8]
Total landings	227763	324596	331036	322784	321814
Discards	6005	3918	4769	6354[12]	1386
Total catch	**233769**[6]	**328514**	**335805**	**329138**	**323200**
Estimates of the parts of the catches which have been allocated to spring spawning stocks					
IIIa type (WBSS)	979	7833	4732	6649	6449
Thames estuary[5]	202	88	88	76	107
Others[11]				378	1097

[1] Preliminary.
[4] Catches of Norwegian spring spawners removed (taken under a separate TAC).
[5] Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).
[6] Altered in 2000 based on revised estimates of misreporting into VIa (North)
[7] Including any bycatches in the industrial fishery.
[8] Catches misreported into VIaN could not be separated, they are included in unallocated.
[9] Figure altered in 2001.
[10] Figure altered in 2002 (was 7851 t higher before).
[11] Caught in the whole North Sea, included in the catch figure for the Netherlands.
[12] Figure altered in 2000.
[13] Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

Table 3.5.8.2 Herring, catch in tonnes in Division IVa West.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Denmark	10751	10604	20017	17748	3237
Faroe Islands	-	-	-	-	-
France	4714[4]	3362	11658	10427	3177
Germany	21836	17342[4]	18364	17095	2167
Netherlands	29845	28616	16944	24696	2978
Norway	39244	33442	56422	56124	22187
Sweden	985	1372	2159	1007	2398
UK (England)	4916	4742	3862	3091	2391
UK (Scotland)	39269	36628[4]	44687	40159	12762
UK (N. Ireland)	-	-	-	-	-
Unallocated landings	4855	-8271[5]	3214[9]	26018	9959
Misreporting from VIa North	22593	24397	30234	32146	38254
Total Landings	179008	152234	207561	228511	99510
Discards	850	825	550	-	356
Total catch	**179858**	**153059**	**208111**	**228511**	**99866**

Country	1997	1998	1999	2000	2001[1]
Denmark[7]	2667	4634	15359	25530	17770
Faroe Islands	-	25	1977	205	192
France	361	4757	6369	3210	8164
Germany	-	7752	11206	5811	17753
Netherlands	6904[9]	11851	17038	15117	18560[10]
Norway	16485[12]	27218[12]	30585	32895	11472
Sweden	1617	245	859	1479	1418
Russia	1619	-	-	-	-
UK (England)	-	4306	7163	8859	12283
UK (Scotland)	17120	30552	28537	29055	25105
UK (N. Ireland)	-	-	-	996	1018
Unallocated landings	7574	15952	3889	30581[11]	17578
Misreporting from VIa North	29763[6]	32446	23625	[8]	[8]
Total Landings	84110	139738	146607	153738	131313
Discards	1138	730	654	5841[11]	1386
Total catch	**85248**[6]	**140468**	**147261**	**159579**	**132699**

[1] Preliminary.
[4] Including IVa East.
[5] Negative unallocated catches due to misreporting from other areas.
[6] Altered in 2000 on the basis of a Bayesian assessment on misreporting into VIa (North).
[7] Including any bycatches in the industrial fishery.
[8] Catches misreported into VIaN could not be separated, they are included in unallocated.
[9] Figure altered in 2001.
[10] Including 1057 t of local spring spawners.
[11] Figure altered in 2002.
[12] Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

Table 3.5.8.3 Herring, catch in tonnes in Division IVa East.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Denmark[5]	53692	43224	43787	45257	19166
Faroe Islands	-	-	-	-	-
France	-[3]	4	14	+	-
Germany	-[3]	-[3]	-	-	-
Netherlands	-	-	-	-	-
Norway[2]	61379	56215	40658	62224	18256
Sweden	508	711	1010	2081	
UK (Scotland)	196	-[3]	-	-	693
Unallocated landings	-	-	-	-	-
Total landings	115775	100154	85469	109562	38115
Discards	-	-	-	-	-
Total catch	**115775**	**100154**	**85469**	**109562**	**38115**

Country	1997	1998	1999	2000	2001[1]
Denmark[5]	22882	25750	18259	11300	18466
Faroe Islands	-	-	-	710	890
France	3	-	115	-	-
Germany	4576	-	-	29	-
Netherlands	-	-	1965	38	-
Norway[1]	18490[6]	41260[6]	37433	39696	56287
Sweden	427	1259	772	1177	517
Unallocated landings	-	-	-1965[4]	-4[4]	0[4]
Total landings	46378	68269	56579	52946	76160
Discards	-	-	-	-	-
Total catch	**46378**	**68269**	**56579**	**52946**	**76160**

[1] Preliminary.
[2] Catches of Norwegian spring spawners herring removed (taken under a separate TAC).
[3] Included in IVa West.
[4] Negative unallocated catches due to misreporting into other areas.
[5] Including any bycatches in the industrial fishery.
[6] Not in accordance with official final catch figures, should be corrected prior to next year's Working Group.

Table 3.5.8.4 Herring, catch in tonnes in Division IVb.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Belgium	13	-	-	-	-
Denmark[4]	125229	109994	55060	87917	43749
Faroe Islands	-	-	-	231[8]	-
France	2313	2086	5492	7639	2373
Germany	20005	23628	14796	21707	11052
Netherlands	26987	31370	39052	30065	18474
Norway	16240	33158	28442	12678	3296
Sweden	3446	3699	2256	1929	-
UK (England)	3026	3804	7337	9688	2757
UK (Scotland)	16707	18904	5101	4654	4449
Unallocated landings[3]	-13637	-16415	-26988	-10831[9]	-8826
Total landings	200329	210228	130548	165677	77324
Discards[1]	1900	245	460	-	592
Total catch	**202229**	**210473**	**131008**	**165677**[9]	**77916**

Country	1997	1998	1999	2000	2001[1]
Belgium	-	-	1	-	-
Denmark[4]	11636	26667	26211	26825	30277
Faroe Islands	-	1	-	-	-
France	6069	8944	7634	10863	7601
Germany	7456	13591	13529	18818	8340
Netherlands	14697	27408	22825	26845	24160
Norway	3770	45	2700	253	7330
Sweden	209	1717	1610	390	1760
UK (England)	2033	1767	1641	669	814
UK (Scotland)	5461	1851	1374	978	1614
Unallocated landings[3]	-1615	-11270	-313	-13769	-12878
Total landings	49716	70720	77212	71872	69018
Discards[1]	1855	1188	873	317	-[2]
Total catch	**51571**	**71908**	**78085**	**72189**	**69018**

[1] Preliminary.
[2] Discards partly included in unallocated.
[3] Negative unallocated catches due to misreporting from other areas.
[4] Including any bycatches in the industrial fishery.
[8] Figure inserted in 2001.
[9] Figure altered in 2001.

Table 3.5.8.5 Herring, catch in tonnes in Divisions IVc and VIId.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1992	1993	1994	1995	1996
Belgium	229	56	144	12	-
Denmark	4296	995	2695	2441	1344
France	9560	7171	10777	11433	6950
Germany	824	649	4964	4996	997
Netherlands	18851	19204	20159	23730	13824
UK (England)	3372	3456[10]	3016	1896	1733
UK (Scotland)	-	-	131	-	262
Unallocated landings	34649	43096	29792	18397	23934
Total landings	71781	66776[10]	71678	62905	49044
Discards[1]	2200	2400	2400	-	521
Total catch	**73981**	**69176[10]**	**74078**	**62905**	**49565**
Coastal spring spawners included above[2]	202	201	215	203	168

Country	1997	1998	1999	2000	2001[1]
Belgium	1	1	1	1	-
Denmark	1246	1873	1439	468	583
France	8091	7081	12844	6879	8750
Germany	1349	916	2029	2029	3686
Netherlands	13528	11395	12490	12348	9670
UK (England)	1388	1562	1794	1537	1485
UK (Scotland)	333	-	-	-	-
Unallocated landings	21624	23040	20042	20966	21149
Total landings	47559	45868	50639	44228	45323
Discards	3012	2000	3242	196	-[3]
Total catch	**50571**	**47868**	**53881**	**44424**	**45323**
Coastal spring spawners included above[2]	143	88	88	76	147[11]

[1] Preliminary.
[2] Landings from the Thames estuary area are included in the North Sea catch figure for UK (England).
[3] Discards partly included in unallocated.
[9] Figure altered in 2001.
[10] Figure altered in 2002 (was 7851 t higher before).
[11] Thames/Blackwater herring landings: 107 t, others included in the catch figure for the Netherlands

Table 3.5.8.6 Herring in Subarea IV, Divisions VIId and IIIa (in thousand tonnes)

Year	1989	1990	1991	1992	1993	1994	1995[18]
Subarea IV and Division VIId: TAC (IV and VIId)							
Recommended Divisions IVa,b[1]	484	373-332	363[6]	352	290[7]	296[7]	389[11]
Recommended Divisions IVc, VIId	30	30	50-60[6]	54	50	50	50
Expected catch of spring spawners				10	8		
Agreed Divisions IVa,b[2]	484	385	370[6]	380	380	390	390
Agreed Divisions IVc, VIId	30	30	50[6]	50	50	50	50
Bycatch ceiling in the small mesh fishery							
CATCH (IV and VIId)							
National landings Divisions IVa,b[3]	639	499	495	481	463	421	456
Unallocated landings Divisions IVa,b	-2	14	30	14	-1	6	47
Discard/slipping Divisions IVa,b[4]	3	4	2	3	1	1	0
Total catch Divisions IVa,b[5]	638	516	527	498	463	428	503
National landings Divisions IVc, VIId[3]	30	24	42	37	40	42	45
Unallocated landings Divisions IVc,VIId	48	32	16	35	43	30	18
Discard/slipping Divisions IVc, VIId	1	5	3	2	2	2	-
Total catch Divisions IVc, VIId	79	61	61	74	85	74	63
Total catch IV and VIId as used by ACFM[5]	**717**	**578**	**588**	**572**	**548**	**498**	**566**
CATCH BY FLEET/STOCK (IV and VIId)[10]							
North Sea autumn spawners directed fisheries (Fleet A)	n.a.	n.a.	446	441	438	447	506
North Sea autumn spawners industrial (Fleet B)	n.a.	n.a.	134	124	101	38	65
Baltic-IIIa-type spring spawners	20	8	8	8	9	13	10
Coastal-type spring spawners	2.3	1.1	0.3	0.2	0.2	0.2	0.2
North Sea autumn spawners in IV and VIId total	**696**	**569**	**580**	**564**	**539**	**485**	**559**
Division IIIa: TAC (IIIa)							
Predicted catch of autumn spawners			96	153	102	77	98
Recommended spring spawners	84	67	91	90	93-113	-[9]	-[12]
Recommended mixed clupeoids	80	60	0	0	0	-	-
Agreed herring TAC	138	120	104.5	124	165	148	140
Agreed mixed clupeoid TAC	80	65	50	50	45	43	43
Bycatch ceiling in the small mesh fishery							
CATCH (IIIa)							
National landings	192	202	188	227	214	168	157
Catch as used by ACFM	162	195	191	227	214	168	157
CATCH BY FLEET/STOCK (IIIa)[10]							
Autumn spawners human consumption (Fleet C)	n.a.	n.a.	26	47	44	42	21
Autumn spawners mixed clupeoid (Fleet D)[19]	n.a.	n.a.	13	23	25	12	6
Autumn spawners other industrial landings (Fleet E)	n.a.	n.a.	38	82	63	32	43
Autumn spawners in IIIa total	**91**	**77**[8]	**77**	**152**	**132**	**86**	**70**
Spring spawners human consumption (Fleet C)	n.a.	n.a.	68	53	68	59	59
Spring spawners mixed clupeoid (Fleet D)[19]	n.a.	n.a.	5	2	1	1	2
Spring spawners other industrial landings (Fleet E)	n.a.	n.a.	40	20	12	24	29
Spring spawners in IIIa total	**71**	**118**	**113**	**75**	**81**	**84**	**90**
North Sea autumn spawners: Total as used by ACFM	**787**	**646**	**657**	**716**	**671**	**571**	**629**

Continued…

Table 3.5.8.6 Continued

Year	1996	1997	1998	1999	2000	2001	2002
Subarea IV and Division VIId: TAC (IV and VIId)							
Recommended Divisions IVa,b[1]	156	159	254	265	265	265	265
Recommended Divisions IVc, VIId	-[14]	-[14]	-[14]	-[14]	-[14]	-[14]	-[14]
Expected catch of spring spawners							
Agreed Divisions IVa,b[2]	263;131[13]	134	229	240	240	240	223
Agreed Divisions IVc, VIId	50;25[13]	25	25	25	25	25	42
Bycatch ceiling in the small mesh fishery		24	22	30	36	36	36
CATCH (IV and VIId)							
National landings Divisions IVa,b[3]	176	144	241	255	263	272	
Unallocated landings Divisions IVa,b	39	36	37	25	16	5	
Discard/slipping Divisions IVa,b[4]	1	3[16]	2	2	6	1	
Total catch Divisions IVa,b[5]	216	183[16]	281	282	285	278	
National landings Divisions IVc, VIId[3]	25	26	23	31	23	24	
Unallocated landings Divisions IVc,VIId	24	22	23	20	21	21	
Discard/slipping Divisions IVc, VIId	1	3	2	3	0.2	0	
Total catch Divisions IVc, VIId	50	51	48	54	44	45	
Total catch IV and VIId as used by ACFM[5]	**266**	**234[16]**	**329**	**336**	**329**	**323**	
CATCH BY FLEET/STOCK (IV and VIId)[10]							
North Sea autumn spawners directed fisheries (Fleet A)	226	220[16]	306	316	304	295	
North Sea autumn spawners industrial (Fleet B)	38	13	14	15	18	20	
Baltic-IIIa-type spring spawners	0.9	0.9	8	5	7	6	
Coastal-type spring spawners	0.2	0.2	0.1	0.1	0.1	1	
North Sea autumn spawners in IV and VIId total	**265**	**233[16]**	**320**	**331**	**322**	**308**	
Division IIIa: TAC (IIIa)							
Predicted catch of autumn spawners	48	35	58	43	53	67	63
Recommended spring spawners	-[12]	-[15]	-[15]	-[15]	-[15]	-[15]	-[15]
Recommended mixed clupeoids	-	-	-	-	-	-	-
Agreed herring TAC	120	80	80	80	80	80	80
Agreed mixed clupeoid TAC	43						
Bycatch ceiling in the small mesh fishery		20	17	19	21	21	21
CATCH (IIIa)							
National landings	115	83	120[16]	86	108	90	
Catch as used by ACFM	115	83	105[16]	86	108	90	
CATCH BY FLEET/STOCK (IIIa)[10]							
Autumn spawners human consumption (Fleet C)	23	34	54	31[17]	37	36	
Autumn spawners mixed clupeoid (Fleet D)[19]	12	4	5	8[17]	13	12	
Autumn spawners other industrial landings (Fleet E)	7	2					
Autumn spawners in IIIa total	**42**	**40**	**59**	**39[17]**	**50**	**48**	
Spring spawners human consumption (Fleet C)	69	34	43	44[17]	53	39	
Spring spawners mixed clupeoid (Fleet D)[19]	1	1	3	3[17]	5	3	
Spring spawners other industrial landings (Fleet E)	3	1					
Spring spawners in IIIa total	**73**	**37**	**46**	**47[17]**	**58**	**42**	
North Sea autumn spawners:Total as used by ACFM	**307**	**273[16]**	**380**	**370[17]**	**372**	**364**	

[1] Includes catches in directed fishery and catches of 1-ringers in small mesh fishery up to 1992.
[2] IVa,b and EC zone of IIa.
[3] Provided by Working Group members.
[4] One country only.
[5] Includes spring spawners not included in assessment.
[6] Revised during 1991.
[7] Based on **F**=0.3 in directed fishery only; TAC advised for IVc, VIId subtracted.
[8] Estimated.
[9] 130-180 for spring spawners in all areas.
[10] Based on sum-of-products (number x mean weight at age).
[11] Status quo **F** catch for fleet A.
[12] The catch should not exceed recent catch levels.
[13] During the middle of 1996 revised to 50% of its original agreed TAC.
[14] Included in IVa,b.
[15] Managed in accordance with autumn spawners.
[16] Figure altered in 2000.
[17] Figure altered in 2001.
[18] Data for 1995 show some inconsistencies and need to be revised intersessionally
[19] Fleet D and E are merged from 1999 onwards.

Table 3.5.8.7 Autumn-spawning Herring in Subarea IV and Divisions VIId and IIIa.

Year	Recruitment	SSB	Landings	Mean F	Mean F
	Age 0[2]			Ages 0–1[2]	Ages 2-6[2]
	Thousands	tonnes	tonnes		
1960	12097900	1911811	696,200	0.1408	0.3320
1961	108865820	1684621	696,700	0.0740	0.4267
1962	46272650	1136203	627,800	0.0473	0.5205
1963	47657610	2207286	716,000	0.0695	0.2245
1964	62788650	2046742	871,200	0.1605	0.3419
1965	34896680	1462521	1,168,80	0.1266	0.6936
1966	27860680	1289112	895,500	0.1034	0.6190
1967	40257670	923195	695,500	0.1618	0.7976
1968	38699260	414076	717,800	0.1675	1.3361
1969	21583200	424520	546,700	0.1687	1.1048
1970	41077280	374758	563,100	0.1516	1.1038
1971	32312470	266324	520,100	0.3181	1.3980
1972	20862860	288554	497,500	0.3182	0.6947
1973	10113630	233666	484,000	0.3600	1.1331
1974	21719920	162321	275,100	0.2631	1.0504
1975	2857050	82110	312,800	0.4214	1.4629
1976	2739360	78696	174,800	0.1962	1.4228
1977	4351920	48797	46,000	0.1964	0.7829
1978	4615780	66361	11,000	0.1223	0.0512
1979	10616800	108857	25,100	0.1249	0.0631
1980	16745490	133007	70,764	0.1194	0.2798
1981	37893580	197901	174,879	0.3834	0.3453
1982	64802850	281046	275,079	0.2796	0.2619
1983	61862590	435943	387,202	0.3254	0.3349
1984	53498420	682523	428,631	0.2156	0.4520
1985	80979990	703223	613,780	0.2339	0.6389
1986	97640080	683046	671,488	0.1888	0.5675
1987	85641680	904630	792,058	0.2674	0.5484
1988	41837460	1198630	887,686	0.3560	0.5329
1989	38728880	1247511	787,899	0.2845	0.5428
1990	35593590	1174169	645,229	0.2596	0.4434
1991	33814610	960957	658,008	0.2142	0.4987
1992	63627580	680708	716,799	0.3367	0.6022
1993	53073310	448835	671,397	0.3798	0.7410
1994	35983550	502526	568234	0.2210	0.7641
1995	44377750	480400	639,146	0.3081	0.8166
1996	56121940	483788	306,157	0.1568	0.4327
1997	31660860	584344	272,627	0.0757	0.4199
1998	26359460	781524	380,178	0.0757	0.4198
1999	75812270	935096	372,341	0.0644	0.3569
2000	48332960	943389	372,420	0.0585	0.3246
2001	83504000	1428052	364,029	0.0438	0.2433
2002	61090000	1699000[1]			0.2433
Average	42354188	762344	502,273		0.6129

[1] Assuming **F** status quo in 2002.
[2] Age is expressed as winter rings, year class is year minus 1.

3.5.9 Sprat in the North Sea (Subarea IV)

State of stock/exploitation: The sprat stock shows signs of being in good condition, as the biomass seems to be stable and relatively high. There is an indication from the IBTS (February) 2002 survey of a good 2001 year class recruiting to the 2002 fishery (the age-1 index in 2002 was among the highest observed).

Management objectives: There are no explicit management objectives for this stock.

Advice on management: For this stock only in-year advice is available. Based on the historic relationship between survey and catch, the 2002 survey value indicates that a catch of 160 000 t in 2002 would allow SSB to remain stable or increase.

Relevant factors to be considered in management: Sprat has a short life span, and most of the production of the stock is therefore likely to be due to recruitment and the growth of recruits rather than the growth of post-recruits. The use of the IBTS (February) as an index of abundance may introduce some underestimation of the stock biomass, because the surveys cannot cover the most shallow parts of the North Sea where sprat also occur.

The proportion of herring by-catch in the sprat fishery has been around 8% for the last four years. In 2002, high by-catch of 0- and 1-ringer herring is expected to occur during the third and the fourth quarter as the incoming year classes of herring are estimated to be strong. Therefore, the sprat fishery in 2002 may be restricted by the existing limit placed on the allowable by-catch of herring, rather than by the actual sprat TAC.

Catch forecast for 2003: Because the fishery in a given year is very dependent on that year's incoming year class of sprat, ICES is not able to predict catches for 2003.

Comparison with previous assessment and advice: The assessment method and input data were similar to last year. The decrease in the advised TAC (160 000 t compared to 225 000 t advised last year) reflects changes in the stock.

Elaboration and special comment: The present assessment and TAC-setting regime requires a two-year forecast. This means that the estimated TAC for 2003 has to be calculated in 2002 based on data collected in 2001. This may not be a realistic approach for a stock consisting of only a few year classes, with a predominance of 1-year-old fish in the catches. Instead, a two-step management process is suggested consisting of a provisional TAC for January-March 2003 that could be revised in April, taking into account the most recent survey data. Although this would require a change in the actual process of setting TACs for sprat, it would result in a better utilisation of this stock.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Catch data (Tables 3.5.9.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Catch
1987	Catch at lowest practical level	0	57	78	32
1988	TAC < recent catches, preferably zero	0	57	93	87
1989	No advice	-	59	50	63
1990	No advice	-	59	49	73
1991	No advice	-	55	92	112
1992	No advice	-	55	72	124
1993	No advice	-	114	127	200
1994	No advice for sprat; maintain by-catch regulations	-	114	184	320
1995	No advice	-	175	190	357
1996	No advice	-	200	141	136
1997	Enforce by-catch regulations	-	150	123	103
1998	Limited by restrictions on juvenile herring	-	150	175	163
1999	Limited by restrictions on juvenile herring	-	225	167	188
2000	Limited by restrictions on juvenile herring	-	225	208	196
2001	TAC restricted	225	225	180	170
2002	TAC restricted	160	232		
2003					

[1]EU zone

Sprat in the North Sea (Subarea IV)

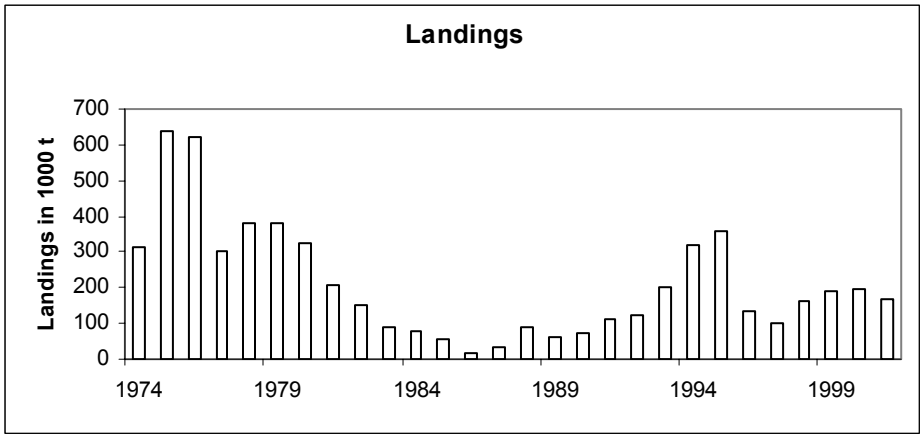


Table 3.5.9.1 Sprat in the North Sea, Subarea IV. (Data provided by Working Group members).

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes**.**

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Division IVa West														
Denmark	0.1				0.3	0.6						0.7		0.1
Netherlands														
Norway														
Sweden				0.1										0.1
UK(Scotland)							0.1							
Total	0.1			0.1	0.3	0.6	0.1					0.7		
Division IVa East (North Sea) stock														
Denmark									0.3					
Norway					0.5	2.5		0.1						
Sweden				2.5										
Total				2.5	0.5	2.5		0.1	0.3					
Division IVb West														
Denmark	1.4	2	10	9.4	19.9	13	19	26	1.8	82.2	21.1	13.2	18.8	11.1
Norway	3.5	0.1	1.2	4.4	18.4	16.8	12.6	21	1.9	2.3				0.9
UK(Engl. & Wales)					0.5	0.5								
UK(Scotland)						0.5						0.8		
Total	4.9	2.1	11.2	13.8	38.8	30.8	31.6	47	3.7	84.5	21.1	14	18.8	
Division IVb East														
Denmark	80.7	59.2	59.2	67	66.6	136.2	251.7	283.2	74.7	10.9	98.2	147.1	144.1	132.9
Germany														
Norway	0.6		0.6	25.1	9.5	24.1	19.1	14.7	50.9	0.8	15.3	13.1	0.9	5.0
Sweden			+	+				0.2	0.5		1.7	2.1		1.4
UK(Scotland)												0.6		
Total	81.3	59.2	59.8	92.1	76.1	160.3	270.8	298.1	126.1	11.7	115.2	162.9	145	
Division Ivc														
Denmark	0.1	0.5	1.5	1.7	2.5	3.5	10.1	11.4	3.9	5.7	11.8	3.3	28.2	13.1
France								+						
Netherlands	0.4	0.4										0.2		
Norway						0.4	4.6	0.4		0.1	16	5.7	1.8	3.6
UK(Engl. & Wales)	0.6	0.9	0.2	1.8	6.1	2	2.9	0.2	2.6	1.4	0.2	1.6	2	2.0
Total	1.1	1.8	1.7	3.5	8.6	5.9	17.6	12	6.5	7.2	28	10.8	32	
Total North Sea														
Denmark	82.3	61.7	70.7	78.1	89.2	153.3	280.8	320.6	80.7	98.8	131.1	164.3	191.1	157.2
France								+						
Germany														
Netherlands	0.4	0.4										0.2		
Norway	4.1	0.1	1.8	29.6	28.4	43.8	36.3	36.2	52.8	3.2	31.3	18.8	2.7	9.5
Sweden				2.5								2.7		1.4
UK(Engl. & Wales)	0.6	0.9	0.2	1.8	6.6	2.5	2.9	0.2	2.6	1.4	0.2	1.6	2	2.0
UK(Scotland)						0.5	0.1					0.8		
Total	87.4	63.1	72.7	112	124.3	200.1	320.1	357	136.1	103.4	162.6	188.4	195.9	170.1

Table 3.5.9.2 Sprat in the North Sea (Subarea IV)

Year	Landings
	Tonnes
1974	313600
1975	641200
1976	621500
1977	304000
1978	378300
1979	379600
1980	323400
1981	209100
1982	153800
1983	88400
1984	76700
1985	56100
1986	16300
1987	32400
1988	87400
1989	63100
1990	72700
1991	112000
1992	124300
1993	200100
1994	320100
1995	357000
1996	136100
1997	103400
1998	162600
1999	188400
2000	195900
2001	170100
Average	210271

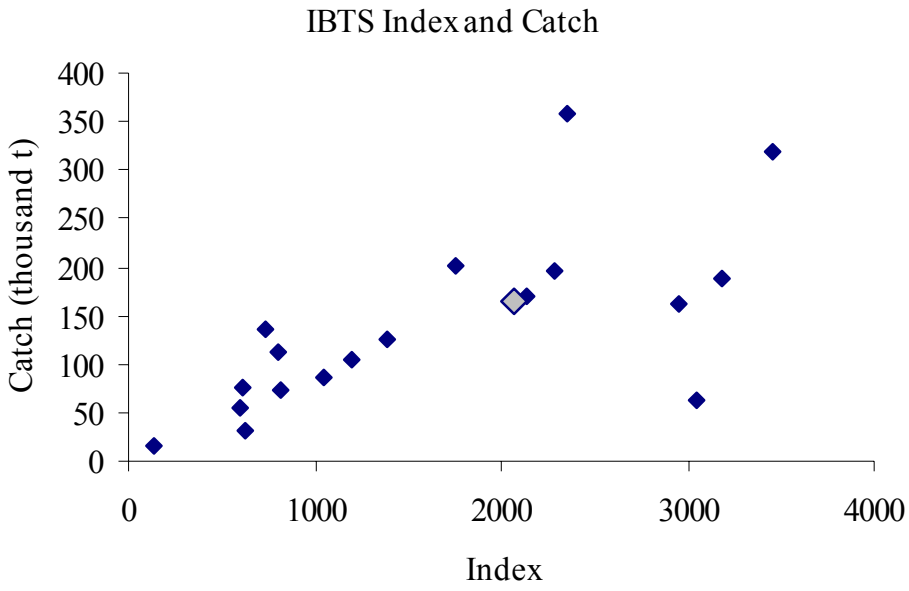


Figure 3.5.9.1 IBTS Sprat Index (February) and catch of the entire year.

3.5.10 Mackerel in Subarea IV (North Sea component)

For information on this mackerel component see mackerel (combined Southern, Western and North Sea spawning components) section 3.12.3.

3.5.11 North Sea horse mackerel (*Trachurus trachurus*) (Division IIIa (eastern part), Divisions IVb,c, VIId)

State of stock/exploitation: The state of the stock is not known. There is no recent quantitative information on stock size. Catches have been increasing in recent years.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2003 be no more than the 1982-1997 average of 18 000 t, in order to avoid an expansion of the fishery until there is more information about the structure of horse mackerel stocks, and sufficient information to facilitate an adequate assessment.

Relevant factors to be considered in management: Advice in 1999 was to constrain expansion of the fishery until there was a scientific basis for advice because high catch rates can be maintained in pelagic fisheries even when the stock is in decline. Despite this advice catches increased by one third, from about 37 000 t in 1999 to 48 000 t in 2000 and 46 000 t in 2001. ICES maintains this advice reflecting its concern over the potential impact of the recent expansion of the fishery.

These fish migrate out of the North Sea to areas where they mix with the western horse mackerel stock. The present agreed TAC is for the North Sea and Division IIa and this area does not correspond to the distribution area of the stock. The TAC should apply to all those areas where the North Sea horse mackerel are fished, i.e. Divisions IIIa, IVb,c and VIId.

In recent years there has been a change in the age composition of the landings with a higher proportion of younger age groups. In 1998 about 55%, in 1999 40%, and in 2001 74% of the catch in numbers were fish 1-4 years old. The 1998 year class appears to be abundant in the landings in recent years and may be a relatively strong year class.

Catch forecast for 2003: Not available.

Medium- and long-term projections: Not available.

Elaboration and special comment: The stock cannot be assessed unless adequate data become available. Egg surveys from 1989 to 1991 indicated a spawning stock biomass of about 240 000 t. The age composition of the relatively small catches until 1997 and the past biomass estimates suggest that the exploitation rate may have been low in the early 1990s. However, the catch increased from a long-term level of 18 000 t to the historic high in 2000 of 48 000 t, and was close to that level in 2001. The exploitation in recent years may therefore have been increasing.

In earlier years the majority of the catch was taken as by-catch in the small-mesh industrial fishery. In recent years most of the catch has come from a directed fishery for human consumption, mainly in Division VIId.

The allocation of catches to the different horse mackerel stocks is based on the temporal and spatial distribution of the fishery. It is therefore important that the fishing nations report their catches by ICES rectangle and by quarter.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10 – 19 September 2002 (ICES CM 2003/ACFM:07).

Catch data (Tables 3.5.11.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings[2]
1987	Not assessed	-	30	12
1988	No advice	-	50	24
1989	No advice	-	45	33
1990	No advice	-	40	19
1991	No advice	-	45	12
1992	No advice	-	55	15
1993	No advice	-	60	14
1994	No advice	-	60	6
1995	No advice	-	60	17
1996	No advice	-	60	19
1997	No advice	-	60	20
1998	Develop and implement management plan	-	60	31
1999	Develop and implement management plan	-	60	37
2000	Develop and implement management plan	-	51	48
2001	No increase in catch	-	51	46
2002	No increase in catch from 1982-1997 average	<18	58	
2003	No increase in catch from 1982-1997 average	<18		

[1]Division IIa and Subarea IV (EU waters only). [2]Catch of North Sea stock (Divisions IIIaE, IVb,c & VIId). Weights in '000 t.

North Sea horse mackerel (Divisions IIIaE, IVb,c & VIId)

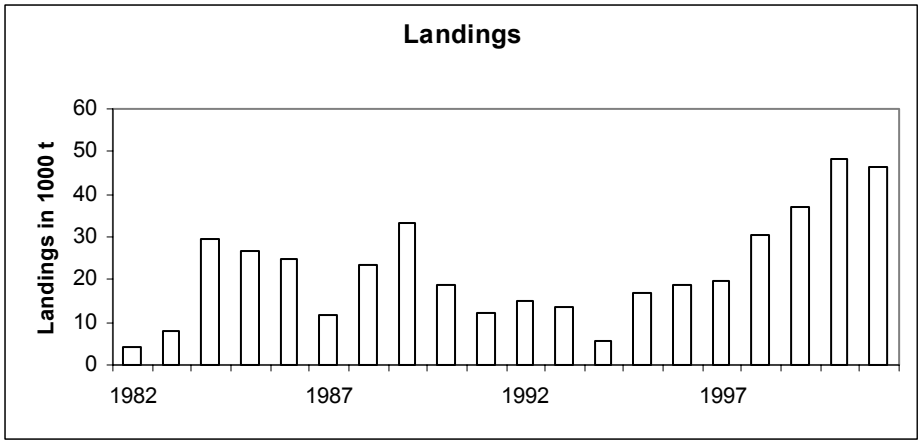


Table 3.5.11.1 Landings and discards of HORSE MACKEREL (t) by year and division, for the North Sea, Western and Southern horse mackerel. (Data submitted by Working Group members.)

Year	North Sea horse mackerel					Western horse mackerel							Southern horse mackerel			Total
	IIIa		IVb,c	Discards	VIId	Total	IIa	IVa	VIa,b	VIIa-c,e-k	VIIIa,b,d,e	Discards	Total	VIIIc	IXa	Total	All stocks
1982	-	2,788[3]	-		1,247	4,035	-	-	6,283	32,231	3,073	-	41,587	19,610	39,726	59,336	104,958
1983	-	4,420[3]	-		3,600	8,020	412	-	24,881	36,926	2,643	-	64,862	25,580	48,733	74,313	147,195
1984	-	25,893[3]	-		3,585	29,478	23	94	31,716	38,782	2,510	500	73,625	23,119	23,178	46,297	149,400
1985	1,138		22,897		2,715	26,750	79	203	33,025	35,296	4,448	7,500	80,551	23,292	20,237	43,529	150,830
1986	396		19,496		4,756	24,648	214	776	20,343	72,761	3,071	8,500	105,665	40,334	31,159	71,493	201,806
1987	436		9,477		1,721	11,634	3,311	11,185	35,197	99,942	7,605	-	157,240	30,098	24,540	54,638	223,512
1988	2,261		18,290		3,120	23,671	6,818	42,174	45,842	81,978	7,548	3,740	188,100	26,629	29,763	56,392	268,163
1989	913		25,830		6,522	33,265	4,809	85,304[2]	34,870	131,218	11,516	1,150	268,867	27,170	29,231	56,401	358,533
1990	14,872[1]		17,437		1,325	18,762	11,414	112,753[2]	20,794	182,580	21,120	9,930	373,463	25,182	24,023	49,205	441,430
1991	2,725[1]		11,400		600	12,000	4,487	63,869[2]	34,415	196,926	25,693	5,440	333,555	23,733	21,778	45,511	391,066
1992	2,374[1]		13,955	400	688	15,043	13,457	101,752	40,881	180,937	29,329	1,820	370,550	24,243	26,713	50,955	436,548
1993	850[1]		3,895	930	8,792	13,617	3,168	134,908	53,782	204,318	27,519	8,600	433,145	25,483	31,945	57,428	504,190
1994	2,492[1]		2,496	630	2,503	5,689	759	106,911	69,546	194,188	11,044	3,935	388,875	24,147	28,442	52,589	447,153
1995	240		7,948	30	8,666	16,756	13,133	90,527	83,486	320,102	1,175	2,046	510,597	27,534	25,147	52,681	580,034
1996	1,657		7,558	212	9,416	18,843	3,366	18,356	81,259	252,823	23,978	16,870	396,652	24,290	20,400	44,690	460,185
1997	2,037[4]		15,504[5]	10	5,452	19,540	2,617	63,647	40,145	318,101	11,677	2,921	442,571	29,129	27,642	56,771	518,882
1998	3,693		10,530	83	16,194	30,500	2,540[6]	17,011	35,043	232,451	15,662	830	303,543	22,906	41,574	64,480	398,523
1999	2,095[4]		9,335		27,889	37,224	2,557[7]	47,316	40,381	158,715	22,824		273,888	24,188	27,733	51,921	363,033
2000	1,105[4]		25,954		22,471	48,425	1,169[8]	4,524	20,657	115,245	32,227		174,927	21,984	27,160	49,144	272,496
2001	157[9]		8,157		38,114	46,425	60	11,525[10]	24,636	100,676	54,293		191,193	20,828	24,911	45,739	283,357

[1]Norwegian and Danish catches are included in the Western horse mackerel.
[2]Norwegian catches in Division IVb included in the Western horse mackerel.
[3]Divisions IIIa and IVb,c combined.
[4]Included in Western horse mackerel.
[5]Norwegian catches in IVb (1,426 t) included in Western horse mackerel.
[6]Includes 1,937 t from Vb.
[7]Includes 132 t from Vb.
[8]Includes 250 t from Vb.
[9]Includes 72 t allocated to western horse mackerel.
[10]Includes 69 t allocated to North Sea horse mackerel.

Table 3.5.11.2 Landings (t) of HORSE MACKEREL in Subarea IV and Division IIIa by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-	275	17	-	-
Faroe Islands	-	942	340	-	360	1,014	-	-	296
France	248	220	174	162	302	415	-	-	-
Germany, Fed.Rep.	506	2,469[4]	5,995	2,801	1,570	1,329	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	94,000	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	-	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	2,087	84,747	14,639	45,314
Poland	-	-	-	-	-	389	-	-	-
Sweden	-	102	953	800	697	7,582	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	1,511	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059		3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-	-278[6]	-3,270		-28	136	-31,615
Unallocated + discards	12,482[4]	-317[4]	-750[4]						
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001[1]
Belgium	19	21	19	19
Denmark	2,048	8,006	4,409	2288
Estonia	22	-	-	-
Faroe Islands	28	908	24	-
France	379	60	49	48
Germany	4,620	4,071	3,115	230
Ireland	-	404	103	375
Netherlands	3,811	3,610	3,382	4685
Norway	13,129	44,344	1,246	7948
Poland	-	-	-	-
Russia	-	-	2	-
Sweden	3,411	1,957	1,141	119
UK (Engl. + Wales)	2	11	15	317
UK (N. Ireland)	-	-	-	-
UK (Scotland)	3,041	1,658	3,465	3161
Unallocated + discards	737	-325	14613	649
Total	31,247	64,725	31583	19,839

[1] Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported. [5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4,000 t.

3.5.12 Norway pout in ICES Subarea IV and Division IIIa

State of stock/exploitation: The stock is within safe biological limits. Recruitment is highly variable and influences stock size rapidly due to the short life span of the species. Fishing mortality has generally been lower than the natural mortality and fishing mortality has generally decreased in recent years to well below the long-term average.

Management objectives: There is no management objective set for this stock. With present fishing mortality levels the state of the stock is more determined by natural processes and less by the fishery. However, there is a need to ensure that the stock remains high enough to provide food for a variety of predator species.

Precautionary Approach reference points (Unchanged since 1997):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 90 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be established at 150 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
Note: With present fishing mortality levels the status of the stock is more determined by natural processes and less by the fishery. It may be more appropriate to formulate reference points based on total mortality, recruitment, and stock biomass for use within management procedures using surveys (and real-time monitoring of catches). However, it is a question whether the 0-group is fully recruited to the 3rd quarter surveys in relation to forecast based on surveys alone. Forecast of the 0-group is relevant as the fishery starts on the 0-group already in 3rd and 4th quarter of the year.	

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$ = 90 000 t.	$\mathbf{B}_{pa}$ Below-average recruitment below: 150 000 t.
$\mathbf{F}_{lim}$ None advised.	$\mathbf{F}_{pa}$ None advised.

Advice on management: The stock can sustain current fishing mortality.

Relevant factors to be considered in management: The stock can on average sustain current fishing mortality. The fishery targets both Norway pout and blue whiting. In managing this fishery, by-catches of haddock, whiting, and blue whiting should be taken into account and existing measures to protect these by-catch species should be maintained.

This stock is an important food source for other species. The fishing mortality is lower than the natural mortality, and multispecies analyses have indicated that when F is below M for these types of species, the fisheries are not causing problems for their predators on the scale of the stock. Locally concentrated harvesting may cause local and temporary depletions of food for predators and, therefore, harvesting should be spread widely across the stock area. The population dynamics of Norway pout in the North Sea and Skagerrak are very dependent on changes caused by recruitment variation and predation mortality (or other natural mortality causes) and less by the fishery.

Deterministic catch forecasts are not feasible because: (a) the potential catches are largely dependent on the size of a few year classes, (b) large dependence on the strength of the recruiting 0-group year classes that is unknown for 2002, and (c) added uncertainty arising from variations in natural mortality.

Comparison with previous assessment and advice: The assessment and advice is largely consistent with those from previous years. SSB in 2001 has been revised upwards by 5% and fishing mortality in 2000 was revised downwards by 13%.

Catch forecast for 2003: Deterministic catch forecasts are not feasible for this stock.

Medium- and long-term projections: No medium-term predictions are carried out for this stock.

Elaboration and special comment: The fishery is mainly by Danish and Norwegian vessels using small mesh trawls in the northern North Sea at Fladen Ground and along the edge of the Norwegian Trench. Main fishing seasons are 1st, 3rd, and 4th quarters of the year. The fishery targets both Norway pout and blue whiting. The assessment is analytical using catch-at-age analysis based on quarterly catch and CPUE data. The assessment is considered appropriate to indicate trends in the stock and immediate changes in the stock because of the seasonal assessment taking into account the seasonality in fishery.

The linkage between blue whiting and the Norway pout fisheries has been evaluated. Blue whiting is caught by different gears and mesh sizes and can be grouped in two types of fisheries. The first is a directed fishery for blue whiting where by-catches of other species are insignificant. These landings are used for human consumption or for meal and oil production. Secondly, there is a mixed industrial fishery for Norway pout where varying proportions of juvenile blue whiting are caught as a by-catch. The majority of these landings are for meal and oil production.

The by-catch of blue whiting in the Norway pout fishery in 2001 in Subarea IV was 52 000 t and in Division IIIa 13 700 t. An additional 6 700 t was caught as a by-catch by the Faroese, but ACFM has not been able to verify that this was taken in a Norway pout fishery. The total blue whiting by-catch in the Norway pout and other fisheries in Subarea IV and Division IIIa combined was 79 100 t, which is 4% of the total international blue whiting landings in 2001 (1 780 000 t).

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, June 2002 (ICES CM 2003/ACFM:02).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 1-2	Yield/R	SSB/R
Average Current	0.816	1.827	9.984
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	N/A		
$\mathbf{F}_{med}$	N/A		

Catch data (Tables 3.5.12.1–2):

North Sea (Subarea IV)

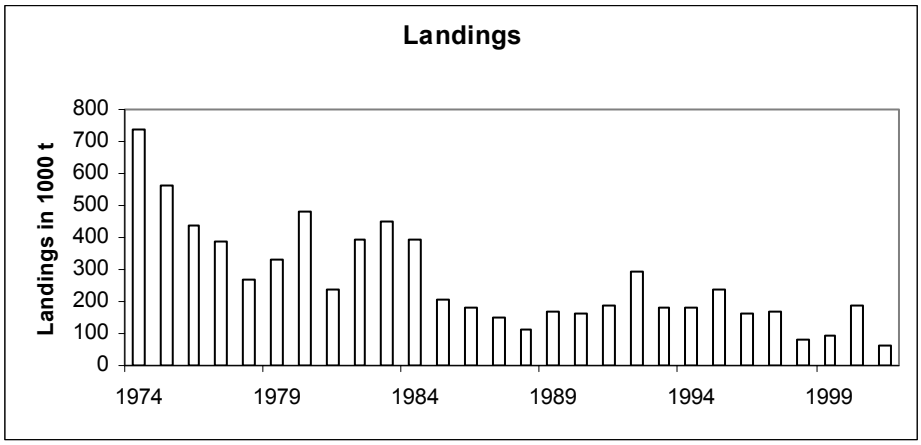
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM landings
1987	No advice	-	200	215	147
1988	No advice	-	200	187	102
1989	No advice	-	200	276	167
1990	No advice	-	200	212	140
1991	No advice	-	200	223	155
1992	No advice	-	200	335	255
1993	No advice	-	220	241	176
1994	No advice	-	220	214	176
1995	Can sustain current F	-	180	289	181
1996	Can sustain current F; take by-catches into consid.	-	220	197	122
1997	Can sustain current F; take by-catches into consid.	-	220	155	133
1998	Can sustain current F; take by-catches into consid.	-	220	72	62
1999	Can sustain current F; take by-catches into consid.	-	220	93	85
2000	Can sustain current F; take by-catches into consid.	-	220	182	175
2001	Can sustain current F; take by-catches into consid.	-	211	63	57
2002	Can sustain current F; take by-catches into consid.	-	198		
2003	Can sustain current F; take by-catches into consid.	-	198		

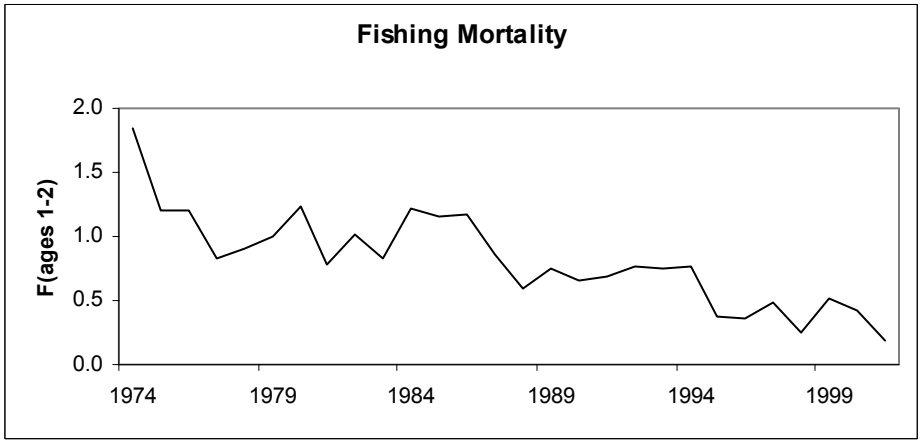
[1] IIa(EU), IIIa, IV(EU). Weights in '000 t.

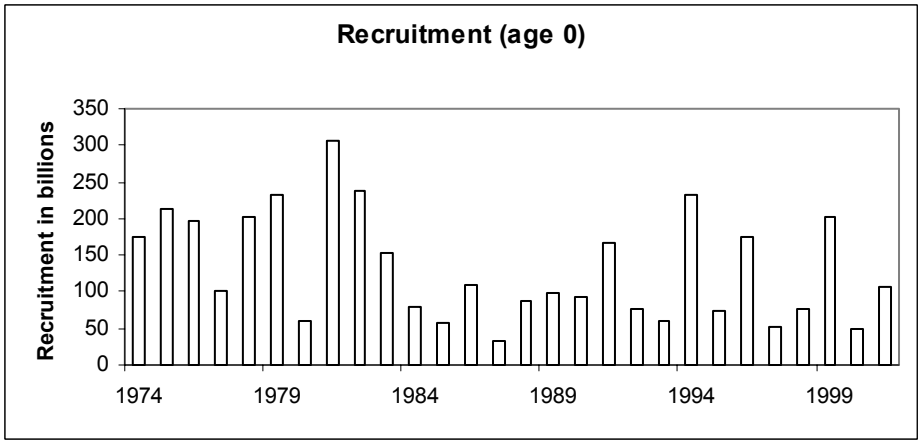
Skagerrak (Division IIIa)

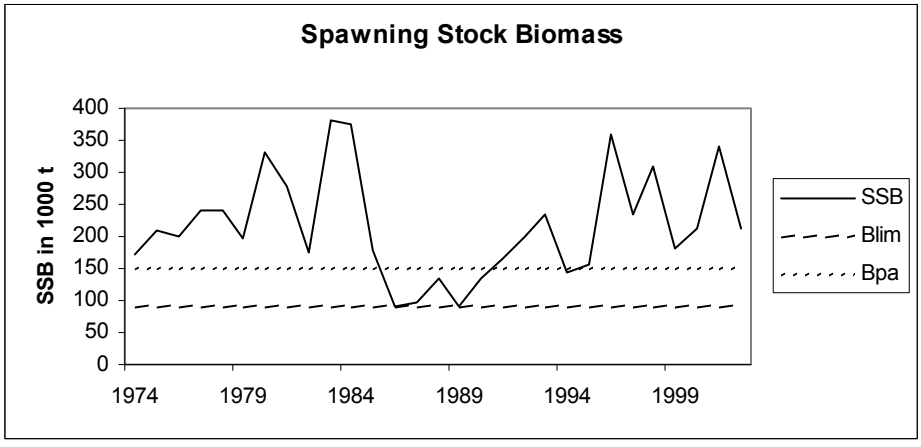
Year	ICES Advice	Official landings	ACFM Catch
1987	No advice		2
1988	No advice		8
1989	No advice	17	5
1990	No advice	41	12
1991	No advice	49	38
1992	No advice	84	45
1993	No advice	37	8
1994	No advice	24	7
1995	No advice	68	50
1996	No advice	58	36
1997	See advice for North Sea	35	29
1998	See advice for North Sea	11	13
1999	See advice for North Sea	7	8
2000	See advice for North Sea	15	10
2001	See advice for North Sea	14	7
2002	See advice for North Sea		
2003	See advice for North Sea		

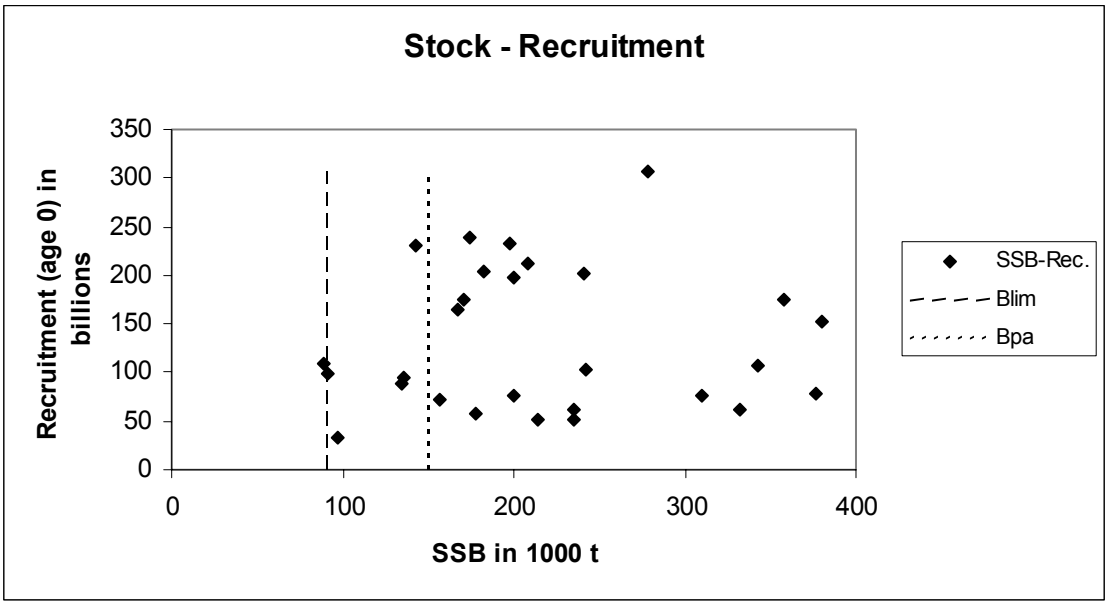
Weights in '000 t.


Landings
Landings in 1000 t
800
700
600
500
400
300
200
100
0
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 1-2)
2.0
1.5
1.0
0.5
0.0
1974
1979
1984
1989
1994
1999


Recruitment (age 0)
Recruitment in billions
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
400
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
350
300
250
200
150
100
50
0
0
100
200
300
400
SSB in 1000 t
SSB-Rec.
Blim
Bpa

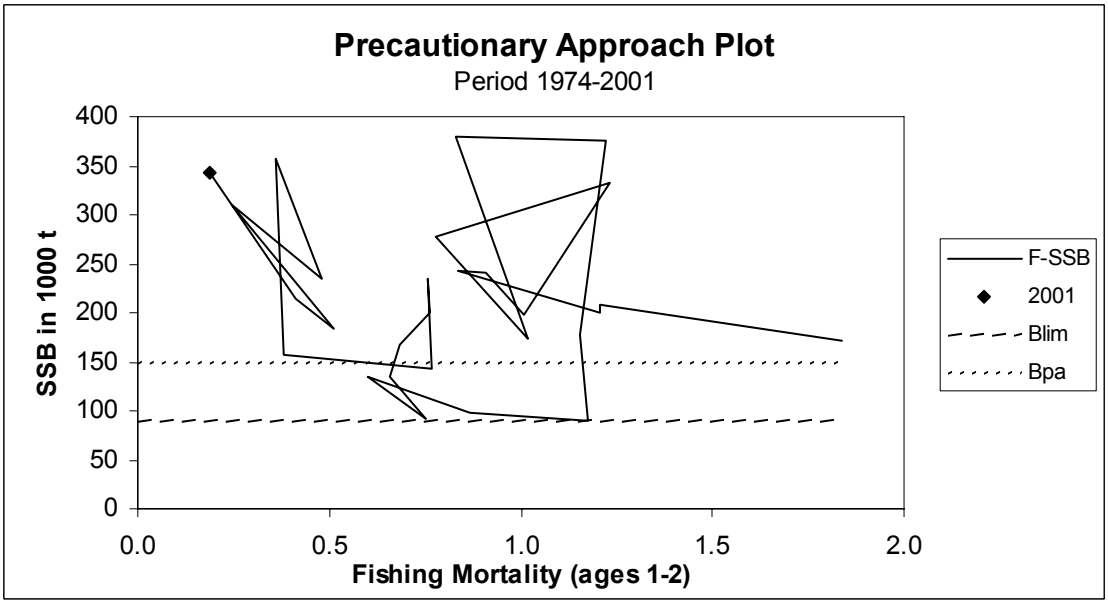

Precautionary Approach Plot
Period 1974-2001
SSB in 1000 t
400
350
300
250
200
150
100
50
0
0.0
0.5
1.0
1.5
2.0
Fishing Mortality (ages 1-2)
F-SSB
2001
Blim
Bpa

Table 3.5.12.1 Norway pout annual landings ('000 t) in the North Sea and Skagerrak (not incl. Kattegat, IIIaS) by country, for 1961-2001 (Data provided by Working Group members). (Norwegian landing data include landings of by-catch of other species).

Year	Denmark		Faroes	Norway	Sweden	UK (Scotland)	Others	Total
	North Sea	Skagerrak						
1961	20.5	-	-	8.1	-	-	-	28.6
1962	121.8	-	-	27.9	-	-	-	149.7
1963	67.4	-	-	70.4	-	-	-	137.8
1964	10.4	-	-	51.0	-	-	-	61.4
1965	8.2	-	-	35.0	-	-	-	43.2
1966	35.2	-	-	17.8	-	-	+	53.0
1967	169.6	-	-	12.9	-	-	+	182.5
1968	410.8	-	-	40.9	-	-	+	451.7
1969	52.5	-	19.6	41.4	-	-	+	113.5
1970	142.1	-	32.0	63.5	-	0.2	0.2	238.0
1971	178.5	-	47.2	79.3	-	0.1	0.2	305.3
1972	259.6	-	56.8	120.5	6.8	0.9	0.2	444.8
1973	215.2	-	51.2	63.0	2.9	13.0	0.6	345.9
1974	464.5	-	85.0	154.2	2.1	26.7	3.3	735.8
1975	251.2	-	63.6	218.9	2.3	22.7	1.0	559.7
1976	244.9	-	64.6	108.9	+	17.3	1.7	437.4
1977	232.2	-	50.9	98.3	2.9	4.6	1.0	389.9
1978	163.4	-	19.7	80.8	0.7	5.5	-	270.1
1979	219.9	9.0	21.9	75.4	-	3.0	-	329.2
1980	366.2	11.6	34.1	70.2	-	0.6	-	482.7
1981	167.5	2.8	16.6	51.6	-	+	-	238.5
1982	256.3	35.6	15.4	88.0	-	-	-	395.3
1983	301.1	28.5	24.5	97.3	-	+	-	451.4
1984	251.9	38.1	19.1[1]	83.8	-	0.1	-	393.0
1985	163.7	8.6	9.9	22.8	-	0.1	-	205.1
1986	146.3	4.0	6.6	21.5	-	-	-	178.4
1987	108.3	2.1	4.8	34.1	-	-	-	149.3
1988	79.0	7.9	1.5	21.1	-	-	-	109.5
1989	95.7	4.2	0.8	65.3	+	0.1	0.3	166.4
1990	61.5	23.8	0.9	77.1	+	-	-	163.3
1991	85.0	32.0	1.3	68.3	+	-	+	186.6
1992	146.9	41.7	2.6	105.5	+	-	0.1	296.8
1993	97.3	6.7	2.4	76.7	-	-	+	183.1
1994	97.9	6.3	3.6	74.2	-	-	+	182.0
1995	138.1	46.4	8.9	43.1	0.1	+	0.2	236.8
1996	74.3	33.8	7.6	47.8	0.2	0.1	+	163.8
1997	94.2	29.3	7.0	39.1	+	+	0.1	169.7
1998	39.8	13.2	4.7	22,1	-	-	+	79.8
1999	41.0	6.8	-	44.2	+	-	-	92.0
2000	127.0	9.3	-	48.0	0.1	-	+	184.4
2001	40.6	7.5	-	16.8	0.7	+	+	65.6

Table 3.5.12.2 Norway pout in Subarea IV and Division IIIa.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-2
1974	176000000	171000	735800	1.840
1975	212000000	208000	559700	1.206
1976	198000000	200000	437400	1.204
1977	102000000	242000	389900	0.835
1978	201000000	241000	270100	0.907
1979	233000000	198000	329200	1.006
1980	61000000	332000	482700	1.233
1981	306000000	278000	238500	0.777
1982	238000000	174000	395300	1.016
1983	153165000	380466	451400	0.830
1984	78866000	376509	393000	1.223
1985	57107000	177452	205100	1.156
1986	110121000	89435	178400	1.176
1987	32236000	97524	149300	0.866
1988	88447000	134852	109500	0.599
1989	99506000	91656	166400	0.754
1990	94330000	135552	163300	0.660
1991	165660000	167172	186600	0.686
1992	77065000	200006	296800	0.762
1993	60943000	235210	183100	0.756
1994	231158000	142215	182000	0.767
1995	72968000	156145	236800	0.382
1996	175308000	357896	163800	0.360
1997	51013000	235323	169700	0.481
1998	76539000	310060	79800	0.248
1999	203023000	182800	92000	0.513
2000	50462000	214010	184400	0.415
2001	106750000	342128	65600	0.186
2002		211512		
Average	132559536	216618	267700	0.816

3.5.13 Sandeel

3.5.13.a Sandeel in Subarea IV

Catches for the total North Sea are given by country in Table 3.5.13.1 and by the Subareas shown in Figure 3.5.13.1 and Table 3.5.13.2.

State of stock/exploitation: The stock is within safe biological limits. SSB in 2002 is estimated to be just above $\mathbf{B}_{pa}$. No fishing mortality reference points have been set for this stock. The 2001 year class is estimated to be the strongest in the time-series.

Management objectives: There are no management objectives set for this stock. There is a need to develop management objectives that ensure that the stock remains high enough to provide food for a variety of predator species.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 430 000 t	$\mathbf{B}_{pa}$ is 600 000 t

Technical basis:

$\mathbf{B}_{lim}$ is 430 000 t, the lowest observed biomass	$\mathbf{B}_{pa}$ is set to 1.4* $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$ None advised	$\mathbf{F}_{pa}$ None proposed

Advice on management: ICES recommends that fishing mortality should not be allowed to increase because the consequences of removing a larger fraction of the food-biomass for other biota are unknown. Local depletion of sandeel aggregations by fisheries should be prevented, particularly in areas where predators congregate.

Relevant factors to be considered in management: The stock can sustain current fishing mortality.

Sandeels are important prey species for many marine predators. The fishing mortality is lower than the natural mortality and multispecies analyses have indicated that when F is below M for these types of species the fisheries are not causing problems for their predators on the scale of the stock. Locally concentrated harvesting may cause local and temporary depletions of food for predators and, therefore, harvesting should be spread widely across the stock area.

In the light of studies linking low sandeel availability to poor breeding success of kittiwake, ICES advised for 2000 a closure of the sandeel fisheries east of Scotland (Figure 3.5.13.1). All commercial fishing was excluded, except for a maximum of 10 boat days in each of May and June for stock monitoring purposes. The closed area will be maintained for three years with an evaluation every year.

Catch forecast for 2003: The few year classes in the fishery make the stock size and catch opportunities largely dependent on the size of the incoming year classes. Traditional deterministic forecasts are therefore not feasible. Initial estimates of the 2001 year class indicate that it is very strong.

Medium- and long-term projections: No medium-term analysis is carried out for this stock.

Comparison with previous assessment and advice: The assessment method used for sandeel has changed since the last assessment. In general, the present method gives a slightly lower F and a higher SSB compared to the previous method. However, there are substantial discrepancies between the current assessment and previous assessments due to the addition of the 2001 data. SSB in 2001 is now estimated to be 25% lower and fishing mortality in 2000 is estimated to be 56% higher.

Elaboration and special comment: Sandeel is taken by trawlers using small mesh gear. The fishery is seasonal, taking place mostly in the spring and summer. Most of the catch consists of *Ammodytes marinus* and there is a low percentage by-catch by weight of TAC species.

Sandeels are largely stationary after settlement and the North Sea sandeel must be considered as a complex of local populations. Recruitment to local areas may not only be related to the local stock, as interchange between areas seems to take place during the early phases of life before settlement. The Shetland sandeel stock is assessed as a separate unit.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM:

02).

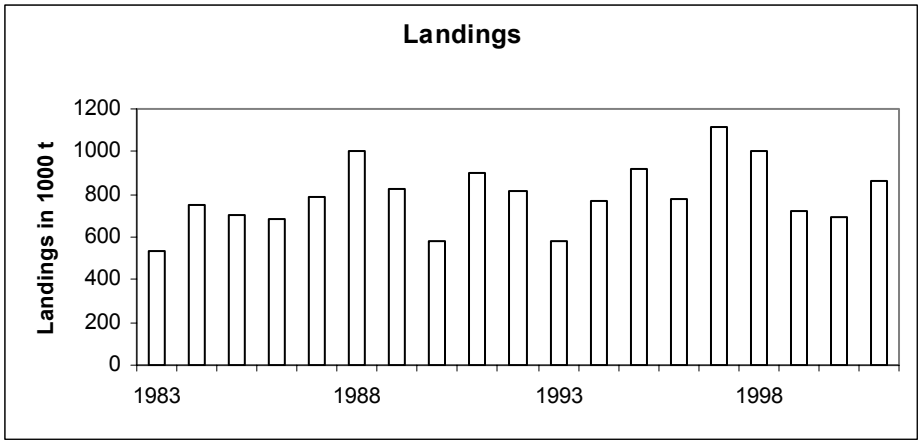
Yield and spawning biomass per Recruit F-reference points:

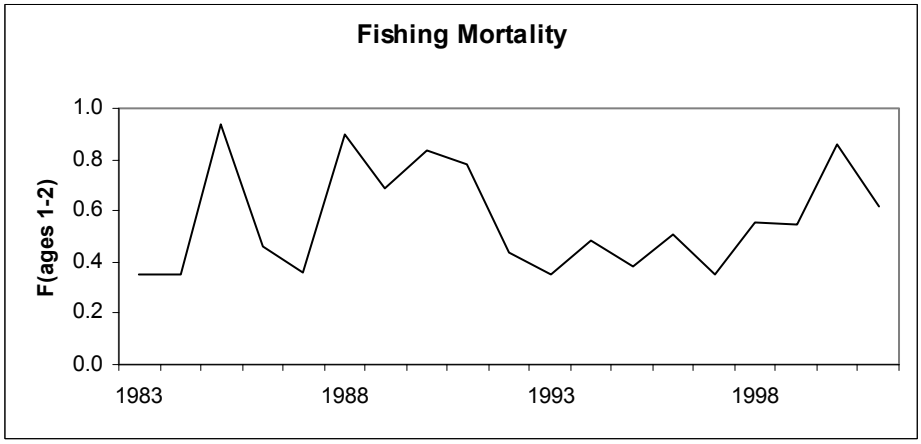
	Fish Mort Ages 1-2	Yield/R	SSB/R
Average Current	0.566	0.001	0.001
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.894	0.001	0.001
$\mathbf{F}_{med}$	0.319	0.001	0.002

Catch data (Tables 3.5.13.1–3):

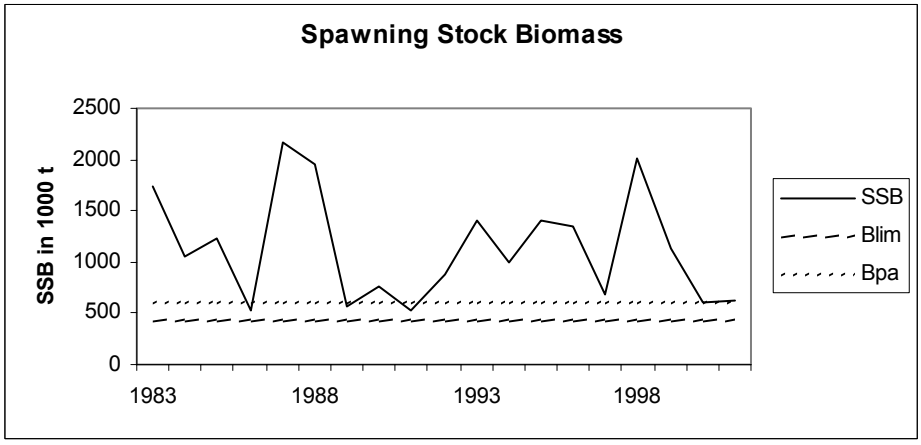
Year	ICES Advice	TAC	ACFM Catch
1987	No advice[1]; No advice[2]		825
1988	No advice[1]; No advice[2]		893
1989	No advice[1]; No advice[2]		1039
1990	No advice[1]; No advice[2]		591
1991	No advice[1]; No advice[2]		843
1992	No advice[1]; No advice[2]		855
1993	No advice[1]; No advice[2]		579
1994	No advice[1]; No advice[2]		786
1995	Can sustain current F[1]; No advice[2]		918
1996	Can sustain current F		777
1997	Can sustain current F		1138
1998	Can sustain current F	1000	1004
1999	Can sustain current F	1000	735
2000	Can sustain current F	1020	699
2001	Can sustain current F	1020	859
2002	Can sustain current F	1020	
2003	No increase in F		

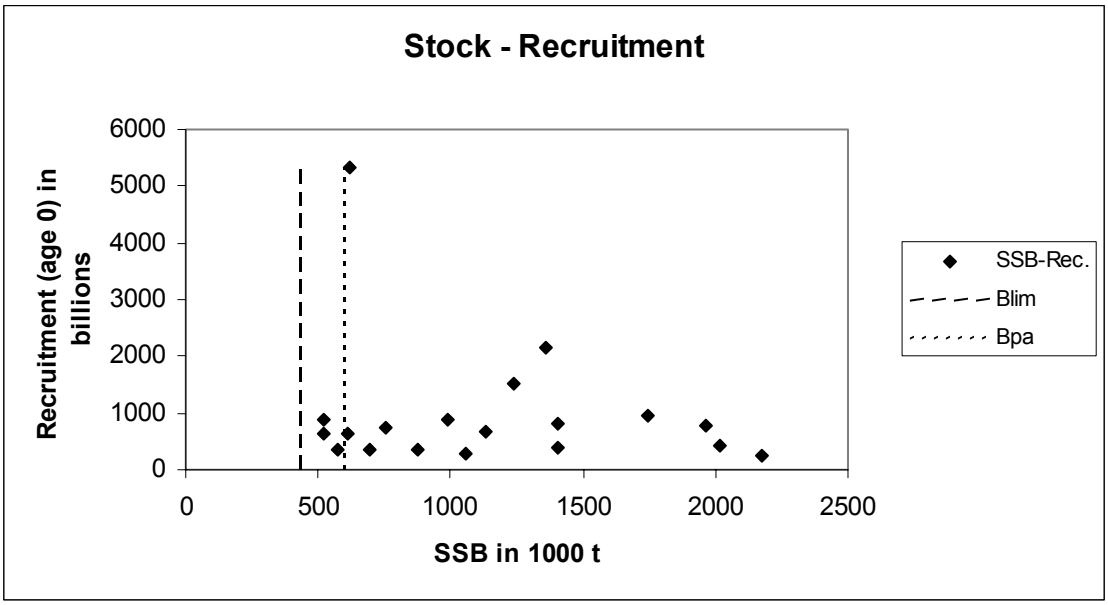
[1]Southern stock component. [2]Northern stock component. Weights in '000 t.

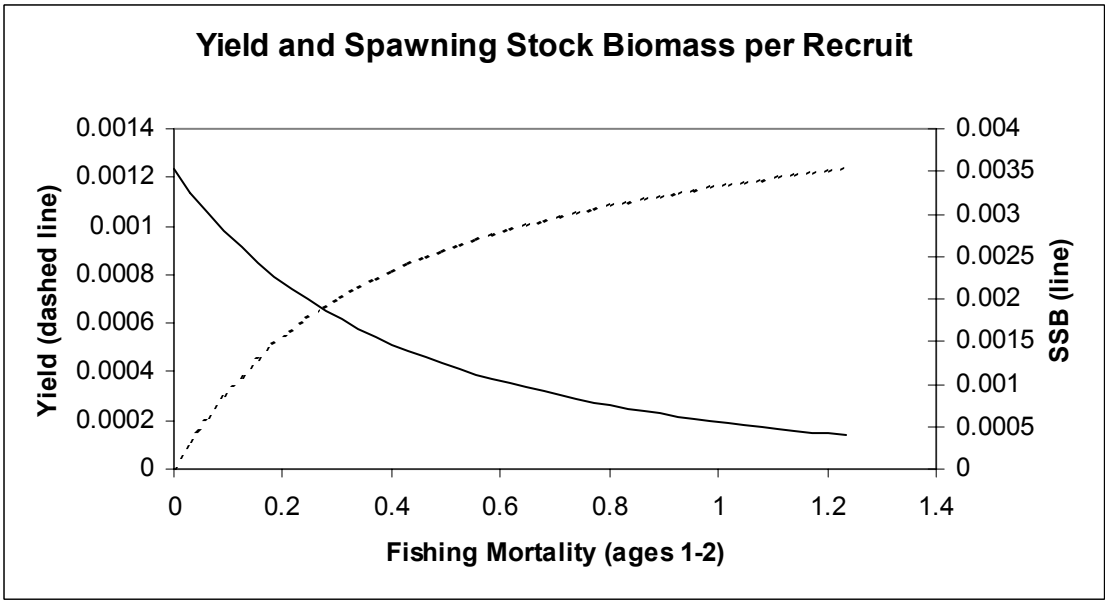

Landings
Landings in 1000 t
1200
1000
800
600
400
200
0
1983
1988
1993
1998


Fishing Mortality
F(ages 1-2)
1.0
0.8
0.6
0.4
0.2
0.0
1983
1988
1993
1998

Recruitment (age 0)
Recruitment in billions
6000
5000
4000
3000
2000
1000
0
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
6000
5000
4000
3000
2000
1000
0
0
500
1000
1500
2000
2500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
SSB (line)
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 1-2)

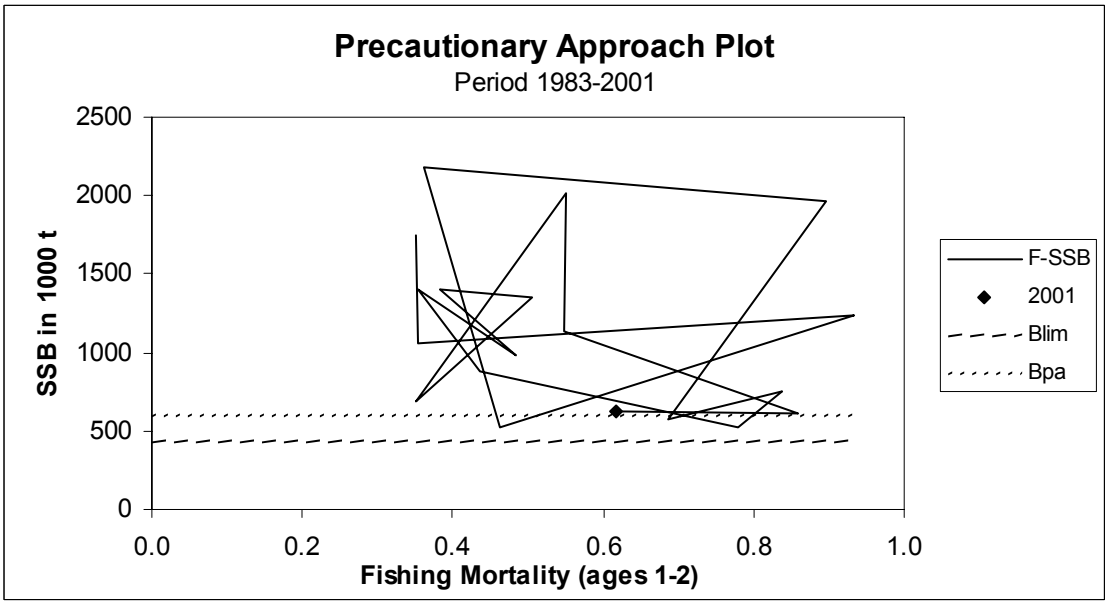

Precautionary Approach Plot
Period 1983-2001
SSB in 1000 t
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 1-2)
F-SSB
2001
Blim
Bpa

Table 3.5.13.1 SANDEEL in the North Sea. Landings ('000 t), 1952-2001.
(Data provided by Working Group members.)

Year	Denmark	Germany	Faroes	Ireland	Netherlands	Norway	Sweden	UK	Total
1952	1.6	-	-	-	-	-	-	-	1.6
1953	4.5	+	-	-	-	-	-	-	4.5
1954	10.8	+	-	-	-	-	-	-	10.8
1955	37.6	+	-	-	-	-	-	-	37.6
1956	81.9	5.3	-	-	+	1.5	-	-	88.7
1957	73.3	25.5	-	-	3.7	3.2	-	-	105.7
1958	74.4	20.2	-	-	1.5	4.8	-	-	100.9
1959	77.1	17.4	-	-	5.1	8.0	-	-	107.6
1960	100.8	7.7	-	-	+	12.1	-	-	120.6
1961	73.6	4.5	-	-	+	5.1	-	-	83.2
1962	97.4	1.4	-	-	-	10.5	-	-	109.3
1963	134.4	16.4	-	-	-	11.5	-	-	162.3
1964	104.7	12.9	-	-	-	10.4	-	-	128.0
1965	123.6	2.1	-	-	-	4.9	-	-	130.6
1966	138.5	4.4	-	-	-	0.2	-	-	143.1
1967	187.4	0.3	-	-	-	1.0	-	-	188.7
1968	193.6	+	-	-	-	0.1	-	-	193.7
1969	112.8	+	-	-	-	-	-	0.5	113.3
1970	187.8	+	-	-	-	+	-	3.6	191.4
1971	371.6	0.1	-	-	-	2.1	-	8.3	382.1
1972	329.0	+	-	-	-	18.6	8.8	2.1	358.5
1973	273.0	-	1.4	-	-	17.2	1.1	4.2	296.9
1974	424.1	-	6.4	-	-	78.6	0.2	15.5	524.8
1975	355.6	-	4.9	-	-	54.0	0.1	13.6	428.2
1976	424.7	-	-	-	-	44.2	-	18.7	487.6
1977	664.3	-	11.4	-	-	78.7	5.7	25.5	785.6
1978	647.5	-	12.1	-	-	93.5	1.2	32.5	786.8
1979	449.8	-	13.2	-	-	101.4	-	13.4	577.8
1980	542.2	-	7.2	-	-	144.8	-	34.3	728.5
1981	464.4	-	4.9	-	-	52.6	-	46.7	568.6
1982	506.9	-	4.9	-	-	46.5	0.4	52.2	610.9
1983	485.1	-	2.0	-	-	12.2	0.2	37.0	536.5
1984	596.3	-	11.3	-	-	28.3	-	32.6	668.5
1985	587.6	-	3.9	-	-	13.1	-	17.2	621.8
1986	752.5	-	1.2	-	-	82.1	-	12.0	847.8
1987	605.4	-	18.6	-	-	193.4	-	7.2	824.6
1988	686.4	-	15.5	-	-	185.1	-	5.8	892.8
1989	824.4	-	16.6	-	-	186.8	-	11.5	1039.1
1990	496.0	-	2.2	-	0.3	88.9	-	3.9	591.3
1991	701.4	-	11.2	-	-	128.8	-	1.2	842.6
1992	751.1	-	9.1	-	-	89.3	0.5	4.9	854.9
1993	482.2	-	-	-	-	95.5	-	1.5	579.2
1994	603.5	-	10.3	-	-	165.8	-	5.9	785.5
1995	647.8	-	-	-	-	263.4	-	6.7	917.9
1996	601.6	-	5.0	-	-	160.7	-	9.7	776.9
1997	751.9	-	11.2	-	-	350.1	-	24.6	1137.8
1998	617.8	-	11.0	-	+	343.3	8.5	23.8	1004.4
1999	500.1	-	13.2	0.4	+	187.6	22.4	11.5	735.1
2000	541.0	-	-	-	+	119.0	28.4	10.8	699.1
2001	630.8	-	-	-	-	183.0	46.5	1.3	861.6

+ = less than half unit.
- = no information or no catch.

Table 3.5.13.2 SANDEEL in the North Sea. Annual landings ('000 t) by area of the North Sea Data provided by Working Group members (Denmark, Norway and Scotland).

	Area										Sampling area		
Year	1A	1B	1C	2A	2B	2C	3	4	5	6	Shetland	Northern	Southern
1972	98.8	28.1	3.9	24.5	85.1	0.0	13.5	58.3	6.7	28.0	0	130.6	216.3
1973	59.3	37.1	1.2	16.4	60.6	0.0	8.7	37.4	9.6	59.7	0	107.6	182.4
1974	50.4	178.0	1.7	2.2	177.9	0.0	29.0	27.4	11.7	25.4	7.4	386.6	117.1
1975	70.0	38.2	17.8	12.2	154.7	4.8	38.2	42.8	12.3	19.2	12.9	253.7	156.5
1976	154.0	3.5	39.7	71.8	38.5	3.1	50.2	59.2	8.9	36.7	20.2	135.0	330.6
1977	171.9	34.0	62.0	154.1	179.7	1.3	71.4	28.0	13.0	25.3	21.5	348.4	392.3
1978	159.7	--50.2--		346.5	--70.3--		42.5	37.4	6.4	27.2	28.1	163.0	577.2
1979	194.5	0.9	61.0	32.3	27.0	72.3	34.1	79.4	5.4	44.3	13.4	195.3	355.9
1980	215.1	3.3	119.3	89.5	52.4	27.0	90.0	30.8	8.7	57.1	25.4	292	401.2
1981	105.2	0.1	42.8	151.9	11.7	23.9	59.6	63.4	13.3	45.1	46.7	138.1	378.9
1982	189.8	5.4	4.4	132.1	24.9	2.3	37.4	75.7	6.9	74.7	52.0	74.4	479.2
1983	197.4	-	2.8	59.4	17.7	-	57.7	87.6	8.0	66.0	37.0	78.2	419.0
1984	337.8	4.1	5.9	74.9	30.4	0.1	51.3	56.0	3.9	60.2	32.6	91.8	532.8
1985	281.4	46.9	2.8	82.3	7.1	0.1	29.9	46.6	18.7	84.5	17.2	79.7	513.5
1986	295.2	35.7	8.5	55.3	244.1	2.0	84.8	22.5	4.0	80.3	14.0	375.1	457.4
1987	275.1	63.6	1.1	53.5	325.2	0.4	5.6	21.4	7.7	45.1	7.2	395.9	402.8
1988	291.1	58.4	2.0	47.0	256.5	0.3	37.6	35.3	12.0	102.2	4.7	384.8	487.6
1989	228.3	31.0	0.5	167.9	334.1	1.5	125.3	30.5	4.5	95.1	3.5	492.4	526.3
1990	141.4	1.4	0.1	80.4	156.4	0.6	61.0	45.5	13.8	85.5	2.3	219.5	366.7
1991	228.2	7.1	0.7	114.0	252.8	1.8	110.5	22.6	1.0	93.1	+	372.9	458.9
1992	422.4	3.9	4.2	168.9	67.1	0.3	101.2	20.1	2.8	54.4	0	176.7	668.6
1993	196.5	21.9	0.1	26.2	164.9	0.3	88.0	26.6	3.9	48.7	0	276.0	301.9
1994	157.0	108.6	-	61.7	203.4	2.7	175.0	16.0	2.8	42.0	0	489.7	279.5
1995	322.4	43.9	147.4	86.7	169.5	1.0	59.4	26.6	5.3	55.8	1.3	421.2	496.8
1996	310.5	18.6	31.2	40.8	153.0	4.5	134.1	12.7	3.0	52.5	1	341.2	419.5
1997	352.0	53.3	8.9	92.8	390.5	1.2	112.9	18.1	4.7	88.6	2.4	566.8	535.8
1998	282.2	58.3	2.0	90.3	395.3	1.0	40.6	34.5	4.2	63.4	5.2	497.2	480.7
1999	266.7	32.6	0.1	132.8	167.9	0.0	48.0	16.9	2.7	27.2	4.2	248.7	446.4
2000	226.1	29.2	0.0	87.2	139.9	0.3	111.7	20.4	8.3	43.3	4.3	281.0	385.4
2001	239.9	13.0	1.6	263.0	177.9	0.1	49.6	12.4	7.3	49.0	1.3	242.2	571.6

Sampling areas: Northern - Areas 1B, 1C, 2B, 2C, 3.
Southern - Areas 1A, 2A, 4, 5, 6.

Table 3.5.13.3 Sandeel in Subarea IV

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1-2
1983	937219328	1746479	530640	0.3515
1984	267035072	1054563	750040	0.3550
1985	1501430144	1239700	707105	0.9343
1986	637127296	519749	685950	0.4631
1987	232975712	2177245	791050	0.3617
1988	773113728	1960427	1007304	0.8964
1989	339971808	572160	826835	0.6865
1990	732942592	758347	584912	0.8386
1991	881409536	522139	898959	0.7782
1992	348655904	877877	820140	0.4354
1993	802584256	1403708	576932	0.3541
1994	879747072	988379	770747	0.4843
1995	382363008	1407776	915043	0.3819
1996	2145684608	1356703	776126	0.5056
1997	347538240	692029	1114044	0.3508
1998	417682368	2013825	1000375	0.5510
1999	660095936	1135217	718668	0.5473
2000	633442240	614597	692498	0.8578
2001	5339951000	619656	858619	0.6166
2002		640558*		
Average	961103676	1140030	790841	0.5658

* calculated using the 2001 weight in the stock

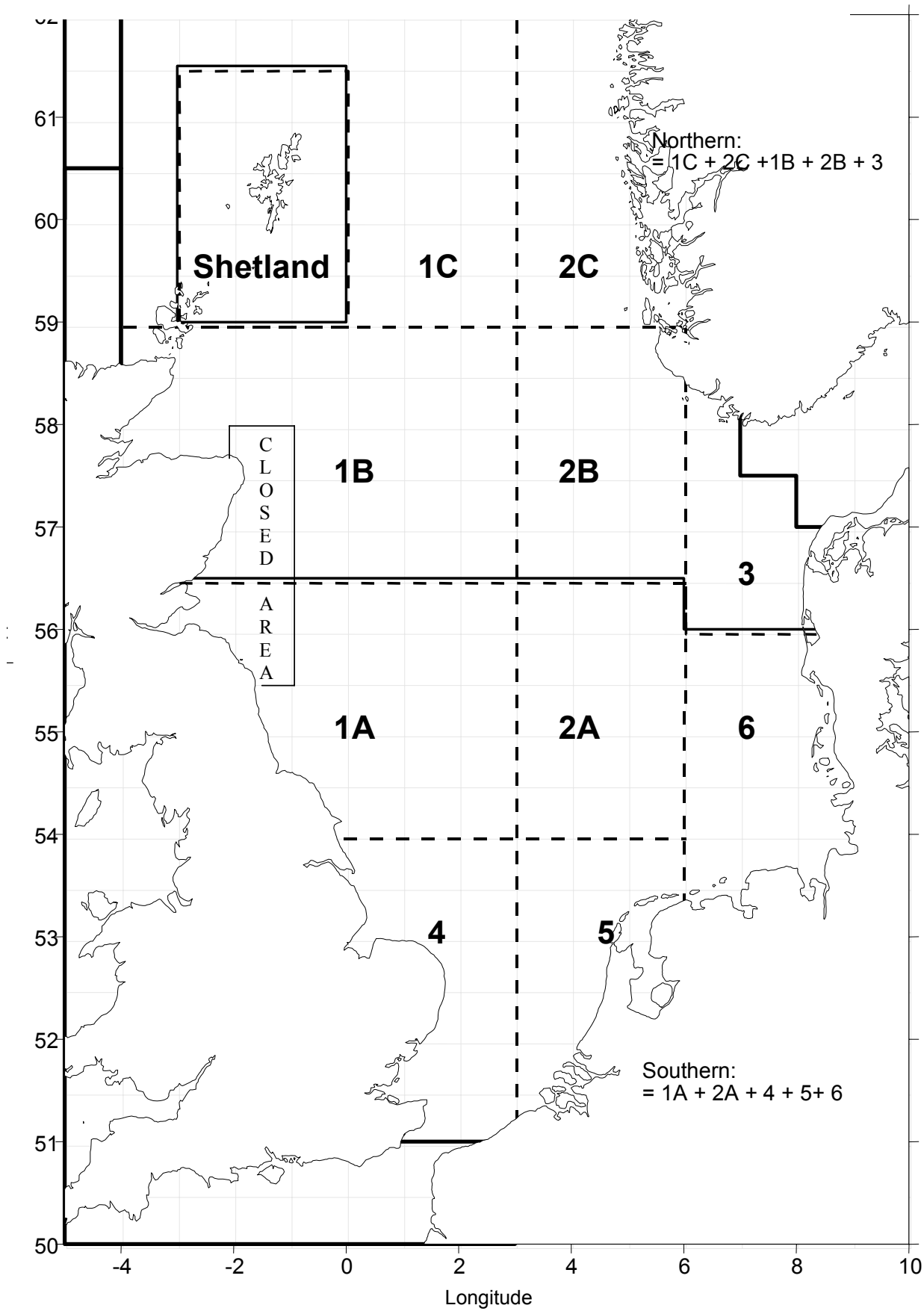


Figure 3.5.13.1 North Sea sandeel. Sampling areas and assessments area used by ICES.

3.5.13.b Sandeel in the Shetland area

State of stock/exploitation: Safe biological limits have not been defined for this stock. It is believed that fishing mortality is well below natural mortality. This means that natural processes largely drive stock variations. Landings in 2001 were 1 264 t, substantially lower than in 2000 and below the TAC of 7 000 t.

Management objectives: The Shetland sandeel fishery re-opened in 1995 subject to a multi-annual management regime. This was revised for the 1998 fishing season onwards. The new regime consists of an annual TAC of 7 000 t and a closure during the months of June and July. The seasonal closure is to avoid any possibility of direct competition between the fishery and seabirds during the chick-rearing season. There is also a limit on vessel size to boats of 20 m or less. These arrangements were renewed in 2001 for another three years.

Advice on management: None.

Relevant factors to be considered in management: ICES suggested in October 2001 that the management plan be evaluated before the agreed end date. The evaluation has been carried out and all interest groups have agreed to the continuation of the current measures.

Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply, especially during the breeding season. For some seabird species the availability of 0-group sandeel as prey is very important.

In some years most of the recruitment comes from spawning areas away from Shetland. The availability of 0-group sandeel is, therefore, not closely linked to the local spawning population. The sandeel population is also an important food source for other predator species in the Shetland area.

An assessment based on survey data alone suggests that the SSB in 2000 is close to its lowest observed value and that recent recruitment has been weak.

Elaboration and special comment: The previous assessment was undertaken in 2001 and was based on survey data only. Because fishing mortality appears to be very low compared with natural mortality, the assessment used a model, which only attempted to estimate total mortality. The assessment was consistent with the previous assessment (1997), but was subject to high uncertainty. It indicated that SSB has declined recently and that recent recruitment has been poor. If these indications are correct then the SSB is likely to decline further in the short term.

The sandeel population at Shetland is not a separate stock, but forms part of a larger complex of sub-populations. Estimates of the consumption of sandeel by seabirds and other predators greatly exceed the quantities taken by the fishery in recent years.

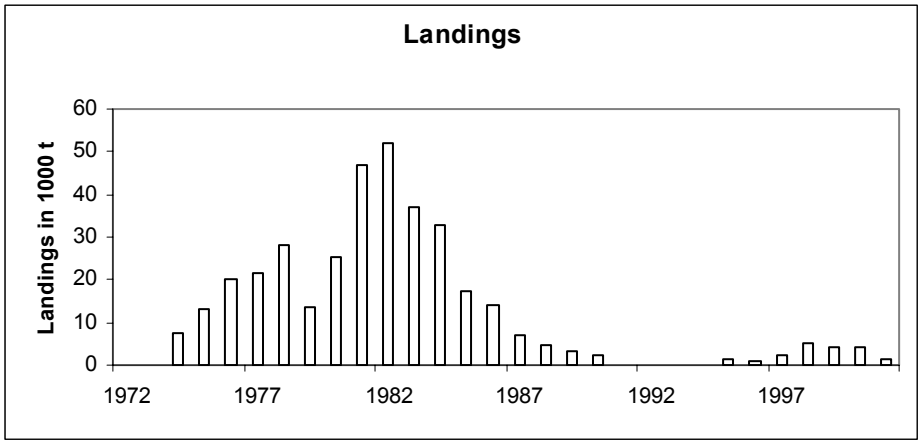
Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

Catches in the total North Sea are given in Table 3.5.13.1. For the Shetland Area see Table 3.5.13.2.

Year	ICES Advice	Predicted Catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No advice	-		7.2
1988	No advice	-		4.7
1989	No advice	-		3.5
1990	No advice	-		2.3
1991	Low fishing	-		+
1992	No fishing prudent	-		-
1993	No fishing prudent	-		-
1994	TAC	3		-
1995	TAC	3	3	1.2
1996	No advice	-	3	1.0
1997	No advice	-	3	2.1
1998	No advice	-	7	5.2
1999	No advice	-	7	4.2
2000	No catch advice	-	7	4.9
2001	No advice	-	7	1.3
2002	No advice	-	7	
2003	No advice	-		

Weights in '000 t.

Sandeel in the Shetland Area



3.5.14 *Pandalus borealis*

3.5.14.a *Pandalus borealis* in Division IVa (Fladen Ground)

State of the stock/exploitation: The current state of the stock is unknown. During the last 10 years total landings fluctuated between a low of around 500 t to a high of about 6 000 t. Total effort has been relatively low in 1999, 2000, and 2001.

Relevant factors to be considered in management: The fishery is highly dependent on year class strength. Only age groups 2 and 3 at the beginning of the year and age groups 1 and 2 at the end of the year are caught. There is no basis for defining biological reference points for this stock.

Sorting grids or other means of facilitating the escape of fish should be implemented in this fishery.

Elaboration and special comment: No assessment was conducted in 2002.

A main characteristic of the Fladen stock of *Pandalus* is that the catches consist of mainly 2 age groups. During the first two quarters of the year age groups 2 and 3 normally dominate the catches. During quarter 4, age group 3 usually disappears from the catches, while age group 1 adds to the catches. Because of the few age groups constituting this stock predictions for the Fladen fishery are possible only if very reliable information on recruitment is available.

The Fladen stock is mainly exploited by Danish and UK trawlers normally using 35 – 40 mm cod-end mesh size. It is a targeted fishery on *Pandalus* with low by-catches of other species. In recent years the by-catch in the Danish fishery of other species was estimated to be 11% of the total landings.

Source of information: Report of the *Pandalus* Assessment Working Group, Charlottenlund, Denmark, August 2002 (ICES CM 2003/ACFM:05).

Catch data(Table 3.5.14.a.1):

Year	ICES Advice	TAC (EC part of Div. IV)	ACFM landings
1987	Not assessed		9.3
1988	Large fluctuations of stock at current F and mesh size		1.7
1989	Large fluctuations of stock at current F		3.1
1990	No advice		2.1
1991	No advice		0.5
1992	No advice	4.5	1.6
1993	No advice	4.5	2.1
1994	No advice	5.4	1.3
1995	No advice	4.8	6.0
1996	No advice	4.5	5.8
1997	No advice	4.5	3.4
1998	No advice	5.2	4.3
1999	No advice	7.0	1.5
2000	No advice	7.1	1.9
2001	No advice	6.5	1.7
2002	No advice	4.98	
2003	No advice		

Weights in ‘000 t.

Table 3.5.14.a.1 Landings in tonnes of *Pandalus borealis* from the Fladen Ground (Division IVa) as estimated by the Working Group.

Year	Denmark	Norway	Sweden	UK (Scotland)	Total
1972	2204			187	2391
1973	157			163	320
1974	282			434	716
1975	1308			525	1833
1976	1552			1937	3489
1977	425	112		1692	2229
1978	890	81		2027	2998
1979	565	44		268	877
1980	1122	76		377	1575
1981	685	1		347	1033
1982	283			352	635
1983	5729	8		1827	7564
1984	4553	13		25	4591
1985	4188			1341	5529
1986	3416			301	3717
1987	8620			686	9306
1988	1662	2		84	1748
1989	2495	25		547	3067
1990	1681	3	4	365	2053
1991	422	31		53	506
1992	1448			116	1564
1993	1521	38		509	2068
1994	1229	0		35	1264
1995	4659	15		1298	5972
1996	3858	32		1893	5783
1997	3022	9		365	3396
1998	2900	3		1365	4268
1999	1005	9		456	1470
2000	1482			378	1860
2001	1263	18		397	1678

3.5.15 Anglerfish in Subarea IV (North Sea)

Anglerfish in this area is assessed as part of the complex covering Division IIIa (Skagerrak and Kattegat), Subarea IV (North Sea) and Division VIa (West of Scotland), see section 3.7.7.

3.5.16 Answer to Request from EC concerning the Status of Sea Bass in European Waters

ICES has been asked by the European Commission (DG Fisheries) to provide information on bass (*Dicentrarchus labrax*) in response to the following questions:

1) The stock identity of bass in Community waters and, if necessary, adjacent waters in the Northeast Atlantic. How many bass stocks are there; what is their geographical extent? (Not in the Mediterranean or NW Atlantic).
2) The historical and current state of these stocks of bass. Are the stocks under-exploited, over-exploited? Can ICES provide the usual time-series of biomass, fishing mortality rate, recruits, landings, yield-per-recruit plots, etc.? If possible, provide catch-at-age composition, F-at-age, and effort data by métier as a possible precursor to economic analyses to be conducted outside ICES.
3) Current problems in the exploitation of bass and provide advice on possibilities for overcoming these problems. Is exploitation in the Channel and/or Celtic Sea a problem? If so, how can it be solved?

The SGBASS Terms of Reference agreed by ACFM were to work by correspondence in 2001 and to meet in Brest from March 11–15, 2002, to:

a) compile information on European fisheries in which sea bass are taken;
b) compile information pertinent for the assessment of sea bass, including information that can be used to identify unit stocks of sea bass;
c) where possible, present assessments of sea bass stocks in European waters and identify their stock conservation requirements.

Q1. Stock identity:

The results of tagging studies and the seasonal distribution of the fisheries taking bass in Subareas IV, VII, and VIII suggest that it may be possible to identify four sub-units for management/assessment purposes: fish which move between the Channel and the southern North Sea; fish which migrate along the west coast of Britain and into Cornish waters; fish which move between Biscay and the western Channel; and fish which remain largely within Irish waters (Figure 3.5.16.1). It should be noted that adult fish from the first three of these "stocks" are exploited to some extent by the same offshore pair-trawl fishery in winter.

Basis for advice:

The 2001 SGBASS report (ICES CM 2001/ACFM:25) presented information which can be used to identify stocks of bass in Community and adjacent waters in the Northeast Atlantic, and provided an interpretation in relation to potential stock assessment areas. Sea bass, *D. labrax*, are distributed in Northeast Atlantic shelf waters from southern Norway, through the North Sea, the Irish Sea, the Bay of Biscay, the Mediterranean, and the Black Sea to Northwest Africa, and the species is at the northern limits of its range around the British Isles and southern Scandinavia.

Sea bass spawn in the Channel and Celtic Sea from February to May and occasionally off the Isle of Man in the Irish Sea and in the southern North Sea during April - June. In the Bay of Biscay, bass spawn in two areas; in the south of Division VIIIa and close by in the north of Division VIIIb in January–March. Other spawning grounds may exist in areas that have not been sampled by pelagic trawling or by plankton surveys. Bass larvae resulting from offshore spawning move steadily inshore towards the coast as they grow and, when they reach a specific developmental stage at around 11–15 mm in length (at 30–50 days old), it is thought that they respond to an environmental cue and actively swim into estuarine nursery habitats. From June onwards, 0-group bass in excess of 15 mm long are found in creeks, estuaries, and shallow bays all along the southeast, south, and west coasts of England and Wales, where they remain through their first and second years, after which they migrate to over-wintering areas in deeper water, returning to the larger estuaries in summer. Several studies indicate the existence of similar bass nursery areas in bays and estuaries on the French coasts of the Channel and Bay of Biscay.

After 4–7 years, or at approximate lengths of 35 cm for males and 42 cm for females, bass attain maturity and adopt the migratory movements of the adult fish. In general, adult bass move north and east following spawning (peak February-May), and appear to return to the same inshore feeding area each summer. The reciprocal movement of maturing fish to pre-spawning areas occurs as the water temperature decreases during October-December. The spatial and temporal distributions of recaptures of adult bass tagged in the Channel offshore fishery in winter 2000 and in the summer inshore fisheries in 2000 and 2001 suggest that the patterns of movement are similar to those previously reported from tagging around England and Wales in the 1970s and early 1980s. A higher proportion of recaptures of adult bass in the recent study, however, were recaptured late in the year in "summer" feeding areas, and also inshore in the northeastern Irish Sea, eastern Channel, and southern North Sea in February and March. This suggests that not all adult bass may partake in offshore spawning. These results show that the bass taken by pair-trawls offshore in winter pre-spawning and spawning areas in the western Channel are also exploited in a wide range of areas extending

from the northeastern Irish Sea to the southern North Sea.

Recaptures of bass tagged as juveniles in nursery areas around England and Wales indicate dispersal at the age of 4–6 years (around 36 cm), often moving well outside the 'home' range and not necessarily recruiting to their parent spawning stock. This mixing of recruiting bass between regions is borne out by genetic studies. Analyses of samples of 0-group bass from Divisions IVc, VIIe, VIIf, and VIIg provide little, if any, sign of population structuring. Similarly, analysis of adult seabass captured at spawning grounds in VIIe, VIIf, and VIIIa,b indicated very limited genetic differentiation between spawning grounds. This suggests that mixing between generations is sufficient to homogenise the genetic make-up of the bass population in Northwest Europe.

The lack of genetic differentiation, and the wide dispersion of bass as they move from nursery areas to join spawning populations, provide little evidence for the existence of biological stocks within the bass population occupying the region between the Bay of Biscay, the Irish Sea, and the North Sea. However, tagging studies suggest there is little, if any, interchange of bass between Ireland and the UK.

Q2. The historical and current state of these stocks of bass:

Exploitation of bass stocks in Northwest Europe has a long history, both in capture fisheries and extensive aquaculture using wild-caught fry. Prior to the 1980s, however, sea bass were mainly the target of small-scale inshore fisheries using lines and seine nets, and especially by recreational anglers around the British Isles. These fisheries continue today, but bass have now become an important by-catch for demersal trawlers and have been increasingly targeted by French and UK pair-trawlers fishing offshore in the winter on pre-spawning and spawning aggregations. Nominal landings by country and ICES division since 1984 are given in Tables 6.1.1.1 – 6.1.1.7 in the SGBASS report for 2002.

Analyses carried out by ICES using catch-at-age data indicated that fishing mortality has remained relatively stable at around 0.2 – 0.3 for the years 1985, 1990, and 1995 in the southern North Sea and Subarea VII, but these results are considered preliminary and give no indication whether these levels are sustainable. CPUE time-series, which show a declining trend from 1985 to 1992 followed by a strong increase to a peak in 1994, and then generally high but fluctuating catch rates until 2000, suggest that the abundance of bass in north European fisheries has remained higher in the mid-late 1990s than in the late 1980s.

Data on year-class strength are available for Subareas IV and VII, though these are more likely to reflect the influence of environmental conditions on survival of eggs, larvae, and juveniles than the abundance of spawning adults on the local spawning grounds. The data suggest that the pattern of above and below-average year classes varies throughout the range of bass, though strong year classes such as 1976 and 1989 tend to occur in all areas. The very strong 1989 year class has been followed by several year's good recruitment in the North Sea and Subarea VII.

Technical measures (MLS, EU 1990; gillnet mesh size UK 1990 and EU 1998; and closed nursery areas, UK 1990) introduced to protect juvenile bass have resulted in an exploitation pattern that shows peak recruitment at around age 6 in 1990 and 1995. Bass of this age are leaving nursery areas to join the adult stock, and are targeted by inshore fisheries whilst they are most accessible. As a consequence, much of this fishery is recruit-driven, and above-average year classes may be heavily exploited for one or two years. A yield-per-recruit analysis, using the output from an equilibrium age-based VPA, suggests that the resource is not over-exploited in growth terms, and the recent occurrence of above-average year classes indicates that it is not subject to recruit over-fishing. Further evidence that the current level and pattern of exploitation could be sustainable is provided by the observation that considerable numbers of fish in the 15+ group were recorded in UK and French landings from VIIe,h in 1995, and length distributions for 2000 show no overall reduction in large fish through the 1990s. It has not yet been possible to determine biological reference points for sea bass.

Whilst ICES is confident that the information presented in the SGBASS report (ICES CM2002/ACFM:11 Ref. G) is a fair representation of what is happening in the bass fisheries of those sea areas for which data are currently available, i.e. the North Sea, Channel, west coast of Britain, and Biscay, it recognises that more robust analyses are required to provide advice on the management requirements of fisheries that take bass. Time-series of landings by country and sea area are already available, and catch-at-age data are being brought up to date. Whilst all UK metiers taking bass (including the recreational boat sector) are sampled for catch (discards are negligible given the package of technical measures and high value of small bass) and effort, further work is planned to improve our knowledge of French small-boat fisheries (including the recreational sector), and it is likely that data will be available in 2003 to enable an evaluation of technical interactions and economic factors.

Q3. Management considerations:

The above analysis indicates that there are no problems with the exploitation of bass in relation to overall yield-per-recruit or recruitment over-fishing in the North Sea, Channel, west coast of Britain and Biscay, though the population structure has certainly changed since data were first collected in the 1970s. In all areas, the high abundance of fish >20 years old associated with a

virtually unexploited population has now declined, though strong cohorts are still recognisable at age 15+, and the incidence of above-average year classes has increased in the 1990s. This is particularly noticeable in the North Sea and Channel (where climate warming may be more apparent), and there appears to be an east-west decline in bass production as the species extends its range through the North Sea.

In Irish waters, the decline in large bass through the 1970s and 1980s led to a policy banning its commercial exploitation in favour of recreational fishing and tourism. These are also important in the UK and France, where recreational anglers co-exist with inshore artisanal fishermen who regard bass as a valuable seasonal source of income. There is some conflict between these fisheries, but the main problem is that inshore fishermen are most affected by the technical measures protecting bass under 36 cm (for which there is a strong market) and they perceive that the benefits of their conservation accrue to the offshore pair trawl fishery taking adult bass.

ICES is aware that there is an incidental by-catch of small cetaceans in the bass pair trawl fishery, and also that trials with separator panels are planned to ameliorate this problem. ICES has advised that "harbour porpoise populations are threatened by by-catch in [some] fisheries" (ACE 2001), and expressed concern about the sustainability of by-catch rates for other small cetaceans on several occasions through the 1990s. Although sea bass fisheries are not a primary source of by-catch mortality, ICES strongly encourages the testing and, where they are shown to be effective, adoption of technical measures to reduce cetacean by-catch in fisheries for sea bass.

Although bass stocks in Divisions IVb,c and VIIa,d,e,f,g,h, appear to be fished with an exploitation pattern that avoids growth over-fishing and at a fishing mortality level which is sustainable, given the uncertainties in the assessments and the possibility that an unfavourable change in environmental conditions may negatively influence recruitment, ICES considers that fishing mortality should not be allowed to increase. Bass is currently a non-TAC species, and management by quota is not seen as an appropriate tool for the small boat fisheries that account for the major part of landings and in which monitoring and enforcement of catch controls would be impractical. With the exception of Ireland, there is no management objective for this fishery, but it would be prudent to limit the effort of the vessels with the largest catching capacity. Ring-fencing the current participants in the pair-trawl fleets (which are subject to a weekly landings quota of 5 t per vessel) by licensing would be one option.

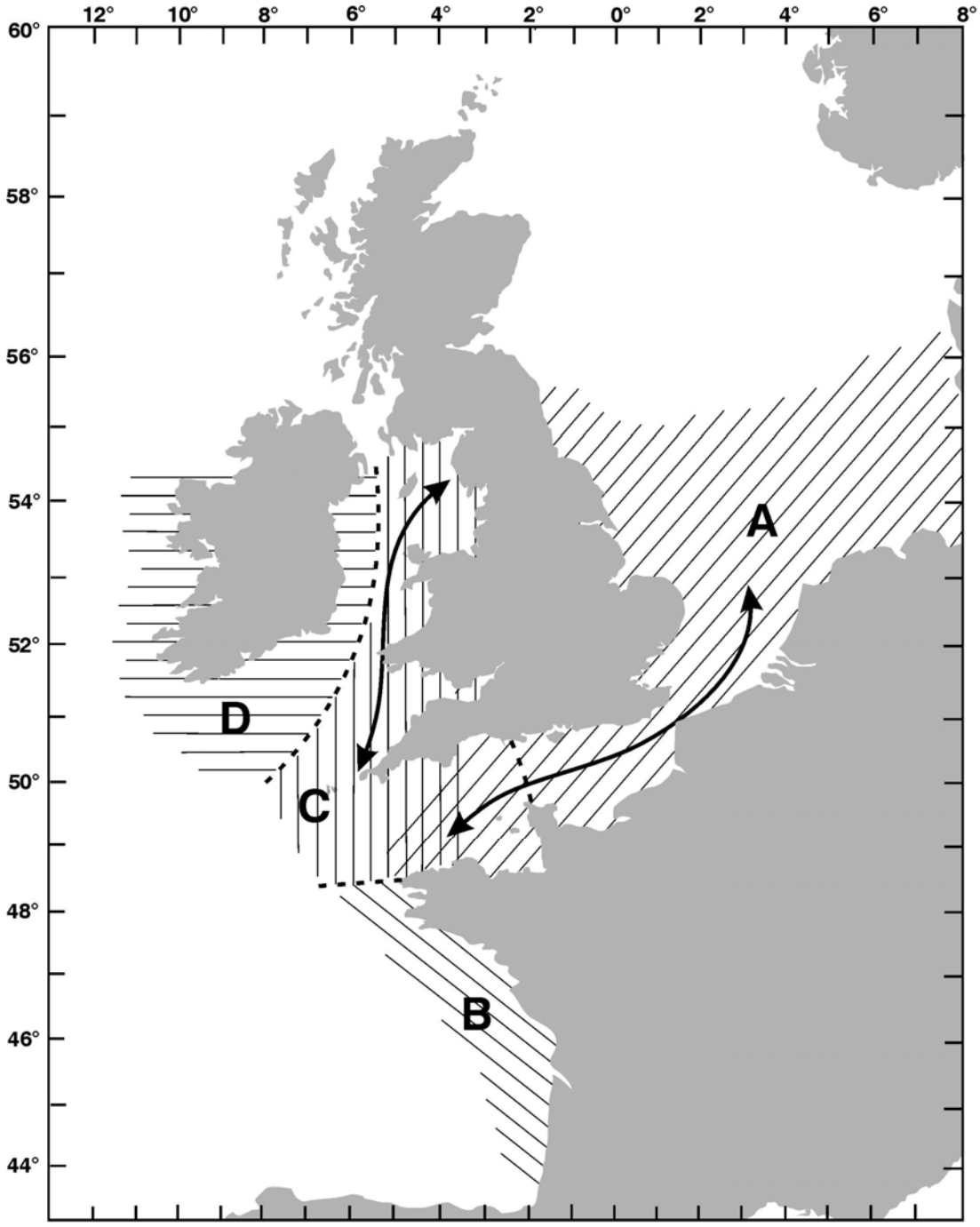


Figure 3.5.16.1 The sea areas in which four tentative stocks of bass are found, A) North Sea – Channel; B) Biscay; C) UK west coast, and D) Ireland. Arrows indicate the known migrations of adult bass between summer feeding areas and spawning areas to the south and west.

3.5.17 Advice on Multiannual TAC Arrangements and Recovery Plans

1) Technical Review

ICES is requested to review the scientific, statistical, biological, and technical basis for the results described in the report "Analysis of possibilities of limiting the annual fluctuations in TACs"; Reference FISH-2000–02–01. If such basis is found to be satisfactory, ICES is requested to consider, with reference to that report and any other relevant information, the following questions on targets and limits and on recovery plants. For the purposes of addressing these requests, the Commission has requested Dr L. Kell (CEFAS Lowestoft) to provide detailed access to the database of simulation results corresponding to the report.

2) Targets and limits

The EC is seeking to establish target fishing mortalities and corresponding limits on the amounts by which TACs may vary between years.

ICES is requested to consider, for flatfish stocks, the following target fishing mortalities and associated limitations on interannual TAC variability (in brackets):

Plaice in the Skagerrak: 0.4 (10%)

Plaice in the North Sea: 0.3 (10%)

Plaice in the Irish Sea: 0.3 (10%)

Plaice in the Eastern English Channel: 0.4 (10%)

Sole in the North Sea: 0.25 (20%)

Sole in the Eastern English Channel: 0.25 (20%)

For these values, ICES should consider:

a) Conformity with criteria of sustainability, precautionary management, catch stability, and high yield.

b) The robustness of appropriate values to alternative biological hypotheses.

ICES should propose any alternative values for fishing mortality and limits on TAC changes that it considers conform better to the aforementioned criteria than the values tabulated above.

3) Recovery Plans

The abovementioned targets and limits would apply once the spawning stock biomasses exceed precautionary levels ($\boldsymbol{B}_{pa}$). The European Commission wishes to be informed of the consequences of alternative programmes for altering fishing mortality from present levels to those proposed above. To that end, ICES should illustrate in detail the consequences of applying alternative TAC-setting rules (as set out in Table 3.3.1.2 of the report in question):

a) A 10% annual change in fishing mortality;

b) A 50% annual change in fishing mortality;

c) A linear reduction in fishing mortality, proportionate to the amount by which spawning biomass is less than $\boldsymbol{B}_{pa;}$

d) Applying a maximum catch corresponding to historic catch;

e) Any other programmed approach for altering fishing mortality considered suitable by ICES.

For these cases, ICES is asked to illustrate the likely development of yield, fishing mortality, and stock biomass, using stochastic methods where appropriate.

1) Technical Review

It was not possible for ICES to check all details of the software used for this work, so the review focussed only on the approach and the results presented. These represented a substantial volume of work, which was nonetheless well presented. With regard to the operating model used, many sources of natural variation and error were simulated, but some important components of uncertainty and bias were not considered. Some elements of process error (e.g., variation in natural mortality and maturity) were not simulated. The inaccuracy of assuming no discards in assessments is not included in estimation errors. Bias in projections (including retrospective bias in the assessment as well as inaccurate assumptions in projections) was not explicitly simulated. However, many flatfish forecasts tend to overestimate SSB. In addition, the modelling assumed that the TACs were taken, i.e. no error was assumed in the implementation in the advice. However, the catches often do not correspond to the TAC. ICES understands that most of these constraints were specified by the client, so comments about the absence of these effects are not intended as a criticism of the work that has been done. Inclusion of all of these components of variation would be difficult to reliably simulate, but ignoring such variation considerably underestimates the uncertainty involved in implementing the various management scenarios.

A second limitation of the methods is the unknown Effect of statistical assumptions on the results. Unfortunately, there is little guidance on the nature of variability in process error and different assumed distributions can have different systematic affects on simulations. For example, the stochastic simulations often converge on different equilibria than indicated by deterministic calculations.

ACFM finds that the scientific basis of the operating model is sound, and results are reliable for providing management advice with some provisions. Because not all sources of bias and uncertainty were simulated and risk and bias may be under-estimated, ACFM concludes

that the results reported in "Analysis of possibilities of limiting the annual fluctuations in TACs" (Reference FISH-2000–02–01) should be interpreted with care and conclusions should be based on comparative patterns rather than on absolute estimates of probability or risk.

2) Targets and limits

The basic management scenarios that were investigated consisted of a target F and a constraint on the annual percentage changes in TAC, which would be permitted. The results from these scenarios were presented in terms of mean yield and the risk of the SSB being below $\mathbf{B}_{pa}$.

In general, ACFM observed a non-linear relationship between risk of SSB being reduced to less than $\mathbf{B}_{pa}$ and the magnitude of TAC constraints. In most short- and medium-term simulations, a TAC constraint of 10% (i.e., restricting annual changes in TAC to 10% or less) had substantially greater risk than a 20% constraint, but the difference in risk of from 20% to 40% constraints was much less. It was also clear that the current state of the stock also had an important effect on the results. For stocks below $\mathbf{B}_{pa}$, imposing a restrictive constraint on the TAC delayed recovery and thus led to an increased risk to the stock. Conversely, for stocks above $\mathbf{B}_{pa}$, such a TAC constraint served to reduce the risk to the stock. For several stocks, the projections indicated a clear optimum target F for minimising risk and maximizing yield in the medium or long term.

Results from the individual stocks are summarized below, together with the current perception of the state of each stock.

Plaice in the Skagerrak (2001 SSB=130%$\mathbf{B}_{pa}$, 2001 F=112%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.73):

A 10% TAC constraint has substantially greater risk than looser constraints, and risk is similar at various levels of F. For example, in the short-term, a target F of 0.4 with a 20% TAC constraint produces approximately one-third of the risk produced with a 10% TAC constraint and also produces some gains in yield. Although simulation results are sensitive to the assumed stock-recruit model, this pattern is similar for all assumed models. In the medium term, a 10% constraint also produces greater risk, and F has slightly more effect on risk, but only affects yield at very low Fs. In the long-term, the TAC constraint has less effect, and risk is much more a function of F, because the stock is fluctuating less and is nearly in equilibrium. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive, because it does not allow a quick response to strong recruitment or poor conditions. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the North Sea (2001 SSB=96%$\mathbf{B}_{pa}$ 2001 F=143%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.30):

In the short-term, risk is more affected by the target F than the level of TAC constraint, because simulations are starting with SSB levels that are less than $\mathbf{B}_{pa}$. Alternative stock-recruit models produced similar results. In the medium-term, yield is similar among all scenarios, but risk is greatly increased at greater target Fs. In the long term, target Fs greater than 0.35 produce less yield and great risk, with TAC constraints also producing less yield. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, there is substantial risk of SSB being below $\mathbf{B}_{pa}$ in the short, medium and long term when the target is $\mathbf{F}_{pa}$, regardless of TAC constraints.

Plaice in the Irish Sea (2001 SSB=179%$\mathbf{B}_{pa}$ 2001 F=69%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than looser constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$ and low Fs, and constraints do not allow F to quickly increase to the target. Risk is lower at low target Fs, but there is substantial loss in yield. A target F of 0.363 produces much less risk than $\mathbf{F}_{pa}$ with no loss of yield for much reduced risk. Yield is much less at target Fs of less than 0.275. In the long-term the 10% TAC constraint produced relatively high risk and low yield. There is substantial risk of equilibrium SSB produced by a target of $\mathbf{F}_{pa}$ being less than $\mathbf{B}_{pa}$. The target F that produced the greatest yield and least risk in the long term was 0.275. In conclusion, the 10% TAC constraint appears to be too restrictive. Furthermore, target F should be less than $\mathbf{F}_{pa}$.

Plaice in the Eastern English Channel (2001 SSB=119%$\mathbf{B}_{pa}$ 2001 F=116%$\mathbf{F}_{pa}$, $\mathbf{F}_{pa}$=0.45):

In the short term, the more restrictive TAC constraints have less risk than no constraints, because simulations are starting with SSB levels that are much greater than $\mathbf{B}_{pa}$. In the medium term, $\mathbf{F}_{pa}$ produces the most yield at low risk. In the long term target Fs greater than $\mathbf{F}_{pa}$ produce much less yield and have much greater risk. The 10% TAC constraint substantially increases risk, particularly at higher target Fs. Simulations at lower Fs produce SSBs that are much greater than the observed maximum. In conclusion, the 10% TAC constraint appears to be too restrictive, but $\mathbf{F}_{pa}$ appears to produce low risk and high yield.

Sole in the North Sea (2001 SSB=113%B_{pa} 2001 F=115%F_{pa}, F_{pa}=0.40):

In the short term, target F and to a lesser extent TAC constraints affect on risk. Target Fs greater than 0.5 produce a very high risk, with or without TAC constraints. At lower target Fs, TAC constraints have more affect on risk. The 10% TAC constraint produces substantially greater risk than looser constraints, irrespective of target Fs, probably resulting from highly variable recruitment. The 10% TAC constraint is also much riskier in the medium term. In the long term, risk is more a function of target F, with losses in yield at Fs greater than 0.4. There was no clear optimum target F for minimizing risk and maximizing yield in the long term. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% TAC constraint with a target F of $\mathbf{F}_{pa}$ or less has substantially less risk.

Sole in the Eastern English Channel (2001 SSB=158%B_{pa} 2001 F=85%F_{pa}, F_{pa}=0.40):

In the short term, there is a distinct tradeoff between risk and yield in which target Fs greater than $\mathbf{F}_{pa}$ have substantially greater risk, but also produce greater yield. The 10% TAC constraint also has greater risk for the lower target Fs. The target F that produced the greatest yield and least risk in the medium term was 0.3, but the 10% TAC constraint had greater risk at all target Fs. The target F that produced the greatest yield and least risk in the long term was 0.2–0.3, and the 10% TAC constraint was more risky. In conclusion, the 10% TAC constraint appears to be too risky, but a 20% constraint with a target F of between 0.2 and 0.3 has relatively low risk and produces relatively high yields.

3) Recovery Plans

This request could not be completely addressed with the information that was provided, because the proposed rebuilding strategies were not directly simulated. Although ACFM cannot respond to the specific request, the general simulation results show that TAC constraints should be not be applied during rebuilding and TACs should be as responsive as possible to the perceived stock conditions. One technical aspect of a rapid response is that some assessment methods that assume stable F may not perform well for monitoring rebuilding.

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3.5.18 Answer to requests from EC on rebuilding plans for cod and hake stocks

3.5.18.a ICES is requested to investigate the performance and robustness of proposed multi-annual arrangements to set TACs (harvest control rules) as part of the stock rebuilding plans for North Sea cod.

1. The experts shall perform analyses, by means of computer simulations, which include, as appropriate:

- Alternative models (e.g. different stock-recruit relations and catchability relationships);
- Consideration of assessment error by modelling separately the underlying operating models representing the fish stocks, and the perceived populations as measured using surveys and assessment models;
- Application of defined harvest rules as detailed below;
- Alternative assumptions about past and future changes in fishing practices.

   New software shall be developed as needed in support of the above-mentioned tasks.

   The analyses shall be used to evaluate the likely development and consequent risks for the stock, with particular reference to future spawning stock biomass, fishing mortality rate, landings and discards.

2. The harvest control rules to be studied shall imply:

   a) setting a TAC allowing for an expected increase in the spawning stock biomass from one year to the next by a range of percentages including a 30% increase, and

   b) setting a TAC according to a predetermined regime of fishing mortality rates.

   In both cases, the following constraints shall be applied:

   1. Projected fishing mortality shall not exceed $\mathbf{F}_{pa}$; and

   2. Wherever possible, annual changes in landings shall be limited to particular percentage increases or decreases. Consequences of using alternative percentage limits shall be explored.

3. The simulations shall be used to evaluate the robustness of the harvest rules in assuring stock recovery, considering a range of uncertainty (variance and bias) that are plausible in the light of statistical analysis and of historical experience about assessment performance.

4. The simulations shall include consideration of:

   a) discarding, taking into account possible changes in discarding practice;

   b) the effect of possible changes in natural mortality due to multi-species effects; and

   c) possible changes in selectivity due to planned measures for fishing gears.

Answer to the request on North Sea cod

1. The European Commission has recently proposed a regulation [COM(2001) 724] which includes harvest control rules for the selection of total allowable catches (TACs) for a number of fish stocks. In order to evaluate the risks and benefits of the proposed harvest control rules, the Commission invited a number of national experts to attend an *ad hoc* sub-group of the Scientific, Technical and Economic Committee for Fisheries (STECF). This meeting took place in Brussels from 20-22 March 2002 and was immediately preceded by a two-day meeting of scientists from the EU and Norway. The report is available from EC DG Fish.

2. The meeting of EU-Norway scientists addressed harvest control scenarios for cod in the North Sea, Skagerrak, and eastern Channel. Scenarios were investigated which

   a) aim for a certain percentage increase in spawning stock biomass (SSB);

   b) aim for a pre-determined regime of fishing mortality rates (Fs);

   c) investigate robustness to assumptions (e.g. natural mortality, exploitation pattern, weight-at-age).

3. The STECF sub-group addressed harvest control scenarios for northern hake and cod stocks in the Kattegat, in the Irish Sea, and to the west of Scotland. The STECF sub-group did not address further the harvest control scenarios for cod in the North Sea, Skagerrak, and eastern Channel. The scenarios under 2a) and 2b) above were

investigated, but unlike the EU-Norway scientists' meeting, the STECF sub-group did not evaluate:

- the effects of possible selectivity changes
- the effect of possible changes in natural mortality
- the effect of variable weight-at-age.

4. In both meetings, discarding was not considered.

5. Both the STECF sub-group and the EU-Norway meeting defined *recovery* as two successive years with SSB above $\mathbf{B}_{pa}$, in line with the requirements from the European Commission.

6. The results of the STECF sub-group and the EU-Norway meeting have been evaluated by the STECF meeting in April 2002 (Report of the STECF April 2002, DG Fish, EC). ACFM in general endorses the conclusions from the STECF evaluation.

7. The probabilities referred to in the STECF sub-group report and the discussion of the likely outcomes of the different harvest control rules should not be interpreted as absolute values. They are conditional upon a number of assumptions within the forecast models that have been used, and can only be considered as relative values to be compared with one another. They can be informative about whether any particular harvest control rule has a higher probability of reaching an objective than other rules do (or, equivalently, is likely to reach the objective sooner). They may not give reliable estimates of the absolute likelihood or actual time required to reach a specified objective for any particular scenario, nor of the absolute differences in F, SSB, or yield between scenarios during the rebuilding period.

8. The results produced at the two meetings indicate that none of the stocks are likely to recover within a five-year period for any of the scenarios evaluated. Only after six years do stocks and scenarios begin to indicate a non-negligible probability of recovery, with some scenarios requiring more than a decade for even a 50% chance of recovery.

9. All recovery scenarios require a sustained reduction in fishing mortality, which in turn requires a corresponding reduction in fishing effort, that is both sustained and effective.

10. There is a trade-off between a quick response in the trajectory of the population (through a strong reduction in fishing mortality) and a more gradual response (allowing more fishing in the short term) achieved by aiming for a pre-defined increase in SSB.

11. For stocks to have no greater than 50% risk of falling below $\mathbf{B}_{pa}$ in the long term requires that F is at or below $\mathbf{F}_{pa}$ in the long term. $\mathbf{F}_{pa}$ therefore represents the maximum permitted fishing mortality consistent with sustainability. In the post-recovery period, it may be possible to allow the severely reduced F to rise to $\mathbf{F}_{pa}$ but certainly no higher.

12. The harvest control strategies were implemented only to the point where stocks recovered to $\mathbf{B}_{pa}$; beyond that a different control strategy might be required.

13. The simulations presented assume complete compliance with the management measures implemented to obtain the required reductions in fishing mortality and thereby the recovery of the stocks. Lack of compliance or any inefficiency in implementation of the measures will reduce the probability of achieving any specified objective in a given time, and increase the time required to achieve the rebuilding target. The simulations shed no light on whether all harvest control rules are equally vulnerable to incomplete compliance or ineffective implementation.

14. The simulations did not examine if the criteria of recovery; namely, two successive years with SSB above $\mathbf{B}_{pa}$, is sufficient to ensure a resilient and robust recovery. Notably, when the aim is to restore the stock in a resilient way, there needs to be an additional criterion that gives a measure of the population structure. For example, an option may be to derive a so-called age diversity index that could be compared to values of the index during the historical period of the stock development.

15. In general, it should be remembered that predictions and simulations of this kind have had a tendency to be overly optimistic. This tendency has some potential serious consequences, such as:

- in practice, management constraints on harvesting may have to be kept in place much longer than forecast by the simulations in order to reach rebuilding targets; and
- harvest control strategies which are based on gradual increments in SSB and which allow harvesting of substantial portions of the annual stock productivity may be ineffective. If the annual productivity is overestimated, and a substantial portion of the overestimated production is allocated to harvest, then the actual annual increment in SSB will be much lower than simulated.

3.5.18.b Answer to EC request on evaluation of the effectiveness of certain management measures in relation to rebuilding cod and hake stocks

EC DG Fish asked:

> *Evaluate the effectiveness of the management measures described in the Commissions Communication, as found in http://europa.eu.int/comm/fisheries/doc_et_publ/factsheets/legal_texts/docscom/en/com_01_326f_en.pdf, and in particular their conformity with ICES' usual interpretation of the precautionary approach.*
>
> *Take note of the agreed record recently concluded with Norway about technical measures concerning the cod stock. Information contained in these two documents will be relevant to ICES' annual considerations about the state and management of the stocks of the cod and hake.*

Specifically, this request applies to a communication from the Commission to the (European) Council and to the European Parliament (CEC COM(2001) 326). However, at the current ACFM meeting, the EU observer asked for ACFM also to comment on a proposed Council Regulation that followed this communication and establishes measures for the recovery of cod and hake stocks (CEC COM(2001) 724). In this respect, ACFM has asked its relevant assessment working groups to address this at their current or forthcoming meetings. One such working group was meeting at the same time as ACFM and another about a week after the close of the current ACFM meeting. Thereafter ACFM will consider the WG comments by e-mail and seek to provide a direct response to the EU's revised request. For the moment, it will restrict its response to consideration of the communication referred to in the original EU request.

ICES has taken note of the agreed record and has informed relevant assessment working groups on the content of EU-Norway agreement. ICES will take this arrangement into account in the assessments and advice to be presented to the Commission in October 2002. The North Sea and Skagerrak Demersal Assessment Working Group in their report from June 2001 offered an analysis of the agreement and the effects on various fisheries. This report is available from the ICES Secretariat on request.

It is not possible to make a detailed evaluation of the Communication CEC COM(2001) 326 in relation to an implementation of the precautionary approach as the communication does not provide sufficient details. However, the general principles laid down in this communication are in accordance with the precautionary approach. There are several aspects of the communication that are outside ICES competence, e.g. Market Measures and Accompanying Structural Measures. These are not commented upon. Concerning biological reference points, ICES has sent a separate letter of 31 May 2001 to Governments and to the Fisheries Commissions informing them of the plans for revisiting the Precautionary Approach reference points in 2003. Following the chapters of the Communication, ACFM offers the comments given below.

Introduction

The Communication provides an appropriate summary of the problems facing the stocks of cod and hake. In particular, it addresses the frequently stated view of ACFM that TACs alone are not sufficient to regulate fishing mortality and that regulation of fishing effort is also needed.

Objectives and Targets

The objectives and targets as stated are appropriate to the recovery phase for stock rebuilding, subject to the following caveats:

- It is true that other species may be caught in association with cod and hake and that the fishing mortality of these other species must be regulated in accordance with the cod and hake recovery plans. However, it should be noted that the degree to which this is necessary is variable depending on the species and area concerned;
- The absence of clearly defined and agreed management objectives and targets in the past has reduced the ability of ACFM to provide appropriate management advice. It is important, therefore, to note that the objectives and targets referred to here relate solely to the stock recovery phase and must be succeeded by appropriately defined objectives and targets, possibly in a framework of harvest control rules, for any post-recovery management phase;
- The specific precautionary biomass values to be used as targets for recovery have been queried in the case of northern hake. However, ACFM has proposed a procedure to be adopted in September for revision of the reference points in. As discussed above, ACFM has requested its relevant assessment WGs to comment more fully on the specific terms of the proposed recovery plans, and will report on this shortly;
- The EC communication refers specifically to stock recovery rules that are based on fishing mortality. Subsequent EC proposals have referred also to recovery rules that are based on target increases in SSB. These are discussed more fully above.

Actions Already Taken

ICES working groups have already commented on the perceived effectiveness of some of the actions already undertaken with regard to stock recovery measures.

Preparation of the Full Recovery Plans

The text referring to the setting of TACs and the need for effort limitations are straightforward statements of fact. In particular, the need for input regulation (fishing effort) to accompany output regulation (TACs) specifically reflects the frequently re-iterated view of ICES. However, options for the ways in which input regulation may be addressed require more of an economic view than can be expressed by ICES.

Technical Measures

Whereas improvements in the selection of fishing gears can certainly be attained, they can commonly be circumvented by a number of means that are well-known to fishermen, fisheries scientists, and gear technologists. For such technical measures to be effective, they require a level of compliance by fishermen that entails active support for the measures rather than an enforcement-lead imposition of them.

Regarding closed or controlled areas, comments on the likely effectiveness of the measures previously adopted are provided by WGNSSK June 2001.

Reinforcement of Control Measures

This is largely outside ICES scientific competence. However, the goals defined in the scientific advice can only be achieved with compliance of the fishing regulations by the fishing industry. Compliance with regulations is the basis for the scientific advice.

National fishery research institutes commonly depend upon the goodwill of their fishing industries to permit biological sampling of catches both onshore and at sea, and that such sampling may be undertaken remotely from enforcement agencies. If the proposed observer scheme is viewed as a reinforcement to control measures, it is possible that the national institutes will lose voluntary access to fish catches, and also the goodwill of the fishing industry when sampling catches.

Means to Take Rapid Action

There is a mismatch between the time required for management to react and the time frame within fish stocks and of the fishing industry change. Any improvement in the speed at which management measures can be enacted is to be welcomed, providing the measures are well-founded.

Accompanying Measures

Observer schemes may help improve knowledge of fish distributions, etc., as well as catch composition, but it is extremely expensive for national research institutes to mount such schemes and it is unlikely that sufficient coverage will prevail specifically to identify distributions, etc., with high precision. It is not clear whether the Commission anticipates Member States mounting such schemes independently of the research institutes and for costs to be recovered from the sampled vessels, or if national institutes are expected to organise and fund the scheme.

3.5.18.c Answer to special request from EC on recovery plans for cod and hake stocks

DG Fish has requested ICES to:

> *Evaluate the effectiveness of the management measures described in the Commissions Communication, as found in: http://europa.eu.int/comm/fisheries/doc_et_publ/factsheets/legal_texts/docscom/en/com_01_326f_en.pdf, and in particular their conformity with ICES' usual interpretation of the precautionary approach.*

> *Take note of the agreed record recently concluded with Norway about technical measures concerning the cod stock. Information contained in these two documents will be relevant to ICES' annual considerations about the state and management of the stocks of the cod and hake.*

ICES Comments:

In November 2000, ICES indicated that a number of cod stocks and the stock of northern hake were at serious risk of collapse. Following this, various emergency measures covering these stocks were enacted in 2001 by Norway and the EU. This was in addition to measures adopted by the EU to aid recovery of Irish Sea cod in the previous year. Proposals for longer-term recovery plans for these stocks were also made by the EU. These proposals include multi-annual recovery plans for northern hake and for cod in the North Sea, to the west of Scotland, in the Kattegat, and in the Irish Sea**.**

The proposed recovery plans aim to increase spawning stock biomass, SSB, to above the adopted biological reference point, $\mathbf{B}_{pa}$, of each stock. The necessary tools proposed to achieve recovery are TACs set to ensure a high probability that SSB will increase annually by 30% for the cod stocks and 15% for the hake stocks. Within the recovery period there is a proposed maximum annual variation of TACs of no more than 50% from year to year. The tolerance for year-to-year changes in TACs is symmetric, and has higher priority than ensuring the target increase in SSB if the two rules are in conflict. The rule with highest priority is that fishing mortality should not be permitted to exceed $\mathbf{F}_{pa}$ in any year. To achieve the necessary decreases in fishing mortality, fishing effort limitations are also an integral part of the proposal in addition to measures to temporarily close fishing areas and to increase monitoring and control of fishing vessels.

For North Sea cod, a joint EU-Norway Working Group was established to evaluate the likely effects of the proposed multi-annual plans as set out in the proposal by European Commission. In addition, the EU STECF has reported on the likely development of SSB, fishing mortality, and yield for northern hake and the other cod stocks for which recovery plans were advised, and commented on the robustness of the proposed rules. The results of simulation modelling within these groups incorporating uncertainty in recruitment and bias in the estimation of population numbers were available to ICES. The starting point for simulations was the most recent stock data as provided by ICES Working Groups, usually from the assessment working group meetings convened during 2001. Two categories of scenarios were conducted: simulations constrained by annual biomass increases and simulations constrained by defined fishing mortality rates. Within those two categories, a number of simulations were run with annual catch deviations ranging from zero to ±50%. The definition of recovery was considered to be two successive years with a probability greater than 50% that the SSB exceeded $\mathbf{B}_{pa}$. An overview of scenarios is given in the text table below:

Biomass or F Control	Biomass or F constraint		Catch constraint	Scenario name
	Cod	Hake		
B	+ 30%	+ 15%	± 50%	Sc01_base
B	+ 45%	+ 20%	± 50%	Sc02
B	+ 15%	+ 10%	± 50%	Sc03
F	0.8 x Fpa	0.8 x Fpa	± 50%	Sc04
F	0.6 x Fpa	0.6 x Fpa	± 50%	Sc05
F	1.0 x Fpa	1.0 x Fpa	± 50%	Sc06
B	+ 30%	+ 15%	± 20%	Sc07
B	+ 45%	+ 20%	± 20%	Sc08
B	+ 15%	+ 10%	± 20%	Sc09
F	0.8 x Fpa	0.8 x Fpa	± 20%	Sc10
F	0.6 x Fpa	0.6 x Fpa	± 20%	Sc11
F	1.0 x Fpa	1.0 x Fpa	± 20%	Sc12
B	+ 30%	+ 15%	none	Sc13
B	+ 45%	+ 20%	none	Sc14
B	+ 15%	+ 10%	none	Sc15
F	0.8 x Fpa	0.8 x Fpa	none	Sc16
F	0.6 x Fpa	0.6 x Fpa	none	Sc17
F	1.0 x Fpa	1.0 x Fpa	none	Sc18

The evaluation of the simulations by an STECF sub-group (SGRST) can be summarized as follows:

i. The simulations implied a high probability of recovery within 6-9 years for all stocks except for Irish Sea cod. These results were specific to stock-specific scenarios. However, it was emphasised that the time frames given in the sub-group report should not be taken as absolute, that the periods were relative and to be used in comparison of scenarios only, and that the simulations assume that fishing mortality is controlled effectively.

ii. All scenarios were associated with dramatic decreases in yield and F in the first year of the recovery plan.

iii. The positive slope of the relationship between yield and recovery time do not allow easy choice of ”best” scenario taking into account socio-economic considerations, i.e. the choice requires other objectives.

iv. At current stock sizes, constraining F to $\mathbf{F}_{pa}$ is not effective for rebuilding, requiring the longest recovery time.

v. During the recovery phase, sustained reduction of F<$\mathbf{F}_{pa}$ is required to ensure a high probability of stock recovery.

The SGRST evaluation was considered by STECF, which concluded that:

i. The simulation model platform was not optimal with regard to the evaluation of economic impacts, because economic analyses were impeded by the single-species modelling approach.

ii. Some consequences for harvesting that result from the harvest rules or rebuilding constraints were considered unattainable (e.g. sharp reduction in fishing mortality and in catches in 2003, and realizing very low fishing mortalities by the end of the period), and some biological assumptions (no long-term trends in recruitment, no change in mean weight-at-age between years) were considered implausible.

For each stock, STECF had the following comments:

Northern hake: Most scenarios have a high probability to achieve recovery within a 10-year period. STECF noted that the $\mathbf{B}_{pa}$ and $\mathbf{F}_{pa}$ bases for the simulations were poorly determined and the reference points should be revised. The various catch constraints had no effect on recovery time and on annual change in SSB.

North Sea cod: Fishing at 80% of $\mathbf{F}_{pa}$ or higher produced no stock recovery within an 8-year period. A biomass target of 15% annual increase in SSB is not sufficient for recovery of this stock.

Cod in Kattegat: Scenarios associated with fishing at $\mathbf{F}_{pa}$ did not result in a high probability of recovery; this was attained when fishing at the lower Fs examined. All the biomass-controlled scenarios resulted in a high probability of recovery.

Irish Sea cod: Only 7 of 18 scenarios indicated more than a 90% probability of recovery of this stock within 6-7 years. Recovery within the period could be achieved both by F and SSB constraints. To achieve recovery within 9 years annual catches would have to be limited to below 4700 t.

West of Scotland cod: None of the 18 scenarios indicate recovery within five years. Recovery within 10 years could be achieved both by SSB and F controlled management. To achieve a recovery of more than 90% probability within a 10-year period, catches would have to be limited to below 5600 t.

ICES Evaluation:

An evaluation by ACFM of the current status of all stocks for which emergency measures have been applied, i.e. cod in the Kattegat, cod in the North Sea, Skagerrak, and Eastern Channel, cod to the West of Scotland, cod in the Irish Sea and hake in the Northern area, as given in 2002 ACFM report, revealed that none of the stocks currently fulfilled the condition SSB>$\mathbf{B}_{pa}$. An examination of recent fishing mortality rates compared to those of recent previous years, did not show any sign of decrease in F-at-age.

Should any recovery plan be implemented, then the evaluation of stock status with regard to the details of the plan should be undertaken following implementation (the plans are still under consideration and the measures to be implemented are still under discussion). In June 2002, the WGNSSK analysed the effects of the starting population in the medium-term simulations, the effect of different recruitment models, the effect of bias in the assessment, and software effects. The results of this comparative analysis can be summarised as follows:

- The medium-term projections were sensitive to the terminal assessment year since the starting population in 2002 was found to be significantly reduced compared to 2001. The reduction in the starting population of North Sea cod resulted in a reduced probability of recovery from 90% in the baseline scenario to 82%.

- The main factor affecting the estimated recovery time and recovery probability was assessment bias. Assuming a consistent 20% stock size overestimation caused a prolongation of the potential recovery time of almost 4 years.

- Yield, SSB, fishing mortality, and recruitment projections were also found to differ for different simulation methods. Properties of the various programs that could be used in the simulations generated dissimilar recruitment variation.

- As fitted, Shepherd, Beverton & Holt, and Ricker functions were found almost identical over the SSB range up to $\mathbf{B}_{pa}$. No effect on the medium-term stock parameters could be detected.

ACFM notes that implementation error due to the lack of reliable information on catches (e.g. discards) and to systematic overestimation of spawning biomass (retrospective error) appear to be substantial. These sources of uncertainty alone can severely compromise achieving the objectives of recovery plans, including the rapid rebuilding of spawning biomass towards $\mathbf{B}_{lim}$ or $\mathbf{B}_{pa}$.

ICES does not accept the likely time frames to recovery indicated from the results of the stochastic simulations undertaken to evaluate harvest strategies, and also expressed doubt over the assumption of 100% implementation efficiency implied by the simulations. The success of any recovery plan will depend upon the ability of managers to monitor catches and discards, to adhere to the effort reduction schemes, and to achieve reductions in fishing mortality despite assessment uncertainties. Attention has to be paid to all stages of implementation.

Impact of new technical measures:

Two analyses of mesh changes were presented, one for cod, haddock, and whiting in the North Sea, and one for Northern hake.

North Sea demersal fisheries have been subjected to a number of EC and national regulations designed to modify the selectivity of fishing gears. No complete evaluation of their likely impacts has yet been undertaken, but an overview of their potential effects is available based upon a number of simplifying assumptions. This overview considers measures outlined in EC regulations 850/98 and 2056/2001, and UK measures SSI 227/2000, SSI 250/2001 and SI 649/2001. Results are expressed as the percentage deviation from baseline simulations, which assume that no selectivity changes occur. The results are considered to be indicative of the likely impacts. The simulations are made assuming single-species population dynamics and assuming full and effective implementation of the measures , i.e. that all fleets catching cod are subject to the full impact of the measures. For 2002 it is assumed that all UK vessels have adopted the 110 mm mesh size derogation of EU regulation 2056/2001 and that 20% of non-UK fleets have adopted it. For 2003 no such derogation is assumed to apply. The results can be summarised in the following way:

Cod

Year	Landings for human consumption	Discards	Industrial bycatch	Spawning stock biomass
2002	<-1%	-	-	
2003	<-1%	-	-	<1%
Long Term	7%	-	-	5%

The absence of information on discards in the cod assessment and forecasts mean that the effect of increased selectivity at the youngest ages is not accounted for in the above table.

Haddock

Year	Landings for human consumption	Discards	Industrial bycatch	Spawning stock biomass
2002	-11%	-64%	10%	
2003	9%	-70%	29%	28%
Long Term	120%	-77%	113%	160%

Whiting:

Year	Landings for human consumption	Discards	Industrial bycatch	Spawning stock biomass
2002	-66%	-88%	6%	
2003	-72%	-93%	16%	13%
Long Term	-42%	-91%	26%	57%

The results are based on single-species forecasts in which biological interactions, *ie.*, predation, are excluded.

Northern Hake

Very simple simulations have been carried out regarding Northern Hake, using modified selection patterns for the predicted period. A partial improvement of the selection pattern is assumed in the intermediate year (no catch at age 0-1), and further improvement is assumed from 2003 onwards (preventing any catch at age 0-2, i.e. less than 30 cm). It is recognised that this improvement remains theoretical and has not been documented in the fishery.

The main results are:

- Since hake is a late maturing fish [23% age 3 are mature, 60% age 4, 90% age 5 and 100% at age 6 and above], any improvement in the selection pattern preventing the capture of younger fish (ages 0-2, ~ less than 30 cm) will only result in SSB increases in the medium term.
- An improvement in the selection pattern alone is unlikely to be effective enough to rebuild SSB. At *status quo* F and with no catch at ages 0-1 in 2002 and no catch at ages 0-2 in 2003 onwards, the SSB is expected to be 18% higher in 2007 than with the current selection pattern.
- An improvement of the selection pattern would increase the probability that a reduction in F will allow a rebuilding in SSB.

General Conclusion

ACFM notes that the theoretical gains in spawning biomass depicted in these studies may not, in effect, be realized, as mesh size measures are not always as effective as expected in their implementation, often because adjustments in fishing practices may undermine their effect.

3.5.19 Answer to EC Request on Overestimation in the Forecasting of Haddock and Whiting by-catch in the Industrial Fisheries

ICES is requested by the EC:

> *to look into the problem of predicting industrial by-catches of whiting and haddock in the North Sea. It appears that there is a consistent tendency for the predictions to exceed the realized catch.*

ICES Comments

The amount of "overshoot" is largest for the predicted by-catch of whiting and was more than 350% for the year 1997. The forecast suggested 28 000 tonnes by-catch of whiting in the industrial fishery, while the estimated by-catch was as low as 6 000 tonnes. The forecast for haddock by-catch in 1996 was more than 200% higher than the estimated by-catch that year (16 000 tonnes compared to 5 000 tonnes). The degree of overestimation has been decreasing in later years and the forecast of whiting by-catch for 2000 was an underestimate. Table 3.5.19.1 shows predicted (as given in the ICES advice) and observed by-catches of haddock and whiting in the industrial fisheries. The forecast procedures are described in detail in the Report of the Assessments of North Sea and Skagerrak Demersal Fish Stocks, CM 2003/ACFM:02.

The nature of the problem makes it unlikely that ICES will be able to make precise forecasts of industrial catches, but ICES will continue to investigate methods to improve the precision in the forecasts.

The results of the study are summarized in the following table:

	Whiting	***Haddock***
Weight-at-age prediction	A clear source for overestimating the industrial by-catch in some years. Contributes towards an underestimate in 1995 and 2000, but towards an overestimate in the years between.	Contributes to an overestimate in 1996 and 2000. No clear picture for the years between.
Partial fishing mortality	The use of a *status quo* fishing mortality would contribute to an overestimate in the period 1991 to 1996 during the time that the fishing mortality of whiting in the industrial by-catches decreased. The small increase in F the last year contributes towards an underestimate in 2000 (which also occurred).	The use of a *status quo* fishing mortality would contribute to an overestimate in the period 1991 to 1995, but possibly to an underestimate in some of the following years. The problem with the estimation of the partial fishing mortality of the 1998 year class contributes strongly towards an overestimate of the by-catch of haddock.
Stock size	The overestimation of stock size in 1995 and 1996 could possibly have contributed to an overestimate of the industrial by-catch those years. The effect is not straightforward to assess because the estimate of stock size is closely linked to the estimate of fishing mortality, which again is linked to the perception of the *status quo* partial fishing mortality (in the by-catches).	A relatively small overestimation of fishing mortality in the period 1992-1995, followed by a (still small) underestimation of fishing mortality in the years 1996-1999. There are clear signs of autocorrelation in this pattern. Previous assessments used commercial cpue data, and the tendency to overestimate the stock was larger and could have been the major source of the prediction error in at least some years.
Conclusions	**The sources of error described above are quite likely to have produced the large discrepancies between predicted and observed by-catch of whiting in the industrial fishery.**	**The picture is not as clear as for whiting. Future studies could go more into detail to see if there are any systematic differences between small and large year classes. The use of the age range 2 to 6 in calculating mean fishing mortality should be compared with the use of other age ranges (in the prediction of partial fishing mortality in the by-catch).**

Table 3.5.19.1 Comparison of predicted and observed by-catches of whiting and haddock in the industrial fisheries.

		Haddock by-catch ('000 t)		Whiting by-catch ('000 t)	
Assessment	**Year**	Predicted	Observed	Predicted	Observed
October 1990	1991	7	5	70	38
October 1991[1]	1992		11		27
October 1992	1993	16	11	50	20
October 1993	1994	13	4	47	10
October 1994	1995	14	8	28	27
October 1995	1996	16	5	19	5
October 1996	1997	7	7	28	6
October 1997	1998	10	5	9	3
October 1998	1999	8	4	11	5
October 1999	2000	13	8	6	9
October 2000	2001	10	8	10	7

[1]No prediction of by-catches given in the ACFM advice.

3.6 Stocks in the Eastern Channel (Division VIId)

3.6.1 Overview

Major fleets

A large proportion of the Eastern Channel is in the coastal zones (12-mile zone), which are exploited by small-scale fisheries. The major fleets operating in this area are: a French inshore fleet, mainly comprising small vessels using various gears, an English inshore fleet using fixed gear, English and Belgian offshore beam trawlers and French offshore otter trawlers.

Both beam trawl fleets mainly target sole and take a significant amount of plaice as a by-catch. Sole is also taken in directed inshore UK fisheries using trammels and in French fisheries using trammels and otter trawl. The major part of the plaice landings originates from a seasonal fishery in winter by French offshore otter trawlers taking sole as by-catch. The major part of the cod landings originates from French offshore trawlers and inshore gill-netters. Cod is also taken as a by-catch in other fisheries. Whiting are caught by inshore and offshore French trawlers in the Channel in mixed fisheries.

A pelagic trawl fishery takes place in the winter during the herring spawning season.

Effort directed at flatfish increased consistently and considerably in all fleets from 1975 and reached a peak during 1989–1990, after which it has remained at that level.

There are no separate TACs for cod and whiting in Division VIId, but they are part of a total TAC for the whole of Subarea VII excluding Division VIIa. Sole is managed by a TAC for the Division VIId, and plaice is managed by a TAC for Divisions VIId and VIIe combined. TACs for cod, whiting, plaice, and sole in recent years have generally not been restrictive.

Cod and whiting are assessed together with the North Sea stocks; reference is made to Sections 3.5.1, 3.5.2, and 3.5.4.

The spawning stock of plaice has been fairly constant since 1992 although the estimates of fishing mortality are rather variable. The stock is harvested outside of safe biological limits. Although the spawning biomass of the sole stock is above the proposed $\mathbf{B}_{pa}$, the exploitation rate is high and unsustainable.

Pelagic species caught in Division VIId are herring (Downs herring), horse mackerel, mackerel, and sprat. These species are subject to TACs set over larger areas. There are no separate estimates of the state of the stocks in this area. Also no separate statistics on catches and landings are available.

3.6.2 Sole in Division VIId (Eastern Channel)

State of stock/exploitation: The stock is within safe biological limits. The SSB in 2002 is above $\mathbf{B}_{pa}$, and the fishing mortality in 2001 was below $\mathbf{F}_{pa}$.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$.	$\mathbf{B}_{pa}$ be set at 8 000 t. This is the lowest observed biomass, at which there is no indication of impaired recruitment.
$\mathbf{F}_{lim}$ is 0.55. This is a fishing mortality at or above which the stock has shown continued decline.	$\mathbf{F}_{pa}$ be set at 0.4. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$: Poor biological basis for definition.	$\mathbf{B}_{pa}$: Smoothed $\mathbf{B}_{loss}$ (no sign of impairment): 8 000 t.
$\mathbf{F}_{lim}$ is set equal to $\mathbf{F}_{loss}$, but poorly defined; analogy to North Sea and setting of 1.4 $\mathbf{F}_{pa}$ = 0.55.	$\mathbf{F}_{pa}$: Between $\mathbf{F}_{med}$ and 5th % of $\mathbf{F}_{loss}$; SSB>$\mathbf{B}_{pa}$ and probability ($\mathbf{SSB}_{mt}$<$\mathbf{B}_{pa}$), 10%: 0.4.

Advice on management: ICES recommends that the fishing mortality be less than $\mathbf{F}_{pa}$ = 0.4, corresponding to landings of less than 5 400 t in 2003.

Relevant factors to be considered in management: Due to the large 1999 year class, SSB is expected to remain above $\mathbf{B}_{pa}$ in the short term, providing fishing mortality does not exceed $\mathbf{F}_{pa}$.

There is no long-term gain in yield by increasing current fishing mortality. Restricting landings to 4 700 t would maintain *status quo* fishing mortality.

Catch forecast for 2003:

Basis: F(sq) = F(99–01, scaled) = 0.34; Landings(2002) = 4.9; SSB(2003) = 15.1.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0.27	0.8*$\mathbf{F}_{sq}$	3.9	16.1
0.31	0.9*$\mathbf{F}_{sq}$	4.3	15.6
0.34	1.0*$\mathbf{F}_{sq}$	4.7	15.1
0.40	$\mathbf{F}_{pa}$ = 1.18*$\mathbf{F}_{sq}$	5.4	14.4
0.41	1.2*$\mathbf{F}_{sq}$	5.5	14.3

Weights in '000 t

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium-term and long-term predictions carried out for this stock.

Comparison with previous assessment and advice: Fishing mortality in 2001 has been revised upwards by 31% and SSB in 2001 downwards by 17%. This is considered to be an expression of the uncertainty of the assessment.

Elaboration and special comment: There are 5 main commercial fleets fishing for sole in Division VIId. Belgian and English offshore beam trawlers (> 300 HP) fish mainly for sole, but can switch to scallops or move to adjacent areas. French offshore trawlers target roundfish and take sole as by-catch. Numerous inshore (under 10 m vessels) on the English and French coasts using mainly fixed nets target sole in the spring and autumn. The inshore vessels take half the reported landings and sole forms their main source of income. The minimum mesh size in the sole fishery with towed gears is 80 mm and in the fishery with static gears 90 mm.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

Analytical assessment using catch-at-age and CPUE data from commercial fleets and surveys. Under-reporting from the inshore fleet and mis-reporting by beam trawlers, fishing in adjacent management areas is

thought to be significant. The lack of information on this phenomenon contributes to the uncertainty of the stock assessment and forecasts.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM:02).

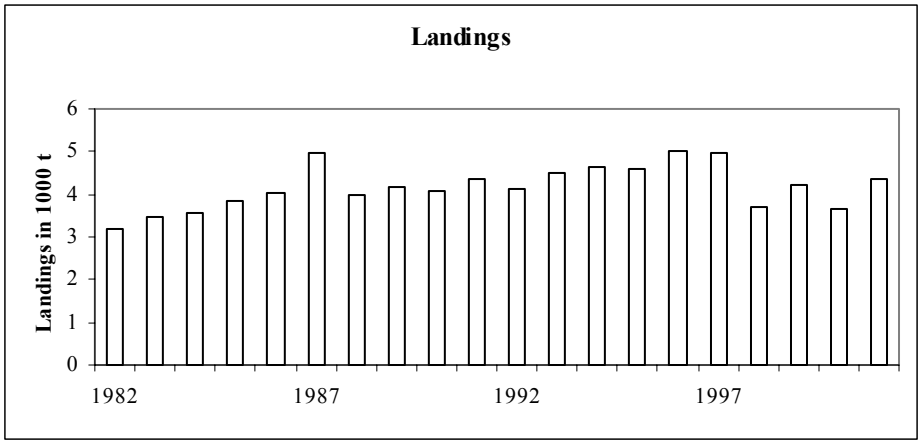
Yield and spawning biomass per Recruit F-reference points:

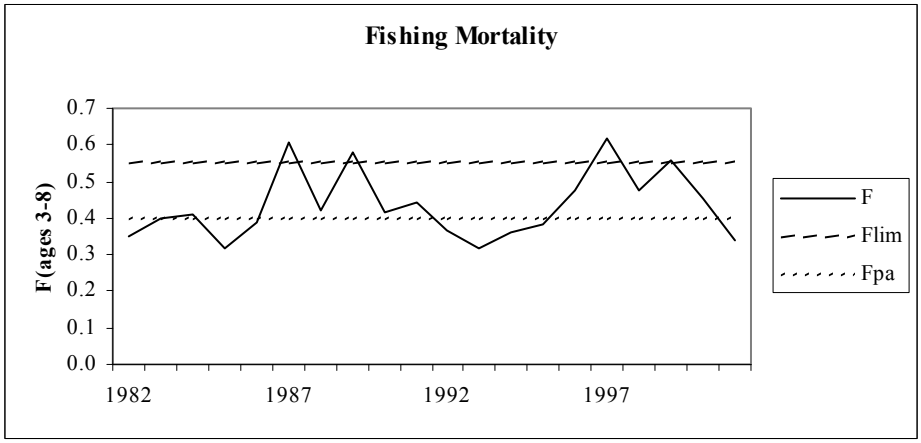
	Fish Mort Ages 3-8	Yield/R	SSB/R
Average Current	0.434	0.177	0.583
$\mathbf{F}_{max}$	0.279	0.178	0.715
$\mathbf{F}_{0.1}$	0.128	0.162	1.434
$\mathbf{F}_{med}$	0.515	0.172	0.373

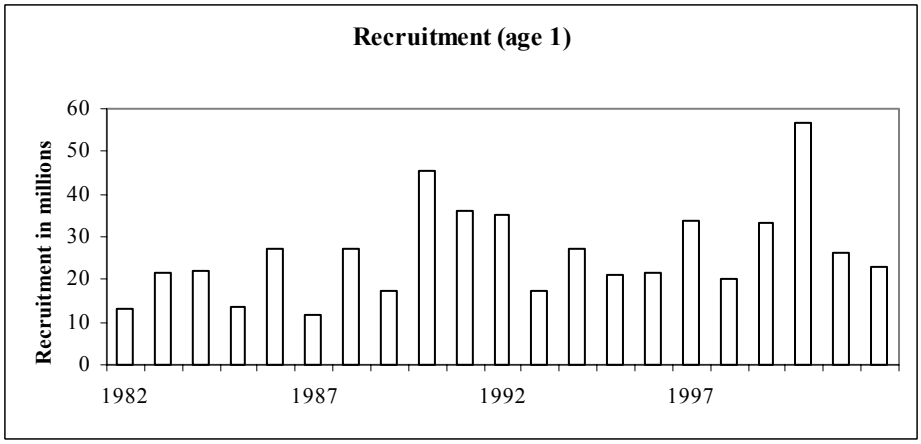
Catch data (Tables 3.6.2.1–2):

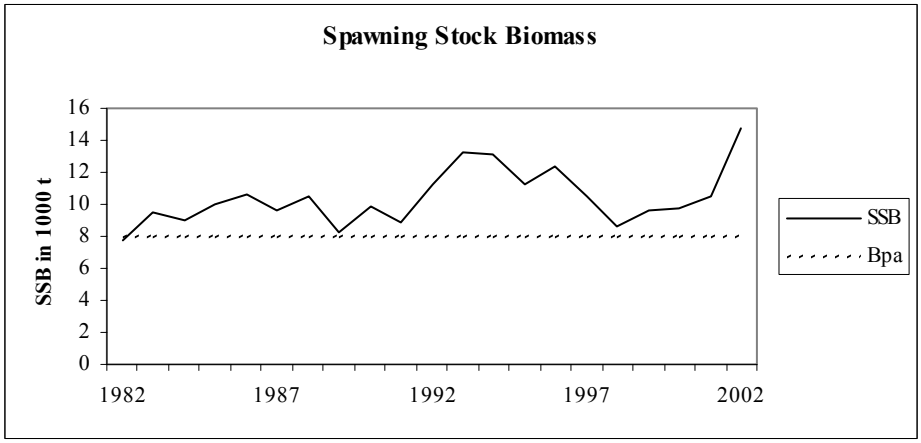
Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Precautionary TAC	3.1	3.85	3.8	5.0
1988	*Status quo* (Shot) TAC	3.4	3.85	3.3	4.0
1989	*Status quo* (Shot) TAC	3.8	3.85	2.9	4.2
1990	No effort increase; TAC	3.7	3.85	3.0	4.1
1991	*Status quo* F; TAC	3.4	3.85	3.8	4.4
1992	TAC	≤2.7	3.5	3.8	4.1
1993	70% of F(91)~2 800 t	2.8	3.2	3.4	4.5
1994	Reduce F	<3.8	3.8	3.7	4.6
1995	No increase in F	3.8	3.8	3.7	4.5
1996	No long-term gain in increasing F	4.7	3.5	4.1	5.0
1997	No advice	-	5.23	3.8	5.0
1998	No increase in effort	4.5	5.23	3.0	3.7
1999	Reduce F to $\mathbf{F}_{pa}$	3.8	4.7	3.9	4.2
2000	F < $\mathbf{F}_{pa}$	<3.9	4.1	3.8	3.6
2001	F < $\mathbf{F}_{pa}$	<4.7	4.6	4.6	4.4
2002	F < $\mathbf{F}_{pa}$	<5.2	5.2		
2003	F < $\mathbf{F}_{pa}$	<5.4			

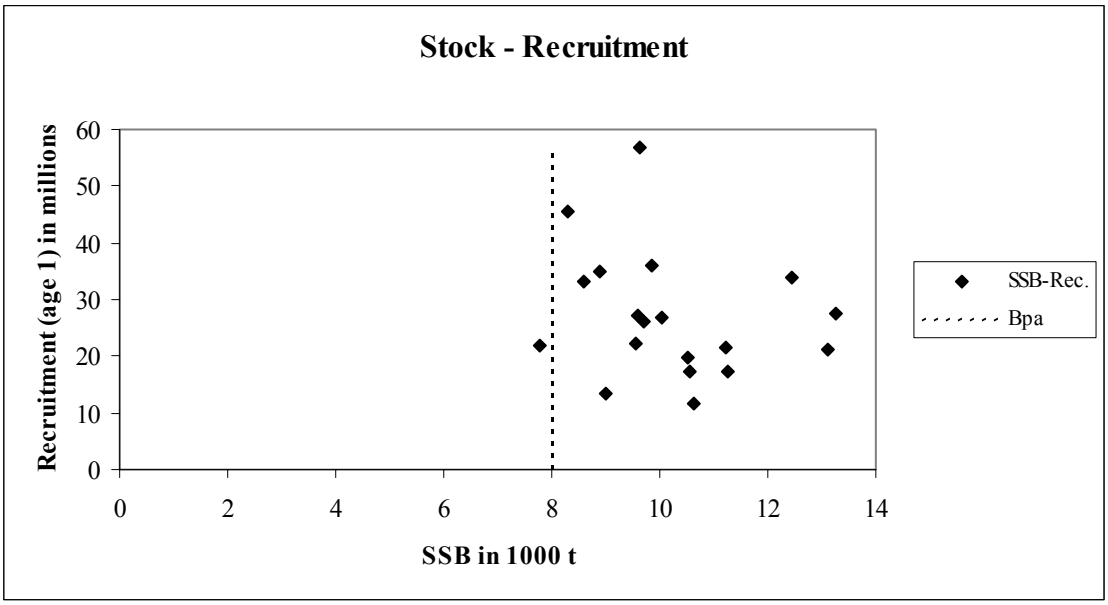
Weights in '000 t.

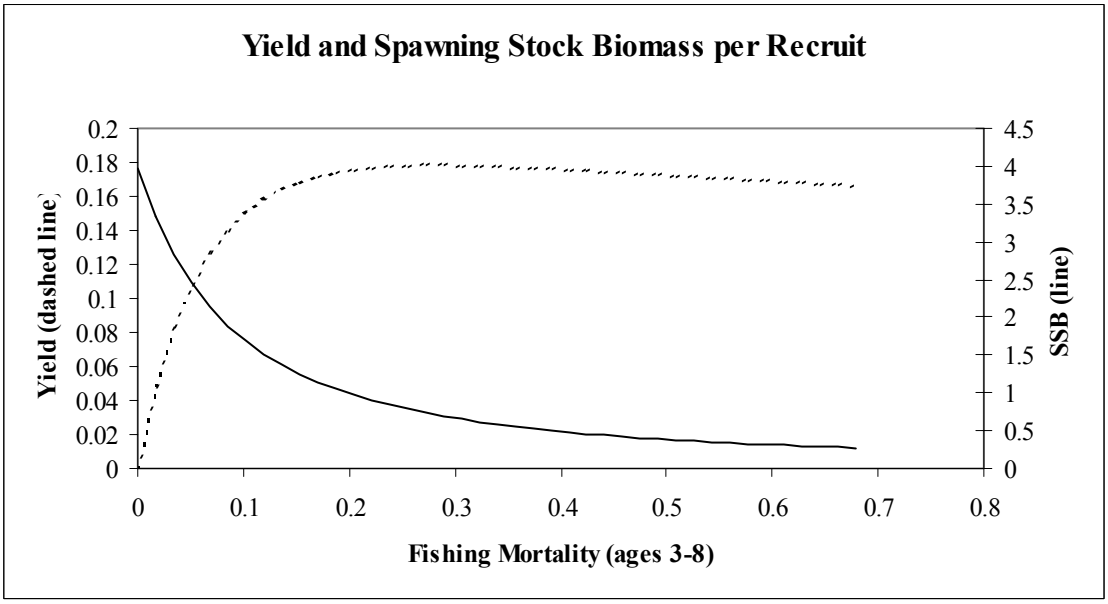

Landings
Landings in 1000 t
0
1
2
3
4
5
6
1982
1987
1992
1997


Fishing Mortality
F(ages 3-8)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1982
1987
1992
1997
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
0
10
20
30
40
50
60
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
0
2
4
6
8
10
12
14
16
1982
1987
1992
1997
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-8)

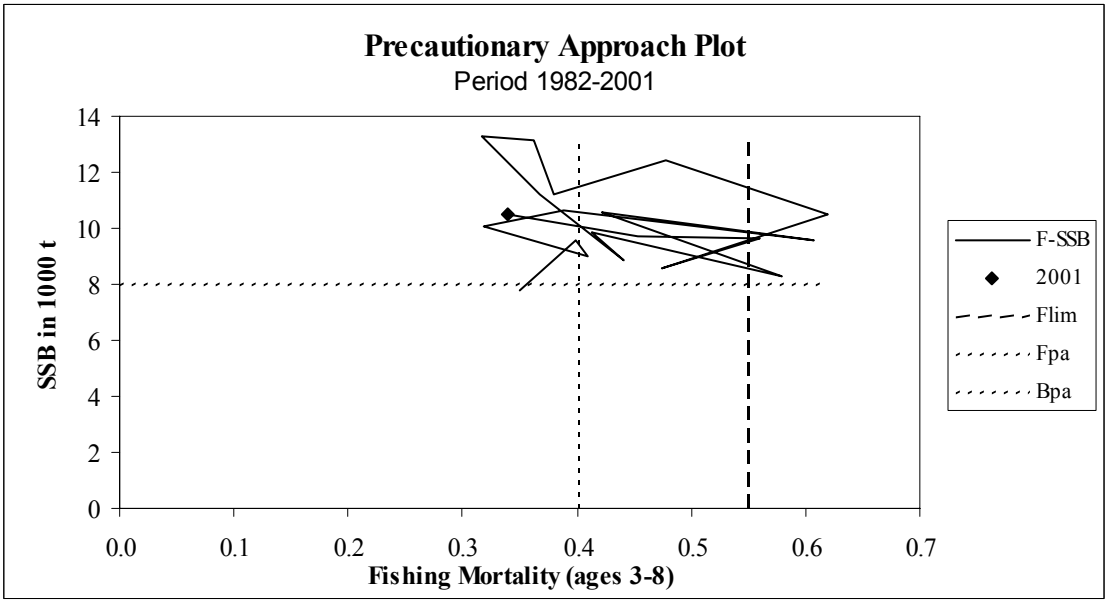

Precautionary Approach Plot
Period 1982-2001
SSB in 1000 t
14
12
10
8
6
4
2
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 3-8)
F-SSB
2001
Flim
Fpa
Bpa

Table 3.6.2.1 Sole in Division VIId. Nominal landings (tonnes) as officially reported to ICES and used by the Working Group.

Year	Belgium	France	UK (E&W)	Others	Total reported	Unallocated*	Total used by WG	TAC
1974	159	469	309	3	940	-56	884	
1975	132	464	244	1	841	41	882	
1976	203	599	404	.	1,206	99	1,305	
1977	225	737	315	.	1,277	58	1,335	
1978	241	782	366	.	1,389	200	1,589	
1979	311	1,129	402	.	1,842	373	2,215	
1980	302	1,075	159	.	1,536	387	1,923	
1981	464	1,513	160	.	2,137	340	2,477	
1982	525	1,828	317	4	2,674	516	3,190	
1983	502	1,120	419	.	2,041	1,417	3,458	
1984	592	1,309	505	.	2,406	1,169	3,575	
1985	568	2,545	520	.	3,633	204	3,837	
1986	858	1,528	551	.	2,937	1,087	4,024	
1987	1,100	2,086	655	.	3,841	1,133	4,974	3,850
1988	667	2,057	578	.	3,302	680	3,982	3,850
1989	646	1,610	689	.	2,945	1,242	4,187	3,850
1990	996	1,255	742	.	2,993	1,067	4,060	3,850
1991	904	2,054	825	.	3,783	599	4,382	3,850
1992	891	2,187	706	10	3,794	348	4,142	3,500
1993	917	1,907	610	13	3,447	1,064	4,511	3,200
1994	940	2,001	701	15	3,657	984	4,641	3,800
1995	817	2,248	669	9	3,743	840	4,583	3,800
1996	899	2,335	877	.	4,111	914	5,025	3,500
1997	1,306	1,609	933	.	3,848	1,135	4,983	5,230
1998	541	1,703**	803	.	3,047	647	3,694	5,230
1999	880	2,239**	769	.	3,888	350	4,238	4,700
2000	1,021	2,171	621	.	3,813	-164	3,649	4,100
2001	1,313	2,436	816	.	4,565	-215	4,350	4,600

* Unallocated mainly due to misreporting.
** Preliminary.

Table 3.6.2.2 Sole in Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-8
1982	12991	7779	3190	0.3504
1983	21786	9542	3458	0.3989
1984	22175	8991	3575	0.4101
1985	13505	10045	3837	0.3191
1986	26959	10641	4024	0.3880
1987	11572	9576	4974	0.6072
1988	27065	10552	3982	0.4212
1989	17148	8289	4187	0.5801
1990	45403	9859	4060	0.4138
1991	35909	8890	4382	0.4411
1992	35104	11241	4142	0.3672
1993	17275	13274	4511	0.3165
1994	27367	13121	4643	0.3623
1995	21096	11208	4583	0.3801
1996	21510	12435	5025	0.4777
1997	33786	10505	4983	0.6202
1998	19934	8603	3694	0.4747
1999	33349	9636	4238	0.5594
2000	56686	9707	3649	0.4530
2001	26084	10472	4350	0.3397
2002	23054	14800		
Average	26179	10436	4174	0.4340

3.6.3 Plaice in Division VIId (Eastern Channel)

State of stock/exploitation: The stock is outside safe biological limits. SSB in 2002 is estimated to be below the proposed $\mathbf{B}_{pa}$, and has fluctuated near this level since 1992. Fishing mortality in 2001 is estimated to be above $\mathbf{F}_{pa}$.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below the proposed $\mathbf{F}_{pa}$ and to increase or maintain the spawning stock biomass above the proposed $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 600 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 8 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
$\mathbf{F}_{lim}$ is 0.54, the fishing mortality estimated to lead to stock collapse.	$\mathbf{F}_{pa}$ be set at 0.45. This F is considered to provide approximately 95 % probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of the assessment.

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$: 5 600 t.	**$\mathbf{B}_{pa}$: 1.4 $\mathbf{B}_{lim}$: 8 000 t.**
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$: 0.54	**$\mathbf{F}_{pa}$: 5th % of $\mathbf{F}_{loss}$; B*>$\mathbf{B}_{pa}$ and P($\mathbf{SSB}_{MT}$<$\mathbf{B}_{pa}$)<10 %:0.45**

B* is equilibrium SSB at $\mathbf{F}_{pa}$.

Advice on management: ICES recommends that fishing mortality in 2003 be reduced to less than the proposed $\mathbf{F}_{pa}$ (0.45), corresponding to landings in 2003 of less than 5 300 t.

Relevant factors to be considered in management: The TAC is set for Divisions VIId and VIIe combined. Managers should consider restrictions on where catches should be taken. The plaice stock in VIId is harvested in a mixed fishery with sole in VIId, and the advice given for the two stocks is broadly consistent.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$(99-01, scaled) = 0.48; Landings(2002) = 4.8; SSB(2003) = 7.2.

F(2003 onwards)	Basis	Landings (2003)	SSB (2004)
0	0*$\mathbf{F}_{sq}$	0.7	14.0
0.05	0.1*$\mathbf{F}_{sq}$	1.3	13.4
0.1	0.2*$\mathbf{F}_{sq}$	1.9	12.8
0.14	0.3*$\mathbf{F}_{sq}$	2.4	12.2
0.19	0.4*$\mathbf{F}_{sq}$	3.0	11.7
0.24	0.5*$\mathbf{F}_{sq}$	3.5	11.2
0.29	0.6*$\mathbf{F}_{sq}$	4.0	10.7
0.34	0.7*$\mathbf{F}_{sq}$	4.5	10.3
0.39	0.8*$\mathbf{F}_{sq}$	4.9	9.8
0.43	0.9*$\mathbf{F}_{sq}$	5.0	9.4
0.45	$\mathbf{F}_{pa}$=0.93*$\mathbf{F}_{sq}$	5.3	9.3
0.48	1*$\mathbf{F}_{sq}$	5.8	9.0
0.53	1.1*$\mathbf{F}_{sq}$	6.1	8.7
0.58	1.2*$\mathbf{F}_{sq}$	0.7	8.3

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: No medium- and long-term projections have been done.

Comparison with previous assessment and advice. The current assessment deviates from the previous assessment for the most recent years. SSB is now estimated to be lower and F to be higher. The main reasons for this change are a revision of stock weights and the uncertainty in the calibration data that is used in this assessment. The revision of stock weights is also responsible for the reclassification to outside safe biological limits in 2001.

Elaboration and special comments: In the Channel, plaice are taken mainly in a mixed flatfish fishery by otter and beam trawlers. There is a directed fishery in winter by French offshore otter trawlers. Large numbers of plaice are discarded, but are not included in the assessment.

There is a tendency to underestimate F and overestimate SSB in the assessment. SSB in 2002 and 2003 is mostly driven by the apparently strong 2000 year class, which is not well defined yet.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

The analytical assessment uses CPUE data from 3 commercial fleets and 3 surveys.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11 – 20 June 2002 (ICES CM 2003/ACFM: 02).

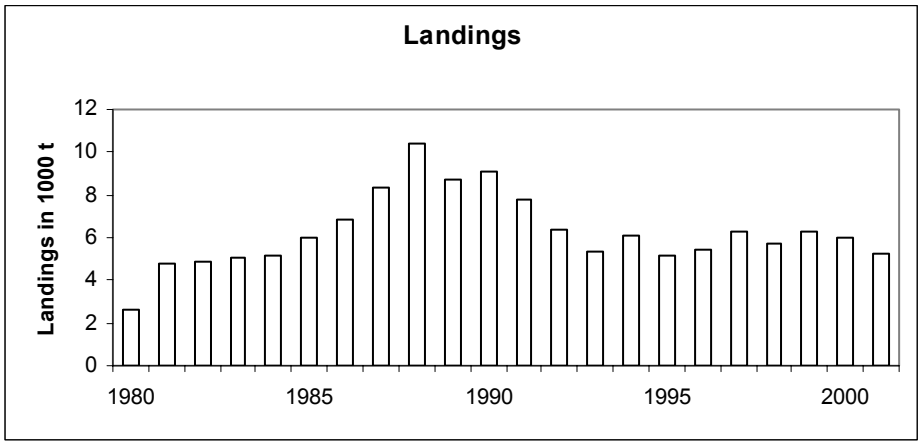
Yield and spawning biomass per Recruit F-reference points:

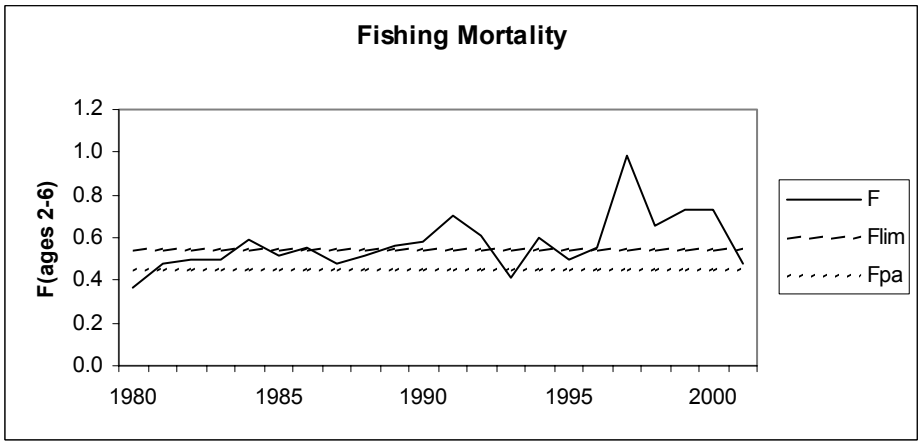
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.572	0.260	0.443
$\mathbf{F}_{max}$	0.195	0.296	1.533
$\mathbf{F}_{0.1}$	0.113	0.276	2.670
$\mathbf{F}_{med}$	0.554	0.252	0.361

Catch data (Tables 3.6.3.1–2):

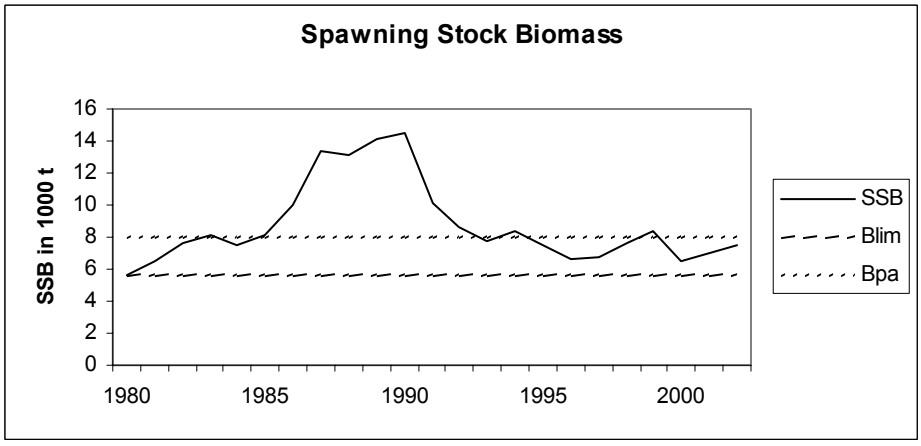
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings
1987	Precautionary TAC[1]	6.8[1]	8.3	7.9	8.4
1988	Precautionary TAC[1]	6.9[1]	9.96	9.1	10.4
1989	No increase in effort[1]	11.7[1]	11.7	6.7[2]	8.8
1990	No increase in F; TAC	10.7[1]	10.7	7.8[2]	9.0
1991	TAC	8.8[1]	10.7	7.4[2]	7.8
1992	*Status quo* F gives mean SSB	7.6[3]	9.6	6.2	6.3
1993	Within safe biological limits	6.4[3]	8.5	4.8	5.3
1994	No long-term gains in increased F	-	9.1	5.6	6.1
1995	No increase in F	5.6	8.0	4.6	5.1
1996	No long-term gains in increasing F	6.5	7.53	4.6	5.4
1997	No advice	-	7.09	5.3	6.3
1998	Reduce F in 98 by 30% from 96 value	4.3	5.7	4.8	5.8
1999	Fishing at $\mathbf{F}_{pa}$	6.3	7.4	5.4	6.3
2000	Fishing at $\mathbf{F}_{pa}$	4.9	6.5	5.6	6.0
2001	Fishing at $<\mathbf{F}_{pa}$	<4.4	6.0	5.3	5.3
2002	Fishing at $<\mathbf{F}_{pa}$	<5.8	6.7		
2003	Fishing at $<\mathbf{F}_{pa}$	<5.3			

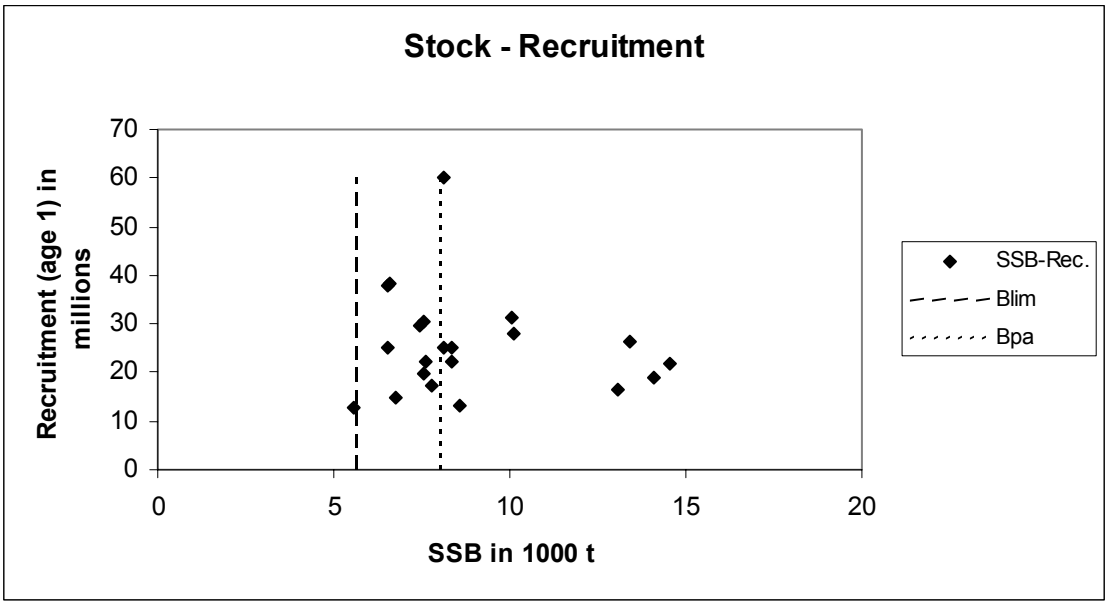
[1]TACs for Divisions VIId,e. [2]For France Division VIId landings are estimated by ICES from combined VIId,e landings.
[3] Catch at *status quo* F. Weights in '000 t.

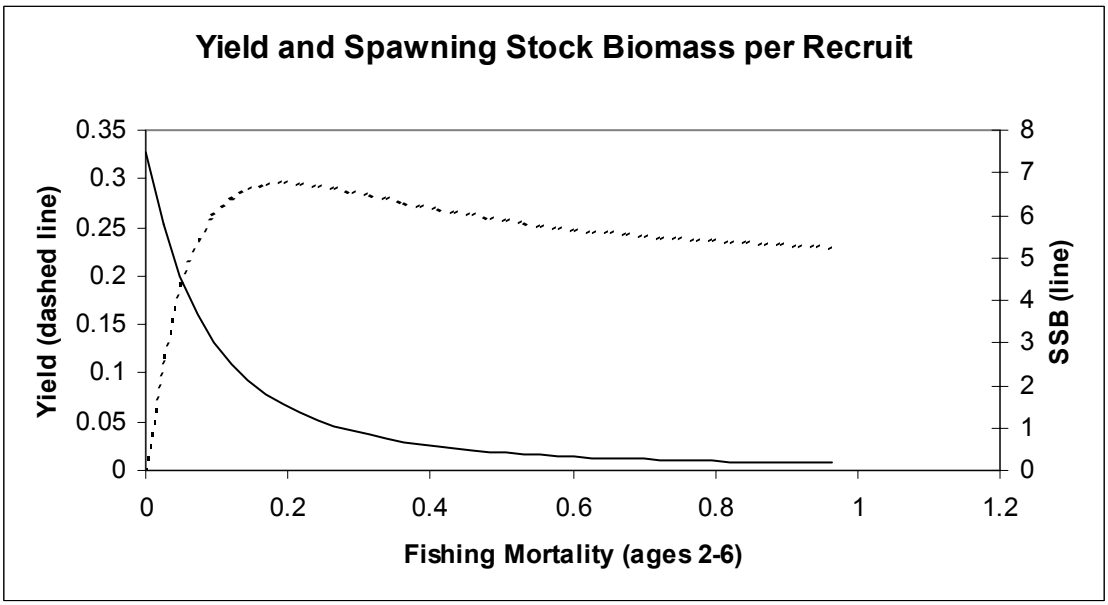

Landings
Landings in 1000 t
0
2
4
6
8
10
12
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 2-6)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1980
1985
1990
1995
2000
F
Flim
Fpa

Recruitment (age 1)
Recruitment in millions
0
10
20
30
40
50
60
70
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
0
2
4
6
8
10
12
14
16
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
70
60
50
40
30
20
10
0
0
5
10
15
20
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
8
7
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 2-6)

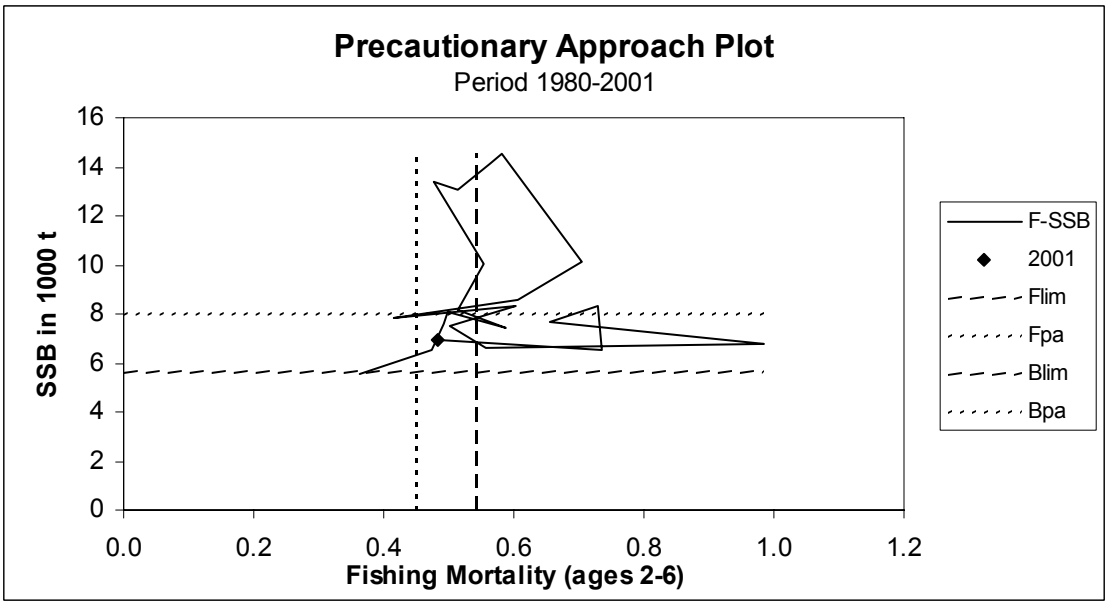

Precautionary Approach Plot
Period 1980-2001
SSB in 1000 t
16
14
12
10
8
6
4
2
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 2-6)
F-SSB
2001
Flim
Fpa
Blim
Bpa

Table 3.6.3.1 Plaice in Division VIId (Eastern Channel). Nominal landings (tonnes) as officially reported to ICES.

Year	Belgium	Denmark	France	UK (E&W)	Others	Total reported	Un-allocated	Total as used by WG
1976	147	1 [1]	1,439	376	-	1,963	-	1,963
1977	149	81 [2]	1,714	302	-	2,246	-	2,246
1978	161	156 [2]	1,810	349	-	2,476	-	2,476
1979	217	28 [2]	2,094	278	-	2,617	-	2,617
1980	435	112 [2]	2,905	304	-	3,756	-1,106	2,650
1981	815	-	3,431	489	-	4,735	34	4,769
1982	738	-	3,504	541	22	4,805	60	4,865
1983	1,013	-	3,119	548	-	4,680	363	5,043
1984	947	-	2,844	640	-	4,431	730	5,161
1985	1,148	-	3,943	866	-	5,957	65	6,022
1986	1,158	-	3,288	828	488 [2]	5,762	1,072	6,834
1987	1,807	-	4,768	1,292	-	7,867	499	8,366
1988	2,165	-	5,688 [2]	1,250	-	9,103	1,317	10,420
1989	2,019	-	3,265 [1]	1,383	-	6,667	2,091	8,758
1990	2,149	-	4,170 [1]	1,479	-	7,798	1,249	9,047
1991	2,265	-	3,606 [1]	1,566	-	7,437	376	7,813
1992	1,560	1	3,099	1,553	19	6,232	105	6,337
1993	877	+ [2]	2,792	1,075	27	4,771	560	5,331
1994	1,418	+	3,199	993	23	5,633	488	6,121
1995	1,157	-	2,598 [2]	796	18	4,569	561	5,130
1996	1,112	-	2,630 [2]	856	-	4,598	795	5,393
1997	1,161	-	3,077	1,078	-	5,316	991	6,307
1998	854	-	3,276 [2,3]	700	-	4,830	932	5,762
1999	1,306	-	3,388 [2,3]	743	-	5,437	889	6,326
2000	1,315	-	3,513 [2]	752	-	5,580	434	6,014
2001	1,346	-	3,265 [2]	655	+	5,266	-	5,266

[1]Estimated by the Working Group from combined Division VIId,e. [2]Includes Division VIIe.
[3]Provisional.

Table 3.6.3.2 Plaice in Division VIId (Eastern Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1980	25536	5584	2650	0.3632
1981	12863	6558	4769	0.4743
1982	25201	7574	4865	0.4935
1983	19917	8122	5043	0.4995
1984	25025	7453	5161	0.5869
1985	29678	8130	6022	0.5148
1986	60223	10047	6834	0.5548
1987	31260	13394	8366	0.4762
1988	26464	13077	10420	0.5150
1989	16293	14115	8758	0.5641
1990	18828	14549	9047	0.5811
1991	21713	10101	7813	0.7033
1992	27942	8564	6337	0.6048
1993	13212	7800	5331	0.4161
1994	17281	8333	6121	0.6033
1995	25073	7538	5130	0.5009
1996	30481	6577	5393	0.5561
1997	38310	6783	6307	0.9843
1998	14818	7640	5762	0.6548
1999	22044	8363	6326	0.7288
2000	22317	6512	6015	0.7359
2001	37774	6966	5266	0.4823
2002	23427	7230		
Average	25464	8751	6261	0.5725

3.7 Stocks in Sub-area VI

3.7.1 Overview

Fisheries

To a large extent, the roundfish fishery in Division VIa is an extension of the similar fishery in the North Sea. The demersal fisheries in Division VIa are predominantly conducted by otter trawlers fishing for cod, haddock, anglerfish, and whiting, with by-catches of saithe, megrim, and lemon sole. Since 2001, these trawlers have adopted mesh sizes of 100–120 mm and other gear modifications depending on the requirements of recent EU technical conservation regulations and national legislation. These measures are aimed at reducing the considerable rates of discarding of young fish, particularly haddock and whiting that have been observed on vessels using 80-100 mm mesh trawls. The majority of the vessels in the demersal fishery are locally-based Scottish trawlers using 'light-trawls', but trawlers from Ireland, Northern Ireland, England, France, and Germany also participate in this fishery. The importance of Scottish seiners essentially targeted at haddock has been declining in recent years as many of these vessels have been converted to trawlers. A part of the fleet of light trawlers has diversified into a fishery for anglerfish that has been expanding into deeper water off the northern coast of Scotland. By-catches in this fishery include megrim and cod.

The larger Scottish trawlers and Irish trawlers fish for haddock at Rockall when opportunities arise for good catches from the Division VIb stock. Vessels from the Russian federation have fished for haddock and other demersal species at Rockall since 1999 when part of the Bank was designated as being in international waters. Although young saithe are caught by coastal trawlers in Subarea VI, the fishery for saithe essentially takes place on the shelf edge to the west and northwest of Scotland. Traditionally, this fishery has largely been operated by the larger deep-sea French trawlers. However, the number of these vessels has declined in recent years. Since the late 1980s, some of these vessels diverted their activity toward deep-sea species, notably orange roughy, and some medium-sized trawlers also participate in the fishery for deep-sea species during summer in some years.

Some 200 Scottish trawlers also take part in fisheries for *Nephrops* on inshore grounds. Some use 70 mm mesh with an 80 mm square mesh panel, but others use 100 mm mesh to avoid the by-catch limitations associated with the smaller mesh size. These boats also land small quantities of haddock, cod, whiting, and small saithe, but discard large amounts of whiting and haddock.

The pelagic fishery for herring is mainly operated by UK, Dutch, and German vessels in the north, and by Irish vessels in a roe fishery in the south. Substantial misreporting of catches from the North Sea and between the northern and southern stocks occurred in the past, but UK licensing regulations are thought to have reduced misreporting since 1997. In recent years TACs for the northern stock have not been restrictive, presumably because of low effort and a weak market. The Clyde herring fishery has declined sharply in recent years as the stock has suffered from a series of low recruitments. Recent TACs have not been taken and the catches have been less than 1 000 t since 1991.

There is a directed trawl fishery for mackerel and horse mackerel in the area. The mackerel fishery mainly takes place in the fourth and first quarter of the year, when the mackerel is returning from the feeding area to the spawning area. The horse mackerel is mainly fished in the second half of the year. In addition, there are fisheries for blue whiting in the area.

The industrial fisheries in Division VIa are much smaller than in the North Sea. The Scottish sandeel fishery started in the early 1980s, peaking in 1986 and 1988. It is irregular, depending on the availability of the resource and of processing facilities at Shetland, Denmark, and the Faroes. By-catches in this fishery are very small. The Norway pout fishery is conducted mainly by Danish vessels.

State of stocks

The assessments of demersal and herring stocks in Subarea VI continued to be hampered by the poor quality of catch data due to misreporting, although this has become less of a problem for roundfish species in recent years. Quantities misreported during 1992-1995 were estimated for Division VIa cod, and estimates of area misreporting since 1987 were made for anglerfish and megrim. The distribution of reported catch data were also examined to estimate the likely extent of misreporting of herring between the North Sea and Division VIa North.

It is likely that the stocks of haddock, saithe, anglerfish, and megrim in Division VIa are closely related to those of the same species in the North Sea. The saithe stock is now assessed as part of the North Sea stock, and the pattern of haddock recruitment in the two areas is very similar. The assessment of anglerfish now treats the catches from Division VIa and the North Sea as coming from a single stock.

All roundfish stocks in Subarea VI are outside safe biological limits and ICES advice points to the need of reducing fishing mortality in the relevant fisheries.

The stock of cod is outside safe biological limits and the spawning stock sizes in 2000 and 2001 are the smallest

recorded. Analysis indicates that with the current rates of exploitation it is very unlikely to achieve safe limits in the medium term. Due to the poor state of the cod in Division VIa, emergency measures were enacted by the EU for 2001 and 2002 prior to the agreement and implementation of a five-year cod recovery plan that was intended to start in 2002. The principal regulatory measure for 2001 and 2002, other than the TAC, was the establishment of three controlled areas from 6 March – 30 April 2001. The regulations sought to minimise cod catches, but also to minimise the effect of the measures on certain pelagic and shellfish fisheries. Consequently, derogations existed for: purse seine and pelagic trawls targeting pelagic fish species; dredges, pots and creels; and for the inner Clyde area, *Nephrops* trawls. The aim of the controlled areas was to allow as many cod as possible to spawn before the end of April when the spawning season finishes (Commission Regulation (EC) No. 456/2001). Consequently, the regulation targeted areas where high catch rates of cod are usually experienced during March and April. The controlled areas were not defined for the purposes of regulating fishing effort on the cod stock in this area. No measures were applied to regulate effort displaced during the period of the control.

The haddock spawning stock in Division VIa fell below $\mathbf{B}_{pa}$, in 2000, but has increased above B_{pa} from 2001 onwards because of a very strong 1999 year class, which is also expected to dominate catches in the short term. Fishing mortality remains above $\mathbf{F}_{pa}$. The spawning biomass in Division VIb has declined continuously since 1995 and has been below $\mathbf{B}_{pa}$ since 2000, whilst fishing mortality has increased above $\mathbf{F}_{pa}$ in recent years.

The whiting stock in Division VIa is outside safe biological limits. Spawning biomass declined to the lowest recorded in 2000, well below $\mathbf{B}_{pa}$, whilst fishing mortality has been above $\mathbf{F}_{pa}$ in all years since 1983.

There are indications that fishing mortality on anglerfish may not be sustainable in the long term. The fish are exploited at an early age due to their size and shape, and are subject to considerable fishing mortality prior to first maturity. The expansion of this fishery has been further accelerated by the diversion of fishing effort from other stocks subject to more restrictive quotas in recent years and by market opportunities. Trends in fishing mortality on megrim are poorly defined, and high rates of discarding have been observed in some fisheries. Megrim are taken as a by-catch in the anglerfish fishery and show similar trends in landings to anglerfish. Recent studies have shown that male megrim attain a much smaller maximum size than females which consequently make up the bulk of the landed catch.

The assessment of the stock of herring in Division VIa North is less uncertain than in previous years, reflecting the stability of the input data over the last two or three years. The fishing mortality is at present considered to be low. SSB is believed to have risen recently due to a good year class that entered the fishery in 2001 and an increase in the proportion mature. However, reference points have not been set so far. The state of the herring stock in Division VIa South is uncertain and the fishery appears to be dependent on occasional strong year classes. There are indications that this stock may have declined considerably in recent years, and that levels of fishing mortality may be comparatively high. There is evidence that the Clyde herring stock remains low.

When last assessed (in 1996) the level of exploitation on sandeel was moderate and the SSB of this stock appears to be high. The stock is, however, subject to large variations depending on recruitment. Precautionary management has been put in place on a three-year basis, including a TAC and fishery closures after 31 July each year, in order to reduce the interaction with breeding seabirds.

The fisheries for mackerel and horse mackerel exploit the southern and western components of mackerel and the western horse mackerel stock. Information on these widely distributed stocks is presented in Section 3.12. The mackerel stock is harvested outside safe biological limits: the spawning biomass is well above $\mathbf{B}_{pa}$, but fishing mortality is above $\mathbf{F}_{pa}$. Following the outstanding 1982 year class of horse mackerel, which for more than a decade contributed a significant part of the catches, recruitment of horse mackerel has been weak. SSB is bound to be low as this year class is fished out, and the sustainable yield is unlikely to be higher than about 130 000 t per year.

The *Nephrops* stocks are assessed every two years. The overall catches of *Nephrops* from Division VIa North have remained stable since the mid-1980s, and catch-rates of the different stocks have fluctuated without trend.

3.7.2 Cod

3.7.2.a Cod in Division VIa (West of Scotland)

State of stock/exploitation: The stock remains outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ in all years since 1976 and above $\mathbf{F}_{lim}$ from 1983 to 2000. SSB has been declining since the early 1980s and the estimates for 2000 and 2001 are the lowest recorded, well below $\mathbf{B}_{pa}$ and $\mathbf{B}_{lim}$. At the average rate of exploitation estimated for recent years, the chance of continued poor recruitment is high. In the last ten years, only one year class has been above average and the four poorest year classes have been recruited since 1995.

Management objectives: Due to the poor state of the cod stock in Division VIa, emergency measures were enacted by the EU for 2001 prior to the agreement and implementation of a five-year cod recovery plan to start in 2002.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 14 000 t.	$\mathbf{B}_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. This also corresponds with the lowest range of SSB during the earlier, more productive, historical period.
$\mathbf{F}_{lim}$ is 0.8. Fishing mortalities above this have historically led to stock decline.	$\mathbf{F}_{pa}$ be set at 0.60. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim}$ = smoothed estimate of $\mathbf{B}_{loss}$ (as enumerated in 1998).	$\mathbf{B}_{pa}$ = previously set at 25 000 t at which good recruitment is probable. Reduced to 22 000 t due to an extended period of stock decline.
$\mathbf{F}_{lim}$ = F's above 0.8 have led to stock decline in the early 1980's.	$\mathbf{F}_{pa}$ consistent with $\mathbf{B}_{pa}$.

Advice on management: Given the very low stock size, the recent poor recruitments, and continued high fishing mortality despite management efforts to promote stock recovery, ICES recommends a closure of all fisheries for cod as a targeted species or by-catch. In fisheries where cod comprises solely an incidental catch there should be stringent restrictions on the catch and discard rates of cod, with effective monitoring of compliance with those restrictions.

These and other measures that may be implemented to promote stock recovery should be kept in place until there is clear evidence of the recovery of the stock to a size associated with a reasonable probability of good recruitment and there is evidence that productivity has improved. The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the operations of the fisheries are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios.

Relevant factors to be considered in management: Although large short-term losses will be incurred in many Division VIa fisheries, the advised measures are required if the cod stock is to reach a level where it can regain historic productivity. The advice will likely result in greatly reduced harvesting of other stocks where the fisheries take cod as part of a mixed species fisheries, particularly haddock and whiting. However, the current state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that more stringent action is required.

Time and area closures for particular fisheries may be a tool in rebuilding this stock, and their effect can be considered in evaluating harvest opportunities for other species.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for other species down to near zero, then these programs could be considered in management of such fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent method for ensuring their catches of cod are fully and credibly reported.

The EC regulation No. 456/2001 of the Commission targeted areas where high catch rates of cod are usually experienced during March and April. The controlled areas were not defined for the purposes of regulating fishing effort on the cod stock in this area. No measure was applied to regulate effort displaced during the period of the control. It is unlikely that the controlled areas in Division VIa will significantly have affected fishing mortality on cod in 2001. Observer trips since 1978 have given very variable estimates of discard rates, mainly at age 1 but with significant quantities at age 2 in some years. The estimate of discards for 1-year-olds in 2000 (1999 year class) was comparatively large.

Even with no directed harvest or by-catch of cod in 2003,

SSB is forecasted in the short term to remain below $\mathbf{B}_{pa}$ and $\mathbf{B}_{lim}$. All possible measures should be considered for implementation in the recovery plan. Fishing effort displaced due to the cod rebuilding plan in Division VIIa, should not be permitted to target cod in Division VIa, or any other stocks considered to be outside safe biological limits.

Cod is taken with whiting and haddock in a mixed demersal fishery. *Nephrops* trawlers take a by-catch of cod. Management needs to take this into account.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(01) = 0.61; Landings (2002) = 3.18 ; SSB(2003) = 6.73

F(2003 onwards)	Basis	Catch (2003)	Landings (2003)	SSB (2004)	Probability (%)SSB < $\mathbf{B}_{pa}$ in 2004	Probability (%)SSB < $\mathbf{B}_{pa}$ in 2011
0	0.0* $\mathbf{F}_{sq}$	0	0	13.5	> 50%	<25%
0.12	0.2*$\mathbf{F}_{sq}$	0.9	0.9	12.3	90%	<25%
0.24	0.4*$\mathbf{F}_{sq}$	1.8	1.8	11.1	>90%	<25%
0.37	0.6*$\mathbf{F}_{sq}$	2.5	2.5	10.1	>90%	<25%
0.41	0.67*$\mathbf{F}_{sq}$ 45% SSB increase	2.7	2.7	9.8	>90%	25%
0.49	0.8*$\mathbf{F}_{sq}$	3.2	3.2	9.2	>90%	40%
0.54	0.89*$\mathbf{F}_{sq}$ 30% SSB increase	3.5	3.5	8.8	>90%	50%
0.61	$\mathbf{F}_{sq}$ [1)]	3.8	3.8	8.3	>90%	50 - 90%

[1] $\mathbf{F}_{pa}$ = 0.60

Weights in '000 t.

Shaded scenarios considered inconsistent with a precautionary approach.

Medium- and long-term projections: Although the short-term forecast suggests some improvement in SSB, medium-term analyses indicate that with the current rates of exploitation, there remains a high probability that it will remain below $\mathbf{B}_{pa}$.

Comparison with previous assessment and advice: The estimate of F for 2000 is 8% lower, and SSB in 2001 the same, as given in last year's assessment. Previous assessments of this stock have shown a tendency to underestimate fishing mortality in the last year. It is possible that the sharp decline in the estimate of fishing mortality from 2000 to 2001, given by the present assessment, is a further manifestation of this bias.

Elaboration and special comment: The directed fishery consists mainly of Scottish vessels using towed gears. Since 1976, effort by Scottish heavy trawl and seine effort has decreased, whilst that of light trawlers has generally increased, particularly in more offshore areas.

Immature cod in Division VIa are subject to high fishing mortality. The fish are not fully mature until age group 4, increasing the susceptibility of the stock to collapse.

Analytical assessment is based on landings-at-age and survey CPUE data. Although data on discarding are available, the estimates are extremely variable and there is a need to carefully examine the sensitivity on the assessment before these data can be included. Discard data have not been taken into account in the assessment model and the youngest age groups are therefore likely underestimated. The quantities of fish mis-reported during 1992–1995 are estimated in the assessment, but the true quantities caught in those years remain uncertain.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

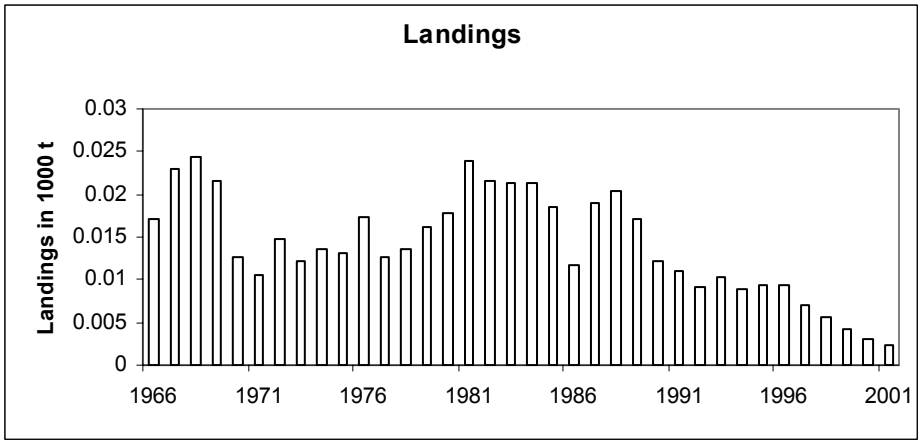
Yield and spawning biomass per Recruit F-reference points:

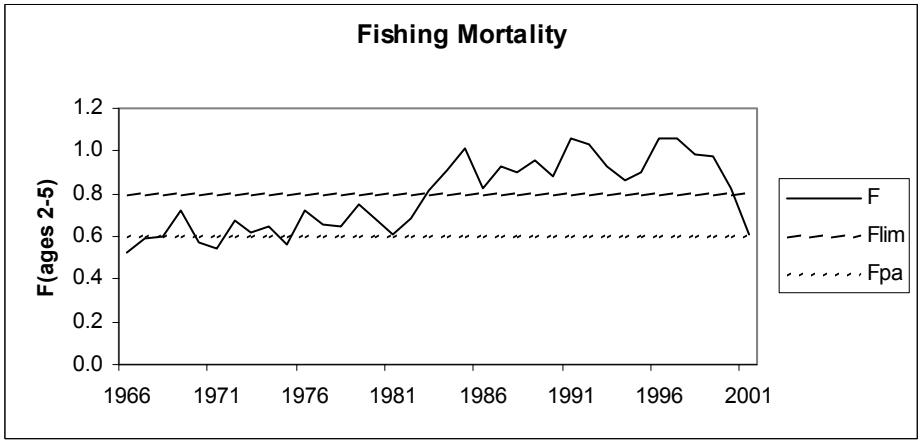
	Fish Mort Ages 2-5	Yield/R	SSB/R
1999-2001 mean	0.787	1.380	2.654
F_{max}	0.267	1.631	6.898
$F_{0.1}$	0.163	1.531	10.391
F_{med}	0.641	1.354	2.483

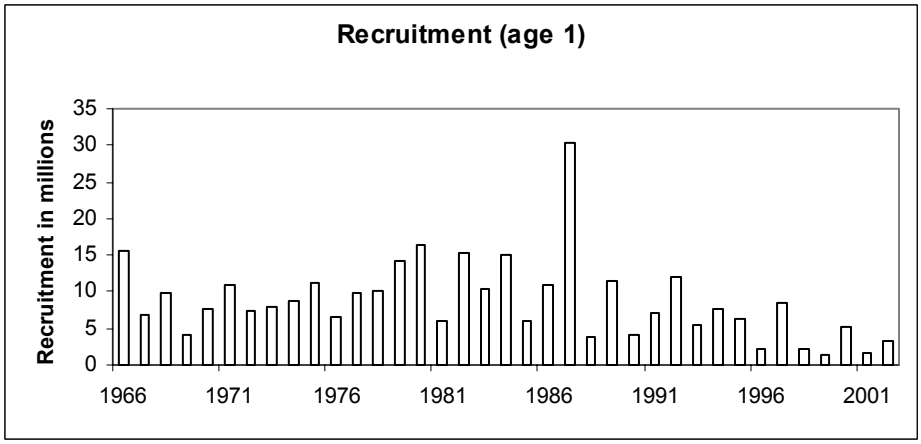
Catch data (Tables 3.7.2.a.1-2):

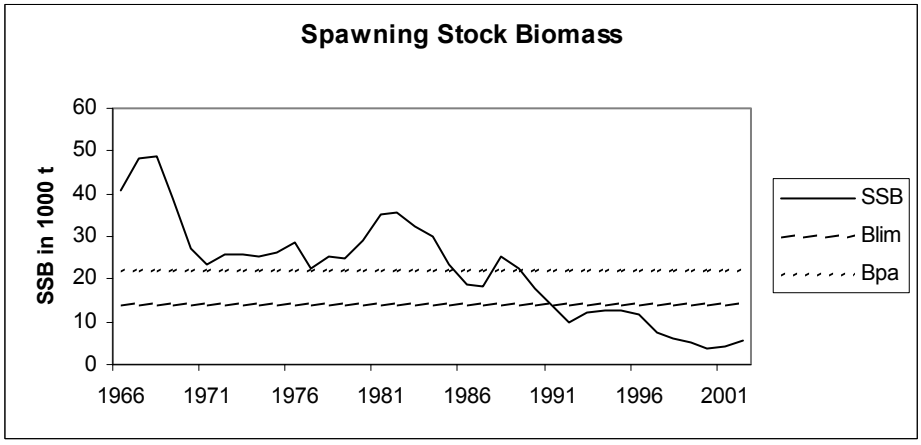
Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings
1987	Reduce F towards F_{max}	18.0	22.0	19.2	19.0
1988	No increase in F; TAC	16.0	18.4	19.2	20.4
1989	80% of F(87); TAC	16.0	18.4	15.4	17.2
1990	80% of F(88); TAC	15.0	16.0	11.8	12.2
1991	70% of effort (89)	-	16.0	10.6	10.9[2]
1992	70% of effort (89)	-	13.5	9.0	9.3[3]
1993	70% of effort (89)	-	14.0	10.5	10.8[3]
1994	30% reduction in effort	-	13.0	9.1	10.1[3]
1995	Significant reduction in effort	-	13.0	9.6	9.6[3]
1996	Significant reduction in effort	-	13.0	9.6	9.4
1997	Significant reduction in effort	-	14.0	7.0	7.0
1998	20% reduction in F	9.5[5]	11.0	5.7	5.7
1999	F reduced to below F_{pa}	<9.7[5]	11.8	4.3	4.2
2000	Recovery plan, 60 % reduction in F	<4.2	7.48	2.8[4]	3.1
2001	Lowest possible F, recovery plan	-	3.7	2.5	2.3
2002	Recovery plan or lowest possible F	-	4.6		
2003	Closure	-			

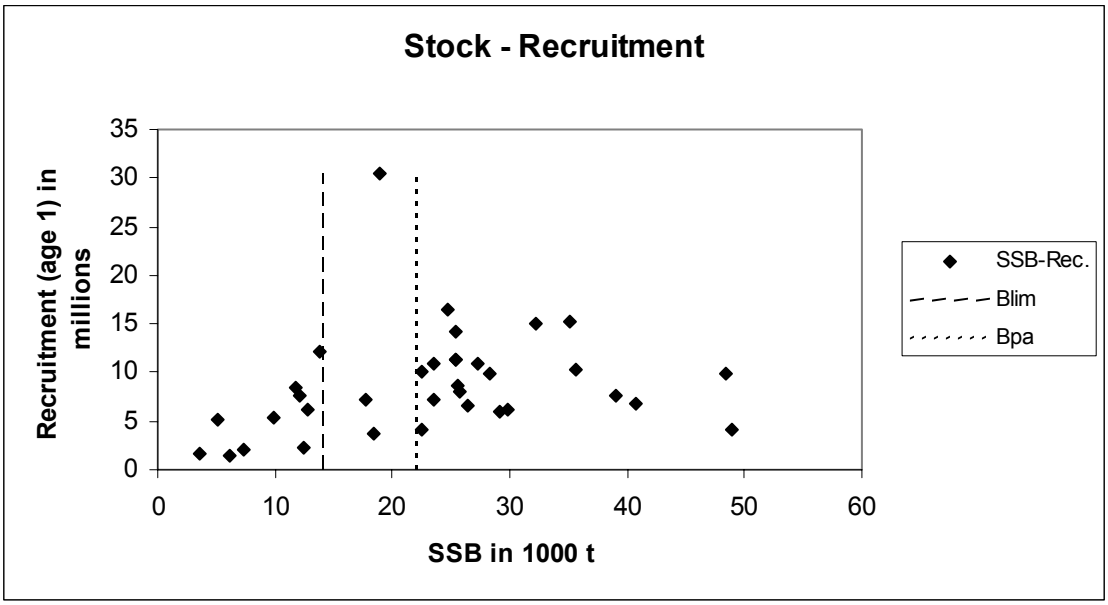
[1]TAC is for the whole of Subareas Vb1, VI, XII and XIV. [2]Not including mis-reporting. [3]Including ACFM estimates of mis-reporting. [4]Incomplete data. [5]For VIa only. Weights in '000 t.

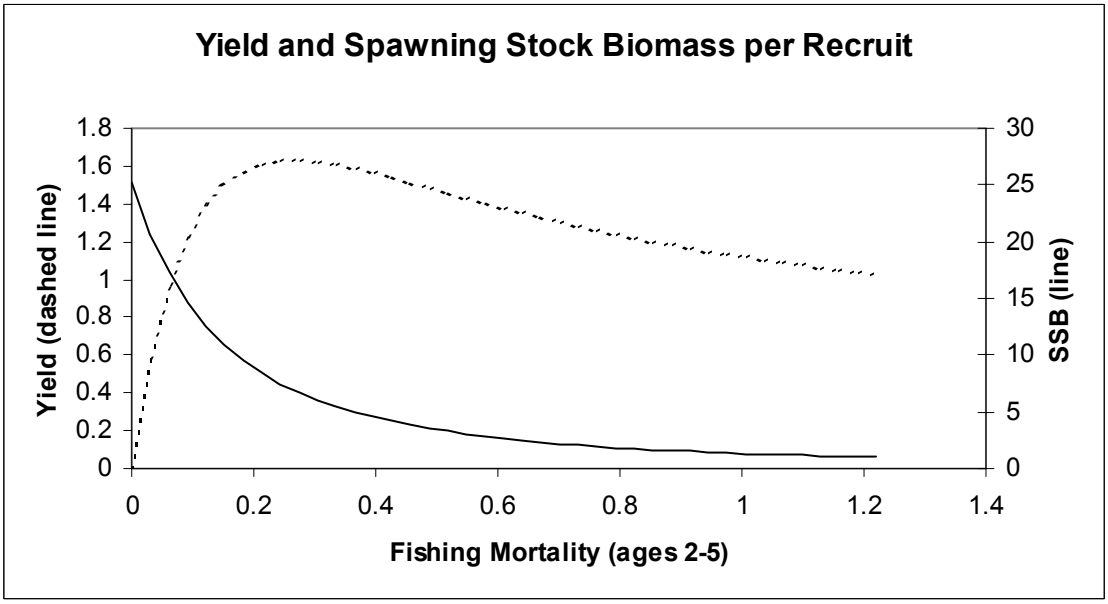

Landings
Landings in 1000 t
0.03
0.025
0.02
0.015
0.01
0.005
0
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 2-5)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1966
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
35
30
25
20
15
10
5
0
1966
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
60
50
40
30
20
10
0
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-5)

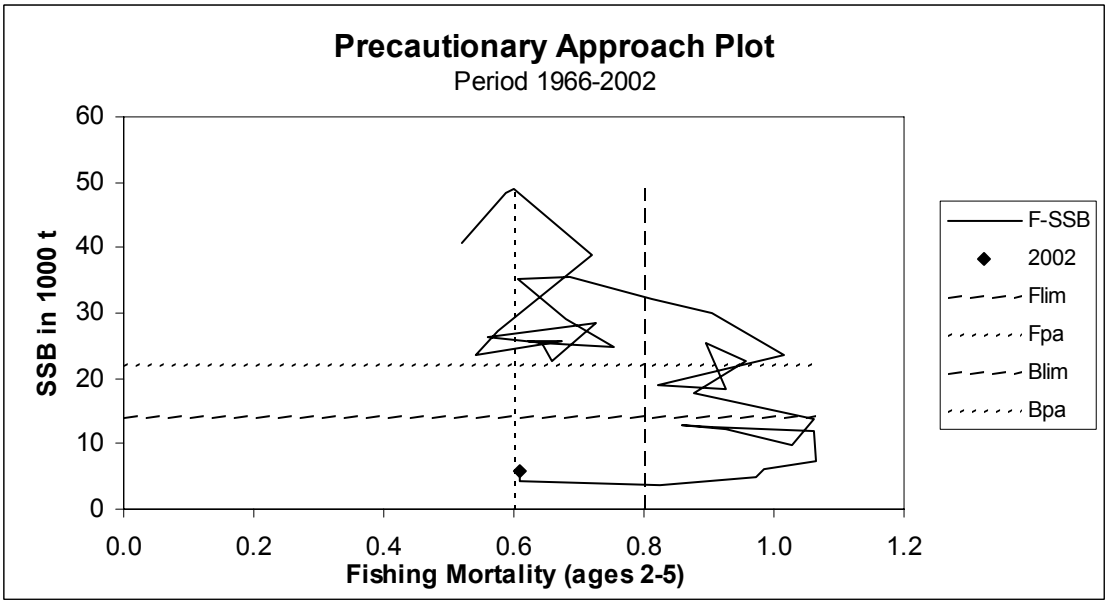

Precautionary Approach Plot
Period 1966-2002
SSB in 1000 t
Fishing Mortality (ages 2-5)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.7.2.a.1 Nominal landings of COD in Division VIa, 1984–2001, as officially reported to ICES.

	1984	1985	1986	1987	1988	1989	1990	1991	1992
Belgium	22	48	88	33	44	28	-	6	-
Denmark	-	-	-	4	1	3	2	2	3
Faroes Islands	-	-	-	-	11	26	-	-	-
France	7,637	7,411	5,096	5,044	7,669	3,640	2,220	2,503	1,957
Germany	75	66	53	12	25	281	586	60	5
Ireland	2,316	2,564	1,704	2,442	2,551	1,642	1,200	761	761
Netherlands	-	-	-	-	-	-	-	-	-
Norway	231	204	174	77	186	207	150	40	171
Spain	64	28	-	-	-	85	-	-	-
UK (E. & W. & N.I.)	724	260	160	444	230	278	230	511	577
UK (Scotland)	9,483	8,032	4,251	11,143	8,465	9,236	7,389	6,751	5,543
UK									
Total	20,552	18,613	11,526	19,199	19,182	15,426	11,777	10,634	9,017
Unallocated	720	-6	294	-228	1,231	1,743	399	293	240
As used by W.G.	21,272	18,607	11,820	18,971	20,413	17,169	12,176	10,927	9,257[1]

	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Belgium	22	1	2	+	11	1	+	+	2
Denmark	2	+	4	2	-	+	+	-	-
Faroes Islands	-	-	-	-	-	-	-	n/a	-
France	3,047	2,488	2,533	2,253	956	714*	842*	310*	424
Germany	94	100	18	63	5	6	8	6	4
Ireland	645	825	1,054	1,286	708	478	223	n/a	319
Netherlands	-	-	-	-	2	1	-	-	
Norway	72	51	61	137	36	36	79	114	40
Spain	-	-	16	+	6	42	45	n/a	
UK (E. & W. & N.I.)	524	419	450	457	779	474	381	280	
UK (Scotland)	6,069	5,247	5,522	5,382	4,489	3,919	2,711	2,057	
UK									1679
Total	10,475	9,131	9,660	9,580	6,992	5,671	4,289	2,767	2,468
Unallocated	281	883	-38	-153	42	43	-88	349	-135
As used by W. G.	10,756[1]	10,014[1]	9,622[1]	9,427	7,034	5,714	4,201	3,116	2,333

* Preliminary.
[1] Estimated by TSA (2001 WG meeting).

Table 3.7.2.a.2 Cod in Division VIa (West of Scotland)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings[1)] tonnes	Mean F Ages 2-5
1966	15697	40676	17102	0.521
1967	6702	48353	22978	0.587
1968	9923	48931	24338	0.599
1969	4098	38957	21599	0.720
1970	7559	27216	12652	0.575
1971	10961	23524	10657	0.543
1972	7249	25821	14695	0.675
1973	8001	25568	12262	0.621
1974	8646	25382	13636	0.645
1975	11344	26448	13162	0.561
1976	6657	28366	17406	0.725
1977	9876	22547	12619	0.660
1978	10120	25328	13521	0.643
1979	14183	24694	16089	0.753
1980	16403	29172	17879	0.681
1981	6050	35075	23865	0.607
1982	15319	35615	21511	0.687
1983	10265	32215	21305	0.813
1984	14987	29890	21272	0.906
1985	6121	23596	18607	1.015
1986	10998	18858	11820	0.821
1987	30456	18385	18971	0.926
1988	3757	25327	20413	0.896
1989	11403	22542	17169	0.957
1990	4216	17786	12176	0.877
1991	7191	13777	10927	1.063
1992	12164	9913	9086	1.027
1993	5345	12098	10314	0.927
1994	7553	12866	8928	0.860
1995	6180	12479	9439	0.904
1996	2310	11827	9427	1.063
1997	8353	7313	7034	1.064
1998	2156	6113	5714	0.986
1999	1434	5035	4201	0.971
2000	5129	3596	2977	0.826
2001	1739	4331	2333	0.610
2002	3292	5844		0.610
Average	8752	22310	14113	0.782

[1)] Landings fitted by TSA value may differ slightly from values given in catch tables

3.7.2.b Cod in Division VIb (Rockall)

Catch data are given in Table 3.7.2.b.1.

Special comments: There is no information on the status of cod in Division VIb. Official catch data are incomplete.

Relevant factors to be considered in management: Due to the rapid decline in cod catches in Division VIa the official landings reported from this area now account for about 25 % of the catch in Subarea VI. TAC set for Division VIb cod should not jeopardise a rebuilding plan for cod in Division VIa nor management measures for haddock in this area.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2003 (ICES CM 2003/ACFM:04).

Table 3.7.2.b.1 COD in Division VIb (Rockall).

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992
Faroes Islands	18	-	1	-	31	5	-	-	-
France	9	17	5	7	2	-	-	-	-
Germany	-	3	-	-	3	-	-	126	2
Ireland	-	-	-	-	-	-	400	236	235
Norway	373	202	95	130	195	148	119	312	199
Portugal	-	-	-	-	-	-	-	-	-
Russia	-	-	-	-	-	-	-	-	-
Spain	241	1200	1219	808	1345	-	64	70	-
UK (E. & W. & N.I.)	161	114	93	69	56	131	8	23	26
UK (Scotland)	221	437	187	284	254	265	758	829	714
Total	1,023	1,973	1,600	1,298	1,886	549	1,349	1,596	1,176

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Faroes Islands	1	-	-	-	-	-	-	n/a	n/a
France	-	-	-	-	-	-	-	-	+
Germany	-	-	-	10	22	3	11	1	-
Ireland	472	280	477	436	153	227	148	119	n/a
Norway	199	120	92	91	55*	51*	85*	152*	164*
Portugal	-	-	-	-	5	-	-	-*	-
Russia	-	-	-	-	-	-	-	7*	26
Spain	-	-	2	5	1	6	4	3	
UK (E. & W. & N.I.)	103	25	90	23	20	32	22	4	
UK (Scotland)	322	236	370	210	706	341	389	286	
UK									178*
Total	1,097	661	1,031	775	962	660	659	572	358*

* Preliminary.

3.7.3 Haddock

3.7.3.a Haddock in Division VIa (West of Scotland)

State of stock/exploitation: This stock is harvested outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ in every year since 1987. SSB varied around $\mathbf{B}_{pa}$ during the 1990s, and reached a historic low at 60% of $\mathbf{B}_{pa}$ in 2000. The very strong 1999 year class, the 4th largest since 1965, has caused SSB to increase rapidly above $\mathbf{B}_{pa}$ in 2001 and 2002.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$= 22 000 t	$\mathbf{B}_{pa}$ be set at 30 000 t
$\mathbf{F}_{lim}$= not defined	$\mathbf{F}_{pa}$ be set at 0.50

Technical basis:

$\mathbf{B}_{lim}$ = lowest observed SSB	$\mathbf{B}_{pa} = \mathbf{B}_{lim}*1.4$
$\mathbf{F}_{lim}$ = not defined	$\mathbf{F}_{pa}$ = high probability of avoiding SSB<$\mathbf{B}_{pa}$ in the long term

Advice on management: Since haddock is mostly taken in demersal fisheries with cod, whiting, and in a directed *Nephrops* fishery, the advice for cod determines the advice for haddock. Unless ways to harvest haddock without by-catch or discards of cod can be demonstrated, fishing for haddock should not be permitted.

Relevant Factors: On the basis of the status of haddock alone, ICES would recommend that the fishing mortality be less than F = 0.50 (=$\mathbf{F}_{pa}$). This would correspond to landings of less than 15 800 t in 2003 and a reduction of fishing mortality of at least 20%. If any fisheries on haddock are permitted, despite the advice on cod and haddock, then total catches should not exceed these values.

The extent to which the cod-haddock-whiting fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and probably variable. It is possible for fishing vessels to increase their targeting of individual species within the demersal fish complex, but there will always be a significant by-catch of other roundfish.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for haddock down to near zero, then these programs could be considered in management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent method for ensuring that their catches of cod are fully and credibly reported.

Catch forecast for 2003:

Fisheries targeting *Nephrops* may take a by-catch of haddock. In this case ICES notes that haddock may continue to be caught subject to existing EU regulations applying to *Nephrops* fisheries, and providing the catch of cod complies with the advice on cod.

Haddock, while a principal target for some fleets, are taken in a mixed roundfish fishery. This means it is important to take into account the impact of management of haddock on other stocks, notably cod and whiting. The reverse is, of course, also true. Recent measures to protect Division VIa cod, such as the closed area in 2001, and agreements to increase mesh size, will affect the haddock fishery. Improvements in selectivity related to measures to protect cod should, if effectively implemented, benefit the haddock fishery by reducing discards and increasing landings in the long term.

A high proportion (up to 50% in weight, 1991–2001) of the total haddock catch is discarded. Square mesh panels were introduced in UK fisheries in 2000 in an attempt to improve selectivity. The minimum mesh size for vessels fishing for cod in the mixed demersal fishery in EC Zones 1 and 2 (West of Scotland and North Sea excluding Skagerrak) was changed from 100 mm to 120 mm from the start of 2002 under EU regulations regarding the cod recovery plan (Commission Regulation EC 2056/2001), with a one-year derogation of 110 mm for vessels targeting other species, including haddock. If implemented effectively, these measures should help to improve gear selectivity and reduce discarding of haddock. Measures to control by-catch and discarding of cod should be implemented within any directed haddock fisheries.

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01) = 0.63; Catch(2002) = 28.8 ; Landings(2002) = 19.8; SSB(2003) = 48.1.

F(2003 onwards)[1]	Basis	Catch (2003)	Discards (2003)	Landings (2003)	SSB (2004)
0.25	0.4* $\mathbf{F}_{sq}$	11.5	2.6	8.9	52.8
0.38	0.6*$\mathbf{F}_{sq}$	16.4	3.8	12.6	47.6
0.50	$\mathbf{F}_{pa}$ (0.8* $\mathbf{F}_{sq}$)	20.7	4.9	15.8	42.9
0.63	$\mathbf{F}_{sq}$	24.6	5.9	18.7	38.8
0.76	1.2* $\mathbf{F}_{sq}$	28.1	6.8	21.3	35.1

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The basis for a single-stock fishery advice is the same as last year. The assessment of this stock shows a tendency for the fishing mortality estimates for the final year to be revised upwards when additional catch and survey data for the following year are included. The F for 2000 was estimated last year to be 0.63, and has been revised to 0.76 by the current assessment. The SSB estimate for 2001 has been revised downwards by 10%.

Elaboration and special comment: The fishery is dominated by Scottish light trawlers. Effort by Scottish seiners and heavy trawlers has declined since 1976. Haddock in Division VIa are fully exploited by age group 3, and also reach full maturity at that age. Immature fish are subject to comparatively high fishing mortality, and comprise a large fraction of the discarded catch. High fishing mortality on immature haddock increases the susceptibility of the stock to over-exploitation.

Analytical age-based assessment uses landings-at-age data, discard-at-age data, and indices from research vessel surveys. Some misreporting of landings has occurred in recent years.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

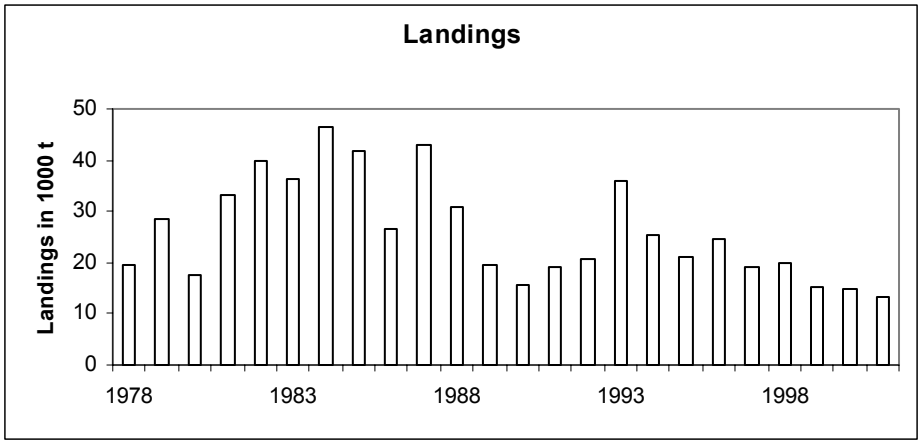
Yield and spawning biomass per Recruit F-reference points:

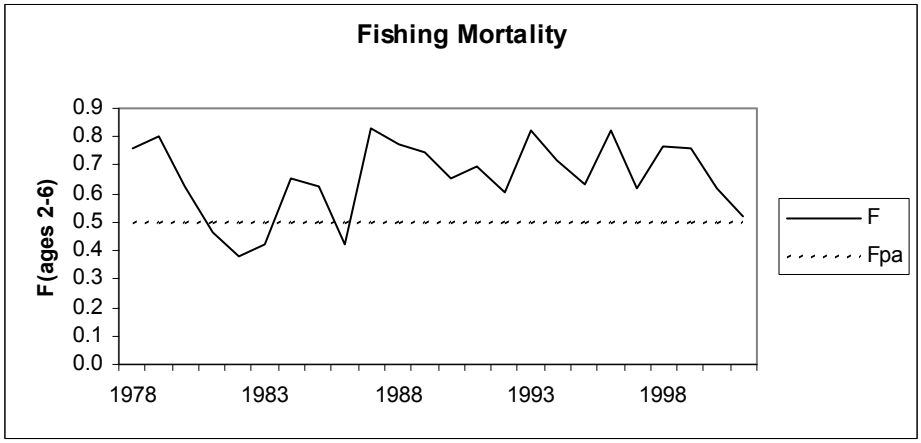
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.634	0.130	0.363
$\mathbf{F}_{max}$	0.246	0.163	0.854
$\mathbf{F}_{0.1}$	0.148	0.152	1.218
$\mathbf{F}_{med}$	0.572	0.136	0.403

Catch data (Tables 3.7.3.a.1-2):

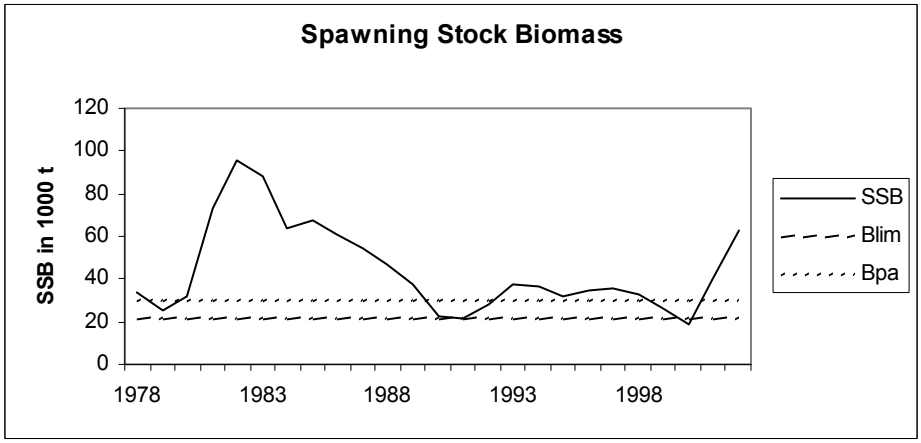
Year	ICES Advice	Predicted landings corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Landings	Discard Slip.	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{max}$	20.0	32.0	27	27.0	16.2	43.2
1988	No increase in F; TAC	25.0	35.0	21	21.1	10.2	31.3
1989	80% of F(87); TAC	15.0	35.0	24	16.7	3.2	19.9
1990	80% of F(88); TAC	14.0	24.0	13	10.1	5.4	15.5
1991	70% of effort (89)	-	15.2	10	10.6	9.2	19.8
1992	70% of effort (89)	-	12.5	7	11.4[2]	9.4[2]	20.8[2]
1993	70% of effort (89)	-	17.6	13	19.1[2]	16.9[2]	36.0[2]
1994	30% reduction in effort	-	16.0	9	14.2[2]	11.2[2]	25.4[2]
1995	Significant reduction in effort	-	21.0	13	12.4	8.8	21.2
1996	Significant reduction in effort	-	22.9	13	13.4	11.8	25.3
1997	Significant reduction in effort	-	20.0	13	12.9	6.6	19.5
1998	No increase in F	20.8[3]	25.7	14	14.4	5.7	20.1
1999	F reduced to $\mathbf{F}_{pa}$	14.3[3]	19.0	11	10.4	5.1	15.6
2000	Maintain F below $\mathbf{F}_{pa}$	<14.9[3]	19.0	7	6.9	8.2	15.2
2001	Reduce F below $\mathbf{F}_{pa}$	<11.2[3]	13.9	7	6.7	6.7	13.4
2002	Reduce F below $\mathbf{F}_{pa}$	<14.1[3]	14.1				
2003	No cod catches	-					

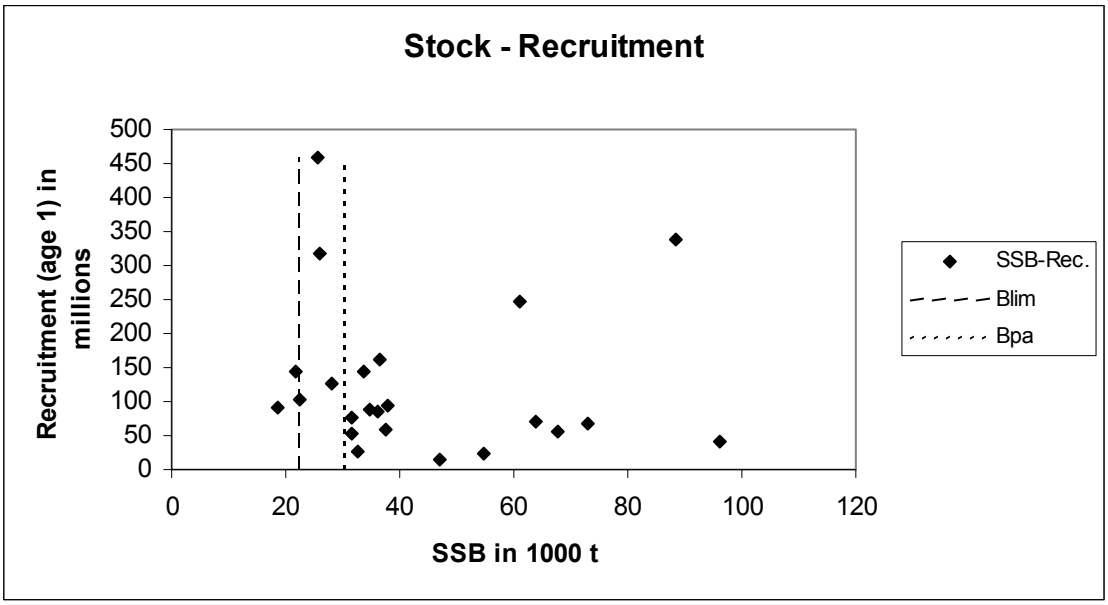
[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. [2]Adjusted for misreporting. [3] For VIa only. Weights in '000 t.

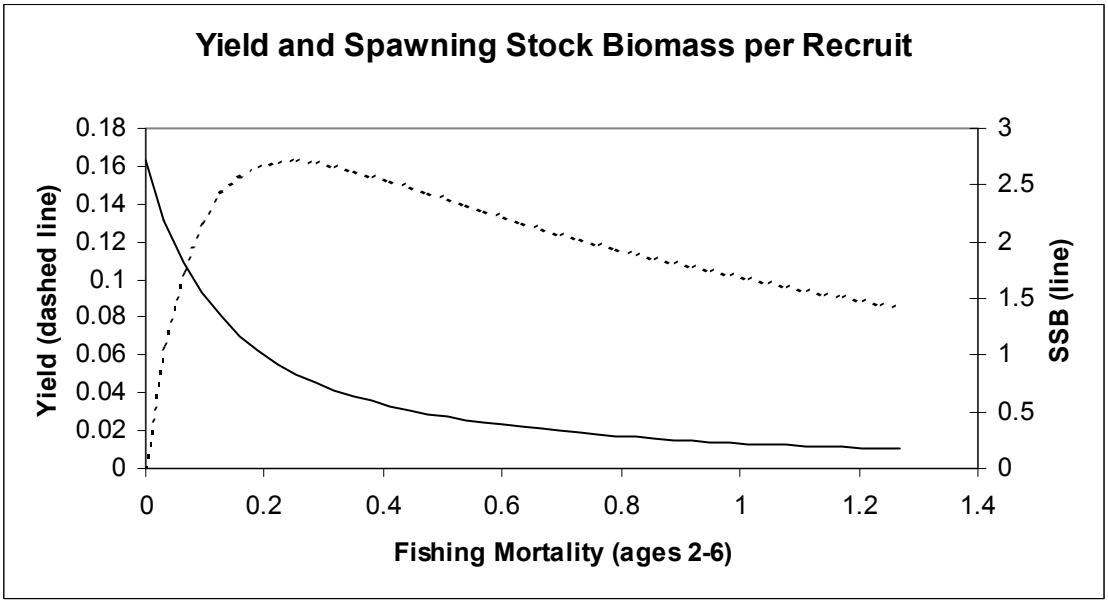

Landings
Landings in 1000 t
50
40
30
20
10
0
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-6)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1978
1983
1988
1993
1998
F
Fpa

Recruitment (age 1)
Recruitment in millions
500
400
300
200
100
0
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
120
100
80
60
40
20
0
1978
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
500
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
120
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 2-6)

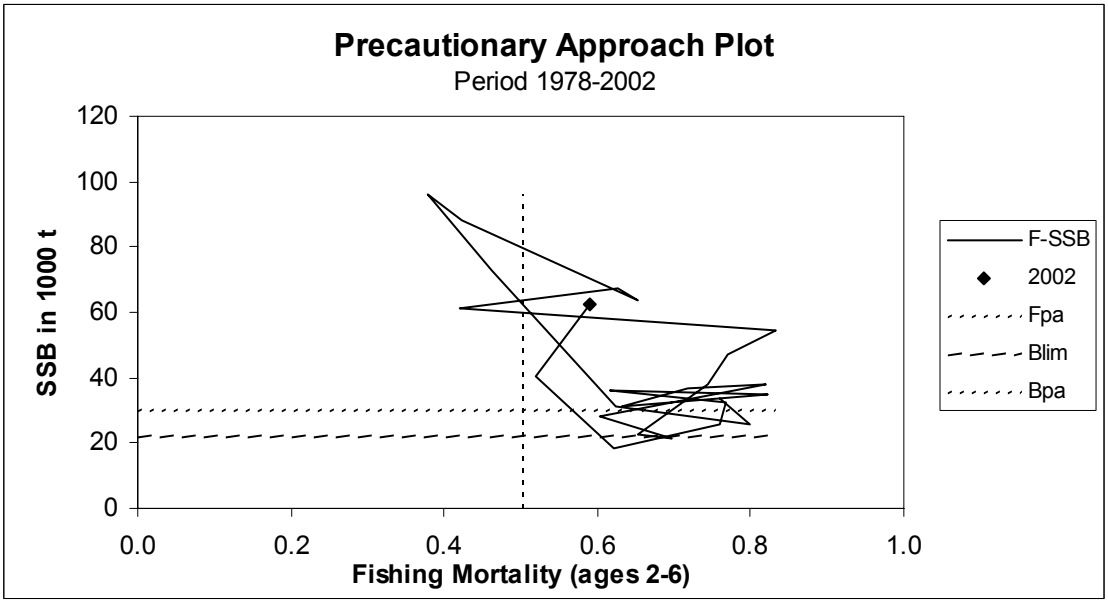

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 2-6)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.7.3.a.1 Haddock, Division VIa. Nominal catch (tonnes) of haddock, 1986–2001, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	-	29	8	9	-	9	1	7	1	+	1	3	2	2	1	2
Denmark	+	+	+	+	+	+	1	1	-	1	1	-	+	-	-	-
Faroe Islands	1	-	-	13	-	1	-	-	-	-	-	-	-	-	n/a	n/a
France	4,956	5,456	3,001	1,335[1,2]	863[1,2]	761[1,2]	761	1,132	753	671	445	270	394[1]	788	358	159[1]
Germany, Fed.Rep.	25	21	4	4	15	1	2	9	19	14	2	1	1	2	1	1
Ireland	2,026	2,628	2,731	2,171	773	710	700	911	746	1,406	1,399	1447	1,352	1054	677	1000
Norway	45	13	54	74	46	12	72	40	7	13	16[1]	21[1]	28	18	70[1]	33[1]
Spain	-	-	-	-	-	-	-	-	-	-	-	-	2	4	9	n/a
UK (E & W)[3]	222	425	114	235	164	137	132	155	254	322	448	493	458	315	199	199
UK (N. Ireland)	155	1	35								...	...	…	...	…	…
UK (Scotland)	12,955	18,503	15,151	19,940	10,964	8,434	5,263	10,423	7,421	10,367	10,790	10,352	12,125	8,630	5,933	
UK (total)																6,107
Total	20,385	27,076	21,098	23,781	12,825	10,065	6,932	12,678	9,201	12,794	13,102	12,587	14,360	10,813	7,248	7,302
Landings as used by WG	19,574	27,004	21,137	16,693	10,136	10,560	11,353	19,067	14,243	12,372	13,452	12,866	14,401	10,426	6,949	6,724
Discards	7,352	16,218	10,164	3,178	5,406	9,192	9,398	16,904	11,192	8,794	11,838	6,623	5,712	5,131	8,207	6,650
Unallocated landings	-811	-72	39	-7,088	-2,689	495	4,421	6,389	5,042	-423	350	279	41	-387	-299	-578
Total as used by WG	26,926	43,222	31,301	19,871	15,542	19,752	20,752[1]	35,971	25,435	21,166	25,290	19,489	20,114	15,557	15,156	13,374

[1]Preliminary. [2]Includes Divisions Vb(EC) and VIb. [3]1989–2001 N. Ireland included with England and Wales. n/a = Not available.

Table 3.7.3.a.2 Haddock in Division VIa (West of Scotland)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings[1)] tonnes	Mean F Ages 2-6
1978	61249	33651	19515	0.7610
1979	143064	25761	28653	0.7999
1980	459273	31516	17461	0.6238
1981	54183	73124	33246	0.4618
1982	68751	96005	39710	0.3796
1983	40381	88314	36188	0.4227
1984	336766	63815	46341	0.6527
1985	71992	67623	41868	0.6270
1986	54864	61132	26745	0.4201
1987	246556	54700	43163	0.8324
1988	22703	47054	30667	0.7702
1989	14893	37932	19662	0.7454
1990	94214	22554	15488	0.6520
1991	103971	21664	19239	0.6982
1992	144886	28174	20548	0.6042
1993	127429	37678	35862	0.8211
1994	58611	36545	25351	0.7176
1995	161066	31452	20945	0.6319
1996	75695	34759	24802	0.8232
1997	87486	36062	19334	0.6156
1998	84049	32492	19933	0.7671
1999	27442	25905	15315	0.7604
2000	316368	18433	14844	0.6215
2001	92522	40196	13381	0.5193
2002	75682	62511		0.5911
Average	120964	44362	26178	0.6528

[1)] Landings fitted by TSA value may differ slightly from values given in catch tables

3.7.3.b Haddock in Division VIb (Rockall)

State of stock/exploitation: The stock remains outside safe biological limits. Spawning stock biomass was below B_{lim} in 2001 and fishing mortality was above F_{pa} in 2001. Fishing mortality was above F_{pa} in most years from 1985 to 1992, then declined to 60% of F_{pa} in 1998 before increasing above F_{pa} again in 2000 and 2001. SSB increased from around B_{pa} in 1990 to more than double B_{pa} in 1995, but has since declined rapidly to below B_{pa} in 2000 and 2001. Recruitment has been weak since 1998.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1999):

ICES considers that:	ICES proposes that:
B_{lim} is 6 000 t, the lowest observed spawning stock.	B_{pa} be set at 9 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above B_{lim}, taking into account the uncertainty of assessments.
F_{lim} is not defined.	F_{pa} be set at 0.4. This F provides a small probability that SSB will fall below B_{pa} in the long term.

Technical basis:

$B_{lim} = B_{loss}$ as estimated in a previous assessment.	$B_{pa} = B_{loss} * 1.4$
F_{lim} = could not be defined, due to uninformative stock recruitment data.	F_{pa} = adopted by analogy with other haddock stocks.

Advice on management: ICES recommends that fishing mortality in 2003 should be reduced to the lowest possible level.

Relevant factors to be considered in management: The TAC applies to Subarea VI, with a limit on how much of the catch may be taken in Division VIa, but no such limit for Division VIb. In addition, part of Division VIb now falls within international waters where non-EU vessels are not subject to TAC. This allows for an unregulated fishery in that area. A separate TAC applicable only to Division VIb, including international waters, would ensure a sustainable fishery in Division VIb.

Following the NEAFC agreement in March 2001, an area of the NEAFC zone around Rockall was closed to fishing. It is too early to quantify the effect this closure has had on the haddock stock. It is difficult to predict actual fishing mortality as fleet behaviour will depend on fishing opportunities elsewhere.

Catch forecast for 2003:

Basis F(2002) = F(99-01) = 0.55; Landings(2002) = 1.7; SSB(2003) = 2.8.

F(2002)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0	0.0* F_{sq}	0	0	4.6
0.11	0.2*F_{sq}	0.4	0.4	4.2
0.22	0.4*F_{sq}	0.8	0.8	3.8
0.33	0.6*F_{sq}	1.1	1.1	3.5
0.40	F_{pa}	1.3	1.3	3.3
0.44	0.8*F_{sq}	1.4	1.4	3.2
0.55	F_{sq}	1.6	1.6	2.9

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The recent three assessments of this stock have consistently shown an increase in fishing mortality from 1999 onwards, and a decline in SSB to the lowest observed value in the last year. The estimate of fishing mortality in 2000 is 26% higher, and that of SSB in 2001 34% lower, in this year's assessment compared to last year's assessment.

Elaboration and special comment: The Rockall fishery is dominated by Scottish vessels and until recently has taken place largely in the summer if fishing at Rockall is more profitable than in the North Sea or West of Scotland. A few Irish vessels exploit this stock on a more regular basis. Scottish and Irish vessels fish mainly for haddock, whilst Russian trawlers also fish for species such as gurnard.

During 1999 a substantial spring fishery developed for the first time, fishing on concentrations of haddock in a different area of the Rockall bank than previously. A fishery on part of the bank which now falls outside of the EU EEZ also started during 1999 and has led to opportunities for other nations to exploit the fishery, notably Russia. The table on official statistics has included Russian catches from the Rockall area for the last three years. Russian vessels operating in international waters catch and retain haddock below the EU minimum landing size of 30 cm. As the assessment contains no data on discards of such fish from EU fleets, the Russian catch data have been adjusted to exclude fish below 30 cm.

The analytical, age-based assessment uses landings-at-age data and research vessel survey data. The Scottish research vessel survey takes place every two years, most recently in 2001. Although no discard data are available, there is likely to be substantial discarding of younger fish. The short time-series, variable fishing effort, and mis-reporting of landings limit the precision of the assessment. Fifty percent of the SSB forecast for 2004 comprises the 2001 year class which is assumed to be at the recent average. The time-series is too short to estimate the stock-recruitment relationship for medium-term projections and estimation of fishing mortality reference points. Maturity is assumed to be attained at age 3, but information from surveys in 2001 indicates that fish may be maturing at an earlier age.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

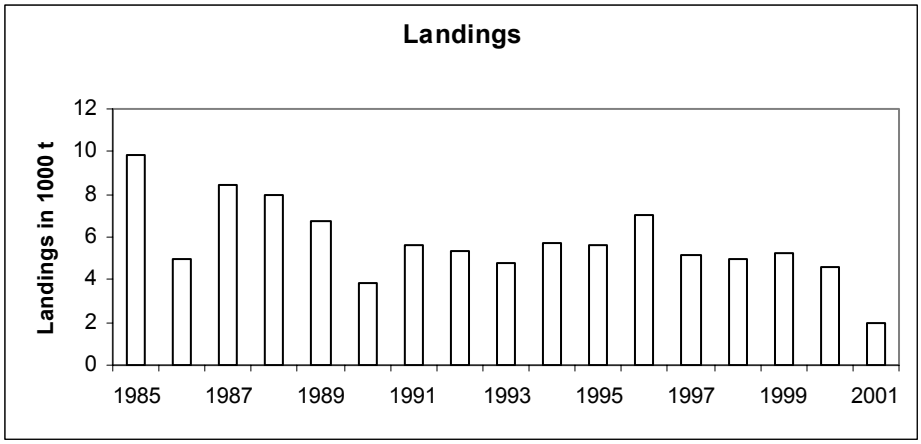
Yield and spawning biomass per Recruit F-reference points:

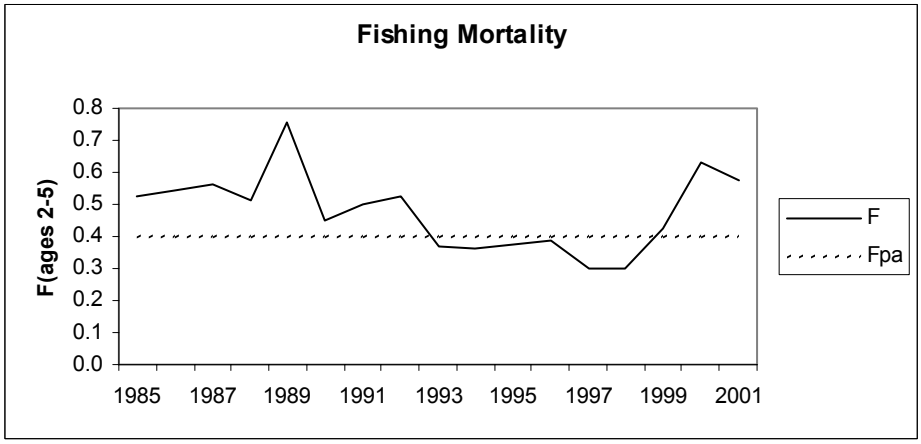
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average Current	0.477	0.234	0.407
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.130	0.179	0.934
$\mathbf{F}_{med}$	0.116	0.173	0.985

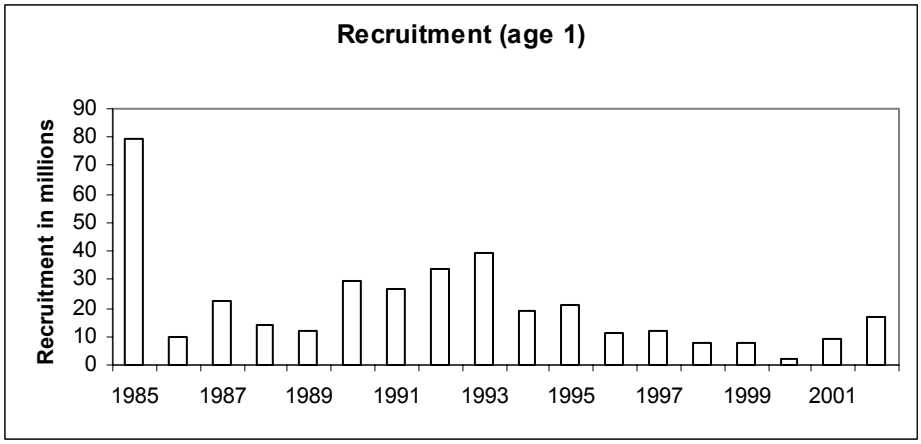
Catch data (Tables 3.7.3.b.1–2):

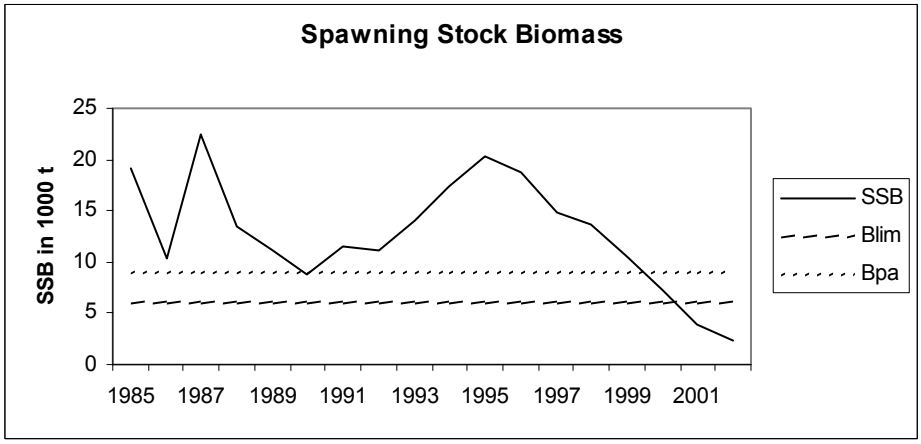
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC	10.0		8.0	8.4
1988	Precautionary TAC	10.0		7.6	7.9
1989	*Status quo* F; TAC	18.0		6.6	6.7
1990	Precautionary TAC	5.5		8.2	3.9
1991	Precautionary TAC	5.5		5.9	5.7
1992	Precautionary TAC	3.8		4.5	5.3
1993	80% of F(91)	3.0		4.1	4.8
1994	If required, precautionary TAC	-		3.7	5.7[2]
1995	No long-term gain in increasing F	5.1[3]		5.5	5.6
1996	No long-term gains in increasing F	6.9[3]		6.8	7.1
1997	No advice given	4.9[3]		5.2	5.2
1998	No increase in F	4.9		5.1	5.0
1999	Reduce F below $\mathbf{F}_{pa}$	3.8		6.0	5.2[5]
2000	Reduce F below $\mathbf{F}_{pa}$	< 3.5		5.7[4]	4.6[5]
2001	Reduce F below $\mathbf{F}_{pa}$	< 2.7		1.9[4]	1.9[5]
2002	Reduce F below 0.2	<1.3			
2003	Lowest possible F	-			

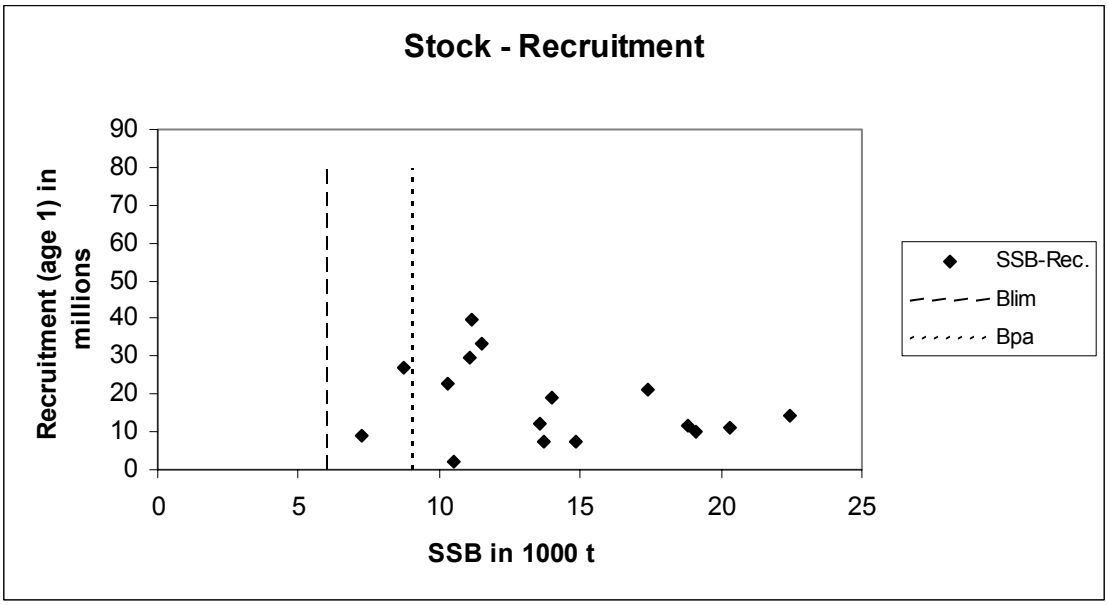
[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV) combined with restrictions on quantity that can be taken in VIa from 1990. [2]Including mis-reporting. [3]Landings at *status quo* F. [4]Incomplete data. [5]Russian data adjusted to exclude fish below MLS of 30 cm. Weights in '000 t.

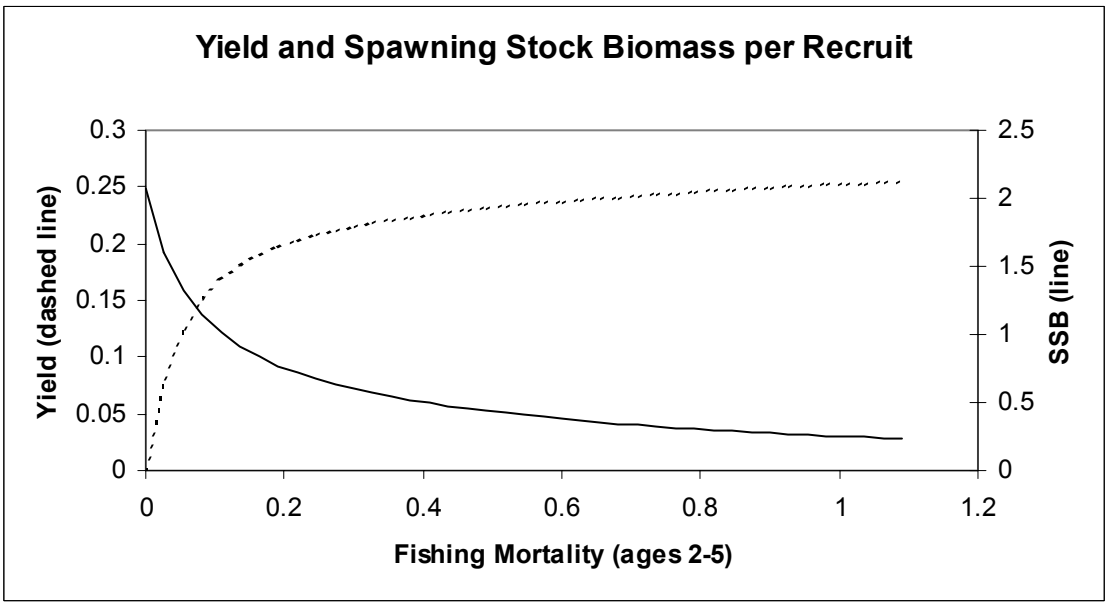

Landings
Landings in 1000 t
0
2
4
6
8
10
12
1985
1987
1989
1991
1993
1995
1997
1999
2001


Fishing Mortality
F(ages 2-5)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1985
1987
1989
1991
1993
1995
1997
1999
2001
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
10
20
30
40
50
60
70
80
90
1985
1987
1989
1991
1993
1995
1997
1999
2001


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
1985
1987
1989
1991
1993
1995
1997
1999
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 2-5)

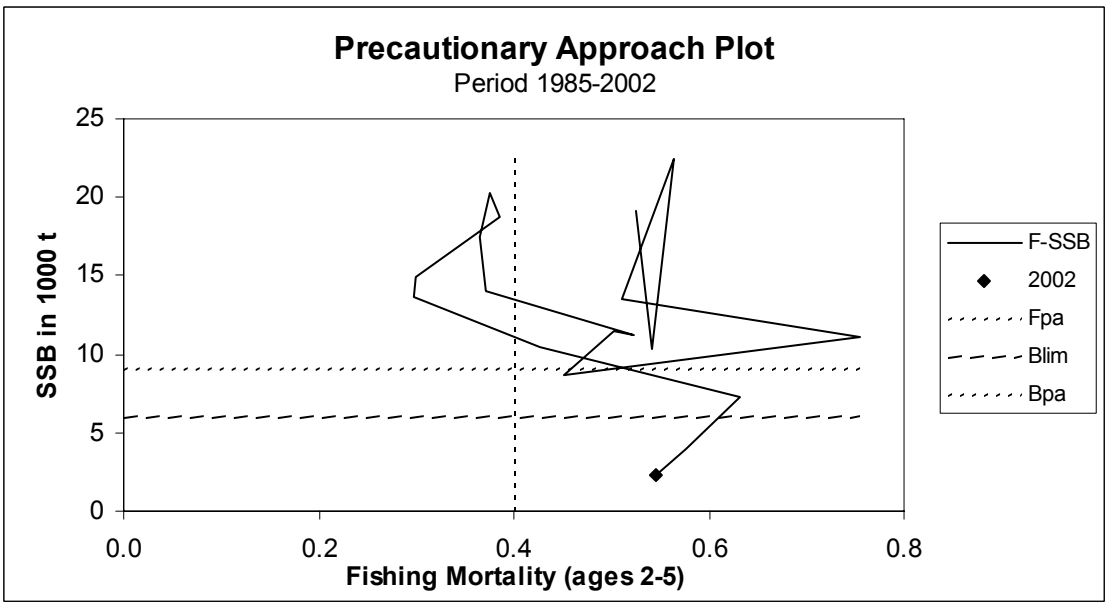

Precautionary Approach Plot
Period 1985-2002
SSB in 1000 t
25
20
15
10
5
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-5)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.7.3.b.1 Nominal catch (tonnes) of HADDOCK in Division VIb, 1986–2001, as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Faroe Islands	-	5	-	-	-	-	-	-	-	-	-	-	-	n/a	n/a
France	99	5	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	2
Germany, Fed.	-	4	1	-	-	-	-	-	-	-	-	-	-	-	-
Iceland	-	-	-	-	-	-	-	-	-	-	+	-	167	3[1]	-
Ireland	-	-	-	620	640	571	692	956	677	747	895	704	1,021	824	n/a
Norway	33	20	47	38	69	47	68	75	29	24	24[1]	40[1]	61[1]	152[1]	70[1]
Portugal	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Russia	-	-	-	-	-	-	-	-	-	-	-	-	458	2,154	630
Spain	371	245	337	178	187	51	-	-	28	1	22	21	25	50	n/a
UK (E & W)[3]	1,271	753	272	238	165	74	308	169	318	293	165	561	288	36	-
UK (N. Ireland)	-	-	…	…	…	…	…	…	…	…	…	…	…	…	…
UK (Scotland)	6,221	6,542	5,986	7,139	4,792	3,777	3,045	2,535	4,439	5,753	4,114	3,768	3,970	2,470	1,205[1]
Total	7,995	7,574	6,643	8,213	5,853	4,520	4,113	3,735	5,491	6,818	5,220	5,098	5,990	5,686	1,907
Unallocated catch	437	355	85	-	-198	800	671	1,998	96	257	-54	-114	-769	-	17
WG estimate	8,432	7,929	6,728	3,884	5,655	5,320	4,784	5,733	5,587	7,075	5,166	4,984	5,221	4,559	1,924

[1]Preliminary.

[2]Included in Division VIa.

[3]1989–2001 N. Ireland included with England and Wales.

[4]includes a reduction in Russian catch data to approximate to "landings-equivalent values" (see Section 4.2.3).

n/a = Not available.

Table 3.7.3.b.2 Haddock in Division VIb (Rockall)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1985	79707	19117	9810	0.5259
1986	10190	10328	5014	0.5423
1987	22816	22476	8433	0.5648
1988	14061	13569	7929	0.5103
1989	11937	11093	6728	0.7557
1990	29585	8732	3884	0.4522
1991	26918	11501	5655	0.5021
1992	33408	11163	5320	0.5233
1993	39710	14024	4784	0.3707
1994	19126	17434	5733	0.3651
1995	20936	20322	5587	0.3759
1996	11228	18797	7075	0.3860
1997	11894	14865	5166	0.2993
1998	7447	13709	4984	0.2970
1999	7639	10492	5221	0.4271
2000	2327	7269	4559	0.6325
2001	8911	3960	1924	0.5767
2002	7350[1]	2328		
Average	20805	12843	5753	0.4807

[1] 1996-2001 GM

3.7.3.c Answer to NEAFC regarding Rockall Haddock

Regarding Rockall haddock NEAFC has requested ICES to consider:

a) to evaluate the spatial distributions of the fishery, the spawning stock and the juvenile fish of the stock of haddock around Rockall to allow NEAFC to consider the appropriateness of area and seasonal closures amongst other measures, for example the evaluation of the consequences of fishing with larger mesh sizes (within a range as considered appropriate by ICES), TACs and other measures;

b) to evaluate the effectiveness of the closure of the area implemented for 2001 in preventing by-catch of juvenile haddock and consider other possible area closures.]

ICES Comments:

Ad a) In 2001 ICES, in the ACFM report (CRR 246, pp. 361-398) presented extensive information on the spatial distribution of the fishery, spawning grounds, and the juvenile fish around Rockall. Since that time little new information has become available. The fishery in 2001 was the lowest since 1985.

ICES advises that fishing in 2003 should be at the lowest possible level and does not consider that mesh regulations are sufficient for management of the haddock on Rockall.

ICES does not have information available that allows it to propose changes in the seasonal and area closures.

Ad b) Following the NEAFC agreement in March 2001, an area of the NEAFC zone around Rockall was closed to fishing. It is too early to quantify the effect this closure has had on the haddock stock. It is difficult to predict actual fishing mortality as fleet behaviour will depend on fishing opportunities elsewhere.

3.7.4 Whiting

3.7.4.a Whiting in Division VIa (West of Scotland)

State of stock/exploitation: The stock remains outside safe biological limits. Fishing mortality has exceeded $\mathbf{F}_{pa}$ in all years since 1983, and is estimated to be close to $\mathbf{F}_{lim}$ since 1999. Spawning stock, which has been in decline since 1981, has exceeded $\mathbf{B}_{pa}$ in only one year since 1988 and has been below $\mathbf{B}_{lim}$ since 1998. There has been a general decline in recruitment since the mid-1980s, and the 1996, 1998, and 2000 year classes are the three weakest on record.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 16 000 t, the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ be set at 22 000 t. This is considered to be the minimum SSB required to have a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 1.0, above which stock decline has been observed.	$\mathbf{F}_{pa}$ be set at 0.6. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{lim}(1998) = 16\,000$ t	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$ = see above	$\mathbf{F}_{pa} = 0.6 * \mathbf{F}_{lim}$

Advice on management: Since whiting is mostly taken in demersal fisheries with cod and haddock, the advice for cod determines the advice for whiting. Unless ways to harvest whiting without by-catch or discards of cod can be demonstrated, fishing for whiting should not be permitted.

Relevant factors to be considered in management: On the basis of the status of whiting alone, ICES would recommend that to bring SSB above $\mathbf{B}_{pa}$ in 2004, fishing mortality in 2003 should be below 0.14, corresponding to a human consumption landing of less than 900 t. If any fisheries on whiting are permitted, despite the advice on cod and whiting, then total catches should not exceed these values.

The extent to which the cod-haddock-whiting fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and probably variable. It is possible for fishing vessels to increase their targeting of individual species within the demersal fish complex, but there will always be a significant by-catch of other roundfish.

Fisheries targeting *Nephrops* may take a by-catch of whiting. In this case ICES notes that whiting may continue to be caught subject to existing EU regulations applying to *Nephrops* fisheries, and providing the catch of cod complies with the advice on cod.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for whiting down to near zero, then these programs could be considered in management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent method for ensuring that their catches of cod are fully and credibly reported.

Whiting are taken in a mixed roundfish fishery. This means it is important to take into account the impact of management of whiting on other stocks, notably cod and haddock. The reverse is, of course, also true. Recent measures to protect Division VIa cod, such as the closed area, and agreements to increase mesh size, will affect the whiting fishery. Improvements in selectivity related to measures to protect cod should, if effectively implemented, benefit the whiting fishery by reducing discards and increasing landings in the long term.

Whiting are taken as a by-catch with cod and haddock in a mixed demersal fishery. The emergency measures introduced for cod in Division VIa have had no measurable effect on the stock and fishery for whiting in Division VIa. A reduced whiting fishery should have a positive impact on the rebuilding of the cod stock in Division VIa.

Over 50% of the SSB in 2004 is expected to be comprised of the 2002 year class for which short-term geometric mean recruitment has been assumed. Retrospective analysis indicates that the overestimation of the stock may not be fully accounted for in the current assessment and catch forecast.

Fishing effort displaced due to the cod rebuilding plan in Division VIIa, should not be permitted to target whiting in Division VIa, or any other stocks considered to be outside safe biological limits.

The proportion of fish discarded is very high and appears to have increased in recent years. Approximately half of the annual catch weight comprises undersized or low-value whiting which are discarded. Measures to improve the exploitation pattern would be beneficial to the stock and to the fishery. The more widespread use of 110 mm mesh nets in 2002, and the requirement to fit square mesh panels to certain towed gears since late 2000, may improve the selection pattern for whiting.

Catch forecast for 2003:

Basis F(2002) = $\mathbf{F}_{sq}$ = F(2001) = 0.85; Catch(2002) = 6.3; Landings(2002) = 3.7 ; SSB(2003) = 12.0.

F(2002 onwards)	Basis	Catch (2003)	Discards (2003)	Landings (2003)	SSB (2004)
0.09	$0.1*\mathbf{F}_{sq}$	1.0	0.4	0.6	22.7
0.14	$0.16*\mathbf{F}_{sq}$	1.5	0.6	0.9	22.0
0.17	$0.2*\mathbf{F}_{sq}$	1.9	0.8	1.1	21.5
0.26	$0.3*\mathbf{F}_{sq}$	2.7	1.1	1.6	20.4
0.43	$0.5*\mathbf{F}_{sq}$	4.3	1.8	2.4	18.3
0.60	$\mathbf{F}_{pa}=0.71*\mathbf{F}_{sq}$	5.7	2.4	3.2	16.4
0.68[1]	$0.8*\mathbf{F}_{sq}$	6.2	2.7	3.5	15.7[1]
0.85	$\mathbf{F}_{sq}$	7.3	3.2	4.1	14.2

Weights in '000 t. [1] Option giving 30% increase in SSB.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The estimate of fishing mortality in 2000 is 2% lower and the estimate of SSB in 2001 30% lower in this year's assessment compared to last year's assessment. Whilst estimates of fishing mortality have been quite consistent from year to year in this stock, there has been a pronounced tendency for the estimate of SSB for the final year to be revised downwards when an additional year's catch and survey data are included in the assessment. The basis for the single-stock fishery advice is the same as last year.

Elaboration and special comment: Whiting in Division VIa are caught mainly by Scottish trawlers. Since 1976, Scottish heavy trawl and seine effort has declined, whilst that of light trawlers has generally increased. Approximately 50% of the total catch in weight is discarded, so restricted landings alone will not achieve the necessary increase in SSB. The analytical age-based assessment uses landings-at-age data, discard-at-age data, and indices from research vessel surveys.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

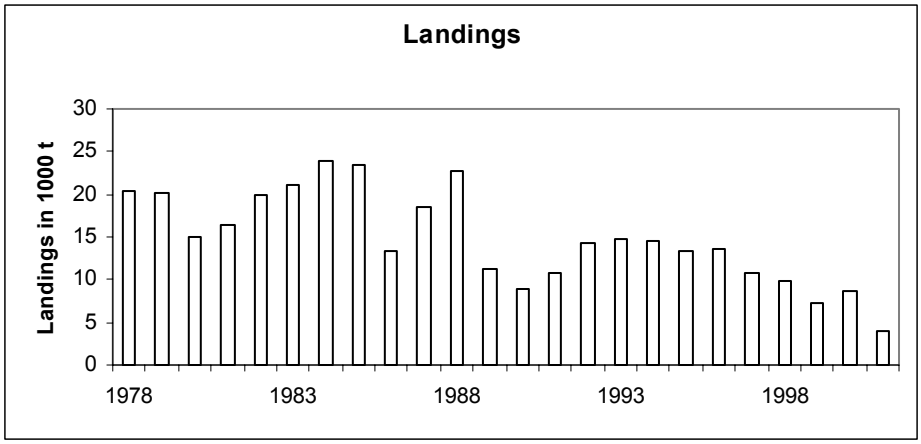
Yield and spawning biomass per Recruit F-reference points:

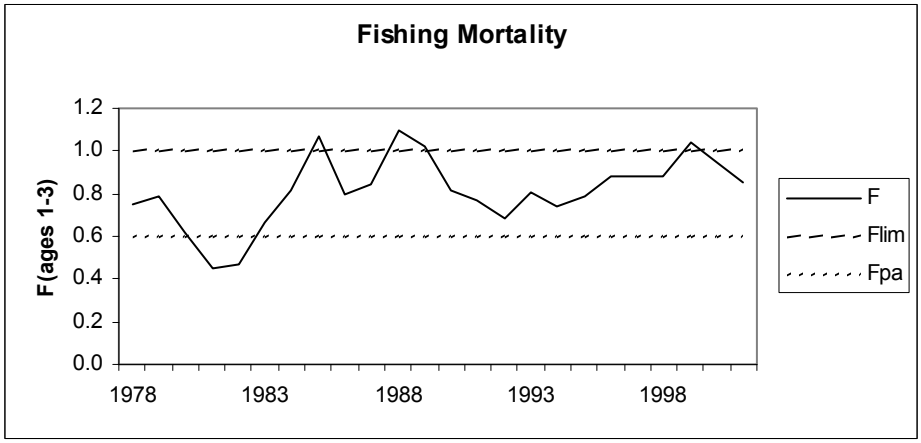
	Fish Mort Ages 1-3	Yield/R	SSB/R
Average Current	0.946	0.063	0.150
$\mathbf{F}_{max}$	0.182	0.119	0.614
$\mathbf{F}_{0.1}$	0.107	0.111	0.859
$\mathbf{F}_{med}$	0.557	0.087	0.248

Catch data (Tables 3.7.4.a.1-2):

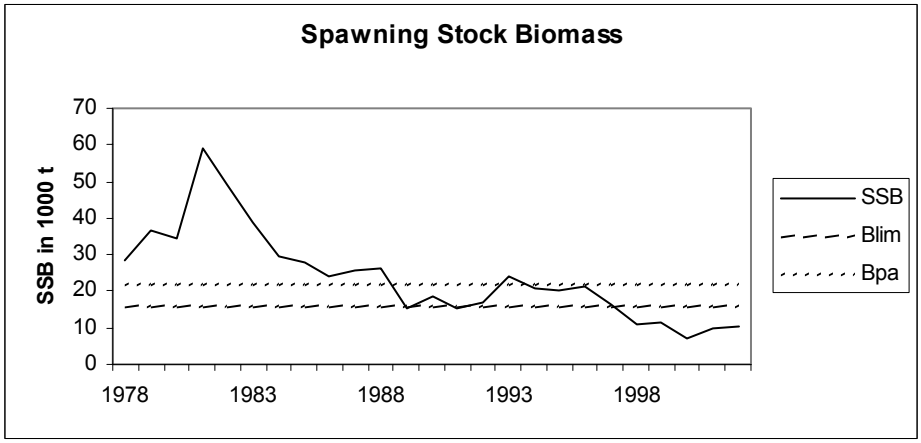
Year	ICES Advice	Predicted landing corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Landings	Discards slip	ACFM catch
1987	No increase in F	15.0	16.4	12.4	11.5	6.9	18.4
1988	No increase in F; TAC	15.0	16.4	11.9	11.4	11.5	22.9
1989	No increase in F; TAC	13.0	16.4	7.7	7.5	3.7	11.3
1990	No increase in F; TAC	11.0	11.0	6.0	5.6	3.4	9.0
1991	70% of effort (89)	-	9.0	6.9	6.7	4.0	10.7
1992	70% of effort (89)	-	7.5	6.0	6.0	8.4	14.3[4]
1993	70% of effort (89)	-	8.7	6.8	6.9	8.0	14.9[4]
1994	30% reduction in effort	-	6.8	5.8	5.9	8.6	14.5[4]
1995	Significant reduction in effort	-	6.8	6.3	6.1	7.3	13.4[4]
1996	Significant reduction in effort	-	10.0	6.6	7.2	6.6	13.7
1997	Significant reduction in effort	-	13.0	6.2	6.3	4.6	10.9
1998	No increase in F	6.5	9.0	4.7	4.7	5.2	9.9
1999	Reduce F below $\mathbf{F}_{pa}$	4.3	6.3	4.7	4.6	2.6	7.2
2000	Reduce F below $\mathbf{F}_{pa}$	<4.3	4.3	3.3	3.0	5.6	8.7
2001	Reduce F below $\mathbf{F}_{pa}$	<4.2	4.0	2.4	2.4	1.6	4.0
2002	SSB>$\mathbf{B}_{pa}$ in short term	<2.0	3.5				
2003	No cod catches	-					

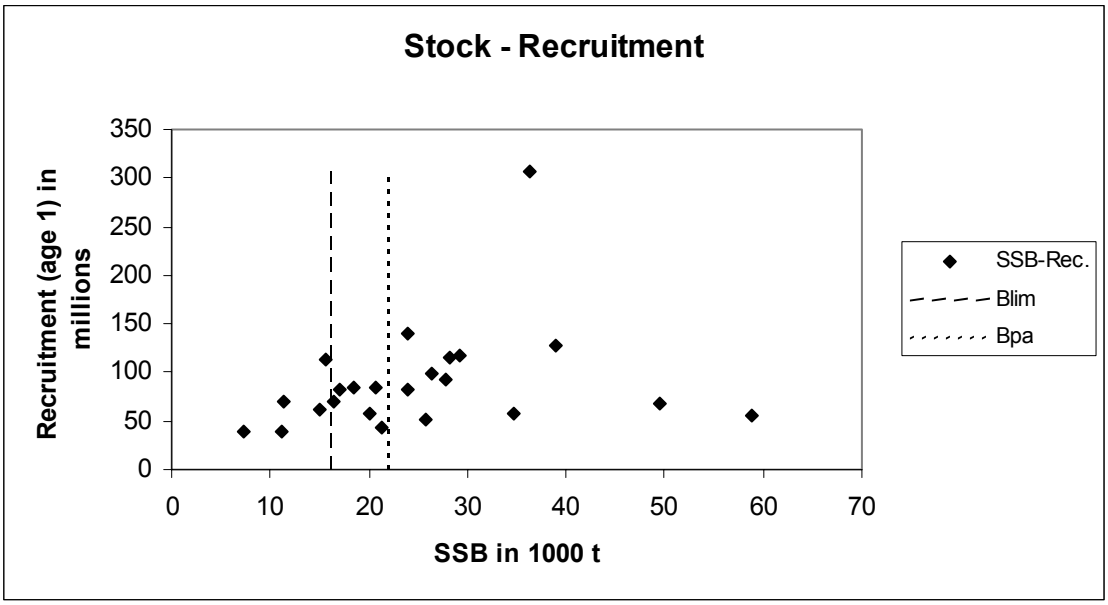
[1]TAC is set for Divisions VIa and VIb combined. [2]Incomplete. [3]Not including misreporting. [4]Including ACFM estimates of misreporting. Weights in '000 t.

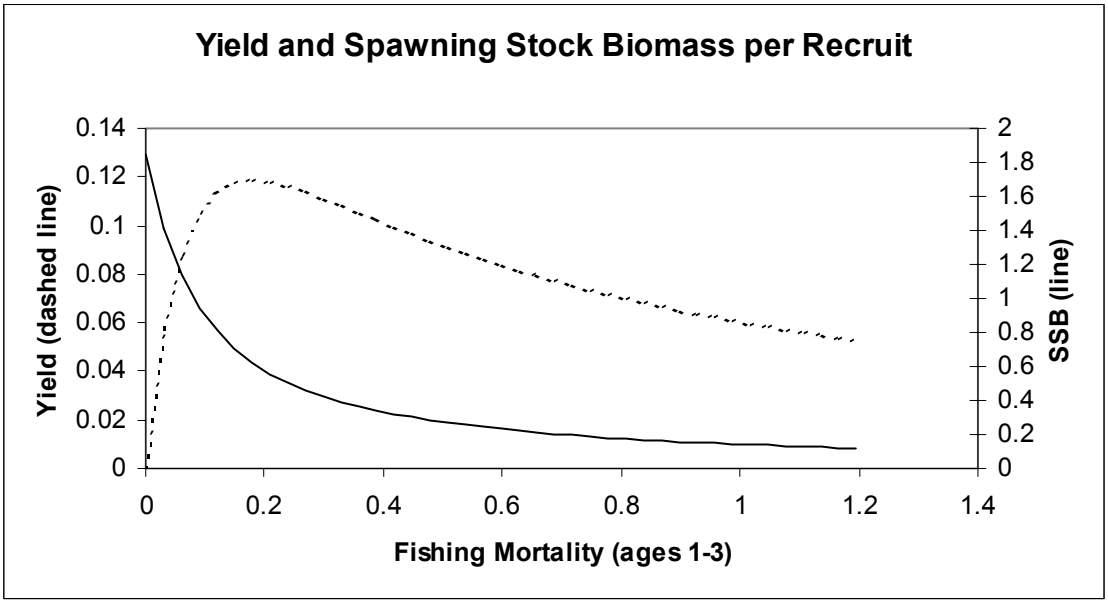

Landings
Landings in 1000 t
30
25
20
15
10
5
0
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 1-3)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1978
1983
1988
1993
1998
F
Flim
Fpa

Recruitment (age 1)
Recruitment in millions
350
300
250
200
150
100
50
0
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
70
60
50
40
30
20
10
0
1978
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 1-3)

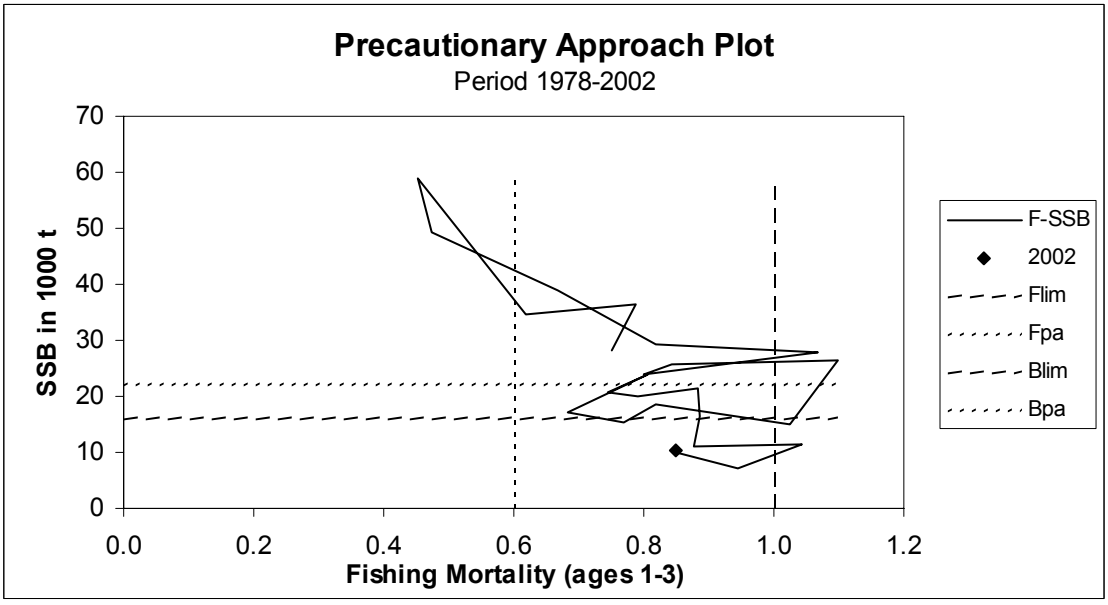

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
70
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 1-3)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.7.4.a.1 Nominal catch (t) of WHITING in Division VIa, 1986–2001, as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999[1]	2000[1]	2001
Belgium	4	3	1	-	+	-	+	+	+	-	1	1	+	+	-
Denmark	5	-	1	+	3	1	1	+	+	+	+	-	-	-	-
France	1,644	1,249	199[1,2]	180	352[1,2]	105	149	191	362	202	108	82[1]	300[1]	164[1]	54[1]
Germany	+	4	+	+	+	1	1	+	-	-	-	-	+	-	-
Ireland	2,868	2,640	1,315	977	1,200	1,377	1,192	1,213	1,448	1,182	977	952	1,121	793	631[1]
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spain	-	-	-	-	-	-	-	-	1	-	1	2	+	-	n/a
UK (E&W)[3]	62	30	44	50	218	196	184	233	204	237	453	251	210	104	…
UK (N.I.)	13	89	…	…	…	…	…	…	…	…	…	…	…	…	…
UK (Scot.)	7,803	7,864	6,109	4,819	5,135	4,330	5,224	4,149	4,263	5,021	4,638	3,369	3,046	2,258	…
UK (total)															1,724[1]
Total landings	12,399	11,879	7,669	6,026	6,908	6,010	6,751	5,786	6,278	6,642	6,178	4,657	4,677	3,319	2,409
Unallocated landings	-857	-530	-142	-382	-234	-5	122	177	-199	527	113	38	-49	-301	-5
Discards as used by W.G.	6,875	11,460	3,713	3,356	4,044	8,360	8,017	8,570	7,272	6,568	4,571	5,211	2,567	5,644	1,586
Landings as used by W.G.	11,542	11,349	7,527	5,644	6,674	6,005	6,873	5,963	6,079	7,169	6,291	4,695	4,628	3,018	2,404
Total catches as used by W.G.	18,417	22,809	11,240	9,000	10,718	14,365	14,890	14,533	13,351	13,737	10,862	9,906	7,195	8,662	3,990

[1]Preliminary.
[2]Includes Divisions Vb (EC) and VIb.
[3]1989–2001 N. Ireland included with England and Wales.
n/a = Not available.

Table 3.7.4.a.2 Whiting in Division VIa (West of Scotland)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings[1)] tonnes	Mean F Ages 1-3
1978	163886	28276	20436	0.750
1979	114988	36394	20159	0.788
1980	307610	34669	15101	0.620
1981	58071	58824	16462	0.452
1982	56310	49455	20025	0.473
1983	68546	39015	21150	0.667
1984	128059	29273	24007	0.818
1985	118169	27833	23390	1.069
1986	93328	23924	13373	0.800
1987	139818	25778	18453	0.842
1988	50932	26408	22845	1.097
1989	99722	15058	11248	1.024
1990	61904	18541	8981	0.819
1991	83530	15532	10739	0.769
1992	112919	17025	14332	0.684
1993	83291	24023	14881	0.807
1994	82908	20620	14532	0.745
1995	83634	20023	13372	0.792
1996	58427	21258	13706	0.882
1997	43880	16420	10857	0.885
1998	69198	11178	9864	0.878
1999	38330	11367	7202	1.042
2000	69371	7208	8661	0.945
2001	38475	10107	3984	0.850
2002	59371	10200		0.850
Average	91387	23936	14907	0.814

[1)] Landings fitted by TSA value may differ slightly from values given in catch tables

3.7.4.b Whiting in Division VIb (Rockall)

Elaboration and special comments: Landings of whiting from Division VIb are negligible. No assessment has been carried out on this stock.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, September 2002 (ICES CM 2003/ACFM:04).

Whiting in Division VIb (Rockall)

Table 3.7.4.b.1 Nominal catch (t) of WHITING in Division VIb, 1986–2000, as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999[1]	2000[1]	2001[1]
France	-	-	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	[2]	[2]	[2]
Ireland	-	-	-	-	-	-	32	10	4	23	3	1	-	n/a	[1]
Spain	-	-	-	-	-	-	-	n/a	n/a	n/a	n/a	n/a	+	n/a	n/a
UK (E & W)[3]	4	-	16	6	1	5	10	2	5	26	49	20	+	+	
UK (N.Ireland)	-	-	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	108	23	18	482	459	283	86	68	53	36	65	23	44	58	
UK (all)															4[1]
Total	112	23	34	488	460	288	128	80	62	85	117	44	44	58	4

[1]Preliminary.
[2]Included in Division VIa.
[3]1989–2000 N. Ireland included with England and Wales.
n/a = not available.

3.7.5 Saithe in Subarea VI (West of Scotland and Rockall)

Saithe in Subarea VI has previously been assessed as a separate stock. This component has now been combined with saithe in the North Sea (Subarea IV) and saithe in Skagerrak and Kattegat (Division IIIa), see Section 3.5.5.

3.7.6 Megrim in Subarea VI (West of Scotland and Rockall)

State of stock/exploitation: The absence of a time-series of abundance indices and discards estimates means that the historical perspective of SSB, fishing mortality and recruitment is not well estimated for this stock. It is likely that fishing mortality increased in the 1990s as the fishery for anglerfish, (in which megrim is taken as a by-catch) expanded into progressively deeper water. Landings of both species peaked in 1996 and have subsequently declined. There are weak indications that fishing mortality on megrim may have declined in recent years, as has also been estimated for anglerfish.

Management objectives: No explicit management objectives are set for this stock.

Reference points: There is not sufficient information to estimate appropriate reference points.

Advice on management: ICES advises that catches in 2003 be no more than the recent TAC.

Relevant factors to be considered in management: Megrim are caught as part of a targeted anglerfish fishery, which expanded rapidly in the 1990s. Vessels targeting anglerfish in waters deeper than 450 m are likely to have reduced by-catches of megrim, particularly when using 100 mm and larger meshes. Maintenance of the existing megrim TAC should help to prevent expansion of the fishery for anglerfish that is considered to be outside safe biological limits. Megrim are also caught in a mixed-species fisheries in VIa, and discarding is a problem particularly from trawls with 80 mm meshes. The megrim in Subarea VI consists of two species,*Lepidorhombus whiffiagonis* and *L. boscii.*

The large majority of the landings are *L. whiffiagonis*. Although total landings are less than the TAC, some national quotas are restrictive and this has led to mis-reporting. Previously, the adjacent fishery in the North Sea was not subject to a TAC for megrim, and catch controls on anglerfish in Subarea VI have led to mis-reporting of landings, including the megrim component, into the North Sea. Male megrim grow to a smaller maximum size than females, and as a consequence the majority of males in the catches are discarded and the bulk of fish landed comprise females.

The landings from Division VIa showed a marked increase from 1991 to 1996 (4 400 t), but have subsequently fallen to the recent low of 2 300 t in 2001.

Elaboration and special comment: Until recently, megrim was taken mainly as a by-catch in bottom trawl groundfish fisheries. The expansion of the fishery for anglerfish has led to increased fishing pressure on megrim in the area, where they are now caught as a by-catch in the targeted anglerfish fishery. Previous analyses have indicated that megrim are more robust to exploitation than anglerfish, hence management of the fishery should primarily reflect concerns for the anglerfish stock.

Length frequency and age composition data are only available for 1992–2001. Incomplete data were available for 1990 and 1991. Preliminary assessments have previously indicated that F may be rather low, but this impression may be due to the expansion of the area fished.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

Catch data (Tables 3.7.6.1-2)

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[3]
1987	Not assessed	-	4.4	3.9	-
1988	Not assessed	-	4.84	4.5	-
1989	Not assessed	-	4.84	2.7	-
1990	Not assessed	-	4.84	2.7	2.9
1991	No advice	-	4.84	3.2	2.7
1992	No advice	-	4.84	3.2	3.7
1993	No long-term gain in increased F	-	4.84	3.0	3.4
1994	No long-term gain in increased F	-	4.84	3.0	3.3
1995	No advice	-	4.84	3.3	3.8
1996	No advice	-	4.84	2.9	4.4
1997	No advice	-	4.84	2.8	3.6
1998	Adequate catch controls	-	4.84	2.7	3.1
1999	Maintain current TAC	4.84	4.84	2.5	2.9
2000	Maintain current TAC	4.84	4.84	2.0	2.7
2001	Maintain current TAC	4.84	4.36	1.8[2]	2.3
2002	Maintain current TAC	4.36	4.36		
2003	Maintain current TAC	4.36			

[1]Vb(EC), VI, XII and XIV. [2] Incomplete data. [3] Landings in VIa. Landings in Vb (EC), XII, and XIV negligible. Weights in '000 t.

Megrim in Subarea VI (West of Scotland and Rockall)

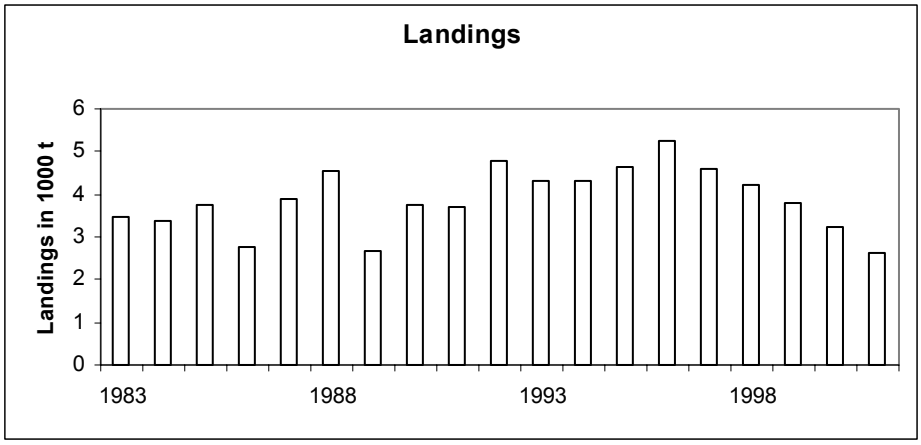


Table 3.7.6.1 Nominal catch (t) of MEGRIM in Subarea VI (West of Scotland and Rockall), as officially reported to ICES, and WG best estimates of landings for Division VIa.

Megrim in Division VIa (West of Scotland)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*	2000*	2001*
Belgium	1	1	1	-	1	-	-	1	-	-	-	-	-	+	-
Denmark	-	-	1	-	-	-	-	-	-	-	-	-		-	-
France	997	1,295	457	398	455	504	517	408	618	462	192	172	203	167	244
Germany	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Ireland	403	685	474	317	260	317	329	304	535	460	438	433	438	417	507†
Spain	102	121	43	91	48	25	7	1	24	22	87	111	83	85	n/a
UK(E&W&NI)	380	354	122	25	167	392	298	327	322	156	123	65	42	20	-
UK(Scotland)	991	1,068	1,169	1,093	1,223	887	896	866	952	944	954	841	831	754	-
UK															776
Total	2,874	3,526	2,267	1,924	2,154	2,125	2,047	1,907	2,451	2,044	1,794	1,622	1,597	1,443	1,527
Unallocated				1,000	518	1,595	1,356	1,373	1,375	2,381	1,795	1,522	1,338	1,247	821
As used by WG				2,924	2,672	3,720	3,403	3,280	3,826	4,425	3,589	3,144	2,935	2,690	2,348

Megrim in Division VIb (Rockall)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*	2000*	2001*
France	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Ireland	-	-	-	196	240	139	128	176	117	124	141	218	127	167	-
Spain	583	751	205	363	587	683	594	574	520	515	628	549	404	22	-
UK(E&W&NI)	261	77	18	19	14	53	56	38	27	92	76	116	57	57	-
UK(Scotland)	174	185	178	226	204	198	147	258	152	112	164	208	278	309	-
UK															278
Total	1,020	1,014	401	804	1,045	1,073	925	1,046	816	843	1,009	1,091	866	555	279

Total Megrim in Sub-area VI (West of Scotland and Rockall)

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*	2000*	2001*
Total	3,894	4,540	2,668	2,728	3,199	3,198	2,972	2,953	3,267	2,887	2,803	2,713	2,463	1,998	1,806
As used by WG				3,728	3,717	4,793	4,328	4,326	4,642	5,268	4,598	4,235	3,801	3,245	2,627

* Preliminary. † Includes 6b landings.

Table 3.7.6.2 Megrim in Subarea VI (West of Scotland and Rockall)

Year	Landings
	tonnes
1983	3469
1984	3384
1985	3753
1986	2780
1987	3894
1988	4540
1989	2668
1990	3728
1991	3717
1992	4793
1993	4328
1994	4326
1995	4642
1996	5268
1997	4598
1998	4235
1999	3801
2000	3245
2001	2627
Average	3884

3.7.7 Anglerfish in Division IIIa (Kattegat and Skagerrak), Subarea IV (North Sea), and Subarea VI (West of Scotland and Rockall) (*Lophius piscatorius* and *L. budegassa*)

Two species occur, *Lophius piscatorius* and *L. budegassa*, although catches are almost exclusively of the former.

This year, for the first time, an assessment was accepted for anglerfish in Division IIIa, Subarea IV, and in Division VIa. Therefore, the advice has a structure different from what has been previously presented.

State of stock/exploitation: The stock is harvested outside of safe biological limits. An assessment for the combined area indicates that the recent F's have been well above $\mathbf{F}_{pa}$**.** Even though the historical perspective of SSB, fishing mortality, and recruitment is not well estimated, it is likely that fishing mortality has increased since the 1980s as the fishery has expanded into deeper water with an associated increase in catches, although these have declined since 1997. The fishery has expanded into areas believed to have been refugia for adult anglerfish, increasing the vulnerability of the stock to over-exploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$.

Precautionary Approach reference points (unchanged since 1998):

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$	$F_{35\%SPR}$= 0.30 be chosen as $\mathbf{F}_{pa}$. This fishing mortality corresponds to 35% of the unfished SSB/R. It is considered to be an approximation of $\mathbf{F}_{MSY}$.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{pa}$. This implies landings of less than 6 700 t for the combined Division IIIa, Subarea IV, and Division VIa. The corresponding catch in Division VIb will be about 400 t, applying a cut proportional to that used in the other areas.

Relevant factors to be considered in management: Catches for the combined area are believed to be adequately estimated. However, due to a long history of mis-reporting, the correct allocation of catches to Subareas IV and VI is not possible. Estimates which take into account mis-reporting indicate that the percentage of the catch taken in Division IIIa, Subarea IV, and Division VIa in the years 1992-2001 (the period used in the assessment) is 3%, 58%, and 39%, respectively. These values may be used as a basis to allocate the 2003 TAC between these areas.

The lack of TAC regulation in the adjacent Subarea IV before 1998 encouraged mis-reporting of landings into that area and undermined management for Subarea VI. The agreed TACs in 1998 and 1999 for Subarea IV were based on recent landings reported from that area. Because those landings included mis-reporting in the preceding years these TACs are unlikely to have prevented further mis-reporting or to have improved conservation in either area.

Anglerfish are subject to significant fishing mortality before attaining full maturity, and this means the stock is particularly vulnerable to depletion of the spawning component. Their body shape means that at a young age they are easily retained by the minimum mesh size currently in force. They are known to be discarded, although no routine discard sampling is undertaken. There is also a by-catch of small anglerfish associated with scallop dredging.

In past assessments the existence of a large unexploited reservoir of mature females was assumed to exist in deep waters. In recent years, surveys and fisheries have explored deep water areas widely, without locating any such aggregations of mature anglerfish.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(01 unscaled) = 0.91 ; Landings (2002) = 16.5 ; SSB(2003) = 9.6.

F(2003 onwards)	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0	0	0	0	17
0.18	$0.2*\mathbf{F}_{sq}$	4.1	4.1	15
0.30	$\mathbf{F}_{pa}$	6.7	6.7	14
0.37	$0.4*\mathbf{F}_{sq}$	7.9	7.9	13
0.55	$0.6*\mathbf{F}_{sq}$	11.3	11.3	12
0.73	$0.8*\mathbf{F}_{sq}$	14.3	14.3	11
0.92	$\mathbf{F}_{sq}$	17.1	17.1	10

Weights in '000 t.
Shaded scenarios considered inconsistent with a precautionary approach.

Comparison with previous assessment and advice: Following trials in 2000 and 2001, the length-based assessment has now been evaluated as providing sufficient information on the state of the stock for making an analytical forecast. Previous advice was based on 2/3 of the landings in the period 1973-1999.

Elaboration and special comment: The distribution of anglerfish in the North Sea, Kattegat, and Skagerrak is closely associated with the distribution to the West of Scotland (Division VIa). It is likely that catches from these areas come from the same biological stock. The link with the anglerfish in Rockall is less certain, and separate advice is therefore given for Division VIb.

Until the mid-1980s, anglerfish was taken mainly as a by-catch in bottom trawl groundfish fisheries. Restrictive TACs for other species in Division VIa have led to increased fishing pressure on anglerfish in that area, where they are now caught in a targeted anglerfish fishery. Species such as cod, haddock, and saithe form a significant by-catch in the anglerfish fishery.

The North Sea catch-at-length distribution is derived solely from Scottish market sampling. Information for catch composition is unavailable from other countries. The assessment does not contain data from Rockall, and the forecast refers to landings in Division IIIa, Subarea IV, and Division VIa.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

Catch data (Tables 3.7.7.2):

Subarea IV - North Sea

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1989	Not assessed	-	-	10.1	9.3
1990	Not assessed	-	-	10.6	9.5
1991	Not assessed	-	-	11.8	10.6
1992	Not assessed	-	-	13.3	11.7
1993	Not assessed	-	-	15.5	13.1
1994	Not assessed	-	-	18.2	15.4
1995	Not assessed	-	-	20.9	15.8
1996	Not assessed	-	-	27.3	16.2
1997	Not assessed	-	-	25.8	18.2
1998	Not assessed	-	22.1	19.0	14.0
1999	Not assessed	-	22.1	14.9	11.7
2000	40% reduction in catches	<9.7	17.66	14.0	11.6
2001	2/3 of the catches in 1973-1990	5.7	14.13	14.6	10.1
2002	2/3 of the catches in 1973-1990	5.7	10.50		
2003	Reduce F below $\mathbf{F}_{pa}$	<6.7 [1)]			

Weights in '000 t.
[1)] Advice for Division IIIa, Subarea IV, and Subarea VIa combined.

Catch data (Tables 3.7.7.3):

Subarea VI - West of Scotland and Rockall

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[2]
1987	Not assessed	-	7.8	5.2	5.6
1988	Not assessed	-	8.6	7.7	7.7
1989	Not assessed	-	8.6	6.0	7.3
1990	Not assessed	-	8.6	6.4	6.6
1991	No advice	-	8.6	6.0	6.3
1992	No advice	-	8.6	6.6	9.2
1993	No long-term gain in increased F	-	8.6	6.2	10.1
1994	No long-term gain in increased F	-	8.6	6.0	8.8
1995	A precautionary TAC not exceeding recent catch levels	-	8.6	7.2	12.3
1996	A precautionary TAC not exceeding recent catch levels	-	8.6	7.0	18.2
1997	Reduction in fishing effort	-	8.6	6.2	13.7
1998	Reduction in fishing effort	-	8.6	5.4	10.6
1999	Reduce fishing effort, effective implementation of the TAC	-	8.6	5.3	8.4
2000	40% reduction in catches	<7.4	8.0	4.9	7.3
2001	2/3 of the catches in 1973-1990	4.3	6.4	3.5	5.7
2002	2/3 of the catches in 1973-1990	4.3	4.8		
2003	Reduce F below $\mathbf{F}_{pa}$	<6.7 [4)]			

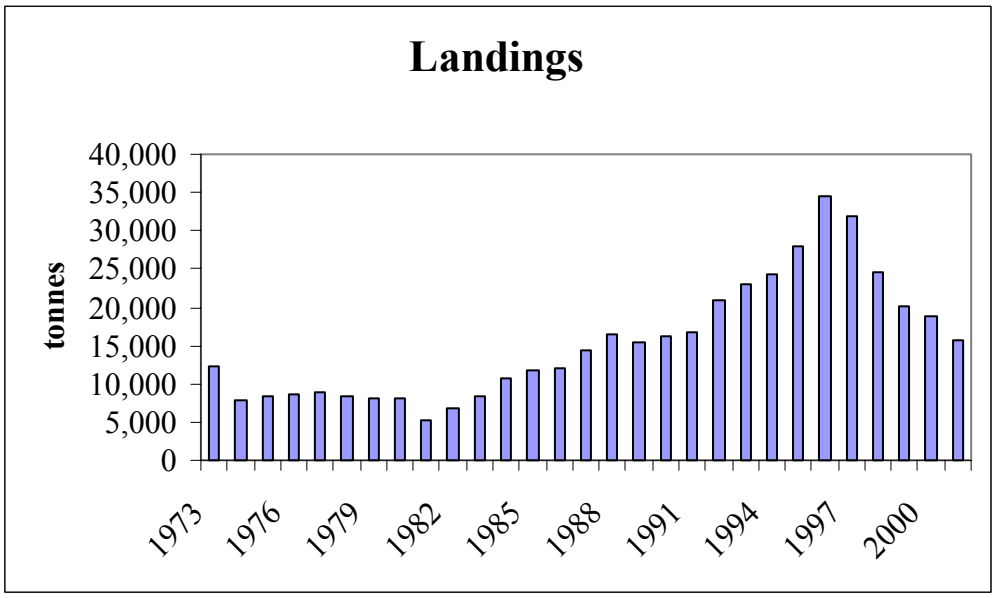
[1]Vb(EC), VI, XII, and XIV. [2]Division VIa only. [3]Incomplete data. Weights in '000t.
[4)] Advice for Division IIIa, Subarea IV, and Subarea VIa combined.

Catch data (Tables 3.7.7.1-3):

Division IIIa, Subarea IV, and Subarea VI combined

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official landings	ACFM landings[2]
2003	Reduce F below F_{pa}	<6.7			

Anglerfish in Subarea IV (North Sea) and VI (W of Scotland and Rockall)



Anglerfish in Division VIa and the North Sea: stock trends.

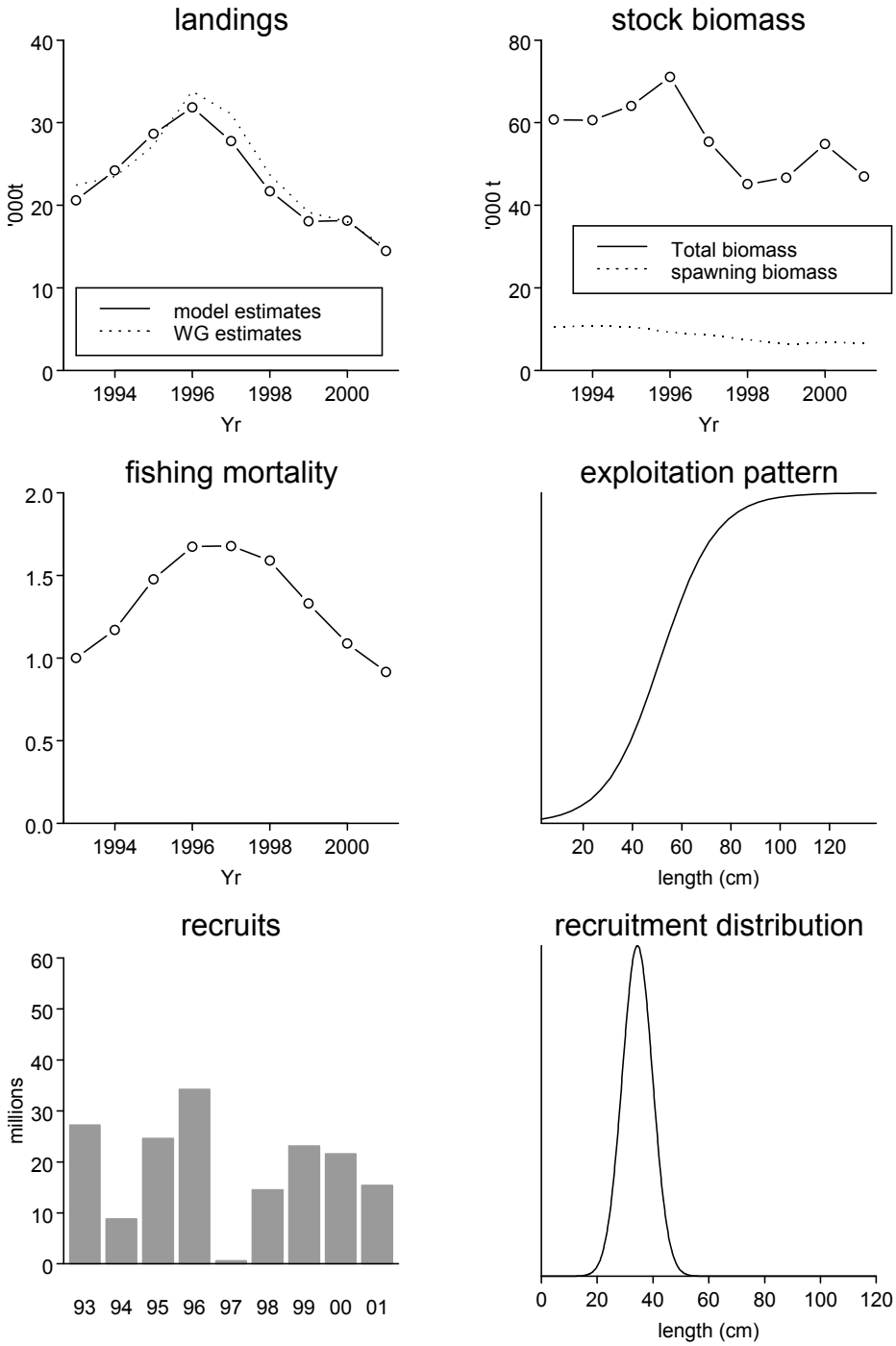


Table 3.7.7.1 Nominal catch (t) of Anglerfish in Division IIIa, 1990–2001, as officially reported to ICES.

Skagerrak and Kattegat (IIIa)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	22	15	48	34	21	35	-	-	-	-	-	-
Denmark	477	493	658	565	459	312	367	550	415	362	377	375
Germany	1	-	-	1	-	-	1	1	1	2	1	+
Norway	57	64	170	154	263	440	309	186	177	260	197*	200*
Sweden	13	23	62	89	68	36	25	39	33	36	27	46
Total	570	595	938	843	811	823	702	776	626	660	602	621

*Preliminary.

Table 3.7.7.2 Nominal catch (t) of ANGLERFISH in the North Sea, 1989–2001, as officially reported to ICES.

Northern North Sea (IVa)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	1	8	2	9	3	3	2	8	4	1	5	12	-
Denmark	835	984	1,245	1265	946	1,157	732	1,239	1,155	1,024	1,128	1,087	1,289
Faroes	1	7	1	-	10	18	20	-	15	10	6	n/a	
France	-	-	124	151	69	28	18	7	7	3*	18[1*]	19[1*]	19*
Germany	187	70	71	68	100	84	613	292	601	873	454	182	95
Netherlands	70	18	23	44	78	38	13	25	12	-	15	12	-*
Norway	309	421	587	635	1,224	1,318	657	821	672	954	1,219	1,182*	1,209*
Sweden	9	5	14	7	7	7	2	1	2	8	8	78	44
UK(E, W&NI)	99	91	129	143	160	169	176	439	2,174	668	781	218	…
UK (Scotland)	6,366	6,788	7,039	7,887	9,712	11,683	15,658	22,344	18,783	13,319	9,710	9,559	…
UK (total)													10,194
Total	7,877	8,392	9,235	10,209	12,309	14,505	17,891	25,176	23,425	16,860	13,344	12,349	12,850

* Preliminary. [1]Includes IVb,c.

Central North Sea (IVb)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	209	216	357	538	558	713	579	287	336	371	270	449	579
Denmark	211	278	345	421	347	352[1]	295	225	334	432	368	260	251
Faroes	-	-	-	-	2	-	-	-	-	-	-	n/a	
France	-	-	-	1	-	2	-	-	-	-*	…[2*]	…[2*]	-*
Germany	2	1	4	2	13	15	10	9	18	19	9	14	9
Netherlands	574	267	285	356	467	510	335	159	237	223	141	141	-*
Norway	2	27	17	4	3	11	15	29	6	13	17	9*	15*
Sweden	-	-	-	-	-	3	2	1	3	3	4	3	2
UK(E, W&NI)	628	754	669	998	1,285	1,277	919	662	664	603	364	423	…
UK (Scotland)	495	634	845	733	469	564	472	475	574	424	344	318	…
UK (total)													848*
Total	2,121	2,177	2,522	3,053	3,144	3,447	2,627	1,847	2,172	2,088	1,517	1,617	1,704

* Preliminary. [1]Includes 2 tonnes reported as Subarea IV. [2]Included in IVa.

Southern North Sea (IVc)

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	54	21	13	12	34	37	26	28	17	17	11	15	15
Denmark	-	-	2	-	-	-	-	-	-	+	+	+	+
France	-	-	-	-	-	-	-	-	-	10	…[1*]	…[1*]	-*
Germany	-	-	-	-	-	-	-	-	-	-	-	+	-
Netherlands	2	7	5	10	14	20	15	17	11	15	10	15	-*
Norway							-	-	-	-	+	-*	+*
UK(E&W&NI)	30	6	6	17	18	136	361	256	131	36	3	1	…
UK (Scotland)	-	-	-	-	-	17	-	3	1	+	+	+	…
													+*
Total	86	34	26	39	66	210	402	304	160	78	24	31	15

* Preliminary. [1]Included in IVa.

Total North Sea

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Total	10,084	10,603	11,783	13,301	15,519	18,162	20,920	27,327	25,757	19,026	14,885	13,997	14,569
WG estimate	9,342	9,491	10,566	11,728	13,078	15,432	15,794	16,240	18,217	14,027	11,719	11,564	10,102
Unallocated	-742	-1,112	-1,217	-1,573	-2,441	-2,730	-5,126	-	-7,540	-4,999	-3,166	-2,433	-4,467

*Preliminary.

Table 3.7.7.3 Anglerfish in Subarea VI. Nominal landings (t) as officially reported to ICES.

Anglerfish in Division VIa (West of Scotland)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	2	8	-	3	2	9	6	5	+	5	2	+	+	+
Denmark	-	34	-	1	3	4	5	10	4	1	2	1	+	+
France	2,329	1,901	2,182	1,910	2,308	2,467	2,382	2,648	2,899	2,058	1,634*	1,814[1]*	1,843[1]*	951*
Germany	9	10		1	2	60	67	77	35	72	137	50	39	11
Ireland	324	556	398	250	403	428	303	720	717	625	749	617	515	500*
Netherlands	-	-	-	-	-	-	-	-	-	27	1	-	-	-*
Norway	8	27	8	6	14	8	6	4	4	1*	3*	1*	3*	2*
Spain	269	15	35	7	11	8	1	37	33	63	86	53	79	
UK(E&W&NI)	433	153	71	270	351	223	370	320	201	156	119	60	44	…
UK(Scotland)	2,629	3,024	2,921	2,613	2,385	2,346	2,133	2533	2,515	2,322	1,773	1,688	1,496	…
UK (total)														1,158*
Total	6,003	5,728	5,615	5,061	5,479	5,553	5,273	6,354	6,408	5,330	4,506	4,284	4,019	2,622
Unallocated			184	296	2,638	3,816	2,766	5,112	11,148	7,506	5,234	3,799	2,406	2,186
As used by WG			5,799	5,357	8,117	9,369	8,039	11,466	17,556	12,836	9,654	7,413	6,425	4,808

*Preliminary. [1]Includes Vib.

Anglerfish in Division VIb (Rockall)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Faroe Islands	6	1	-	-	2	-	-	-	15	4	2	2		
France	4	-	-	-	-	29	-	-	-	1	1	…[1]*	…[1]*	195*
Germany	-	-	-	-	-	103	73	83	78	177	132	144	119	67
Ireland	-	-	400	272	417	96	135	133	90	139	130	75	81	-*
Norway	7	13	16	18	10	17	24	14	11	4	6	5	11*	5*
Portugal	-	-	-	-	-	-	-	-	-	-	+	-	20	19
Russia	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Spain	1340	81	138	333	263	178	214	296	196	171	252	291	14	
UK(E&W&NI)	123	17	19	99	173	76	50	105	144	247	188	111	272	…
UK(Scotland)	250	201	249	201	224	182	281	199	68	156	189	344	374	…
UK (total)														565*
Total	1,730	313	822	923	1,089	681	777	830	602	899	900	972	891	852

*Preliminary. [1]Included in VIa.

Total Anglerfish in Sub-area VI (West of Scotland and Rockall)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001*
Total official	7,733	6,041	6,437	5,984	6,568	6,234	6,050	7,184	7,010	6,229	5,406	5,256	4,910	3,474
Total ICES	7,733	6,041	6,621	6,280	9,206	10,050	8,816	12,296	18,158	13,735	10,554	8,385	7,316	5,660

*Preliminary.

3.7.8 Herring West of Scotland

3.7.8.a Herring in Division VIa (North)

State of stock/exploitation: The fishing mortality is at present considered to be low. SSB is believed to have risen recently due to a good year class that entered the fishery in 2001 and an increase in the proportion mature.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: None adopted. Candidate reference points are under investigation.

Advice on management: **ICES recommends that the fishing mortality be maintained at *status quo* (=0.20), corresponding to catches in 2003 of less than 30 000 t**.

Relevant factors to be considered in management: In recent years TACs have not been restrictive, presumably because of low effort and a weak market. There has been substantial misreporting of catches into this area from the North Sea and Division VIa(S).

Catch forecast for 2003:
Basis: F(2002) =$\mathbf{F}_{sq}$=F(99-01), scaled = 0.197; Landings(2002) = 28; SSB(2002) = 139 .

F(2003 and 2004)	Basis	SSB(2003)	Landings(2003)	SSB(2004)
0.16	0.81$\mathbf{F}_{sq}$	146	25	152
0.20	$\mathbf{F}_{sq}$	143	30	145
0.24	1.22$\mathbf{F}_{sq}$	140	35	137
0.28	1.42$\mathbf{F}_{sq}$	136	40	130
0.32	1.62$\mathbf{F}_{sq}$	133	45	123

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The perception of the state of the stock and management advice has not changed.

Elaboration and special comment: There are three main fleets operating: 1) the Scottish inshore paired mid-water trawl fleet, that, together with the Northern Irish fleet, operates in the Minches and around the Isle of Barra in the southern part of the area; 2) the Scottish purse-seine fleet, which operates in the northern part of Division VIa; 3) the offshore (mainly Dutch and German freezer trawlers) fleet, which operates in the deeper waters near the edge of the continental shelf.

Misreporting of the catches has decreased in recent years. Better information of the catches has been obtained and biological sampling of catches has improved over the last 3-4 years. Satellite surveillance data has improved knowledge of vessel behaviour. The assessment in 2002 is less uncertain than in previous years reflecting the stability of the input data over the last two or three years. Estimates of F are reasonably reliable and suggest that F is well below candidate $\mathbf{F}_{pa}$. Estimates of SSB are more uncertain but suggest the stock is well above any candidate $\mathbf{B}_{pa}$. Analyses in recent years have consistently pointed towards the stock being exploited at a sustainable rate. Data from the acoustic surveys and the catch, coupled with a high proportion mature of both 2- and 3-ringers, indicate a considerable increase in spawning biomass due to a large recruitment of 2-ring herring into the population. Yield per recruit analysis with geometric mean recruitment suggests that an F of 0.28 would provide a yield of 35 000 t in the long term.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

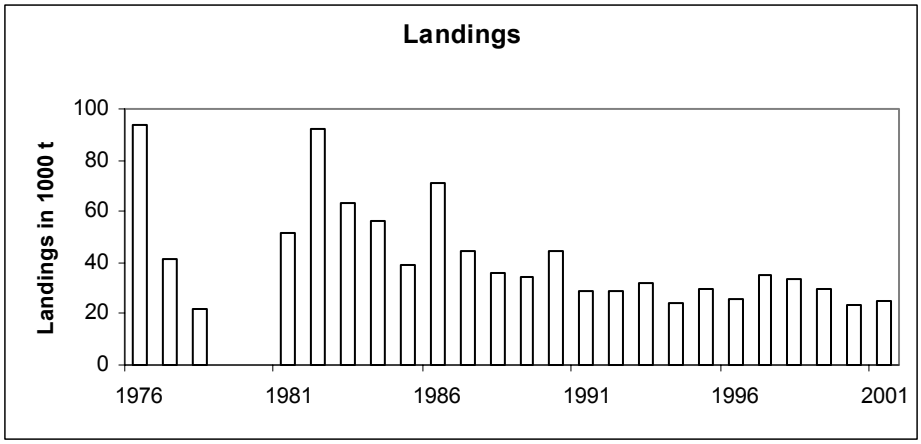
Yield and spawning biomass per Recruit F-reference points:

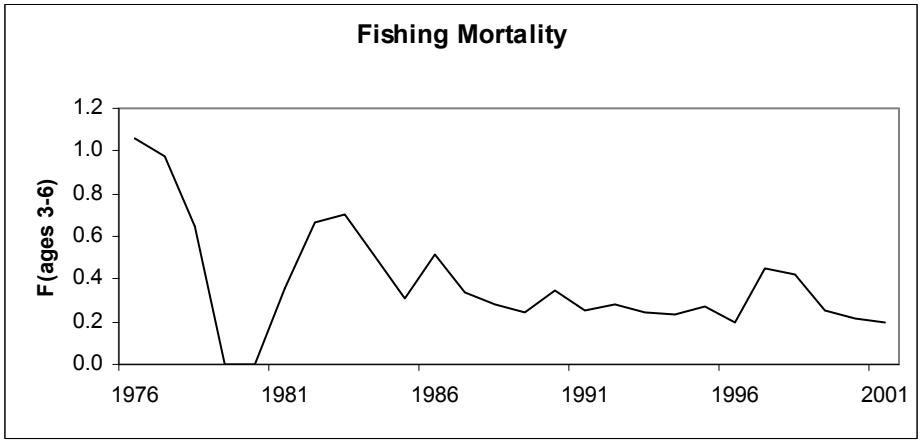
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.383	0.034	0.165
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.167	0.033	0.186
$\mathbf{F}_{med}$	0.264	0.036	0.130

Catch data (Tables 3.7.8.a.1-2):

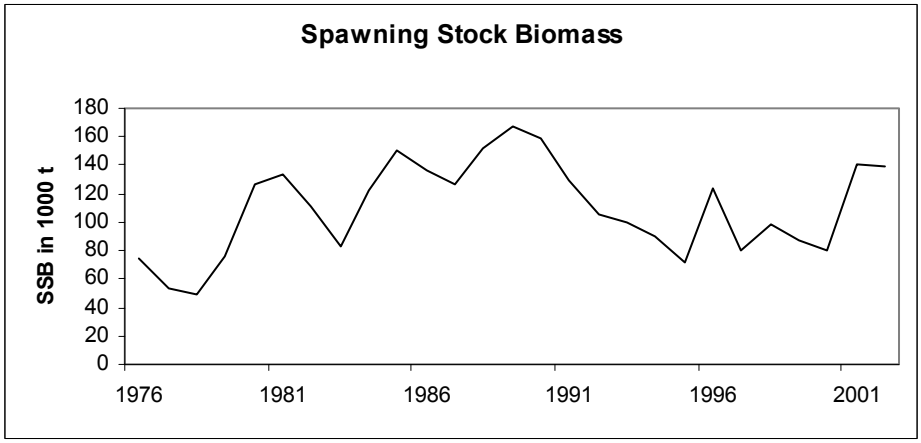
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch[1]
1987	Reduce F to $\mathbf{F}_{0.1}$/*status quo* F	38-55	49.7		44
1988	TAC	46	49.8		36
1989	TAC	58	58	1.6	34
1990	TAC	61	75	1.3	45
1991	TAC	57	62	1.2	29
1992	TAC	62	62	0.2	29
1993	Catch at *status quo* F	54-58	62	0.8	32
1994	Catch at *status quo* F	50-60	62	0.7	24
1995	No specific advice	60[2]	77		30
1996	No advice because of misreporting	-	83.57		26
1997	Catch at *status quo* F		83.57	0.1	33[3]
1998	Catch at *status quo* F	59	80.37	0.9	33
1999	Average catches, 1991–1996	28	68		30
2000	Average catches, 1991–1996	28	42		23
2001	Average catches, 1991–1999	30	36.36		25
2002	Average catches, 1991–1999	30	33		
2003	Catch at *status quo* F	30			

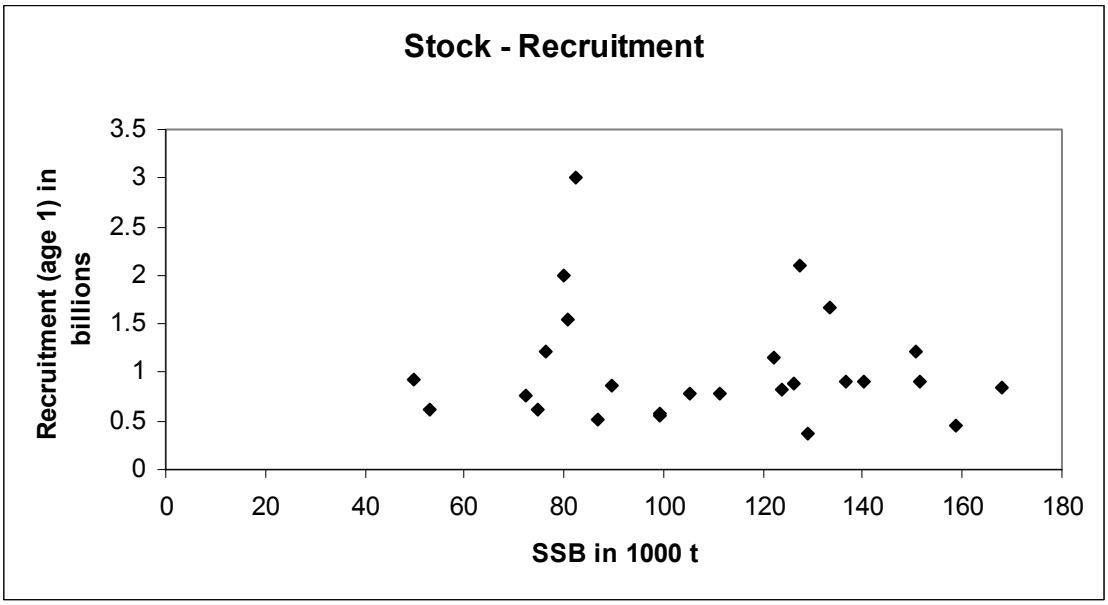
[1]Adjusted for misreporting. [2]Catch at *status quo* F. Weights in '000 t. [3]Revised down from 60 in 1999.


Landings
Landings in 1000 t
100
80
60
40
20
0
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 3-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1976
1981
1986
1991
1996
2001

Recruitment (age 1)
Recruitment in billions
3.5
3
2.5
2
1.5
1
0.5
0
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
180
160
140
120
100
80
60
40
20
0
1976
1981
1986
1991
1996
2001


Stock - Recruitment
Recruitment (age 1) in billions
3.5
3
2.5
2
1.5
1
0.5
0
0
20
40
60
80
100
120
140
160
180
SSB in 1000 t

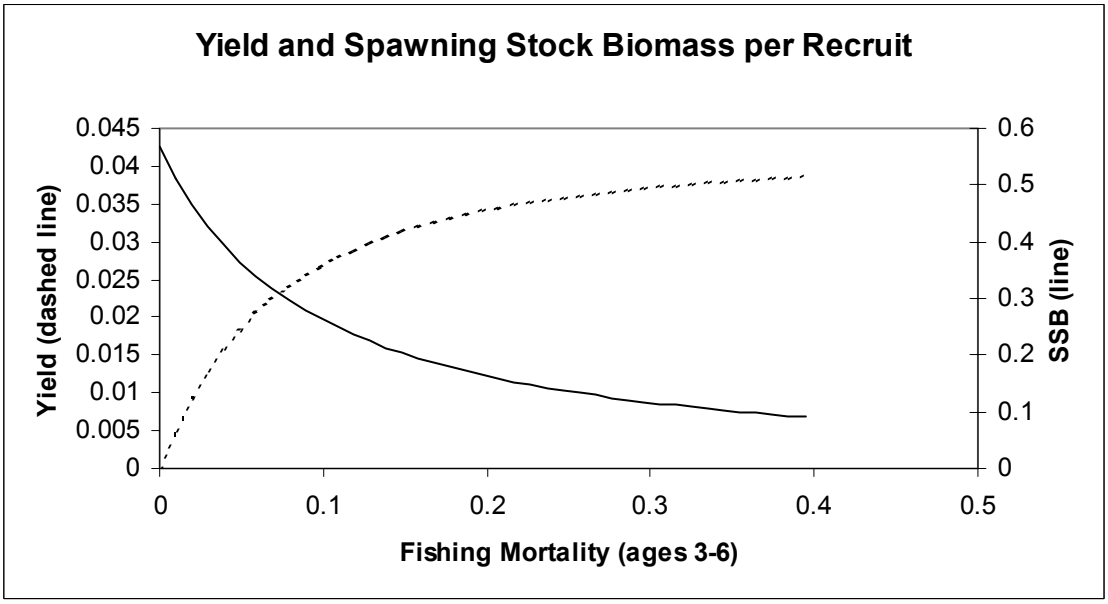

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
SSB (line)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)

Table 3.7.8.a.1 Nominal Landings Herring in VIa(N). Catch in tonnes by country, 1981—2001.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1981	1982	1983	1984	1985	1986	1987
Denmark	1580			96			
Faroes Islands		74	834	954	104	400	
France	1243	2069	1313		20	18	136
Germany	3029	8453	6283	5564	5937	2188	1711
Ireland						6000	6800
Netherlands	5602	11317	20200	7729	5500	5160	5212
Norway	3850	13018	7336	6669	4690	4799	4300
United Kingdom	31483	38471	31616	37554	28065	25294	26810
Unallocated	4633	18958	-4059	16588	-502	37840	18038
Discards							
Total	51420	92360	63523	75154	43814	81699	63007
Area-Misreported				-19142	-4672	-10935	-18647
WG Estimate	**51420**	**92360**	**63523**	**56012**	**39142**	**70764**	**44360**
Source (WG)	1983	1984	1985	1986	1987	1988	1989

Country	1988	1989	1990	1991	1992	1993	1994
Denmark							
Faroes Islands			326	482			
France	44	1342	1287	1168	119	818	274
Germany	1860	4290	7096	6450	5640	4693	5087
Ireland	6740	8000	10000	8000	7985	8236	7938
Netherlands	6131	5860	7693	7979	8000	6132	6093
Norway	456		1607	3318	2389	7447	8183
United Kingdom	26894	29874	38253	32628	32730	32602	30676
Unallocated	5229	2123	2397	-10597	-5485	-3753	-4287
Discards		1550	1300	1180	200		700
Total	47354	53039	69959	50608	51578	56175	54664
Area-Misreported	-11763	-19013	-25266	-22079	-22593	-24397	-30234
WG Estimate	**35591**	**34026**	**44693**	**28529**	**28985**	**31778**	**24430**
Source (WG)	1990	1991	1992	1993	1994	1995	1996

Country	1995	1996	1997	1998	1999	2000	2001
Denmark							
Faroes Islands							
France	3672	2297	3093	1903	463	870	760
Germany	3733	7836	8873	8253	6752	4615	3944
Ireland	3548	9721	1875	11199	7915	4841	4311
Netherlands	7808	9396	9873	8483	7244	4647	4534
Norway	4840	6223	4962	5317	2695		
United Kingdom	42661	46639	44273	42302	36446	22816	21862
Unallocated	-4541	-17753	-8015	-11748	-8155		
Discards			62	90			
Total	61271	64359	64995	65799	61514	37789	35411
Area-Misreported	-32146	-38254	-29766	-32446	-23623	-14626	-10437
WG Estimate	**29575**	**26105**	**35233***	**33353**	**29736**	**23163**	**24974**
Source (WG)	1997	1997	1998	1999	2000	2001	2002

*WG estimate for 1997 has been revised according to the Bayesian assessment (Working Group Report Section 5.1.3).

Table 3.7.8.a.2 Herring in Division VIa (North)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1976	613130	74572	93642	1.0573
1977	625870	53121	41341	0.9738
1978	918160	49875	22156	0.6493
1979	1218170	76139	60	0.0007
1980	891330	126025	306	0.0004
1981	1664130	133253	51420	0.3588
1982	772340	111116	92360	0.6683
1983	3009950	82530	63523	0.7036
1984	1150750	121989	56012	0.5096
1985	1206360	150687	39142	0.3086
1986	896180	136499	70764	0.5163
1987	2107780	127192	44360	0.3361
1988	908810	151468	35591	0.2776
1989	848170	167820	34026	0.2423
1990	444740	158549	44693	0.3423
1991	367420	129053	28529	0.2546
1992	781080	105165	28985	0.2791
1993	583740	99385	31778	0.2482
1994	860420	89704	24430	0.2307
1995	754010	72155	29575	0.2706
1996	817420	123623	26105	0.1977
1997	1546920	80829	35233	0.4478
1998	551720	99078	33353	0.4197
1999	516800	86602	29736	0.2576
2000	2004690	79944	23163	0.2157
2001	913633	140331	24974	0.1972
2002	913633	139181	0	0.1972
Average	1032865	109848	37232	0.3763

3.7.9 Norway pout in Division VIa (West of Scotland)

State of the stock/exploitation: There is no current information on which to evaluate the state of the stock.

Management objectives: There are no specific management objectives for the fisheries exploiting this stock.

Elaboration and special comment: The fishery is a small-mesh trawl fishery operated by Danish vessels.

Catches are highly variable. The only data available are official landings statistics. There is no information available on which to base scientific advice. By-catches in this fishery should be quantified and made available to ICES.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11-20 June 2002 (ICES CM 2003/ACFM:02).

Catch data (Tables 3.7.9.1-2):

Year	ICES advice	Official Landings
1987	No advice	38.3
1988	No advice	6.7
1989	No advice	28.2
1990	No advice	3.3
1991	No advice	4.3
1992	No advice	5.2
1993	No advice	7.3
1994	No advice	14.1
1995	No advice	24.4
1996	No advice	6.3
1997	No advice	9.6
1998	No advice	7.2
1999	No advice	4.6
2000	No advice	2.0
2001	No advice	3.2
2002	No advice	
2003	No advice	

Weights in '000 t.

Norway pout in Division VIa (West of Scotland)

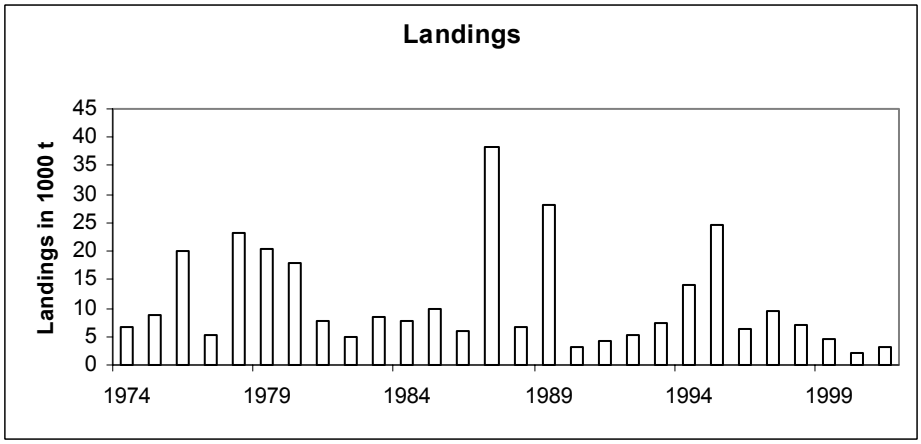


Table 3.7.9.1 Norway pout in Division VIa. Officially reported landings (tonnes).

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	5849	28180	3316	4348	5147	7338	14147	24431	6175	9549
Faroes	376	11	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	1	-	-
Netherlands	-	-	-	-	10	-	-	7	7	-
Norway	-	-	-	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-	-	-	-
UK (E+W)	-	-	-	-	1	-	1	-	-	-
UK (Scotland)	517	5	-	-	-	-	+	-	140	13
Total	6742	28196	3316	4348	5158	7338	14148	24439	6322	9562

Country	1998	1999	2000	2001
Denmark	7186	4624	2005	3214
Faroes	-	-	-	
Germany	-	-	-	
Netherlands	-	1	-	
Norway	-	-	-	
Poland	-	-	-	
UK (E+W)	-	-	-	
UK (Scotland)	-	-	-	
Total	7186	4625	2005	3214

Table 3.7.9.2 Norway pout in Division VIa (West of Scotland).

Year	Landings tonnes
1974	6721
1975	8655
1976	19933
1977	5206
1978	23250
1979	20502
1980	17870
1981	7757
1982	4911
1983	8325
1984	7794
1985	9697
1986	5832
1987	38267
1988	6742
1989	28196
1990	3316
1991	4348
1992	5158
1993	7338
1994	14148
1995	24439
1996	6322
1997	9562
1998	7186
1999	4625
2000	2005
2001	3214
Average	11119

3.7.10 Sandeel in Division VIa

State of the stock/exploitation: There is no current information on which to evaluate the state of the stock.

Management objectives: The current management regime uses a multi-annual TAC of 12 000 t per year with the fishery closed from 31 July. Access is limited to vessels with a track record. These arrangements took effect in 1998 for a period of three years and were renewed in 2001.

Relevant factors to be considered in management: Fishing grounds are close inshore and often adjacent to large colonies of seabirds for which the sandeel population is an important food supply, especially during the breeding season.

Elaboration and special comment: The stock was last assessed in 1996 and a new assessment has not been made. At that time it was considered to be within safe biological limits.

The justification of treating Division VIa as a management area for sandeel separately from Subarea IV and Division IIIa has been explored. The available information suggests that Division VIa should be considered as a separate stock unit for sandeel assessment.

Source of information: Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 11-20 June 2002, Copenhagen (ICES CM 2003/ACFM: 02).

Catch data (Table 3.7.10.1):

Year	ICES Advice	Agreed TAC	Official landings	ACFM catch
1987	No advice		14.5	14.5
1988	No advice		24.5	24.5
1989	No advice		18.8	18.8
1990	No advice		16.5	16.5
1991	No advice		8.5	8.5
1992	No advice		4.9	4.9
1993	No advice		6.2	6.2
1994	No advice		10.6	10.6
1995	No advice		7.1	7.1
1996	No advice		13.3	13.3
1997	No advice		12.7	12.7
1998	No advice	12	5.3	5.3
1999	No advice	12	2.6	2.6
2000	No advice	12	5.8	5.8
2001	No advice	12	0.3	0.3
2002	No advice	12		
2003	No advice			

Weights in '000 t.

Sandeel, Division VIa. Trends in effort and landings

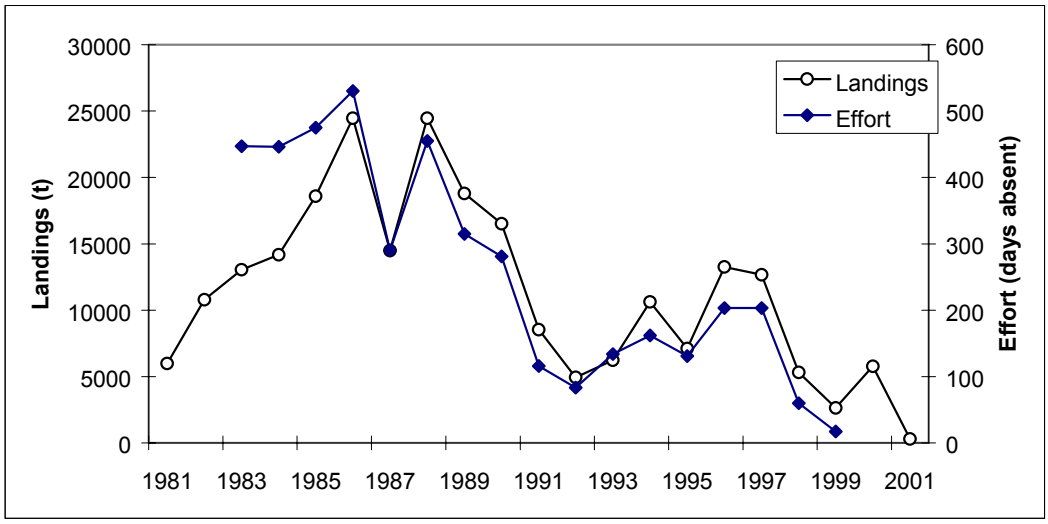


Table 3.7.10.1 Sandeel, Division VIa.
Landings (tonnes), 1981-2001, as officially reported to ICES.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Denmark	-	-	-	-	-	-	-	-	-	-
UK, Scotland	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515
Total	5972	10786	13051	14166	18586	24469	14479	24465	18785	16515

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Denmark	-	-	80	-	-	-	-	-	-	-
UK, Scotland	8532	4935	6156	10627	7111	13257	12679	5320	2627	-
United Kingdom										5771
Total	8532	4935	6236	10627	7111	13257	12679	5320	2627	5771

Country	2001*
Denmark	
UK, Scotland	
United Kingdom	295
Total	295

*Preliminary data for 2001

3.8 Stocks in the Irish Sea (Division VIIa)

3.8.1 Overview

Fisheries

The roundfish fisheries in the Irish Sea are conducted primarily by vessels from the bordering countries (UK and Ireland). The majority of vessels are otter trawlers fishing for cod, haddock, whiting, and plaice, with by-catches of anglerfish, hake, and sole. Since 2001, these trawlers have adopted mesh sizes of 100–120 mm, and other gear modifications, depending on the requirements of recent EU technical conservation regulations and national legislation. These measures are aimed at reducing the considerable rates of discarding of young fish, particularly haddock and whiting, that have been observed on vessels using 80-100 mm mesh trawls. Square mesh panels have been mandatory for UK otter trawlers since 1993, and for Irish trawlers since 1994. The number of Irish vessels operating in this region has declined in recent years. Some Irish vessels participate in a fishery for rays in the southern Irish Sea. Fishing effort in the England and Wales fleet by vessels longer than 12.2 m declined rapidly after 1989, and over 1992–1995 was about 40% of the effort reported in the 1980s, although it has increased slightly in recent years. Since the early 1980s there has been a development of semi-pelagic trawling for cod and whiting, and more recently haddock, predominantly by vessels from Northern Ireland. Some of these vessels switch between pelagic trawling and twin-trawl fishing for *Nephrops,* depending on fishing opportunities and market demands.

Although some of the otter trawlers also take part in the fishery for sole, there have been a growing number of beam trawlers, particularly from southern England and from Belgium, exploiting this stock. The most important by-catches of this fleet are plaice, rays, brill, turbot, and anglerfish. The fishing effort of the Belgian beam-trawl fleet varies according to the catch-rates of sole in the Irish Sea compared with other areas in which the fleet operates. Fishing effort peaked in the late 1980s following a series of strong year classes of sole, but is presently only about 60% of the peak value.

A fleet of vessels, primarily from Ireland and Northern Ireland, takes part in a targeted *Nephrops* fishery using 70 mm nets and 75 mm square-mesh panels. The larger vessels, including some that normally target roundfish, may use twin trawls with 80 mm mesh. Decommissioning has reduced the size of the Northern Ireland fleet in recent years. All boats take a considerable by-catch of whiting, much of which is discarded. Discards comprise mainly juveniles because the distribution of *Nephrops* coincides with the main nursery grounds for whiting. In this fishery as well as in the roundfish fishery in the western Irish Sea, the by-catch of haddock has increased substantially in recent years because of strong year classes in the 1990s, whilst landings of whiting have declined substantially.

The other gears employed to catch demersal species are gillnets and tangle nets, notably by inshore boats targeting cod, bass, grey mullet, sole, and plaice.

The main pelagic fishery in the Irish Sea is for herring. In recent years, it has been predominantly operated by pair trawlers from Northern Ireland. The size of this fleet has declined to a very low level in recent years.

State of the Stocks

The stock of cod is outside safe biological limits. The spawning biomass is below $\mathbf{B}_{lim}$ and fishing mortality above $\mathbf{F}_{lim}$. Fishing mortality on cod increased progressively throughout the 1980s and has been close to or above F_{lim} since 1987. As with stocks of cod to the west of Scotland and in the North Sea, the high rate of fishing mortality has caused a long-term decline in spawning stock biomass, slowed or reversed only temporarily by occasional strong year classes. During the early 1990s, the spawning stock declined rapidly and recruitment has since varied around a lower average than in earlier decades. Two of the weakest year classes on record were formed in 1997 and 1998 and caused the spawning stock biomass to decline sharply in 2000 to a historic low well below F_{lim}. The EU introduced an emergency spawning closure in 2000 to try to maximise the egg production from the severely depleted spawning stock (Council Regulation (EC) No. 304/2000) and subsequently established additional technical measures to improve the selectivity of towed gears (Council Regulation (EC) No. 2549/2000). The spawning closure covered known cod spawning grounds in the Irish Sea from 14 February to 30 April 2000. Within the closure it was prohibited to use any demersal trawl, seine, or similar towed net, any gillnet, trammel net, tangle net, or similar static net or any fishing gear incorporating hooks. Derogations were permitted for *Nephrops* trawlers within defined areas, and for certain beam trawls, and some limited experimental fisheries were permitted with observers to examine by-catch of cod in fisheries for haddock and flatfish. The closure was continued in 2001 and 2002, but was restricted to the western Irish Sea west of 4°50′W on the evidence that the abundance of adult cod in the eastern Irish Sea was too low to justify the restrictions on fishing for other species. Derogations for *Nephrops* fishing were continued in 2001 and 2002, and further experimental fishing for haddock and rays was permitted in 2001. Although certain areas of the *Nephrops* grounds close to the centres of cod spawning were closed to all fishing, *Nephrops* vessels with observers were permitted provided the nets were fitted with recently developed

inclined separator panels that had been shown to markedly reduce the by-catch of cod.

Landings of whiting in the main otter trawl fisheries, which now operate mostly in the western Irish Sea, have declined precipitously over time. Total international landings in 2000 and 2001 were below 1 000 t compared with to 10 000 t in the 1980s. Research surveys commencing in the early 1990s show this substantial decline to be a phenomenon mainly of the western Irish Sea, whereas average catch-rates of whiting above the commercial minimum landing size are not only higher in the eastern Irish Sea throughout this period, but show little trend over time. These different trends have prevented an analytical assessment of the state of the stock throughout the Irish Sea. The Irish Sea whiting fishery has been characterised by high levels of fishing mortality throughout the 1980s and 1990s. At such high fishing mortalities, the spawning stock contains few age classes and is vulnerable to poor recruitment. Discarding of whiting is considered a major problem in the *Nephrops* directed fishery, which continues to use 70 mm and 80 mm meshes. The increases in mesh size to 100 mm or more in the roundfish fisheries, required under recent EU and national legislation, should reduce discard rates in these fisheries.

A notable phenomenon in the Irish Sea, and also in the Celtic Sea, during the 1990s has been a growth in the stocks of haddock. Very strong 1994 and 1996 year classes caused a substantial increase in stock size in the Irish Sea leading to the development of targeted haddock fisheries using pelagic and demersal trawls. The fish are confined mainly to the western Irish Sea where established roundfish and *Nephrops* fisheries take place. This concentration of the stock may be responsible for the very high rates of fishing mortality observed in the 1990s, three times higher than the $\mathbf{F_{pa}}$. Due to the TAC arrangements for Subarea VII, some national quotas proved limiting in the 1990s, causing substantial misreporting as the stock and fishery expanded. To alleviate this problem, a separate TAC allocation for Irish Sea haddock has operated since 1999. Substantial discarding of small haddock has been observed in the otter trawl fisheries. The stock should benefit from the recent increases in mesh size in the roundfish fisheries. Due to the poor quality of landings data for this stock, and the absence of complete data on discards, the recent trends in abundance and fishing mortality are relatively poorly defined, although there is evidence that fishing mortality may have reduced in 2000 and 2001, although remaining above $\mathbf{F_{pa}}$. The biomass is expected to remain high in the short term due to relatively strong recruitment since 1999.

The stock of plaice is within safe biological limits. The landings declined in the 1990s, and in 1998 were close to the lowest recorded. This resulted from a combination of declining fishing effort and a succession of below-average year classes recruited since 1987. The spawning stock is currently above $\mathbf{B_{pa}}$ and the fishing mortality since 1998 has been below $\mathbf{F_{pa}}$. The stock is expected to increase and will have a low probability of falling outside safe biological limits in the medium term.

The sole stock is within safe biological limits. It has benefited several times since 1970 from very strong year classes, and as a consequence has sustained fishing mortalities that are considered high for a sole stock. In 2001, fishing mortality was below $\mathbf{F_{pa}}$ and SSB above $\mathbf{B_{pa}}$. The frequency of strong year classes has decreased since the mid-1980s, leading to a decline in spawning stock to a historical low in 1996.

The stocks of *Nephrops* in the Irish Sea are considered to be fully exploited. There is some concern that fishing mortality may rise from the current high level if the use of twin trawls expands. Account should also be taken of the impact of this fishery on the stocks of protected species. There has been no assessment in recent years of the effects on *Nephrops* of predation by cod, but the low abundance of the latter has probably reduced its impact.

The stock of Irish Sea herring is presently subject to low fishing mortality exerted by a small fleet of trawlers from Northern Ireland. The stock has recovered from a collapse that followed high fishing mortalities in the 1970s. However, its present state is uncertain because the series of survey estimates remains too short to establish the recent trends in biomass.

3.8.2 Cod in Division VIIa (Irish Sea)

State of stock/exploitation: The stock remains outside of safe biological limits. Fishing mortality in 2001 was estimated to be above $\mathbf{F}_{lim}$ and SSB in 2002 below $\mathbf{B}_{lim}$. Fishing mortality has increased progressively over time and has been above $\mathbf{F}_{pa}$ since 1980 and close to, or above $\mathbf{F}_{lim}$ since 1987. A general decline in SSB since the early 1980s was reversed temporarily only by the strong 1986 year class, and, following two weak year classes in 1997 and 1998, SSB reached a historic low in 2000 at less than 50% of $\mathbf{B}_{lim}$. SSB has increased slightly since 2000 due to reduced influence of the weak 1997 and 1998 year classes. The probability of good recruitment appears to have been reduced at the SSBs observed since 1990, and the five weakest year classes on record were produced since 1992.

Management objectives: To rebuild the SSB of the stock, a spawning closure was introduced in 2000 for ten weeks from mid-February to maximize the reproductive output of the stock (EU Regulations 304/2000 and 2549/2000). The measures were revised in 2001 and 2002, involving a continued, but smaller spawning ground closure, coupled with changes in net design to improve selectivity.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 000 t.	$\mathbf{B}_{pa}$ be set at 10 000 t. This is the previously agreed MBAL and affords a high probability of maintaining the SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of assessments. Below this value the probability of below-average recruitment increases.
$\mathbf{F}_{lim}$ is 1.0. This is the fishing mortality above which there is a reduced probability that the stock can sustain itself.	$\mathbf{F}_{pa}$ be set at 0.72. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$. Fishing mortalities above $\mathbf{F}_{pa}$ have been associated with observed stock decline.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = Previous MBAL with signs of reduced recruitment
$\mathbf{F}_{lim} = \mathbf{F}_{med}$	$\mathbf{F}_{pa} = \mathbf{F}_{med} * 0.72$

Advice on management: Given the very low stock size, the recent poor recruitments, and continued high fishing mortality despite management efforts to promote stock recovery, ICES recommends a closure of all fisheries for cod as a targeted species or by-catch. In fisheries where cod comprises solely an incidental catch there should be stringent restrictions on the catch and discard rates of cod, with effective monitoring of compliance with those restrictions.

These and other measures that may be implemented to promote stock recovery should be kept in place until there is clear evidence of the recovery of the stock to a size associated with a reasonable probability of good recruitment and there is evidence that productivity has improved. The current SSB is so far below historic stock sizes that both the biological dynamics of the stock and the operations of the fisheries are unknown, and therefore historic experience and data are not considered a reliable basis for medium-term forecasts of stock dynamics under various rebuilding scenarios.

Relevant factors to be considered in management: Although large short-term losses will be incurred in many Irish Sea fisheries, the advised measures are required if the cod stock is to reach a level where it can regain historic productivity. The advice will likely result in greatly reduced harvesting of other stocks where the fisheries take cod as part of a mixed species fisheries, particularly haddock and *Nephrops*. However, the current state of the cod stock, and the failure of past measures to bring fishing mortality down to rates that allow rebuilding, mean that more stringent action is required.

Time and area closures for particular fisheries may be a tool in rebuilding this stock, and their effect can be considered in evaluating harvest opportunities for other species.

Diversion of effort from the cod spawning grounds to other vulnerable stocks should also be prevented. It is important that management action being taken to reduce fishing mortality on the adult component of the stock is not compensated for by an increase in fishing mortality on the juveniles.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for other species down to near zero, then these programs could be considered in management of such fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent

observer coverage, or other fully transparent method for ensuring their catches of cod are fully and credibly reported.

Catch forecast for 2003:
Basis: F(2002) = F(2001) = 1.08; Landings (2002) = 4.4; SSB(2003) = 4.6.

F (2003) Onwards	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0	0.0* $\mathbf{F}_{sq}$	0	0	10.6
0.22	0.2*$\mathbf{F}_{sq}$	1.2	1.2	8.9
0.43	0.4*$\mathbf{F}_{sq}$	2.2	2.2	7.4
0.57	0.5*$\mathbf{F}_{sq}$ 45% SSB increase	2.7	2.7	6.6
0.65	0.6*$\mathbf{F}_{sq}$	3.0	3.0	6.2
0.72	$\mathbf{F}_{pa}$; 30% SSB increase	3.2	3.2	5.9
0.86	0.8*$\mathbf{F}_{sq}$	3.6	3.6	5.3
1.08	$\mathbf{F}_{sq}$	4.2	4.2	4.5

Weights in '000 t.
Shaded scenarios are considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The estimate of mean fishing mortality at ages 2 to 4 given by last year's assessment was influenced by a very high value at age 2 (1998 year class), and a very low value at age 4 (1996 year class). The former year class is by far the weakest recorded, making estimates of fishing mortality very unreliable. The current assessment gives a more even distribution of fishing mortality across these age groups, although the estimate for the 1998 year class remains relatively high. The estimate of fishing mortality in 2000 is 12% higher and SSB in 2001 40% lower in this year's assessment compared to last year's assessment. The basis for the advice is the same as last year.

Elaboration and special comment: The cod fishery was traditionally carried out by otter trawlers targeting spawning cod in spring and juvenile cod in autumn and winter. Activities of these vessels have decreased, whilst a fishery for cod and haddock using large pelagic trawls increased substantially during the 1990s. In recent years the pelagic fishery has also targeted cod during the summer. Cod are also taken as a by-catch in fisheries for *Nephrops*, plaice, sole, and rays. The closure of the spawning grounds during spring from 2000 onwards has mainly affected pelagic trawlers and whitefish otter trawlers, causing displacement of effort into surrounding regions and in some cases switching to *Nephrops* trawl gear to take advantage of the derogation for *Nephrops* fishing within the closure. Given the precision of the assessment and the tendency to underestimate F in the final year, it is not yet possible to determine if the emergency measures from 2000 onwards have been successful in reducing fishing mortality and improving SSB.

Analytical assessment is based on landings-at-age and recruitment indices from surveys in Division VIIa. Estimates of mis-reported landings are included from 1991 onwards. There has been a tendency for the fishing mortality estimates for adult cod in the final year of the assessment to be revised upwards, and SSB revised downwards, when new catch and survey data for the following year are added.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

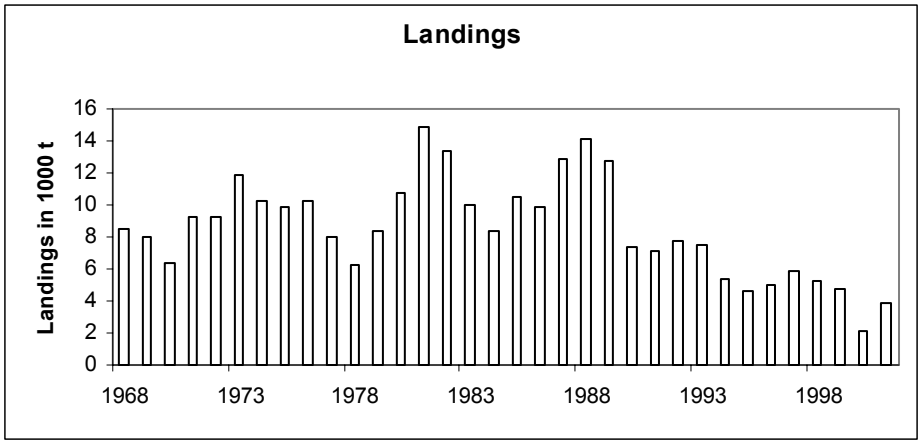
Yield and spawning biomass per Recruit F-reference points:

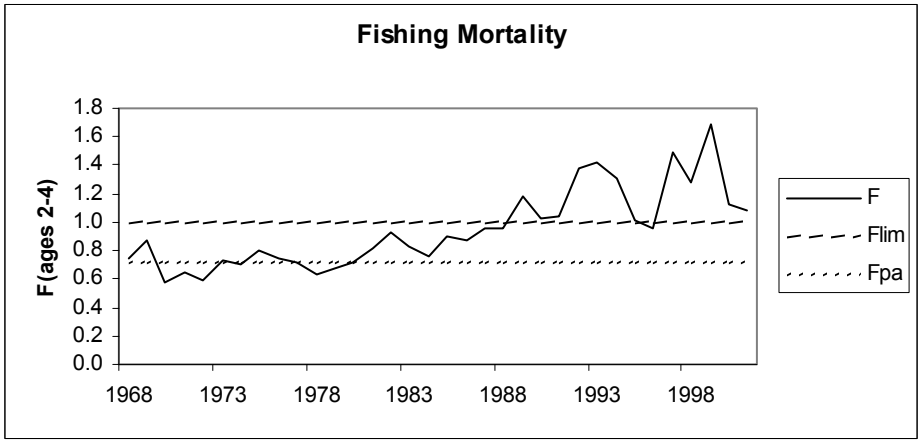
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average Current	1.296	1.291	1.197
$\mathbf{F}_{max}$	0.301	1.750	5.976
$\mathbf{F}_{0.1}$	0.165	1.618	9.633
$\mathbf{F}_{med}$	1.005	1.393	1.623

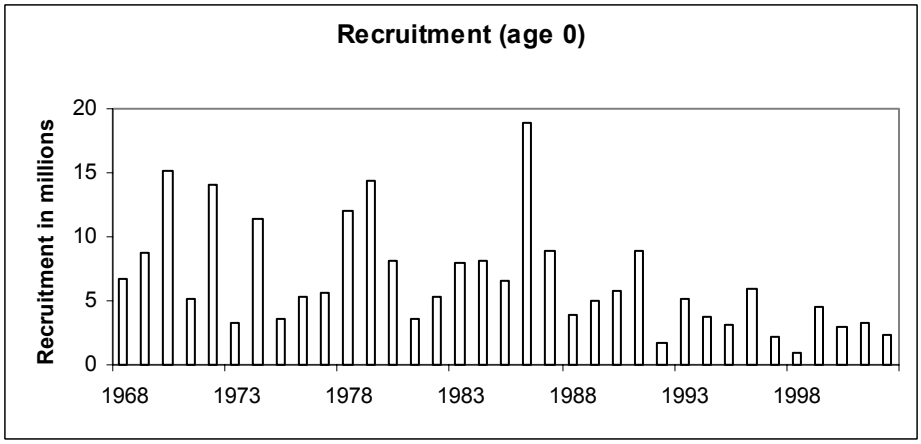
Catch data (Tables 3.8.2.1–2):

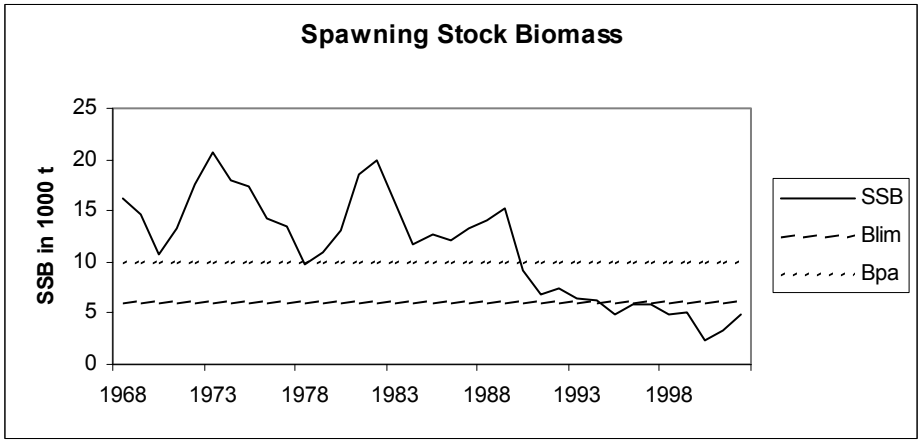
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	No increase in F; interaction with *Nephrops*	10.3	15.0	13.2	12.9
1988	No increase in F; interaction with *Nephrops*	10.1	15.0	15.8	14.2
1989	No increase in F	13.4	15.0	11.3[1]	12.8
1990	F at $\mathbf{F}_{med}$; TAC	15.3	15.3	9.9[1]	7.4
1991	Stop SSB decline; TAC	6.0	10.0	7.0[1]	7.1[2]
1992	20% of F(90) ~ 10 000 t	10.0	10.0	7.4	7.7[2]
1993	$\mathbf{F}_{med}$ ~ 10 200 t	10.2	11.0	5.9	7.6[2]
1994	60% reduction in F	3.7	6.2	4.5	5.4[2]
1995	50% reduction in F	3.9	5.8	4.5	4.6[2]
1996	30% reduction in F	5.4	6.2	5.30	4.96[2]
1997	30% reduction in F	5.9	6.2	4.44	5.86[2]
1998	No increase in F	6.2	7.1	4.96	5.31[2]
1999	Reduce F below $\mathbf{F}_{pa}$	4.9	5.5	2.96	4.69[2]
2000	Lowest possible F	0	2.1	1.43[3]	2.18[2]
2001	Lowest possible F	0	2.1	1.07[3]	3.88[2]
2002	Establish rebuilding plan	-	3.2		
2003	Closure of all fisheries for cod	-			

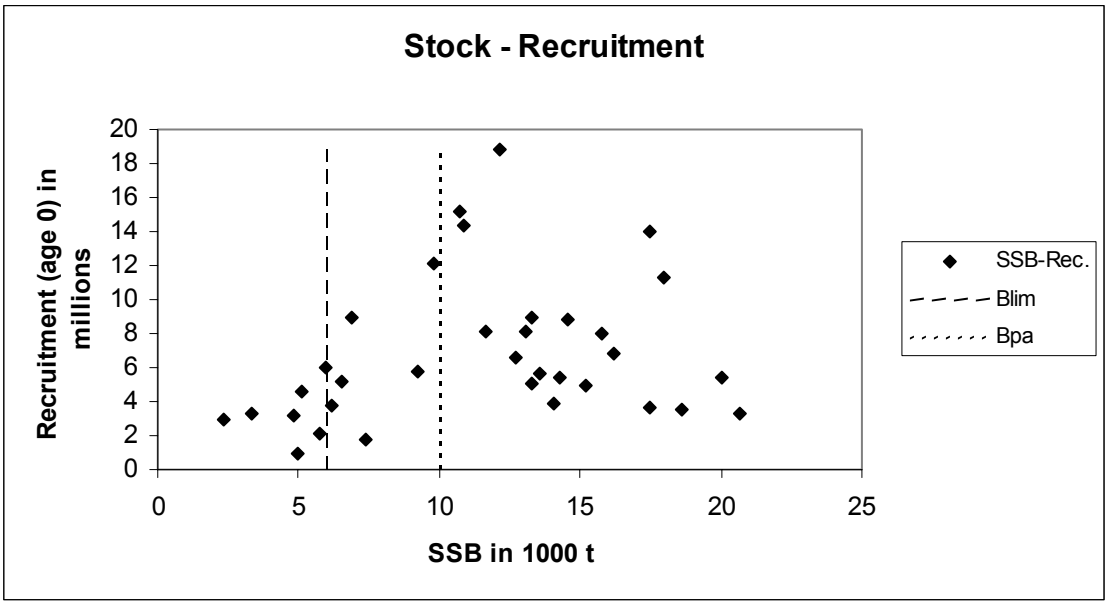
[1]Preliminary. [2]Including estimates of mis-reporting. [3]Incomplete data. Weights in '000 t.

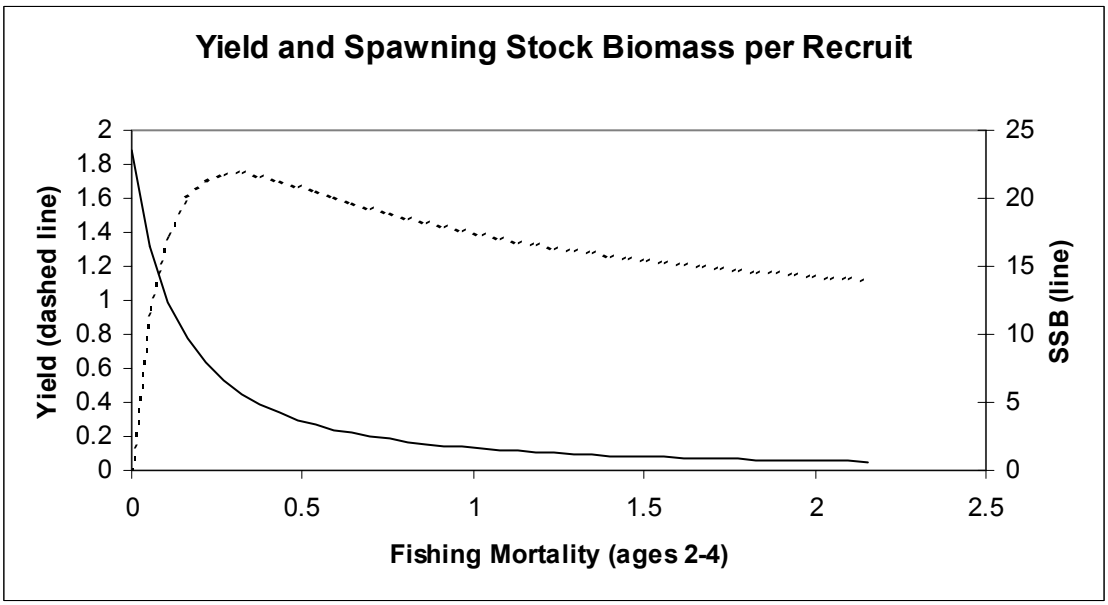

Landings
Landings in 1000 t
0
2
4
6
8
10
12
14
16
1968
1973
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-4)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1968
1973
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 0)
Recruitment in millions
0
5
10
15
20
1968
1973
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
1968
1973
1978
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-4)

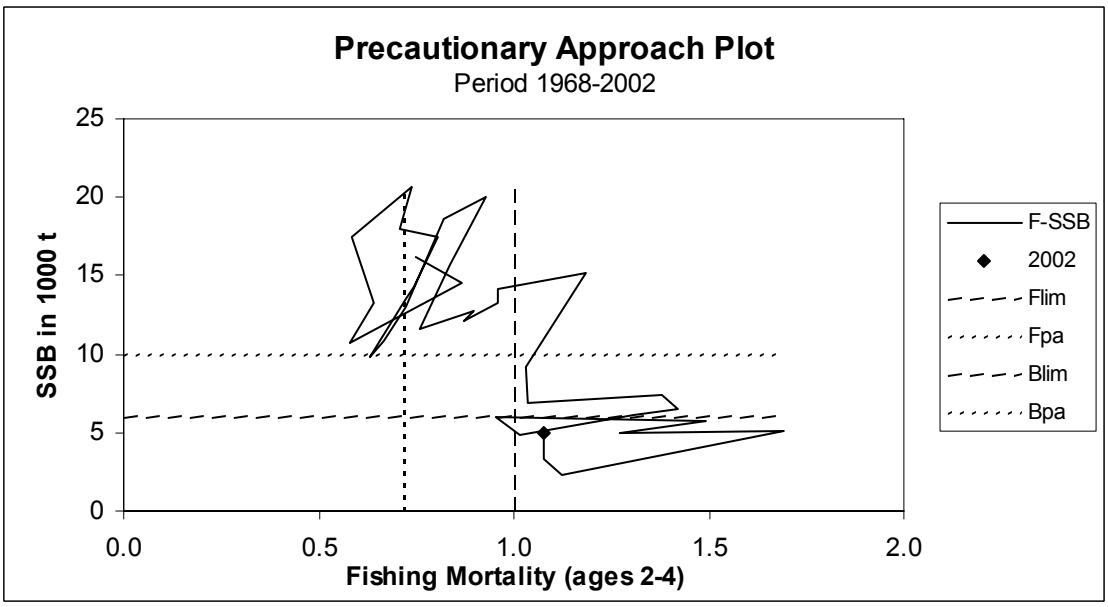

Precautionary Approach Plot
Period 1968-2002
SSB in 1000 t
Fishing Mortality (ages 2-4)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.8.2.1 Nominal catch (t) of COD in Division VIIa as officially reported to ICES, and Working Group estimates of annual landings.

Country	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	222	344	269	467	310	78	174	169
France	1,480	1,717	2,406	352[1]	201[1]	320[1]	916	686
Ireland	3,991	5,017	5,821	3,656	2,800	2,364	2,260	1,328
Netherlands	-	-	-	-	-	-	-	-
UK (England & Wales)[3]	847	1,922	2,667	6,320	4,752	3,562	3,529	3,244
UK (Isle of Man)	80	44	118	39	48	175	129	57
UK (N. Ireland)	2,992	3,565	4,080	…	…	…	…	…
UK (Scotland)	446	574	472	465	1,767	515	393	453
Total	10,058	13,183	15,833	11,299	9,878	7,014	7,401	5,937
Unallocated	-206	-289	-1,665	1,452	-2,499	81	334	1,618
Total figures used by Working Group for stock assessment	9,852	12,894	14,168	12,751	7,379	7,095	7,735	7,555

Country	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	129	187	142	183	316	150	60	283
France	208	166	148	268	269[1]	85[1]	66[1]	74
Ireland	1,506	1,414	2,476	1,492	1,739	966	n/a	714
Netherlands	-	-	25	29	20	5	1	-[1]
UK (England & Wales)[3]	2,274	2,330	2,359	2,370	2,517	1,665	799	n/a
UK (Isle of Man)	26	22	27	19	34	9	n/a	n/a
UK (N. Ireland)[3]	…	…	…	…	…	…	…	…
UK (Scotland)	326	414	126	80	67	80	38	n/a
Total	4,469	4,533	5,303	4,441	4,962	2,960	1,430	1,071
Unallocated	933	54	-339	1,418	348	1,734	749	2,804
Total figures used by Working Group for stock assessment	5,402	4,587	4,964	5,859	5,310[2]	4,694[2]	2,179[2]	3,875

[1]Preliminary.
[2]Revised.
[3]1989–2000 N. Ireland included with England and Wales.
n/a = not available.

Table 3.8.2.2 Cod in Division VIIa (Irish Sea)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1968	6790	16226	8541	0.7487
1969	8803	14570	7991	0.8688
1970	15209	10719	6426	0.5783
1971	5085	13313	9246	0.6432
1972	14035	17507	9234	0.5858
1973	3285	20667	11819	0.7367
1974	11350	17998	10251	0.7067
1975	3615	17464	9863	0.8035
1976	5355	14270	10247	0.7433
1977	5593	13553	8054	0.7237
1978	12093	9801	6271	0.6304
1979	14374	10897	8371	0.6686
1980	8074	13056	10776	0.7238
1981	3578	18573	14907	0.8192
1982	5364	20014	13381	0.9278
1983	7951	15741	10015	0.8345
1984	8071	11652	8383	0.7593
1985	6548	12716	10483	0.8970
1986	18860	12143	9852	0.8704
1987	8901	13303	12894	0.9583
1988	3864	14096	14168	0.9593
1989	4987	15215	12751	1.1871
1990	5738	9226	7379	1.0319
1991	8928	6889	7095	1.0336
1992	1774	7383	7735	1.3815
1993	5169	6524	7555	1.4213
1994	3781	6160	5402	1.3091
1995	3181	4849	4587	1.0178
1996	5945	5945	4964	0.9521
1997	2163	5781	5859	1.4948
1998	994	4973	5310	1.2737
1999	4601	5106	4694	1.6898
2000	2932	2312	2179	1.1207
2001	3295	3364	3875	1.0762
2002	2396	4932		
Average	6648	11341	8546	0.9501

3.8.3 Haddock in Division VIIa (Irish Sea)

State of stock/exploitation: Historical perspectives of SSB, fishing mortality, and recruitment are not well known for this stock, but fishing mortality appears to be high. Occasional pulses of strong recruitment have in the past resulted in opportunistic fisheries lasting only for relatively short periods. The relatively longer productivity in the 1990s indicates that a more sustained population exists.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
B_{lim} not defined	B_{pa} not set
F_{lim} not defined	F_{pa} be set at 0.5

Technical basis:

B_{lim} = not defined	B_{pa} = not set
F_{lim} = not defined	F_{pa} adopted by analogy with other haddock stocks

Advice on management: Since haddock is mostly taken in demersal fisheries with cod and in a *Nephrops* directed fishery, the advice for cod determines the advice for haddock. Unless ways to harvest haddock without by-catch or discards of cod can be demonstrated, fishing for haddock should not be permitted.

Relevant factors to be considered in management: On the basis of the status of the haddock stock alone, ICES would recommend that catches in 2003 be no higher than 2000 t, the average of the last two years.

The extent to which the cod-haddock fisheries are linked has not been quantified. This linkage is not one-to-one, but it is evident and probably variable. It is possible for fishing vessels to increase their targeting of individual species within the demersal fish complex, but there will always be a significant by-catch of other roundfish. Fisheries targeting *Nephrops* may take a by-catch of haddock. In this case ICES notes that haddock may continue to be caught subject to existing EU regulations applying to *Nephrops* fisheries and providing the catch of cod complies with the advice on cod.

ICES notes that this advice presents a strong incentive to fisheries to avoid catching cod. If industry-initiated programs can be demonstrated to bring their catch rates of cod in fisheries for haddock down to near zero, then these programs could be considered in management of these fisheries. Industry-initiated programs to pursue such incentives should be encouraged, but must include a high rate of independent observer coverage, or other fully transparent method for ensuring that their catches of cod are fully and credibly reported.

The haddock stock is mainly confined to the western Irish Sea where important mixed-species fisheries for *Nephrops* and cod take place. A directed fishery has developed for haddock during the 1990s. Large catches of haddock are taken in the *Nephrops* fishery during periods of high haddock abundance. A directed fishery for mature haddock in spring, using pelagic trawls and whitefish otter trawls, has been curtailed since 2000 by the cod spawning closure. Fishing effort of these vessels has been redirected to surrounding regions, and some vessels switched to using *Nephrops* trawls to take advantage of the derogation for *Nephrops* fishing in the closure.

A TAC is set for haddock for the whole of Subareas VII, VIII, IX, and X. The present high availability of haddock in Division VIIa has resulted in substantial mis-reporting and/or discarding due to large by-catches of haddock taken by fleets with restrictive allocations available to them. To alleviate this problem, a separate TAC allocation has been made for Division VIIa since 1999.

The haddock stock in the Irish Sea could be sustained if recent year classes indicated by surveys are allowed to realise their potential for growth, and contribute to SSB. This would only occur if fishing mortality is reduced substantially from the high values recorded in the 1990s.

A study of discards from the midwater trawl, single *Nephrops* and twin trawl fleet indicates that almost all fish younger than 2 years old and around 50% of the fish at age 2 are discarded.

The current directed fishery for haddock in the Irish Sea is likely to generate by-catches of cod in the same area. Experimental haddock fisheries with observers were permitted inside the cod closure by the European Commission in spring 2000 and 2001, and yielded by-catches of cod of approximately 15 - 20% by weight.

Comparison with previous assessment and advice: The advice last year was based on an analytical assessment and forecast. This assessment has been considered very unreliable because of sensitivity towards various model settings. The current advice is based on the average catch of the last two years.

Elaboration and special comment: Haddock production in the Irish Sea has been irregular, with one productive period in the late 1950s, two in the early 1970s, and a recent one in the latter half of the 1990s. Production in the 1990s has exceeded that in the earlier periods and also coincided with increased abundance of haddock in the Celtic Sea. Previous productive periods, other than the recent one, are believed to have coincided with strong year classes in Subarea VI. Whilst the 1994 year class was relatively strong in Divisions VIa, VIIa, and VIIb-k, patterns of recruitment in subsequent years have differed markedly between areas. Growth rates of individual haddock also differ between areas, and haddock grow fastest in the Irish Sea.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

Catch data (Tables 3.8.3.1–2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings[2]	ACFM landings
1987	Not dealt with			1.287	1.287
1988	Not dealt with			0.747	0.747
1989	Not dealt with			0.560	0.560
1990	Not dealt with			0.582	0.582
1991	Not dealt with			0.616	0.616
1992	Not dealt with			0.656[6]	0.703
1993	Not dealt with			0.730	0.813
1994	Not dealt with			0.681	1.043
1995	Not dealt with		6[1]	0.841	1.753
1996	No advice		7[1]	1.453	3.023
1997	Means of setting catch limits required		14[1]	1.925	3.391
1998	Catch limit for VIIa	3.0	20[1]	3.015	4.902
1999	No increase in F; Catch limit for VIIa	7.0	4.99[2]	2.370	4.119
2000	Reduce F below F_{pa}	<2.8	3.4[2]	2.398[3]	1.380
2001	Reduce F below F_{pa}	<1.71	2.7[2]	2.102[3]	2.498
2002	Reduce F below F_{pa}	<1.20	1.3[2]		
2003	No cod catches	-			

[1] precautionary TAC for VII, VIII, IX, X. [2] VIIa allocation of precautionary TAC. [3]Incomplete data.

Haddock in Division VIIa (Irish Sea)

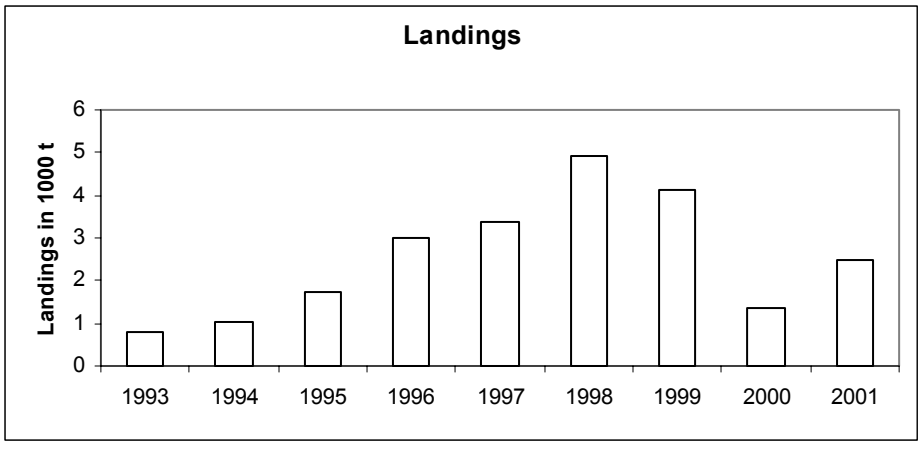


Table 3.8.3.1 Nominal landings (t) of HADDOCK in Division VIIa, 1984–2001, as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991
Belgium	3	4	5	10	12	4	4	1
France	38	31	39	50	47	n/a	n/a	n/a
Ireland	199	341	275	797	363	215	80	254
Netherlands	-	-	-	-	-	-	-	-
UK (England & Wales)[1]	29	28	22	41	74	252	177	204
UK (Isle of Man)	2	5	4	3	3	3	5	14
UK (N. Ireland)	38	215	358	230	196	…	…	…
UK (Scotland)	78	104	23	156	52	86	316	143
Total	387	728	726	1,287	747	560	582	616
Unallocated	0	0	0	0	0	0	0	0
Total figures used by Working Group	387	728	726	1,287	747	560	582	616

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000
Belgium	8	18	22	32	34	55	104	53	22
France	26	41	22	58	105	74	86	n/a	n/a
Ireland	251	252	246	320	798	1,005	1,699	759	1,238
Netherlands	-	-	-	-	1	14	10	5	2
UK (England & Wales)[1]	244	260	301	294	463	717	1,023	1,479	1,061
UK (Isle of Man)	13	19	24	27	38	9	13	7	19
UK (N. Ireland)	…	…	…	…	…	…	…	…	…
UK (Scotland)	114	140	66	110	14	51	80	67	56
United Kingdom									
Total	656	730	681	841	1,453	1,925	3,015	2,370	2,398
Unallocated	47	83	362	912	1,570	1,466	1,887	1,749	-1,018
Total figures used by Working Group	703	813	1,043	1,753	3,023	3,391	4,902	4,119	1,380

Country	2001
Belgium	68
France	183*
Ireland	528*
Netherlands	
UK (England & Wales)[1]	
UK (Isle of Man)	
UK (N. Ireland)	
UK (Scotland)	
United Kingdom	1,323*
Total	2,102
Unallocated	396
Total figures used by Working Group	2,498

*Preliminary.
[1]1989–2000 Northern Ireland included with England and Wales.
n/a = not available.

3.8.4 Whiting in Division VIIa (Irish Sea)

State of stock/exploitation: The current state of the stock in the Irish Sea as a whole is poorly defined. There has been a severe decline in abundance in the western Irish Sea where the bulk of the catch is taken, and fishing mortality is very high in this region. Historical estimates of fishing mortality have been above $\mathbf{F}_{pa}$. Catches have declined progressively since the early 1980s, and the proportion discarded has increased. Estimates for 2000 and 2001 indicate that 60 - 70% of the catch was discarded.

Management objectives: No explicit management objectives are set for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$ and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 000 t, the lowest observed spawning stock biomass as estimated in previous assessment. There is no clear evidence of reduced recruitment at the lowest observed SSB's.	$\mathbf{B}_{pa}$ be set at 7 000 t, which is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
$\mathbf{F}_{lim}$ is 0.95. This is the fishing mortality estimated to lead to a potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.65. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and is consistent with a high probability of remaining above $\mathbf{B}_{pa}$ in the long run.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} = \mathbf{B}_{loss} * 1.4$
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ as estimated in an earlier assessment	$\mathbf{F}_{pa} = 0.65$, implies an equilibrium SSB of 10.6 kt, and a relatively low probability of SSB < $\mathbf{B}_{pa}$ (= 7 kt), and is within the range of historic Fs.

Advice on management: ICES recommends that fishing mortality on whiting should be reduced to as close to zero as possible in 2003. A rebuilding plan, including provisions to effectively reduce directed harvest, discards, and by-catch in other fisheries should be developed and implemented in order to rebuild SSB.

Relevant factors to be considered in management: A *Nephrops*-directed fishery operates on the main whiting nursery areas in the Irish Sea. Recent levels of discards in this *Nephrops*-directed fishery during the late 1990s have been at around 43% by weight of the estimated catch of whiting in this fishery, rising to over 60% in 2000 and 2001. Discard rates have increased because of the scarcity of fish above minimum landing size and the low value of the catch. This means that the fishing mortality on whiting cannot be effectively controlled by restrictions on landings alone, but would also require measures to reduce discards. Square mesh panels have been mandatory for all UK trawlers (excluding beam trawlers) in the Irish Sea since 1993, and for Irish trawlers since 1994. While the effects of this technical measure have not been formally evaluated, the *Nephrops* fishery still generates substantial quantities of whiting discards, indicating that further measures are necessary. Management measures for the *Nephrops* fishery should also take into account the effect on whiting. Increased use of 100 mm mesh size in whitefish trawlers since 2001 should also improve selectivity for whiting.

Medium- and long-term projections: No medium-term projections have been carried out because of the uncertainties in the assessment.

Comparison with previous assessment and advice: The advice last year was based on an analytical assessment and forecast. This assessment has been considered very unreliable because of conflicting signals between survey and commercial catch data, and is now considered inadequate for making an analytical forecast.

Elaboration and special comment: Whiting is taken mainly as a by-catch in mixed-species otter trawl fisheries for *Nephrops*, cod, and other demersal species, and to a lesser extent in the pelagic fishery for cod and haddock.

Uncertainties in the assessment are related to different trends in survey indices from the Eastern and Western Irish Sea. Survey catch-rates of whiting above the MLS of 27 cm have declined continuously in the western region since 1992, reflecting the rapid decline in commercial landings, whilst survey catch-rates in the eastern region are much higher and show little or no trend over time. The commercial fishery has become more concentrated in the western region in recent years as the English and Welsh fleets, which operate mainly in the east, have declined over time. Reconciling the conflicting signals in the assessment will necessitate understanding

dispersal of whiting between the two areas. It is not known if the collapse of the population of adult whiting in the western Irish Sea represents a localised depletion of a more broadly distributed stock, or the depletion of a local sub-population.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

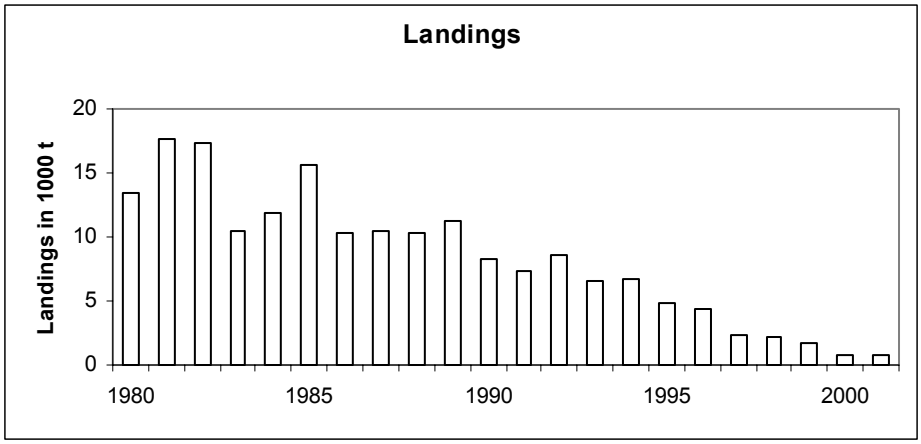
Yield and spawning biomass per Recruit F-reference points:

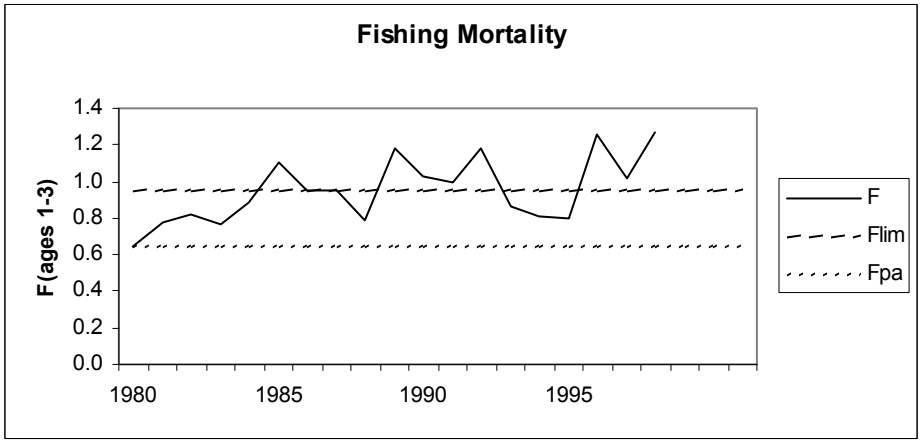
	Fish Mort Ages 1-3	Yield/R	SSB/R
Average Current	0.908	0.067	0.321
$\mathbf{F}_{max}$	0.252	0.068	0.280
$\mathbf{F}_{0.1}$	0.165	0.064	0.398
$\mathbf{F}_{med}$	0.677	0.047	0.085

Catch data (Tables 3.8.4.1-2):

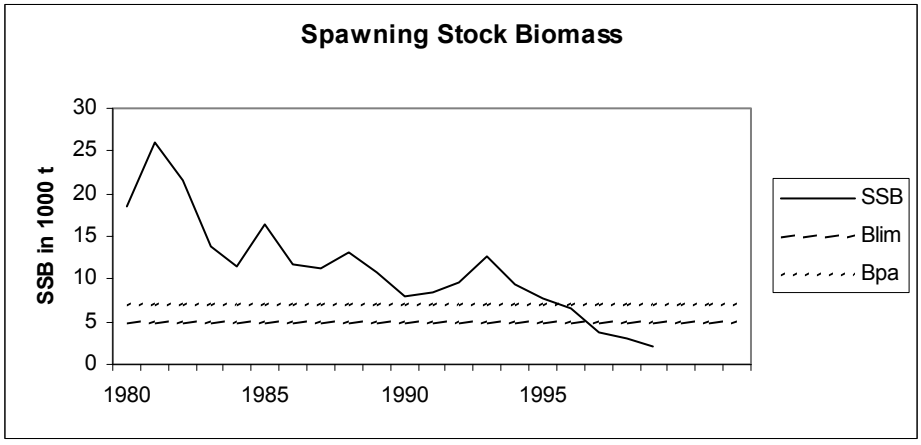
Year	ICES Advice	Predicted catches corresp. to advice	Agreed TAC	Official Landings	Disc.[2]	ACFM catch
1987	Reduce F	16.0	18.2	11.7	3.8	14.4
1988	No increase in F; enforce mesh regulations	12.0	18.2	11.5	1.9	11.9
1989	F = $\mathbf{F}_{high}$; enforce mesh regulation	11.0	18.2	11.3	2.0	13.4
1990	No increase in F; TAC	8.3[1]	15.0	8.2	2.7	10.7
1991	Increase SSB to SSB(89); TAC	6.4[1]	10.0	7.4	2.7	9.9
1992	80% of F(90)	9.7[1]	10.0	7.1	4.3	12.8[3]
1993	70% of F(91) ~ 6 500 t	6.5	8.5	6.0	2.7	9.2[3]
1994	Within safe biological limits	-	9.9	5.6	1.2	7.9[3]
1995	No increase in F	8.3[1]	8.0	5.5	2.2	7.0[3]
1996	No increase in F	9.8[1]	9.0	5.6	3.5	8.0[3]
1997	No advice given	-	7.5	4.5	1.9	4.2[3]
1998	20% reduction in F	3.8[5]	5.0	3.4	1.3	3.5[3]
1999	Reduce F below $\mathbf{F}_{pa}$	3.5[5]	4.41	2.0	1.1	2.8[3]
2000	Reduce F below $\mathbf{F}_{pa}$	<1.6[5]	2.64	1.2	2.1	2.9[3]
2001	Lowest possible F	~0	1.39	1.1	1.0	1.7[3]
2002	Lowest possible F	~0	1.00			
2003	Lowest possible F	~0				

[1]Not including discards from the *Nephrops* fishery. [2]From *Nephrops* fishery. [3]Including estimates of misreporting.
[5]Landings only, no discards included. Weights in '000 t.


Landings
Landings in 1000 t
20
15
10
5
0
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 1-3)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1980
1985
1990
1995
F
Flim
Fpa

Recruitment (age 0)
Recruitment in millions
300
250
200
150
100
50
0
1980
1985
1990
1995


Spawning Stock Biomass
SSB in 1000 t
30
25
20
15
10
5
0
1980
1985
1990
1995
SSB
Blim
Bpa

UK(NI) groundfish survey catch-rates of whiting above MLS of 27cm, by area

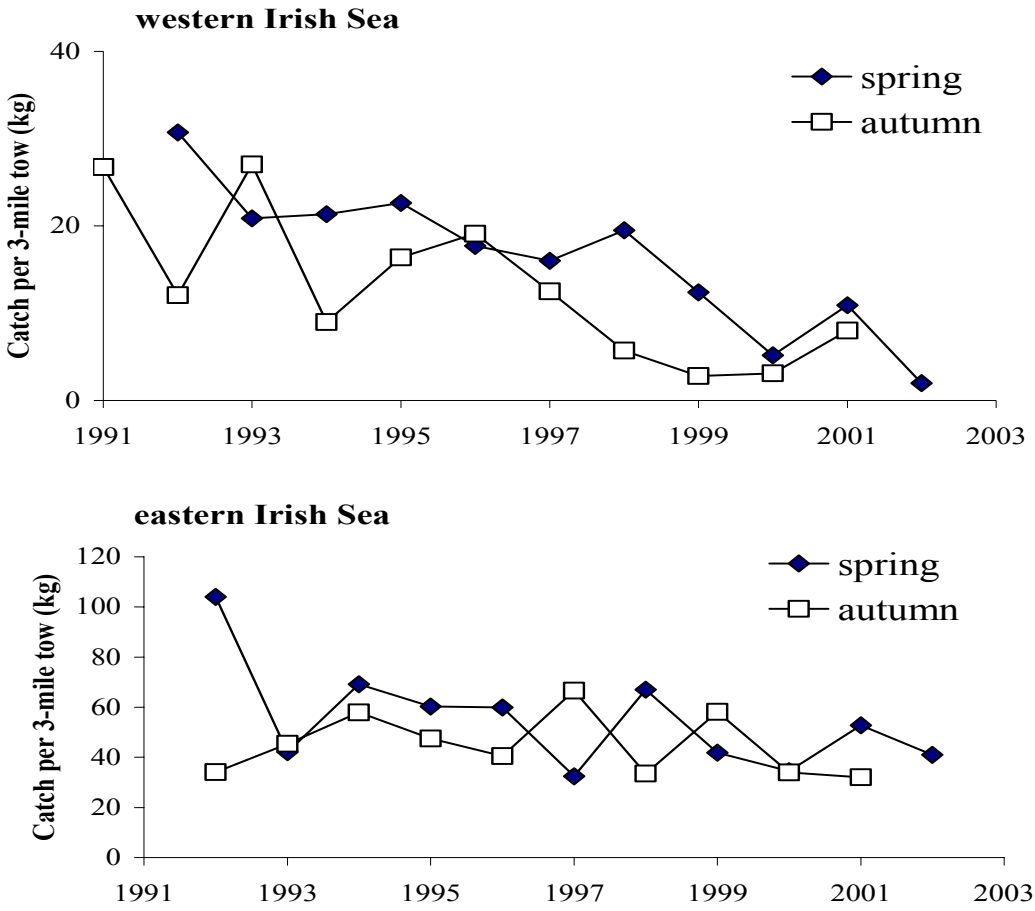


Table 10.1.3.1 **Table 3.8.4.1** Nominal catch (t) of WHITING in Division VIIa, 1987–2001, as officially reported to ICES and Working Group estimates of human consumption and discards.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	109	90	92	142	53	78	50	80	92	80	47	52	46	30	27
France	826	1,063	533	528	611	509	255	163	169	78	86	81	150	96	25
Ireland	4,067	4,394	3,871	2,000	2,200	2,100	1,440	1,418	1,840	1,773	1,119	1,260	509	353	467
Netherlands										17	14	7	6	1	
UK (Engl.& Wales) [a]	1,529	1,202	6,652	5,202	4,250	4,089	3,859	3,724	3,125	3,557	3,152	1,900	1,229	670	
UK (Isle of Man)	14	15	26	75	74	44	55	44	41	28	24	33	5	2	
UK (N. Ireland)	4,858	4,621													
UK (Scotland)	281	107	154	236	223	274	318	208	198	48	30	22	44	15	
UK															531
Total human consumption	11,684	11,492	11,328	8,183	7,411	7,094	5,977	5,637	5,465	5,581	4,472	3,355	1,989	1,167	1,050
Estimated *Nephrops* fishery discards used by the WG [b]	3,899	1,611	2,103	2,444	2,598	4,203	2,707	1,173	2,151	3,631	1,928	1,304	1,092	2,118	1,012
Estimated landings used by the WG	10,519	10,245	11,305	8,212	7,348	8,588	6,523	6,763	4,893	4,335	2,277	2,229	1,670	762	733
Unallocated human consumption	-1,165	-1,247	-23	29	-63	1,494	546	1,126	-572	-1,246	-2,195	-1,126	-319	-405	-317
Total catch figures used by the WG	14,418	11,856	13,408	10,656	9,946	12,791	9,230	7,936	7,044	7,966	4,205	3,533	2,762	2,880	1,745

Revised
Preliminary

[a] 1989–2000 Northern Ireland included with England and Wales.

[b] Based on UK (N. Ireland) and Ireland data.

Table 3.8.4.2 Whiting in Division VIIa (Irish Sea)

Year	Landings tonnes
1980	13461
1981	17646
1982	17304
1983	10525
1984	11802
1985	15582
1986	10300
1987	10519
1988	10245
1989	11305
1990	8212
1991	7348
1992	8588
1993	6523
1994	6763
1995	4893
1996	4335
1997	2277
1998	2229
1999	1670
2000	762
2001	733
Average	8319

3.8.5 Plaice in Division VIIa (Irish Sea)

State of stock/exploitation: The stock remains within safe biological limits. The SSB in 2002 was above $\mathbf{B}_{pa}$ and fishing mortality in 2001 was below $\mathbf{F}_{pa}$. Fishing mortality on this stock was above $\mathbf{F}_{pa}$ in most years between 1967 and 1997, but declined through the 1990s and is now at about 60% of $\mathbf{F}_{pa}$. SSB has been above $\mathbf{B}_{pa}$ throughout the period of assessment.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
There is no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$.	$\mathbf{B}_{pa}$ be set at 3 100 t. There is evidence of high recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
	$\mathbf{F}_{pa}$ be set at 0.45. This is considered to provide a high probability that SSB remains above $\mathbf{B}_{pa}$ in the long term.

Technical basis:

$\mathbf{B}_{lim}$ and $\mathbf{F}_{lim}$: stock-recruitment data uninformative; $\mathbf{F}_{loss}$ poorly defined.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$.
	$\mathbf{F}_{pa} = \mathbf{F}_{med}$ in a previous assessment, and long-term considerations.

Advice on management: ICES recommends that fishing mortality on plaice in 2003 should not be allowed to increase above the current level, corresponding to landings of less than 1 900 t. This is consistent with the advice for sole, which is taken in the same fisheries. In addition there is no long-term gain in yield-per-recruit at higher fishing mortality.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99-01) = 0.30; Landings(2002) = 1.7; SSB(2003) = 5.5.

F(2003) onwards	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0.30	1.0*$\mathbf{F}_{sq}$	1.9	1.9	5.7
0.36	1.2*$\mathbf{F}_{sq}$	2.2	2.2	5.4
0.45	$\mathbf{F}_{pa}$ (= 1.5*$\mathbf{F}_{sq}$)	2.6	2.6	5.0

Weights in '000 t.

Medium- and long-term projections: At current F, and assuming that the pattern of reduced recruitment observed since the late 1980s continues into the future, SSB is expected to increase to around 6 000 t by 2004 and to 7 000 t by 2011. The probability of SSB falling below $\mathbf{B}_{pa}$ remains very small for fishing mortality rates at $\mathbf{F}_{pa}$ and below. Current F is close to the value giving maximum yield-per-recruit.

Comparison with previous assessment and advice: The estimate of fishing mortality in 2000 is 18% higher and SSB in 2001 14% lower in this year's assessment compared to last year's assessment. The basis for the advice is the same as last year.

Elaboration and special comment: Plaice are taken mainly in long-established UK and Irish otter trawl fisheries for demersal fish. They are also taken as a by-catch in the beam trawl fishery for sole. The main fishery is concentrated in the North-east Irish Sea. Effort in the UK and Belgian beam trawl fleets increased in the late 1980s, but declined in the early 1990s.

Multiannual TAC Arrangements and Recovery Plans: Section 3.5.17 reviewed a study on schemes for Multiannual advice on TACs for four plaice and two sole stocks. These studies indicated possible target fishing mortalities for specific TAC schemes. ICES considers that target values must be defined by management taking scientific studies into account. ICES has not received feed-back with specification of target reference points and therefore continues to provide advice based on the precautionary reference points consistent with previous practice.

The analytical assessment is based on a tuned catch-at-age analysis with CPUE data from three commercial fleets and three surveys, and does not include estimates of discarded fish.

Reported landings in recent years are likely to be more accurate than in the past.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

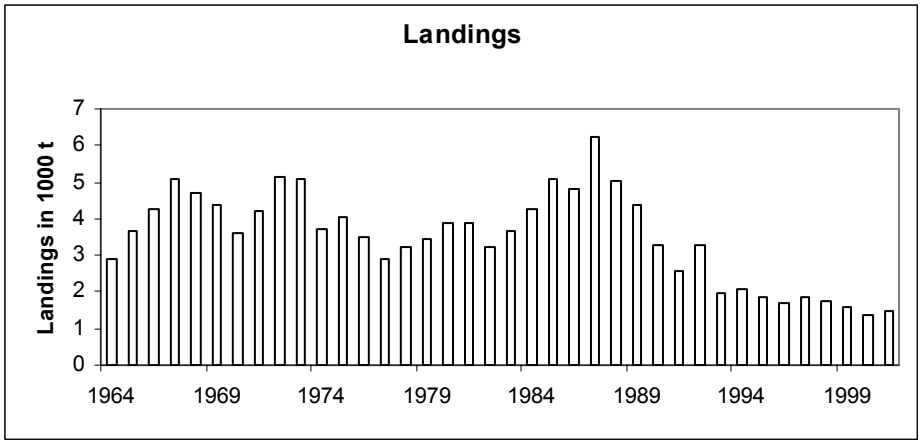
Yield and spawning biomass per Recruit F-reference points:

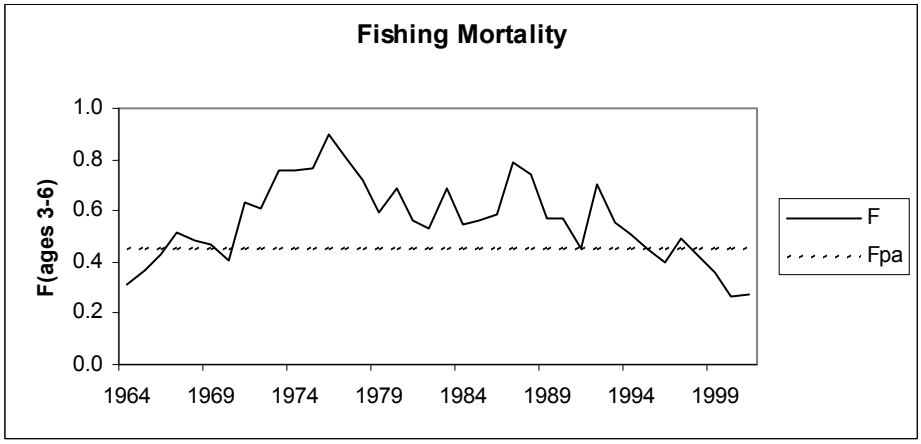
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.559	0.211	0.630
$\mathbf{F}_{max}$	0.317	0.211	0.599
$\mathbf{F}_{0.1}$	0.124	0.187	1.283
$\mathbf{F}_{med}$	0.426	0.209	0.456

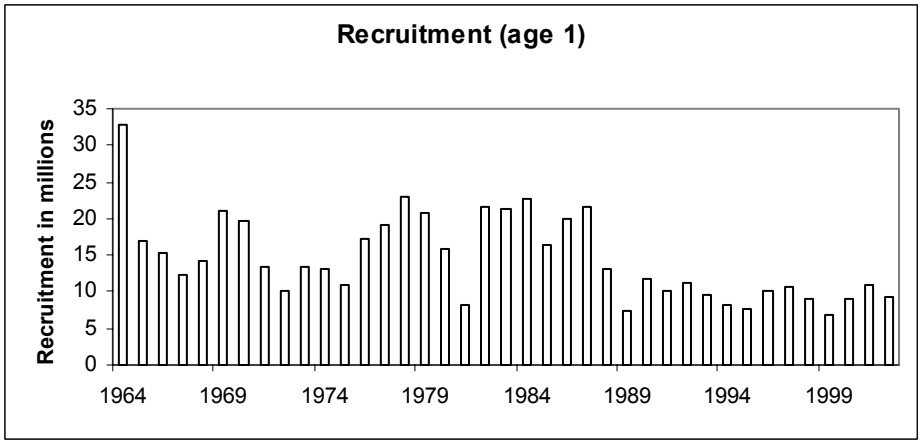
Catch data (Tables 3.8.5.1-2):

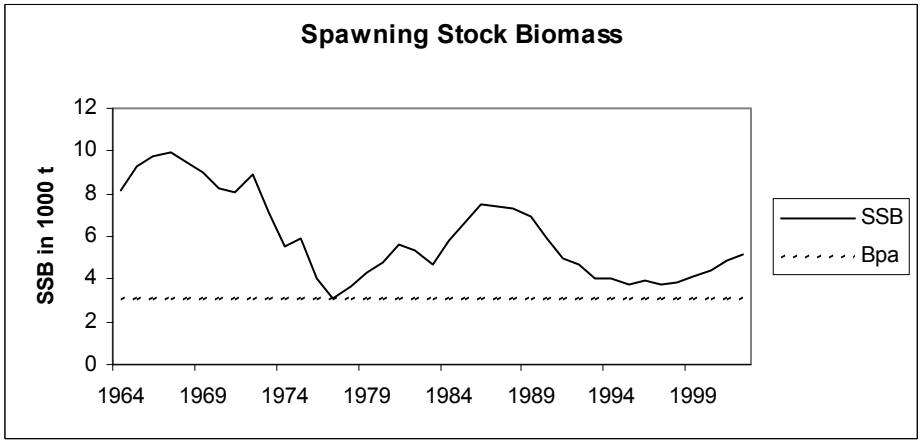
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	F high; no long-term gains in increasing F	5.0	5.0	5.6	6.2
1988	No increase in F	4.8	5.0	4.4	5.0
1989	80% of F(87); TAC	5.8	5.8	4.2	4.4
1990	Halt decline in SSB; TAC	5.1	5.1	4.0	3.3
1991	Rebuild SSB to SSB(90); TAC	3.3	4.5	2.8	2.6
1992	70% of F(90)	3.0	3.8	3.2	3.3
1993	F = 0.55 ~ 2 800 t	2.8	2.8	2.0	2.0
1994	Long-term gains in decreasing F	<3.7	3.1	2.1	2.1
1995	Long-term gains in decreasing F	2.4[1]	2.8	2.0	1.9
1996	No long-term gain in increasing F	2.5	2.45	1.9	1.7
1997	No advice	-	2.1	2.0	1.9
1998	No increase in F	2.4	2.4	1.8	1.8
1999	Keep F below $\mathbf{F}_{pa}$	2.4	2.4	1.6	1.6
2000	Keep F below $\mathbf{F}_{pa}$	<2.3	2.4	1.5	1.4
2001	Keep F below $\mathbf{F}_{pa}$	<2.4	2.0	1.5	1.5
2002	Keep F below $\mathbf{F}_{pa}$	<2.8	2.4		
2003	No increase in F	1.9			

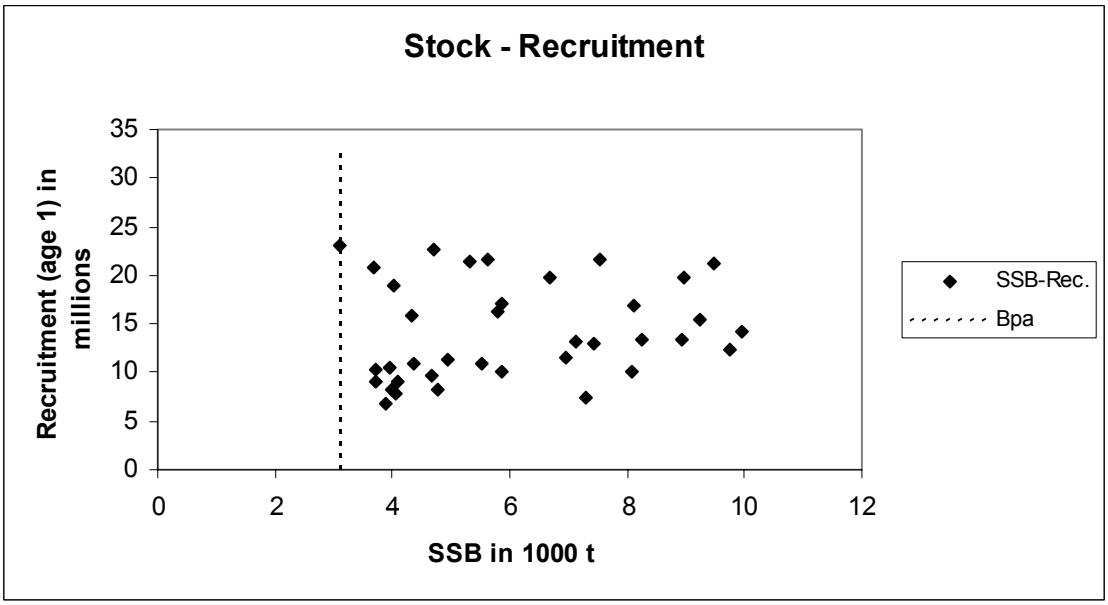
Weights in '000 t. [1]Catch at *status quo* F. [2] Incomplete statistics.

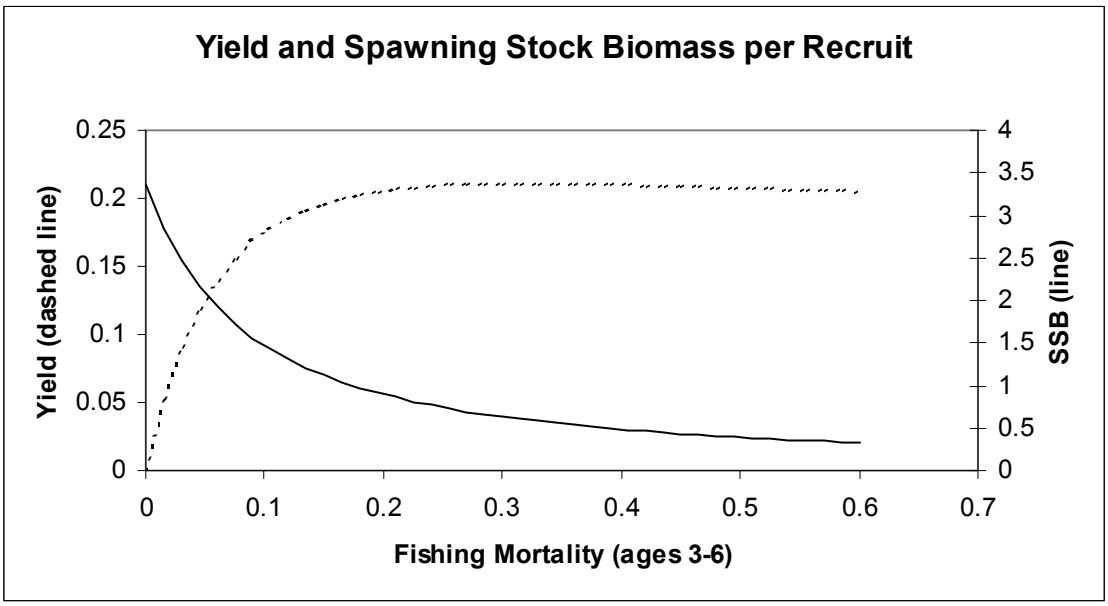

Landings
Landings in 1000 t
0
1
2
3
4
5
6
7
1964
1969
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-6)
0.0
0.2
0.4
0.6
0.8
1.0
1964
1969
1974
1979
1984
1989
1994
1999
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
5
10
15
20
25
30
35
1964
1969
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
0
2
4
6
8
10
12
1964
1969
1974
1979
1984
1989
1994
1999
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 3-6)

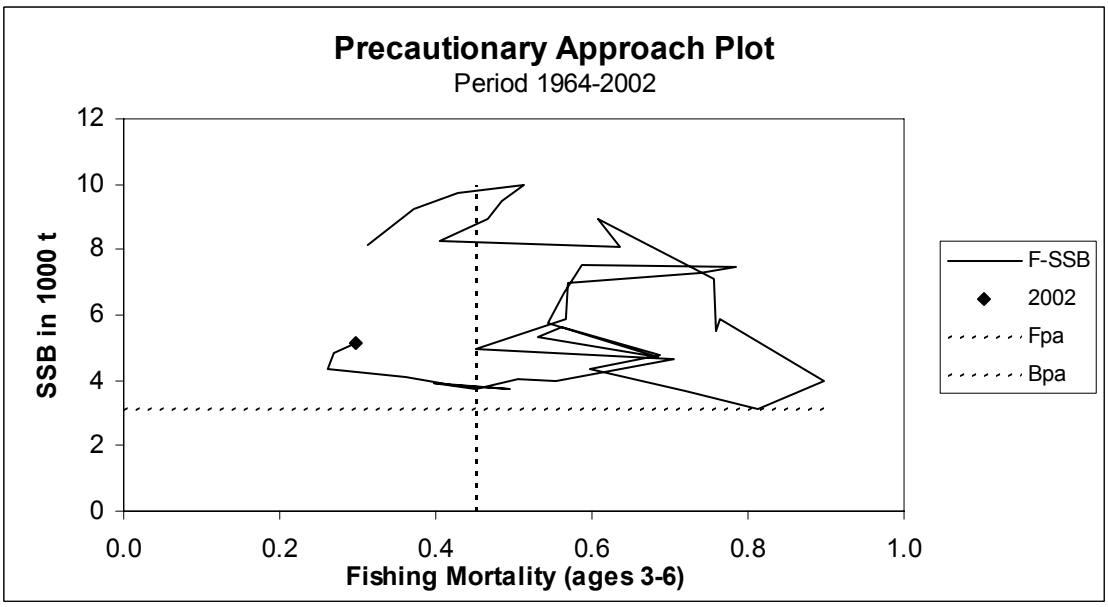

Precautionary Approach Plot
Period 1964-2002
SSB in 1000 t
12
10
8
6
4
2
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-6)
F-SSB
2002
Fpa
Bpa

Table 3.8.5.1 Nominal landings (t) of PLAICE in Division VIIa as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]
Belgium	243	265	301	138	321	128	332	327	344[3]	459	327	275	325	482
France	58	11	105	20	42	19	13	10	11	8	8	5	22	9[1]
Ireland	2,009	1,406	1,350	900	1,355	654	547	557	538	543	730	541	420	367[1]
Netherlands	-	-	-	-	-	-	-	-	69	110	27	30	47	-[1]
UK (Eng.&Wales)[2]	1,630	2,409	1,959	1,584	1,381	1,119	1,082	1,050	878	798	679	687	610	618[1]
UK (Isle of Man)	12	18	27	51	24	13	14	20	16	11	14	5	6	
UK (N. Ireland)	286	…	…	…	…	…	…	…	…	…	…	…	…	…
UK (Scotland)	127	76	219	104	70	72	63	60	18	25	18	23	21	…
UK (Total)														
Total	4,365	4,185	3,961	2,797	3,193	2,005	2,051	2,024	1,874	1,954	1,803	1,566	1,451	1,476
Discards	220	-	-	-	-	-	-	-	-	-	-	-	-	-
Unallocated	420	187	-686	-243	74	-9	15	-150	-167	-83	-38	34	-80	-3
Total figures used by the Working Group for stock assessment	5,005	4,372	3,275	2,554	3,267	1,996	2,066	1,874	1,707	1,871	1,765	1,600	1,371	1,473

[1]Provisional.
[2]1989–1999 Northern Ireland included with England and Wales.
[3]Final Statlant 27a data.
{UK (Total) excludes Isle of Man data}.
n/a = not available.

Table 3.8.5.2 Plaice in Division VIIa (Irish Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1964	32801	8128	2879	0.3117
1965	16941	9246	3664	0.3709
1966	15435	9757	4268	0.4288
1967	12377	9950	5059	0.5122
1968	14252	9492	4695	0.4857
1969	21154	8962	4394	0.4677
1970	19664	8255	3583	0.4041
1971	13481	8064	4232	0.6362
1972	9987	8920	5119	0.6066
1973	13337	7129	5060	0.7552
1974	13141	5529	3715	0.7602
1975	11007	5862	4063	0.7639
1976	17123	4007	3473	0.8975
1977	19023	3095	2904	0.8123
1978	22957	3691	3231	0.7195
1979	20707	4332	3428	0.5976
1980	15794	4756	3903	0.6866
1981	8323	5618	3906	0.5619
1982	21516	5324	3237	0.5316
1983	21406	4721	3639	0.6838
1984	22715	5779	4241	0.5441
1985	16280	6685	5075	0.5653
1986	19852	7542	4806	0.5879
1987	21716	7443	6220	0.7857
1988	13011	7309	5005	0.7396
1989	7487	6969	4372	0.5701
1990	11628	5866	3275	0.5666
1991	10123	4938	2554	0.4511
1992	11331	4680	3267	0.7048
1993	9579	3993	1996	0.5529
1994	8208	4071	2066	0.5042
1995	7722	3711	1874	0.4504
1996	10229	3944	1707	0.3967
1997	10599	3719	1871	0.4956
1998	8993	3878	1765	0.4202
1999	6787	4089	1600	0.3623
2000	8979	4375	1371	0.2626
2001	10896	4863	1473	0.2703
2002	9184[1]	5172		
Average	14506	5997	3500	0.5519

[1] Short-term GM (1989-2000)

3.8.6 Sole in Division VIIa (Irish Sea)

State of stock/exploitation: The stock is within safe biological limits. The SSB in 2002 was above B_{pa} and fishing mortality in 2001 was below F_{pa}. Fishing mortality varied around F_{lim} from 1970 to 1999, but has declined to 80% of F_{pa} in 2001. SSB has recently increased from the historic low in 1997.

Management objectives: No explicit management objectives are set for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
B_{lim} is 2 800 t. The lowest observed spawning stock in an earlier assessment.	B_{pa} be set at be set at 3 800 t, which is considered to be the minimum SSB required to ensure a high probability of maintaining SSB above its lowest observed value, taking into account the uncertainty of assessments.
F_{lim} is 0.4. Although poorly defined, there is evidence that fishing mortality in excess of 0.4 has led to a general stock decline and is only sustainable during periods of above-average recruitment.	F_{pa} be set at 0.30. This F is considered to have a high probability of avoiding F_{lim}.

Technical basis:

$B_{lim} = B_{loss}$	$B_{pa} \sim B_{lim} * 1.4$
$F_{lim} = F_{loss}$ poorly defined; based on historical considerations	F_{pa} = see above

Advice on management: ICES recommends that fishing mortality in 2003 remains below the proposed F_{pa}, corresponding to landings of less than 1 010 t in 2003.

Relevant factors to be considered in management: Limited observations on discarding of sole indicate that rates of discarding are relatively low. **Catch forecast for 2003:**

Basis: F(2002) = F(99-01); F_{sq} = 0.28; Landings (2002) = 1.05; SSB (2003) = 4.11.

F(2003) onwards	Basis	Landings (2003)	SSB (2004)
0.26	$0.9*F_{sq}$	0.88	4.31
0.28	$1*F_{sq}$	0.97	4.23
0.30	$F_{pa}=1.05*F_{sq}$	1.01	4.18
0.31	$1.1*F_{sq}$	1.05	4.14
0.34	$1.2*F_{sq}$	1.13	4.06

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The estimate of fishing mortality in 2000 is 12% higher, and SSB in 2001 the same, in this year's assessment compared to last year's assessment. The basis for a single-stock fishery advice is the same as last year.

Elaboration and special comment: Sole are taken mainly in a beam trawl fishery and are also taken as a by-catch in otter trawl fisheries. In recent years, catch rates of sole have been low in the Irish Sea, and part of the beam

trawl fleet has moved to sole fishing grounds in other areas. The analytical assessment is based on a tuned catch-at-age analysis with CPUE data from two commercial beam trawl fleets and two surveys.

Source of information: Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, August 2002 (ICES CM 2003/ACFM:04).

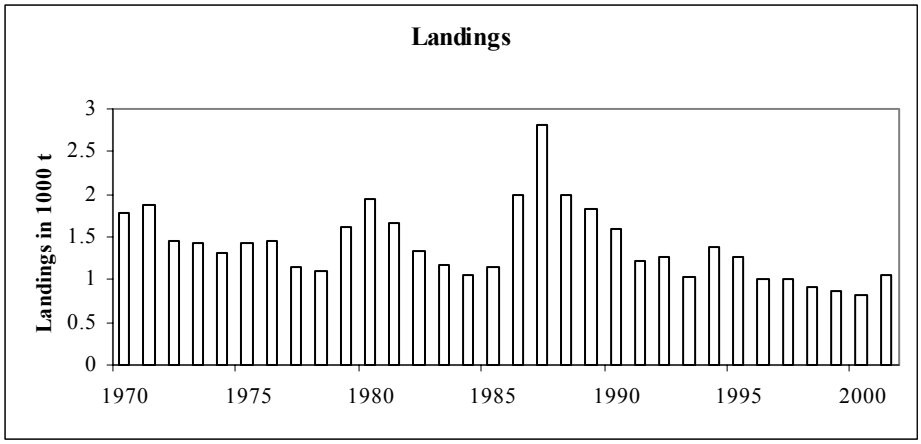
Yield and spawning biomass per Recruit F-reference points:

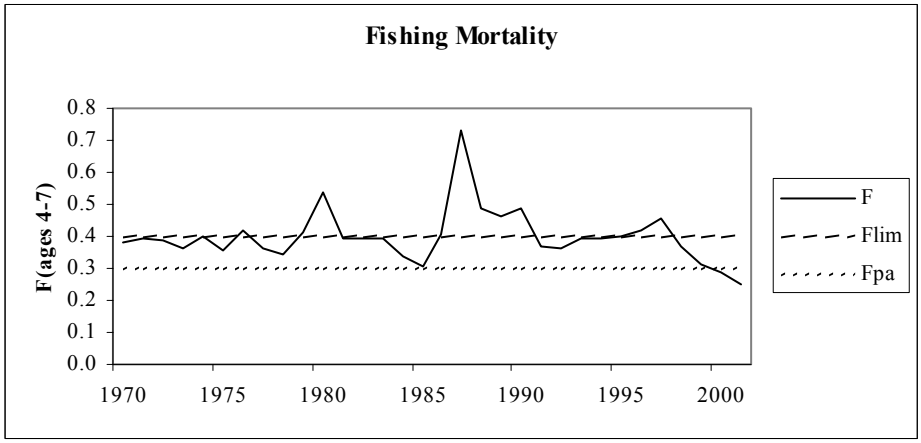
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	0.399	0.186	0.795
F_{max}	0.523	0.192	0.463
$F_{0.1}$	0.177	0.169	1.169
F_{med}	0.300	0.187	0.758

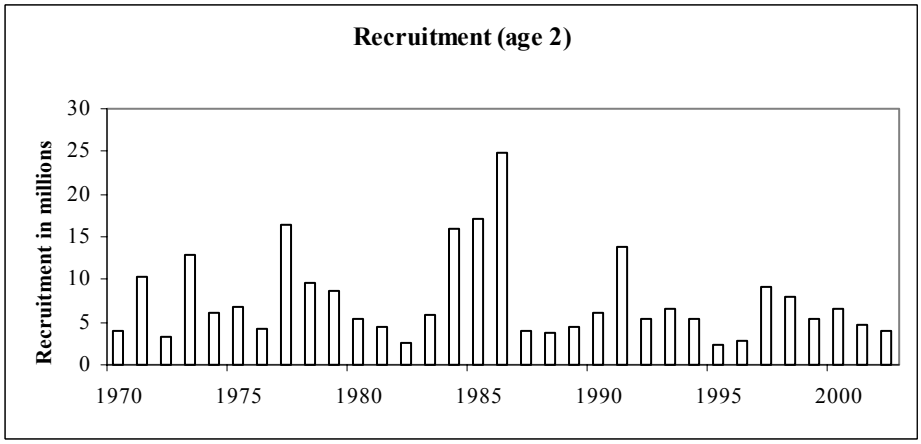
Catch data (Tables 3.8.6.1–2):

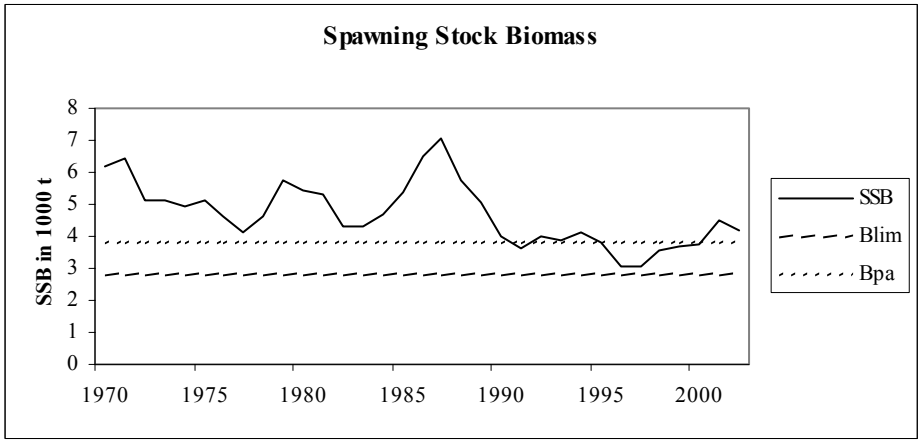
Year	ICES Advice	Predicted catch. corresp. to advice	Agreed TAC	Official landings	ACFM landings[2]
1987	No increase in F	1.9	2.1	2.0	2.8
1988	80% of F(86); TAC	1.6	1.75	1.9	2.0
1989	80% of F(87); TAC	< 1.48	1.48	1.8	1.8
1990	Interim advice	1.05[3]	1.5	1.6	1.6
1991	90% of F(89); TAC	1.3	1.5	1.2	1.2
1992	No long-term gains in increased F	1.2[1]	1.35	1.2	1.3
1993	F = F(91) ~ 920 t	0.92	1.0	1.0	1.0
1994	No long-term gains in increased F	1.51[1]	1.5	1.4	1.4
1995	20% reduction in F	0.8	1.3	1.3	1.3
1996	20% reduction in F	0.8	1.0	1.0	1.0
1997	20% reduction in F	0.8	1.0	1.0	1.0
1998	20% reduction in F	0.85	0.9	0.9	0.9
1999	Reduce F below $\mathbf{F}_{pa}$	0.83	0.9	0.8	0.9
2000	Reduce F below $\mathbf{F}_{pa}$	< 1.08	1.08	0.8	0.8
2001	Reduce F below $\mathbf{F}_{pa}$	< 0.93	1.1	1.0	1.1
2002	Keep F below $\mathbf{F}_{pa}$	<1.10	1.1		
2003	Keep F below $\mathbf{F}_{pa}$	<1.01			

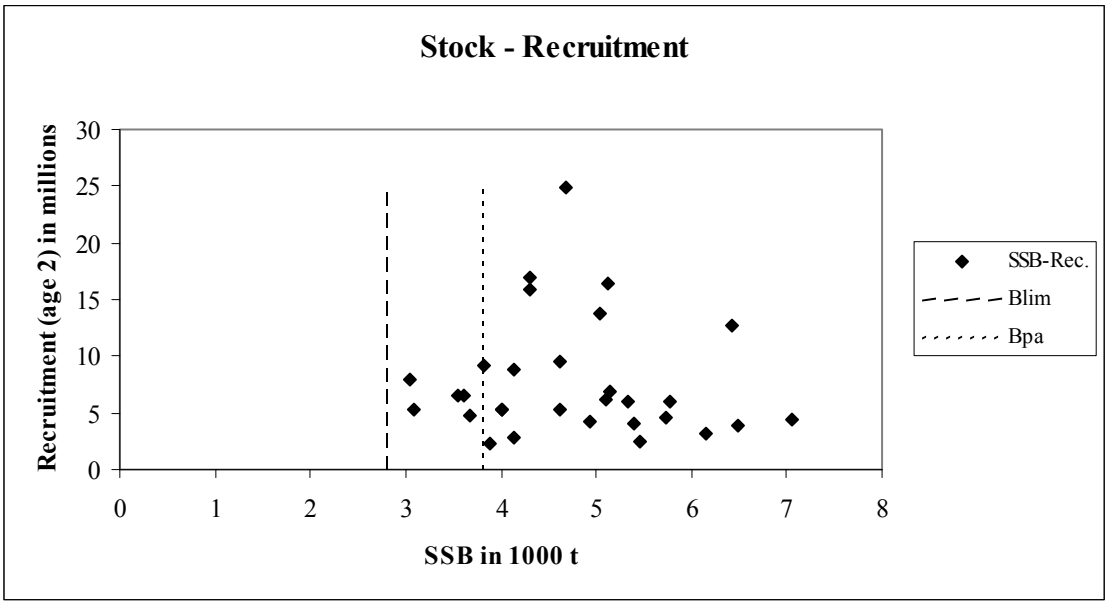
[1]Catch at *Status quo* F. [2] Not including misreporting. [3]Revised in 1990 to 1.5. Weights in '000 t.

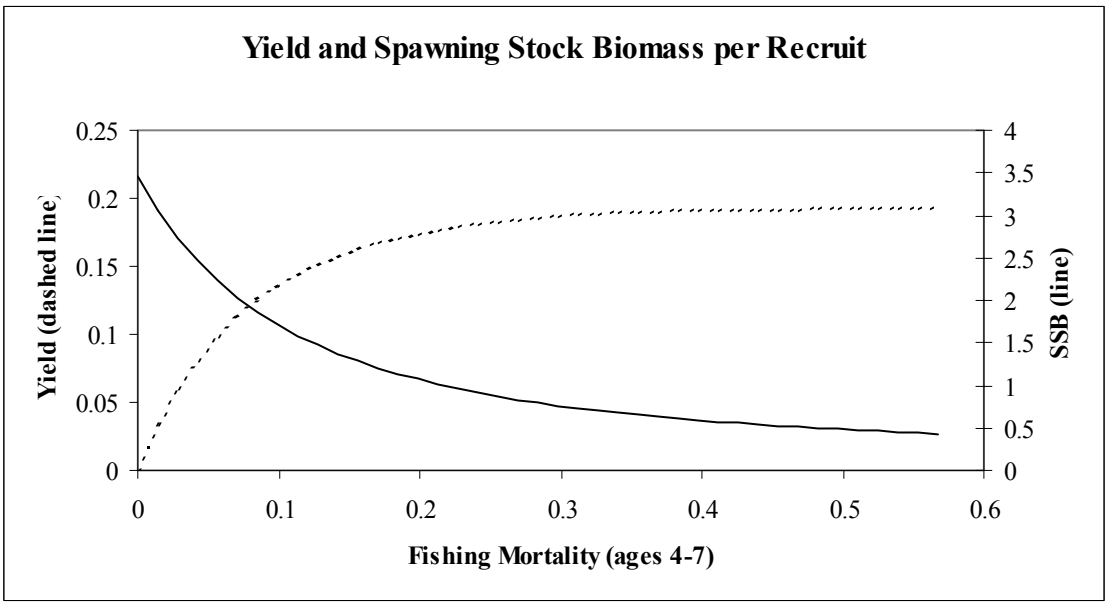

Landings
Landings in 1000 t
0
0.5
1
1.5
2
2.5
3
1970
1975
1980
1985
1990
1995
2000

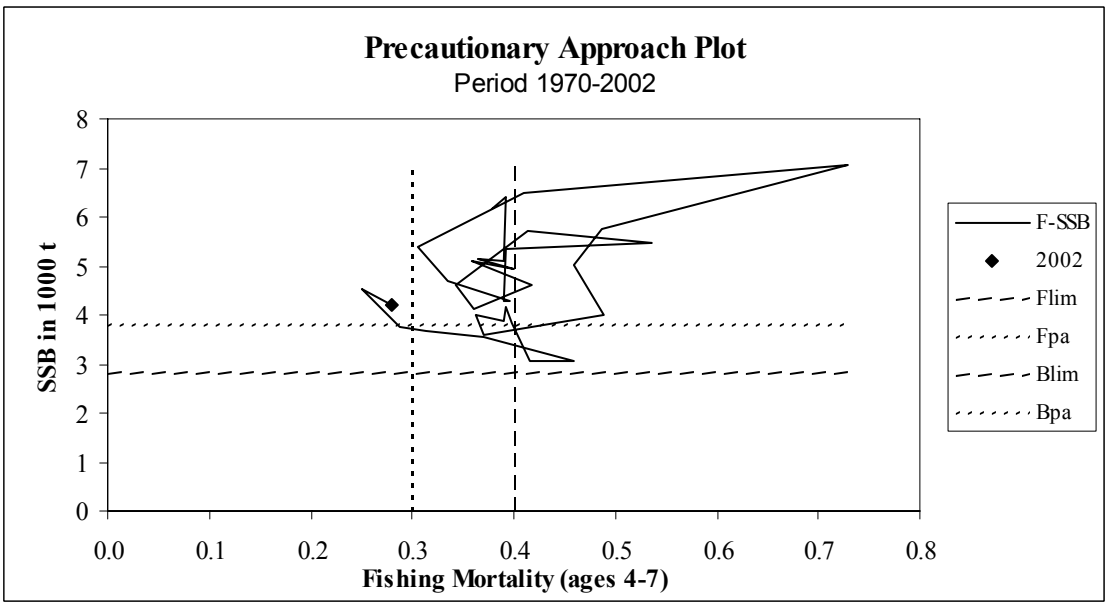

Fishing Mortality
F (ages 4-7)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1970
1975
1980
1985
1990
1995
2000
F
Flim
Fpa


Recruitment (age 2)
Recruitment in millions
0
5
10
15
20
25
30
1970
1975
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
0
1
2
3
4
5
6
7
8
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-7)


Precautionary Approach Plot
Period 1970-2002
SSB in 1000 t
Fishing Mortality (ages 4-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

able 12.1.1.1 Sea Sole. Nominal landings (tonnes) as officially reported by ICES

Table 3.8.6.1 Irish Sea Sole. Divisions VIIa. Nominal landings (t), as officially reported to ICES

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	930	987	915	1010	786	371	531	495	706	675	533	570	525	469	493	674
France	17	5	11	5	2	3	11	8	7	5	5	3	5 *	1 *	2 *	4 *
Ireland	235	312	366	155	170	198	164	98	226	176	133	130	134	120	134	125 *
Netherlands	-	-	-	-	-	-	-	-	-	-	149	123	60	46	60	- *
UK (Engl.& Wales)[1]	637	599	507	613	569	581	477	338	409	424	194	189	161	165	133	...
UK (Isle of Man)	1	3	1	2	10	44	14	4	5	12	4	5	3	1	1	
UK (N. Ireland)[1]	50	72	47													
UK (Scotland)	46	63	38	38	39	26	37	28	14	8	5	7	9	8	8	...
United Kingdom																198 *
Total	1,916	2,041	1,885	1,823	1,576	1,223	1,234	971	1,367	1,300	1,023	1,027	897	810	831	1,001
Unallocated	79	767	114	10	7	-9	25	52	2	-34	-21	-24	14	50	-13	52
Total used by Working Group in Assessment	1,995	2,808	1,999	1,833	1,583	1,214	1,259	1,023	1,369	1,266	1,002	1,003	911	859	818	1053

* Preliminary

[1] 1989 onwards: N. Ireland included with England & Wales

Table 3.8.6.2 Sole in Division VIIa (Irish Sea)

Year	Recruitment Age 2 thousands	SSB tonnes	Landings[1)] tonnes	Mean F Ages 4-7
1970	4047	6159	1785	0.3782
1971	10297	6419	1882	0.3926
1972	3221	5106	1450	0.3902
1973	12785	5141	1428	0.3636
1974	6199	4942	1307	0.4006
1975	6804	5119	1441	0.3581
1976	4185	4626	1463	0.4171
1977	16453	4140	1147	0.3602
1978	9591	4627	1106	0.3438
1979	8762	5722	1614	0.4142
1980	5324	5450	1941	0.5359
1981	4506	5341	1667	0.3917
1982	2516	4305	1338	0.3909
1983	5940	4302	1169	0.3962
1984	15964	4674	1058	0.3354
1985	17025	5387	1146	0.3056
1986	24896	6492	1995	0.4093
1987	4082	7056	2808	0.7286
1988	3860	5769	1999	0.4864
1989	4494	5032	1833	0.4594
1990	6031	4017	1583	0.4892
1991	13744	3603	1212	0.3710
1992	5283	4007	1259	0.3618
1993	6482	3884	1023	0.3909
1994	5377	4146	1374	0.3921
1995	2288	3820	1266	0.3978
1996	2797	3052	1002	0.4165
1997	9117	3080	1003	0.4586
1998	7903	3554	911	0.3709
1999	5313	3683	863	0.3127
2000	6577	3736	818	0.2883
2001	4731	4513	1053	0.2507
2002	3869	4210		
Average	7590	4700	1405	0.3951

[1)] Landings fitted by TSA value may differ slightly from values given in catch tables

3.8.7 Irish Sea herring (Division VIIa)

State of the stock/exploitation: The state of the stock is uncertain. SSB declined in the late 1980s, and may have been stable in the 1990s, but the current stock size cannot be estimated with certainty.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet precautionary criteria, spawning stock biomass should be greater than the proposed $\mathbf{B}_{pa.}$

Precautionary Approach reference points (established in year 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 6 000t	$\mathbf{B}_{pa}$ = 9 500t
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ under review, proposed as 0.36 in 1999, not adopted

Technical basis:

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *1.58; still under consideration
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$

Advice on management: ICES advises that the catch in 2003 should not be allowed to increase above the advised 2002 TAC (4 800 t).

Relevant factors to be considered in management: Areas closed to herring fishing around the east coast of Ireland and west coast of Britain were put in place to protect juveniles when an industrial fishery operated. A closed area exists to the east of the Isle of Man to protect the spawning aggregations.

These closed areas should be maintained. The catch in 1998 to 2001 is uncertain.

Comparison with previous assessment and advice: The update of the assessment gave a similar perception of SSB as last year (2001 assessment) and the 1999 assessment, but was different from the 2000 assessment. Until this change in the perception of the stock size is explained it will not be possible to use the assessment for quantitative catch advice.

Elaboration and special comment: Fishing mortality was high during the 1970s due to a transfer of effort from other closed herring fisheries and the operation of an industrial fleet. Since 1981 the size of the exploiting fleets in this area has declined and the industrial fishery has closed.

Over the years the survey indices have been revised and the new assessments are based on the uncertain catches, with additional survey data series providing more information on recruitment and the age structure of the stock. Further exploratory analyses are required before the current assessment can be regarded as stable.

Many aspects of the biology and fisheries data changed rapidly in the mid-1980s, affecting assessment results. These changes require further investigations and depending on the causes of the changes, reference points may be affected. If the changes are a result of stock components being exploited differently by the fishery, any similar changes in the future could cause serious problems for producing reliable assessments.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Yield and spawning biomass per Recruit F-reference points:

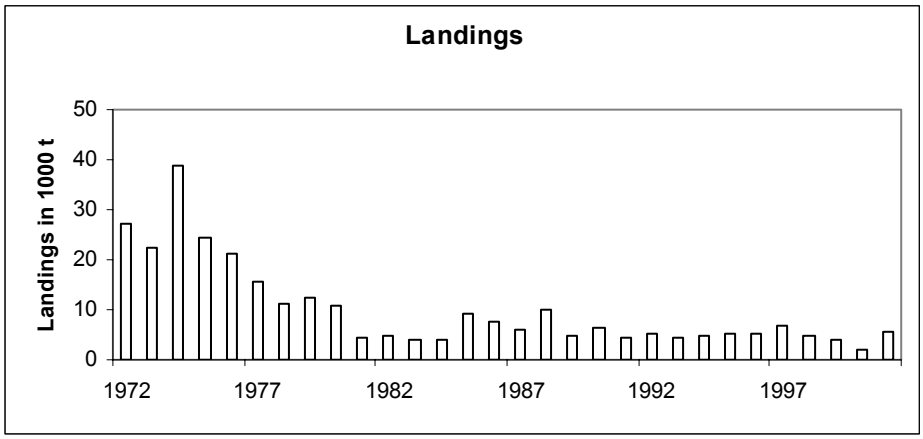
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.277	0.033	0.098
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.166	0.029	0.154
$\mathbf{F}_{med}$	N/A		

Catch data (Tables 3.8.7.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	TAC	4.3	4.5	5.8
1988	TAC (Revised advice in 1988)	10.5 (5.6)	10.5	10.2
1989	TAC	5.5	6.0	5.0
1990	Precautionary TAC	5.7	7.0	6.3
1991	TAC	5.6	6.0	4.4
1992	TAC	6.6	7.0	5.3
1993	TAC	4.9-7.4	7.0	4.4
1994	Precautionary TAC	5.3	7.0	4.8
1995	Precautionary TAC	5.1	7.0	5.1
1996	If required, precautionary TAC	5.0	7.0	5.3
1997	No advice given	-	9.0	6.6
1998	*Status quo* F	6.5	9.0	4.9
1999	F=Proposed $\mathbf{F}_{pa}$=0.36	4.9	6.6	4.1
2000	F=90% F(98)=0.31	3.9	5.4	2
2001	*Status quo* F= 0.26	5.1	6.9	5.5
2002	Average catch of 1996-2000	4.8	4.8	
2003	2002 TAC	4.8		

Weights in ‘000 t.

Irish Sea herring (Division VIIa)



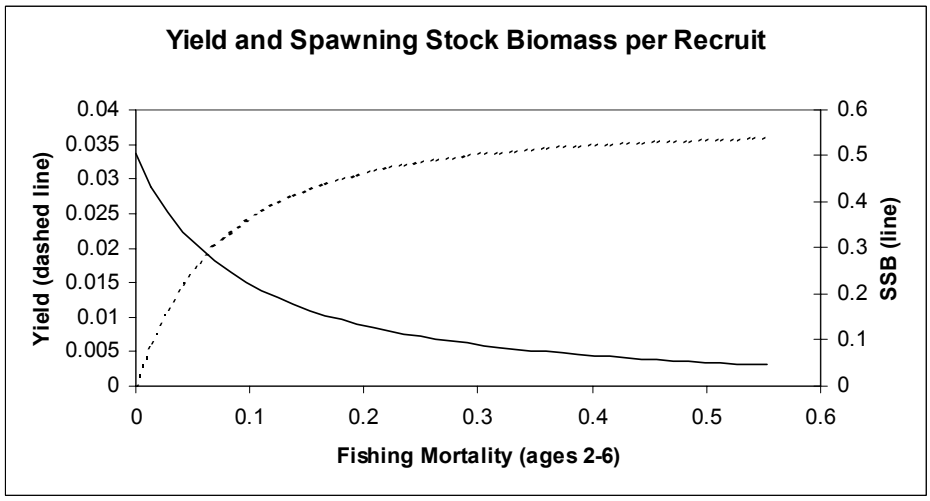


Table 3.8.7.1 Irish Sea Herring (Division VIIa). Catch in tonnes by country, 1985-2001.

The total catch does not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993
Ireland	1,000	1,640	1,200	2,579	1,430	1,699	80	406	0
UK	4,077	4,376	3,290	7,593	3,532	4,613	4,318	4,864	4,408
Unallocated	4,110	1,424	1,333	-	-	-	-	-	-
Total	9,187	7,440	5,823	10,172	4,962	6,312	4,398	5,270	4,408

Country	1994	1995	1996	1997	1998	1999	2000	2001
Ireland	0	0	100	0	0	0	0	862
UK	4,828	5,076	5,180	6,651	4,905	4,127	2,002	4,599
Unallocated	-	-	22	-	-	-	-	
Total	4,828	5,076	5,302	6,651	4,905*	4,127*	2,002*	5,461*

* Preliminary

3.9 Stocks in the Celtic Sea (Divisions VIIf-k), Western Channel (Division VIIe), and northern parts of the Bay of Biscay (Divisions VIIIa,b,d, and e)

3.9.1 Overview

Fleets and fisheries

Most of the demersal fisheries in this area have a mixed catch. Although it is possible to associate specific target species with particular fleets, various quantities of cod, whiting, hake, anglerfish, megrim, sole, plaice, and *Nephrops* are taken together, depending on gear type.

In the Celtic Sea and Western Channel, fisheries for demersal species, mainly cod, whiting, sole and plaice, are conducted by Belgium, France, Ireland, and the UK. The principal gears used are otter trawls and beam trawls. The targeting of sole and plaice using beam trawls became prevalent during the mid-1970s, leading to an increase in the landings of these two species. The gradual replacement of otter trawls by beam trawls has occurred in the Belgian and UK fleets. In the Bay of Biscay there has been a substantial replacement of inshore trawling by gillnet fisheries targeting sole.

A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s and expanded until 1990. In addition, a gillnet fishery has developed in the Celtic Sea in the 1990s. Selectivity is known to be poor for these species.

Nephrops are an important component of the fisheries in this area. These fisheries developed in the 1970s and 1980s. Fishing effort has decreased continuously since the early 1990s. However, gear efficiency has increased in recent years and this may have helped maintaining LPUE at relatively high levels. In the Bay of Biscay, since 1st January 2000, the mesh size used when fishing for *Nephrops* has increased and is now similar to the one used for other demersal fish (70 mm). Management of these fisheries needs to be sensitive to by-catches of stocks requiring protection such as Celtic Sea cod and Northern hake.

There are separate trawl fisheries targeting herring in the Celtic Sea and mackerel and horse mackerel in the whole area. The herring fishery is principally a "roe" fishery and discard rates have at times reached very high levels, but not in the most recent two years. There is also a small directed fishery for sprat in the Channel.

Management measures

The assessment units used for many of the demersal stocks in this area are small and catches deriving from them are generally in the region of 10 000 t or less. However, the TACs set for the stocks often cover many assessment units. In addition, for some units, there are still insufficient data for adequate assessments. This means that TACs comprise a summation across units of analytical forecasts and average catches which may offer no effective management control of the exploitation rate. Since a number of stocks affected by this problem are close to or outside safe biological limits, there is a need to reconsider the areas for which TACs are set if management is to improve.

A notable feature of the demersal fisheries in this area is their mixed nature. The effectiveness of single-species TACs is likely to be diminished unless this is taken into account. Use of measures to reduce fishing mortality directly, such as effort reductions in fleets, is likely to avoid a number of the disadvantages of catch controls in regulating the exploitation rate.

The fisheries in the Celtic Sea are very similar to the fisheries in the Bay of Biscay and some of the same fleets operate in both areas. However, the technical measures in the two areas differ. Despite the revision by the European Commission Technical Conservation Regulation of existing technical measures in 1st January 2000, the minimum mesh sizes in the Celtic Sea are still often different from those in the Bay of Biscay. These differences make enforcement more difficult.

The catch includes a large amount of juveniles of some late-maturing species (anglerfish, hake). While improving selectivity to prevent any catch of hake less than 55 cm (length of maturity for females) seems to be difficult, some selective devices such as rigid grids should be promoted to protect juveniles of the incoming strong year classes of white anglerfish.

State of the stocks

The majority of the fish stocks which are assessed in this area are harvested outside safe biological limits. They are characterised by low spawning stock biomass and recent high fishing mortality rates. Of particular concern are Celtic Sea (VIIf,g) and Western Channel (VIIe) sole and plaice, Celtic Sea (VIIe-k) cod, and Bay of Biscay (VIIIabd) sole. These stocks exhibit high F, low SSB, and low recruitments in most recent years.

The Celtic Sea whiting stock has been fluctuating within safe biological limits, following periods of low and high recruitment.

The assessment of Celtic Sea haddock was considered preliminary due to the short time-series. Recruitment seems to be highly variable, influencing the variation in the stock size. This is also reflected in the landings.

Anglerfish and megrim are close to safe biological limits. Recent recruitment for both species (*Lophius piscatorius* and *Lophius budegassa)* are well above average.

The Northern hake stock is discussed fully in Section 3.12.2. It is important to note that this species is taken by most of the demersal fleets in this area. This hake stock is outside safe biological limits, and a rebuilding plan is needed in order to rebuild the SSB.

There are no major concerns about the *Nephrops* stock in the Celtic Sea.

The *Nephrops* stock in the Bay of Biscay has declined since the early 1990s. A strong reduction in the fishing mortality and an improvement of the selection pattern is required. The recent increase in mesh size (from 55 mm to 70 mm), which occurred in 2000 is unlikely to have improved selectivity significantly.

The abundance of anchovy varies considerably according to fluctuations in recruitment, which is likely to be strongly dependent on environmental factors. In 2002, the stock is inside safe biological limits.

The mackerel caught in the area belong to the Southern and Western spawning components. The Western horse mackerel has declined rapidly since the mid-1980s and is estimated to continue to decline.

3.9.2 Cod in Divisions VIIe-k

State of stock/exploitation: The stock is outside safe biological limits. SSB has decreased since 1996 and is currently well below $\mathbf{B}_{pa}$, and just above $\mathbf{B}_{lim}$. Recruitment is highly variable. The 1997 and 1998 year classes are well below average, while the 1999 year class is estimated to be above average and the 2000 year class around average. Fishing mortality has generally increased since the early 1980s and has increased well above $\mathbf{F}_{pa}$ since 1989. Fishing mortality has been above $\mathbf{F}_{lim}$ since 1998.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach Reference Points (established in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 5 400 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 10 000 t. Biomass above this value affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the variability in the stock dynamics and the uncertainty in assessments.
$\mathbf{F}_{lim}$ is 0.90, the fishing mortality estimated to lead to potential collapse.	$\mathbf{F}_{pa}$ be set at 0.68. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in the medium term, taking into account the uncertainty assessments.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = historical development of the stock
$\mathbf{F}_{lim}$ = based on historical response of the stock	$\mathbf{F}_{pa} = 5^{th}$ percentile of $\mathbf{F}_{loss}$

Advice on management: ICES recommends that fishing mortality should be reduced to less than 0.41 which is below $\mathbf{F}_{pa}$, corresponding to landings of less than 3 800 t in 2003. This represents a reduction in F of at least 60% and this would allow SSB to reach $\mathbf{B}_{pa}$ in the short term.

Relevant factors to be considered in management: The assessment area was expanded in 1997 to cover Divisions VIIe-k and the ICES advice applies to these areas. However, the cod TAC is set for Subareas VII (excluding Division VIIa) and VIII. Within this larger area there is no control over where the catches will be taken. In order to be able to regulate the fishing mortality on the cod stock in Division VIIe-k, a TAC must be set specifically for this area.

The North Sea cod assessment area includes Division VIId and the North Sea stock will be affected by the cod catches taken in Division VIId. Considering the poor state of the North Sea cod stock, the cod TAC for Subareas VII (excl. VIIa) and VIII must be kept at present low levels.

The yield-per-recruit model suggests that a reduction in fishing mortality to $\mathbf{F}_{max}$ (=0.28) will increase the long-term yield.

Catch forecast for 2003:

Basis: F(2002) = F(99–01) =1.01 ; Landings(2002) =9.0 ; SSB(2003) = 7.0.

F(2003) onwards	Basis	Catch(2003)	Landings (2003)	SSB (2004)
0.41	0.4 $\mathbf{F}_{sq}$		3.8	10.1
0.51	0.5 $\mathbf{F}_{sq}$		4.6	9.2
0.61	0.6 $\mathbf{F}_{sq}$		5.2	8.4
0.68	$\mathbf{F}_{pa}$= 0.67 $\mathbf{F}_{sq}$		5.7	7.8
0.81	0.8 $\mathbf{F}_{sq}$		6.4	6.9
1.01	$\mathbf{F}_{sq}$		7.4	5.8

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

About 60% of the calculated SSB(2004) (year classes 2001-2002 at ages 2-3) is based on long-term geometric mean recruitment.

A 30% increase in SSB from 2003 to 2004 requires a 50% reduction in fishing mortality.

Medium- and long-term projections: Assuming the current selection pattern, fishing at $\mathbf{F}_{max}$ would require a 70% reduction in fishing mortality.

Comparison with previous assessment and advice: The estimates of fishing mortality and SSB are very similar to those obtained last year, while the estimate of the 2000 year class is now higher. The fishery took about 60% more cod and the fishing mortality in 2001 was almost twice that advised, causing a decrease in stock size from 2000 to 2001. Therefore, to achieve the same increase in SSB in the short term, this year's advice requires a greater reduction in fishing mortality than the one provided last year.

Elaboration and special comment: Cod in Divisions VIIe-k are taken in mixed trawl fisheries. Landings are made mainly by French gadoid trawlers, which prior to 1980 were mainly fishing for hake in the Celtic Sea. Landings of cod by French *Nephrops* trawlers have fluctuated between 10% and 20% of the total French cod landings from this stock in recent years. UK (England and Wales) accounts for about 10% and Ireland for 15%, while Belgian vessels take about 5%. Landings occur throughout the year, but mainly in the winter months during November to April.

Analysis of landings trip by trip for the French gadoid trawlers for the period 1996-1999 showed that on a trip basis, cod and whiting were mixed. Information from the fishery indicates that on a haul basis, these two species are rather well separated, i.e. fishermen seem to be able, for each trawl operation, to target cod and whiting separately. In Ireland in recent years, cod has increasingly been the target, using gillnet rather than trawl.

Most cod spawning in the Celtic Sea occurs off northern Cornwall in mid- to late March. There is also some spawning off southeast Ireland and a little in the Western Channel. Tagging studies have given no evidence of cod movement out of Division VIIe, where there appears to be a simple inshore-offshore migration between deep-water wrecks and reefs in the summer and inshore spawning areas in the winter. Recent tagging work in the Irish Sea suggest that only a small component of cod landings from the Celtic Sea are fish which spawn in the Irish Sea. Furthermore, no cod tagged in the Celtic Sea were recaptured in the Irish Sea.

The analytical assessment was based on landings data and CPUE data for four commercial fleets and two surveys.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

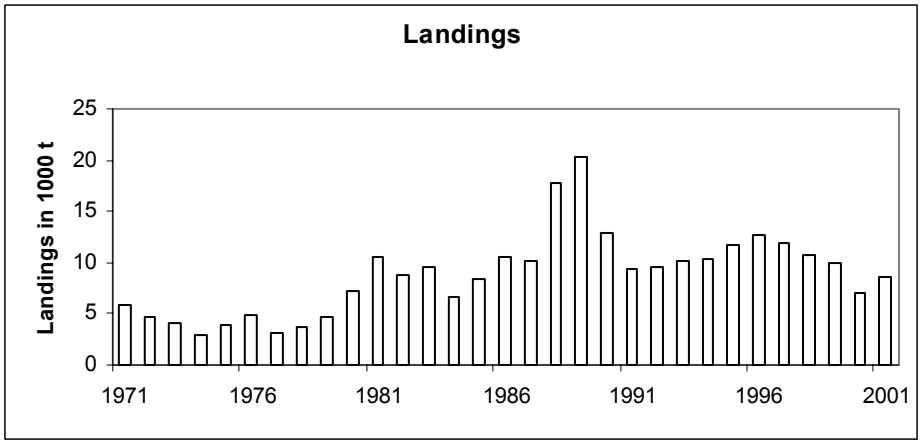
Yield and spawning biomass per Recruit F-reference points:

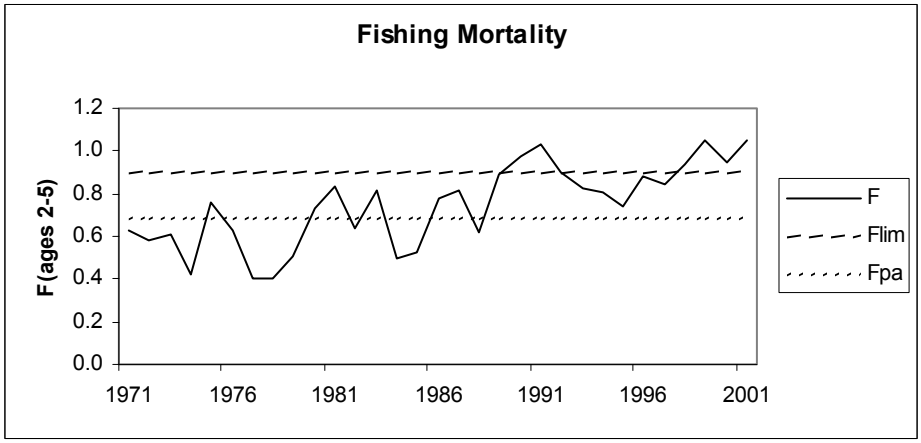
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average Current	1.014	1.774	1.459
$\mathbf{F}_{max}$	0.281	2.519	9.258
$\mathbf{F}_{0.1}$	0.170	2.363	14.604
$\mathbf{F}_{med}$	0.696	2.079	2.752

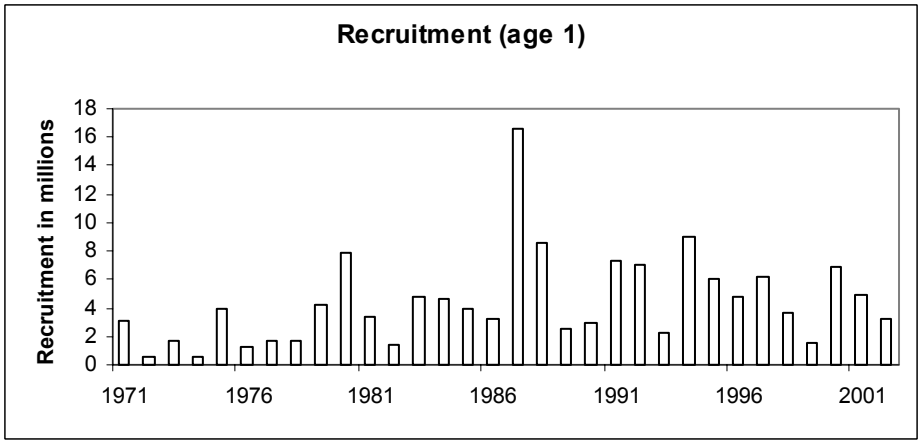
Catch data (Tables 3.9.2.1-3):

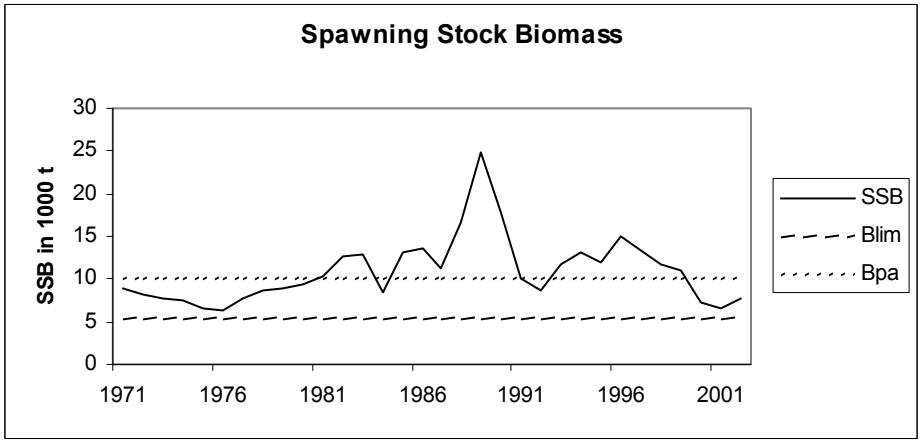
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings
1987	Reduce F	< 6.4[2]		-
1988	No increase in F; TAC	7.0[2]		17.7
1989	No increase in F; TAC	8.6[2]		20.3
1990	No increase in F; TAC	9.2[2]		12.9
1991	TAC; SSB = mean	4.5[2]		9.3
1992	Appropriate to reduce F	-		9.6
1993	20% reduction in F	6.5[2]	19.0	10.2
1994	20% reduction in F	5.6[2]	17.0	10.3
1995	20% reduction in F	4.7[3]	17.0	11.7
1996	20% reduction in F	4.7[3]	20.0	12.8
1997	20% reduction in F	7.4[4]	20.0	11.8
1998	10% reduction in F	8.8[4]	20.0	10.7
1999	Reduce F below $\mathbf{F}_{pa}$	9.2[4]	19.0	9.9
2000	Reduce F below $\mathbf{F}_{pa}$	< 7.6[5]	16.0	7.0
2001	40% reduction in F	< 4.3[5]	10.5	8.5
2002	45% reduction in F	< 5.3[5]	8.7	
2003	60% reduction in F	< 3.8[5]		

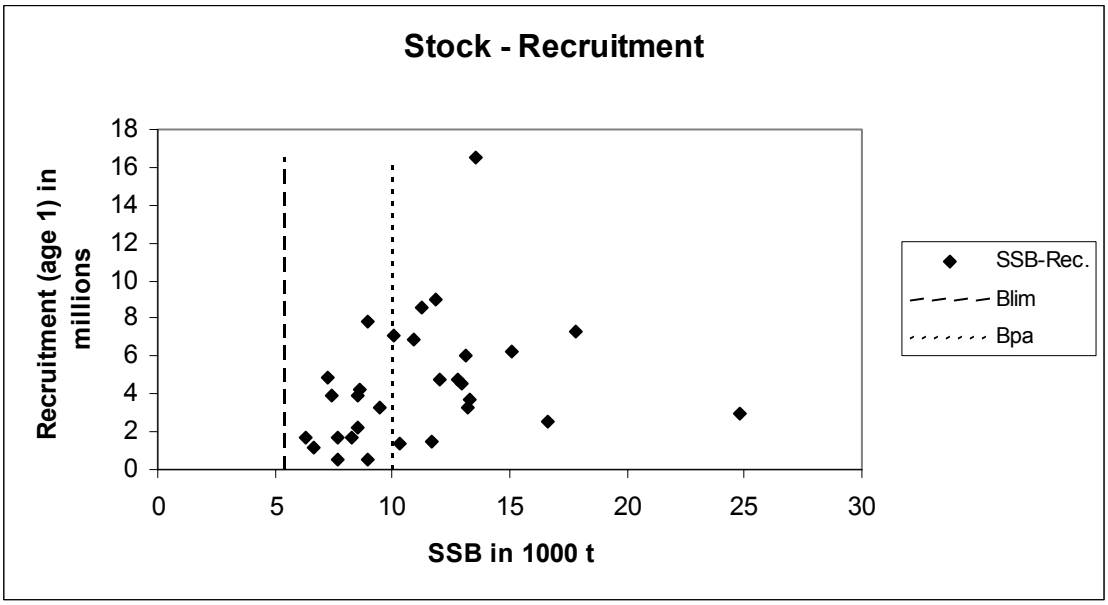
[1]TAC covers Subareas VII (except Division VIIa) and VIII. [2] For the VIIf+g stock component. [3] For the VIIf-h stock component. [4] For the VIIe-h stock component. [5] For VIIe-k stock component. Weights in '000 t.

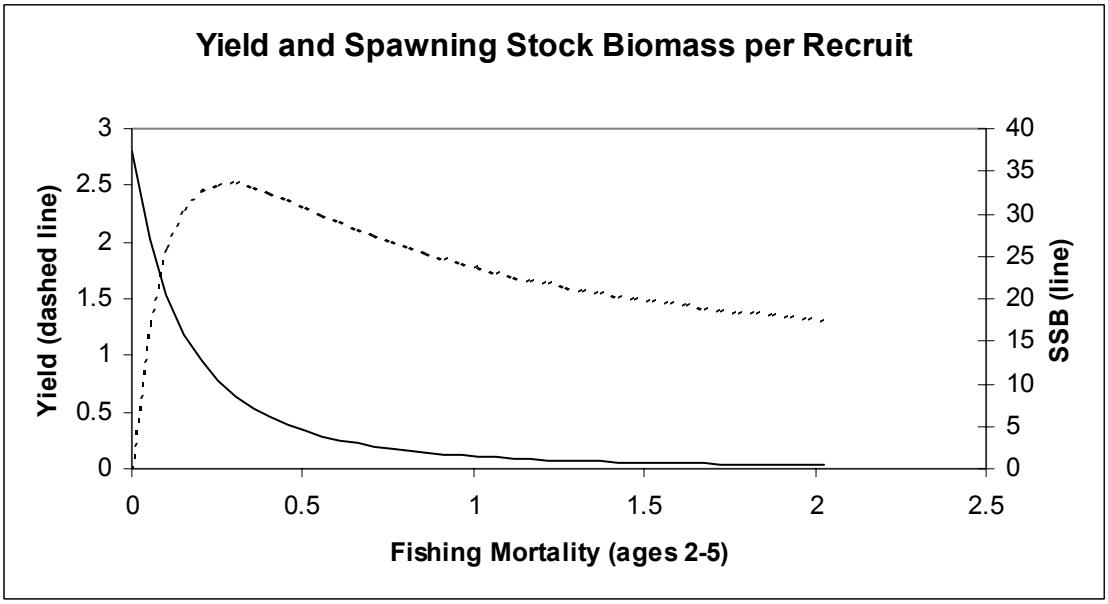

Landings
Landings in 1000 t
0
5
10
15
20
25
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 2-5)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
0
2
4
6
8
10
12
14
16
18
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
30
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 2-5)

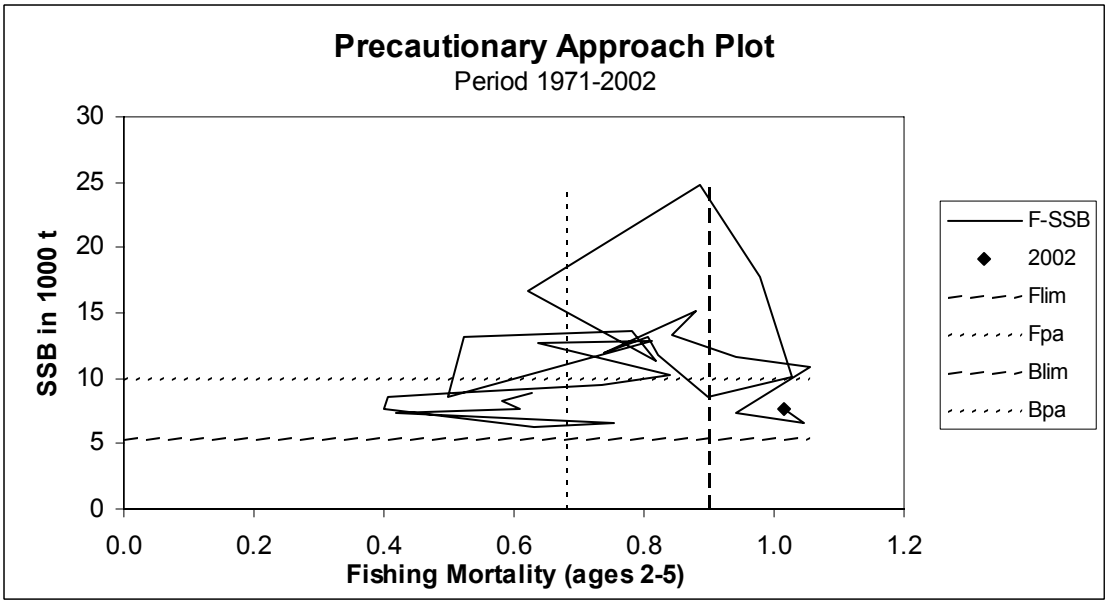

Precautionary Approach Plot
Period 1971-2002
SSB in 1000 t
Fishing Mortality (ages 2-5)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.9.2.1 Nominal landings of Cod in Divisions VIIf–h, VIIe, VIIe–h, VIIj–k, VIIe–k as used by the Working Group in 2002.

Divisions VIIf,g,h

Year	Belgium	France	Ireland	UK (E + W)	Others	Total
1971						4647
1972						3807
1973	524	2413	64	196	30	3227
1974	197	1954	24	154		2329
1975	377	2657	15	130	30	3209
1976	226	3535	13	97	1	3872
1977	107	2272	17	62		2458
1978	88	2744	30	69		2931
1979	110	3469	72	86		3737
1980	172	5187	246	209	7	5821
1981	285	7806	108	317		8516
1982	174	6391	142	338		7045
1983	262	7013	274	199		7748
1984	240	4569	204	316		5329
1985	456	5632	198	398		6684
1986	374	7473	226	345		8418
1987	216	7187	380	437		8220
1988	542	12065	612	400		13619
1989	891	14298	1003	482		16674
1990	615	8612	177	689		10093
1991	297	5750	246	590		6883
1992	193	6417	340	655		7605
1993	386	7650	331	604		8971
1994	397	6947	966	480		8790
1995	388	7571	820	539		9317
1996	550	8324	949	597		10420
1997	687	7665	397	556		9305
1998	519	6326	659	515		8019
1999	326	5879	1220	444		7869
2000	207	4048	961	407		5623
2001*	345	5489**	818	490		7142

Division VIIe

Year	Belgium	France	Ireland	UK	Others	Total
1988	12	1899		839		2750
1989	19	1453		727	2	2201
1990	6	654		610	9	1279
1991	6	341		408		755
1992	2	331		365		698
1993	5	307		274	2	587
1994	1	308		309	2	620
1995	12	554		348		914
1996	2	497		415		914
1997	1	627		441		1069
1998	5	955		456		1416
1999	0	831		431		1262
2000	0	620		318		938
2001*	2	602**		348		952

Continued …

Table 3.9.2.1 Continued

Divisions VIIe, f,g,h

Year	Belgium	France	Ireland	UK	Others	Total
1988	554	13964	612	1239	0	16369
1989	910	15751	1003	1209	2	18875
1990	621	9266	177	1299	9	11372
1991	303	6091	246	998	0	7638
1992	195	6748	340	1020	0	8303
1993	391	7957	331	878	2	9558
1994	398	7255	966	789	2	9410
1995	399	8124	820	888	0	10231
1996	552	8821	949	1012	0	11334
1997	688	8292	397	997	0	10374
1998	525	7280	659	970	0	9434
1999	326	6710	1220	875	0	9131
2000	208	4668	961	725	0	6561
2001*	347	6091**	818	838	0	8094

Divisions VIIj,k

Year	Belgium	France	Ireland	UK	Others	Total
1988		407	868	53	2	1330
1989		508	857	14	13	1392
1990		276	1064	47	149	1536
1991		115	1413	96	20	1644
1992		202	872	187	13	1274
1993		143	435	67	4	649
1994		117	650	117	6	890
1995		193	1126	147	8	1474
1996		233	1033	154	0	1420
1997	6	153	1116	169	0	1444
1998	4	102	1059	118	0	1283
1999	0	110	663	22	0	795
2000	0	80	341	20	0	441
2001*	0	179**	273	0	0	452

Continued …

Table 3.9.2.1 Continued

Divisions VIIe,f,g,h,j,k

Year	Belgium	France	Ireland	UK	Others	Total
1971	-	-	-	-	-	5782
1972	-	-	-	-	-	4737
1973	-	-	-	-	-	4015
1974	-	-	-	-	-	2898
1975	-	-	-	-	-	3993
1976	-	-	-	-	-	4818
1977	-	-	-	-	-	3058
1978	-	-	-	-	-	3647
1979	-	-	-	-	-	4650
1980	-	-	-	-	-	7243
1981	-	-	-	-	-	10596
1982	-	-	-	-	-	8766
1983	-	-	-	-	-	9641
1984	-	-	-	-	-	6631
1985	-	-	-	-	-	8317
1986	-	-	-	-	-	10475
1987	-	-	-	-	-	10228
1988	554	14371	1480	1292	2	17699
1989	910	16259	1860	1223	15	20267
1990	621	9542	1241	1346	158	12908
1991	303	6206	1659	1094	20	9282
1992	195	6950	1212	1207	13	9577
1993	391	8100	766	945	6	10207
1994	398	7372	1616	906	8	10300
1995	399	8317	1946	1035	8	11705
1996	552	9055	1982	1166	0	12754
1997	693	8445	1513	1166	0	11818
1998	528	7383	1718	1089	0	10718
1999	326	6820	1883	897	0	9926
2000	208	4748	1302	745	0	7002
2001*	347	6270**	1091	838	0	8546

* Provisional.

** Estimated landings derived from official landings in TAC area and computed log-books.

Table 3.9.2.2 Nominal landings (t) of Cod in Divisions VIIb,c, VIId, and, VIIe–k as used by the Working Group in 2002.

Year	VIIb,c	VIId	VIIe-k
1971			5782
1972			4737
1973			4015
1974			2898
1975			3993
1976			4818
1977			3058
1978			3647
1979			4650
1980		5020	7243
1981		5336	10596
1982		3981	8766
1983		3841	9641
1984		3524	6631
1985		3331	8317
1986		12814	10475
1987		14219	10228
1988		10729	17699
1989		5538	20267
1990		2763	12908
1991		1886	9282
1992		2669	9577
1993		2432	10207
1994		2850	10300
1995	473	3964	11705
1996	519	3503	12754
1997	301	7043	11818
1998	318	8580	10718
1999	172	6858	9926
2000	148	2325	7002
2001*	99	1573	8546

* Provisional.

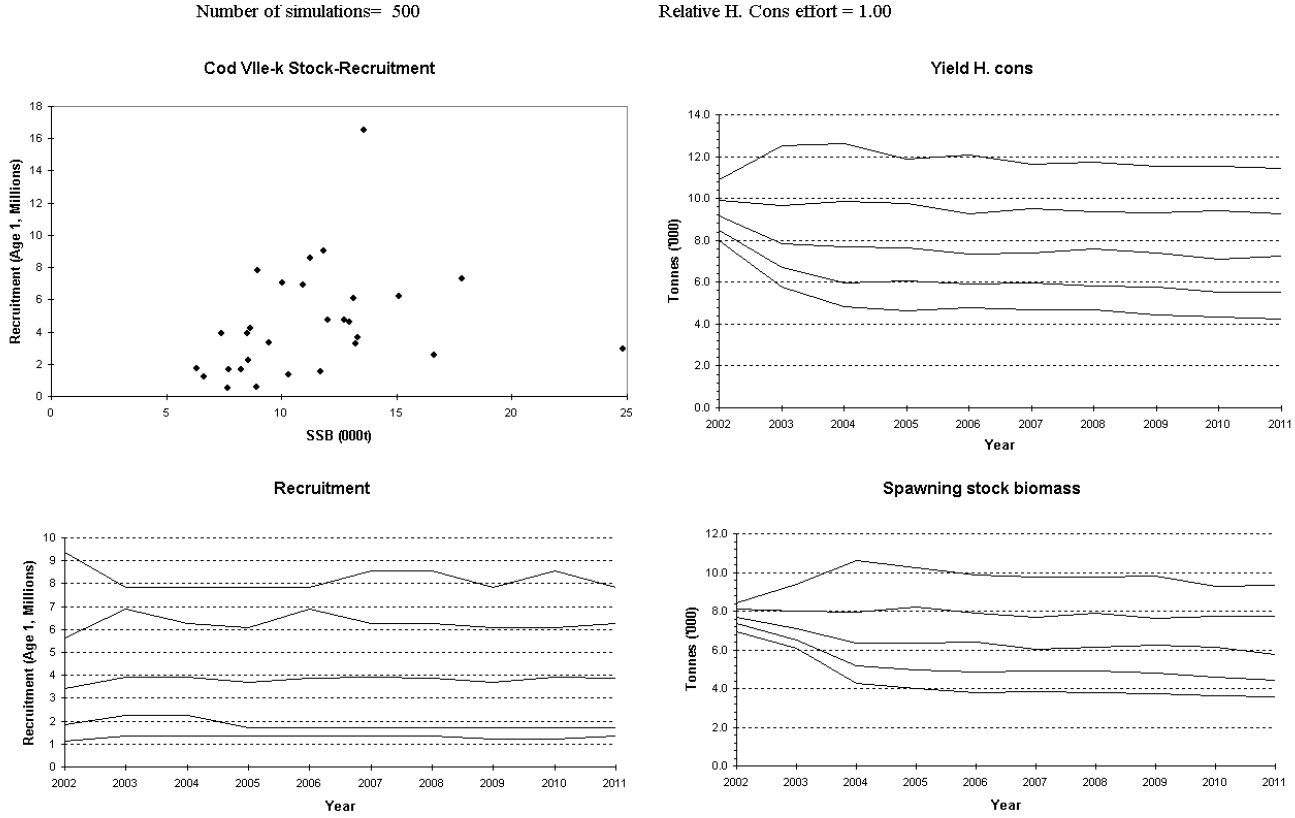
.

Table 3.9.2.3 Cod in Divisions VIIe-k

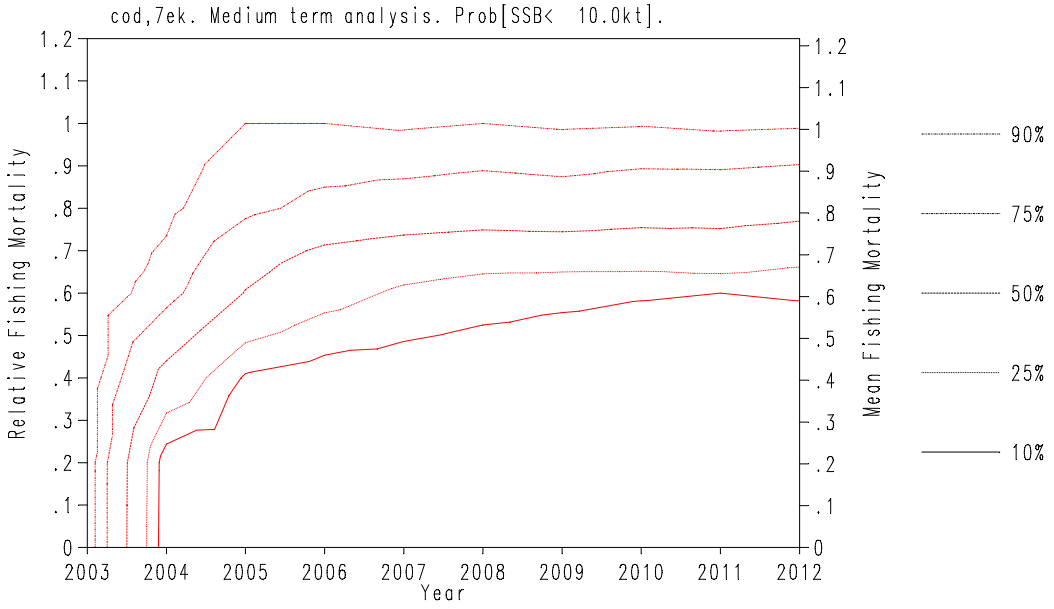
Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1971	3075	8928	5782	0.6284
1972	565	8225	4737	0.5822
1973	1665	7669	4015	0.6096
1974	500	7412	2898	0.4194
1975	3889	6630	3993	0.7549
1976	1202	6304	4818	0.6317
1977	1716	7692	3059	0.3994
1978	1690	8626	3647	0.4050
1979	4221	8951	4650	0.5068
1980	7822	9453	7243	0.7340
1981	3318	10287	10597	0.8387
1982	1350	12745	8766	0.6377
1983	4730	12931	9641	0.8128
1984	4604	8515	6631	0.4999
1985	3919	13204	8317	0.5235
1986	3289	13553	10475	0.7805
1987	16557	11260	10228	0.8182
1988	8574	16644	17699	0.6227
1989	2570	24830	20267	0.8867
1990	2941	17831	12908	0.9789
1991	7325	10041	9282	1.0284
1992	7075	8560	9577	0.8992
1993	2227	11815	10207	0.8222
1994	9015	13115	10300	0.8064
1995	6062	11994	11705	0.7380
1996	4749	15097	12754	0.8809
1997	6244	13305	11818	0.8426
1998	3679	11675	10717	0.9404
1999	1516	10925	9926	1.0541
2000	6891	7277	7002	0.9422
2001	4886	6580	8546	1.0464
2002	3280	7659		1.0142
Average	4411	10929	8781	0.7527

Cod in VIIe-k (Celtic Sea). Medium-term projections. Solid lines show 10, 25, 50, 75 and 90th percentiles. Stock-recruitment relationship estimated by random bootstrap.

Number of simulations = 500 Relative H. Cons effort = 1.00



Medium-term projection starting in 2003 with population numbers from the *status quo* F catch forecast.



3.9.3 Whiting in Divisions VIIe–k

State of stock/exploitation: The stock is within safe biological limits. SSB reached high levels in 1995 and 1996, and has decreased until 1999 though remaining well above $\mathbf{B}_{pa}$. SSB increased sharply in 2001 as the outstanding 1999 year class matured. The 2000 and 2001 year classes are estimated to have been very weak. Fishing mortality was very high during the 1980s, decreased in the early 1990s and is currently estimated to be around 0.6.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 15 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 21 000 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ not proposed.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$ not proposed.	$\mathbf{F}_{pa}$ not proposed.

Advice on management: There is no $\mathbf{F}_{pa}$ defined for this stock, but there is no long-term gain in increasing fishing mortality. Therefore, ICES recommends that fishing mortality should not increase, corresponding to landings of at most 20 200 t in 2003.

Relevant factors to be considered in management: The assessment area was expanded in 1997 to cover Divisions VIIe-k. The TAC for whiting is set for all of Subarea VII (excluding Division VIIa). In order to protect whiting in Divisions VIIe-k, the TAC should be allocated to Divisions, with catches in the other parts of Subarea VII being accounted against such TACs. The state of whiting in Division VIId should be considered, if setting an overall TAC for Subarea VII.

Catch forecast for 2003:

Basis: F(2002) = F(99–01) = $\mathbf{F}_{sq}$ = 0.63 ; Landings(2002) = 25.8 ; SSB(2003) = 40.6.

F (2003 onwards)	Basis	Landings (2003)	SSB (2004)
0.38	$0.6*\mathbf{F}_{sq}$	13.8	41.8
0.50	$0.8*\mathbf{F}_{sq}$	17.2	38.4
0.63	$1*\mathbf{F}_{sq}$	20.2	35.5
0.75	$1.2*\mathbf{F}_{sq}$	22.7	33.0
0.88	$1.4*\mathbf{F}_{sq}$	25.0	30.8

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: $\mathbf{F}_{max}$ is not well estimated due to a flat-topped Y/R curve.

Comparison with previous assessment and advice: The outstanding 1999 year class is now estimated by three surveys and verified by two commercial fleets and found to be 25% lower than previously estimated. There was an upward revision of fishing mortality and a downward revision of SSB in the current assessment.

Elaboration and special comment: Geometric mean recruitment assumptions account for 42% of the forecast SSB (2004).

Celtic Sea whiting are taken in mixed species (cod, whiting, hake, *Nephrops*) fisheries. French trawlers account for about 60% of the total landings, Ireland 30%, and the UK (England and Wales) 7%, while Belgian vessels take less than 1%. The French *Nephrops* trawlers have for several years adopted a larger mesh, following by-catch restrictions and market demand for larger *Nephrops*.

Analysis of landings trip by trip by the French gadoid trawlers for the period 1996-1998 showed that on a trip basis, cod and whiting were mixed. Information from the fishery indicates that on a haul basis, these two species are rather well separated, i.e. that fishermen seem to be able, for each trawl operation, to target cod and whiting separately.

The main Irish fleets in Divisions VIIf,g,h are inshore and offshore otter trawlers and seiners based in Dunmore East and Kilmore Quay. However, in recent years there has been an increase in the number of Irish beamers (+6 vessels) targeting anglerfish and megrim with whiting as by-catch, offshore in Division VIIg. Division VIIj–k whiting are taken in mixed species fisheries (cod/whiting/anglerfish/megrim and *Nephrops*). The main gears used are otter trawl and seiners, and landings are taken by Ireland (90%) and France (7%).

The main Irish fleet in Divisions VIIj,k are otter trawlers that target mixed gadoids and account for 10% of landings of whiting in Divisions VIIe-k. The main UK fisheries in Divisions VIIe,f,g,h are inshore between Newlyn and Salcombe and off the north Cornish coast, the bulk of the landings (> 60%) being made in the winter months between November and March. UK landings in the 1950s were 4–5 times higher than at present, though landings overall have generally increased during the period since 1982, with peaks in 1989 (16 540 t) and in 1995 (22 680 t). The main gears used in the Western Channel are otter trawls targeting a wide range of species, and beam trawls targeting sole, anglerfish, and plaice.

The main spawning areas of whiting in the Western Channel and Celtic Sea are off Start Point (VIIe), off Trevose Head (VIIf), and southeast of Ireland (VIIg). Returns of adult whiting tagged in the Western Channel indicated more movement into the Celtic Sea than between the Western and Eastern Channel. Whiting released in the Bristol Channel moved south and west towards the two spawning grounds off Trevose Head and southeast of Ireland. There was no evidence of emigration out of the Celtic Sea area. The results of returns of whiting tagged and released in the County Down spawning area show that a greater proportion of Irish Sea whiting move south into the Celtic Sea than north towards the west of Scotland.

Analytical assessment is based on landings, commercial CPUE, and surveys data. Some information on discards indicates that they may be substantial.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

Yield and spawning biomass per Recruit F-reference points:

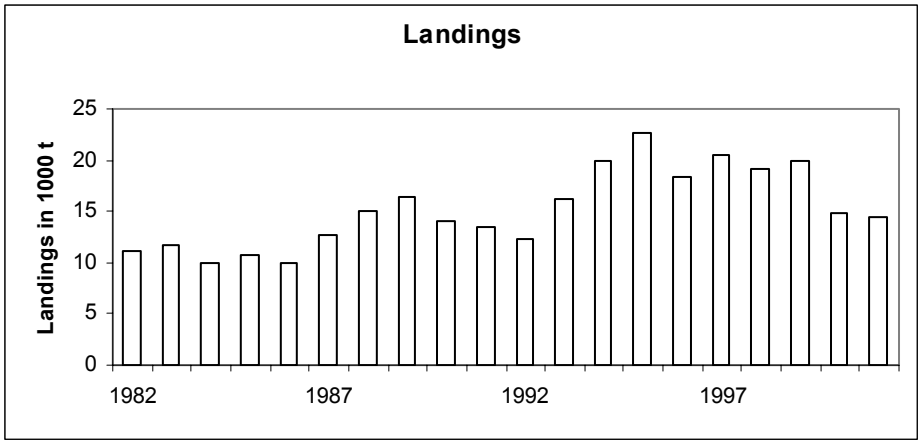
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average Current	0.625	0.191	0.484
$\mathbf{F}_{max}$	1.363	0.195	0.325
$\mathbf{F}_{0.1}$	0.257	0.165	0.790
$\mathbf{F}_{med}$	1.559	0.195	0.304

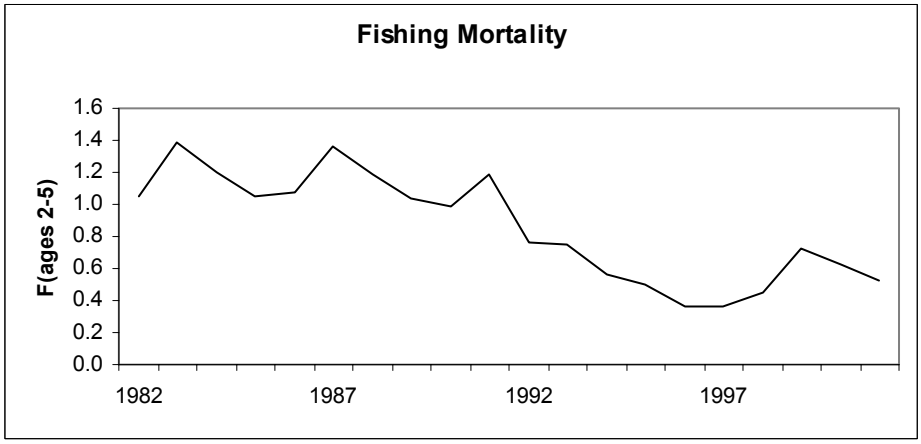
$\mathbf{F}_{max}$ is not well-defined.

Catch data (Tables 3.9.3.1–2):

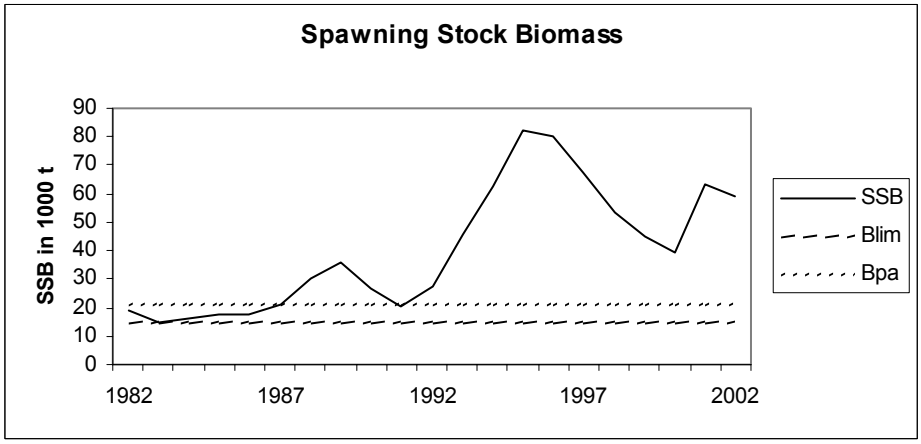
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings
1987	*Status quo* F; TAC	7.1[2]		12.7
1988	Precautionary TAC	7.0[2]		13.6
1989	Precautionary TAC	7.9[2]		16.5
1990	No increase in F; TAC	8.4[2]		14.1
1991	Precautionary TAC	8.0[2]		13.5
1992	If required, precautionary TAC	8.0[2]		12.4
1993	Within safe biological limits	6.6[2]	22.0	16.3
1994	Within safe biological limits	< 9.4[2]	22.0	20.0
1995	20% reduction in F	8.2[3]	25.0	22.7
1996	20% reduction in F	8.6[3]	26.0	18.3
1997	At least 20% reduction in F	< 7.3[4]	27.0	20.5
1998	At least 20% reduction in F	< 8.2[4]	27.0	19.2
1999	No increase in F	12.4[4]	25.0	19.9
2000	17% reduction in F	< 13.1[4]	22.2	14.9
2001	No increase in F	13.5[4]	21.0	14.5
2002	No increase in F	27.7[4]	31.7	
2003	No increase in F	20.2[4]		

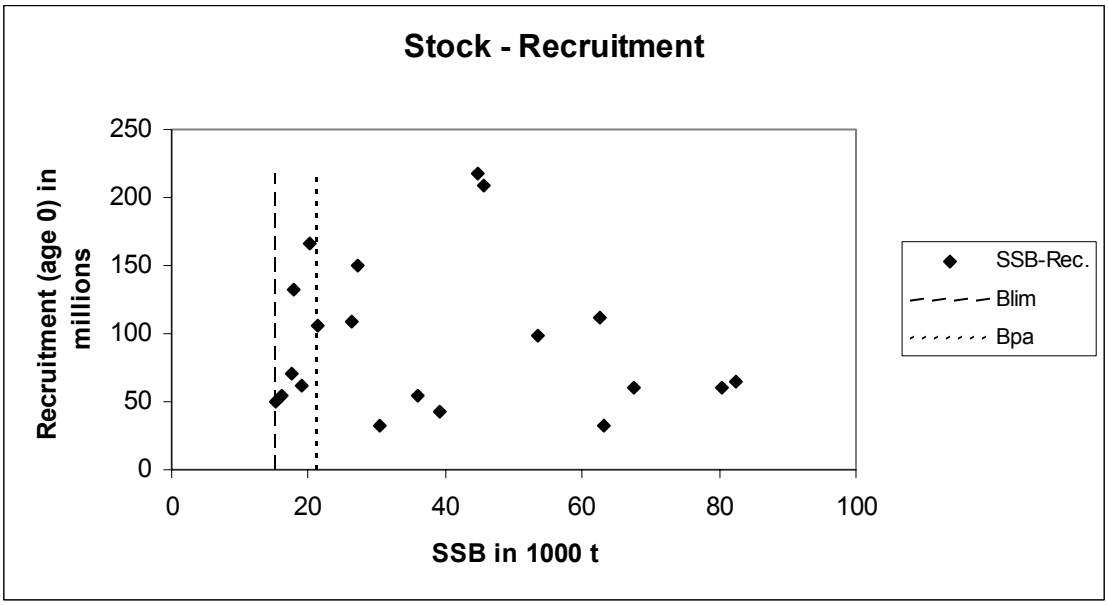
[1] TAC covers Subarea VII (except Division VIIa). [2] For the VIIf+g stock component, [3] For the VIIf-h stock component, [4]For the VII e-k stock component. Weights in '000 t.

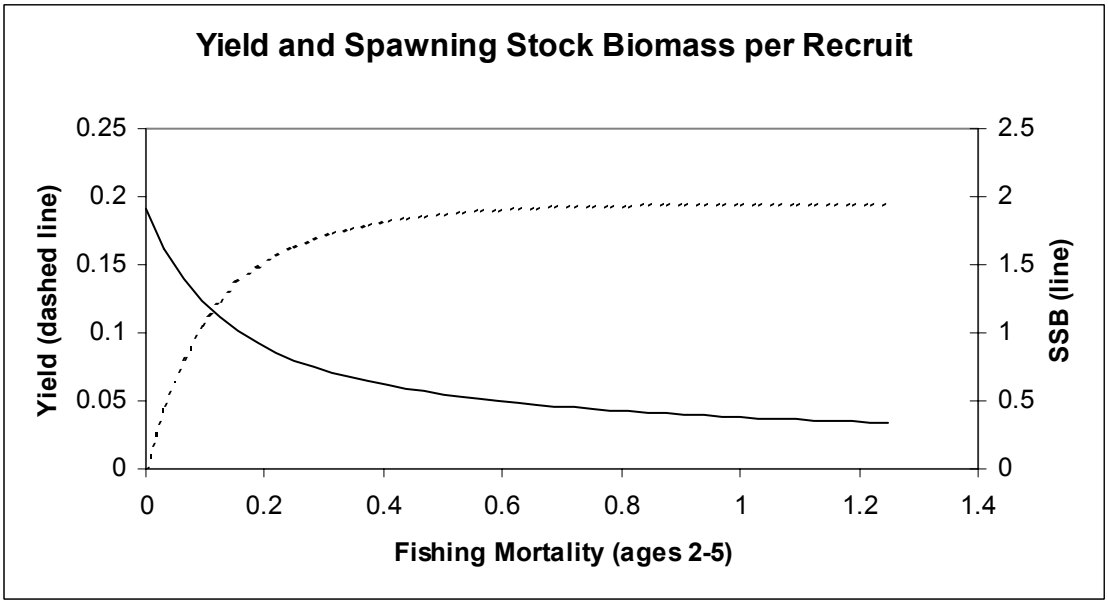

Landings
Landings in 1000 t
25
20
15
10
5
0
1982
1987
1992
1997


Fishing Mortality
F(ages 2-5)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1982
1987
1992
1997

Recruitment (age 0)
Recruitment in millions
250
200
150
100
50
0
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
250
200
150
100
50
0
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 2-5)

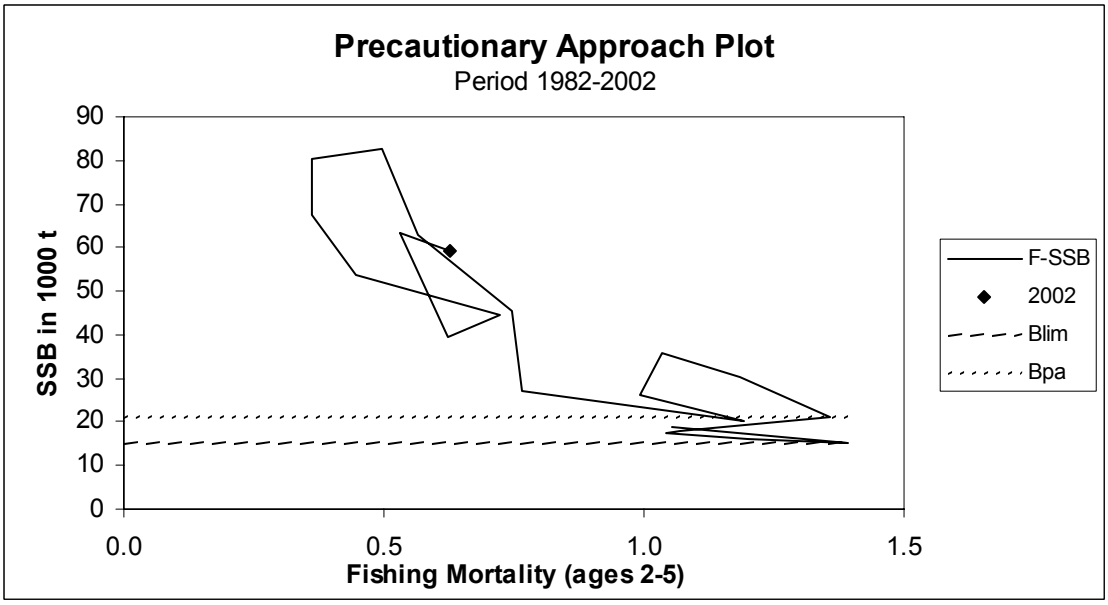

Precautionary Approach Plot
Period 1982-2002
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
Fishing Mortality (ages 2-5)
F-SSB
2002
Blim
Bpa

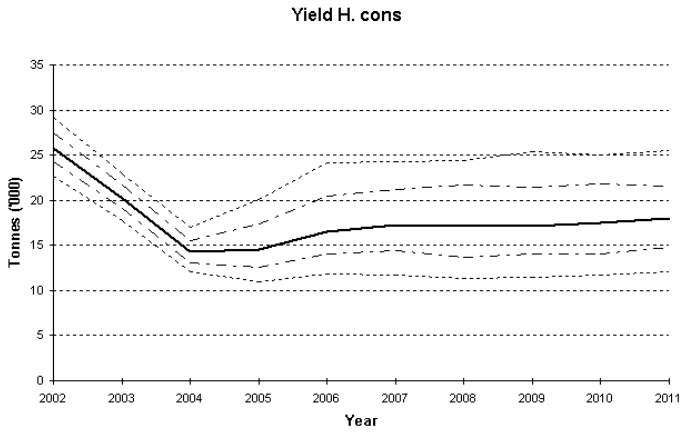
Table 3.9.3.1 WHITING in Divisions VIIe-k.
Nominal Landings (t) as reported to ICES, and total landings as used by the Working Group.

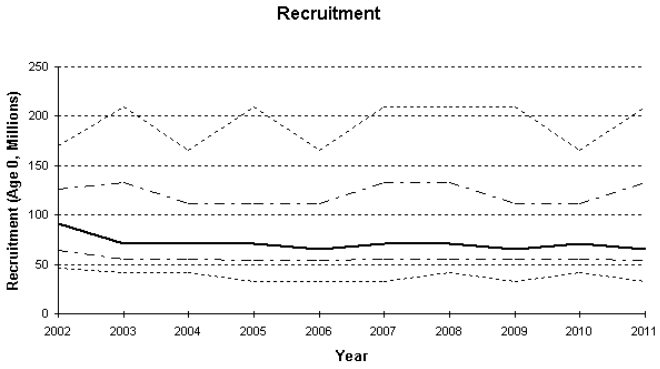
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	135	161	167	107	111	159	296	308	292	107	145	228	205	268	449	479	448	194	171
Denmark																			
France	8,982	7,171	7,820	7,647	10,054	11,410	12,171	10,464	9,956	9,165	10,771	12,634	13,400	9,936	11,370	11,711[1]	12,346[2]	8,954[2]	8867[2]
Germany										14									
Ireland	1,487	1,301	2,241	1,309	1,452	398	2,817	1,478	1,258	1,691	3,631	5,618	6,077	6,115	6,893	5,226	5,807	4,795	4942
Netherlands		398		124										8		1			5
Spain													4	31	24	53	21	10	
UK (E/W/NI)	1,177	954	610	765	1,035	1,598	1,252	1,782	1,969	1,379	1,756	1,548	1,804	1,728	1,742	1,709	1,346	1,252	
UK(Scotland)						1	5	74	33	8	17	6	23	34	42	68	3	2	
United Kingdom																			822
Total	11,781	9,985	10,838	9,952	12,652	13,566	16,541	14,106	13,508	12,364	16,320	20,034	21,513	18,120	20,520	19,247	19,971	15,207	14,807
Unallocated	0	0	0	0	0	1,562	0	0	0	0	0	0	1,165	140	12	-2	-56	-288	-352
Total as used by the Working Group	11781	9985	10838	9952	12652	15128	16541	14106	13508	12364	16320	20034	22678	18260	20532	19245	19915	14919	14455

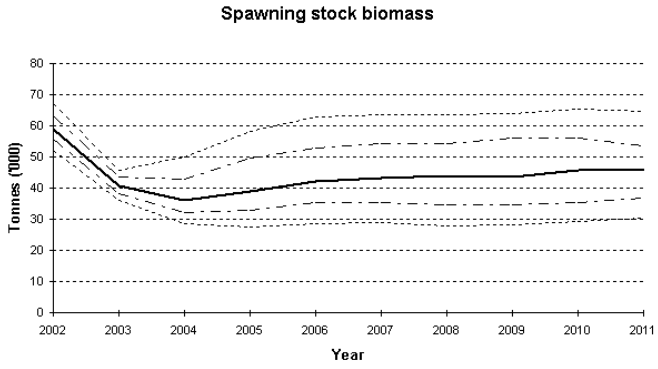
[1] Preliminary
[2] Estimated from logbooks

Table 3.9.3.2 Whiting in Divisions VIIe-k

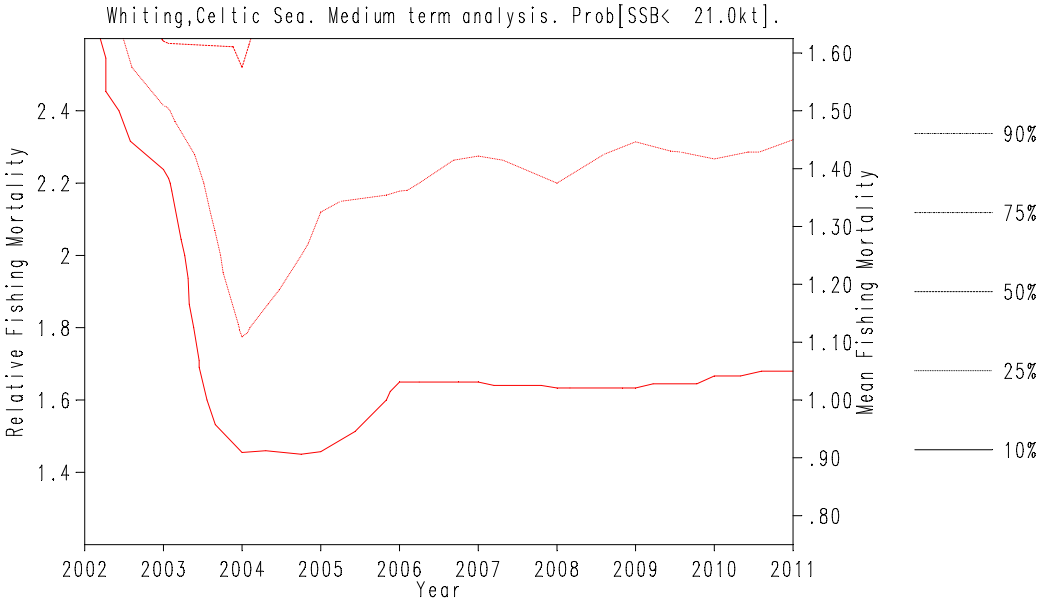
Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	62000	19000	11200	1.052
1983	50000	15100	11800	1.391
1984	54000	16100	10000	1.199
1985	71000	17500	10800	1.044
1986	133000	17700	10000	1.071
1987	106000	21300	12700	1.359
1988	33000	30400	15100	1.186
1989	55000	35900	16500	1.036
1990	109000	26400	14100	0.992
1991	166000	20100	13500	1.193
1992	150000	27300	12400	0.766
1993	209000	45600	16300	0.745
1994	112000	62700	20000	0.566
1995	65000	82500	22700	0.495
1996	61000	80500	18300	0.362
1997	61000	67600	20500	0.362
1998	98000	53600	19200	0.447
1999	218000	44700	19900	0.722
2000	42000	39300	14900	0.622
2001	33000	63200	14500	0.531
2002	88000	59300		0.625
Average	94095	40276	15220	0.846







Whiting in VIIe-k (Celtic Sea)
Medium-term analysis. Lines show 10th, 25th and 50th percentiles.



3.9.4 Celtic Sea plaice (Divisions VIIf and g)

State of stock/exploitation: The stock is outside safe biological limits. SSB decreased from 1988 to 2000 and has been below $\mathbf{B}_{pa}$ since 1998. Fishing mortality has fluctuated around the average. Most recent year classes have been below average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998, modified in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1 100 t, the lowest observed spawning stock biomass $\mathbf{B}_{loss}$.	$\mathbf{B}_{pa}$ be set at 1 800 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty assessments.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ not defined

Technical basis:

$\mathbf{B}_{lim}=\mathbf{B}_{loss}$	$\mathbf{B}_{pa}= \mathbf{B}_{lim} * 1.64$
$\mathbf{F}_{lim}$=Not defined	$\mathbf{F}_{pa}$ not defined

Advice on management: ICES recommends a reduction in fishing mortality of at least 40% relative to $\mathbf{F}_{sq}$, corresponding to landings of less than 660 t in 2003. This is consistent with the reduction in fishing mortality recommended for sole, which is the target species for the flatfish fishery in this area. This is expected to result in an increase in SSB above $\mathbf{B}_{pa}$ in the short term.

Relevant factors to be considered in management: At *status quo* F, SSB is likely to remain below $\mathbf{B}_{pa}$.

Plaice is taken mainly in a directed beam-trawl fishery for sole, and to a lesser extent in otter trawl fisheries. Management should take account of the mix of Celtic Sea sole and plaice.

Catch forecast for 2003:
Basis: TAC constraint; $\mathbf{F}_{sq}$ = F(99-01) =0.55; Landings (2002) = 0.68; SSB(2003) = 1.78.

F(2003) Onwards	Basis	Landings (2003)	SSB(2004)
0.27	0.5 * $\mathbf{F}_{sq}$	0.57	2.12
0.33	0.6 * $\mathbf{F}_{sq}$	0.66	2.03
0.38	0.7 * $\mathbf{F}_{sq}$	0.76	1.94
0.44	0.8 * $\mathbf{F}_{sq}$	0.84	1.86
0.55	$\mathbf{F}_{sq}$	1.01	1.71
0.66	1.2 * $\mathbf{F}_{sq}$	1.16	1.57

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

In order to achieve a 30% increase in SSB from 2003 to 2004 a 70% reduction in F would be required.

Medium- and long-term projections: Assuming the current selection pattern, $\mathbf{F}_{max}$ is estimated to be 0.44 $\mathbf{F}_{sq}$. Results of the medium-term analysis indicate a low probability of SSB falling below $\mathbf{B}_{pa}$ in the medium term when fishing mortality is reduced by 40% from 2003 onwards.

Comparison with previous assessment and advice: Results of this assessment are close to the previous one. As previously, advice has been based on sole.

Elaboration and special comment: The fisheries that catch plaice in the Celtic Sea mainly involve vessels from France, Belgium, England and Wales, and to a lesser extent Ireland.

In the 1970s, the Divisions VIIf,g plaice fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. Effort in the UK and Belgian beam-trawl fleets increased in the late 1980s, but has since declined. Recently, many otter trawlers have been replaced by beam trawlers, which target sole. Landings gradually increased until 1989, then declined rapidly in 1991. The main fishery occurs in the spawning area off the north Cornish coast, at depths greater than 40 m, about 20 to 25 miles offshore. Although plaice are taken

throughout the year, the larger landings occur during March after the peak of spawning, and again in September.

There is some evidence from tagging that plaice from the south and west coasts of Wales move southwards to join the adult population off the north Cornish coast during spawning.

Analytical age-based assessment using landings, survey, and commercial CPUE data.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

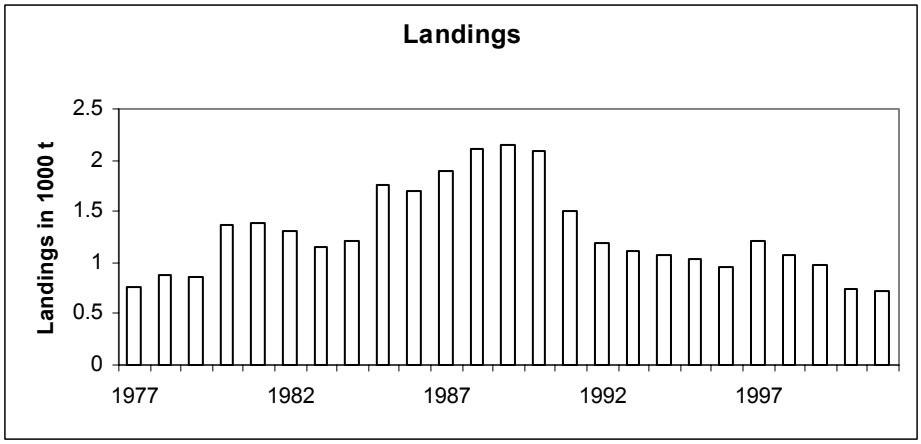
Yield and spawning biomass per Recruit F-reference points:

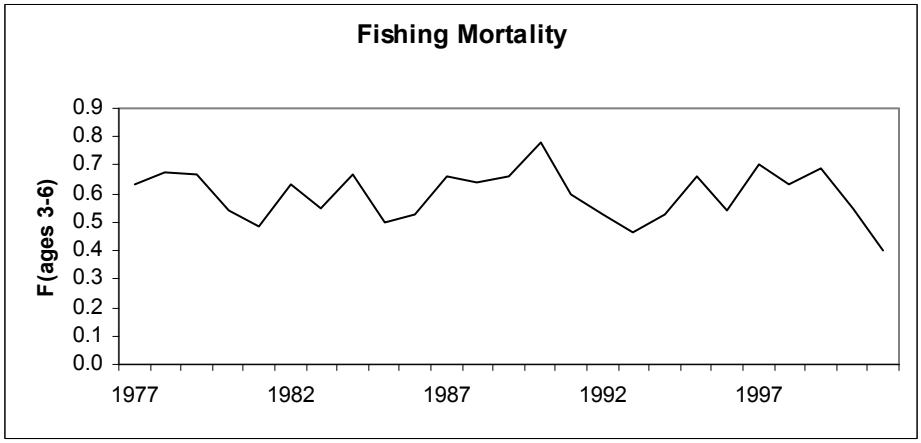
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.545	0.249	0.439
$\mathbf{F}_{max}$	0.240	0.264	0.972
$\mathbf{F}_{0.1}$	0.105	0.237	1.871
$\mathbf{F}_{med}$	0.514	0.251	0.466

Catch data (Tables 3.9.4.1-2):

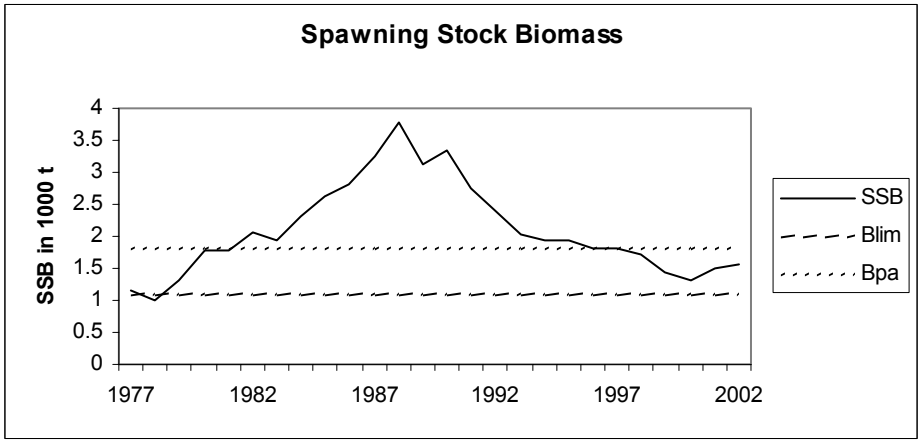
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM Landings
1987	TAC not to be restrictive on other species	-	1.8	1.90	1.90
1988	TAC not to be restrictive on other species	-	2.5	2.12	2.12
1989	TAC not to be restrictive on other species	-	2.5	2.15	2.15
1990	F likely to be F(88)	~1.9	1.9	2.08	2.08
1991	F likely to be F(89)	~1.7	1.9	1.50	1.50
1992	No long-term gains in increasing F	-	1.5	1.19	1.19
1993	No long-term gains in increasing F	-	1.4	1.11	1.11
1994	No long-term gains in increasing F	-	1.4	1.07	1.07
1995	No increase in F	1.29	1.4	1.03	1.03
1996	20% reduction in F	0.93	1.1	0.95	0.95
1997	20% reduction in F	1.10	1.1	1.22	1.22
1998	20% reduction in F	1.00	1.1	1.07	1.07
1999	35% reduction in F	0.67	0.9	0.97	0.97
2000	30% reduction in F	0.70	0.80	0.74	0.74
2001	40% reduction in F	0.60	0.76	0.72	0.72
2002	At least 35% reduction in F	0.68	0.68		
2003	At least 40% reduction in F	<0.66			

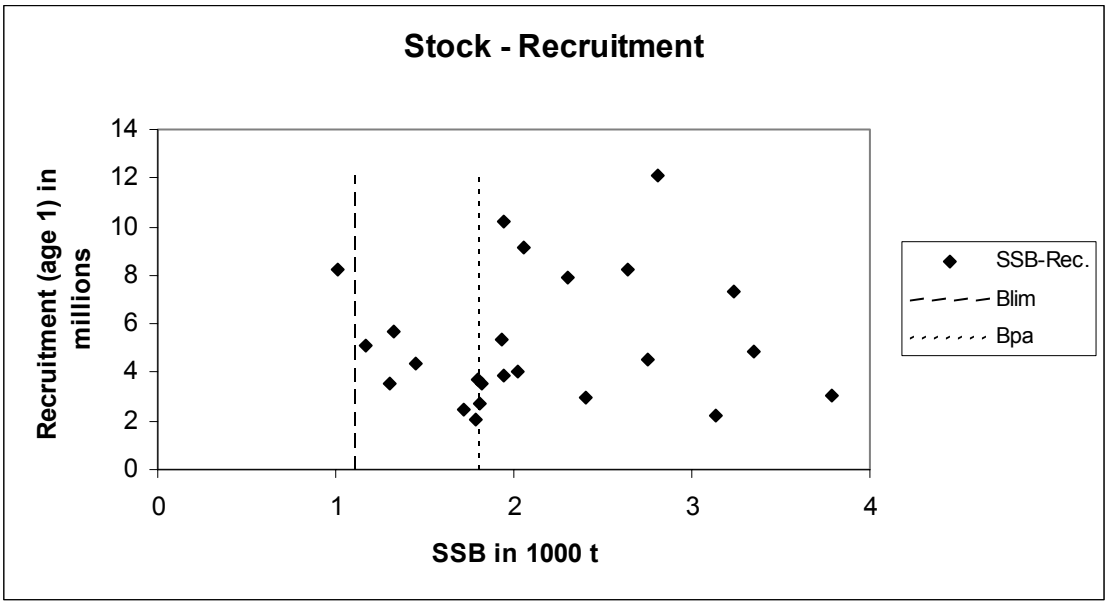
Weights in ‘000 t.

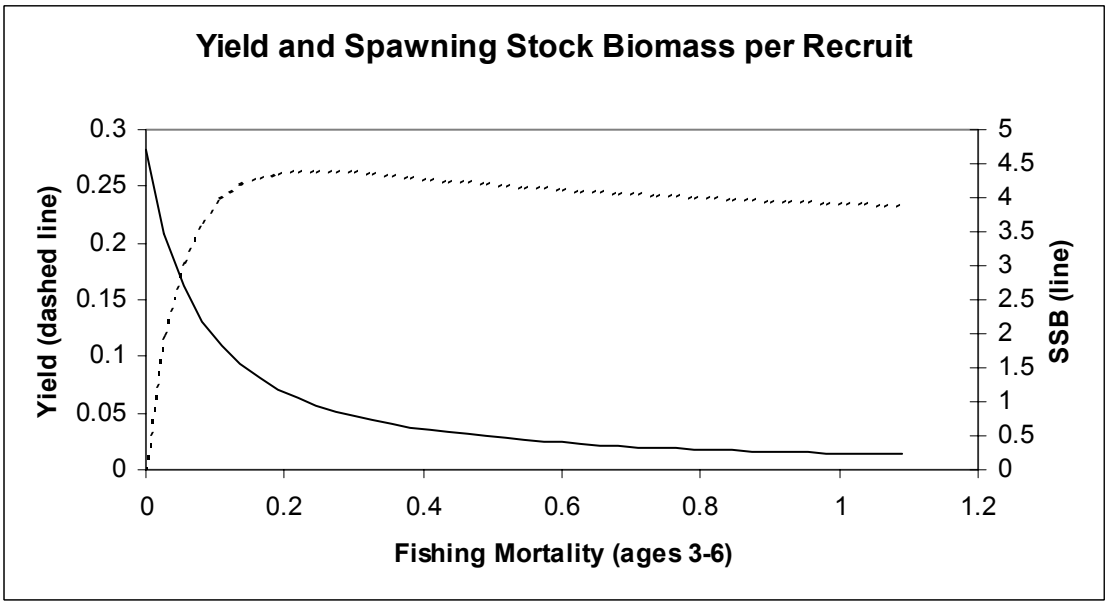

Landings
Landings in 1000 t
2.5
2
1.5
1
0.5
0
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 3-6)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1977
1982
1987
1992
1997

Recruitment (age 1)
Recruitment in millions
14
12
10
8
6
4
2
0
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
4
3.5
3
2.5
2
1.5
1
0.5
0
1977
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-6)

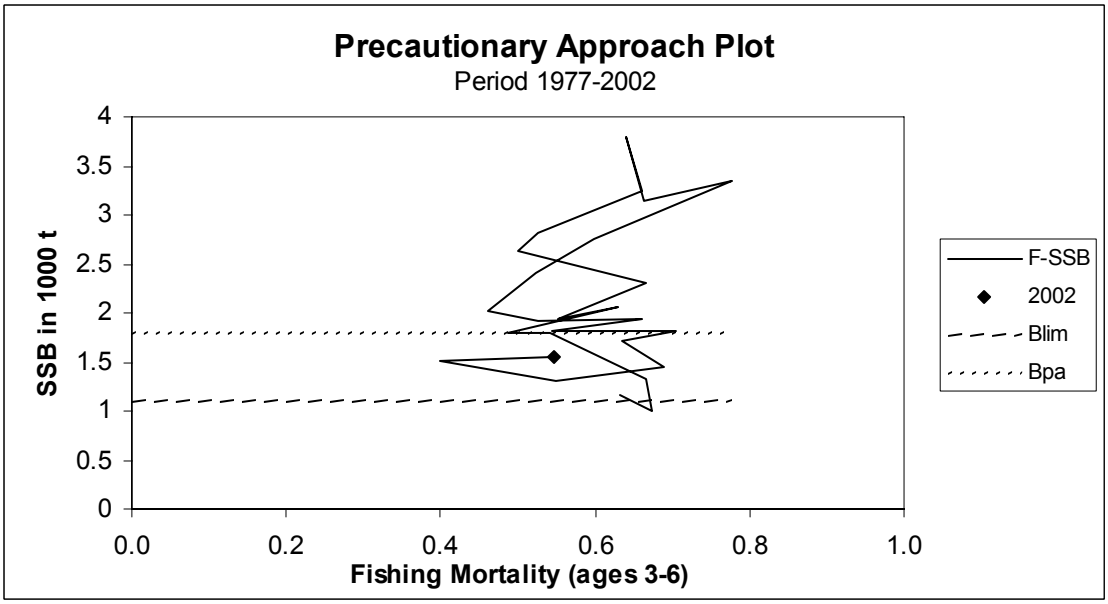

Precautionary Approach Plot
Period 1977-2002
SSB in 1000 t
Fishing Mortality (ages 3-6)
F-SSB
2002
Blim
Bpa

Table 3.9.4.1 Celtic Sea Plaice. Nominal landings (t) in Divisions VIIf+g, as used by Working Group.

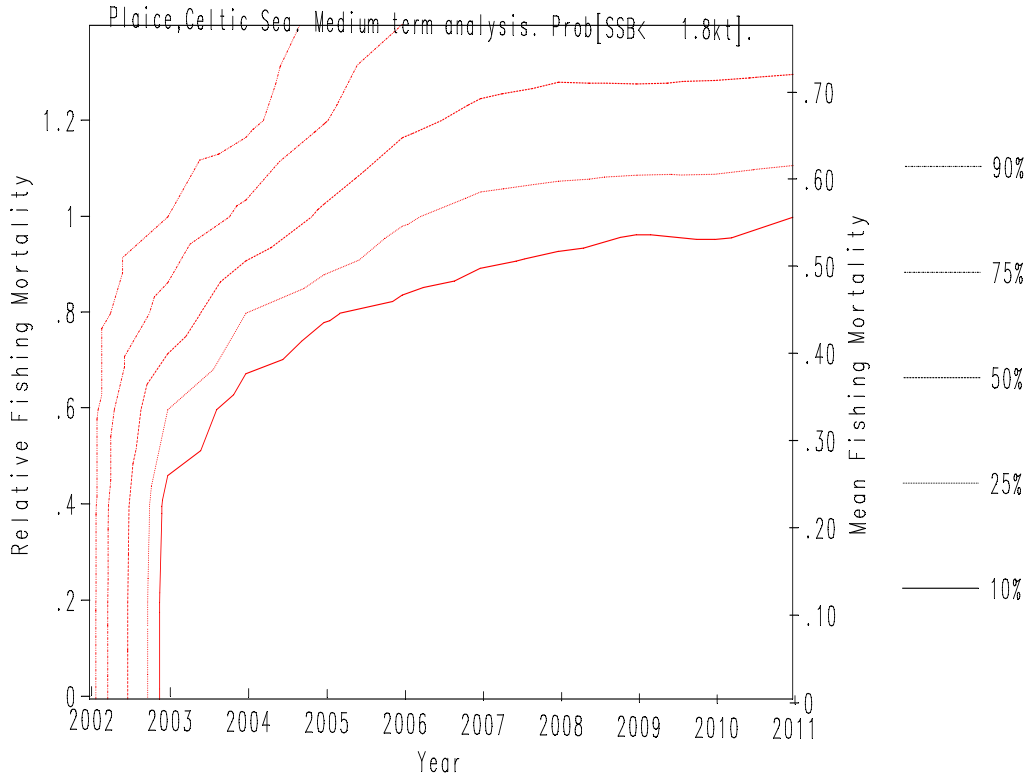
Year	Belgium	France	Ireland	UK (Engl. & Wales)	Others	Total reported	Unallocated	Total as used by WG
1977	214	365	28	150	0	757	0	757
1978	196	527	0	152	0	875	0	875
1979	171	467	49	176	0	863	0	863
1980	372	706	61	227	7	1,373	0	1,373
1981	365	697	64	251	0	1,377	0	1,377
1982	341	568	198	196	0	1,303	0	1,303
1983	314	532	48	279	0	1,173	-27	1,146
1984	283	558	72	366	0	1,279	-69	1,210
1985	357	493	91	466	0	1,407	345	1,752
1986	544	598	59	324	21	1,546	145	1,691
1987	576	708	122	495	0	1,901	0	1,901
1988	635	687	164	630	0	2,116	0	2,116
1989	835	649	195	472	0	2,151	0	2,151
1990	777	642	167	496	0	2,082	0	2,082
1991	479	533	94	395	0	1,501	0	1,501
1992	326	455	106	301	0	1,188	0	1,188
1993	396	342	87	290	0	1,114	0	1,114
1994	357	281	182	250	0	1,070	0	1,070
1995	337	254	153	284	0	1,028	0	1,028
1996	359	239	116	238	0	952	0	952
1997	494	321	143	259	0	1,217	0	1,217
1998	458	298	135	176	0	1,067	0	1,067
1999	415	262	122	169	0	968	0	968
2000	233	302	70	134	0	739	0	739
2001	277	256	46	136	0	715	0	715

N.B.: ICES receives statistics from some countries only for Divisions VIIg-k combined and not for each Division separately. The figures up to 1982 and from 1987 and onwards are provided by members of the Working Group; from 1983–1986, they are figures submitted to the EC by member states.

Table 3.9.4.2 Celtic Sea plaice (Divisions VIIf and g)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1977	3633	1170	757	0.632
1978	5091	1010	875	0.673
1979	8264	1323	863	0.666
1980	5709	1789	1373	0.541
1981	2080	1793	1377	0.488
1982	3679	2055	1303	0.630
1983	9161	1942	1146	0.551
1984	10212	2298	1210	0.666
1985	7947	2635	1752	0.500
1986	8229	2809	1691	0.527
1987	12086	3238	1901	0.661
1988	7291	3792	2116	0.641
1989	3063	3134	2151	0.664
1990	2197	3347	2082	0.777
1991	4884	2751	1501	0.598
1992	4533	2400	1188	0.524
1993	2942	2025	1114	0.462
1994	4074	1927	1070	0.527
1995	5324	1942	1028	0.660
1996	3898	1815	952	0.544
1997	3555	1808	1217	0.704
1998	2692	1717	1067	0.634
1999	2473	1450	968	0.689
2000	4365	1305	739	0.549
2001	3537*	1513	715	0.398
2002	3537*	1553		0.546
Average	5171	2098	1286	0.594

* $GM_{89\text{-}00}$


Plaice,Celtic Sea. Medium term analysis. Prob[SSB< 1.8kt].
Relative Fishing Mortality
Mean Fishing Mortality
Year
0
.2
.4
.6
.8
1
1.2
.10
.20
.30
.40
.50
.60
.70
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
90%
75%
50%
25%
10%

3.9.5 Sole in Divisions VIIf and g (Celtic Sea)

State of stock/exploitation: The stock is harvested outside safe biological limits. Fishing mortality has increased since the late 1970s, exceeding $\mathbf{F}_{pa}$ since the early 1980s, and is at present above $\mathbf{F}_{lim}$. SSB has declined steadily since the early 1970s. SSB fell below $\mathbf{B}_{pa}$ in 1995 and has remained low until 2001, when the outstanding 1998 year class began to contribute and SSB increased above $\mathbf{B}_{pa}$. SSB is forecast to increase further in 2002-2003. Recruitment has fluctuated with some peaks: the 1970 and 1989 year classes were strong, and the 1998 year class the strongest in the series.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined	$\mathbf{B}_{pa}$ be set at 2 200 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is 0.52, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.37. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and maintaining SSB above $\mathbf{B}_{pa}$ in 10 years, taking into account the uncertainty of assessments.

Technical basis:

$\mathbf{B}_{lim}$: Not defined	$\mathbf{B}_{pa}$: $\mathbf{B}_{loss}$
$\mathbf{F}_{lim}$**:** $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72; implies a less than 5% probability that ($SSB_{MT} < \mathbf{B}_{pa}$)

Advice on management: ICES recommends that the fishing mortality should be reduced to below $\mathbf{F}_{pa}$, corresponding to landings of less than 1 240 t in 2003. This corresponds to a reduction of 40% from *status quo* F, and will maintain SSB above $\mathbf{B}_{pa}$ in the short term.

Relevant factors to be considered in management: The assessment indicates a large 1998 year class, and SSB is expected to increase in the short term. However, outstanding year classes have only been produced at long intervals and the stock increase is therefore likely to be temporary.

Sole is taken mainly in a directed beam-trawl fishery with plaice as a by-catch, and to a lesser extent in otter trawl fisheries. Management should take account of the mix of Celtic Sea sole and plaice.

Catch forecast for 2003:

Basis: F(2002)=TAC constraint, $\mathbf{F}_{sq}$ = F(99–01,scaled)=0.63; Landings(2002) = 1.07; SSB(2003) = 3.37.

F(2003)	Basis	Landings (2003)	SSB (2004)
0.25	0.4*$\mathbf{F}_{sq}$	0.89	3.77
0.31	0.5 * $\mathbf{F}_{sq}$	1.08	3.56
0.37	$\mathbf{F}_{pa}$ = 0.59 * $\mathbf{F}_{sq}$	1.24	3.37
0.44	0.7 * $\mathbf{F}_{sq}$	1.43	3.16
0.50	0.8 * $\mathbf{F}_{sq}$	1.59	2.99
0.57	0.9 * $\mathbf{F}_{sq}$	1.74	2.82
0.63	1.0 * $\mathbf{F}_{sq}$	1.88	2.66

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Results of the medium-term analysis indicate a low probability of SSB falling below $\mathbf{B}_{pa}$ after 5-10 years when the fishing mortality is reduced below $\mathbf{F}_{pa}$ from 2003 onwards. Assuming the current selection pattern, $\mathbf{F}_{max}$ is 0.39* $\mathbf{F}_{sq}$.

Comparison with previous assessment and advice: Results are very close to those of the previous assessment. The size of the 1998 year class was re-estimated to be around 30% larger than the previous estimate.

Elaboration and special comment: The fisheries for sole in the Celtic Sea and Bristol Channel involve vessels from Belgium, taking 2/3, the UK 1/4, and France and Ireland taking minimal amounts of the total landings. The sole fishery is concentrated on the north Cornish coast off Trevose Head and around Lands End.

The catch options for 2003 are based on the assumption that the TAC in 2002 represents the catch in 2002. This is based on information that the Belgian fleet has stopped fishing for sole in June 2002 when this fleet reached its TAC limit. Hence the fishing mortality in 2002 would be below $\mathbf{F}_{sq}$.

Sole are taken mainly in a beam trawl fishery that started in the early 1960s and, to a lesser extent, in the longer established otter-trawl fisheries. In the 1970s, the fishery was mainly carried out by Belgian beam trawlers and Belgian and UK otter trawlers. The use of beam trawls (to target sole and plaice) increased during the mid-1970s, and the Belgian otter trawlers have now been almost entirely replaced by beam trawlers. Effort in the Belgium beam-trawl fleet increased in the late 1980s as vessels normally operating in the North Sea were attracted to the west by improved fishing opportunities. Beam trawling by UK vessels increased substantially from 1986, reaching a peak in 1990 and decreasing thereafter. In the Celtic Sea, the beam and otter trawl fleets also take plaice, rays, brill, turbot, and anglerfish.

The main spawning areas for sole in the Celtic Sea are in waters 40–75 m deep, off Trevose Head, and spawning usually takes place between February and April. Juvenile sole are found in relatively high abundance in depths up to 40 m, and adult sole (fish aged 3 plus) are generally found in deeper water. Spawning and nursery grounds are well defined.

The results of recent tagging experiments suggest that there is only limited movement of sole between the Bristol Channel and adjacent areas.

Age-based analytical assessment using catch-per-unit effort data from two commercial fleets and one survey.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

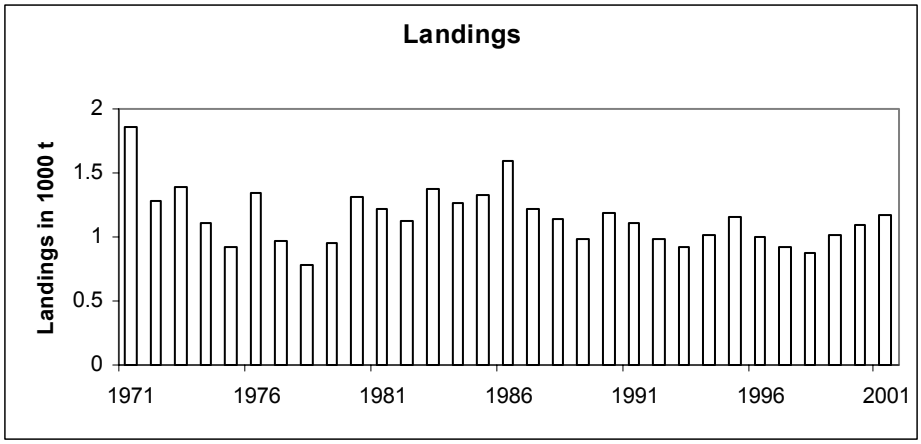
Yield and spawning biomass per Recruit F-reference points:

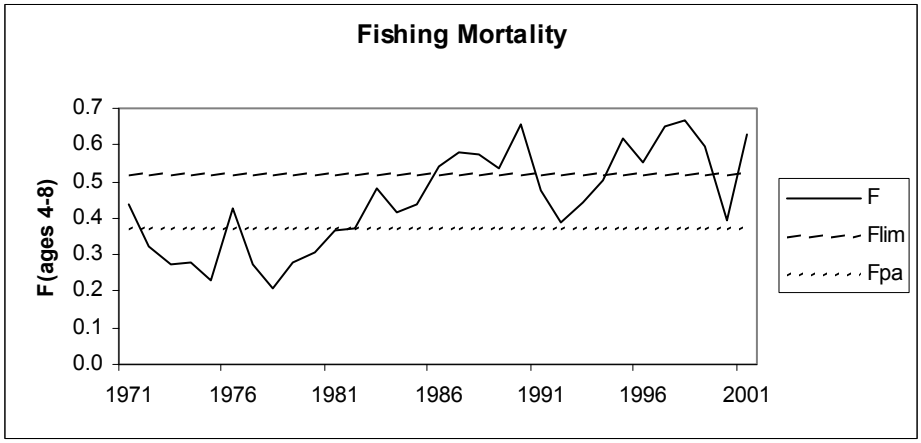
	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.538	0.210	0.384
$\mathbf{F}_{max}$	0.248	0.226	0.959
$\mathbf{F}_{0.1}$	0.117	0.205	1.885
$\mathbf{F}_{med}$	0.345	0.222	0.664

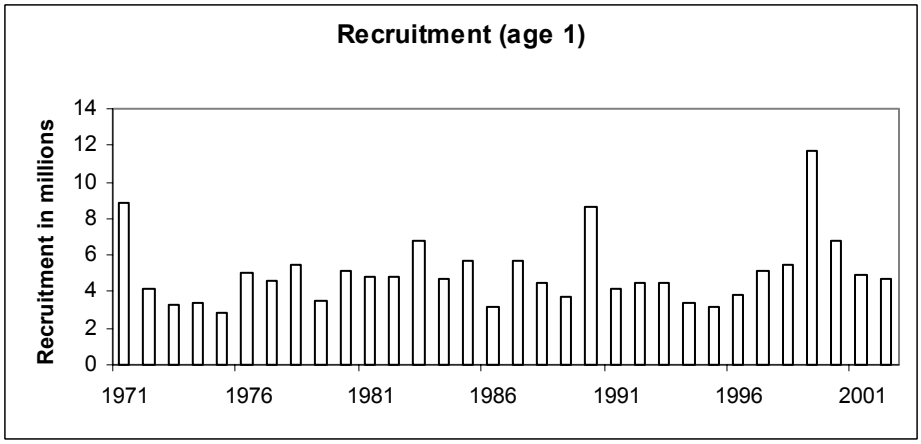
Catch data (Tables 3.9.5.1-2):

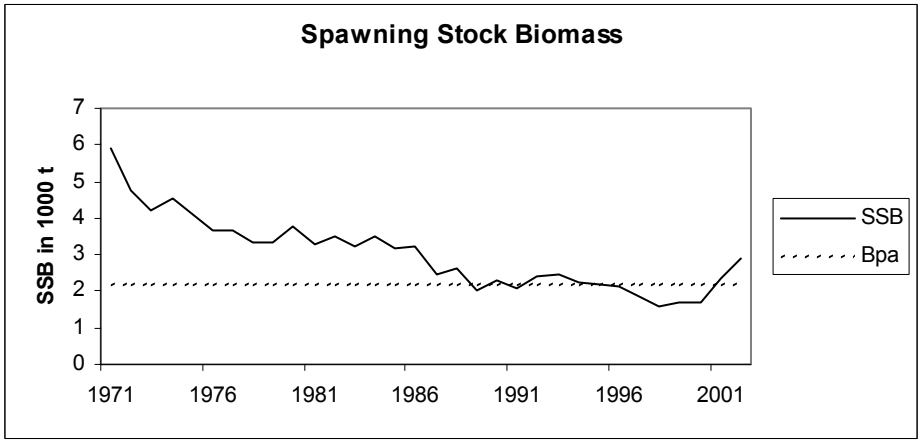
Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	*Status quo* F; TAC	1.6	1.6	1.22
1988	F = F(pre-86); TAC	0.9	1.1	1.15
1989	F at F(81–85); TAC	1.0	1.0	0.99
1990	No increase in F	1.2	1.2	1.19
1991	No increase in F	1.1	1.2	1.11
1992	No long-term gains in increasing F	1.1	1.2	0.98
1993	No long-term gains in increasing F	-	1.1	0.93
1994	No long-term gains in increasing F	-	1.1	1.01
1995	No increase in F	1.0	1.1	1.16
1996	20% reduction in F	0.8	1.0	1.00
1997	20% reduction in F	0.8	0.9	0.93
1998	20% reduction in F	0.7	0.85	0.88
1999	Reduce F below $\mathbf{F}_{pa}$	0.81	0.96	1.01
2000	Reduce F below $\mathbf{F}_{pa}$	<1.16	1.16	1.09
2001	Reduce F below $\mathbf{F}_{pa}$	< 0.81	1.02	1.17
2002	Reduce F below $\mathbf{F}_{pa}$	< 1.00	1.07	
2003	Reduce F below $\mathbf{F}_{pa}$	< 1.24		

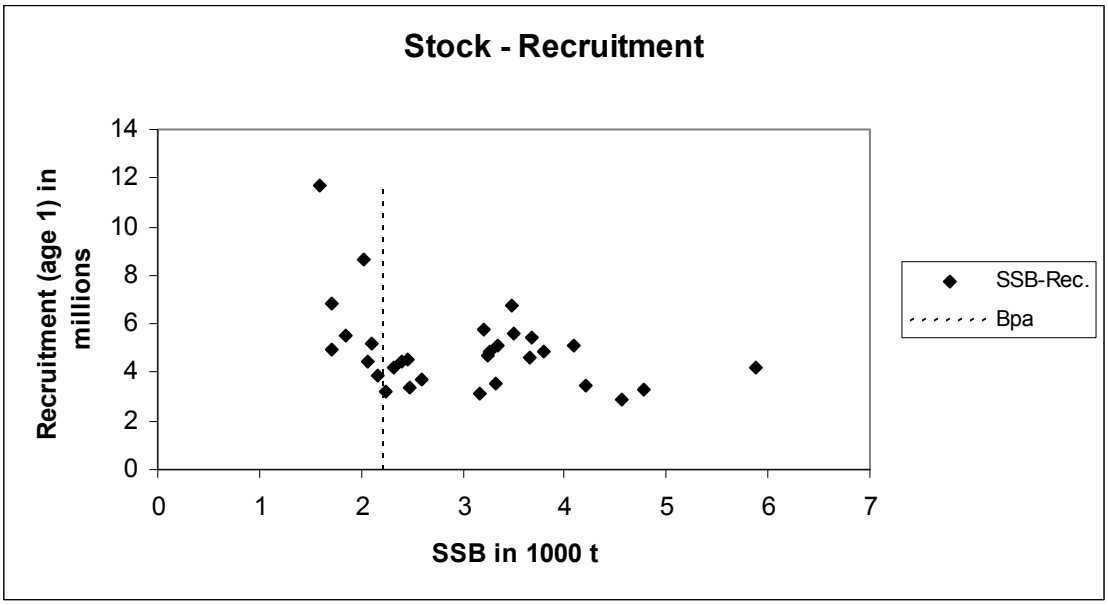
Weights in ‘000 t.

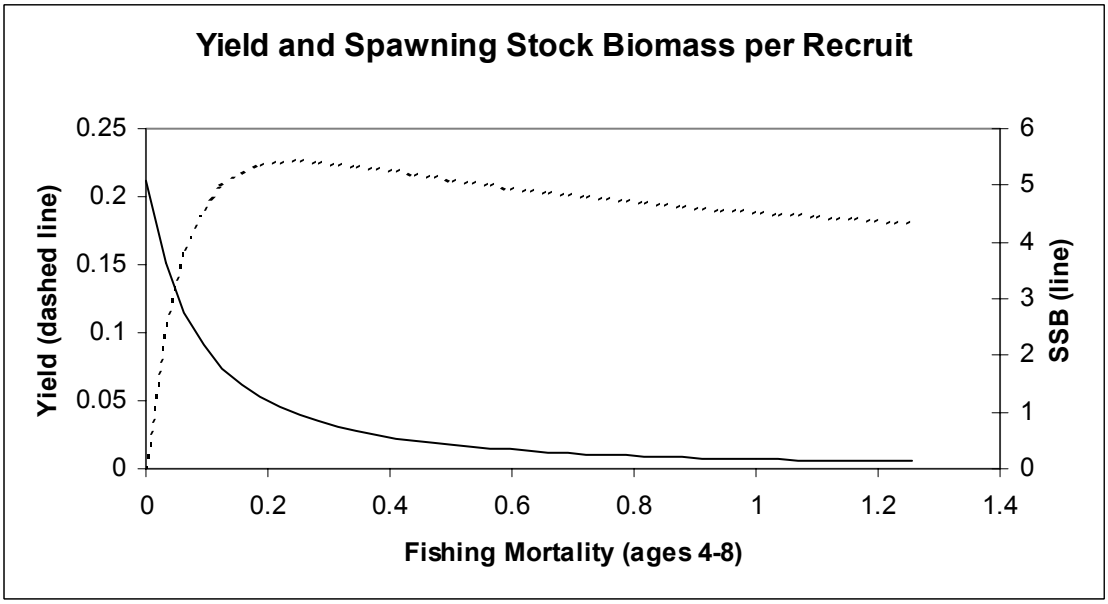

Landings
Landings in 1000 t
0
0.5
1
1.5
2
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 4-8)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
0
2
4
6
8
10
12
14
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
0
1
2
3
4
5
6
7
1971
1976
1981
1986
1991
1996
2001
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

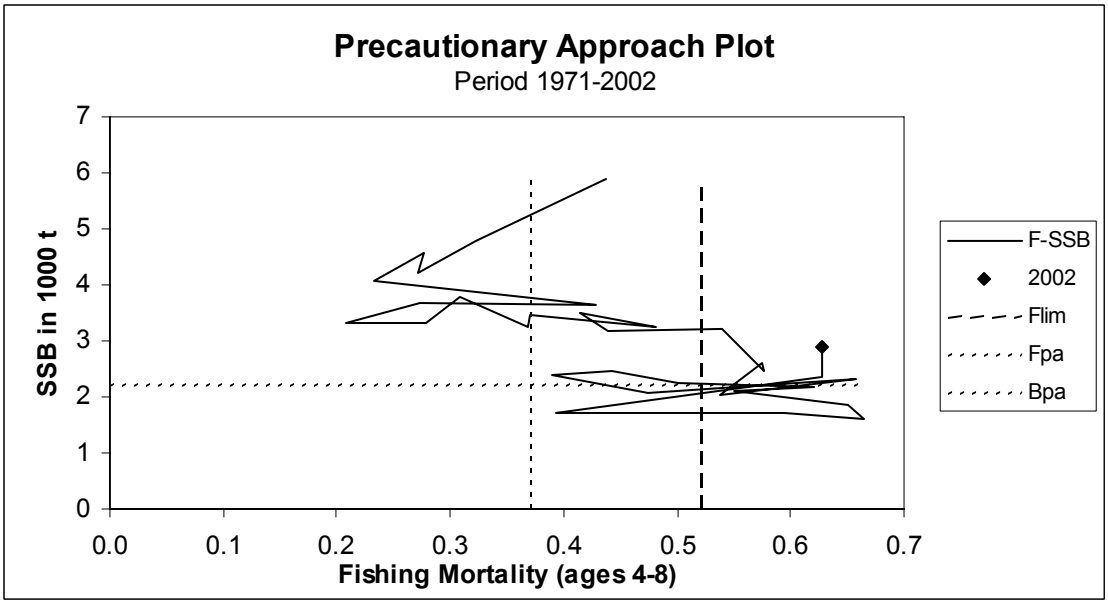

Precautionary Approach Plot
Period 1971-2002
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Bpa

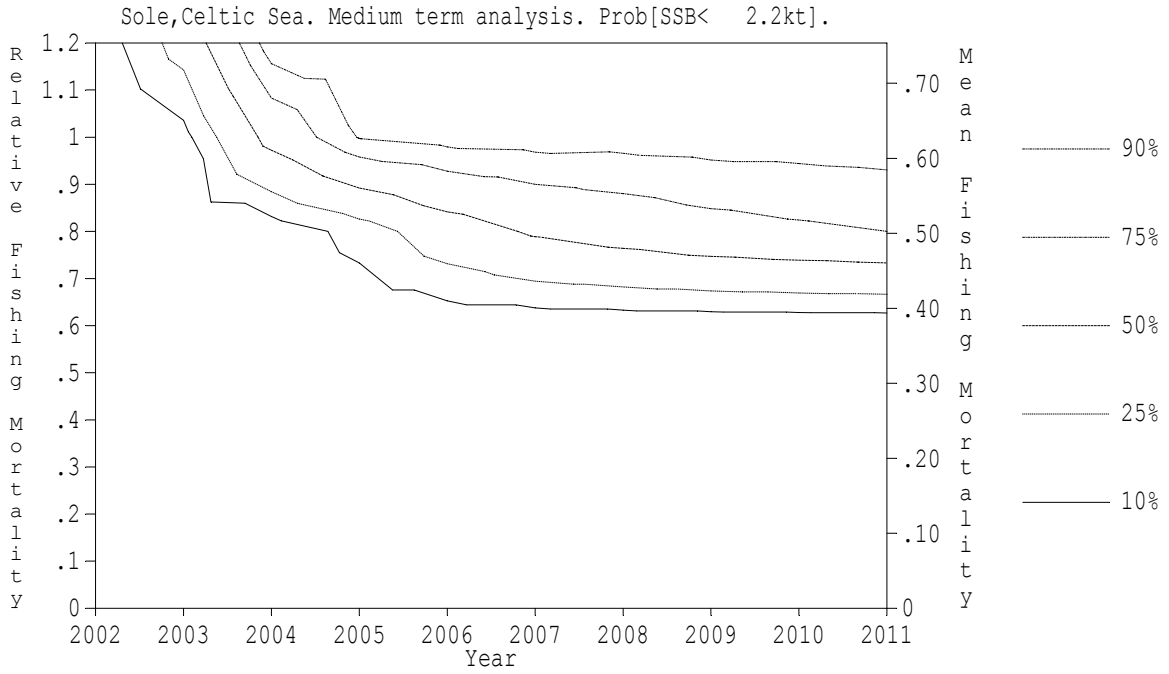
Table 3.9.5.1 Celtic Sea SOLE. Divisions VIIf and VIIg. Nominal landings (t), 1986–2001. Data used by the Working Group.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]
Belgium	1,092	704	725	660	689	839	516	512	612	728	610	562	568	669	694	748
France	92	72	89	97	100	80	136	103	86	89	97	79	72	98	117	78
Ireland	12	9	15	32	41	n/a	4	28	47	45	23	36	37	50	74	36
UK(E. & W.)	404	437	317	203	359	395	325	285	264	294	265	251	198	231	243	288
Others	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Total	1,600	1,222	1,146	992	1,189	1,324	981	928	1,009	1,156	995	928	875	1,047	1,128	1149
Unallocated	-	-	-	-	-	-217	-	-	-	1	-	-1	-	-36	-37	19
Total used in assessment	1,600	1,222	1,146	992	1,189	1,107	981	928	1,009	1,157	995	927	875	1,012	1,091	1168

[1]Preliminary.

Table 3.9.5.2 Sole in Divisions VIIf and g (Celtic Sea)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1971	8900	5883	1861	0.438
1972	4176	4775	1278	0.322
1973	3335	4203	1391	0.271
1974	3423	4555	1105	0.277
1975	2844	4087	919	0.232
1976	5072	3650	1350	0.429
1977	4578	3668	961	0.273
1978	5419	3316	780	0.208
1979	3524	3337	954	0.279
1980	5096	3791	1314	0.308
1981	4827	3265	1212	0.369
1982	4853	3474	1128	0.370
1983	6752	3251	1373	0.481
1984	4675	3500	1266	0.414
1985	5636	3166	1328	0.439
1986	3141	3209	1600	0.539
1987	5738	2460	1222	0.577
1988	4502	2600	1146	0.574
1989	3743	2024	992	0.537
1990	8625	2320	1189	0.657
1991	4201	2059	1107	0.475
1992	4463	2397	981	0.390
1993	4434	2472	928	0.442
1994	3396	2246	1009	0.501
1995	3195	2171	1157	0.620
1996	3851	2110	995	0.550
1997	5164	1850	927	0.651
1998	5491	1599	875	0.665
1999	11663	1712	1012	0.594
2000	6802	1711	1091	0.393
2001	4928	2360	1168	0.628
2002	4716	2904		0.628
Average	5036	3004	1149	0.454


Sole,Celtic Sea. Medium term analysis. Prob[SSB< 2.2kt].
Relative Fishing Mortality
Mean Fishing Mortality
Year
90%
75%
50%
25%
10%

3.9.6 Plaice in Division VIIe (Western Channel)

State of stock/exploitation: The stock is outside safe biological limits. SSB peaked in 1988–1990, following a series of good year classes in the mid-1980s, but has declined rapidly to well below $\mathbf{B}_{pa}$ until 1995 and is currently close to $\mathbf{B}_{lim}$. Fishing mortality increased in the 1980s and has fluctuated well above $\mathbf{F}_{pa}$ in the 1990s. In recent years recruitment has been below average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1 300 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 2 500 t. This is the previously proposed MBAL. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in assessments.
$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ be set at 0.45. This F is considered to have a high probability of maintaining SSB above $\mathbf{B}_{pa}$ in the medium term, taking into account the uncertainty in assessments.

Technical basis:

$\mathbf{B}_{lim}=\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = MBAL
$\mathbf{F}_{lim}$=Not defined	$\mathbf{F}_{pa}$ = low probability that ($SSB_{MT}< \mathbf{B}_{pa}$)

Advice on management: ICES recommends that fishing mortality should be reduced to below 0.31, corresponding to catches of less than 530 t in 2003. This represents a reduction in F of 50% and will allow SSB to reach $\mathbf{B}_{pa}$ in five years with around 50% probability. This advice is consistent with the advice for sole in Division VIIe.

Relevant factors to be considered in management: Only a complete closure of the fishery would be required to bring SSB above $\mathbf{B}_{pa}$ in the short-term. If the advice for sole is followed, it would also imply an approximate 50% reduction in fishing mortality for plaice.

The TAC for plaice in the Channel is set for Divisions VIId,e combined, so the results from this assessment need to be considered along with those for the much larger Division VIId stock. Given that the Division VIId component dominates the TAC, a catch control does not guarantee that fishing mortality in Division VIIe is constrained. To achieve a decrease in fishing mortality, a direct reduction in fishing effort in Division VIIe, or a separate catch control, is necessary.

Plaice are taken in a mixed demersal species otter trawl fishery, and as a by-catch in the sole beam trawl fishery. Management measures should therefore be considered in conjunction with those for Division VIIe sole.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01) = 0.63 ; Landings (2002) = 0.90 ; SSB(2003) = 1.49.

F(2003)	Basis	Landings (2003)	SSB(2004)
0	0*$\mathbf{F}_{sq}$	0	2.45
0.31	0.5*$\mathbf{F}_{sq}$	0.53	1.96
0.38	0.6*$\mathbf{F}_{sq}$	0.62	1.88
0.44	0.7*$\mathbf{F}_{sq}$	0.70	1.80
0.45	$\mathbf{F}_{pa}$ = 0.72*$\mathbf{F}_{sq}$	0.72	1.78
0.50	0.8*$\mathbf{F}_{sq}$	0.78	1.72
0.56	0.9*$\mathbf{F}_{sq}$	0.86	1.65
0.63	1.0*$\mathbf{F}_{sq}$	0.93	1.59

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Under the current selection pattern, $\mathbf{F}_{max}$ is 40% of $\mathbf{F}_{sq}$.

Comparison with previous assessment and advice: The current estimates of SSB and F are very similar to those obtained last year. However, the strength of the 1998 and 1999 year classes has been revised downwards

(40% and 10%, respectively) and the strength of the 2000 year class is estimated to be 30% lower than the geometrical mean assumed last year. This results in a 20% lower estimate of SSB for 2002 than that projected last year.

Elaboration and special comment: The fisheries taking plaice in the Western Channel mainly involve vessels from the bordering countries: The total landings are split among UK vessels (75%), France (22%), and Belgium (the remaining 3%). Landings of plaice in the Western Channel were low and stable between 1950 and the mid-1970s, and increased rapidly during 1976 to 1988 as beam-trawls began to replace otter-trawls, although plaice are taken mainly as a by-catch in beam-trawling directed at sole and anglerfish. Reported landings have been declining throughout the 1990s. The main fishery is south and west of Start Point. Although plaice are taken throughout the year, the larger landings are made during February, March, October and November.

Most plaice tagged whilst spawning during December to March around Start Point in the western Channel migrated into the eastern Channel and the North Sea after spawning, whilst few plaice tagged there during April and May were recaptured outside the Channel. This suggests there is both a resident stock and one, which migrates to the North Sea after spawning in the Channel.

Analytical age-based assessment based on landings, survey, and commercial CPUE data. Mis-reporting of landings is thought to have occurred in the past, but industry comments indicate that in recent years this has not been a problem.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

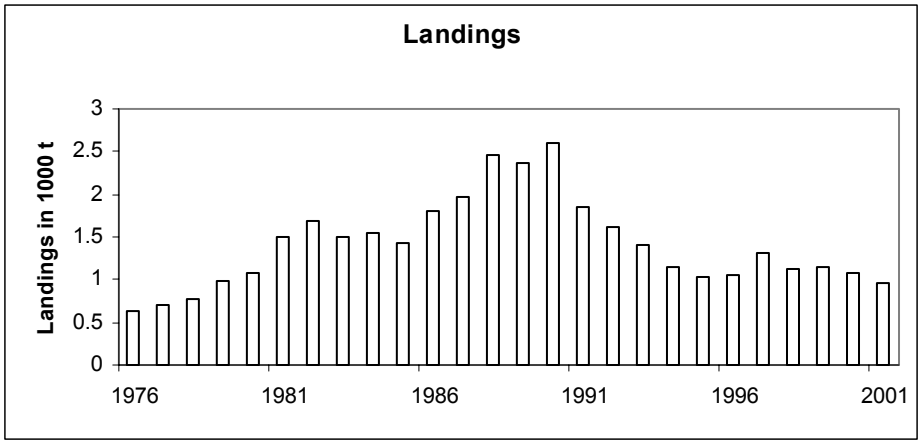
Yield and spawning biomass per Recruit F-reference points:

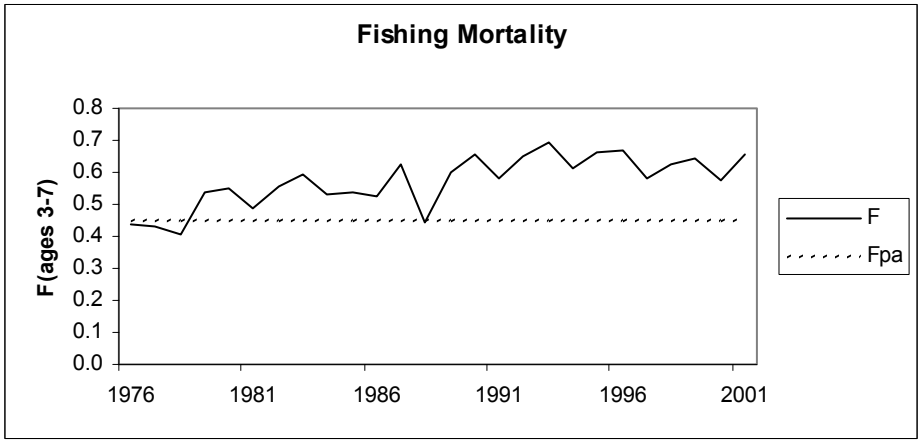
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.628	0.257	0.409
$\mathbf{F}_{max}$	0.248	0.277	1.066
$\mathbf{F}_{0.1}$	0.114	0.251	2.054
$\mathbf{F}_{med}$	0.567	0.260	0.455

Catch data (Tables 3.9.6.1-2):

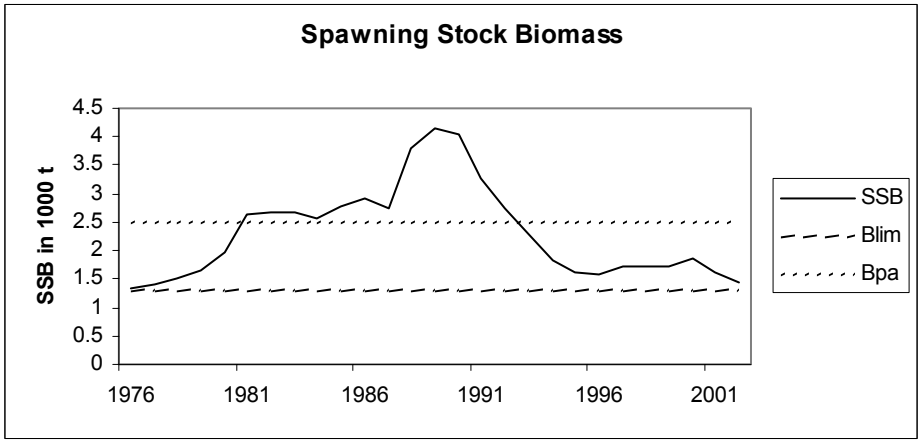
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC	6.8	8.3	1.92	1.96
1988	Precautionary TAC	6.9	9.96	2.33	2.46
1989	No increase in effort; TAC	11.7	11.7	2.25	2.36
1990	No increase in F; TAC	10.7	10.7	1.99	2.59
1991	50% reduction in F in VIIe	8.8	10.7	1.65	1.85
1992	Sq. F gives over mean SSB	2.0[2]	9.6	1.56	1.62
1993	Not outside safe biological limits	-	8.5	1.44	1.42
1994	Within safe biological limits	-	9.1	1.29	1.16
1995	No increase in F	1.4[2]	8.0	1.16	1.03
1996	60% reduction in F	0.6[2]	7.5	1.14	1.04
1997	60% reduction in F	0.51[2]	7.09	1.37	1.32
1998	60% reduction in F	0.5[2]	5.7	1.24	1.13
1999	Reduce F below $\mathbf{F}_{pa}$	1.1[2]	7.4	1.15	1.15
2000	Reduce F below $\mathbf{F}_{pa}$	< 1.08[2]	6.5	1.10	1.08
2001	Reduce F below $\mathbf{F}_{pa}$	< 0.93	6.0	0.96	0.97
2002	Reduce F below $\mathbf{F}_{pa}$	< 0.89	6.7		
2003	At least 50% reduction in F	< 0.53			

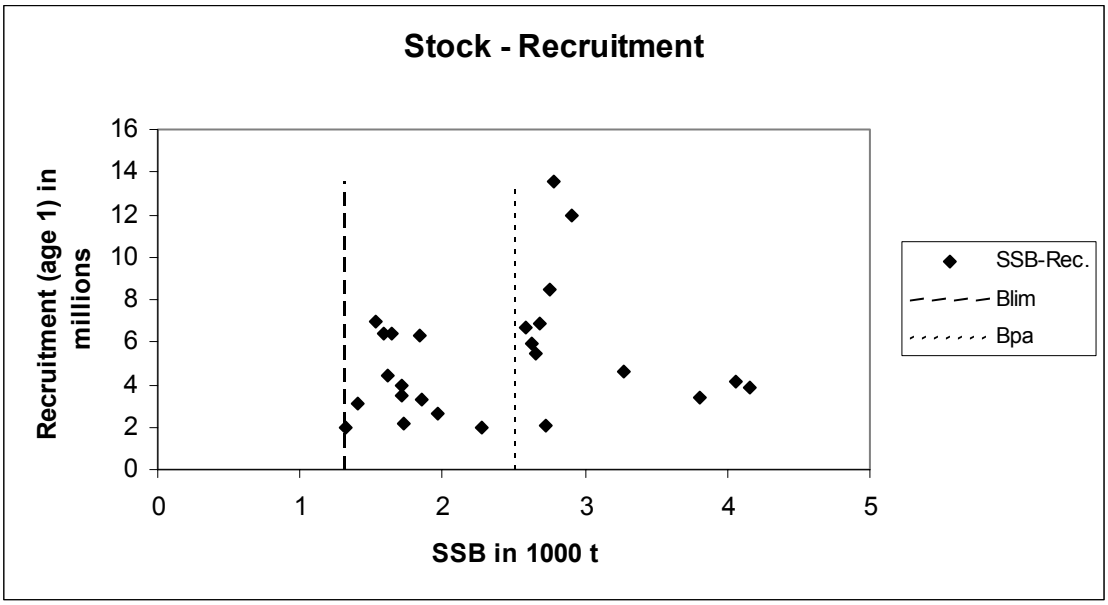
[1]TACs for Divisions VIId,e. [2]For Division VIIe only. Weights in '000 t.

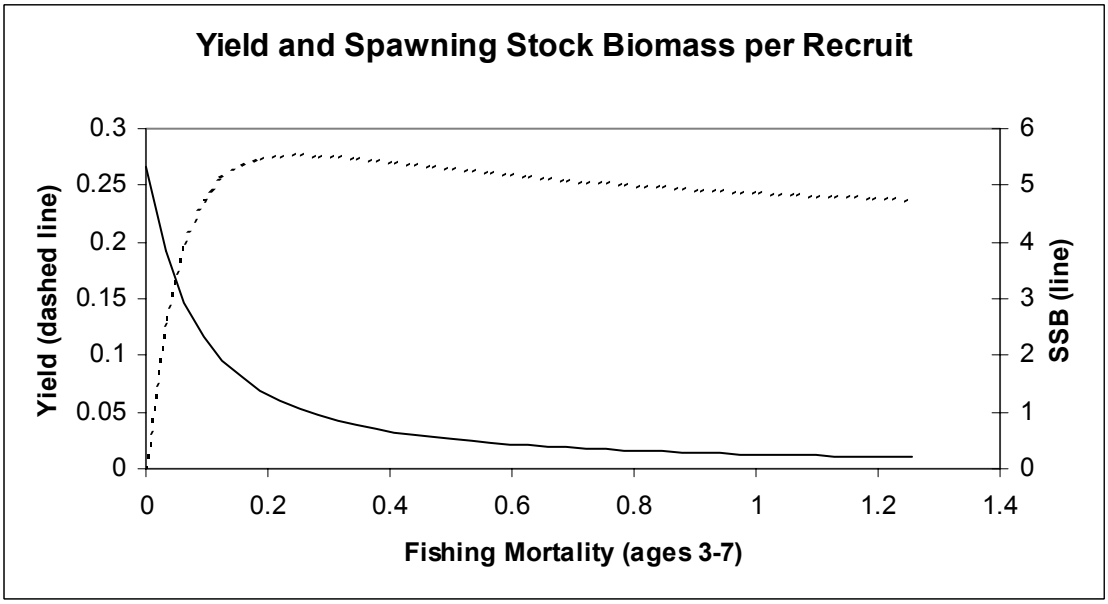

Landings
Landings in 1000 t
3
2.5
2
1.5
1
0.5
0
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 3-7)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1976
1981
1986
1991
1996
2001
F
Fpa

Recruitment (age 1)
Recruitment in millions
16
14
12
10
8
6
4
2
0
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)

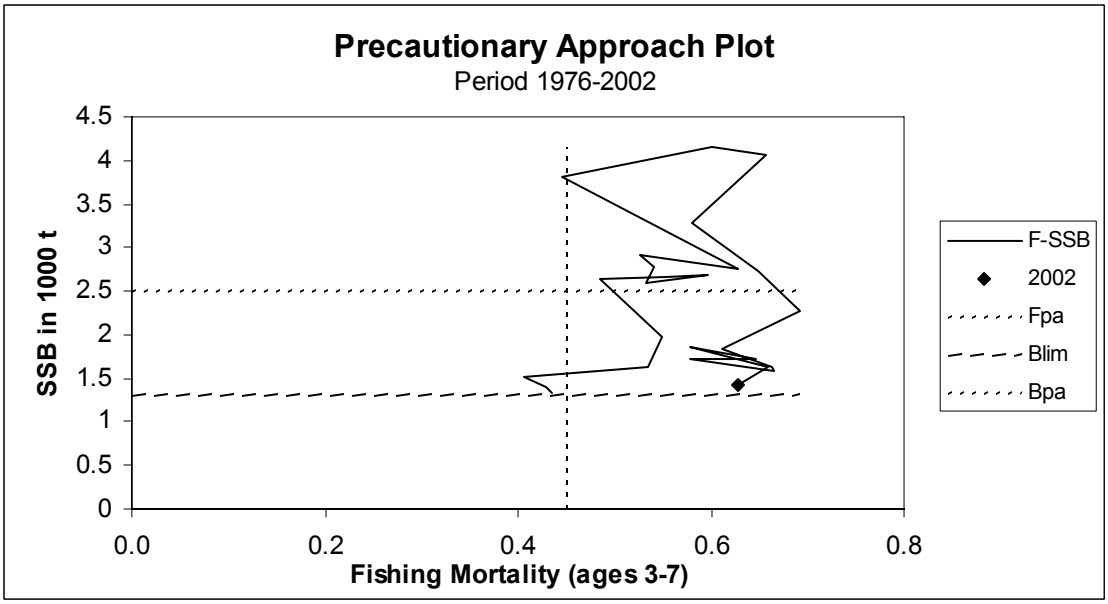

Precautionary Approach Plot
Period 1976-2002
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.9.6.1 Western Channel Plaice. Nominal landings (t) in Division VIIe, as used by Working Group.

Year	Belgium	Denmark	France	UK (Engl. & Wales)	Others	Total reported	Unallocated[2]	Total
1976	5	-[3]	323	312	-	640	-	640
1977	3	-[3]	336	363	-	702	-	702
1978	3	-[3]	314	467	-	784	-	784
1979	2	-[3]	458	515	-	975	2	977
1980	23	-[3]	325	609	9	966	113	1,079
1981	27	-	537	953	-	1,517	-16	1,501
1982	81	-	363	1,109	-	1,553	135	1,688
1983	20	-	371	1,195	-	1,586	-91	1,495
1984	24	-	278	1,144	-	1,446	101	1,547
1985	39	-	197	1,122	-	1,358	83	1,441
1986	26	-	276	1,389	-[1]	1,691	119	1,810
1987	68	-	435	1,419	-	1,922	36	1,958
1988	90	-	584	1,654	-	2,328	130	2,458
1989	89	-	448[1]	1,708	2	2,247	111	2,358
1990	82	2	N/A[2]	1,885	18	1,987	606	2,593
1991	57	-	251[1]	1,323	16	1,647	201	1,848
1992	25	-	419	1,102	14	1,560	64	1,624
1993	56	-	284	1,080	24	1,444	-27	1,417
1994	10	-	277	998	3	1,288	-132	1,156
1995	13	-	288	857	-	1,158	-127	1,031
1996	4	-	279	855	-	1,138	-94	1,044
1997	6	-	329	1,032	1	1,368	-45	1,323
1998	22	-	327	892	1	1,242	-111	1,131
1999	12	-	194[1]	947	-	1,153	1	1,154
2000	4	-	166[1]	926	-	1,096	-12	1,084
2001	12		164[1]	784	-	960	7	967

[1]Estimated by the Working Group.
[2]Divisions VIId,e = 4,739 t.
[3]Included in Division VIId.

Table 3.9.6.2 Plaice in Division VIIe (Western Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1976	3764	1321	640	0.436
1977	2001	1410	702	0.430
1978	3101	1524	784	0.406
1979	6963	1640	977	0.535
1980	6417	1973	1079	0.550
1981	2629	2630	1501	0.486
1982	5908	2660	1688	0.555
1983	5415	2684	1495	0.596
1984	6839	2583	1547	0.532
1985	6643	2775	1441	0.540
1986	13525	2909	1810	0.527
1987	11927	2747	1958	0.627
1988	8502	3801	2458	0.445
1989	3405	4157	2358	0.602
1990	3812	4060	2593	0.656
1991	4144	3279	1848	0.580
1992	4604	2727	1624	0.648
1993	2071	2280	1417	0.692
1994	1950	1838	1156	0.612
1995	6259	1622	1031	0.664
1996	4446	1581	1044	0.666
1997	6401	1718	1323	0.579
1998	3522	1730	1131	0.625
1999	2132	1718	1154	0.646
2000	3910	1849	1084	0.578
2001	3331	1630	967	0.659
2002	4582	1434		0.627
Average	5119	2307	1416	0.574

3.9.7 Sole in Division VIIe (Western Channel)

State of stock/exploitation: The stock is outside safe biological limits. SSB has declined since 1980 and has been estimated to be at its historic lowest level in 2002, well below $\mathbf{B}_{pa}$ and below $\mathbf{B}_{lim}$ since 2001. Fishing mortality has been above $\mathbf{F}_{lim}$ since 1982. Since 1990 most year classes have been below average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (revised in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 2 000 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 2 800 t.
$\mathbf{F}_{lim}$ is 0.28, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.2.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa}$: historical development: Biomass below this has increased risk of reduced recruitment.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa}$:$\mathbf{F}_{lim}$*0.72

Advice on management: In the light of SSB being below $\mathbf{B}_{lim}$, ICES recommends a recovery plan until the safe and rapid recovery of SSB to a level in excess of $\mathbf{B}_{pa}$. If a recovery plan is not implemented, ICES recommends that fishing mortality should be reduced to the lowest possible level.

Rebuilding plan: To rebuild SSB to $\mathbf{B}_{pa}$ in 2006 with 50% probability requires an immediate and sustained reduction of fishing mortality by 50%. These results assume $\mathbf{F}_{sq}$ in 2002. Given the state of the stock, the most rapid possible rebuilding to $\mathbf{B}_{pa}$ is strongly advised.

Relevant factors to be considered in management: Even a complete closure of the fishery is not expected to rebuild SSB above $\mathbf{B}_{pa}$ in the short-term.

Fisheries for sole also take plaice as a by-catch. This needs to be taken into account in management.

The advised recovery plan with a 50 % reduction in fishing mortality is consistent with the advice for plaice in Division VIIe

Catch forecast in 2003:

Basis: F(2002) = F(99–01) = 0.41 ; Landings(2002) = 0.75 ; SSB(2003) = 1.81 .

F(2003) Onwards	Basis	Landings (2003)	SSB (2004)
0.0	0.0	0.0	2.50
0.08	$0.2*F_{sq}$	0.16	2.35
0.2	$\mathbf{F}_{pa}$ $(0.5* F_{sq})$	0.41	2.12
0.25	$0.6* F_{sq}$	0.49	2.04
0.29	$0.7* F_{sq}$	0.56	1.98
0.33	$0.8* F_{sq}$	0.63	1.91
0.37	$0.9* F_{sq}$	0.70	1.85
0.41	F_{sq}	0.76	1.79

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: $\mathbf{F}_{max}$ is poorly determined as the yield-per-recruit curve is flat-topped. There is a high probability that SSB will remain below $\mathbf{B}_{pa}$ in the medium term at $\mathbf{F}_{sq}$.

Comparison with previous assessment and advice: Addition of misallocated landings from 1986 onwards has resulted in a slight change in the trend in F in the 1980s. SSB, although now estimated at a slightly higher

level in the 1980s, is nevertheless at a similar level to that in previous assessments in the most recent period.

Elaboration and special comment: Due to TAC constraints, strategic misallocation and under-reporting of landings from this stock may have affected the assessment in the past. The database has been revised since 1986 to reduce the errors from misallocation. In recent years, UK vessels have accounted for around 60% of the total landings, with France taking approximately a third and Belgian vessels the remainder. UK landings were low and stable between 1950 and the mid-1970s, but increased rapidly after 1978 due to the replacement of otter trawlers by beam trawlers. The principal gears used are otter trawls and beam trawls, and sole tends to be the target species of an offshore beam-trawl fleet, which is concentrated off the south Cornish coast, and also takes plaice and anglerfish and at times cuttlefish.

In the Western Channel the peak spawning period of sole is April and May. The main spawning areas are to the west of the Isle of Wight and in the vicinity of Hurd Deep. The nurseries are in estuaries, tidal inlets and shallow, sandy bays. Adult sole in the Western Channel may recruit from local nurseries and from those in the Eastern Channel, but there is no evidence of subsequent emigration from the Western Channel. Coupled with the localised spawning areas in the western Channel, this suggests that adult sole are largely isolated from those found in northern Biscay, the eastern Celtic Sea, and the Eastern Channel.

The assessment is analytical based on landings, survey, and commercial CPUE data. Revised commercial tuning fleets were used in 2002. Biological sampling data are good. Variations in effort and fleet catchability may occur as vessels move in and out of the fishery dependent on prevailing catch rates of sole.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.411	0.208	0.484
$\mathbf{F}_{max}$	0.379	0.208	0.523
$\mathbf{F}_{0.1}$	0.109	0.179	1.485
$\mathbf{F}_{med}$	0.246	0.205	0.782

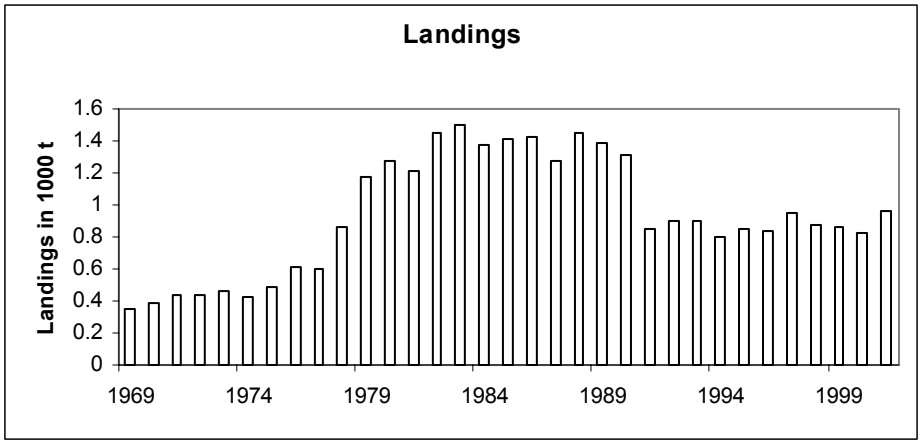
Catch data (Tables 3.9.7.1-2):

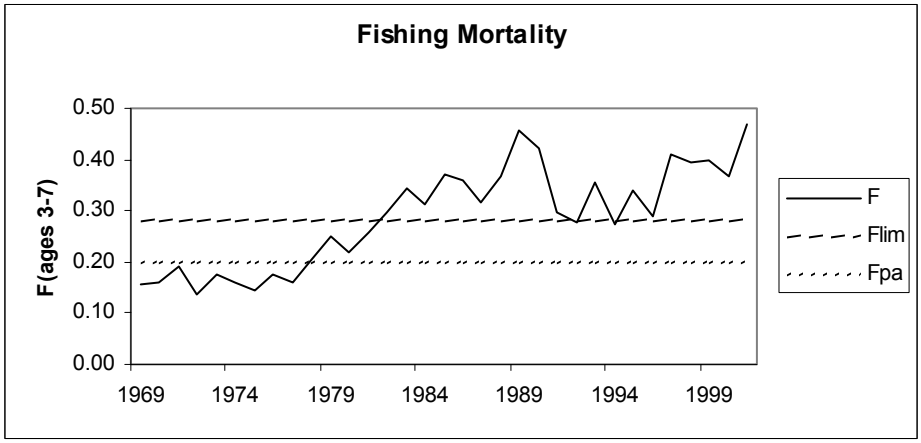
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	ACFM Landings (a)	ACFM Landings (b)
1987	No increase in F	1.15	1.15	1.11	1.16	1.28
1988	No decrease in SSB;	1.3	1.3	0.95	1.35	1.44
1989	No decrease in SSB;	1.0	1.0	0.8	1.16	1,39
1990	SSB = 3,000 t; TAC	0.9	0.9	0.75	1.08	1.31
1991	TAC	0.54	0.8	0.84	0.73	0.85
1992	70% of F(90)	0.77	0.8	0.77	0.77	0.89
1993	35% reduction in F	0.7	0.9	0.79	0.76	0.90
1994	No increase in F	1.0	1.0	0.84	0.68	0.80
1995	No increase in F	0.86	0.95	0.88	0.76	0.85
1996	$F_{96} < F_{94}$	0.68	0.70	0.74	0.65	0.83
1997	No increase in F	0.69	0.75	0.86	0.75	0.95
1998	No increase in F	0.67	0.67	0.77	0.65	0.88
1999	Reduce F below $\mathbf{F}_{pa}$	0.67	0.70	0.66	0.66	0.87
2000	Reduce F below $\mathbf{F}_{pa}$	< 0.64	0.64	0.65	0.65	0.82
2001	Reduce F below $\mathbf{F}_{pa}$	<0.58	0.60	0.62	0.64	0.96
2002	Reduce F below $\mathbf{F}_{pa}$	<0.45	0.53			
2003	Rebuilding plan or F=0	-				

Weights in '000 t.

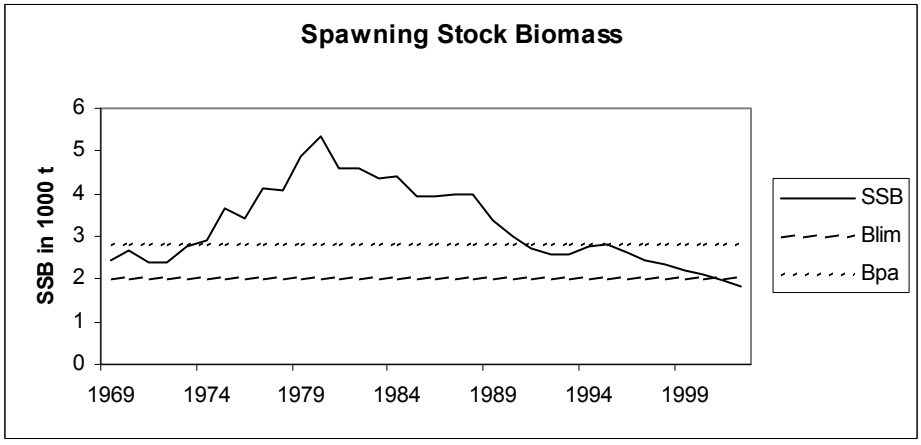
a) Original

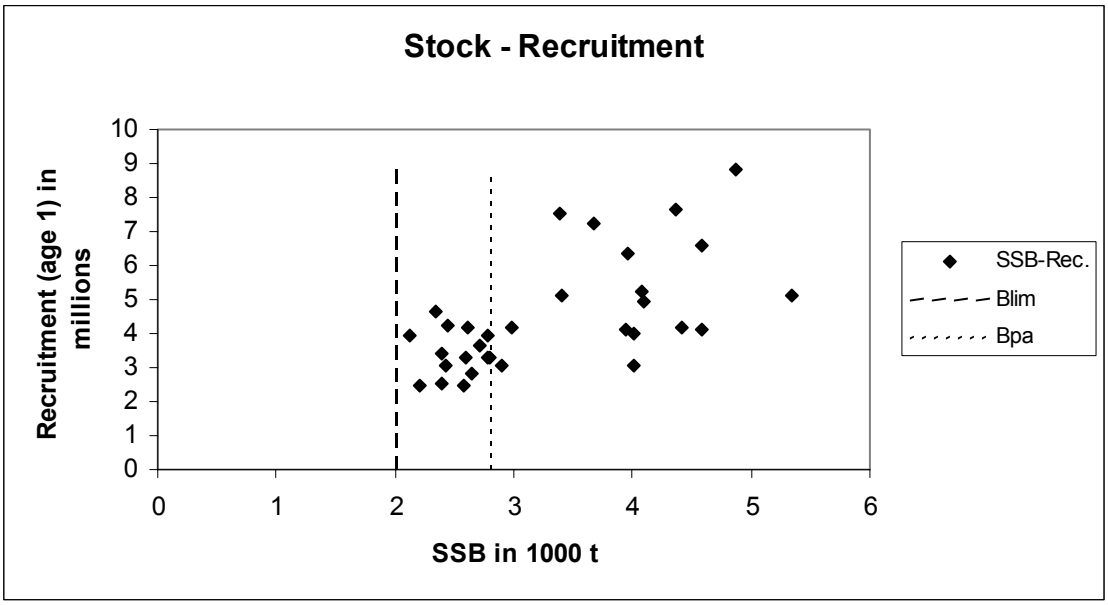
b) Includes misallocated landings

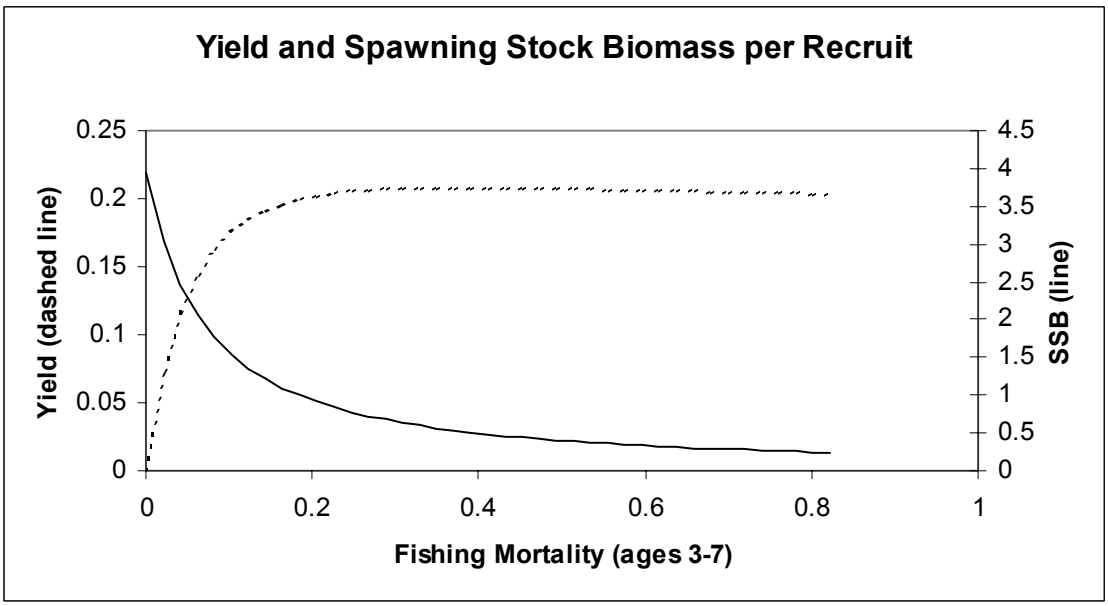

Landings
Landings in 1000 t
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1969
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-7)
0.50
0.40
0.30
0.20
0.10
0.00
1969
1974
1979
1984
1989
1994
1999
F
Flim
Fpa

Recruitment (age 1)
Recruitment in millions
10
8
6
4
2
0
1969
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
6
5
4
3
2
1
0
1969
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)

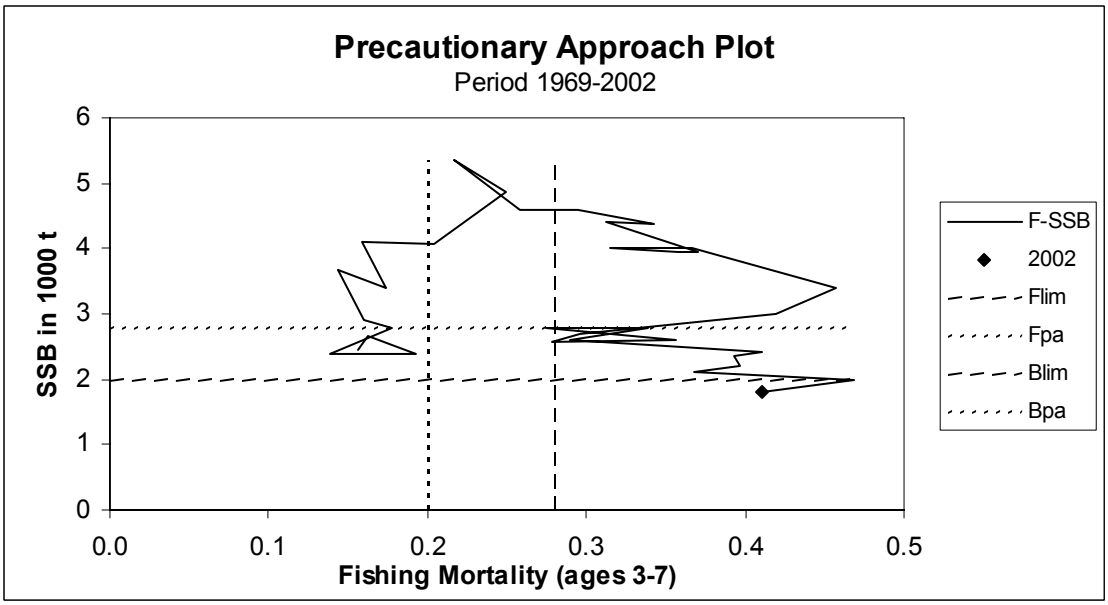

Precautionary Approach Plot
Period 1969-2002
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.9.7.1 Division VIIe Sole. Nominal landings (t), 1972–2001 used by Working Group.

Year	Belgium	France	UK (Engl. & Wales)	Other	Total Reported	Unallocated [2]	Total*
1972	6	230[1]	201	-	437	-	437
1973	2	263[1]	194	-	459	-	459
1974	6	237	181	-	424	3	427
1975	3	271	217	-	491	-	491
1976	4	352	260-	-	616	-	616
1977	3	331	271	-	606	-	606
1978	4	384	453	20	861	-	861
1979	1	515	665	-	1,181	-	1,181
1980	45	447	764	13	1,269	-	1,269
1981	16	415	788	1	1,220	-5	1,215
1982	98	321	1,028	-	1,447	-1	1,446
1983	47	405	1,043	3	1,498	-	1,498
1984	48	421	901	-	1,370	-	1,370
1985	58	130	911	-	1,099	310	1,409
1986	62	467	840	127	1,496	-77	1,419
1987	48	432	632	-	1,112	168	1,280
1988	67	98	784	-	949	495	1,444
1989	69	112[3]	610	6	797	593	1,390
1990	41	81[3]	632	-	754	561	1,315
1991	35	325[3]	477	-	837	15	852
1992	41	267[3]	457	9	774	121	895
1993	59	236[3]	480	18	793	111	904
1994	33	257[3]	548	-	838	-38	800
1995	21	294	565	-	880	-24	856
1996	8	297	437	-	742	91	833
1997	13	348	496	1	858	91	949
1998	40	343[3]	389	-	772	108	880
1999	13	254[3]	396	-	663	205	868
2000	4	237[3]	413	-	654	170	824
2001[3]	19	218[3]	384[4]		621	344	965

[1]Estimated from Division VIId,e total by the Working Group.
[2]Estimated by the Working Group.
[3]Provisional.
[4]United Kingdom.
*Total revised to include additional unallocated landings from 1986 onwards.

Table 3.9.7.2 Sole in Division VIIe (Western Channel)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1969	1484	2438	353	0.156
1970	4233	2653	391	0.162
1971	2839	2390	432	0.193
1972	2503	2397	437	0.138
1973	3436	2780	459	0.177
1974	3284	2898	427	0.160
1975	3087	3673	491	0.143
1976	7240	3406	616	0.174
1977	5129	4102	606	0.159
1978	4929	4077	861	0.204
1979	5263	4869	1181	0.249
1980	8818	5348	1269	0.217
1981	5096	4586	1215	0.258
1982	4111	4588	1446	0.295
1983	6573	4370	1498	0.342
1984	7638	4410	1370	0.312
1985	4158	3956	1409	0.370
1986	6340	3938	1419	0.358
1987	4117	4003	1280	0.315
1988	4026	4007	1444	0.367
1989	3034	3386	1390	0.457
1990	7530	2988	1315	0.420
1991	4158	2706	852	0.296
1992	3658	2579	895	0.278
1993	2456	2601	904	0.357
1994	3272	2776	800	0.274
1995	3963	2801	856	0.339
1996	3282	2607	833	0.290
1997	4148	2432	949	0.411
1998	3080	2351	880	0.393
1999	4659	2203	868	0.397
2000	2449	2127	824	0.368
2001	3933	1977	965	0.468
2002	4137	1814		0.411
Average	4355	3242	937	0.291

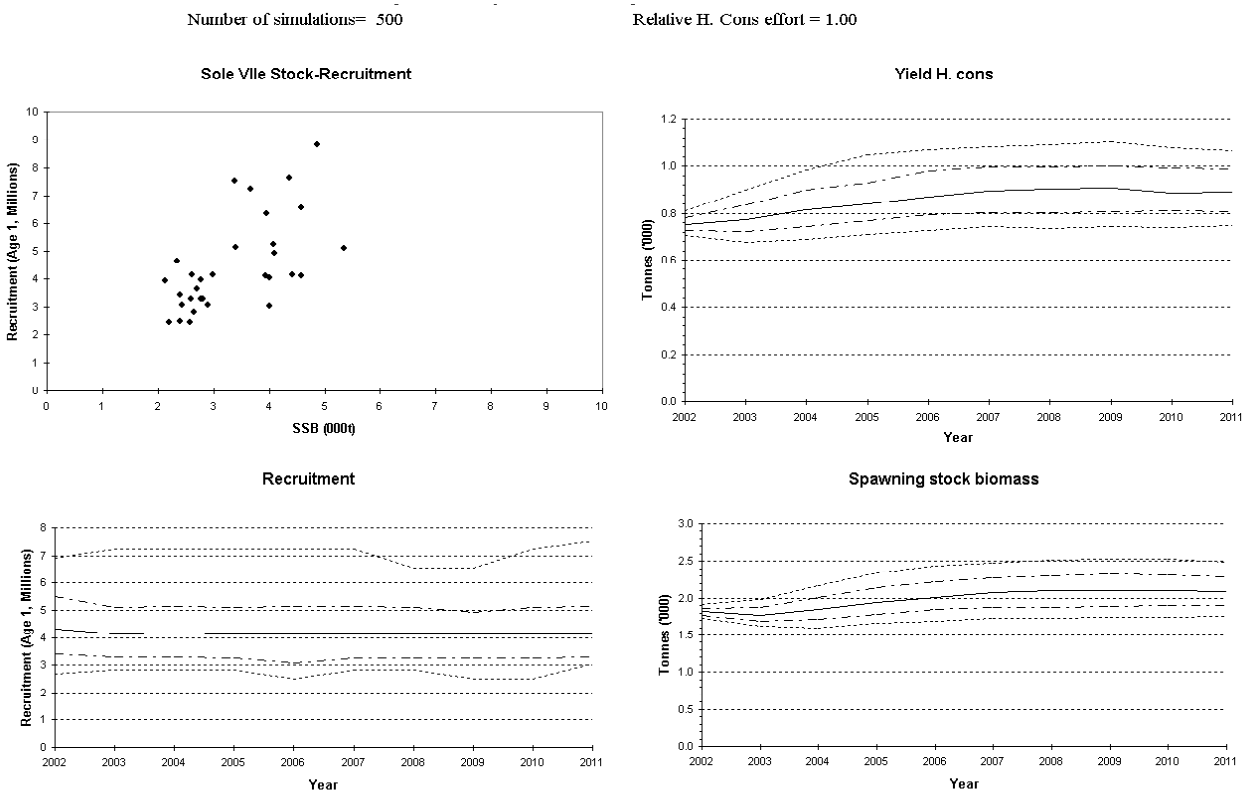


Figure 3.9.7.1 Sole in VIIe Western Channel. Medium term projections. Solid lines show 10, 25, 50, 75 and 90th percentiles. Stock recruitment relationship estimated by random bootstrap.

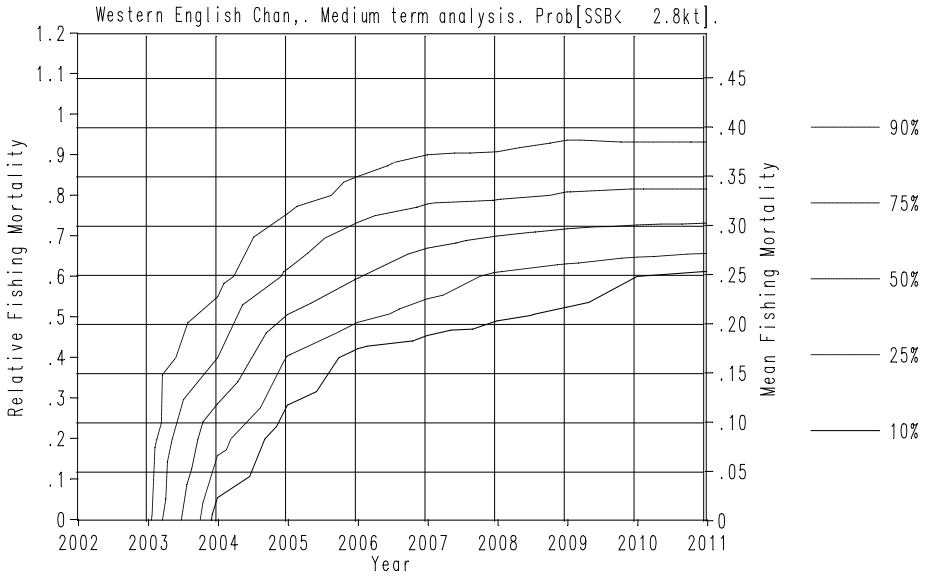
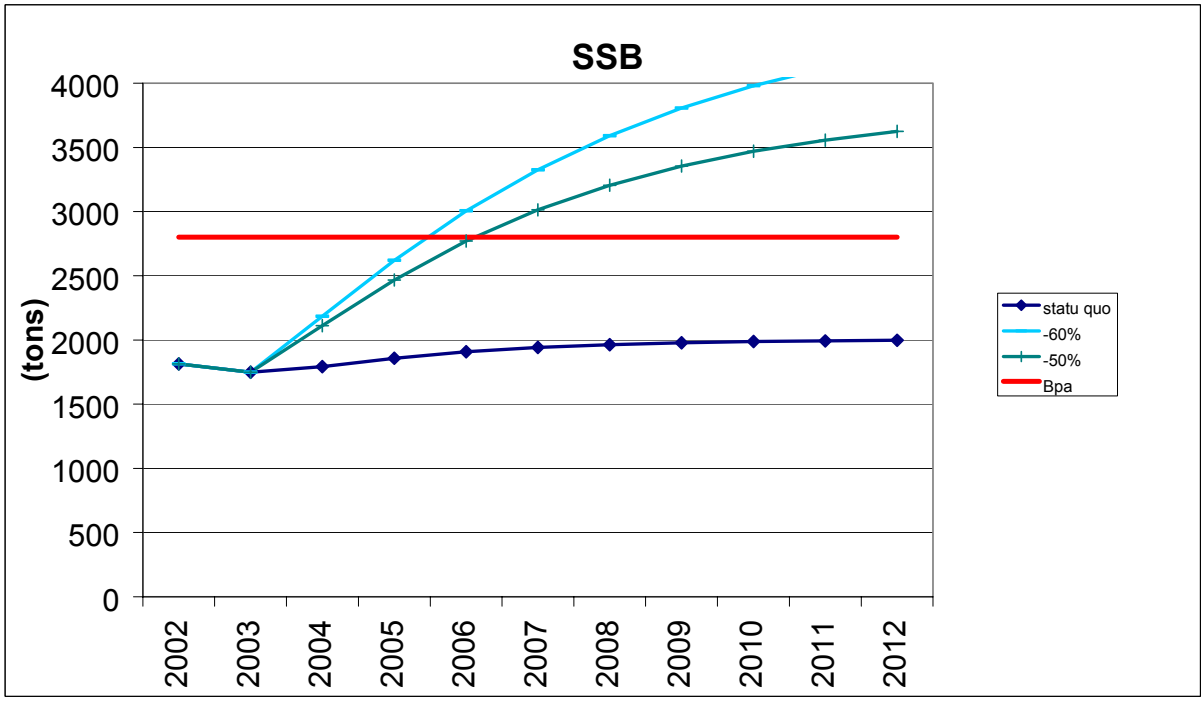


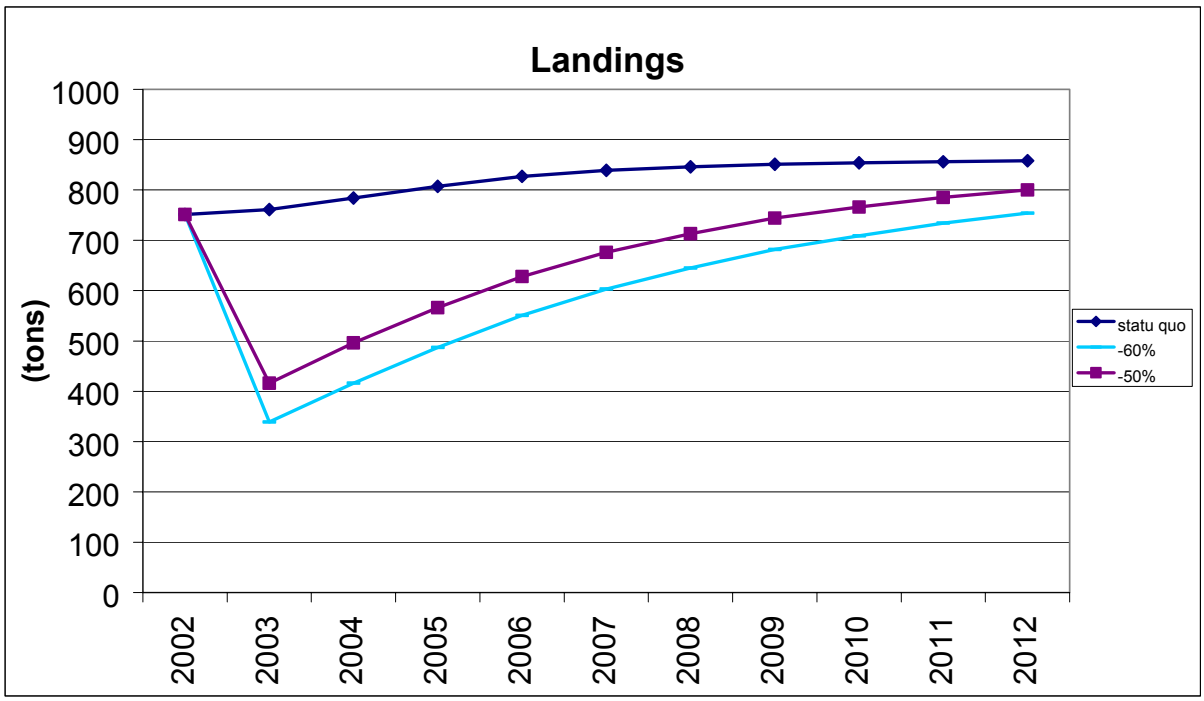
Figure 3.9.7.2 Medium-term projections contour plot (bootstrapped recruitment). Medium-term projection starting in 2002 based on constant fishing mortality from 2002 and onwards; Fishing mortality is expressed as the fishing mortality relative to F_{sq}.

Sole in Division VIIe

Constant F multipliers in 2003 and onwards

Deterministic projection using a constant R = 4.137 millions over the simulated period





3.9.8 Sole in Divisions VIIIa,b (Bay of Biscay)

State of stock/exploitation: The stock is outside safe biological limits. Fishing mortality has generally increased since 1984 and has been above $\mathbf{F}_{lim}$ since 1997. SSB has remained relatively stable up to 1995, but has decreased sharply since then, and has been below $\mathbf{B}_{pa}$ since 1997. Since 1992 recruitment has been at a lower level.

Management objectives: There is no explicit management objective for this stock.

Precautionary Approach reference points (changed in 2001):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined.	$\mathbf{B}_{pa}$ be set at 13 000 t. The probability of reduced recruitment increases when SSB is below 13 000 t.
$\mathbf{F}_{lim}$ = 0.5, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ = 0.36

Technical basis:

$\mathbf{B}_{lim}$: Not defined.	$\mathbf{B}_{pa}$ ~ historical development of the stock [lowest observed for the converged part of the VPA, i.e. the most recent years are not included]
$\mathbf{F}_{lim}$: based on historical response of the stock	$\mathbf{F}_{pa}$ = $\mathbf{F}_{lim}$ * 0.72

Advice on management: In the light of the sharp decrease in SSB, ICES recommends a recovery plan that will ensure a safe and rapid recovery of SSB to a level in excess of $\mathbf{B}_{pa}$. If a recovery plan is not implemented, ICES recommends that the fishing mortality should be reduced to the lowest possible level in 2003.

Rebuilding plan: Rebuilding of the sole stock can be obtained by reducing the fishing mortality, by improving the exploitation pattern, or by a combination of the two.

Even a fishing mortality of zero in 2003 would not allow SSB to reach $\mathbf{B}_{pa}$ by 2004. However, a rebuilding plan could achieve this goal in 3 years. Fishing mortality of around 0.3 ($\mathbf{F}_{sq}$ reduced by 60%) in 2003, 2004, and 2005 is expected to rebuild it by 2006 with close to 50% probability (see Table 3.8.9.3).

An immediate reduction in F of 50% would require one year more to rebuild SSB above $\mathbf{B}_{pa}$. Given the state of the stock, and the risk of impaired recruitment, this is not in accordance with the precautionary approach.

Setting the TAC at a low level may reduce fishing mortality, but past experience has shown that it is very difficult to control fishing mortality by TACs alone. ICES, therefore, recommends that in addition to a TAC, restrictions in effort of fleets exploiting sole should be implemented. Large closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort.

The selection pattern improved in the late 1980s when the gillnet fishery expanded. More than two thirds of the sole is caught by gillnet, and strong regulation of this fishery (limitation of number and length of nets) should be implemented, since no or small further improvement of selectivity of these nets is expected. However, improvement of selection pattern for the trawl fishery would contribute to stock recovery in the medium term. It has to be noted that the stock of sole may benefit from the effort measures taken for the rebuilding of the hake stock.

Relevant factors to be considered in management: Even though the selection pattern of this stock has improved in the past due to the development of the gillnet fishery (in the mid-1980s), fishing mortality is too high to allow a sustainable exploitation of this stock.

Catch forecast for 2003:
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01, scaled) = 0.74 ; Landings(2002) = 4.0; SSB(2003) = 6.7.

F(2003)	Basis	Landings (2003)	SSB (2004)
0	0	0	11.5
0.30	0.4 F_{sq}	1.9	9.3
0.36	$\mathbf{F}_{pa}$ = 0.5 F_{sq}	2.3	8.9
0.42	F= 0.57 F_{sq} (+ 30% SSB)	2.6	8.6
0.52	0.7 F_{sq}	3.0	8.0
0.59	0.8 F_{sq}	3.4	7.7
0.74	1.0 F_{sq}	4.0	7.0

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

About 80% of the projected SSB in 2004 is based on recruitment of yearclasses for which the strength has not been verified, neither by commercial fisheries nor by abundance surveys. The calculations are done assuming that these yearclasses have a strength equal to the geometric mean (1992-2000) of past recruitment, which may still be optimistic.

Medium-term projections: There is a low probability of SSB >$\mathbf{B}_{pa}$ in the medium term.

Comparison with previous assessment and advice: The present assessment is in line with last year's. It confirms the decline of the stock in recent years.

Elaboration and special comment: Catches have increased continuously until a maximum was reached in 1994 (7 400 t). They have decreased afterwards to stay between 5400 t and 6400 t until 2000, but fell to 4800 t in 2001. Since 1984, catches of sole by French small-mesh shrimp trawlers decreased markedly. The gill-net and trammel-net fisheries have expanded and account for three quarters of the French landings in 2001.

Landings by Belgium beam trawlers increased rapidly in the late 1980s and have, since 1991, contributed from 6 to 13% to the total landings. Since 1996, an increase in effort of this fleet is associated with a decrease of its CPUE.

The assessment is analytical and based on landings, available discards information, and CPUE data series from 1984 to 2000. No recruitment indices are available for this stock. Data prior to 1984 are not considered reliable. An observed maturity ogive based on females has been used since 2001.

Unallocated landings may account for more than 25% of estimated landings.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

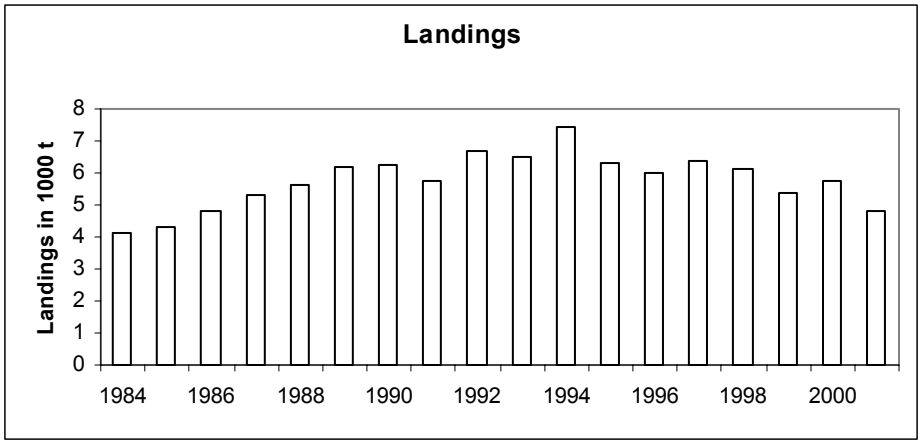
Yield and spawning biomass per Recruit F-reference points:

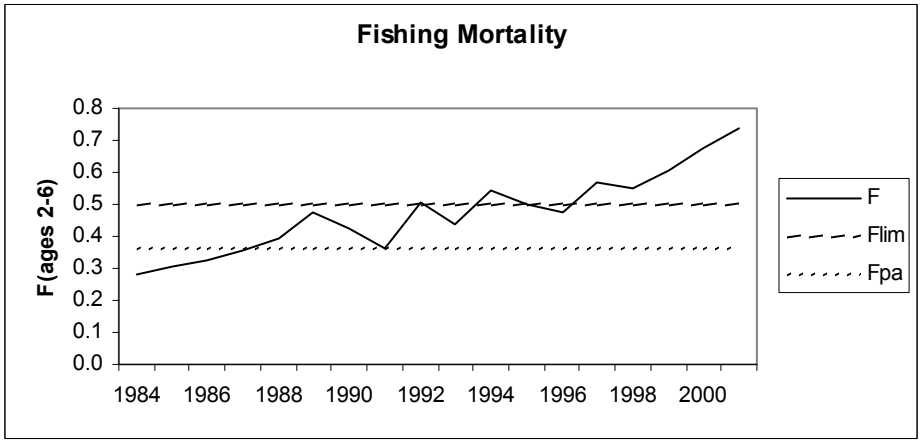
	Fish Mort Ages 2-6	Yield/R	SSB/R
Average Current	0.673	0.176	0.310
$\mathbf{F}_{max}$	0.190	0.209	1.021
$\mathbf{F}_{0.1}$	0.092	0.190	1.781
$\mathbf{F}_{med}$	0.405	0.193	0.503

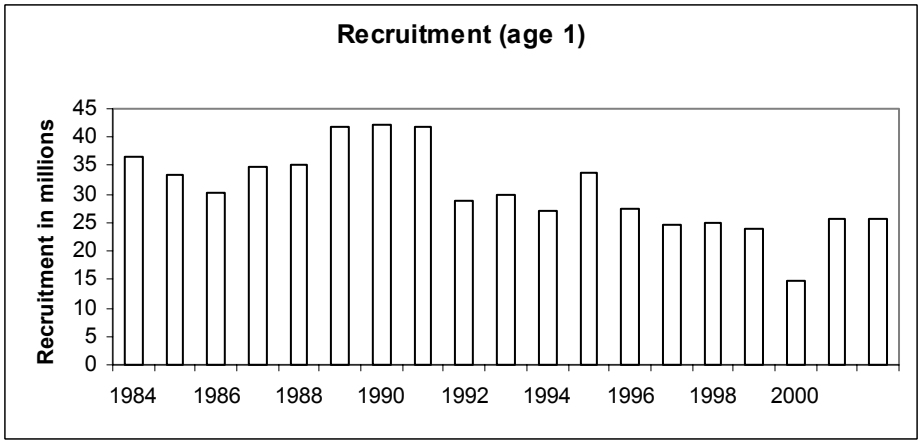
Catch data (Tables 3.9.8.1-2):

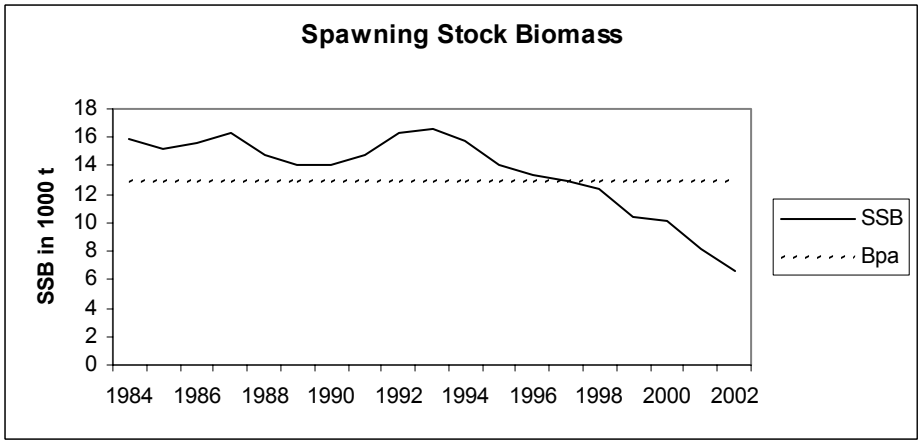
Year	ICES Advice	Catch corresp. to advice	Agreed TAC	Official Landings	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed	-	4.4	4.4	5.1	0.2[3]	5.3
1988	Precautionary TAC	3.7	4.0	4.4	5.4	0.3[3]	5.6
1989	No increase in effort; TAC	4.5	4.8	5.8[1]	5.8	0.4[3]	6.2
1990	No increase in F; TAC	5.1	5.2	5.5[1]	5.9	0.3[3]	6.2
1991	Precautionary TAC	4.7	5.3	4.7[1]	5.6	0.2[3]	5.8
1992	F = F(90)	5.0	5.3	6.4[1]	6.6	0.1[3]	6.7
1993	No long-term gain in increasing F	-	5.7	6.5	6.4	0.1[3]	6.5
1994	No long-term gain in increasing F	-	6.6	7.1	7.2	0.2[3]	7.4
1995	No long-term gain in increasing F	5.4[2]	6.6	5.9	6.2	0.1[3]	6.3
1996	No increase in F	5.0	6.6	4.3	5.9	0.1[3]	6.0
1997	40% reduction in F	3.1	5.4	5.0	6.3	0.1	6.4
1998	No increase in F	7.6	6.0	4.4[4]	6.0	0.1	6.1
1999	Reduce F below $\mathbf{F}_{pa}$	< 5.0	5.4	3.8[4]	5.2	0.2	5.4
2000	F at $\mathbf{F}_{pa}$	< 5.8	5.8	5.9[4]	5.7	0.1	5.8
2001	TAC 2001 at most TAC 2000	< 5.8	6.3	5.2[4]	4.8	0.0	4.8
2002	Establish rebuilding plan or no fishing	-	4.0				
2003	Establish rebuilding plan or no fishing	-					

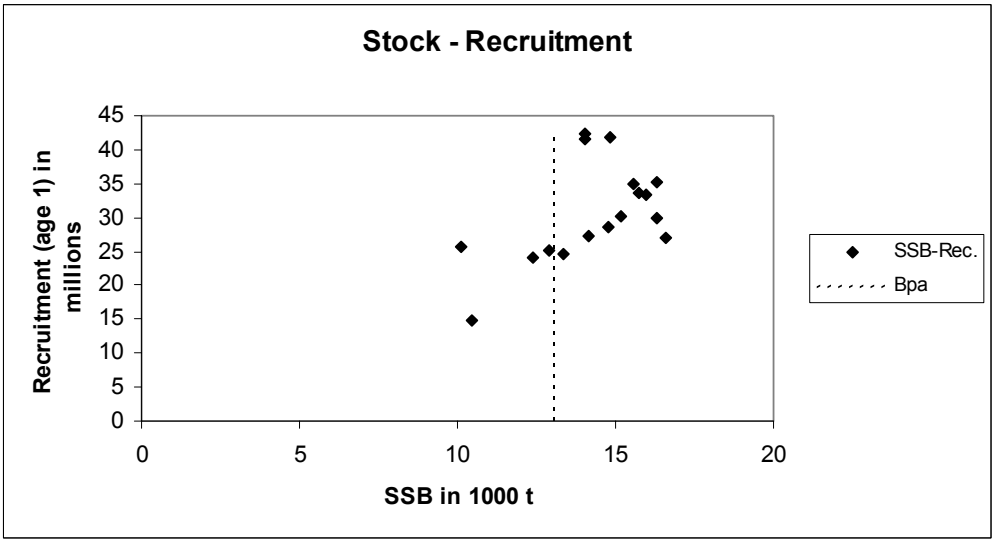
[1]Not reported for all countries. [2]Landings assuming current discarding practise. [3] Discards revised in 1998. [4] Preliminary. TAC in 2001 increased from 5.8 to 6.3 in Nov. Weights in '000 t.

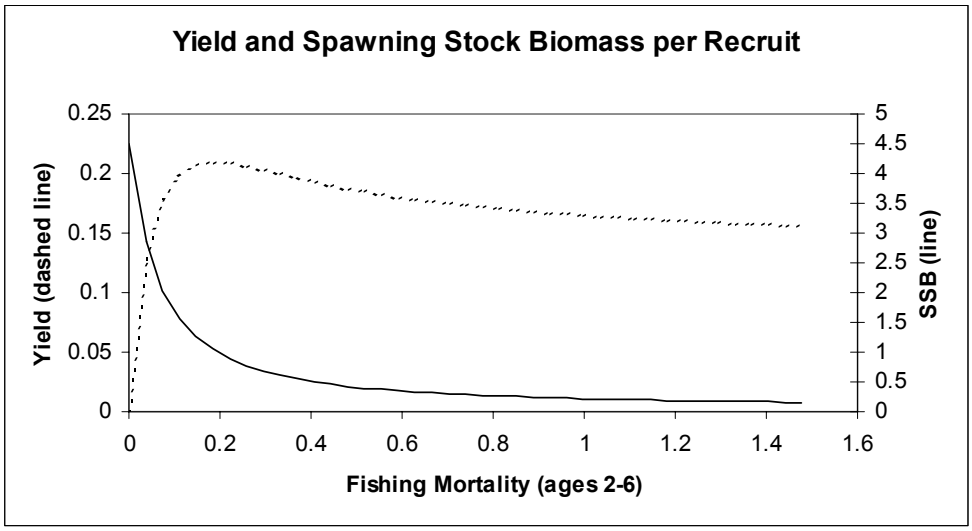

Landings
Landings in 1000 t
0
1
2
3
4
5
6
7
8
1984
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 2-6)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1984
1986
1988
1990
1992
1994
1996
1998
2000
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
0
5
10
15
20
25
30
35
40
45
1984
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
0
2
4
6
8
10
12
14
16
18
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
Fishing Mortality (ages 2-6)

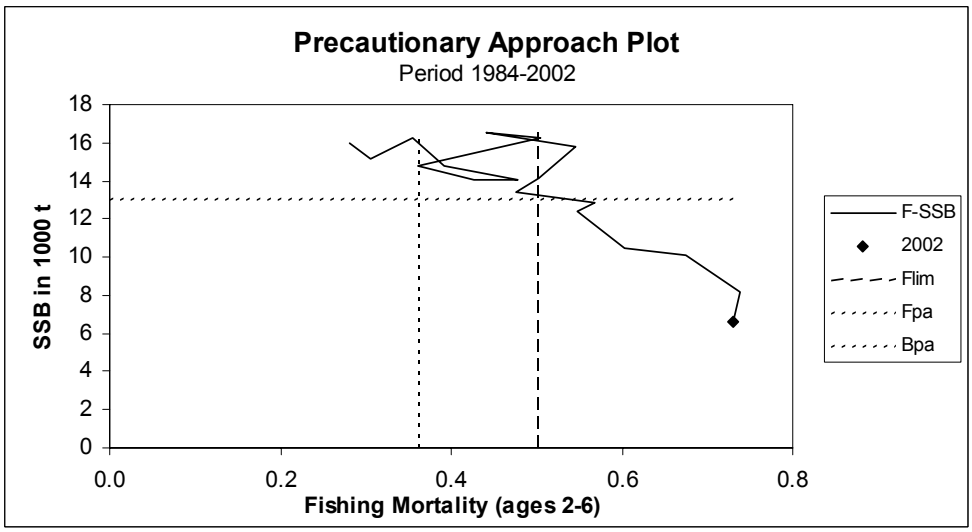

Precautionary Approach Plot
Period 1984-2002
SSB in 1000 t
18
16
14
12
10
8
6
4
2
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-6)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.9.8.1 Sole in Divisions VIIIa,b (Bay of Biscay). International landings and catches used by Working Group (in tonnes).

	Official Landings					Unallocated	WG	Discards[1]	WG
Year	Belgium	France	Nether.	Spain	Total	Landings	Landings		Catches
1979	5*	2376		62*	2443	176	2619	-	-
1980	33*	2549		107*	2689	297	2986	-	-
1981	4*	2581*	13*	96*	2694	242	2936	-	-
1982	19*	1618*	52*	57*	1746	2067	3813	-	-
1983	9*	2590	32*	38*	2669	959	3628	-	-
1984		2968	175*	40*	3183	855	4038	99	4137
1985	25*	3423	169*	308*	3925	326	4251	64	4315
1986	52*	4227	213*	75*	4567	238	4805	27	4832
1987	124*	4009	145*	101*	4379	707	5086	198	5284
1988	135*	4308			4443	939	5382	254	5636
1989	311*	5471*			5782	63	5845	356	6201
1990	301*	5231			5532	384	5916	303	6219
1991	389*	4315		3	4707	862	5569	198	5767
1992	440*	5919			6359	191	6550	123	6673
1993	400*	6083		13	6496	-76	6420	104	6524
1994	466*	6620		17***	7103	123	7226	184	7410
1995	546*	5325		6***	5877	328	6205	130	6335
1996	460*	3843		13***	4316	1537	5853	142	5995
1997	435*	4526		23***	4984	1275	6259	118	6377
1998	469*	3821**	44	40***	4374	1608	5982	127	6109
1999	504*	3280**		41***	3825	1424	5249	109	5358
2000	451*	5303**		148***	5902	-195	5707	58	5765
2001	361*	4588**	201		5150	-395	4755	28	4783
Mean					4485	606	5090	146	5762

*Reported in VIII.
**Preliminary.
*** Reported as *Solea* spp (*Solea lascaris* and *Solea solea*) in VIII.
[1]Discards = Partial estimates for the French offshore trawlers fleet

Table 3.9.8.2 Sole in Divisions VIIIa,b (Bay of Biscay)

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1984	36461	15938	4137	0.280
1985	33281	15191	4315	0.305
1986	30225	15589	4832	0.327
1987	34846	16284	5284	0.354
1988	35148	14806	5636	0.391
1989	41857	14046	6201	0.478
1990	42325	14038	6219	0.427
1991	41685	14753	5767	0.361
1992	28671	16299	6673	0.504
1993	29940	16564	6524	0.440
1994	27046	15764	7410	0.546
1995	33732	14130	6335	0.503
1996	27342	13378	5995	0.476
1997	24656	12873	6377	0.569
1998	25072	12409	6109	0.548
1999	24053	10463	5358	0.604
2000	14841	10110	5765	0.675
2001	25602*	8136	4783	0.739
2002	25602*	6594		0.731
Average	30652	13546	5762	0.487

*GM(1992-2000)

Table 3.8.9.3 Medium-term projections for 2003 onwards for a range of F reductions are presented below. The simulations are based on bootstrapped random recruitment and on F(2002) = $\mathbf{F}_{sq}$ = 0.74.

F(2003) onwards = 1.0 * $\mathbf{F}_{sq}$: Catches 2003 = 4.1

		SSB	
	25%	Median	75%
2003	6.3	6.7	7.1
2004	6.6	7.1	7.5
2005	6.8	7.2	7.7
2006	6.9	7.3	7.7
2007	6.9	7.4	7.8

F(2003) onwards = 0.3 * $\mathbf{F}_{sq}$: Catches 2003 = 1.5

		SSB	
	25%	Median	75%
2003	6.3	6.7	7.1
2004	9.3	9.9	10.5
2005	12.1	**12.8**	**13.6**
2006	**14.6**	15.3	16.3
2007	16.6	17.5	18.3

F(2003) onwards = 0.4 * $\mathbf{F}_{sq}$: Catches 2003 = 2.0

		SSB	
	25%	Median	75%
2003	6.3	6.7	7.1
2004	8.8	9.4	10.0
2005	11.0	11.6	12.4
2006	**12.8**	**13.4**	**14.3**
2007	14.1	14.9	15.6

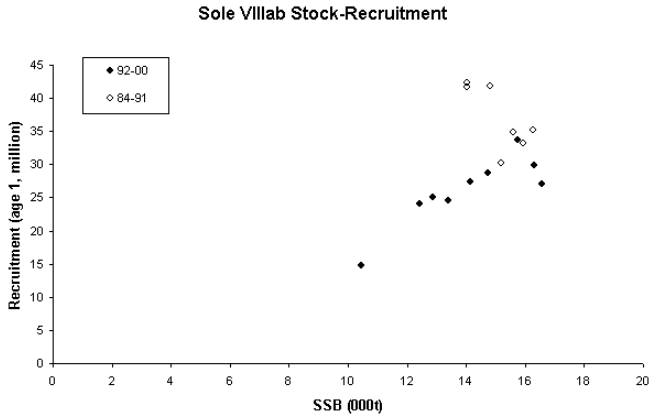
F(2003) onwards = 0.5 * $\mathbf{F}_{sq}$: Catches 2003 = 2.3

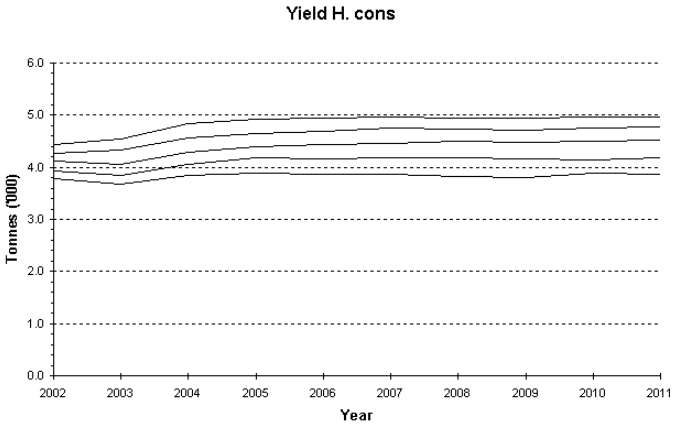
		SSB	
	25%	Median	75%
2003	6.3	6.7	7.1
2004	8.5	9.0	9.6
2005	10.2	10.8	11.5
2006	11.5	12.1	**12.8**
2007	12.4	**13.1**	13.9

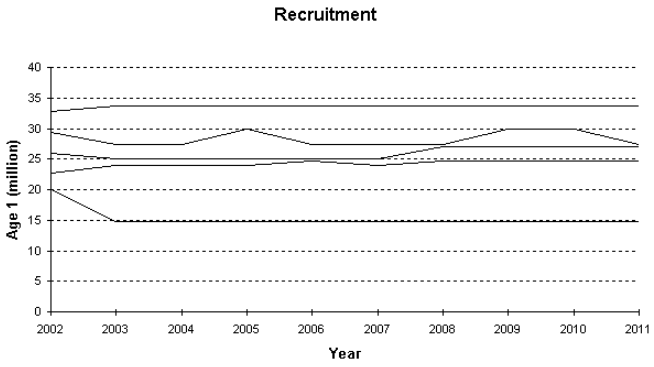
Sole in VIIab (Bay of Biscay). Medium term projections. Solid lines show 10, 25, 50, 75 and 90th percentiles. Stock-recruitment relationship estimated by random bootstrap (1992-2000 series).

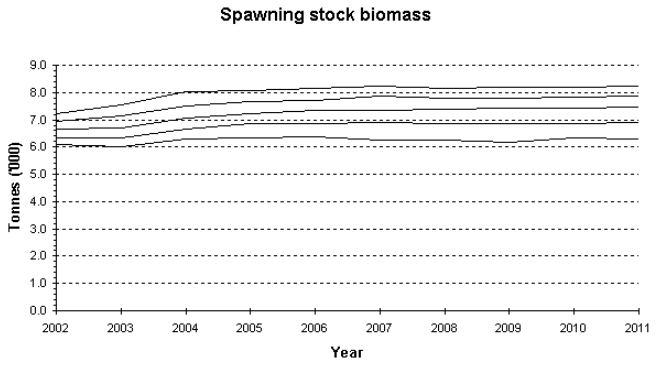
Number of simulations = 500

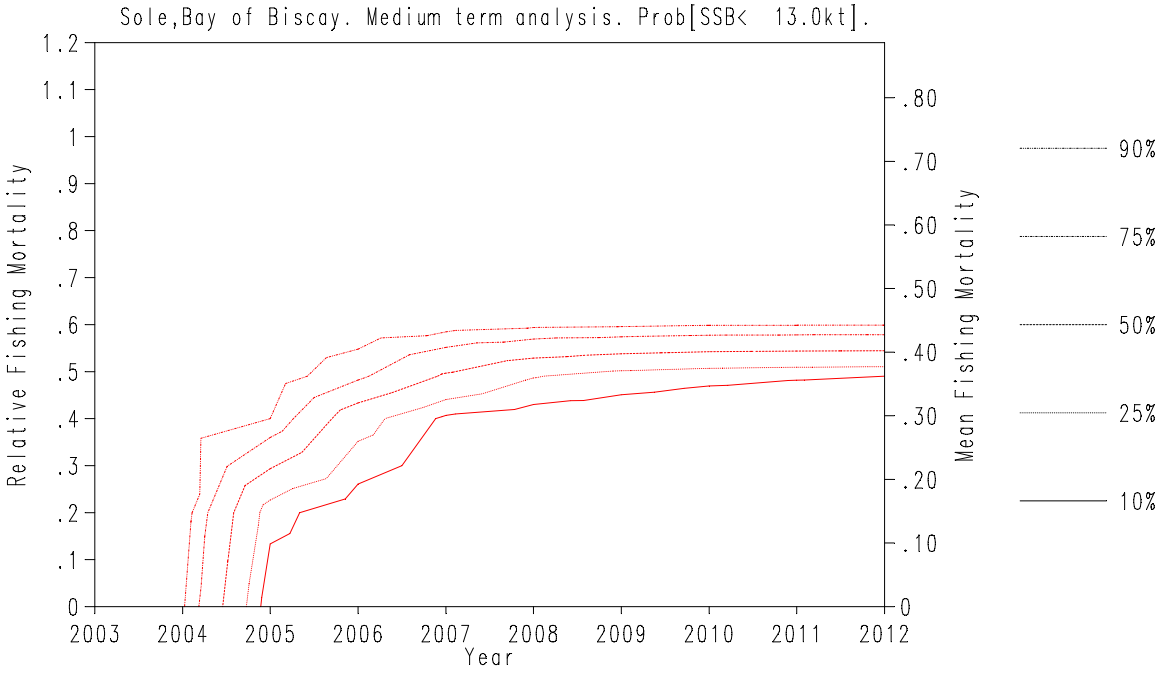
Relative H. Cons effort = 1.00









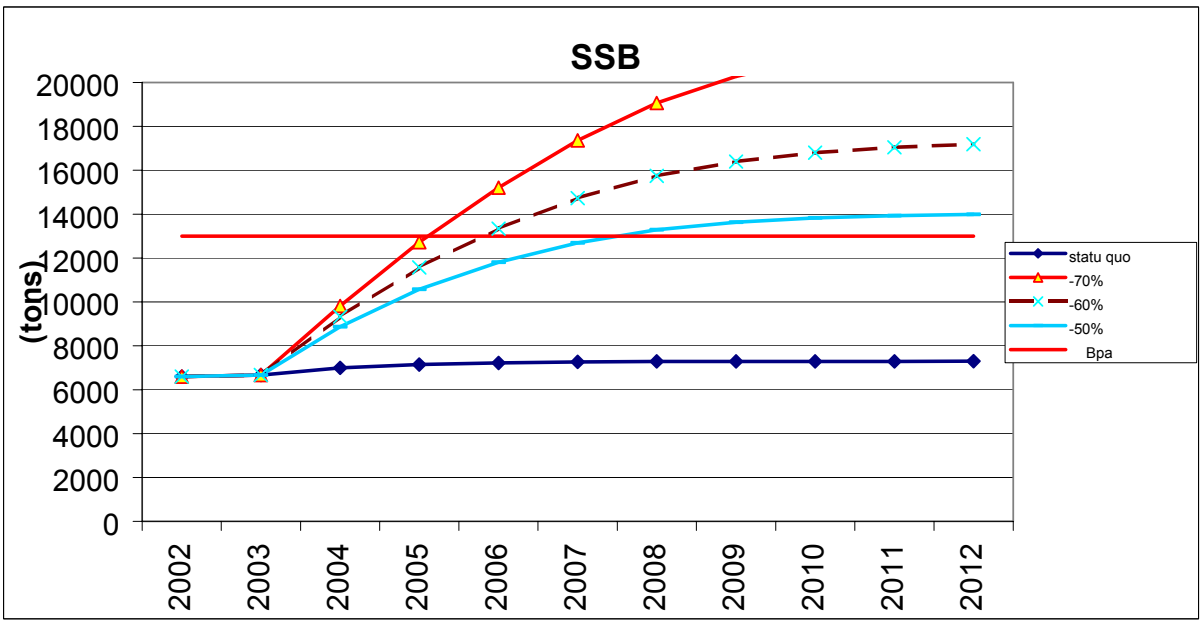


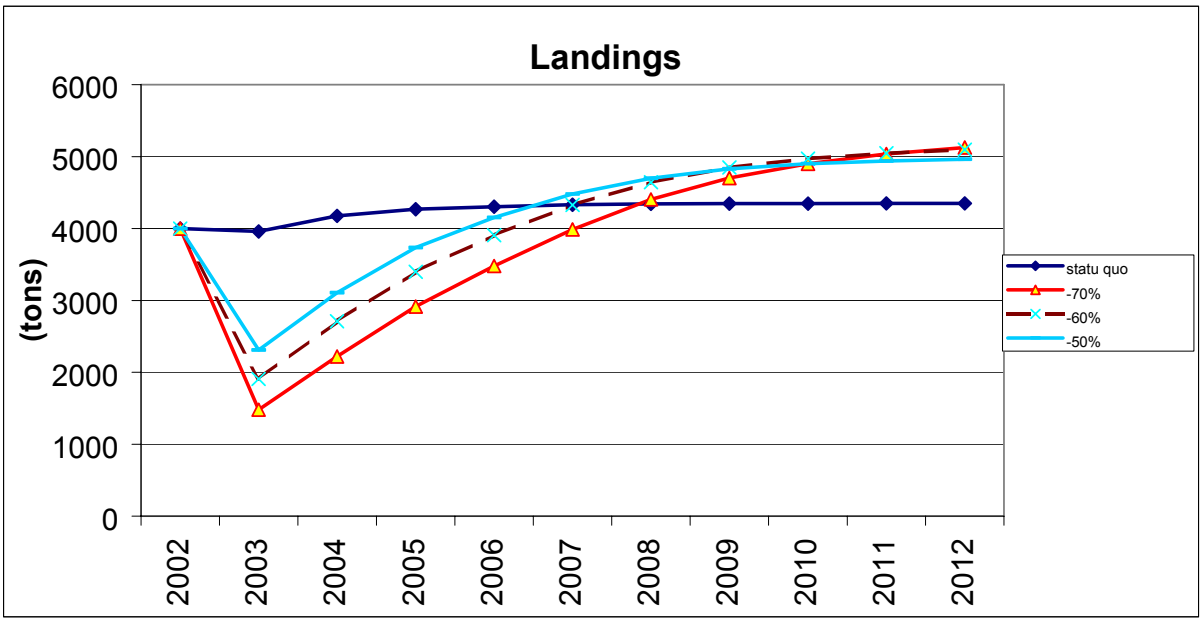
Medium-term projection starting in 2003 with population numbers from the status quo F catch forecast.

Bay of Biscay Sole

Constant F multipliers in 2003 and onwards

Deterministic projection using a constant R = 25.6 millions over the simulated period





3.9.9 Celtic Sea and Division VIIj herring

State of the stock/exploitation: The state of the stock is uncertain. Information from the catch and surveys suggests relatively low abundance of older herring for the past two years, and some years of poor recruitment in the mid- to late- 1990s.

Management objectives: A local Irish management committee has been established for this stock. One of its objectives is the protection of small fish, which is to be enforced by the closure (by Irish statute) of any area in the Celtic Sea and Division VIIj where the landings of herring from the Irish fleet contain more than 50% of individual fish below 23 cm. An Irish management plan is currently in place to protect small first-time spawning fish.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 26 000 t	$\mathbf{B}_{pa}$ be set at 44 000 t
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Technical basis:

$\mathbf{B}_{lim}$: The lowest stock observed	$\mathbf{B}_{pa}$: Low probability of low recruitment
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Advice on management: ICES recommends that catches in 2003 should be substantially less than recent catches. Catches in subsequent years should remain low until there is evidence of increased abundance of older fish in the population.

Relevant factors to be considered in management: The catches largely consist of incoming year classes about which little is know. Therefore, it is difficult to give appropriate management advice for 2002 because of the uncertainty about the current recruitment.

There was a general lack of older fish in the population, indicated by relatively low catches of adults in the fishery and the acoustic survey during 2000. In 2001, there were proportionally more 3+ ringers in the catch, but not nearly as many as observed prior to 1998. There were also proportionally more 3-5 ringers in the 2001 acoustic survey.

Comparison with previous assessment and advice: In 2000 the status of this stock was also considered to be unknown. Due to continued problems with the assessment, precise advice and catch options for 2003 are not possible. The interim advice on the 2002 catch from ICES in May 2002 was based on an assessment that was subsequently rejected by ACFM as a basis for advice for 2003. As stressed in the advice in 2001 and again in the interim advice for 2002, the assessment is highly uncertain, largely caused by the inability to precisely predict recruitment.

Elaboration and special comment: The point estimate of SSB from a provisional assessment is very imprecise and is greatly influenced by the number of recruits in 2001. The stock is so dependent on recruitment that ICES stresses the importance of obtaining and evaluating all recruitment information that is available from surveys in the area.

Due to the variability of the acoustic survey indices, any analytical assessment will likely result in stock size estimates that have low precision. Such estimates cannot be useful in the context of providing point estimates in short-term projections. However, such estimates, together with their uncertainties, can be used in the context of risk assessment if risk levels (e.g., of avoiding $\mathbf{B}_{pa}$ with a high probability) are pre-specified.

Following the 2000-2001 fishery it was decided by the Irish fishing industry (who account for the majority of the catches) to form a Pelagic Management Committee. This committee has stated the following management objective "*to maintain the stock at a level whereby it can sustain annual catches of around 20,000 t. In the event of the stock falling below the level at which these catches can be sustained the Committee will take appropriate rebuilding measures. The Committee will also introduce such measures as are necessary to prevent landings of small first time spawning herring including closed areas, and/or appropriate time closures*". It is also an objective of the Committee that all landings of herring from the fleet should contain at least 50% of individual fish above 23 cm. Spawning Box closures. Like the ones presently in operation should be retained and may, if necessary, be expanded both in time and area. This management measure was brought into effect by statute in the last season and resulted in an area closure, and the season was closed before the Irish quota was taken.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Yield and spawning biomass per Recruit
F-reference points:

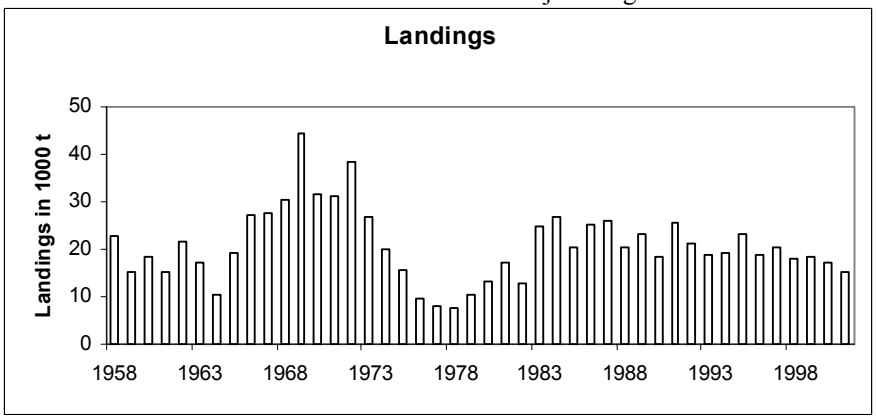
	Fish Mort Ages 2-7	Yield/R	SSB/R
Average Current	0.330	0.035	0.125
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	0.128	0.030	0.218
$\mathbf{F}_{med}$	N/A		

Catch data (Tables 3.9.9.1–2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Discards	ACFM Catch[1]
1987	Precautionary TAC	18	18	18	4.2	27.3
1988	TAC	13	18	17	2.4	19.2
1989	TAC	20	20	18	3.5	22.7
1990	TAC	15	17.5	17	2.5	20.2
1991	TAC (TAC excluding discards)	15 (12.5)	21	21	1.9	23.6
1992	TAC	27	21	19	2.1	23.0
1993	Precautionary TAC (including discards)	20–24	21	20	1.9	21.1
1994	Precautionary TAC (including discards)	20–24	21	19	1.7	19.1
1995	No specific advice	-	21	18	0.7	19.0
1996	TAC	9.8	16.5 – 21[2]	21	3.0	21.8
1997	If required, precautionary TAC	< 25	22	20.7	0.7	18.8
1998	Catches below 25	< 25	22	20.5	0.0	20.3
1999	F = 0.4	19	21	19.4	0.0	18.1
2000	F < 0.3	20	21	18.8	0.0	17.1
2001	F < 0.34	17.9	20	17.8	0.0	17.2
2002	Precautionary TAC for 1st half of 2002	6.0	8 for Jan.-			
2003	Substantially less than recent catches	-				

[1]By calendar year. [2]Revised during 1996 after ACFM May meeting. Weights in '000 t.

Celtic Sea and Division VIIj herring



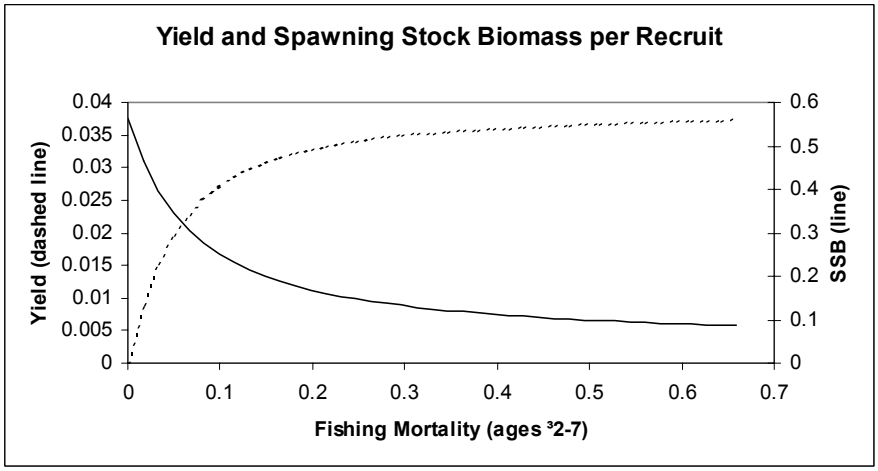


Table 3.9.9.1 Celtic Sea and Division VIIj Herring landings by calendar year (t), 1988-2001. (Data provided by Working Group members.)

These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988	-	-	16,800	-	-	-	2,400	19,200
1989	+	-	16,000	1,900	-	1,300	3,500	22,700
1990	+	-	15,800	1,000	200	700	2,500	20,200
1991	+	100	19,400	1,600	-	600	1,900	23,600
1992	500	-	18,000	100	+	2,300	2,100	23,000
1993	-	--	19,000	1,300	+	-1,100	1,900	21,100
1994	+	200	17,400	1,300	+	-1,500	1,700	19,100
1995	200	200	18,000	100	+	-200	700	19,000
1996	1,000	0	18,600	1,000	-	-1,800	3,000	21,800
1997	1,300	0	18,000	1,400	-	-2,600	700	18,800
1998	+	-	19,300	1,200	-	-200	0	20,300
1999	-	200	17,900	1,300	+	-1300	0	18,100
2000	573	228	18,038	44	1	-617	0	18,267
2001[1]	1,359	219	17,729	-	-	-1578	0	17,729

[1]Preliminary.

Table 3.9.9.2 Celtic Sea and Division VIIj Herring landings (t) by season (1 April-31 March) 1988/1989-2001/2002. (Data provided by Working Group members.)

These figures may not in all cases correspond to the official statistics and cannot be used for management purposes.

Year	France	Germany	Ireland	Netherlands	U.K.	Unallocated	Discards	Total
1988/1989	-	-	17,000	-	-	-	3,400	20,400
1989/1990	+	-	15,000	1,900	-	2,600	3,600	23,100
1990/1991	+	-	15,000	1,000	200	700	1,700	18,600
1991/1992	500	100	21,400	1,600	-	-100	2,100	25,600
1992/1993	-	-	18,000	1,300	-	-100	2,000	21,200
1993/1994	-	-	16,600	1,300	+	-1,100	1,800	18,600
1994/1995	+	200	17,400	1,300	+	-1,500	1,900	19,300
1995/1996	200	200	20,000	100	+	-200	3,000	23,300
1996/1997	1,000	-	17,900	1,000	-	-1,800	750	18,800
1997/1998	1,300	-	19,900	1,400	-	-2100	0	20,500
1998/1999	+	-	17,700	1,200	-	-700	0	18,200
1999/2000	-	200	18,300	1,300	+	-1300	0	18,500
2000/2001	573	228	16,962	44	1	-617	0	17,191
2001/2002[1]	-	-	15,236	-	-	-	0	15,236

[1] Preliminary.

3.9.9.a Response to the request from DG Fish concerning TACs for 2002 for Celtic Sea and Division VIIj herring

EC has requested ICES to reconsider its advice for **Celtic Sea and Division VIIj herring** for 2002 taking into account any additional data that may have become available since the assessment was done in 2001.

Based on its assessment in June 2001, ICES advised as follows:

Advice on management: ICES recommends that catches be restricted to 6 000 t for the first half of 2002, which is about 2/3 of current landings during the 1st half year. Advice for the second half of 2002 will be given in June 2002.

ICES Comments: The Celtic Sea and Division VIIj herring was assessed by the ICES Herring Assessment Working Group for the Area South of 62°N (HAWG), in March 2002. A complete 2001 dataset was available. The ICES Advisory Committee on Fishery Management (ACFM) will review the assessment made by HAWG in May 2002. ACFM will at that time formulate the ICES advice for 2003.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 26 000 t	$\mathbf{B}_{pa}$ be set at 44 000 t
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: not defined

Technical basis:

$\mathbf{B}_{lim}$: The lowest stock observed	$\mathbf{B}_{pa}$: Low probability of low recruitment

In 2001 the status of this stock was considered to be unknown. The current SSB estimate is still highly uncertain, but the SSB figures in the recent period are higher than those estimated last year.

The most recent assessment shows that fishing mortality has decreased significantly in the past year and that fishing mortality in 2000 was overestimated by last year's assessment. However, the point estimate of SSB in 2001 is very imprecise and is greatly influenced by the number of recruits in 2001. Projections based on this perception of the stock are naturally sensitive to recruitment. Recruitment in the most recent years appears to be above average (although these data points are relatively poorly estimated). Following the 2000-2001 fishery, it was decided by the Irish fishing industry (who account for the majority of the catches) to form a Pelagic Management Committee. This committee has stated the following management objective "*to maintain the stock at a level whereby it can sustain annual catches of around 20,000 t. In the event of the stock falling below the level at which these catches can be sustained the Committee will take appropriate rebuilding measures. The Committee will also introduce such measures as are necessary to prevent landings of small first time spawning herring including closed areas, and/or appropriate time closures*". It is also an objective of the Committee that all landings of herring from the fleet should contain at least 50% of individual fish above 23 cm. Spawning Box closures, as are at present in operation, should be retained and may, if necessary, be expanded both in time and area. This management measure was brought into effect by statute in the last season and resulted in an area closure, and the season was closed before the Irish quota was taken.

The catches largely consist of incoming year classes about which little is known. Therefore, it is difficult to give appropriate management advice for 2002. Nonetheless using a conservative estimate based on the geometric mean (1958-1999) would suggest that only catches in excess of 27,000t would reduce the SSB below $\mathbf{B}_{pa}$ in 2002. Fishing in 2002 at $\mathbf{F}_{sq}$ = 0.44, which is fairly high for a herring stock, will maintain SSB above $\mathbf{B}_{pa}$. As stated in the ICES advice for 2001 F ~ 0.35 is close to likely candidate values for $\mathbf{F}_{pa}$, and this will keep the stock above $\mathbf{B}_{pa}$ with a high probability.

Catch options for 2002:

Basis	F(2002)	SSB(2002)	Landings (2002)	SSB(2003) with fishing at given level
F(2002)= 0.57*F_{2001}	0.25	50	8	60
F(2002)= 0.68*F_{2001}	0.30	50	9	56
F(2002)=likely candidate for $\mathbf{F}_{pa}$	0.35	49	11	53
F(2002)=$\mathbf{F}_{sq}$	0.44	49	13	50
F(2002)=1.43*F_{2001}	0.50	48	15	49
F(2002)=1.57*F_{2001}	0.55	48	16	48
F(2002)=1.71*F_{2001}	0.60	48	17	47

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Advice on management: ICES recommends that fishing mortality in 2002 should be at or below 0.35, corresponding to catches in 2002 of no more than 11 000 t.

3.9.10 Sprat in Divisions VIId,e

State of stock/exploitation: The state of the stock is not known.

Management objectives: There are no specific management objectives for this stock.

Elaboration and special comment: Insufficient data are available to carry out an assessment. Sprat catches are very low and are mainly taken in the second half of the year by the Lyme Bay sprat fishery. The 2001 catch has decreased to 1 349 t; the catch has thus been lower than average since 1984.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Catch data (Tables 3.9.10.1-2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	No advice	-	5	2.7
1988	No advice	-	5	5.5
1989	No advice	-	12	3.4
1990	No advice	-	12	2.1
1991	No advice	-	12	2.6
1992	No advice	-	12	1.8
1993	No advice	-	12	1.8
1994	No advice	-	12	3.2
1995	No advice	-	12	1.5
1996	No advice	-	12	1.8
1997	No advice	-	12	1.6
1998	No advice	-	12	2.0
1999	No advice	-	6.3	3.6
2000	No advice	-	12	1.7
2001	No advice	-	12	1.3
2002	No advice	-	12	
2003	No advice	-		

[1]Weights in '000 t.

Sprat in Divisions VIId,e

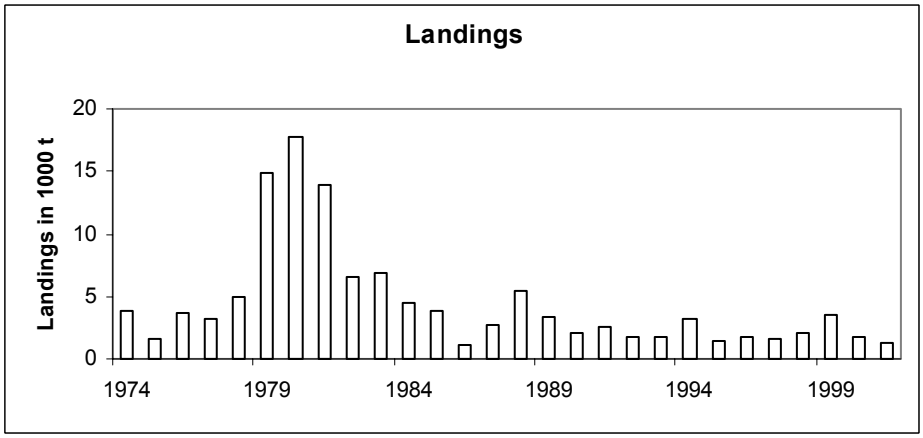


Table 3.9.10.1 Nominal catch of Sprat (t) in Divisions VIId,e 1985–2001.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993
Denmark	-	15	250	2,529	2,092	608	-	-	-
France	14	-	23	2	10	-	-	35	2
Netherlands	-	-	-	-	-	-	-	-	-
UK (Engl.&Wales)	3,771	1,163	2,441	2,944	1,319	1,508	2,567	1,790	1,798
Total	3,785	1,178	2,714	5,475	3,421	2,116	2,567	1,825	1,800

Country	1994	1995	1996	1997	1998*	1999*	2000*	2001*
Denmark	-	-	-	-	-	-	-	-
France	1	0	-	-	-	-	18	-
Netherlands	-	-	-	-	-	1	1	-
UK (Engl.&Wales)	3,177	1,515	1,789	1,621	2,024	3,559	1,692	1,349
Total	3,178	1,515	1,789	1,621	2,024	3,560	1,711	1,349

* Preliminary.

Table 3.9.10.2 Sprat in Divisions VIId,e

Year	Landings
	tonnes
1974	3793
1975	1571
1976	3724
1977	3237
1978	4999
1979	14833
1980	17732
1981	13890
1982	6612
1983	6911
1984	4455
1985	3785
1986	1178
1987	2714
1988	5475
1989	3421
1990	2116
1991	2567
1992	1825
1993	1800
1994	3178
1995	1515
1996	1789
1997	1621
1998	2024
1999	3560
2000	1711
2001	1349
Average	4407

3.9.11 Megrim in Divisions VIIb,c,e-k and VIIIa,b,d (*L. whiffiagonis and L. boscii*)

State of stock/exploitation: The stock of *Lepidorhombus whiffiagonis* is harvested outside safe biological limits. SSB was high from 1984 to 1988, then declined until 1990 but has remained above $\mathbf{B}_{pa}$. The fishing mortality has declined from the 1991 peak until 1997 and has increased since then to above $\mathbf{F}_{pa}$. Recruitment at age 1 has been relatively stable with peaks for the 1997 and the 1999 year classes.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined	$\mathbf{B}_{pa}$ be set at 55 000 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ was therefore set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is 0.44, the fishing mortality above which stock dynamics are unknown	$\mathbf{F}_{pa}$ be set at 0.30, the estimated $\mathbf{F}_{med}$. This F is consistent with the proposed $\mathbf{B}_{pa}$ and it approximates $\mathbf{F}_{MSY}$.

Technical basis:

$\mathbf{B}_{lim}$ = Not defined	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{med}$; implies a less than 5% probability that ($SSB_{MT} < \mathbf{B}_{pa}$)

Advice on management: ICES recommends that fishing mortality should be reduced to below $\mathbf{F}_{pa}$, corresponding to landings of less than 15 300 t in 2003. Including a 5% contribution of *L. boscii* in the landings, the equivalent TAC for the two species combined would be 16 100 t.

Relevant factors to be considered in management: For most fleets, megrim is taken in mixed fisheries for hake, anglerfish, *Nephrops*, cod, and whiting. The selection pattern is poor, i.e. that the fishery takes a disproportionate amount of small fish. Technical measures such as increases in mesh size to reduce the catches of small fish should be investigated for this stock.

Catch forecast for 2003:

Basis: F(2002) = F(99–01) = 0.35; Landings(2002) = 16.3 t ; Catch(2002) = 19.4 t; SSB(2003) = 70.6.

F(2003)	Basis	Catch(2003)	Landings (2003)	SSB(2004)
0.17	0.5 $\mathbf{F}_{sq}$	11.1	9.5	79.0
0.21	0.6 $\mathbf{F}_{sq}$	13.1	11.2	76.7
0.24	0.7 $\mathbf{F}_{sq}$	15.0	12.8	74.4
0.28	0.8 $\mathbf{F}_{sq}$	16.9	14.4	72.2
0.30	$\mathbf{F}_{pa}$	18.0	15.3	70.9
0.31	0.9 $\mathbf{F}_{sq}$	18.7	15.9	70.1
0.35	1 $\mathbf{F}_{sq}$	20.4	17.3	68.0
0.38	1.1 $\mathbf{F}_{sq}$	22.0	18.7	66.1
0.42	1.2 $\mathbf{F}_{sq}$	23.6	20.1	64.2

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections suggest that fishing at status quo leads to a more than 95% probability of SSB exceeding $\mathbf{B}_{pa}$ in 2007, at $\mathbf{F}_{pa}$ there is a 5% probability of SSB falling below $\mathbf{B}_{pa}$ in 2009.

There would be no loss in the long term (yield-per-recruit) if the current fishing mortality rate was reduced to $\mathbf{F}_{max}$. Such a reduction in fishing mortality would increase the expected spawning stock biomass per recruit to the order of 50%.

Comparison with previous assessment and advice: The title for this assessment has been changed to better reflect the areas covered. However, the actual assessment area is unchanged compared to previous years. Historical trends in F and SSB are similar to those in the previous assessment, with a slight downward revision in F and upward revision in SSB in the very recent years (by less than 5% for SSB and less than 10% for F). The present advice is similar to last year's advice.

Elaboration and special comment: Megrim in the Celtic sea, west of Ireland and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 60% of the total landings, and by Irish and UK demersal trawlers. Most UK landings of megrim are made by beam trawlers fishing in Divisions VIIe,f,g,h. Otter trawlers account for the majority of Spanish landings from Subarea VII, prosecuting a mixed fishery for anglerfish, hake, and megrim on the shelf edge around the 200-m contour to the south and west of Ireland. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole, and anglerfish. Megrim landings have remained fairly stable over the period 1986–2001. Discards are estimated to be less than 10% by weight of the total catches in recent years and comprise fish over a large range of sizes.

Megrim are widely distributed over the whole of Subareas VII and VIII and are most abundant in the deeper waters of the continental shelf. Spawning takes place between January and April along the edge of the continental shelf to the southwest and west of the British Isles, and research vessel trawling surveys indicate that 0-group megrim do not move far from the spawning grounds on the shelf edge during their first year.

An age-based analytical assessment using catch-per-unit effort from three commercial fleets and three surveys was performed. Discard estimates were used but were considered incomplete as only Spain provided data. Estimates of recruitment are considered to be very dependent on discard information.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01).

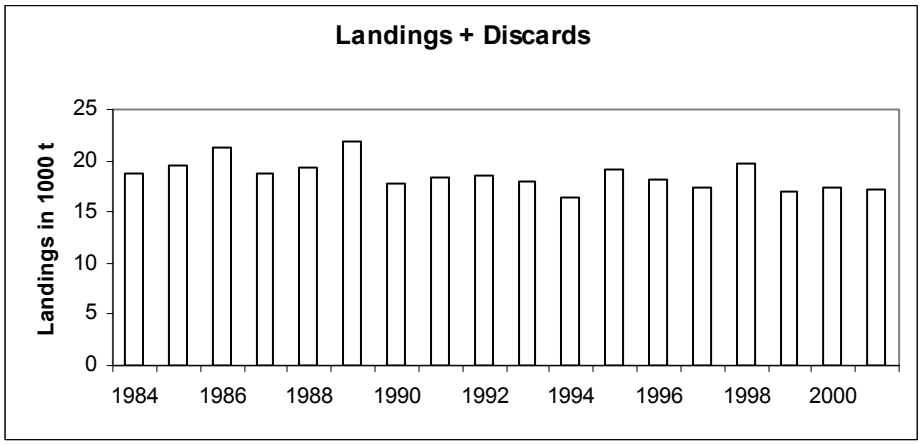
Yield and spawning biomass per Recruit F-reference points:

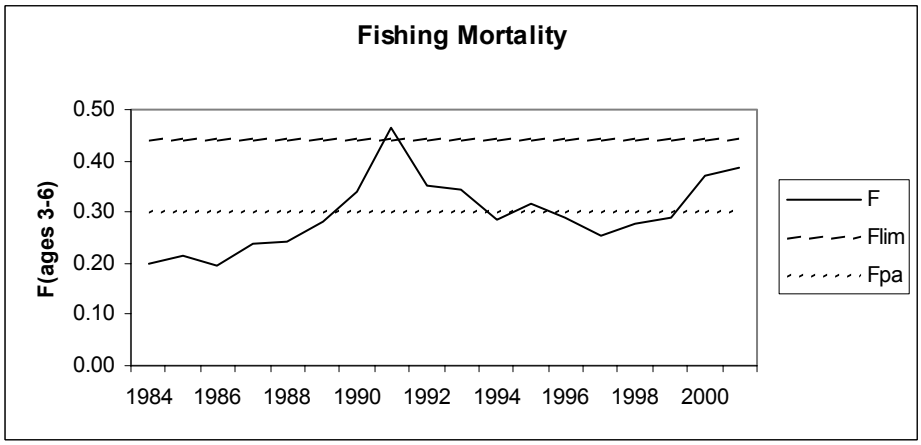
	Fish Mort Ages 3-6	Landings/R	SSB/R
Average Current	0.349	0.066	0.227
$\mathbf{F}_{max}$	0.229	0.068	0.337
$\mathbf{F}_{0.1}$	0.134	0.064	0.522
$\mathbf{F}_{med}$	0.290	0.067	0.271

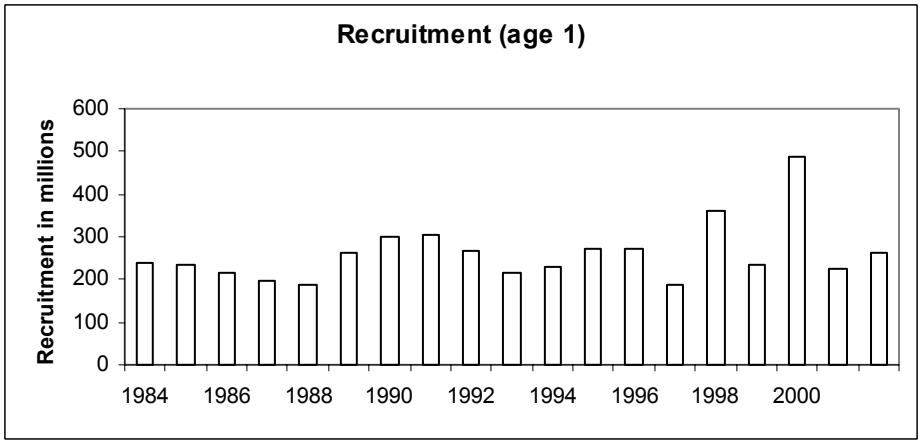
Catch data (Tables 3.9.11.1-2):

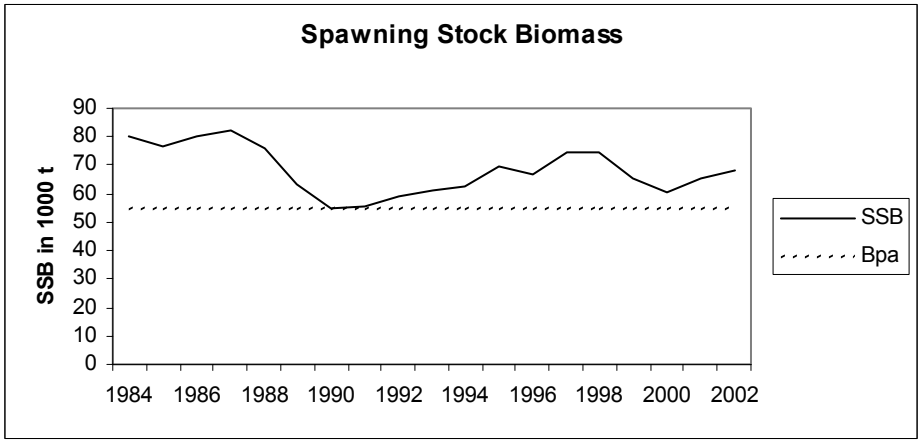
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings	Disc. slip.	ACFM catch
1987	Not assessed	-	16.46	17.1	1.7	18.8
1988	Not assessed	-	18.1	17.6	1.7	19.3
1989	Not assessed	-	18.1	19.2	2.6	21.8
1990	Not assessed	-	18.1	14.4	3.3	17.7
1991	No advice	-	18.1	15.1	3.3	18.4
1992	No advice	-	18.1	15.6	3.0	18.6
1993	Within safe biological limits	-	21.46	14.9	3.1	18.0
1994	Within safe biological limits	-	20.33	13.7	2.7	16.4
1995	No particular concern	-	22.59	15.9	3.2	19.1
1996	No long-term gain in increased F	16.6[2]	21.20	15.1	3.0	18.1
1997	No advice	14.3[2]	25.0	14.3	3.1	17.3
1998	No increase in F	15.2[2]	25.0	14.3	5.4	19.7
1999	Reduce F below $\mathbf{F}_{pa}$	14.6[2,1]	25.0	13.7	3.1	16.9
2000	Reduce F below $\mathbf{F}_{pa}$	<14.2[2,1]	20.0	15.0	2.3	17.3
2001	Reduce F below $\mathbf{F}_{pa}$	< 14.1[2,1]	16.8	15.8	1.3	17.1
2002	Reduce F below $\mathbf{F}_{pa}$	< 13.0[2,1]	14.9			
2003	Reduce F below $\mathbf{F}_{pa}$	< 16.1[2,1]				

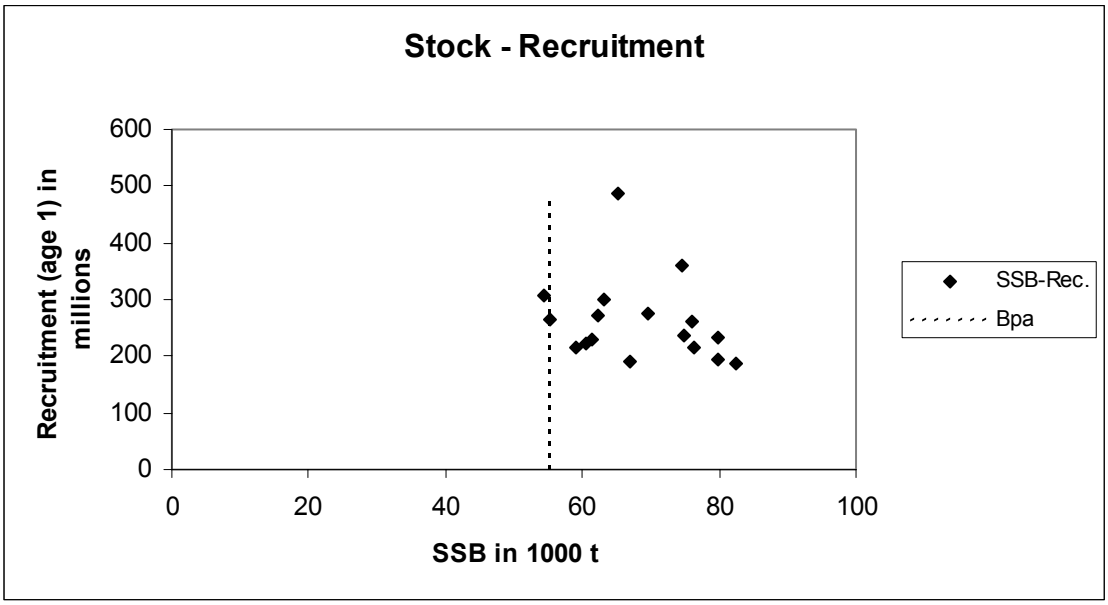
[1]Includes *L. boscii*. [2] Landings assuming current discarding practise. Weights in '000 t.

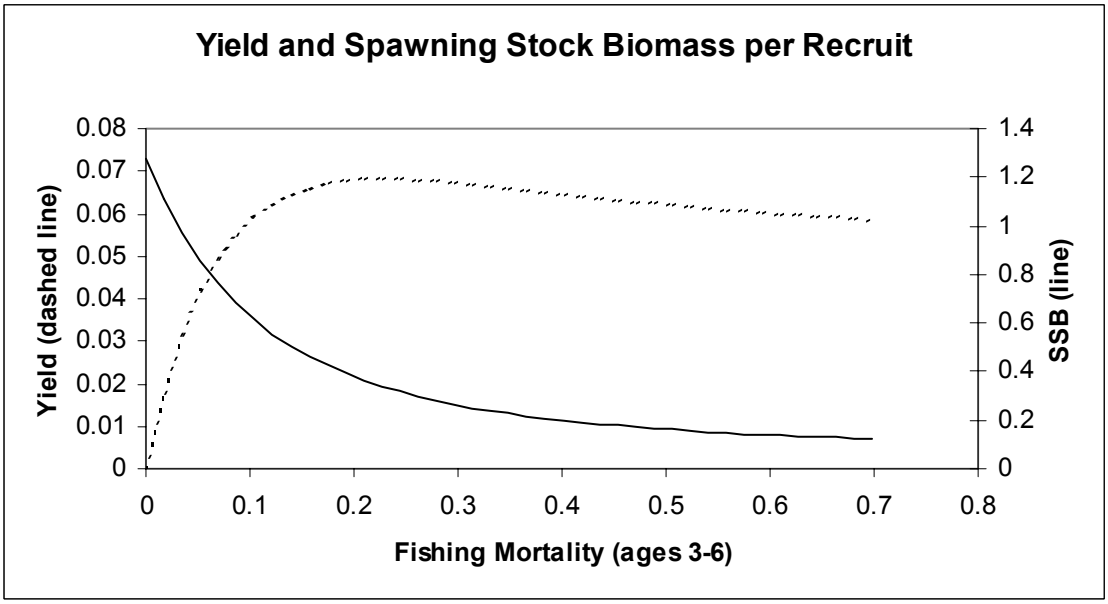

Landings + Discards
Landings in 1000 t
25
20
15
10
5
0
1984
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 3-6)
0.50
0.40
0.30
0.20
0.10
0.00
1984
1986
1988
1990
1992
1994
1996
1998
2000
F
Flim
Fpa


Recruitment (age 1)
Recruitment in millions
600
500
400
300
200
100
0
1984
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
600
500
400
300
200
100
0
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Fishing Mortality (ages 3-6)

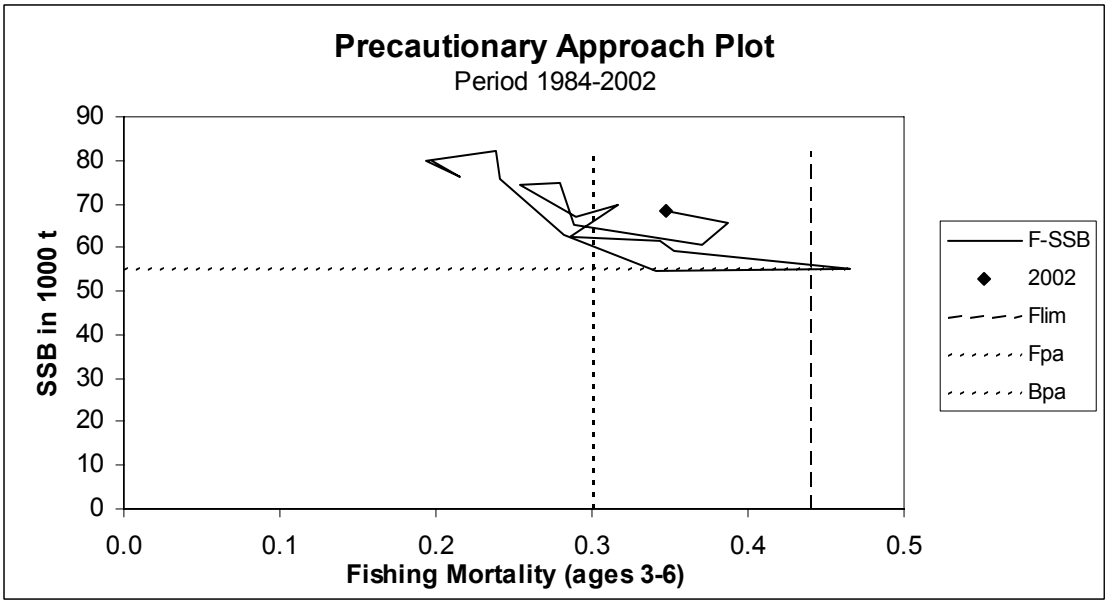

Precautionary Approach Plot
Period 1984-2002
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-6)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.9.11.1 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total landings	17865	18927	17114	17577	19233	14371	15094	15600	14929	13685
Total discards	1732	2321	1705	1725	2582	3284	3282	2988	3108	2700
Total catches	19597	21248	18819	19302	21815	17655	18376	18588	18037	16385
Agreed TAC [1]			16460	18100	18100	18100	18100	18100	21460	20330

	1995	1996	1997	1998	1999	2000	2001
Total landings	15862	15109	14254	14345	13714	15031	15778
Total discards	3206	3026	3066	5371	3135	2265	1275
Total catches	19068	18135	17320	19716	16850	17297	17053
Agreed TAC [1]	22590	21200	25000	25000	25000	20000	16800

[1] For both Megrim species and VIIa included.

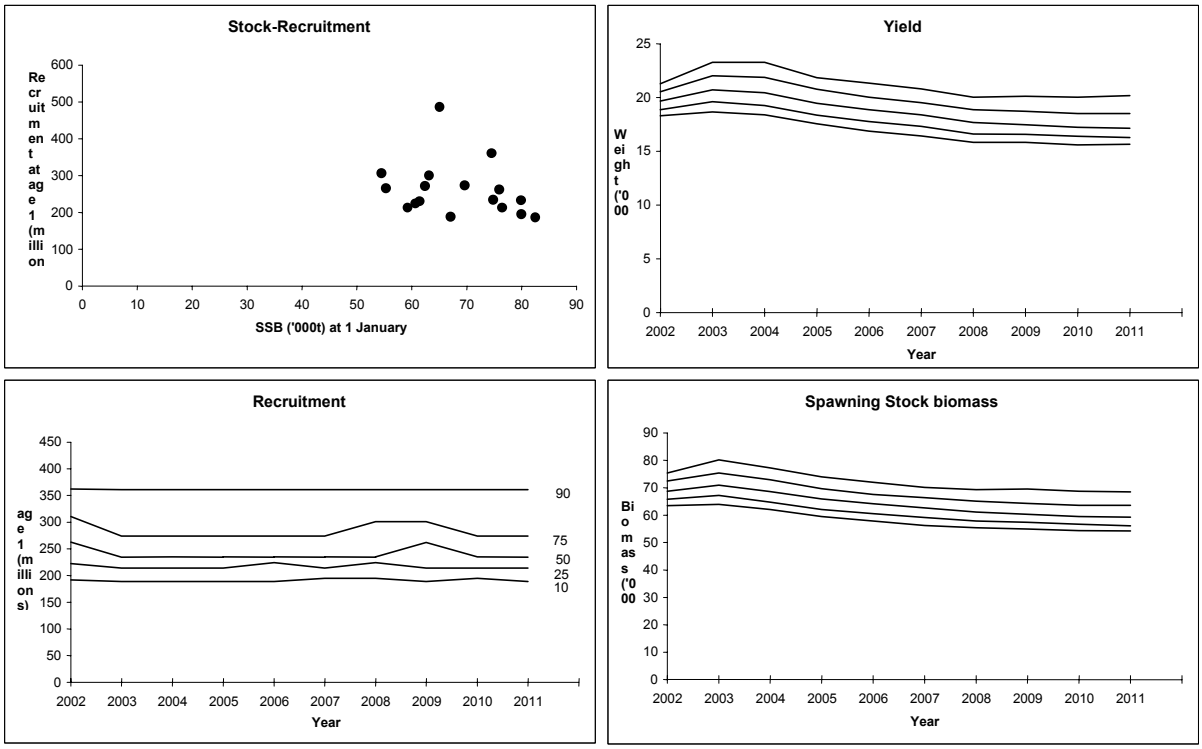
Table 3.9.11.2 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k & VIIIa,b,d

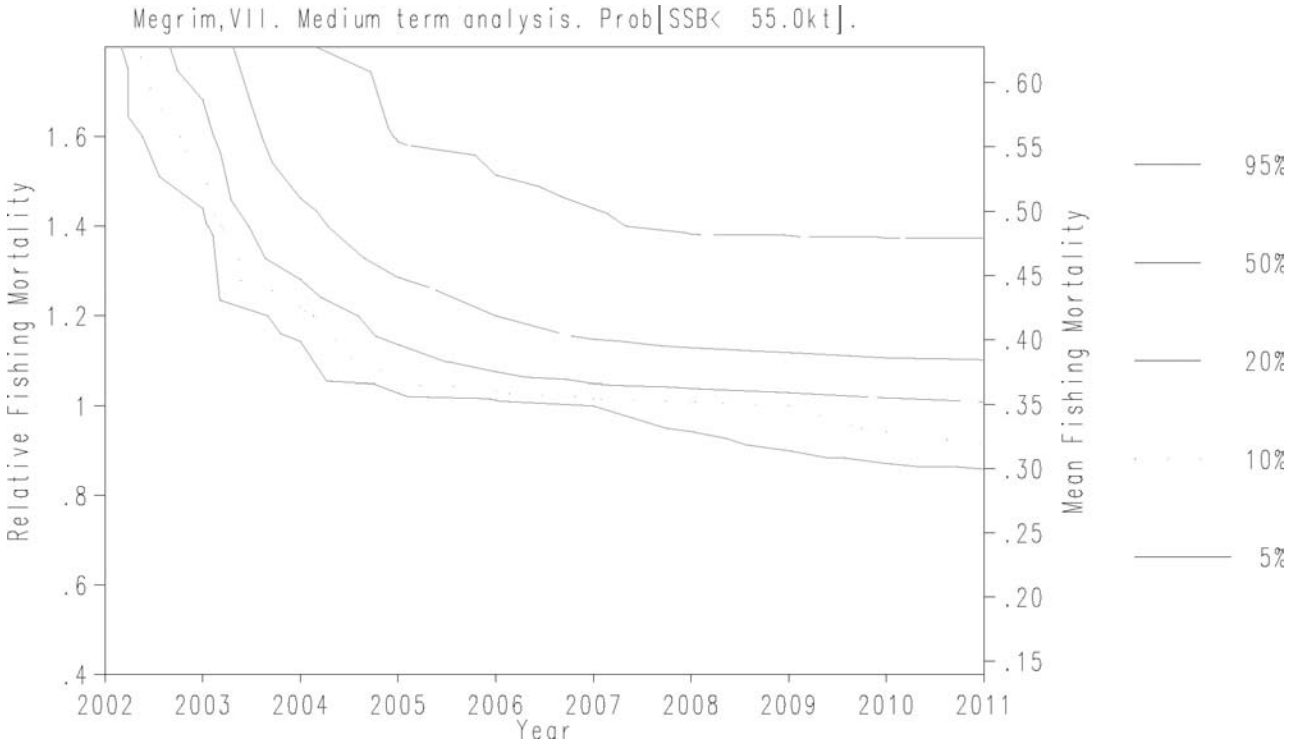
Year	Recruitment Age 1 thousands	SSB tonnes	Landings + Discards tonnes	Mean F Ages 3-6
1984	239000	79900	18800	0.198
1985	234000	76400	19600	0.216
1986	214000	79900	21200	0.194
1987	195000	82400	18800	0.238
1988	187000	75900	19300	0.241
1989	262000	63100	21800	0.282
1990	301000	54500	17700	0.341
1991	307000	55300	18400	0.465
1992	266000	59200	18600	0.353
1993	214000	61400	18000	0.343
1994	231000	62400	16400	0.286
1995	272000	69600	19100	0.317
1996	274000	67100	18100	0.290
1997	189000	74500	17300	0.254
1998	361000	74800	19700	0.279
1999	235000	65100	16900	0.289
2000	487000	60600	17300	0.370
2001	224000	65700	17100	0.387
2002	261000*	68500		0.348
Average	260684	68226	18561	0.300

*GM 87-00

Megrim in Div. VII + VIIIabd. Medium term projections. Lines show 10, 25, 50, 75 and 90 percentiles. Random stock-recruitr

Megrim in Divisions VII and VIIIabd. Medium term analysis, 1.00 * Fsq.





3.9.12 Anglerfish in Divisions VIIb–k and VIIIa,b,d *(L. piscatorius* and *L. budegassa)*

State of stocks/exploitation: The stock of *Lophius piscatorius* is outside safe biological limits, and the stock of *Lophius budegassa* is inside safe biological limits. The SSB of both stocks decreased from 1986 until 1993, then increased up to 1995-1996 and are presently decreasing. For both stocks, fishing mortality in most years has been above $\mathbf{F}_{pa}$, and even above $\mathbf{F}_{lim}$ for *L. piscatorius*. In 2001 fishing mortality is estimated to be below $\mathbf{F}_{pa}$ for *L. budegassa,* while for *L. piscatorius* F_{2001} is above $\mathbf{F}_{lim}$. Recent recruitments of *L. piscatorius* (1998 and 1999 year classes) and of *L. budegassa* (1997 and 1998 year classes) are above average, and there is evidence of strong year classes (2000 and 1999, respectively) recruiting to the fishery.

Management objectives: There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to reduce or maintain F below $\mathbf{F}_{pa}$, and to increase or maintain spawning stock biomass above $\mathbf{B}_{pa}$.

Precautionary Approach reference points:
***L. piscatorius* (changed in 2000)**

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined	$\mathbf{B}_{pa}$ be set at 31 000 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is 0.33, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.24. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in assessments.

Technical basis:

$\mathbf{B}_{lim}$: Not defined	$\mathbf{B}_{pa}$: $\mathbf{B}_{loss}$
$\mathbf{F}_{lim}$:$\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72

***L. budegassa*: ($\mathbf{B}_{pa}$ changed in 2002 due to a correction of the maturity ogive values):**

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 22 000 t. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ can therefore be set equal to the lowest observed SSB.
$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ be set at $\mathbf{F}_{med}$ = 0.23. This F is consistent with the proposed $\mathbf{B}_{pa}$.

Technical basis:

$\mathbf{B}_{lim}$= Not defined	$\mathbf{B}_{pa}$= $\mathbf{B}_{loss}$
$\mathbf{F}_{lim}$= Not defined	$\mathbf{F}_{pa}$= see above.

Advice on management: ICES recommends that F should be reduced by 30% for both species in order to rebuild SSB of *L. piscatorius* above $\mathbf{B}_{pa}$ in the short term. This corresponds to landings of less than 16 400 t in 2003 for both species combined (11 400 t *L. piscatorius*, and 5 000 t *L. budegassa*).

Relevant factors to be considered in management: The fishery may become heavily dependent on the strong year classes entering in the fishery. The increase in small individuals in the catches causes some concern as the potential contribution to the future landings and SSB of the recent strong year classes could be impaired by growth overfishing. There is no minimal landing size for anglerfish, but in order to protect juveniles of these year classes, the use of selective devices, such as rigid grids, should be promoted.

L. piscatorius and *L. budegassa* are both caught on the same grounds by the same fleets, and are usually not separated by species in landings; therefore, management measures for both species must be considered together and in conjunction with other species caught in these fisheries (sole, cod, rays, megrim, and hake). The management area for anglerfish also includes Division VIIa, where catches in recent years have been between 500 and 1 300 t.

Catch forecast for 2003:
Basis: *L. piscatorius*: F_{2002} = F(99-01) = 0.30 ; Landings(2002) = 15.6; SSB(2003) = 26.4.
Basis*: L. budegassa*: F_{2002} = F(99-01) = 0.27 ; Landings(2002) = 6.8 ; SSB(2003) = 22.6.

L. piscatorius				***L. budegassa***			
F(2003)	Basis	Landings(2003)	SSB(2004)	F(2003)	Basis	Landings(2003)	SSB(2004)
0.18	$0.6\mathbf{F}_{sq}$	9.9	32.0	0.16	$0.6\mathbf{F}_{sq}$	4.4	25.1
0.21	$0.7\mathbf{F}_{sq}$	11.4	30.7	0.19	$0.7\mathbf{F}_{sq}$	5.0	24.5
0.24	$\mathbf{F}_{pa}=0.8\mathbf{F}_{sq}$	12.7	29.4	0.21	$0.8\mathbf{F}_{sq}$	5.7	23.9
0.27	$0.87\mathbf{F}_{sq}$	13.7	28.6	0.23	$\mathbf{F}_{pa}=0.87\mathbf{F}_{sq}$	6.1	23.5
0.27	$0.9\mathbf{F}_{sq}$	14.1	28.3	0.24	$0.9\mathbf{F}_{sq}$	6.3	23.3
0.30	$1.0\mathbf{F}_{sq}$	15.4	27.1	0.27	$1.0\mathbf{F}_{sq}$	6.9	22.8
0.33	$1.1\mathbf{F}_{sq}$	16.6	26.1	0.29	$1.1\mathbf{F}_{sq}$	7.5	22.2
0.36	$1.2\mathbf{F}_{sq}$	17.8	25.0	0.32	$1.2\mathbf{F}_{sq}$	8.1	21.7

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Assuming the current selection pattern, $\mathbf{F}_{max}$ is $0.29\mathbf{F}_{sq}$ and $0.59\mathbf{F}_{sq}$ for *L. piscatorius* and *L. budegassa,* respectively.

Medium-term projections suggest that a 20% reduction in F (i.e. $\mathbf{F}_{pa}$ for *L. piscatorius*) leads to a more than 95% probability of both stocks exceeding $\mathbf{B}_{pa}$ in 2005.

Comparison with previous assessment and advice: The title for this assessment has been changed to better reflect the areas covered. However, the actual assessment area is unchanged compared to previous years. For *L. piscatorius* the present estimates of F and SSB are very similar to those obtained from last year's assessment. For *L. budegassa* correction of an error in the values of the maturity ogive did not alter the historic trend in SSB but has scaled it upwards. Fishing mortality for this stock has been revised upwards since 1996. Changes in strategy and fishing grounds of the fishery have caused changes in the selection pattern of some fleets towards smaller fish. Recent recruitments for both stocks have been strongly revised. However, these revisions do not strongly affect the estimate of SSB in the short term.

The present advice is stronger than last year because the stocks have remained low and fishing mortality has increased on small fish.

Elaboration and special comment: Anglerfish landings from the west of the British Isles and down to the northern Bay of Biscay comprise two species - *L. piscatorius* and *L. budegassa*. *L. piscatorius* has a wide distribution in waters from the south-western Barents Sea to the Atlantic coast of Spain, whereas *L. budegassa* has a more southerly distribution, ranging from the British Isles in the north to Senegal in the south. Large specimens of both species are found in deep waters. Juvenile anglerfish have been caught both in deep water and along the shoreline, and discrete nursery areas have not been identified.

Anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. A trawl fishery by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s, and overall annual landings may have attained 35–40 000 t by the early 1980s. Even though fishing effort increased until 1990, landings decreased between 1986 and 1993, but returned to the original level 10 years ago, when France and Spain together reported more than 75% of the total landings of both species combined. The remainder is taken by the UK and Ireland (around 10% each) and Belgium (less than 5%). Otter trawls (the main gear used by French, Spanish and Irish vessels) currently take about 80% of the total landings of *L. piscatorius*, while around 60% of UK landings are by beam trawlers and gill netters. Over 95% of total international landings of *L. budegassa* are taken by otter trawlers. There has been an expansion of the French gillnet fishery in the late 1980s in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels based in Spain and fishing in medium to deep waters. Otter trawling in medium and deep water in ICES Subarea VII appears to have declined, even though the increasing use of twin trawls by French vessels may have increased significantly the overall efficiency of the French fleet. Fishing activity by UK gillnetters and beam trawlers has remained relatively stable over the period 1986–1995. Belgium landings of anglerfish are exclusively by beam trawlers.

The analytical age-based assessment is based on landings, survey and commercial CPUE data. The catch-at-age matrix covers ages to 13+ for *L. piscatorius* and to 14+ for *L. budegassa*. Short-term predictions of landings and SSB are not sensitive to recent assumed recruitment.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01).

Anglerfish (*L. piscatorius)*
Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-8	Yield/R	SSB/R
Average Current	0.302	0.952	1.794
$\mathbf{F}_{max}$	0.088	1.313	8.165
$\mathbf{F}_{0.1}$	0.052	1.226	12.237
$\mathbf{F}_{med}$	0.272	0.998	2.128

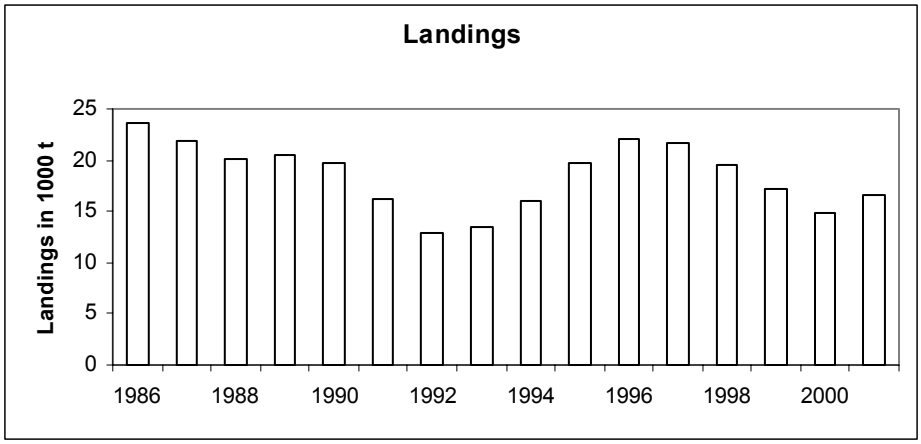
Anglerfish (*L. budegassa*)
Yield and spawning biomass per Recruit
F-reference points:

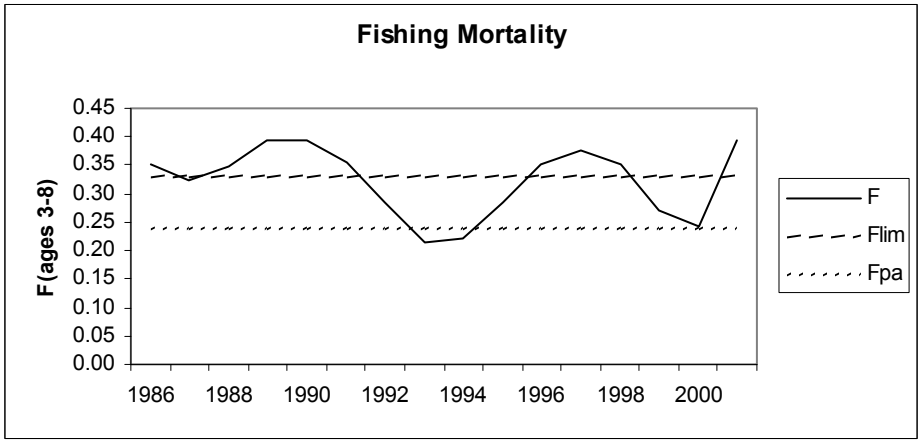
	Fish Mort Ages 6-10	Yield/R	SSB/R
Average Current	0.267	0.464	1.529
$\mathbf{F}_{max}$	0.159	0.497	2.915
$\mathbf{F}_{0.1}$	0.100	0.469	4.494
$\mathbf{F}_{med}$	0.232	0.479	1.853

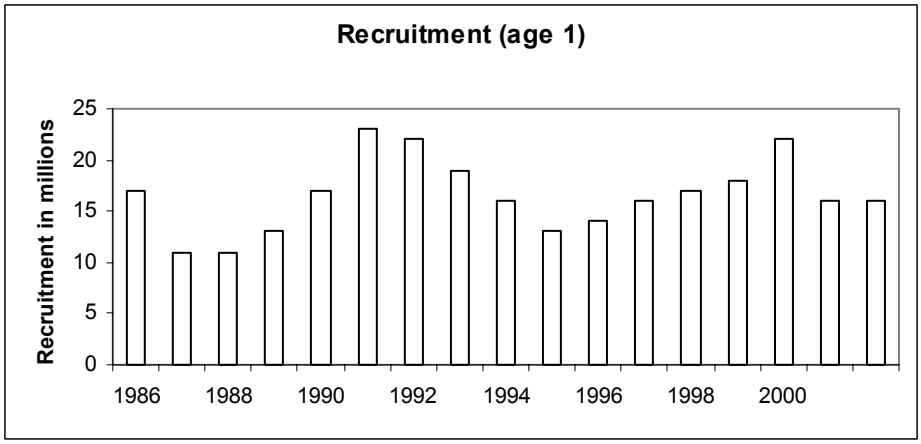
Catch data (Tables 3.9.12.1-5):

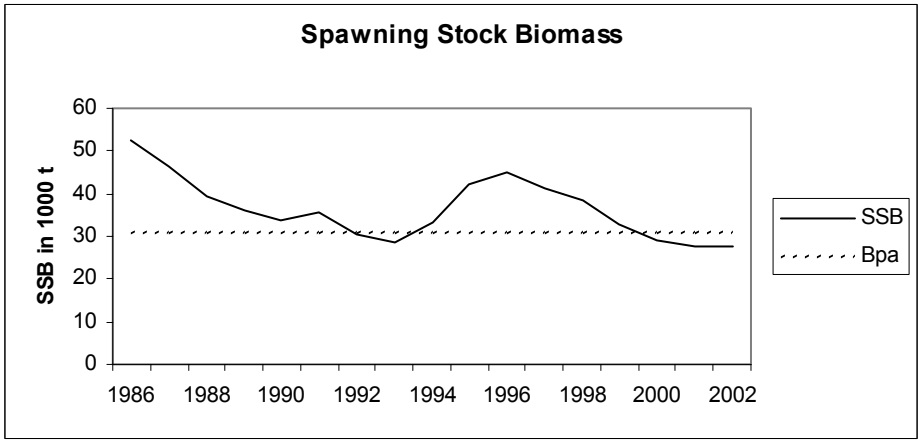
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not assessed	-	39.08	29.5	21.9	7.6
1988	Not assessed	-	42.99	28.5	20.1	8.4
1989	Not assessed	-	42.99	30.0	20.5	9.5
1990	Not assessed	-	42.99	29.4	19.8	9.6
1991	No advice	-	42.99	25.1	16.2	8.8
1992	No advice	-	42.99	21.1	12.8	8.3
1993	Concern about *L. pisc.* SSB decrease	-	25.1	20.1	13.5	6.7
1994	SSB decreasing, still inside safe biological limits	-	23.9	21.9	16.1	5.8
1995	No increase in F	20.0	23.2	26.8	19.7	7.1
1996	No increase in F	30.3	30.4	30.2	22.1	8.1
1997	No increase in F	34.3	34.3	29.8	21.7	8.1
1998	No increase in F	33.0	34.3	28.2	19.6	8.6
1999	No increase in F	32.9	34.3	24.5[3]	17.2[3]	7.3[3]
2000	At least 20% decrease in F	< 22.3	29.6	22.0[3]	14.9[3]	7.1[3]
2001	Reduce F below $\mathbf{F}_{pa}$	< 27.6	27.6	22.2	16.6	5.6
2002	Reduce F below $\mathbf{F}_{pa}$	< 19.9	23.7			
2003	At least 30% decrease in F	< 16.4				

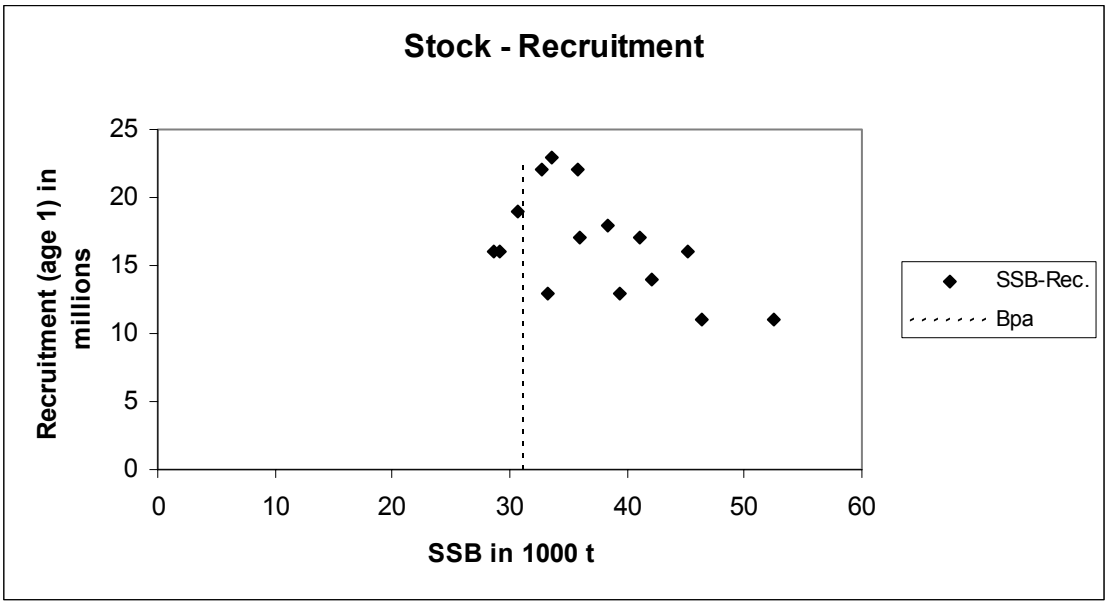
[1]Includes Division VIIa and Divisions VIIId,e; applies to both species. [3]Revised. Weights in '000 t.

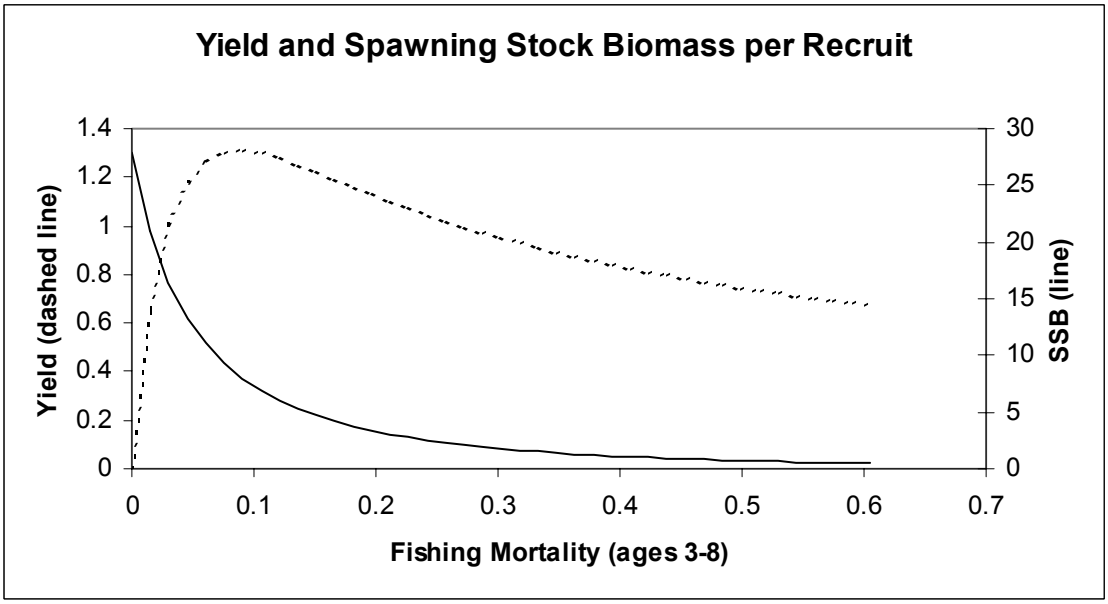

Landings
Landings in 1000 t
0
5
10
15
20
25
1986
1988
1990
1992
1994
1996
1998
2000

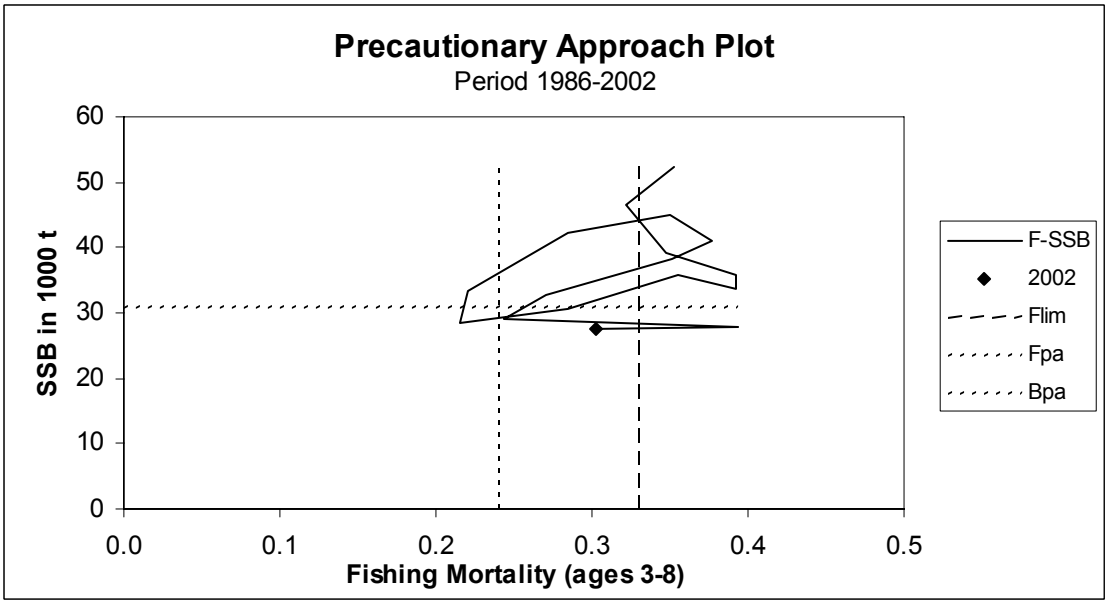

Fishing Mortality
F(ages 3-8)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
1986
1988
1990
1992
1994
1996
1998
2000
F
Flim
Fpa

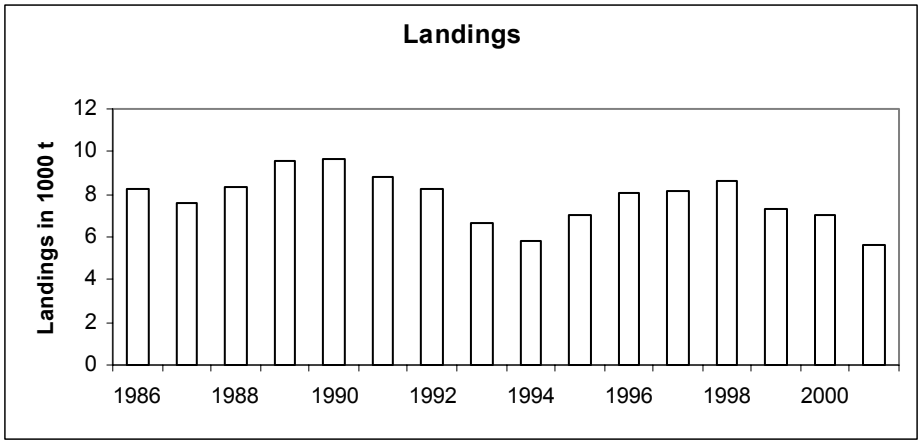

Recruitment (age 1)
Recruitment in millions
0
5
10
15
20
25
1986
1988
1990
1992
1994
1996
1998
2000

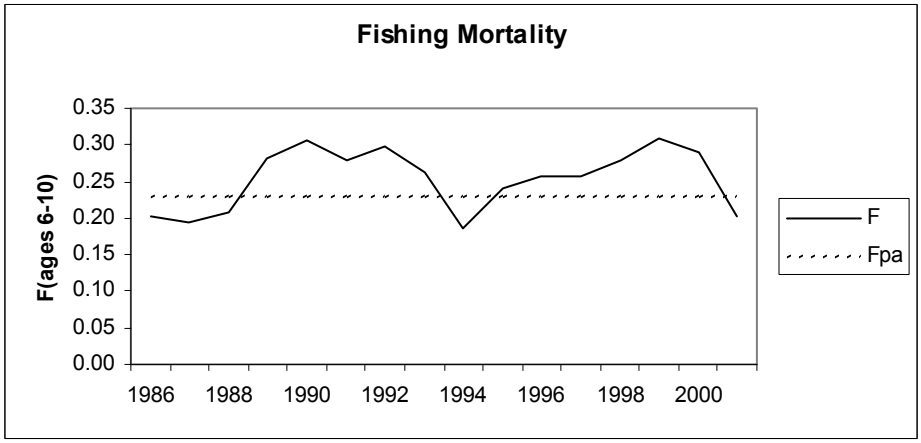

Spawning Stock Biomass
SSB in 1000 t
0
10
20
30
40
50
60
1986
1988
1990
1992
1994
1996
1998
2000
2002
SSB
Bpa

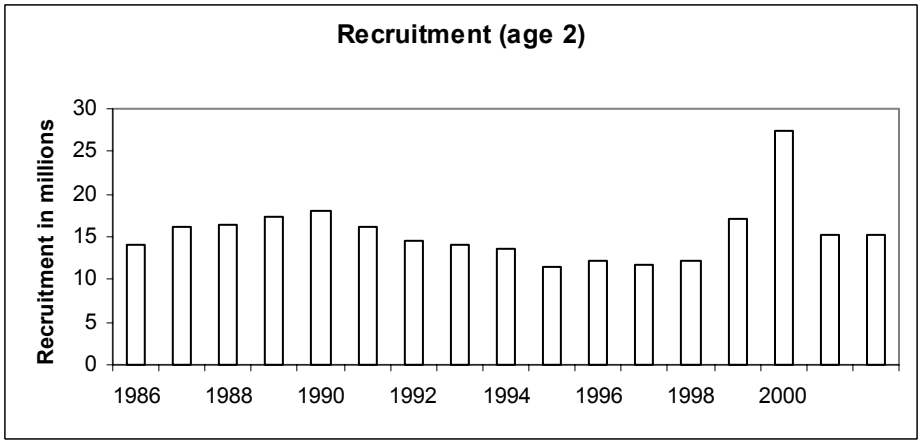

Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Bpa

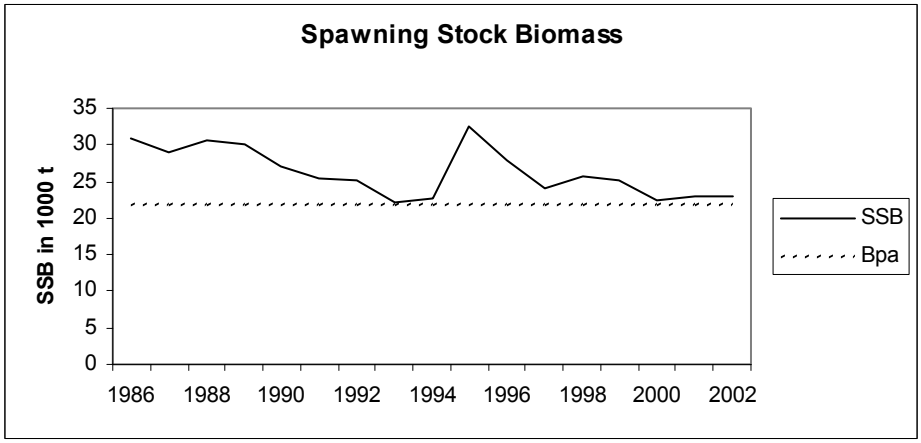

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-8)

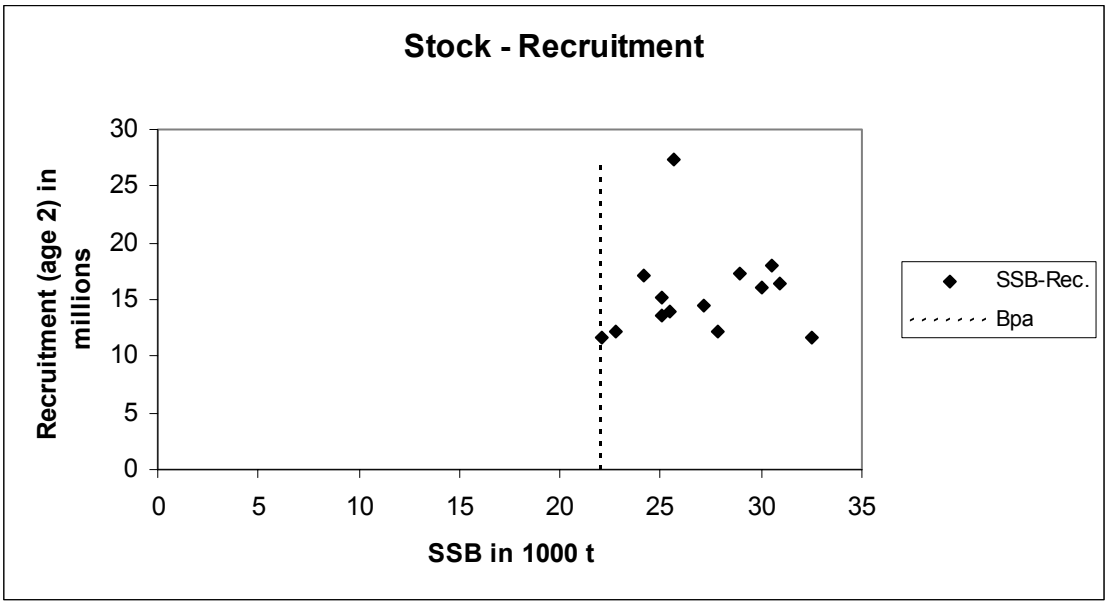

Precautionary Approach Plot
Period 1986-2002
SSB in 1000 t
Fishing Mortality (ages 3-8)
F-SSB
2002
Flim
Fpa
Bpa

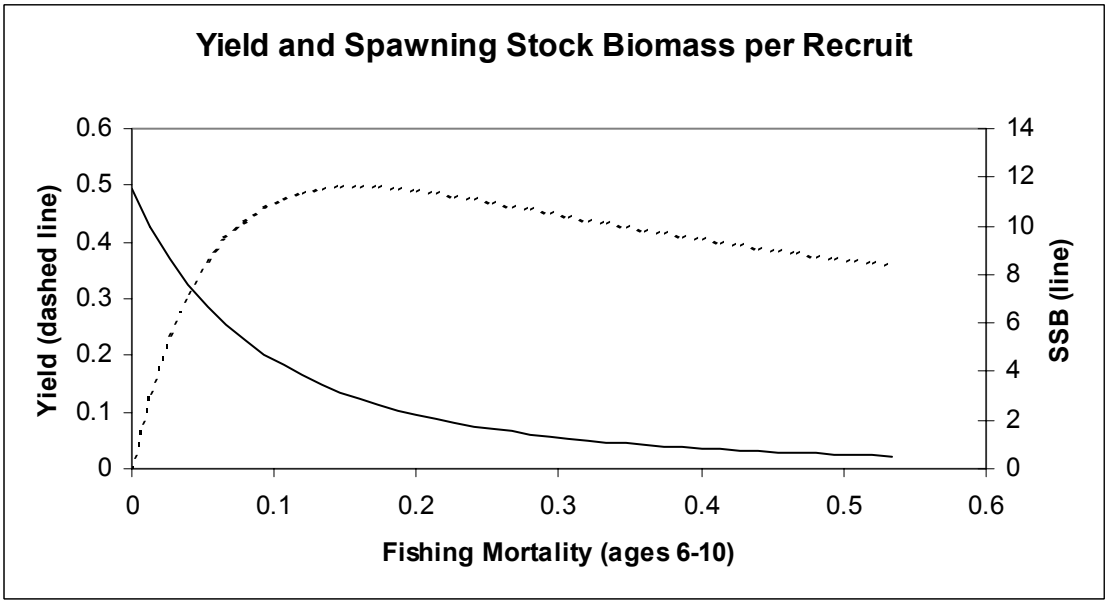

Landings
Landings in 1000 t
0
2
4
6
8
10
12
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 6-10)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
1986
1988
1990
1992
1994
1996
1998
2000
F
Fpa


Recruitment (age 2)
Recruitment in millions
0
5
10
15
20
25
30
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
30
35
1986
1988
1990
1992
1994
1996
1998
2000
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 6-10)

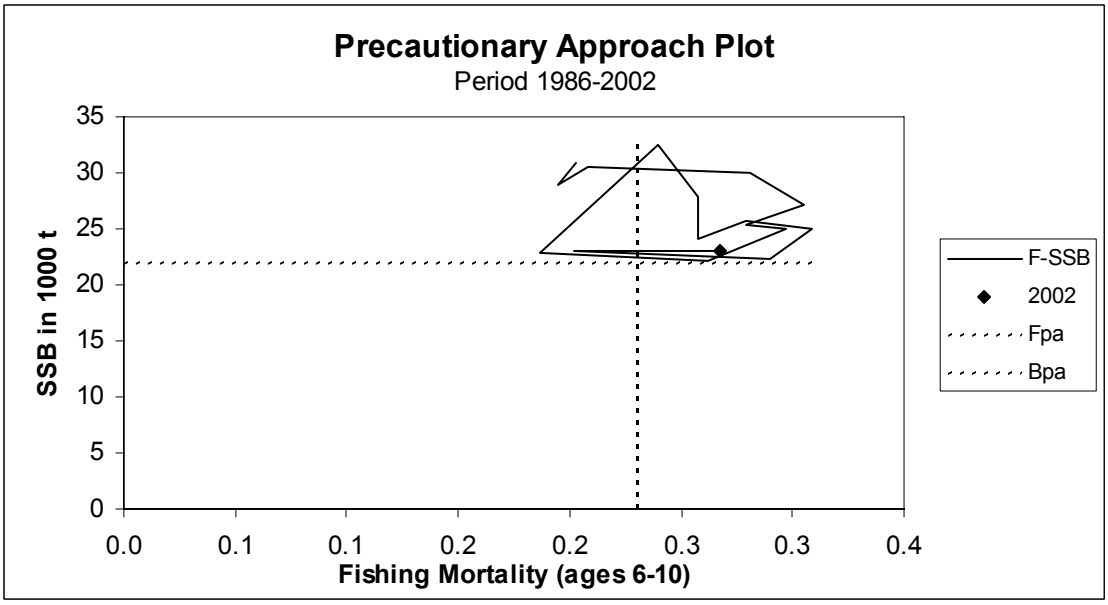

Precautionary Approach Plot
Period 1986-2002
SSB in 1000 t
Fishing Mortality (ages 6-10)
F-SSB
2002
Fpa
Bpa

Table 3.9.12.1 Landings (t) of both species of Anglerfish in Divisions VIIb-k and VIIIa,b,d. Working Group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1977[1]			19895
1978[1]			23445
1979[1]			29738
1980[1]			38880
1981[1]			39450
1982[1]			35285
1983[1]			38280
1984[1]	28847	7909	36756
1985[1]	28491	7161	35652
1986	25987	5897	31883
1987	22295	7233	29528
1988	22494	5983	28477
1989	24731	5276	30007
1990	23434	5950	29384
1991	20385	4684	25069
1992	17554	3530	21084
1993	16633	3507	20140
1994	18093	3841	21934
1995	21922	4862	26784
1996	24132	6102	30233
1997	23928	5846	29774
1998	23295	4876	28171
1999[1]	21288	3224	24512
2000[1]	19250	2711	21961
2001*	19476	2728	22205

*Preliminary.
[1] Revised.

Table 3.9.12.2 Landings (t) of *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d. Working Group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1984[1]	23056	5416	28472
1985[1]	23193	4568	27761
1986	19544	4122	23666
1987	17180	4729	21909
1988	16147	3948	20095
1989	17584	2889	20474
1990	16374	3379	19753
1991	14071	2158	16229
1992	11456	1362	12818
1993	11894	1587	13481
1994	14075	2045	16120
1995	16618	3113	19730
1996	18153	3988	22141
1997	17743	3917	21660
1998	16786	2787	19572
1999[1]	15690	1506	17186
2000[1]	13765	1133	14898
2001*	15026	1544	16571

*Preliminary.
[1] Revised

Table 3.9.12.3 Landings (t) of *L. budegassa* in Divisions VIIb-k and VIIIa,b,d. Working group estimates.

Year	VIIb-k	VIIIa,b,d	Total
1984[1]	5791	2493	8284
1985[1]	5298	2593	7891
1986	6443	1775	8217
1987	5115	2504	7619
1988	6347	2035	8382
1989	7146	2387	9533
1990	7061	2571	9632
1991	6314	2526	8840
1992	6098	2168	8266
1993	4739	1919	6659
1994	4018	1796	5814
1995	5304	1749	7053
1996	5978	2114	8092
1997	6185	1929	8114
1998	6510	2089	8599
1999[1]	5607	1718	7325
2000[1]	5485	1578	7064
2001*	4450	1184	5634

*Preliminary.
[1] Revised.

Table 3.9.12.4 Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b,d.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-8
1986	17000	52500	23700	0.352
1987	11000	46400	21900	0.322
1988	11000	39300	20100	0.348
1989	13000	35900	20500	0.392
1990	17000	33600	19800	0.392
1991	23000	35800	16200	0.355
1992	22000	30600	12800	0.285
1993	19000	28600	13500	0.215
1994	16000	33300	16100	0.220
1995	13000	42100	19700	0.285
1996	14000	45100	22100	0.350
1997	16000	41100	21700	0.377
1998	17000	38300	19600	0.351
1999	18000	32700	17200	0.270
2000	22000	29100	14900	0.244
2001	16000*	27800	16600	0.393
2002	16000*	27600		0.302
Average	16529	36459	18525	0.321

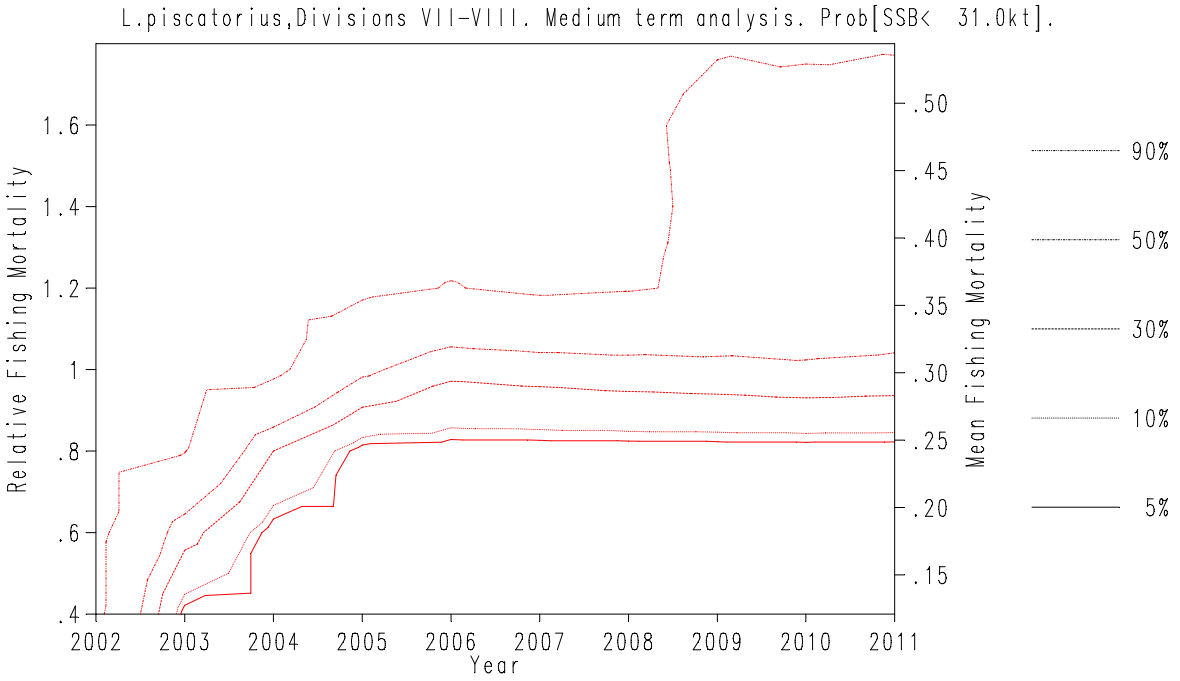
* GM87-00

Table 3.9.12.5 Anglerfish (*L. budegassa*) in Divisions VIIb-k and VIIIa,b,d

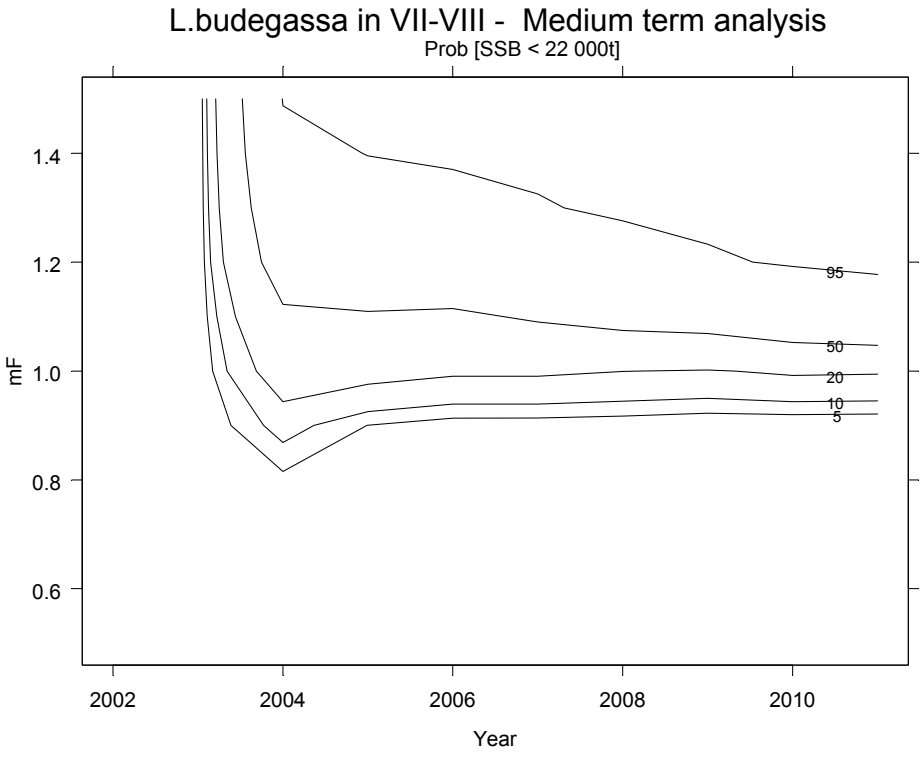
Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 6-10
1986	14024	30969	8217	0.203
1987	16228	28923	7619	0.195
1988	16462	30497	8382	0.208
1989	17255	30051	9533	0.281
1990	18006	27114	9632	0.305
1991	16068	25440	8840	0.279
1992	14460	25021	8266	0.297
1993	13995	22072	6659	0.262
1994	13631	22791	5814	0.187
1995	11561	32527	7053	0.240
1996	12095	27868	8092	0.258
1997	11656	24182	8114	0.258
1998	12183	25673	8599	0.279
1999	17031	25051	7325	0.309
2000	27379	22405	7065	0.290
2001	15166*	23066	5634	0.202
2002	15166*	23092		0.267
Average	15433	26279	7803	0.254

* GM87-00

***L. piscatorius* in Div. VII-VIIIab: Medium-term contour plot.**



***L. budegassa* in VII & VIII. Medium-term analysis**



3.9.13 Response to the request from DG Fish concerning TACs for 2002 for Sole in Divisions VIIIa,b (Bay of Biscay)

EC has requested ICES to reconsider its advice for sole in Division VIIIa,b (Bay of Biscay) for 2002 taking into account any additional data that may have become available since the assessment was done in 2001.

ICES advised based on its assessment in June 2001 as follows:

Advice on management: In the light of the sharp decrease in SSB and recruitment since 1995, ICES recommends a recovery plan that will ensure a safe and rapid recovery of SSB to a level in excess of 13 000 t. If a recovery plan is not implemented, ICES recommends that the fishing mortality should be reduced to the lowest possible level in 2002.

ICES comments:

1. The sole in Divisions VIIIab (Bay of Biscay)) is assessed by the ICES Working Group on the Assessment of Southern Shelf Demersal Stocks (WGSSDS). This group will meet again in July 2002 and at that time have the complete 2001 dataset available. The assessment made by WGSSDS will be reviewed by the ICES Advisory Committee on Fishery Management (ACFM) in October 2002. Also, ACFM will at that time formulate ICES advice for 2003.

2. The fishery on sole in Division VIIIab is almost entirely French although some Belgian beam trawlers are involved in the fishery. IFREMER (Institut Français de Recherche pour l'Exploration de la Mer) provides almost all data for the assessment (tuning series and age composition of catches). Therefore, ICES asked IFREMER to conduct a study to allow ICES to respond to this request.

3. The new available information is as follows:

   - French landings figures have been revised for 1999 and 2000, and the text table below compares the new estimates with those used by the WGSSDS in 2001.

Years	WGSSDS value	Revised value	Difference
1999	5 164 t	4 933 t	- 4 %
2000	5 006 t	5 179 t	+ 3.5 %

These revisions are of minor importance, and do not change the general declining trend of the international landings observed since 1994. Such revisions will not make a significant impact on the perception of the state of this stock. In 1999 and 2000 TACs were not reached (landings below TAC by 9 % and 11 % respectively).

   - The two CPUE series derived from artisanal trawler fleets from La Rochelle and Les Sables d'Olonne have been also revised for 1999 and 2000; these revisions indicate that for the two fleets, CPUE have been overestimated in the last assessment made by WGSSDS in September 2001. Compared to values used by WGSSDS, new values for 1999 and 2000 are respectively 12 % and 13 % lower for Les Sables d'Olonne fleet, 20 % and 27 % for La Rochelle fleet. These two series are used for the assessment of this stock, and a new assessment using the revised CPUE series would produce a lower SSB estimate compared to the results obtained by WGSSDS.

In conclusion, new available information indicates that SSB is lower than the estimate produced by ICES in September 2001, and well below $\mathbf{B}_{pa}$. Therefore, there is no basis to revise the previous ICES advice on the stock of sole in Division VIIIab.

3.9.14 Plaice Southwest of Ireland (Division VIIh-k)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Catches have been declining and the 2001 landings are the lowest in the time-series.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2003 be no more than the recent average (1998-2000) of around 450 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Relevant factors to be considered in management: Recent landings have been about 30% of the TAC. Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species taken in the fishery.

Catch forecast for 2003 and medium- and long-term projections are not available.

Comparison with previous assessment and advice: The assessment for this stock is preliminary. ICES gave no advice for this stock in 2001.

Elaboration and special comment: ICES carried out a preliminary assessment on the status of this stock. This assessment used catch-at-age data from 1993-2001 and commercial and survey tuning data from Ireland. The time-series of the data and tuning fleets were too short to make conclusions about the current stock status.

Plaice are predominantly caught within mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Beam trawlers and seiners generally take a lesser catch of plaice. Ireland is the major participant in this fishery with around 60% of the international landings between 1993-2001.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 9 – 18 July 2002 (ICES CM 2003/ACFM:03).

Catch data (Table 3.9.14.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM landings
1993	-	-	-	652
1994	-	-	-	578
1995	-	-	-	541
1996	-	-	-	431
1997	-	-	-	639
1998	-	-	-	439
1999	-	-	-	538
2000	-	-	-	367
2001	-	-	1215	276
2002	-	-	1080	
2003	Reduce TAC to recent average (1998-2000)	450		

Table 3.9.14.1 Plaice in Divisions VII h-k (Southwest Ireland).
Nominal landings (t) of PLAICE in Divisions VIIh-k, 1993-2001, as officially reported to ICES.

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium									6
France	44	42	47	50	58	74	77	125	98
Ireland	237	184	243	183	203	221	177	107	110
Netherlands				70		7			
UK (England & Wales)	209	172	192	148	113	111	95	95	111
UK (Scotland)	5	2							
Total	495	400	482	451	374	413	349	327	325
Unallocated		-2	-79	-8	190	10	-22		
Total figures used by Working Group	495	398	403	443	564	423	327	327	325

3.9.15 Sole Southwest of Ireland (Division VIIh-k)

State of stock/exploitation: The state of the stock is not known in relation to biological reference points. Catches in the last three years are the lowest in the short time-series.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2003 be no more than the recent average (1999-2001) of around 330 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Relevant factors to be considered in management: Recent landings have been about 50% of the TAC. Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species taken in the fishery.

Catch forecast for 2003: not available.

Medium- and long-term projections: not available.

Comparison with previous assessment and advice: The assessment is preliminary. ICES gave no advice for this stock in 2001.

Elaboration and special comment: ICES carried out a preliminary assessment on the status of this stock. This assessment used catch-at-age data from 1993-2001 and commercial and survey tuning data from Ireland. The time-series of the data and tuning fleets were too short to make conclusions about the current stock status.

Sole are predominantly caught within mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Beam trawlers and seiners generally take a lesser catch of sole. Ireland is the major participant in this fishery with around 50% of the international landings between 1993-2001.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 9 – 18 July 2002 (ICES CM 2003/ACFM:03).

Catch data (Tables 3.9.15.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM landings
1993	No advice	-	-	495
1994	No advice	-	-	398
1995	No advice	-	-	403
1996	No advice	-	-	443
1997	No advice	-	-	564
1998	No advice	-	-	423
1999	No advice	-	-	327
2000	No advice	-	-	327
2001	No advice	-	650	325
2002	No advice	-	650	
2003	Reduce TAC to recent landings	330		

Table 3.9.15.1 Plaice in Divisions VII h-k (Southwest Ireland).
Nominal landings (t) of PLAICE in Divisions VIIh-k, 1993-2001, as officially reported to ICES.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium									6
France	44	42	47	50	58	74	77	125	98
Ireland	237	184	243	183	203	221	177	107	110
Netherlands				70		7			
UK (England & Wales)	209	172	192	148	113	111	95	95	111
UK (Scotland)	5	2							
Total	495	400	482	451	374	413	349	327	325
Unallocated		-2	-79	-8	190	10	-22		
Total figures used by Working Group	495	398	403	443	564	423	327	327	325

na = not available

3.10 Stocks in Divisions VIIb,c,h–k (West of Ireland)

3.10.1 Overview

Fleet and Fisheries

The fishery in Divisions VIIb,c is mainly a trawl fishery although some gillnetting is carried out. The fishery in Divisions VIIh–k is also a trawl fishery, but gillnetting is increasing in importance in the area. These are mixed fisheries for cod, haddock, whiting, hake, monk, megrim, sole, and plaice; and cod and whiting are taken as by-catch in the *Nephrops* fishery. In recent years, there has been an increase in the number of seiners operating in the Irish fleet in Divisions VIIg,j, targeting whiting and haddock.

Landing figures for these ICES Divisions are difficult to interpret as several countries differ in the manner in which they report their landings data for the various ICES Divisions.

Other species taken in the area are herring, mackerel, and blue whiting (See Sections 3.9.9, 3.10.3, 3.12.3, and 3.12.5).

Management Measures

There are single cod and whiting TACs covering the whole of Divisions VIIb–k so that assessment areas do not correspond to management areas. In 1997, the assessment areas for Celtic Sea cod and whiting were extended to include Divisions VIIj,k. The assessment areas now cover Divisions VIIe-k. There are separate plaice and sole TAC's for Divisions VIIbc and for Divisions VIIh-k.

State of the Stocks

Although stock monitoring programmes and annual groundfish and young fish surveys have been in place since 1993, assessments for the stocks of sole and plaice in Divisions VIIbc and for Divisions VIIh-k are considered tentative due to the lack of reliable series of catch and effort data. The state of these stocks is therefore not known at present.

Fish in this area may only be components of larger stock complexes. It is still not clear if the Divisions VIIbc stocks should be assessed with the stocks in the Celtic Sea or with the stocks off the West of Scotland.

There is a directed fishery for hake mainly in Divisions VIIh–k and an overview of hake is provided in Section 3.12.2.

Anglerfish and megrim are important species in this area, but are assessed for Subareas VII and VIII combined. An overview is provided in Sections 3.9.11 and 3.9.12.

Nephrops fisheries take place in Functional units 16–19 (see Section 3.14.2.k in the 2001 ACFM report). Catch per unit of effort is fluctuating without trend. There is a TAC for all of Subarea VII. An overview of *Nephrops* stocks is provided in Section 3.14.1 in the 2001 ACFM report.

3.10.2 Demersal Stocks

3.10.2.a Haddock in Divisions VIIb-k

State of stock/exploitation: The state of the stock is unknown. A preliminary assessment of the state of this stock is considered only indicative of recent stock development. Recruitment seems to be highly variable. This is also reflected in the landings.

Management objectives: none.

Precautionary Approach reference points: not defined.

Advice on management: ICES recommends not to increase landings above the average of the last four years of 7 200 t. ICES recommends that a management plan, including monitoring of the development of the stock and of the fishery should be constructed and implemented.

Relevant factors to be considered in management: This stock is presently managed by a TAC set for the whole of Subareas VII, VIII, IX and X. The TAC currently includes an additional allocation for Division VIIa. The current TAC is not restrictive on catches from Divisions VIIb-k and creates a possibility for mis-reporting from other areas.

Elaboration and special comment: Assessment of the state of this stock is difficult due to a short time-series of assessment data. Catches of haddock are recorded along the entire western seaboard of the British Isles, with concentrations off the west coast of Scotland, off the NW coast of Ireland, in the Celtic Sea, and in the western Irish Sea. The extent of mixing between these areas is not presently known. However, recent patterns of recruitment and growth differ between areas.

Some information on discards indicates that they may be substantial.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, July 2002 (ICES CM 2003/ACFM:03).

Catch data (Tables 3.10.2.a.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Official Landings[2]	ACFM landings
1987	Not dealt with			3.0	2.6
1988	Not dealt with			4.0	3.6
1989	Not dealt with			4.2	3.2
1990	Not dealt with			2.9	2.0
1991	Not dealt with			2.6	2.3
1992	Not dealt with			2.9	2.7
1993	Not dealt with			3.4	3.3
1994	Not dealt with			4.1	4.1
1995	Not dealt with		6	4.5	4.5
1996	Not dealt with		7[3]	6.7	6.8
1997	Not dealt with		14	10.3	10.8
1998	Not dealt with		20	7.4	7.7
1999	Not dealt with		22[5]	5.9	5.0
2000	No expansion of catches		16.6[6]	3.7	7.6
2001	No expansion of catches		12[1]	9.2	8.6
2002	No expansion of catches	8.0	9.3[1]		
2003	No expansion of catches	7.2			

[1]Applies to Subareas VII, VIII, IX and X. [2]Possible underestimates due to misreporting. [3]Increased in-year to 14 000 t. [4]Incomplete official statistics. [5]Includes separate Division VIIa allocation of 4 990 t. [6]Includes separate Division VIIa allocation of 3 400 t. Weights in 000' tonnes.

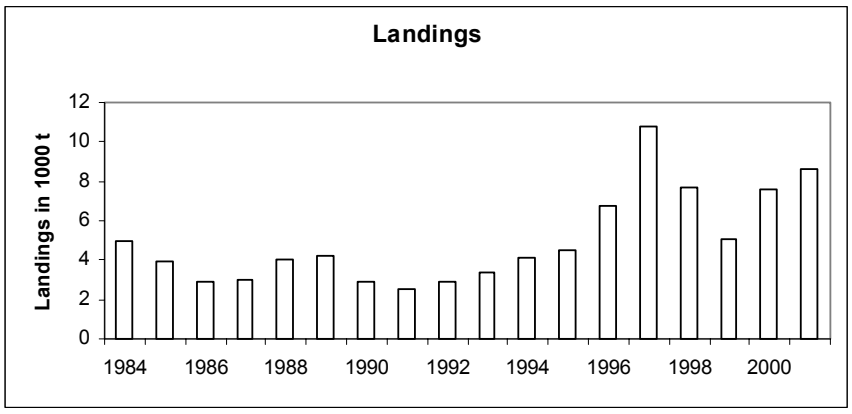


Table 3.10.2.a.1 Nominal landings (t) of Haddock in Divisions VIIb,c,e-k, 1984-2000, as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991
Belgium	-	4	6	12	64	117	22	18
France	3,328	2,438	2,279	2,380	3,275	3,412[a]	2,110[a]	1,247
Ireland	646	794	317	314	275	323	461	1,020
Norway	17	4	86	-	-	27	31	38
Spain	532	561	-	-	-	-	-	-
UK (Channel Islands)	-	-	-	-	-	-	-	-
UK (England & Wales)	340	168	188	194	405	278	123	137
UK (Scotland)	63	7	57	79	4	17	195	113
Total	4,926	3,976	2,933	2,979	4,023	4,174	2,942	2,573
Unallocated	-2,768	-1,383	-654	-405	-375	-940	-948	-231
Total figures used by Working Group	2,158	2,593	2,279	2,574	3,648	3,234	1,994	2,342

Country	1992	1993	1994	1995	1996	1997	1998	1999
Belgium	21	51	123	189	133	246	142	51
France	1,461	1,839	2,788	2,964	4,527	6,581	3,674*	2,725[1]*
Ireland	1,073	1,262	908	966	1,468	2,789	2,788	2,034
Norway	26	-	17	64	38	31	49	71*
Netherlands	-	-	-	-	-	-	3	-
Spain	-	-	-	19	48	54	260	88
UK (Channel Islands)	-	-	1	-	-	-	-	-
UK (England & Wales)	220	189	193	228	432	554	410	273
UK (Scotland)	86	67	47	38	7	15	35	5
Total	2,887	3,408	4,077	4,468	6,653	10,270	7,361	5,247
Unallocated	-183	-60	54	2	103	557	307	-197
Total figures used by Working Group	2,704	3,348	4,131	4,470	6,756	10,827	7,668	5,050

Country	2000	2001*
Belgium	90	165
France	3,357[1]*	5050
Ireland	n/a	3578
Norway	13*	2
Netherlands	-	
Spain	n/a	
UK (Channel Islands)	-	
UK (England & Wales)	287	
UK (Scotland)	2	
United Kingdom		422
Total	3,749	9,217
Unallocated	4,005	-602
Total figures used by Working Group	7,754	8,615

* Preliminary.
[a] Reported as total landings for Subareas VII & VIII.
[1] Includes the whole of area VII.
n/a = not available.

3.10.3 Herring in Divisions VIa (South) and VIIb,c

State of the stock/exploitation: The state of the stock is uncertain. A provisional assessment indicates that SSB decreased from high levels in the late 1980s, to less than 30% of those levels in the mid-1990s, but the current level is unknown. Catches in the last two years have been the lowest observed due to restrictive TACs, and there is a greater proportion of older herring in the 2001 catch.

Management objectives: A local Irish management committee has been established for this stock. One of its aims is to rebuild the stock to above $\mathbf{B}_{pa}$ over a three-year period.

Precautionary Approach reference points (changed in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 81 000 t	$\mathbf{B}_{pa}$ be set at 110 000 t
$\mathbf{F}_{lim}$ is 0.33	$\mathbf{F}_{pa}$ be set at 0.22

Technical basis:

$\mathbf{B}_{lim}$: Lowest reliable estimated SSB	$\mathbf{B}_{pa}$: Approximately 1.4 $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: = $\mathbf{F}_{med}$(98)

Advice on management: ICES recommends that the current TACs (14 000 t) should be continued in 2003.

Rebuilding plan: A management and rebuilding plan for this stock is currently in place. A continuation of this should ensure that catches do not exceed the TAC and that the stock is rebuilt.

Relevant factors to be considered in management: Recent changes to the management of the fisheries on this stock are likely to have greatly reduced the impact of misreporting and under-reporting of catches in this area. These changes add to the reliability of the catch data and should improve the assessment, which is solely based on catch-at-age data. However, a few more years of consistent data under the current management regime will be necessary before it will be possible to produce reliable estimates of SSB and review the appropriateness of the reference points.

The management plan currently in place has led to a closure of this fishery in mid-February 2002, and it will not be re-opened until October 2002.

The high stock levels observed from 1984 to 1992 were the result of two abundant year classes in 1982 and 1986. Apart from these year classes recruitment has been relatively consistent over the time-series from 1970 to 2001.

Catch forecast for 2003: Given the uncertainty of the assessment no short-term forecasts were produced this year.

Comparison with previous assessment and advice: The provisional assessment gives a substantial change in perception from last year, suggesting a much greater SSB and lower F. This inconsistency reflects the instability and imprecision of stock size estimates from the assessments.

Elaboration and special comment: In the absence of tuning data the assessments have been carried out by assuming various terminal F values on the catch-at-age data. These assessments appear to have poorly estimated F. Tuning indices are necessary to gain precision in estimates.

Total catches have decreased since 1998 and have been in line with the TAC since 2000. An acoustic survey has been resumed on the stock, and commercial vessels have been equipped with data loggers to obtain information on the distribution of the stocks.

The Irish fishery, which constitutes 85% of the catch is operated on a closed season basis, and individual boat quota are applied. The Irish fishery was closed early in February 2002 by the Irish Northwest Pelagic Management Committee (NWPMC), based on scientific advice. The Irish NWPMC has stated the following management objectives: "*As regards the herring stock in this area the management policy of the Northwest Pelagic Management Committee is to rebuild the stock to above the* $\boldsymbol{B}_{pa}$ *level of 110 000 t. The time period over which this rebuilding process can be achieved will depend on annual catches and recruitment. In the longer term it is the policy of the committee to further rebuild the stock to the level at which it can sustain annual catches of around 25,000 t. This rebuilding process will be based on scientific advice. In the event of the stock remaining below the required level additional conservation measures will be implemented. It is the policy of the committee to*

ensure that adequate research is carried out, including sampling and surveys, to enable an accurate assessment of the stock".

The fishery exploits a mixture of autumn- and winter/spring-spawning fish, which spawn from October to March. The winter/spring-spawning component is distributed in the northern part of the area. The main decline in the overall stock appears to have taken place on the autumn-spawning component, and this is particularly evident on the traditional spawning.

Source of information: ACFM Working Document and Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

Catch data (Tables 3.10.3.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Disc. slip.	ACFM Catch
1987	TAC	18	17	17	-	49
1988	TAC depending on whether 1987 TAC is taken	11–18	14	15	-	29
1989	TAC	15	20	21	1.0	29
1990	TAC depending on whether 1989 TAC is taken	25–27	27.5	28	2.5	44
1991	TAC	< 26	27.5	23	3.4	38
1992	TAC (including discards)	29	28	27	0.1	32
1993	Precautionary TAC (including discards)	29	28	30	0.3	37
1994	Precautionary TAC	28	28	27	0.7	34
1995	Precautionary TAC (including discards)	36	28	27	-	28
1996	If required, precautionary TAC	34	28	25	-	33
1997	Catches below 25	< 25	28	28	0.1	27
1998	Catches below 25	< 25	28	28	-	39
1999	F 70% of F(97)	19	21	18	-	26
2000	F 40% of F(98) =Proposed $\mathbf{F}_{pa}$	14	14	10	-	15
2001	F 40% of F(99) F = 0.2	14	14	13		14
2002	No increase in catches	14	14			
2003	No increase in catches	14				

[1]Weights in '000 t.

Herring in Divisions VIa (South) and VIIb,c

Herring in Divisions VIa (South) and VIIb,c

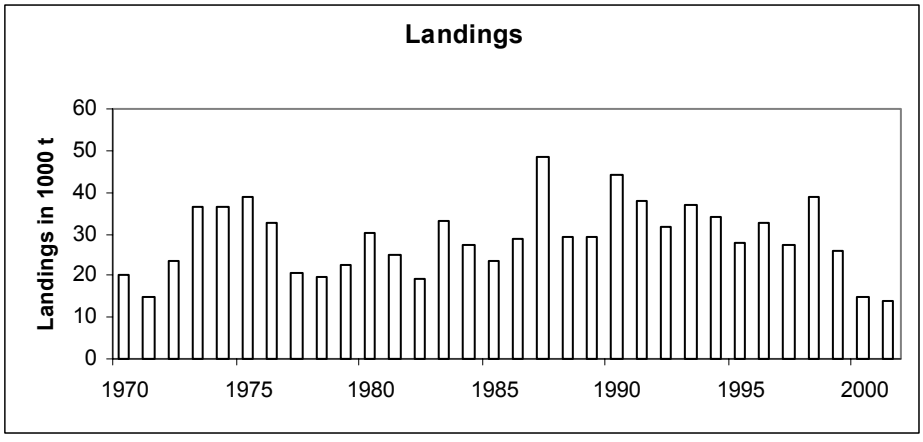


Table 3.10.3.1 Estimated herring catches in tonnes in Divisions VIa (South) and VIIb,c, 1988-2001.

These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1988	1989	1990	1991	1992	1993
France	-	-	+	-	-	-
Germany	-	-	-	-	250	-
Ireland	15,000	18,200	25,000	22,500	26,000	27,600
Netherlands	300	2,900	2,533	600	900	2,500
UK (N.Ireland)	-	-	80	-	-	-
UK (Eng.&Wales)	-	-	-	-	-	-
UK Scotland	-	+	-	+	-	200
Unallocated	13,800	7,100	13,826	11,200	4,600	6,250
Total landings	29,100	28,200	41,439	34,300	31,750	36,550
Discards	-	1,000	2,530	3,400	100	250
Total catch	29,100	29,200	43,969	37,700	31,850	36,800

Country	1994	1995	1996	1997	1998	1999
France	-	-	-	-	-	-
Germany	-	11	-		-	-
Ireland	24,400	25,450	23,800	24,400	25,200	16,325
Netherlands	2,500	1,207	1,800	3,400	2,500	1,868
UK (N.Ireland)	-	-	-		-	-
UK (Eng.&Wales)	50	24	-		-	-
UK (Scotland)	-	-	-		-	-
Unallocated	6,250	1,100	6,900	-700	11,200	7,916
Total landings	33,200	27,792	32,500	27,100	38,900	26,109
Discards	700	-	-	50	-	-
Total catch	33,900	27,792	32,500	27,150	38,900	26,109

Country	2000	2001[1]
France		
Germany		
Ireland	10,164	11,278
Netherlands	1,234	2,088
United Kingdom		
Unallocated	3,607	695
Total landings	15,005	14,061
Discards	-	-
Total catch	15,005	14,061

[1]Provisional according to text.

3.10.4 Plaice West of Ireland (Division VIIb,c)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Catches have declined since 1995 to a historic low in 2001.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2003 be no more than the recent average (1998-2000) of around 160 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Relevant factors to be considered in management: Plaice are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for plaice should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb,c fishery.

Comparison with previous assessment and advice: The assessment for this stock is preliminary. ICES gave no advice for this stock in 2001.

Elaboration and special comment: ICES carried out a preliminary assessment on the status of this stock. This assessment used catch-at-age data from 1993-2001 and commercial and survey tuning data from Ireland. The time-series of the data and tuning fleets were too short to make conclusions about the current stock status. Catch forecast for 2003 and medium- and long-term projections are not available.

Ireland is the major participant in this fishery with around 90% of the international landings between 1993-2001. Plaice are normally caught in mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 9 – 18 July 2002 (ICES CM 2003/ACFM:03).

Catch data (Tables 3.10.4.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM landings
1993	-	-	-	197
1994	-	-	-	215
1995	-	-	-	315
1996	-	-	-	240
1997	-	-	-	213
1998	-	-	-	183
1999	-	-	-	172
2000	-	-	-	116
2001	-	-	240	87
2002	No advice	-	240	
2003	Reduce TAC to recent landings	200		

Table 3.10.4.1 Nominal Landings (t) of Plaice in Divisions VIIb,c 1993-2001, as officially reported to ICES.

	1993	1994	1995	1996	1997	1998	1999	2000	2001*
France	2	1	5	1	3		8*	22*	22*
Ireland	191	200	239	248	206	160	157	3	63
UK(Eng & Wales)	1	2	1	2		1			
UK(Scotland)	2	3	1				2		
Total	196	206	246	251	209	161	167	25	85
Unallocated	1	9	69	-11	4	22	5	91	2
Total figures as used by the Working Group	197	215	315	240	213	183	172	116	87

*Preliminary

3.10.5 Sole West of Ireland (Division VIIb,c)

State of stock/exploitation: The state of the stock in relation to biological reference points is not known. Catches have been relatively stable in recent years.

Management objectives: No explicit management objectives have been established for this stock.

Precautionary Approach Reference points: No precautionary reference points have been proposed for this stock.

Advice on management: ICES recommends that catches in 2003 be no more than the recent average (1993-2000) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Relevant factors to be considered in management: Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species and *Nephrops* taken in the VIIb, c fishery.

Catch forecast for 2003 and medium- and long-term projections are not available.

Comparison with previous assessment and advice: The assessment for this stock is preliminary. ICES gave no advice for this stock in 2001.

Elaboration and special comment: ICES carried out a preliminary assessment on the status of this stock. This assessment used catch-at-age data from 1993-2001 and commercial and survey tuning data from Ireland. The time-series of the data and tuning fleets were too short to make conclusions about the current stock status.

Ireland is the major participant in this fishery with 96% of the international landings between 1993-2001. Sole are normally caught in mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, 9 – 18 July 2002 (ICES CM 2003/ACFM:03).

Catch data (Table 3.10.5.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM landings
1993	-	-	-	60
1994	-	-	-	70
1995	-	-	-	59
1996	-	-	-	57
1997	-	-	-	55
1998	-	-	-	66
1999	-	-	-	72
2000	-	-	-	68
2001	-	-	80	60
2002	No advice	-	80	
2003	Reduce TAC to recent landings	65		

Table 3.10.5.1 Nominal Landings (t) of Sole in Divisions VIIb,c 1993-2001, as officially reported to ICES.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
France	1	1	2	2	3		2*	2*	9*
Ireland	59	60	59	52	51	49	68	73	36
UK(E/W/NI)	+	+	+	+	1	+		+	
Unallocated									
Total	60	61	61	54	55	49	70	75	45
Unallocated		9	-2	3		17	2	-7	15
Total figures as used by the working group	60	70	59	57	55	66	72	68	60

*Preliminary

3.11 Stocks in the Iberian Region (Division VIIIc and Subareas IX and X)

3.11.1 Overview

The fisheries

The Iberian Region along the eastern Atlantic shelf is considered an upwelling area with high productivity; this phenomenon takes place during late spring and summer. The region is characterized by a large number of commercial and non-commercial fish species.

The fisheries are of a typical mixed nature. Different kinds of Spanish and Portuguese fleets operate: one is the mixed trawl fleet (single, pair, and crustacean trawlers) fishing for hake, blue whiting, horse mackerel, megrim, anglerfish, mackerel, *Nephrops*, bib, and cephalopods as the main species. Other fisheries are longliners fishing for hake and hand-line fishing for mackerel, fixed nets used for hake, anglerfish, and mackerel, and purse seiners, which mainly target sardine and anchovy, but also horse mackerel and mackerel.

Many bottom trawlers fish in the southern part of Division IXa (Gulf of Cadiz); these trawlers are smaller than those operating in the northern parts of the Iberian Region. The composition of their catches is also different. They are fishing for hake as well as crustaceans, mollusks, and cephalopods (*Octopus* etc.).

The number of trawlers has decreased since the early 1980s, resulting in a decreasing trend in the overall effort in the Portuguese and Spanish fleets. The number of boats in fleets operating gillnets and longlines has also declined in recent years. Spanish boats using trawl, longline, or fixed nets are currently subjected to a restricted entry system.

Two stocks of anchovy are considered in the Iberian Region, one in Subarea VIII and one in Division IXa. The Spanish and French fleets fishing for anchovy in Subarea VIII are well separated geographically and in time (the Spanish fleet operates mainly in Division VIIIc and VIIIb in spring and the French fleets in Division VIIIa in summer and autumn and in Division VIIIb in winter and summer). Changes in the catch-at-age composition between the 1984–1996 period and the earlier years could be related to a higher dependence of catches on recruitment in recent years and a change in the seasonality in this fishery. The number of Spanish purse seiners for anchovy has remained stable since 1990 and a slight increase in the number of French purse seiners has been observed in the last five years. A sharp increase in fishing effort for anchovy in the Bay of Biscay has occurred since 1987 mainly due to the increased effort in the French pelagic trawl fleet.

Traditionally the anchovy fishery in Division IXa is located in the Gulf of Cadiz (Subdivision IXa South). However, in 1995 the bulk of the fishery was located to the North of Portugal and to the West of Galicia (Subdivision IXa North) and was very reduced in the Gulf of Cadiz, owing to exceptional availability of anchovy in the northern part of Division IXa. In recent years the bulk of the anchovy fishery in IXa has again been located in the Gulf of Cadiz.

In Divisions VIIIc (East) and VIIIb the target species for the purse seine fleet change with the season – anchovy in spring and tuna in the summer. This fleet changes gear and uses trolling and bait boats to catch tuna.

The catches of horse mackerel in Divisions VIIIc and IXa have been relatively stable over the last ten years. The proportion of landings by different gears has changed, i.e., trawl catches are decreasing while the purse seine catches are increasing.

During the 1990s the purse seine fleets in Divisions VIIIc West, normally directed at sardine redirected their effort to horse mackerel because of lower availability of sardine in VIIIc West than during the 1980s.

Mackerel is a target species for the hand line fleet during the spawning season in Division VIIIc, during which about one third of the total catches are taken. It is also taken as a by-catch by the trawl fleets in Division VIIIc and IXa. The highest catches (80%) from the southern component are taken mainly from Division VIIIc in the first half of the year and consist of adult fish. In the second half of the year, catches consist of juveniles and are mainly taken in Division IXa, as by-catches of the trawl fisheries. Catches from the southern component have been increasing in recent years and in 1998 and 1999 reached a maximum of 44 000 t each year.

Management measures

The fisheries in the Iberian Region are managed by a TAC system and technical measures. In 2000 a new EU regulation was established. Common mesh sizes for trawlers are 40 mm (blue whiting or horse mackerel), 55 mm (shrimp), and 70 mm (hake and *Nephrops*). Other technical conservation measures are minimum landing sizes and seasonal area closures to protect juvenile hake.

At national level there are management measures to limit the number of crustacean vessels. Management measures are also enforced in the sardine fishery for restriction of days of absence from the ports, number of purse seiners in activity, annual catch restrictions, and

seasonal closures. A minimum landing size is enforced at the international level and the minimum landing size for rose shrimp is more restrictive.

A TAC for southern mackerel is in place, as a part of the Northeast Atlantic mackerel TAC.

In recent years data quality has improved, including landing statistics and length composition, notably in the Gulf of Cadiz. Routine estimates of discards are only available for Northern Spanish waters in 1994 and in 1999. For most of the stocks the sampling level of the landings is considered adequate for assessment purposes. The low level of samples of discards, particularly of undersized hake, is considered a problem.

The Iberian Region is an important nursery ground for hake, sardine, horse mackerel, and blue whiting. Catches of fleets operating gears with low selectivity therefore contain significant quantities of juvenile fish.

State of stocks

The stock of hake is outside safe biological limits. SSB decreased very sharply between 1982 and 1986 and gradually decreased until 1998 and has slightly increased since then.

The combined anglerfish stocks (*Lophius piscatorius* and *Lophius budegassa*) are outside safe biological limits. Recently, fishing mortality has been decreasing.

The state of both megrim stocks (*Lepidorhombus boscii* and *Lepidorhombus whiffiagonis*) are unknown. Fishing mortality for both species has generally declined during the 1990s.

All *Nephrops* stocks in Divisions VIIIc and IXa are seriously over-exploited. Age-based assessments give evidence of a sharp decline in recruitment and biomass. Further depletion of the stocks in these areas can only be halted by substantial reductions in the fishing mortality.

The status of the southern horse mackerel (*Trachurus trachurus*) stock is unknown. There are, however, indications that SSB and F have been stable over a long period and that the stock can sustain the present catch level.

The state of the sardine stock in relation to precautionary reference points is unknown. Different assessment methods lead to different perceptions as to the absolute levels of stock abundance and fishing mortality, but all indicate that the stock biomass has increased from a historical low. There are large variations in recruitment and stock size is strongly dependant on the incoming year class. There is incomplete knowledge of the environmental factors affecting recruitment. The 2000 year class appears to be strong, and there are indications that the 2001 year class is of average strength.

The Bay of Biscay (VIII) anchovy stock is inside safe biological limits in 2002. The Spawning Stock Biomass is above $\mathbf{B}_{pa}$, and the fishing mortality has remained well below $\mathbf{F}_{pa}$ in recent years. In the absence of PA reference points, the state of anchovy in Division IXa is unknown.

The southern mackerel component is about 12-21% of the Northeast Atlantic mackerel. Egg surveys indicate large fluctuations of the relative share on the SSB of the Northeast Atlantic mackerel stock. Further elaboration on this widely distributed stock is given in Section 3.12.

3.11.2 Hake - Southern stock (Divisions VIIIc and IXa)

State of stock/exploitation: The stock is outside safe biological limits. SSB decreased sharply between 1982 and 1986, then gradually until 1998 and has slightly increased since then, but has remained below $\mathbf{B}_{lim}$ since 1994. Fishing mortality has been variable at, or about $\mathbf{F}_{lim}$ since 1983. Mean recruitment in the 1990s has been well below the average prior to this period.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 20 500 t	$\mathbf{B}_{pa}$ be set at 33 600 t
$\mathbf{F}_{lim}$ is 0.45	$\mathbf{F}_{pa}$ be set at 0.27

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$ the lowest observed spawning stock biomass	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim}$ x 1.64
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ the fishing mortality above which the stock dynamics are unknown	$\mathbf{F}_{pa} \sim \mathbf{F}_{lim}$ x 0.61

Advice on management: In order to rebuild the stock, ICES recommends that fishing mortality should be as close to zero as practicable. Stocks managed in conjunction with the major fisheries for this species should be managed accordingly to limit the catch of hake to the greatest possible extent. A rebuilding plan with such measures probably will have to be in place for several years, because even a reduction in F of 50% will not allow SSB to reach $\mathbf{B}_{pa}$ in the short term.

Relevant factors to be considered in management: The assessment remains uncertain, and the quality of commercial data suggests than it is unlikely that estimates of biomass and fishing mortality will become accurate and precise in the near future. Nonetheless, all indicators suggest that for the past decade the stock has been at a biomass where only poor recruitment is produced, is incapable of rebuilding strongly at current exploitation rates, and the major sources of uncertainty in the assessment are all more likely to produce an assessment with an optimistic bias than one with a pessimistic bias.

The catches in most of the years of the series did not reach the TACs.

In order to protect juveniles, fishing is prohibited in some areas during part of the year.

Hake is taken in a mixed species trawl fishery, and the management of other stocks such as horse mackerel, megrim, anglerfish, and *Nephrops* needs to be taken into account when considering the requirements of the hake stock.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99-01) = 0.44 ; Landings(2002) = 8.1 ; SSB(2003) = 17.3 .

F(2003) onwards	Basis	Landings (2003)	SSB (2004)
0	0 * $\mathbf{F}_{sq}$	0	26.3
0.17	0.4 * $\mathbf{F}_{sq}$	3.7	22.3
0.22	0.5 * $\mathbf{F}_{sq}$	4.6	21.4
0.26	0.6 * $\mathbf{F}_{sq}$	5.4	20.6
0.27	$\mathbf{F}_{pa}$	5.5	20.4
0.35	0.8 * $\mathbf{F}_{sq}$	6.9	19.0
0.44	$\mathbf{F}_{sq}$	8.3	17.6
0.52	1.2 * $\mathbf{F}_{sq}$	9.6	16.3

Weights in '000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Last year it was stated that the assessment might be optimistic. This year's assessment is considered more realistic than last year's since more information is included in the model (more commercial fleets), fleets data are more in agreement with model assumptions and the contribution of commercial fleets to estimate the survivors in older ages is higher which is in agreement with information from the fisheries. Resulting changes as compared to last year's assessment are considerable:

SSB and R were revised downward and F upward for the last decade.

Elaboration and special comment: This assessment is still considered uncertain. There are serious concerns about the data quality and a number of issues need to be addressed such as the stock identity, especially in the Gulf of Cadiz area, and discard information which has never been used in the assessment. Consequently, fishing mortalities on the recruiting year classes could not be estimated.

Spanish and Portuguese fleets exploit this stock in a mixed fishery using trawls, gillnets, and long lines.

Analytical assessment using commercial CPUE and survey data. Information from surveys at age 0 is included. The stock-recruitment relationship is driven by the high values of earlier years, since the recent values are clustered and do not show a clear relationship. Combined age-length keys are used prior to 1993.

Hake landings from the Gulf of Cadiz represent about 10 % of the total hake landings. Length distributions for landings by trawlers operating in the Gulf of Cadiz have been available since 1994 and show large amounts of very small fish. Since this time-series is shorter than the data series available for the total stock, these length distributions have not been incorporated in the assessment since this would create an artificial increase in recruitment around that time. The origin of this population is questioned since these small fish cannot be found elsewhere when becoming older.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01).

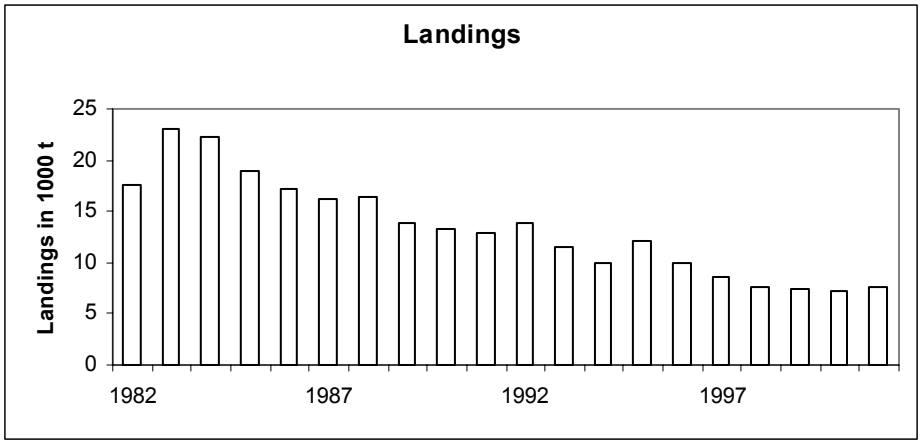
Yield and spawning biomass per Recruit
F-reference points:

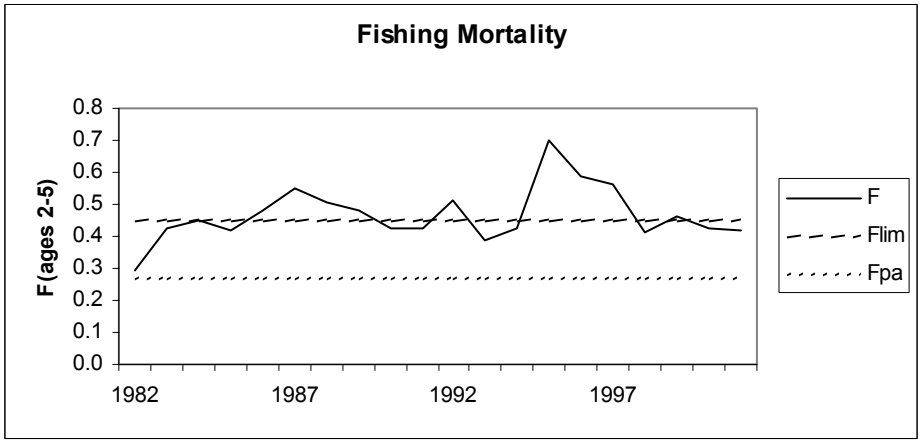
	Fish Mort Ages 2-5	Yield/R	SSB/R
Average Current	0.435	0.170	0.355
$\mathbf{F}_{max}$	0.248	0.184	0.752
$\mathbf{F}_{0.1}$	0.154	0.173	1.191
$\mathbf{F}_{med}$	0.460	0.168	0.326

Catch data (Tables 3.11.2.1-2):

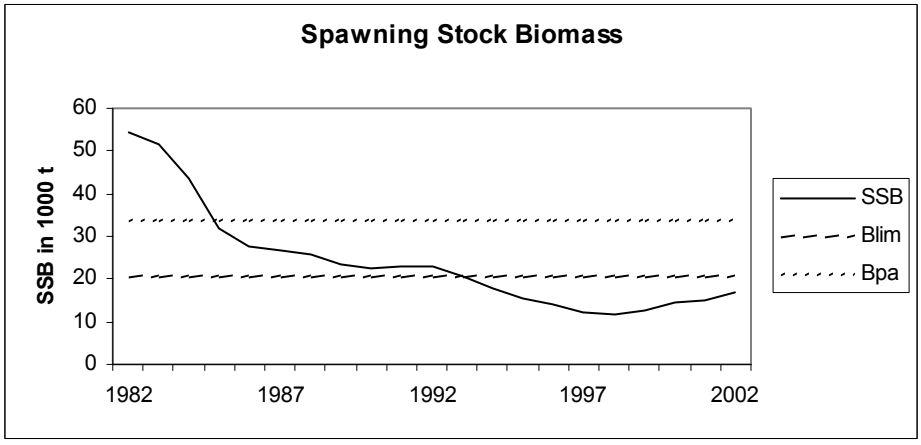
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Landings
1987	Precautionary TAC; juvenile protection	15.0	25.0	16.2
1988	TAC; juvenile protection	15.0	25.0	16.4
1989	TAC; juvenile protection	15.0	20.0	13.8
1990	TAC; juvenile protection	15.0	20.0	13.2
1991	Precautionary TAC	10.0	18.0	12.8
1992	Precautionary TAC	10.3	16.0	13.8
1993	F = 10% of F 91	1.0	12.0	11.5
1994	F lowest possible at least reduced by 80%	2.0	11.5	9.9
1995	F lowest possible	-	8.5	12.2
1996	F lowest possible	-	9.0	9.9
1997	F lowest possible	-	9.0	8.5
1998	60% reduction in F	4.0	8.2	7.7
1999	Reduce F below $\mathbf{F}_{pa}$	9.5	9.0	7.5
2000	20% reduction from 1994-98 average landings	< 7.7	8.5	7.3
2001	Reduce F below $\mathbf{F}_{pa}$; no increase in landings	8.5	8.9	7.6
2002	F below $\mathbf{F}_{pa}$	< 8.0	8.0	
2003	Lowest possible catch / rebuilding plan	0		

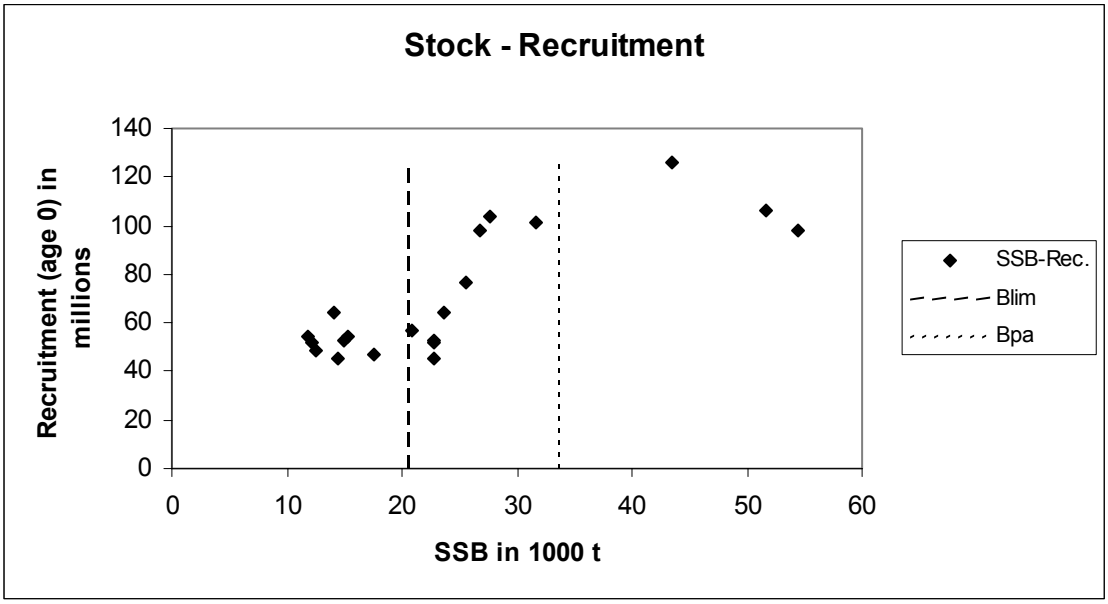
Weights in '000 t.

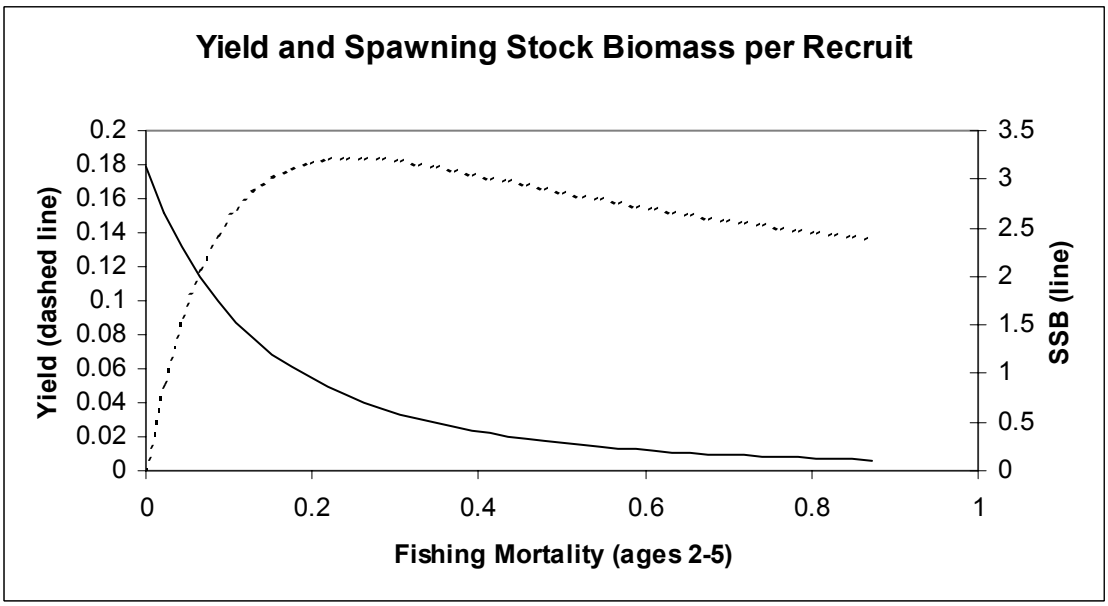

Landings
Landings in 1000 t
25
20
15
10
5
0
1982
1987
1992
1997


Fishing Mortality
F(ages 2-5)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1982
1987
1992
1997
F
Flim
Fpa

Recruitment (age 0)
Recruitment in millions
140
120
100
80
60
40
20
0
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
60
50
40
30
20
10
0
1982
1987
1992
1997
2002
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SSB (line)
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 2-5)

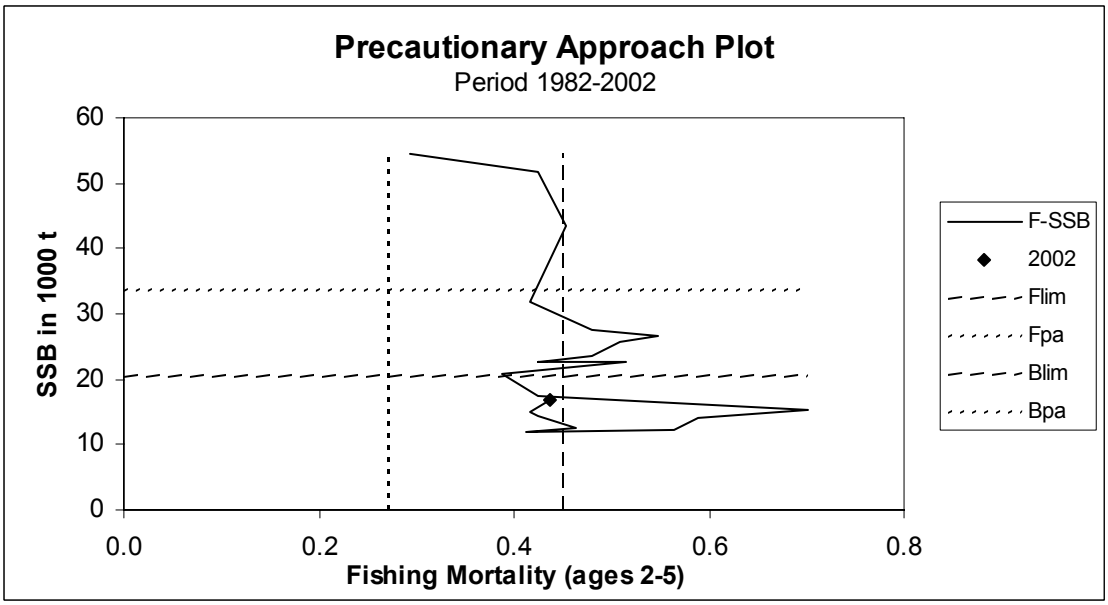

Precautionary Approach Plot
Period 1982-2002
SSB in 1000 t
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
Fishing Mortality (ages 2-5)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.11.2.1 Landing estimates (´000 t) for the Southern Hake stock (Divisions VIIIc and IXa) by country and gear as determined by the Working Group, 1972–2001.

Year	Spain							Portugal			France	Total Stock
	Gillnet[1]	Small Gillnet	Longline	Artisanal Unal-located	Total Artisanal	Trawl[2]	Total	Artisanal	Trawl	Total		
1972	-	-	-	-	7.1	10.2	17.3	4.7	4.1	8.8	-	26.1
1973	-	-	-	-	8.5	12.3	20.8	6.5	7.3	13.8	0.2	34.8
1974	2.6	1.0	2.2	-	5.8	8.3	14.1	5.1	3.5	8.6	0.1	22.8
1975	3.5	1.3	3.0	-	7.8	11.2	19.0	6.1	4.3	10.4	0.1	29.5
1976	3.1	1.2	2.6	-	6.9	10.0	16.9	6.0	3.1	9.1	0.1	26.1
1977	1.5	0.6	1.3	-	3.4	5.8	9.2	4.5	1.6	6.1	0.2	15.5
1978	1.4	0.1	2.1	-	3.6	4.9	8.5	3.4	1.4	4.8	0.1	13.4
1979	1.7	0.2	2.1	-	4.0	7.2	11.2	3.9	1.9	5.8	-	17.0
1980	2.2	0.2	5.0	-	7.4	5.3	12.7	4.5	2.3	6.8	-	19.5
1981	1.5	0.3	4.6	-	6.4	4.1	10.5	4.1	1.9	6.0	-	16.5
1982	1.2	0.3	4.2	-	5.7	4.4	10.1	5.0	2.5	7.5	-	17.6
1983	2.1	0.4	6.6	-	9.0	5.9	14.9	5.2	2.9	8.0	-	23.0
1984	2.3	0.3	7.5	-	10.1	6.5	16.7	4.3	1.2	5.5	-	22.2
1985	1.8	0.8	4.4	-	7.0	6.1	13.1	3.8	2.1	5.8	-	18.9
1986	2.1	0.8	3.5	-	6.4	5.8	12.2	3.2	1.8	4.9	0.0	17.2
1987	2.0	0.5	4.4	-	6.9	4.5	11.4	3.5	1.3	4.8	0.0	16.2
1988	2.0	0.7	3.0	-	5.6	4.7	10.4	4.3	1.7	6.0	0.0	16.4
1989	1.9	0.6	2.0	-	4.4	4.8	9.2	2.7	1.8	4.6	0.0	13.8
1990	1.7	0.6	2.1	-	4.4	5.3	9.8	2.3	1.1	3.4	0.0	13.2
1991	1.4	0.4	2.2	-	4.0	4.8	8.9	2.7	1.2	4.0	0.0	12.8
1992	1.5	0.4	2.1	-	3.9	4.8	8.7	3.8	1.3	5.1	-	13.8
1993	1.3	0.4	2.8	-	4.4	3.2	7.6	3.0	0.9	3.9	-	11.5
1994	1.9	0.4	1.5	-	3.7	3.0	6.8	2.3	0.8	3.1	-	9.9
1995	1.6	0.4	1.0	-	2.9	5.7	8.7	2.6	1.0	3.6	-	12.2
1996	1.2	0.2	1.0	-	2.4	4.6	7.0	2.0	0.9	2.9	-	9.9
1997	1.1	0.3	0.8	-	2.2	4.0	6.1	1.5	0.9	2.4	-	8.5
1998	0.8	0.3	0.6	-	1.7	3.4	5.1	1.7	0.9	2.6	-	7.7
1999	0.6	0.2	0.3	0.2	1.3	3.0	4.3	2.1	1.1	3.2	-	7.5
2000	0.9	0.1	0.1	0.1	1.3	2.8	4.1	2.1	1.2	3.3	-	7.3
2001	0.6	0.2	0.1	0.1	1.0	3.4	4.4	1.2	2.0	3.2	-	7.6

[1] Gulf of Cadiz landings included since 1993.

[2] Gulf of Cadiz landings included since 1982.

Table 3.11.2.2 Hake - Southern stock (Divisions VIIIc and IXa)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	98000	54400	17600	0.294
1983	106000	51700	23000	0.424
1984	126000	43400	22200	0.453
1985	101000	31700	18900	0.417
1986	104000	27600	17200	0.479
1987	98000	26700	16200	0.548
1988	77000	25600	16400	0.509
1989	64000	23600	13800	0.480
1990	53000	22700	13200	0.427
1991	45000	22800	12800	0.425
1992	52000	22800	13800	0.514
1993	57000	20800	11500	0.388
1994	47000	17600	9900	0.424
1995	54000	15300	12200	0.701
1996	64000	14000	9900	0.588
1997	52000	12100	8500	0.564
1998	54000	11800	7700	0.413
1999	49000	12600	7500	0.464
2000	45000	14400	7300	0.425
2001	53000*	14900	7600	0.417
2002	53000*	16800		0.436
Average	69143	23967	13360	0.466

* GM 89-00

3.11.3 Megrim in Divisions VIIIc and IXa (*L. boscii* and *L. whiffiagonis*)

State of stocks/exploitation: The state of these stocks in relation to precautionary reference points is not known. SSB of both species has decreased from the late 1980s until 1995, then has increased slightly for *Lepidorhombus boscii* and has remained stable at a low level for *Lepidorhombus whiffiagonis*. Fishing mortality for both species has generally declined during the 1990s. Recruitment has been below average since 1997 for *L. whiffiagonis*, while for *L. boscii* recruitment is currently close to average.

Management objectives: There are no explicit management objectives for these stocks.

Precautionary Approach Reference Points: No reference points have been proposed.

Advice on management: ICES recommends that F should not be increased above recent levels (0.17 and 0.21, respectively) for both species; at these levels SSB has been stable or possibly slightly increasing. This corresponds to landings in 2003 of less than 1 230 t for *L. boscii* and less than 320 t for *L. whiffiagonis*.

Relevant factors to be considered in management: The TAC covers both megrim species (*L. boscii* and *L. whiffiagonis*) and has been set well above actual catches in recent years. Both megrim species are caught together in fisheries, which also take a large number of other commercial species, including southern hake.

Catch forecast for 2003:

L. boscii: Basis: F(2002) = $\mathbf{F}_{sq}$ = F(99–01) = $\mathbf{F}_{sq}$ = 0.17; Landings (2002) = 1.15; SSB(2003) = 7.01

F(2003) onwards	Basis	Landings (2003)	SSB (2004)
0.14	0.8 * $\mathbf{F}_{sq}$	1.01	7.32
0.17	1.0 * $\mathbf{F}_{sq}$	1.23	7.08
0.21	1.2 * $\mathbf{F}_{sq}$	1.44	6.86

Weights in '000 t.

L. whiffiagonis: Basis: F (2002) = F (99–01) $\mathbf{F}_{sq}$ = 0.21; Landings (2002) = 0.31; SSB(2003) = 1.52

F(2003) onwards	Basis	Landings (2003)	SSB (2004)
0.17	0.8 F_{99-01}	0.26	1.62
0.21	1.0 F_{99-01}	0.32	1.56
0.25	1.2 F_{99-01}	0.37	1.50

Weights in '000 t. There are no Precautionary Reference points, and hence no shading was applied.

Medium- and long-term projections: Medium-term projections were carried out for *L. boscii*, and the results suggest that fishing at *status quo* leads to an increase in SSB for the whole projection period.

Comparison with previous assessment and advice: For *L. boscii*, the values of F estimated are closed to those estimated last year (slight upwards revision in the early period, and downwards revision in recent years). SSB has been revised slightly downwards before 1993 (by less than 5%), and slightly upwards since then (+7% for 2000). For *L. whiffiagonis* the trends in SSB, F, and R are similar to last year's assessment. The advice is similar to last year's advice.

Elaboration and special comment: Megrim species are generally taken as a by-catch in mixed fisheries by Portuguese and Spanish trawlers, and also in small quantities by the Portuguese artisanal fleet. *L. boscii* accounts for about 70–90% of combined megrim landings. *L. boscii* is distributed equally in Divisions VIIIc and IXa. *L whiffiagonis* is also distributed in both Divisions, but with its highest abundance in Division VIIIc.

Total landings data for these stocks are not available prior to 1986. However, some Spanish ports have longer landing series for both species, and the Spanish survey provides abundance indices since 1983. These data sources indicate stable, but low, abundance up to 1986, increasing sharply to 1990, and decreasing again to the low level observed in the initial years. The majority of the catches are taken by Spanish trawlers. As megrims are always a by-catch for the fleets targeting "white fish", operating in these areas, the decreasing catch on hake has modified the target species of the fleets. The fleets now focus on other species such as blue whiting, horse mackerel, or mackerel and do not catch megrim. This has reduced the effort on megrim species. A shifting of the exploitation to pair trawlers and VHVO that do not catch megrims, has also reduced the effort on these species. In Divisions VIIIc and IXa the peak spawning period of both megrim species is in March.

Age-based analytical assessment tuned with survey data only for *L. boscii*, and including commercial CPUE for *L. whiffiagonis*.

Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01).

Four-spot megrim (*L. Boscii*)
Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average Current	0.316	0.052	0.289
$\mathbf{F}_{max}$	0.331	0.054	0.210
$\mathbf{F}_{0.1}$	0.114	0.048	0.353
$\mathbf{F}_{med}$	0.312	0.054	0.216

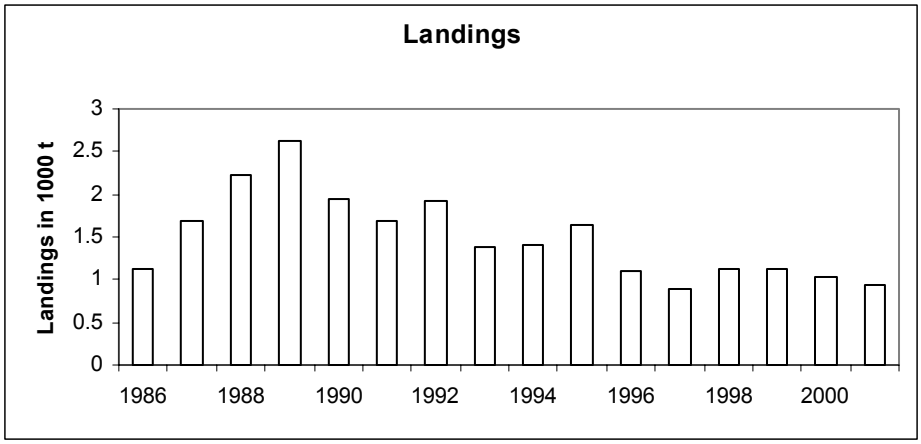
Megrim (*L. Whiffiagonis*)
Yield and spawning biomass per Recruit
F-reference points:

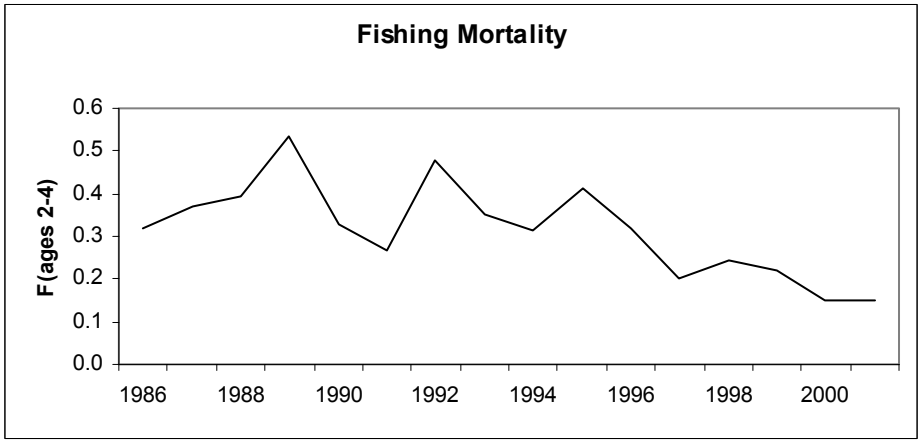
	Fish Mort Ages 2-4	Yield/R	SSB/R
Average Current	0.327	0.061	0.285
$\mathbf{F}_{max}$	0.267	0.061	0.250
$\mathbf{F}_{0.1}$	0.113	0.055	0.397
$\mathbf{F}_{med}$	0.372	0.060	0.209

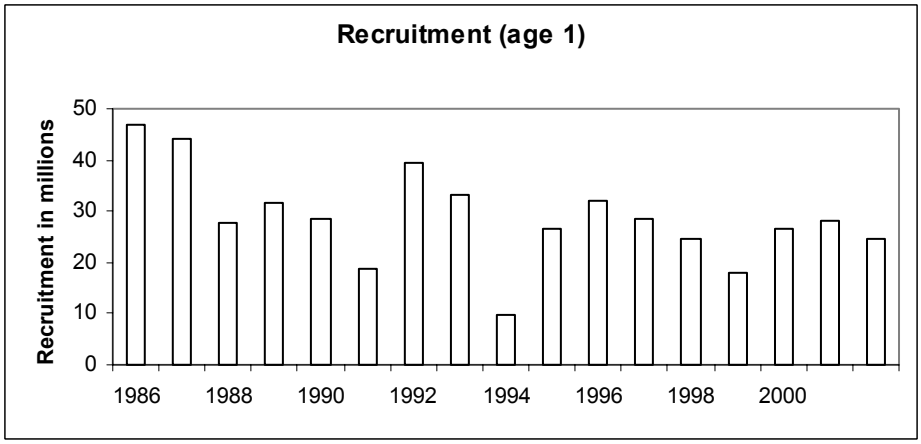
Catch data (Tables 3.11.3.1-4):

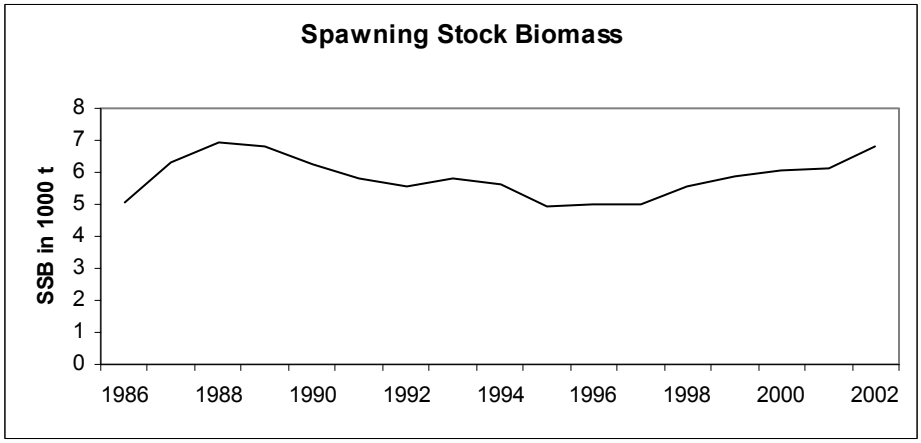
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[1]	ACFM landings[1]	Landings *L. boscii*	Landings *L. whiff.*
1987	Not dealt with	-	13.0	2.19	1.69	0.50
1988	Not dealt with	-	13.0	3.04	2.22	0.82
1989	Not dealt with	-	13.0	3.34	2.63	0.71
1990	Not dealt with	-	13.0	2.93	1.95	0.98
1991	No advice	-	14.3	2.29	1.68	0.61
1992	No advice	-	14.3	2.44	1.92	0.52
1993	*L. boscii* no long-term gain in increasing F, *L. whiff* within safe biological limits	-	8.0	1.76	1.38	0.38
1994	No long-term gains in increasing F	-	6.0	1.88	1.40	0.48
1995	Concern about low SSB	-	6.0	1.87	1.65	0.22
1996	Mixed fishing aspects	-	6.0	1.43	1.10	0.33
1997	Reduce F by at least 50%	-	6.0	1.25	0.90	0.36
1998	Reduce F by at least 50%	0.9	6.0	1.57	1.12	0.45
1999	Reduce F by at least 50%	1.0	6.0	1.46	1.12	0.35
2000	Reduce F by at least 20%	< 1.5	5.0	1.29	1.04	0.25
2001	No increase in F	1.61	5.0	1.11	0.93	0.18
2002	No increase in F	1.55	4.0			
2003	No increase in F	1.55				

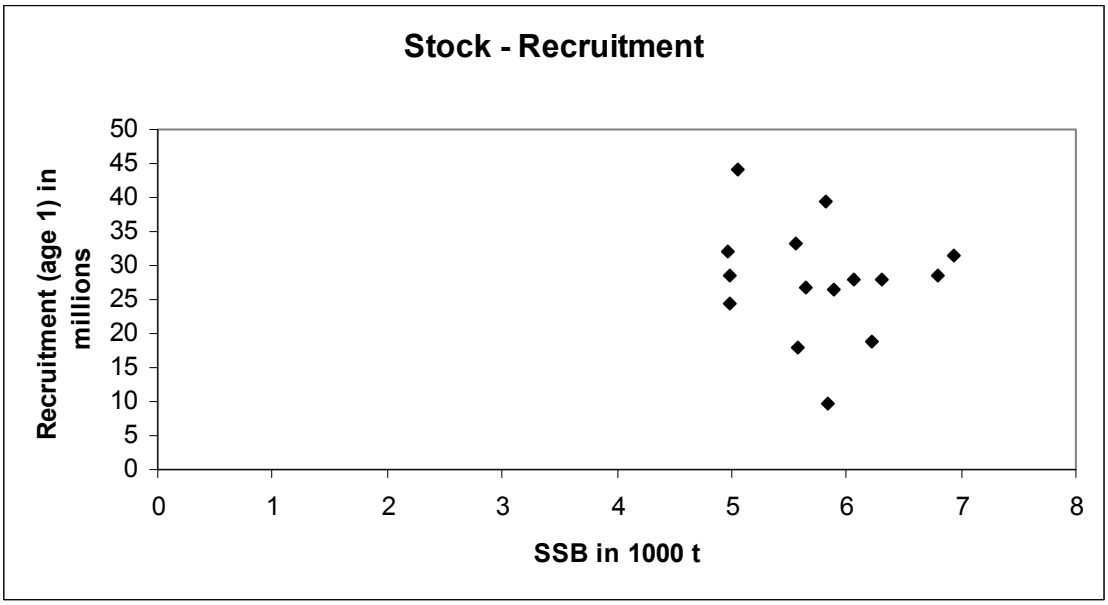
[1] *L. whiffiagonis*+ *L. boscii*. Weights in '000 t.

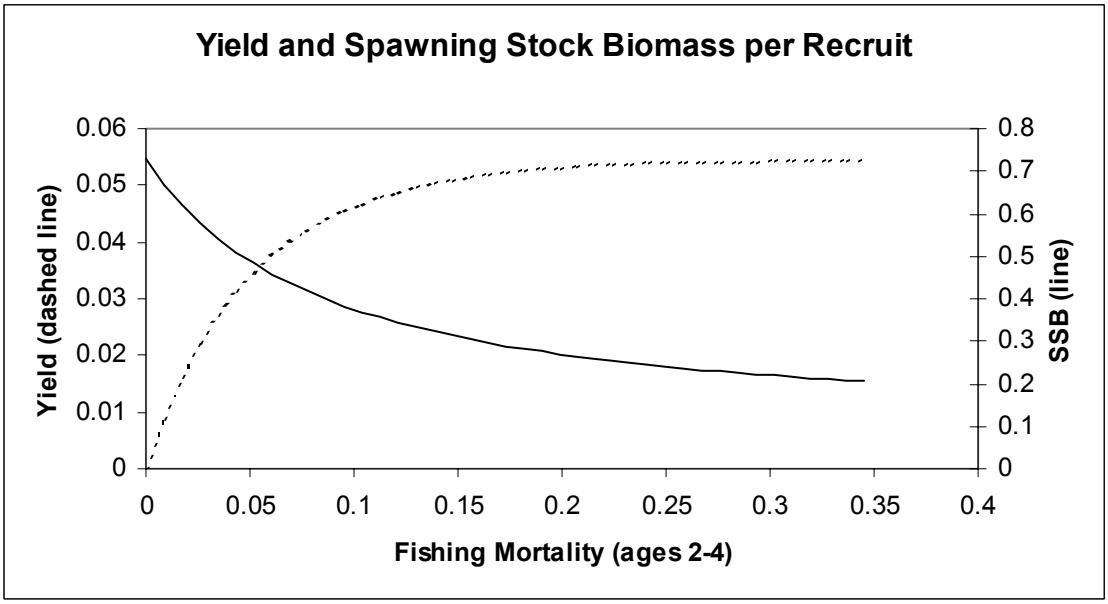

Landings
Landings in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1988
1990
1992
1994
1996
1998
2000

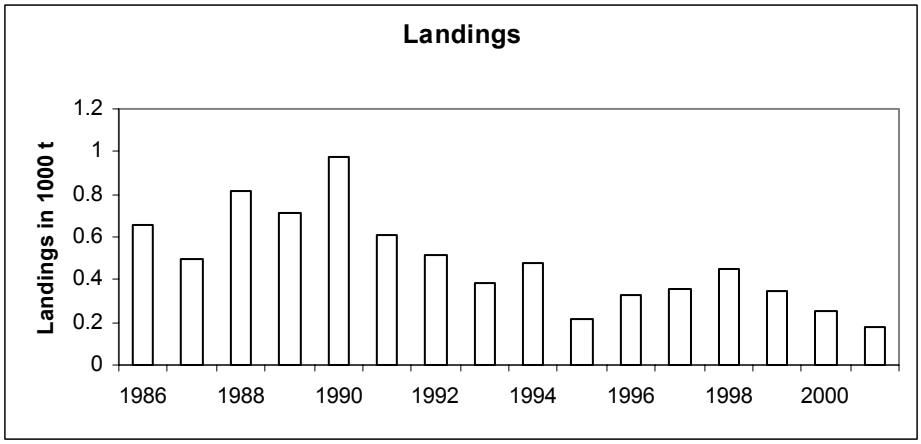

Fishing Mortality
F(ages 2-4)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1986
1988
1990
1992
1994
1996
1998
2000

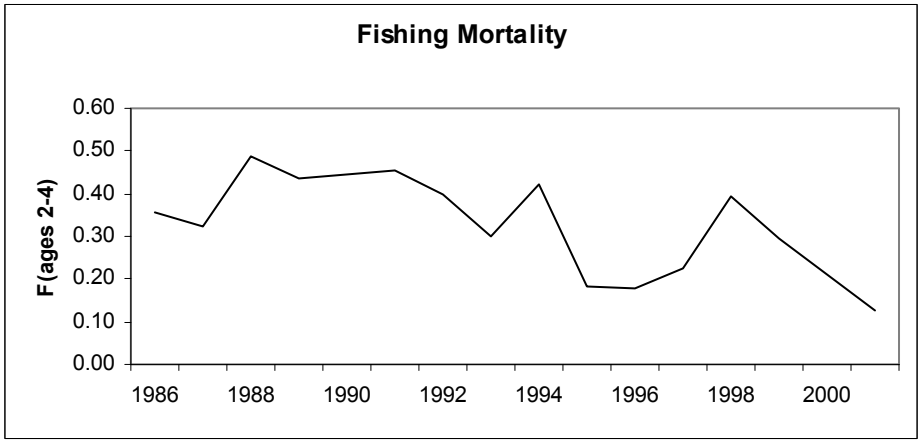

Recruitment (age 1)
Recruitment in millions
50
40
30
20
10
0
1986
1988
1990
1992
1994
1996
1998
2000

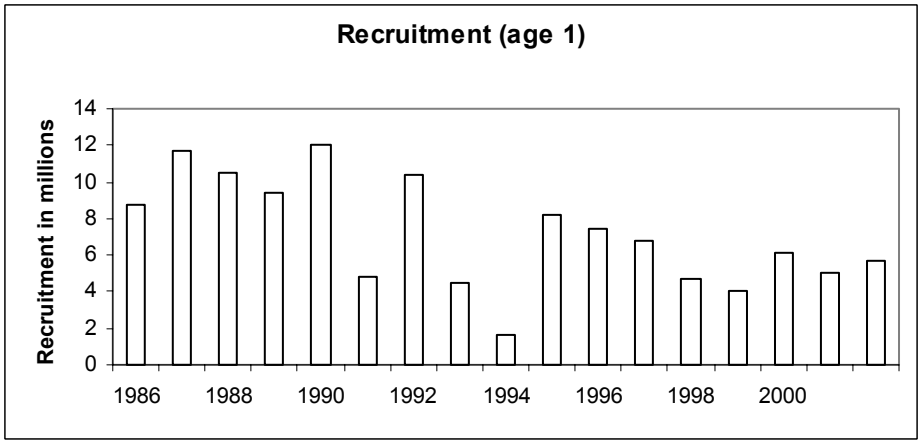

Spawning Stock Biomass
SSB in 1000 t
8
7
6
5
4
3
2
1
0
1986
1988
1990
1992
1994
1996
1998
2000
2002

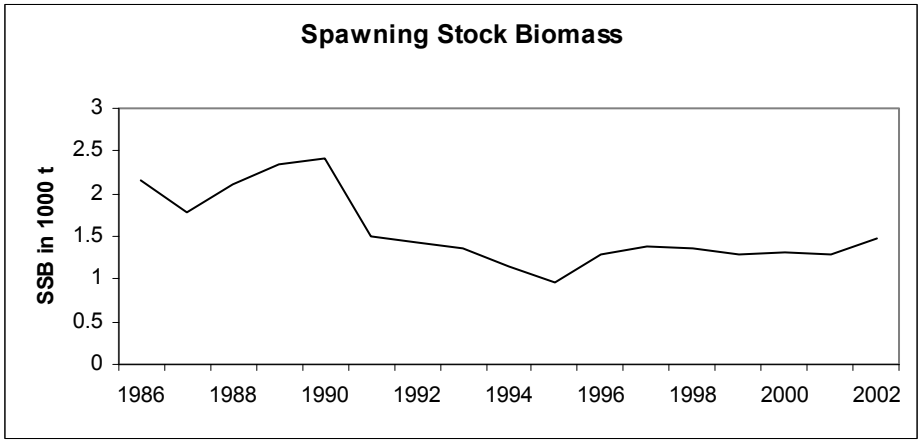

Stock - Recruitment
Recruitment (age 1) in millions
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
SSB in 1000 t

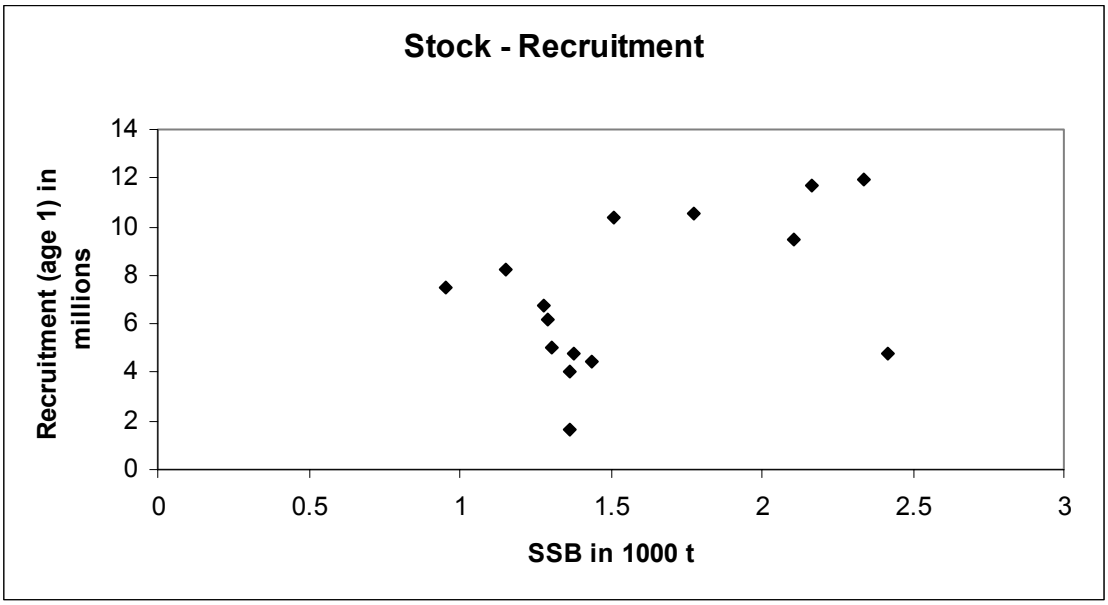

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
Fishing Mortality (ages 2-4)


Landings
Landings in 1000 t
1.2
1
0.8
0.6
0.4
0.2
0
1986
1988
1990
1992
1994
1996
1998
2000


Fishing Mortality
F(ages 2-4)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1986
1988
1990
1992
1994
1996
1998
2000


Recruitment (age 1)
Recruitment in millions
14
12
10
8
6
4
2
0
1986
1988
1990
1992
1994
1996
1998
2000


Spawning Stock Biomass
SSB in 1000 t
3
2.5
2
1.5
1
0.5
0
1986
1988
1990
1992
1994
1996
1998
2000
2002


Stock - Recruitment
Recruitment (age 1) in millions
14
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
3
SSB in 1000 t

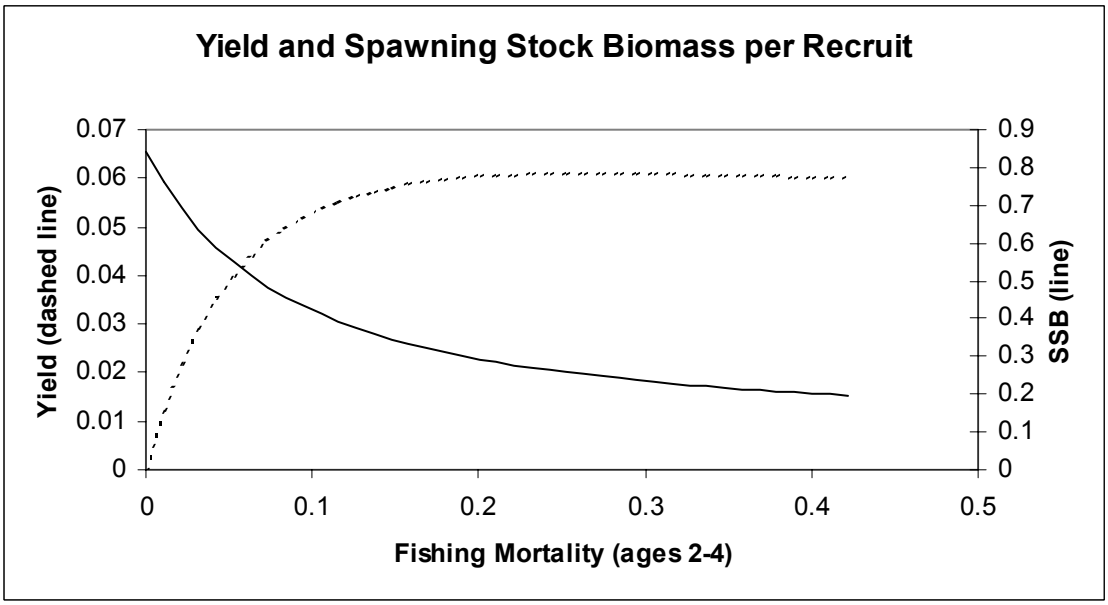

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 2-4)

Table 3.11.3.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	799	197	996	128	1124
1987	995	586	1581	107	1688
1988	917	1099	2016	207	2223
1989	805	1548	2353	276	2629
1990	927	798	1725	220	1945
1991	841	634	1475	207	1682
1992	654	938	1592	324	1916
1993	744	419	1163	221	1384
1994	665	561	1227	176	1403
1995	685	826	1512	141	1652
1996	480	448	928	170	1098
1997	505	289	794	101	896
1998	725	284	1010	113	1123
1999	713	298	1011	104	1115
2000	674	225	899	141	1040
2001	629	177	807	121	927

Table 3.11.3.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	305	24	329
1997	298	12	310	46	356
1998	372	8	380	66	446
1999	332	4	336	12	348
2000	238	5	243	11	254
2001	167	2	169	9	178

Table 3.11.3.3 Megrim (*L. boscii*) in Divisions VIIIc and IXa.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	46976	5058	1124	0.319
1987	44142	6313	1688	0.369
1988	27877	6929	2223	0.395
1989	31487	6803	2629	0.536
1990	28597	6223	1945	0.328
1991	18731	5825	1682	0.268
1992	39270	5555	1916	0.479
1993	33257	5838	1384	0.352
1994	9833	5650	1403	0.315
1995	26715	4967	1652	0.413
1996	32202	4977	1098	0.317
1997	28607	4984	896	0.201
1998	24491	5574	1123	0.242
1999	18031	5897	1115	0.219
2000	26411	6065	1040	0.152
2001	28088	6117	927	0.148
2002	24575*	6785		0.173
Average	28782	5856	1490	0.307

* GM 90-00

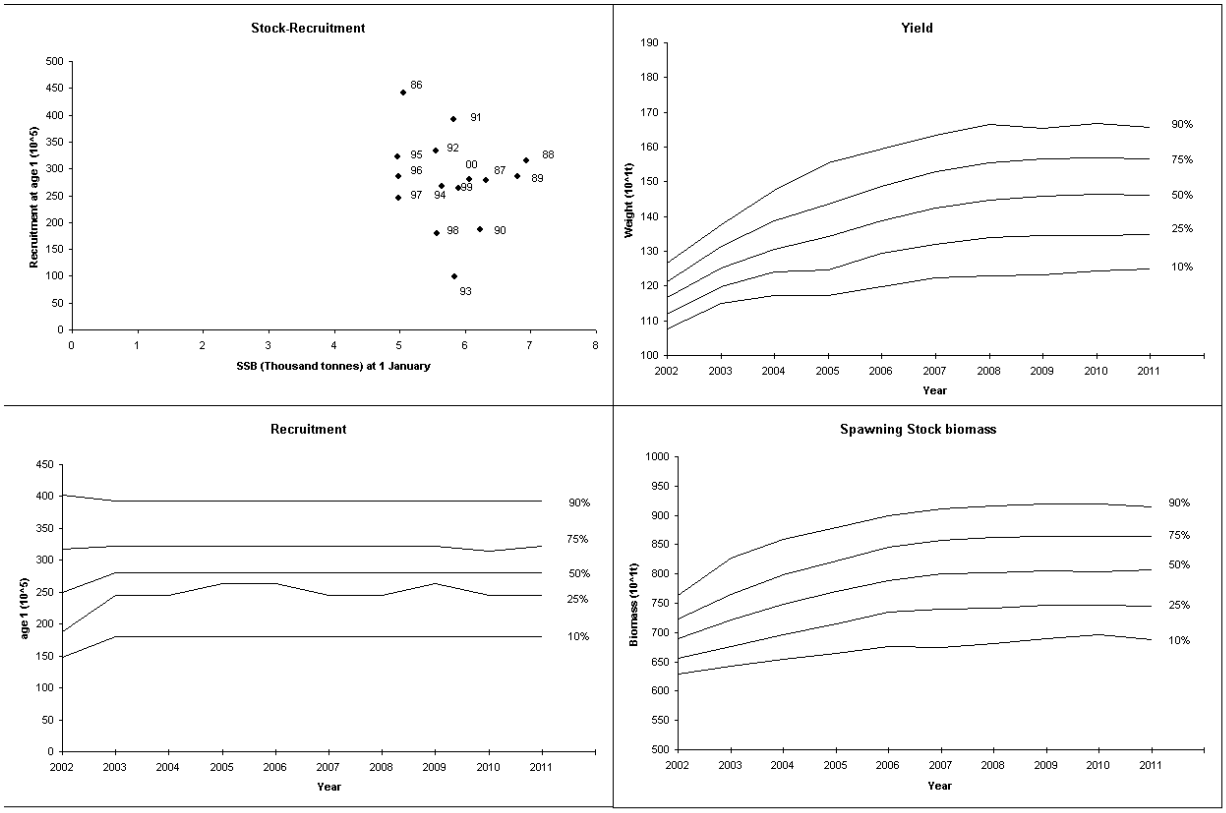
Table 3.11.3.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-4
1986	8713	2163	659	0.355
1987	11709	1775	497	0.325
1988	10526	2103	817	0.486
1989	9435	2339	714	0.435
1990	11978	2415	977	0.445
1991	4794	1510	614	0.454
1992	10412	1434	516	0.397
1993	4443	1361	383	0.299
1994	1622	1150	479	0.420
1995	8227	953	218	0.181
1996	7487	1281	329	0.177
1997	6764	1376	356	0.225
1998	4756	1366	446	0.396
1999	4024	1291	348	0.296
2000	6166	1307	254	0.211
2001	5046	1290	178	0.126
2002	5714*	1472		0.211
Average	7166	1564	487	0.320

* GM 90-00

Four spot megrim (*L. boscii*) Div. VIIIc, IXa. Medium term projections. Lines show 10, 25, 50, 75 and 90 percentiles. Random stock-recruitment

Four spot megrim in Divisions VIIIc and IXa. Medium term analysis, 1.00 * Fsq.



3.11.4 Anglerfish in Divisions VIIIc and IXa (*L. piscatorius* and *L. budegassa*)

State of stocks/exploitation: The combined stocks (*Lophius piscatorius* and *Lophius budegassa*) are outside safe biological limits. The biomass of both species combined is estimated to be around 76% of the $\mathbf{B}_{MSY}$ in 2002, and the fishing mortality has been above $\mathbf{F}_{MSY}$ until 2001. In 2001, fishing mortality is around 63% of $\mathbf{F}_{MSY}$. Current F ($\mathbf{F}_{sq}$=F_{99-01}) is 5% above $\mathbf{F}_{MSY}$.

Management objectives: There are no explicit management objectives for these stocks.

Precautionary Approach reference points: The ASPIC model provides estimates of the biomass relative to $\mathbf{B}_{MSY}$, and of F relative to $\mathbf{F}_{MSY}$. The $\mathbf{B}_{MSY}$ and $\mathbf{F}_{MSY}$ points are used in the advice as a lower boundary for the biomass and an upper boundary for F.

Advice on management: ICES advises that F should be reduced by 5%, corresponding to landings in 2003 of 3 200 t for both species combined. This will allow F to be at $\mathbf{F}_{MSY}$ and for the biomass to increase to $\mathbf{B}_{MSY}$ in the medium term.

Relevant factors to be considered in management: Given that these two species are not usually sorted in the landings and that the proportion of landings by species is based on samples taken from the various ports, an assessment with both species combined was carried out. Previous TACs have been well above the landings. A portion of the catch of *L. piscatorius* and *L. budegassa* is taken together with other species in mixed trawl fisheries.

The length-frequency distributions of *L. piscatorius* show no evidence of strong recruiting year classes.

Catch forecast for 2003:
Both species combined (*L. piscatorius* and *L. budegassa*)
Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999-2001); F/$\mathbf{F}_{MSY}$ = 1.05; Landings(2002) = 3.2; B/$\mathbf{B}_{MSY}$(2003) =0.79

F/$\mathbf{F}_{MSY}$(2003)	Basis	Landings(2003)	B/$\mathbf{B}_{MSY}$ (2004)
0.95	0.95*$\mathbf{F}_{sq}$	3.2	0.82
1.0	1.0* $\mathbf{F}_{sq}$	3.3	0.81

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: Trends in both F and B ratios are similar to those in last year's assessments. However, the addition of another CPUE series has resulted in a shift upwards for the B-ratio and downwards for the F-ratio.

The landings predicted last year for 2001 at *status quo* F were 3 800 t, while the reported landings for 2001 were 1 800 t. Since it is unlikely that the fishery has been reduced more than what was advised, the predictions made last year should be considered overly optimistic. This is probably caused by the high value of the growth population parameter (1.0) estimated last year. In this year's assessment, this parameter has been estimated much lower (0.37), more in line with what is expected for a slow-growing and late-maturing species.

Elaboration and special comment: Both species are caught in mixed fisheries by Portuguese and Spanish species increased and a directed artisanal fishery developed in Spain, originally targeting large fish.

A surplus production model incorporating covariates (ASPIC) was used as in previous assessments. The model provides estimates of stock biomass and fishing mortality relative to their respective MSY values.

ASPIC is used to provide guidance reference points, as well as a perspective of the evolution of total biomass and prediction of landings under different fishing mortalities.

CPUE information from Spain (A Coruña) and Portuguese trawl fleet.

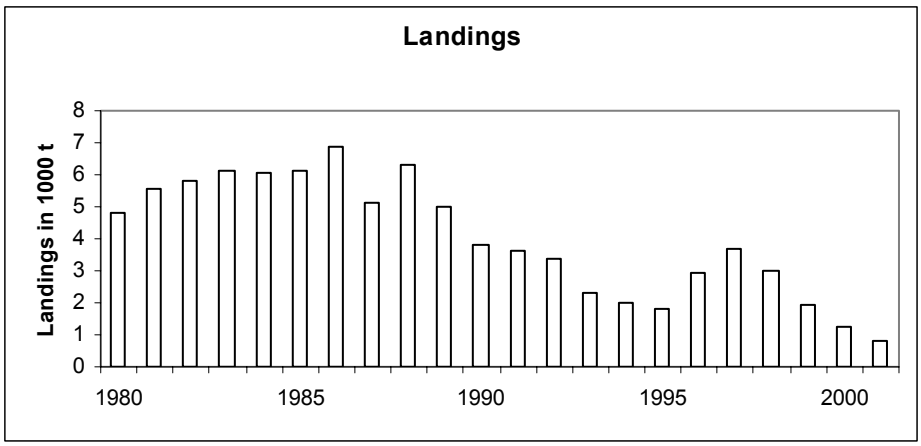
Source of information: Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01).

Catch data (Tables 3.11.4.1–2):

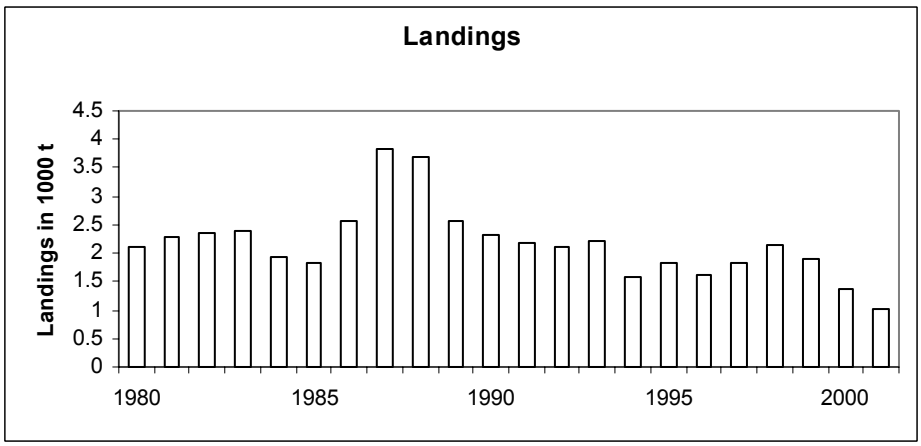
Year	ICES Advice	Predicted catch[1] corresp.to advice	Agreed TAC[1]	ACFM Landings[1]	Landings of *L. piscat.*	Landings of *L. budeg.*
1987	Not dealt with	-	12.0	8.9	5.1	3.8
1988	Not dealt with	-	12.0	10.0	6.3	3.7
1989	Not dealt with	-	12.0	7.6	5.0	2.6
1990	Not dealt with	-	12.0	6.1	3.8	2.3
1991	No advice	-	12.0	5.8	3.6	2.2
1992	No advice	-	12.0	4.2	3.4	2.1
1993	No long-term gain in increasing F	-	13.0	4.5	2.3	2.2
1994	No advice	-	13.0	3.6	2.0	1.6
1995	If required a precautionary TAC	-	13.0	3.6	1.8	1.8
1996	If required a precautionary TAC	-	13.0	4.6	3.0	1.6
1997	If required a precautionary TAC	-	13.0	5.5	3.7	1.8
1998	Restrict catch to < 80% recent levels		10.0	5.1	3.0	2.1
1999	Reduce F to $\mathbf{F}_{pa}$	4.2	8.5	3.8	1.9	1.9
2000	60% reduction in F	1.6	6.8	2.6	1.3	1.4
2001	50% reduction in F	2.8	6.0	1.8	0.8	1.0
2002	30% reduction in F	3.5	4.75			
2003	5% reduction in F	3.2				

[1]For both species combined. Weights in '000 t.

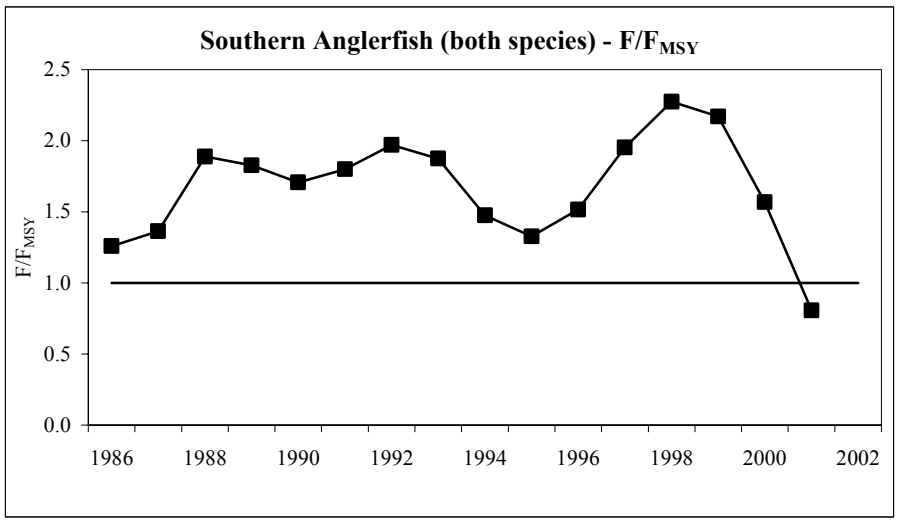
Anglerfish (*L. piscatorius*) in Divisions VIIIc and IXa



Anglerfish (*L. budegassa*) in Divisions VIIIc and IXa



ANGLERFISH (*L.piscatorius* and *L.budegassa*) Divisions VIIIc a
Development of relative Fishing mortality (a) and Biomass (b)
during 1986-2001 and the projected value of B/B_{MSY} for 2002.



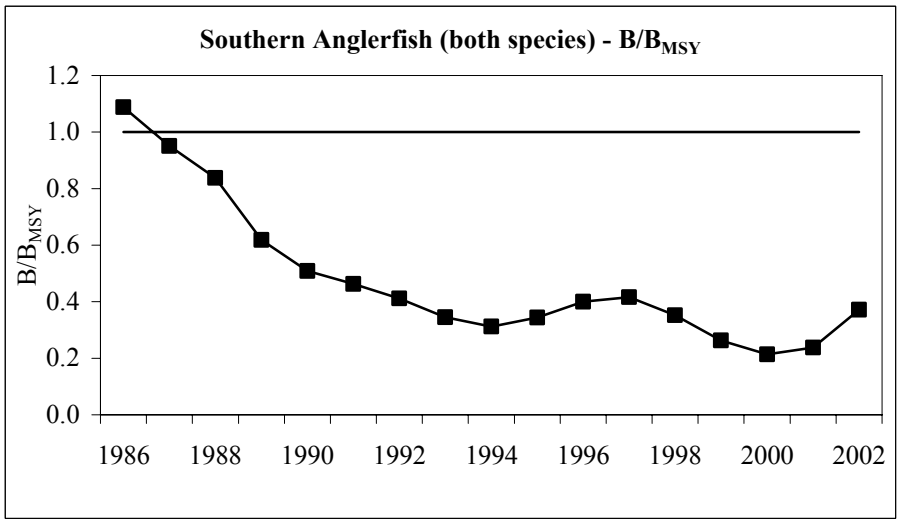


Table 3.11.4.1 Anglerfish (*L. piscatorius*) - Divisions VIIIc and IXa. Landings (t) by the main fishing fleets for 1978–2001 as determined by the Working Group.

	VIIIc			IXa				VIIIc & IXa
Year	Spain Trawl	Spain Gillnet	Total	Spain Trawl	Portugal Trawl	Portugal Artisanal	Total	Total
1978	n/a	n/a	n/a	258	0	115	373	
1979	n/a	n/a	n/a	319	0	225	544	
1980	2806	1270	4076	401	0	339	740	4816
1981	2750	1931	4681	535	0	352	887	5568
1982	1915	2682	4597	875	0	310	1185	5782
1983	3205	1723	4928	726	0	460	1186	6114
1984	3086	1690	4776	578	186	492	1256	6032
1985	2313	2372	4685	540	212	702	1454	6139
1986	2499	2624	5123	670	167	910	1747	6870
1987	2080	1683	3763	320	194	864	1378	5141
1988	2525	2253	4778	570	157	817	1543	6321
1989	1643	2147	3790	347	259	600	1206	4996
1990	1439	985	2424	435	326	606	1366	3790
1991	1490	778	2268	319	224	829	1372	3640
1992	1217	1011	2228	301	76	778	1154	3382
1993	844	666	1510	72	111	636	819	2329
1994	690	827	1517	154	70	266	490	2007
1995	830	572	1403	199	66	166	431	1834
1996	1306	745	2050	407	133	365	905	2955
1997	1449	1191	2640	315	110	650	1075	3714
1998	912	1359	2271	184	28	497	710	2981
1999	545	1013	1558	79	9	285	374	1932
2000	269	538	808	107	4	340	451	1259
2001	231	294	525	57	16	190	263	788

n/a : not available.

Table 3.11.4.2 Anglerfish (*L. budegassa*) - Divisions VIIIc and IXa. Landings (t) by the main fishing fleets for 1978–2000 as determined by the Working Group.

	VIIIc			IXa				VIIIc & IXa
Year	Spain Trawl	Spain Gillnet	Total	Spain Trawl	Portugal Trawl	Portugal Artisanal	Total	Total
1978	n/a	n/a	n/a	248	0	107	355	
1979	n/a	n/a	n/a	306	0	210	516	
1980	1203	207	1409	385	0	315	700	2110
1981	1159	309	1468	505	0	327	832	2300
1982	827	413	1240	841	0	288	1129	2369
1983	1064	188	1252	699	0	428	1127	2379
1984	514	176	690	558	223	458	1239	1929
1985	366	123	489	437	254	653	1344	1833
1986	553	585	1138	379	200	847	1425	2563
1987	1094	888	1982	813	232	804	1849	3832
1988	1058	1010	2068	684	188	760	1632	3700
1989	648	351	999	764	272	542	1579	2578
1990	491	142	633	689	387	625	1701	2334
1991	503	76	579	559	309	716	1584	2163
1992	451	57	508	485	287	832	1603	2111
1993	516	292	809	627	196	596	1418	2227
1994	542	201	743	475	79	283	837	1580
1995	913	104	1017	615	68	131	814	1831
1996	840	105	945	342	133	210	684	1629
1997	800	198	998	524	81	210	815	1813
1998	774	153	926	704	181	332	1217	2144
1999	571	127	698	671	110	406	1187	1885
2000	434	63	497	392	142	336	870	1367
2001	383	69	452	190	101	269	560	1013

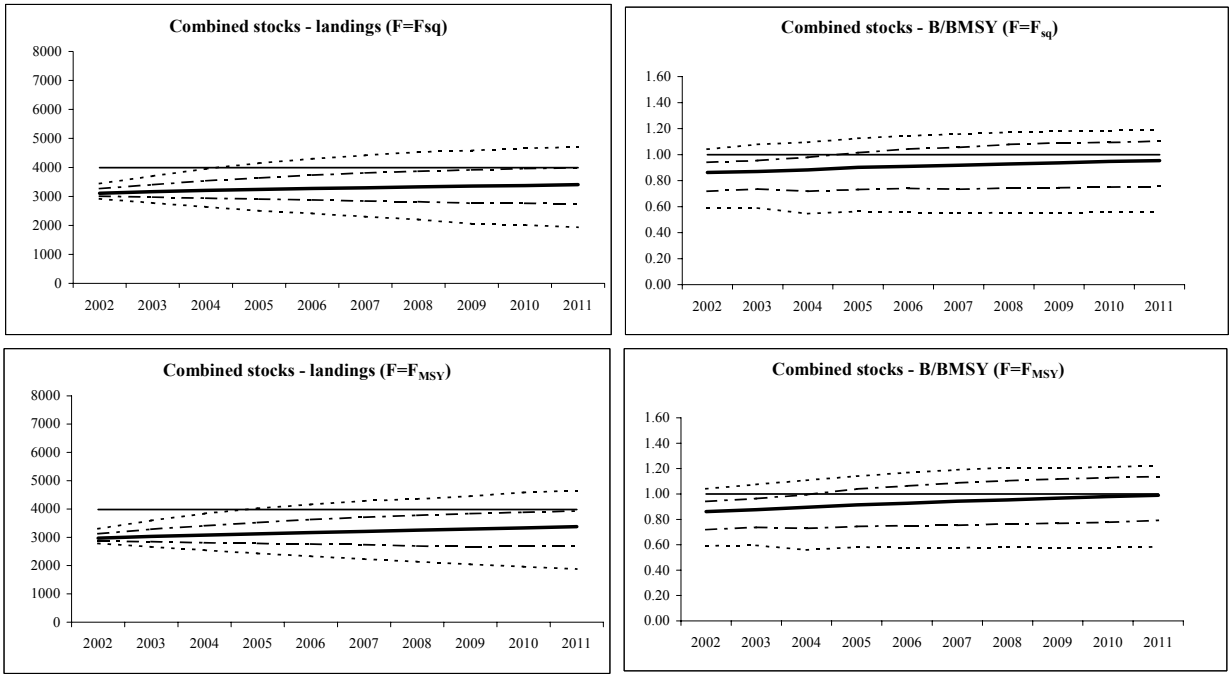
n/a : not available.

Anglerfish in VIIIc and IXa (*L.piscatorius* and *L.budegassa* combined)

Summary of the Aspic results :
r=0.37

	F/F_{MSY}	B/B_{MSY}
1986	1.00	2.12
1987	1.16	1.78
1988	1.52	1.53
1989	1.59	1.29
1990	1.46	1.11
1991	1.51	1.01
1992	1.56	0.92
1993	1.38	0.85
1994	1.10	0.81
1995	1.10	0.83
1996	1.40	0.84
1997	1.82	0.80
1998	1.89	0.72
1999	1.50	0.65
2000	1.01	0.63
2001	0.63	0.67
2002		0.76

Medium-term projections : at $\mathbf{F}_{sq}$ and at $F=\mathbf{F}_{MSY} = 0.95\ \mathbf{F}_{sq}$.



3.11.5 Mackerel in Divisions VIIIc and IXa (Southern component)

For information on this mackerel component see mackerel (combined Southern, Western and North Sea spawning components) section 3.12.3.

3.11.6 Southern horse mackerel (*Trachurus trachurus*) (Divisions VIIIc and IXa)

State of stock/exploitation: The state of the stock is unknown, but seems to have been stable over the last 20 years.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 136 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ be set at 205 000 t. This affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty of the assessment.
$\mathbf{F}_{lim}$ is 0.27, the fishing mortality rate above which recruitment and stock dynamics are unknown.	$\mathbf{F}_{pa}$ be established at 0.17. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty of assessments.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$	$\mathbf{B}_{pa} = \mathbf{B}_{loss} * 1.5$
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{lim} * 0.63$

Advice on management: ICES recommends that the catches in 2003 should not exceed the recent average of 49 000 tonnes (1999–2001). The TAC for this stock should only apply to *Trachurus trachurus*.

Relevant factors to be considered in management: The available information, including SSB estimates from egg surveys, indicates that the stock has been relatively stable over a long period, and can sustain the present catch level.

The current TAC set by management agencies for horse mackerel in Division VIIIc and Subarea IX also includes other *Trachurus* species. Catches of these species are presented in Table 3.11.6.2. Recent catches of these species have been around 1 600 t.

Medium- and long-term projections: Not available.

Comparison with previous assessment and advice: An assessment was attempted this year using partly revised data. This assessment gave a perception of the state of the stock that was different from last year's assessment. As last year survey and commercial tuning were available for demersal fleets. However, because of the statistical problems in the assessment diagnostics and concerns about the appropriateness of demersal tuning fleets for a pelagic species the assessment was considered unreliable.

Elaboration and special comment: Southern horse mackerel are mainly exploited by Spanish and Portuguese purse seiners and by Portuguese trawlers. While the purse seiners mainly catch juvenile fish, the catches taken by trawlers comprise also older fish. There is a significant by-catch of *Trachurus mediterraneus* and *Trachurus picturatus*, mainly in the trawl fishery.

The exploratory assessment was based on catch-at-age data from Spain and Portugal. Abundance indices were available from three bottom trawl surveys and catch per unit of effort data from two commercial bottom trawl fleets. The divergent trends in these tuning fleet data are a source of uncertainty about the state of the stock.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10–19 September 2002 (ICES CM 2003/ACFM:07).

Catch data (Tables 3.11.5.1 and 3.11.6.1–2):

Year	ICES Advice	Predicted catch corresp. to advice[2]	Agreed TAC[1]	ACFM Landings[2]
1987	Not assessed	-	72.5[3]	55
1988	Mesh size increase	-	82.0[3]	56
1989	No increase in F; TAC	72.5	73.0[3]	56
1990	F at $F_{0.1}$; TAC	38	55.0[4]	49
1991	Precautionary TAC	61	73.0[4]	46
1992	If required, precautionary TAC	61	73.0[4]	51
1993	No advice	-	73.0[4]	57
1994	*Status quo* prediction	55[5]	73.0[4]	53
1995	No long-term gains in increasing F	63[5]	73.0[4]	53
1996	No long-term gains in increasing F	60[5]	73.0[4]	45
1997	No advice	-	73.0[4]	57
1998	F should not exceed the F(94–96)	59	73.0[4]	64
1999	No increase in F	58	73.0[4]	52
2000	F <F_{pa}	<59	68.0[4]	49
2001	F <F_{pa}	<54	68.0[4]	46
2002	F <0.113	<34	68.0[4]	
2003	Average of last 3 years	<49		

[1]Includes all *Trachurus* spp. [2]Includes only *Trachurus trachurus* L. [3]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EC waters only). [4] Division VIIIc and Subarea IX. [5]Catch at *status quo* F. Weights in '000 t.

Southern horse mackerel (Divisions VIIIc and IXa)

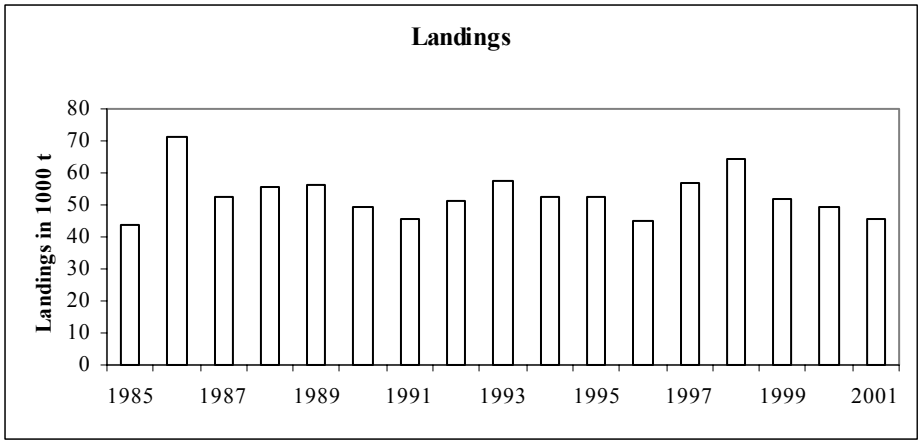


Table 3.11.6.1 Annual catches (tonnes) of SOUTHERN HORSE MACKEREL (*Trachurus trachurus*) by countries and by gear in Divisions VIIIc and IXa. Data from 1984–2001 are Working Group estimates.

Year	Portugal (Division IXa)				Spain (Divisions IXa + VIIIc)					Total VIIIc+IXa
	Trawl	Seine	Artisanal	Total	Trawl	Seine	Hook	Gillnet	Total	
1963	6,593	54,267	3,900	64,760	-	-	-	-	53,420	118,180
1964	8,983	55,693	4,100	68,776	-	-	-	-	57,365	126,141
1965	4,033	54,327	4,745	63,105	-	-	-	-	52,282	115,387
1966	5,582	44,725	7,118	57,425	-	-	-	-	47,000	104,425
1967	6,726	52,643	7,279	66,648	-	-	-	-	53,351	119,999
1968	11,427	61,985	7,252	80,664	-	-	-	-	62,326	142,990
1969	19,839	36,373	6,275	62,487	-	-	-	-	85,781	148,268
1970	32,475	29,392	7,079	59,946	-	-	-	-	98,418	158,364
1971	32,309	19,050	6,108	57,467	-	-	-	-	75,349	132,816
1972	45,452	28,515	7,066	81,033	-	-	-	-	82,247	163,280
1973	28,354	10,737	6,406	45,497	-	-	-	-	114,878	160,375
1974	29,916	14,962	3,227	48,105	-	-	-	-	78,105	126,210
1975	26,786	10,149	9,486	46,421	-	-	-	-	85,688	132,109
1976	26,850	16,833	7,805	51,488	89,197	26,291	376[1]	-	115,864	167,352
1977	26,441	16,847	7,790	51,078	74,469	31,431	376[1]	-	106,276	157,354
1978	23,411	4,561	4,071	32,043	80,121	14,945	376[1]	-	95,442	127,485
1979	19,331	2,906	4,680	26,917	48,518	7,428	376[1]	-	56,322	83,239
1980	14,646	4,575	6,003	25,224	36,489	8,948	376[1]	-	45,813	71,037
1981	11,917	5,194	6,642	23,733	28,776	19,330	376[1]	-	48,482	72,235
1982	12,676	9,906	8,304	30,886	-[2]	-[2]	-[2]	-	28,450	59,336
1983	16,768	6,442	7,741	30,951	8,511	34,054	797	-	43,362	74,313
1984	8,603	3,732	4,972	17,307	12,772	15,334	884	-	28,990	46,297
1985	3,579	2,143	3,698	9,420	16,612	16,555	949	-	34,109	43,529
1986	-[2]	-[2]	-[2]	28,526	9,464	32,878	481	143	42,967	71,493
1987	11,457	6,744	3,244	21,445	-[2]	-[2]	-[2]	-[2]	33,193	54,648
1988	11,621	9,067	4,941	25,629	-[2]	-[2]	-[2]	-[2]	30,763	56,392
1989	12,517	8,203	4,511	25,231	-[2]	-[2]	-[2]	-[2]	31,170	56,401
1990	10,060	5,985	3,913	19,958	10,876	17,951	262	158	29,247	49,205
1991	9,437	5,003	3,056	17,497	9,681	18,019	187	127	28,014	45,511
1992	12,189	7,027	3,438	22,654	11,146	16,972	81	103	28,302	50,956
1993	14,706	4,679	6,363	25,747	14,506	16,897	124	154	31,681	57,428
1994	10,494	5,366	3,201	19,061	10,864	22,382	145	136	33,527	52,588
1995	12,620	2,945	2,133	17,698	11,589	23,125	162	107	34,983	52,681
1996	7,583	2,085	4,385	14,053	10,360	19,917	214	146	30,637	44,690
1997	9,446	5,332	1,958	16,736	8,140	31,582	169	143	40,034	56,770
1998	13,221	5,906	2,217	21,334	13,150	29,805	63	118	43,136	64,480
1999	6,866	5,705	1,849	14,420	10,015	27,332	29	126	37,502	51,922
2000	7,971	4,209	2,168	15,348	10,144	23,373	59	214	33,790	49,138
2001	7,692	4,787	831	13,760	11,222	20,122	45	590	31,979	45,739

[1]Estimated value. [2]Not available by gear.

Table 3.11.6.2 Annual catches (tonnes) of other Horse mackerel species (*T. mediterraneus* & *T. picturatus*) in Divisions VIIIc and IXa. Data from 1989–2001 are Working Group estimates.

Year	*T. mediterraneus*	*T. picturatus*
1989	3903	2394
1990	2943	2012
1991	5020	1700
1992	4804	1035
1993	5576	1028
1994	3344	1045
1995	4585	728
1996	3443	1009
1997	3264	834
1998	3755	526
1999	1592	320
2000	808	464
2001	1293	420

3.11.7 Sardine

3.11.7.a Sardine in Divisions VIIIc and IXa

State of stock/exploitation: The state of the stock is unknown in relation to precautionary reference points. Different assessment methods lead to very different perceptions as to the absolute levels of stock abundance and fishing mortality, but all indicate that the stock biomass has increased from a historical low. The 2000 year class appears to be strong, and there are indications that the 2001 year class is of average strength.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No precautionary approach reference points have been proposed for this stock.

Advice on management: ICES recommends a catch of no more than 100 000 tonnes in 2003. This is expected to prevent a decline in stock size in the short term.

Relevant factors to be considered in management: Although the present SSB is unknown, the available assessments all indicated that a catch of 100 000 t in 2003 would maintain the presently estimated biomass in 2004. All exploratory assessments indicated that the spawning stock in the most recent year has increased from a historical low.

There are large variations in recruitment, and the stock size is strongly dependant on the incoming year class. There is incomplete knowledge of the environmental factors affecting recruitment. The 2000 year class has been confirmed as strong by both the surveys and in the fishery, but the actual size of this year class remains uncertain.

Uncertainty regarding stock units and area distribution and how the changes in fish distribution affect the overall stock dynamics make it difficult to make a meaningful comparison between the stock size and the fishing mortality in the mid-1980s and the late 1990s, and to provide accurate estimates of the state of the stock.

The possibility that the stock in recent years may be at a lower level than previously assumed, as well as the dependence of incoming recruitment indicate that a close monitoring of this stock is still needed, in spite of the recent signs of increase.

Spain and Portugal undertook management measures to reduce fishing effort (i.e., closed periods, limitation of fishing days) and the overall catches (daily and/or annual allowable catches per boat and/or per fisherman organisation), and this may have led to a reduction in the fishing mortality in the last two years.

Medium- and long-term projections: Not available.

Comparison with previous assessment and advice: Several assessment methods were used to interpret the catch and survey data. These gave quite different perceptions of the historical trends in fishing mortality and spawning stock. These differences can be attributed to differences in structural assumptions between the models, and conflicting interpretation of signals and noise in the data, but the detailed effect of these assumptions is complex and still not fully understood. None of the assessments were accepted by ICES as a basis to define the state of the stock and fishery. However, the presence of a strong 2000 year class giving rise to an increased SSB in 2002, is indicated by all methods. ICES considers that the absolute levels of stock biomass and fishing mortality are unknown.

Elaboration and special comment: Almost all catches are taken by Spanish and Portuguese purse seiners in a directed human consumption fishery.

Initial information from an acoustic survey in November 2000 indicated that the strong 2000 year class was not as wide-spread in its geographical distribution, found only in the North of Portugal. Subsequent observations from acoustic surveys in 2001 and 2002 indicated that this year class has spread out over a wider geographical area.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10–19 September 2002 (ICES CM 2003/ACFM:07).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 2–5	Yield/R	SSB/R
Average Current	0.267	0.016	0.050
$\mathbf{F}_{max}$	1.941	0.024	0.007
$\mathbf{F}_{0.1}$	0.427	0.019	0.036
$\mathbf{F}_{med}$	0.296	0.017	0.047

Catch data (Table 3.11.7.a.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings VIII & IX	ACFM Landings[3]
1987	No increase in F; TAC	140	-		178
1988	No increase in F; TAC	150	-	167	162
1989	No increase in F; TAC	212	-	146	141
1990	Room for increased F	227[2]	-	150	149
1991	Precautionary TAC	176	-	135	133
1992	No advice	-	-	139	130
1993	Precautionary TAC	135	-	153	142
1994	No advice	118[1]	-	147	137
1995	No advice; apparently stable stock	-	-	137	125
1996	Lowest possible level	-	-	134	117
1997	Lowest possible level	-	-	n/a	116
1998	Significant reduction	-	-	n/a	109
1999	Reduce F to 0.2	38	-	n/a	94
2000	F below 0.2	<81	-	n/a	86
2001	F below 0.2	<88	-	n/a	102
2002	F below 0.25	<95	-		
2003	Prevent decline in SSB	<100			

[1]Estimated catch at *status quo* F. [2]Catch corresponding to 20% increase in F. [3] Includes only VIIIc and IXa. N/a=not available. Weights in '000 t.

Sardine in Divisions VIIIc and IXa

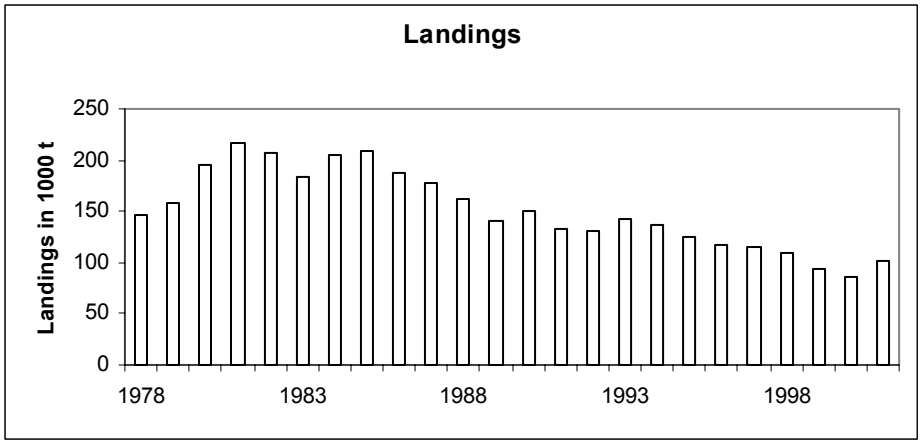


Table 3.11.7.a.1 : Iberian Sardine Landings (tonnes) by sub-area and total for the period 1940-2001.

	Sub-area										
Year	VIIIc	IXa North	IXa Central North	IXa Central South	IXa South Algarve	IXa South Cadiz	All sub-areas	Div. IXa	Portugal	Spain (excl.Cadiz)	Spain (incl.Cadiz)
1940	66816		42132	33275	23724		**165947**	**99131**	**99131**	**66816**	**66816**
1941	27801		26599	34423	9391		**98214**	**70413**	**70413**	**27801**	**27801**
1942	47208		40969	31957	8739		**128873**	**81665**	**81665**	**47208**	**47208**
1943	46348		85692	31362	15871		**179273**	**132925**	**132925**	**46348**	**46348**
1944	76147		88643	31135	8450		**204375**	**128228**	**128228**	**76147**	**76147**
1945	67998		64313	37289	7426		**177026**	**109028**	**109028**	**67998**	**67998**
1946	32280		68787	26430	12237		**139734**	**107454**	**107454**	**32280**	**32280**
1947	43459	21855	55407	25003	15667		**161391**	**117932**	**96077**	**65314**	**65314**
1948	10945	17320	50288	17060	10674		**106287**	**95342**	**78022**	**28265**	**28265**
1949	11519	19504	37868	12077	8952		**89920**	**78401**	**58897**	**31023**	**31023**
1950	13201	27121	47388	17025	17963		**122698**	**109497**	**82376**	**40322**	**40322**
1951	12713	27959	43906	15056	19269		**118903**	**106190**	**78231**	**40672**	**40672**
1952	7765	30485	40938	22687	25331		**127206**	**119441**	**88956**	**38250**	**38250**
1953	4969	27569	68145	16969	12051		**129703**	**124734**	**97165**	**32538**	**32538**
1954	8836	28816	62467	25736	24084		**149939**	**141103**	**112287**	**37652**	**37652**
1955	6851	30804	55618	15191	21150		**129614**	**122763**	**91959**	**37655**	**37655**
1956	12074	29614	58128	24069	14475		**138360**	**126286**	**96672**	**41688**	**41688**
1957	15624	37170	75896	20231	15010		**163931**	**148307**	**111137**	**52794**	**52794**
1958	29743	41143	92790	33937	12554		**210167**	**180424**	**139281**	**70886**	**70886**
1959	42005	36055	87845	23754	11680		**201339**	**159334**	**123279**	**78060**	**78060**
1960	38244	60713	83331	24384	24062		**230734**	**192490**	**131777**	**98957**	**98957**
1961	51212	59570	96105	22872	16528		**246287**	**195075**	**135505**	**110782**	**110782**
1962	28891	46381	77701	29643	23528		**206144**	**177253**	**130872**	**75272**	**75272**
1963	33796	51979	86859	17595	12397		**202626**	**168830**	**116851**	**85775**	**85775**
1964	36390	40897	108065	27636	22035		**235023**	**198633**	**157736**	**77287**	**77287**
1965	31732	47036	82354	35003	18797		**214922**	**183190**	**136154**	**78768**	**78768**
1966	32196	44154	66929	34153	20855		**198287**	**166091**	**121937**	**76350**	**76350**
1967	23480	45595	64210	31576	16635		**181496**	**158016**	**112421**	**69075**	**69075**
1968	24690	51828	46215	16671	14993		**154397**	**129707**	**77879**	**76518**	**76518**
1969	38254	40732	37782	13852	9350		**139970**	**101716**	**60984**	**78986**	**78986**
1970	28934	32306	37608	12989	14257		**126094**	**97160**	**64854**	**61240**	**61240**
1971	41691	48637	36728	16917	16534		**160507**	**118816**	**70179**	**90328**	**90328**
1972	33800	45275	34889	18007	19200		**151171**	**117371**	**72096**	**79075**	**79075**
1973	44768	18523	46984	27688	19570		**157533**	**112765**	**94242**	**63291**	**63291**
1974	34536	13894	36339	18717	14244		**117730**	**83194**	**69300**	**48430**	**48430**
1975	50260	12236	54819	19295	16714		**153324**	**103064**	**90828**	**62496**	**62496**
1976	51901	10140	43435	16548	12538		**134562**	**82661**	**72521**	**62041**	**62041**
1977	36149	9782	37064	17496	20745		**121236**	**85087**	**75305**	**45931**	**45931**
1978	43522	12915	34246	25974	23333	5619	**145609**	**102087**	**83553**	**56437**	**62056**
1979	18271	43876	39651	27532	24111	3800	**157241**	**138970**	**91294**	**62147**	**65947**
1980	35787	49593	59290	29433	17579	3120	**194802**	**159015**	**106302**	**85380**	**88500**
1981	35550	65330	61150	37054	15048	2384	**216517**	**180967**	**113253**	**100880**	**103264**
1982	31756	71889	45865	38082	16912	2442	**206946**	**175190**	**100859**	**103645**	**106087**
1983	32374	62843	33163	31163	21607	2688	**183837**	**151463**	**85932**	**95217**	**97905**
1984	27970	79606	42798	35032	17280	3319	**206005**	**178035**	**95110**	**107576**	**110895**
1985	25907	66491	61755	31535	18418	4333	**208439**	**182532**	**111709**	**92398**	**96731**
1986	39195	37960	57360	31737	14354	6757	**187363**	**148168**	**103451**	**77155**	**83912**
1987	36377	42234	44806	27795	17613	8870	**177696**	**141319**	**90214**	**78611**	**87481**
1988	40944	24005	52779	27420	13393	2990	**161531**	**120587**	**93591**	**64949**	**67939**
1989	29856	16179	52585	26783	11723	3835	**140961**	**111105**	**91091**	**46035**	**49870**
1990	27500	19253	52212	24723	19238	6503	**149429**	**121929**	**96173**	**46753**	**53256**
1991	20735	14383	44379	26150	22106	4834	**132587**	**111852**	**92635**	**35118**	**39952**
1992	26160	16579	41681	29968	11666	4196	**130250**	**104090**	**83315**	**42739**	**46935**
1993	24486	23905	47284	29995	13160	3664	**142495**	**118009**	**90440**	**48391**	**52055**
1994	22181	16151	49136	30390	14942	3782	**136582**	**114401**	**94468**	**38332**	**42114**
1995	19538	13928	41444	27270	19104	3996	**125280**	**105742**	**87818**	**33466**	**37462**
1996	14423	11251	34761	31117	19880	5304	**116736**	**102313**	**85758**	**25674**	**30978**
1997	15587	12291	34156	25863	21137	6780	**115814**	**100227**	**81156**	**27878**	**34658**
1998	16177	3263	32584	29564	20743	6594	**108924**	**92747**	**82890**	**19440**	**26034**
1999	11862	2563	31574	21747	18499	7846	**94091**	**82229**	**71820**	**14425**	**22271**
2000	11697	2866	23311	23701	19129	5081	**85786**	**74089**	**66141**	**14563**	**19644**
2001	16798	8398	32726	25619	13350	5066	**101957**	**85159**	**71695**	**25196**	**30262**

Div. IXa = IXa North + IXa Central-North + IXa Central-South + IXa South-Algarve + IXa South-Cadiz

3.11.8 Anchovy

3.11.8.a Anchovy in Subarea VIII (Bay of Biscay)

State of stock/exploitation: The stock is inside safe biological limits. The SSB in 2002 is above $\mathbf{B}_{pa}$, and the fishing mortality has remained well below $\mathbf{F}_{pa}$ in recent years.

Management objectives: There are no explicit management objectives for this stock. However, for any management objectives to meet precautionary criteria, their aim should be to keep SSB above $\mathbf{B}_{pa}$ and reduce or maintain F below $\mathbf{F}_{pa}$.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 18 000 t, the lowest observed biomass.	$\mathbf{B}_{pa}$ = 36 000 t.
There is no biological basis for defining $\mathbf{F}_{lim}$.	$\mathbf{F}_{pa}$ be established between 1.0–1.2.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$ = 18 000 t.	$\mathbf{B}_{pa}$= SSB that can withstand two successive years of poor recruitment.
	$\mathbf{F}_{pa}$= F for 50% spawning potential ratio, i.e., the F at which the SSB/R is half of what it would have been in the absence of fishing.

Advice on management: ICES recommends that a preliminary TAC for 2003 is set to 12 500 t, in order to keep SSB above B_{pa} in 2003. This is based on the conservative assumption that recruitment in 2002 and beyond is 7.8 billion (mean of the below mean year classes in the historical series. This TAC should be re-evaluated in the middle of the year 2003, based on the development of the fishery and on the results from acoustic and egg surveys in May-June.

Relevant factors to be considered in management: ICES has so far not been able to find sufficient resources to make a full evaluation of the two-stage advisory procedure, see also Section 3.11.8.c. Such an evaluation is urgently needed.

There are large inter-annual fluctuations in the spawning stock due to the short life span of anchovy. The fishery depends largely on the incoming year class, the abundance of which cannot be estimated before it has entered the fishery the next spring as one-year-olds. Ideally, in-season management with a spawner escapement threshold would be appropriate for this stock.

Catch forecast for 2003:
Basis:Landings(2002) =25.0; F(2002) = 0.40=0.69*F_{sq} (F_{sq}=$F_{95–01}$=0.58); SSB (2002) = 56.3.

F(2003)	Basis	SSB (2003)	Catch (2003)
0.41	0.7* $\mathbf{F}_{sq}$	36.2	12.5
0.58	1* $\mathbf{F}_{sq}$	34.2	16.9
0.70	1.2* $\mathbf{F}_{sq}$	33.0	19.6
0.82	1.4* $\mathbf{F}_{sq}$	31.8	22.1
0.93	1.6* $\mathbf{F}_{sq}$	30.7	24.4
1.05	1.8* $\mathbf{F}_{sq}$	29.6	26.5
1.17	2* $\mathbf{F}_{sq}$	28.5	28.6
1.46	2.5* $\mathbf{F}_{sq}$	26.1	33.1

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The current assessment is consistent with the previous ones and it is based on the same assessment model and makes use of all new available information from the catches and the new survey indices.

Elaboration and special comments: The abundance of this short-lived species will vary considerably according to fluctuations in recruitment. The recruitment is likely to be strongly dependent on environmental factors. The low accuracy of the environmental indexes as recruitment predictors makes it impossible at present to estimate the population abundance one year in advance. ICES considers that a fully operative model to evaluate alternative management regimes, including the one considered by STECF, needs to be developed.

The stock is exploited by Spanish purse seiners, mostly in the first half of the year, and French trawlers mostly in the second half of the year. Most of the fish (around 85%) have spawned at least once before being caught. The French fishery takes place outside the spawning season and the Spanish fishery is outside the spawning area.

Analytical assessment (ICA) is based on catch-at-age data from French and Spanish fisheries and stock biomass estimates from egg (1987–2001) and acoustic surveys (1989–2001). Results from biomass production models are in accordance with the ICA assessment.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, September 2002 (ICES CM 2003/ACFM:07).

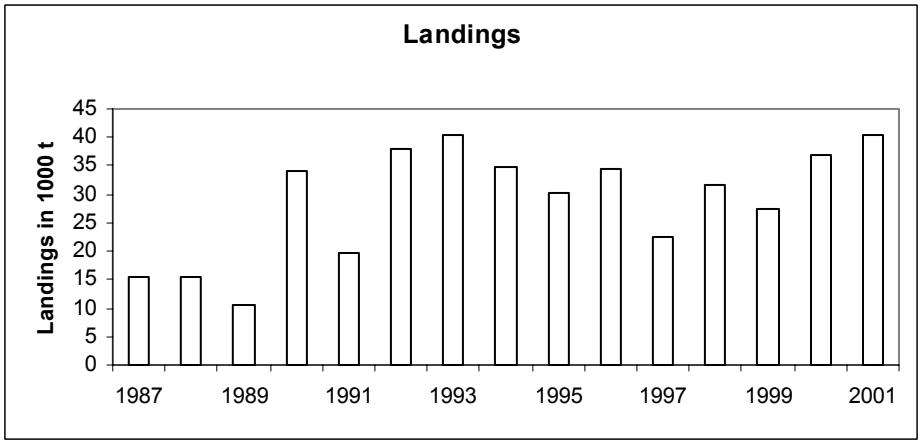
Yield and spawning biomass per Recruit F-reference points:

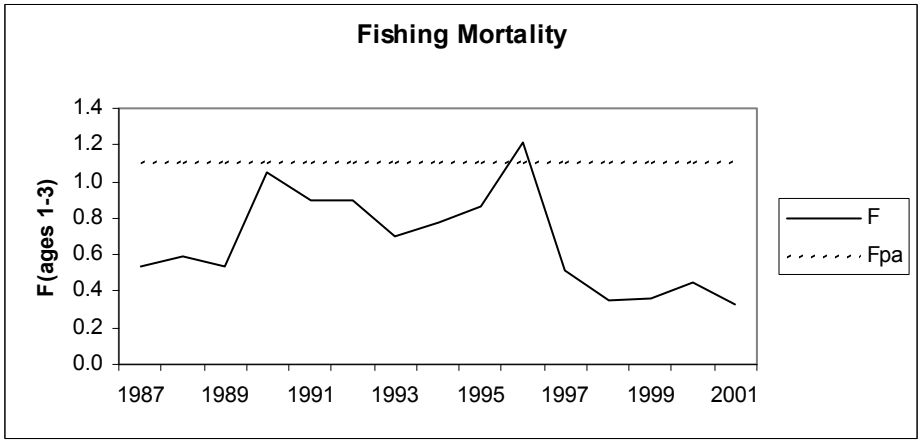
	Fish Mort Ages 1–3	Yield/R	SSB/R
Average Current	0.379	0.001	0.005
$\mathbf{F}_{max}$	N/A		
$\mathbf{F}_{0.1}$	2.376	0.003	0.002
$\mathbf{F}_{med}$	1.550	0.003	0.003

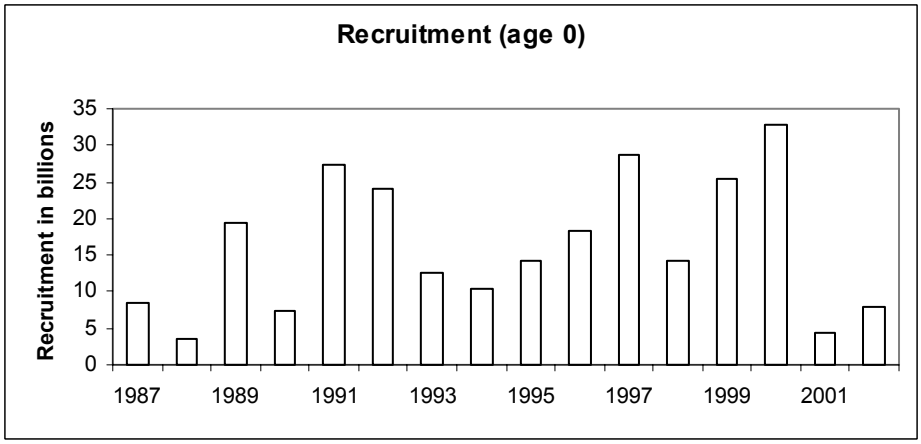
Catch data (Tables 3.11.8.a.1–2):

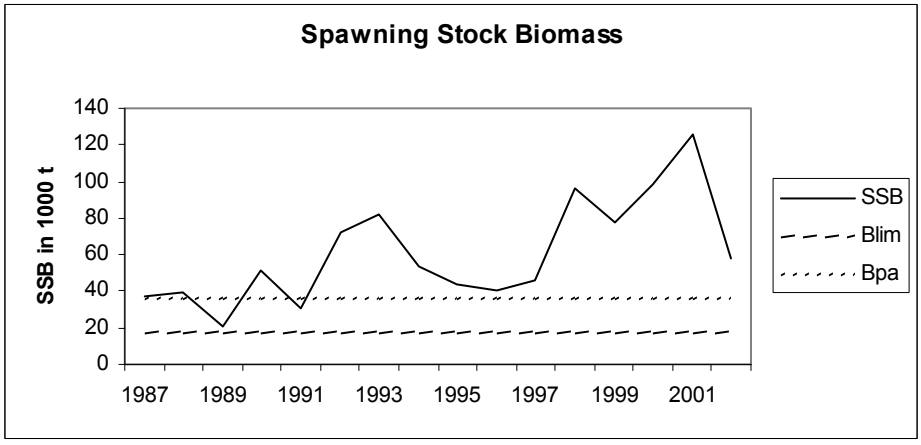
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official landings	ACFM landings
1987	Not assessed	-	32	14	15
1988	Not assessed	-	32	14	16
1989	Increase SSB; TAC	10.0[1]	32	n/a	11
1990	Precautionary TAC	12.3	30	n/a	34
1991	Precautionary TAC	14.0	30	n/a	20
1992	No advice	-	30	n/a	38
1993	Reduced F on juveniles; closed area	-	30	n/a	40
1994	Reduced F on juveniles; closed area	-	30	n/a	35
1995	Reduced F on juveniles; closed area	-	33	n/a	30
1996	Reduced F on juveniles; closed area	-	33	n/a	34
1997	Reduced F on juveniles; closed area	-	33	n/a	22
1998	Reduced F on juveniles; closed area		33	n/a	32
1999	Reduced F on juveniles, closed area		33	n/a	27
2000	Closure of the Fishery	0.0	33	n/a	37
2001	Preliminary TAC corresponding to recent exploitation	18	33	n/a	40
2002	Preliminary TAC corresponding to recent exploitation	33	33	n/a	25[2]
2003	Preliminary TAC corresponding to recent exploitation	12.5			

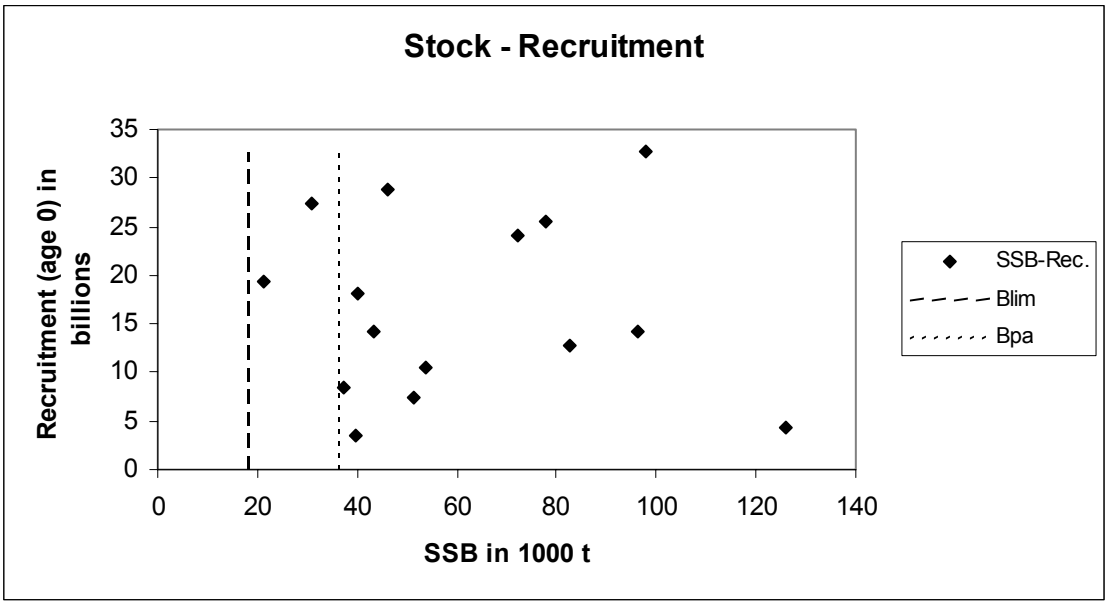
Weights in '000 t. [1]Mean catch of 1985–1987. [2]Preliminary estimate based on catches in the first half of the year. n/a: not available.

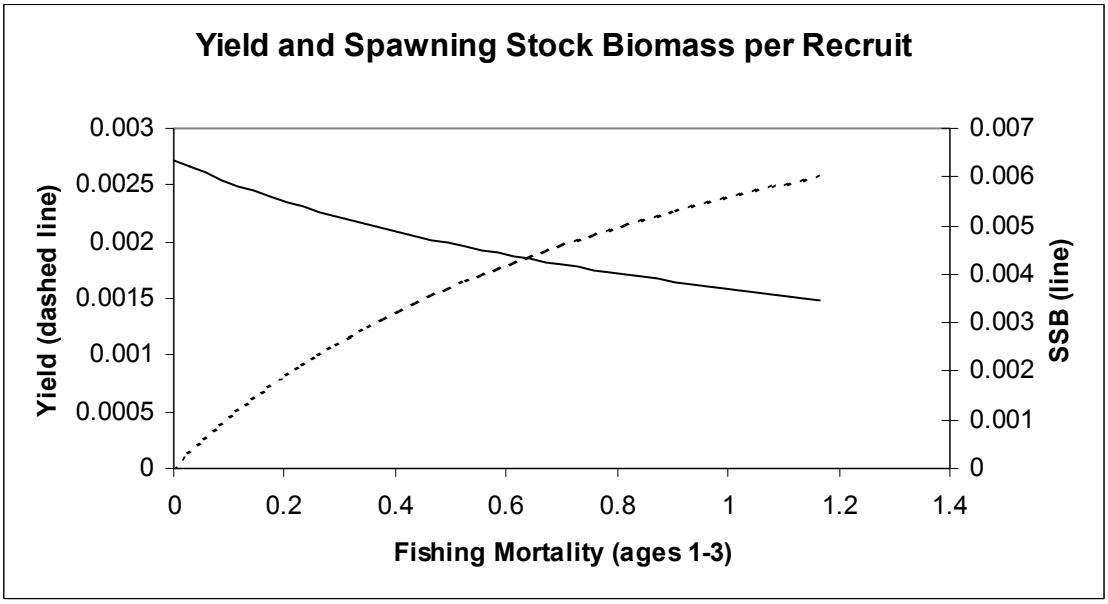

Landings
Landings in 1000 t
45
40
35
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001


Fishing Mortality
F(ages 1-3)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1987
1989
1991
1993
1995
1997
1999
2001
F
Fpa


Recruitment (age 0)
Recruitment in billions
35
30
25
20
15
10
5
0
1987
1989
1991
1993
1995
1997
1999
2001


Spawning Stock Biomass
SSB in 1000 t
140
120
100
80
60
40
20
0
1987
1989
1991
1993
1995
1997
1999
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 1-3)

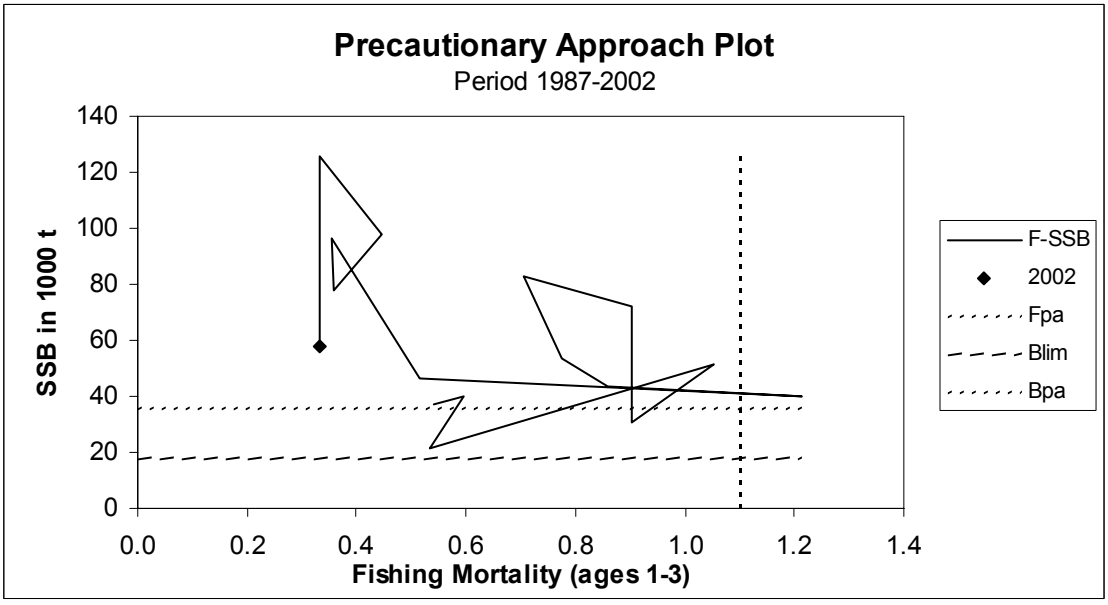

Precautionary Approach Plot
Period 1987-2002
SSB in 1000 t
Fishing Mortality (ages 1-3)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.11.8.a.1: Annual catches (in tonnes) of Bay of Biscay anchovy (Subarea VIII) As estimated by the Working Group members.

Country	France	Spain	Spain	International
Year	VIIIab	VIIIbc, Landings	Live Bait Catches	VIII
1960	1,085	57,000	n/a	58,085
1961	1,494	74,000	n/a	75,494
1962	1,123	58,000	n/a	59,123
1963	652	48,000	n/a	48,652
1964	1,973	75,000	n/a	76,973
1965	2,615	81,000	n/a	83,615
1966	839	47,519	n/a	48,358
1967	1,812	39,363	n/a	41,175
1968	1,190	38,429	n/a	39,619
1969	2,991	33,092	n/a	36,083
1970	3,665	19,820	n/a	23,485
1971	4,825	23,787	n/a	28,612
1972	6,150	26,917	n/a	33,067
1973	4,395	23,614	n/a	28,009
1974	3,835	27,282	n/a	31,117
1975	2,913	23,389	n/a	26,302
1976	1,095	36,166	n/a	37,261
1977	3,807	44,384	n/a	48,191
1978	3,683	41,536	n/a	45,219
1979	1,349	25,000	n/a	26,349
1980	1,564	20,538	n/a	22,102
1981	1,021	9,794	n/a	10,815
1982	381	4,610	n/a	4,991
1983	1,911	12,242	n/a	14,153
1984	1,711	33,468	n/a	35,179
1985	3,005	8,481	n/a	11,486
1986	2,311	5,612	n/a	7,923
1987	4,899	9,863	546	15,308
1988	6,822	8,266	493	15,581
1989	2,255	8,174	185	10,614
1990	10,598	23,258	416	34,272
1991	9,708	9,573	353	19,634
1992	15,217	22,468	200	37,885
1993	20,914	19,173	306	40,393
1994	16,934	17,554	143	34,631
1995	10,892	18,950	273	30,115
1996	15,238	18,937	198	34,373
1997	12,020	9,939	378	22,337
1998	22,987	8,455	176	31,617
1999	13,649	13,145	465	27,259
2000	17,765	19,230	n/a	36,994
2001	17,097	23,052	n/a	40,149
2002	*6,419*	*4,500*	n/a	*10,919*
Average (1960–01)	6,200	27,811	318	33,962

Provisional estimate for the first half of the year

Table 3.11.8.a.2 Anchovy in Subarea VIII (Bay of Biscay)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 1–3
1987	8497490	37164	15308	0.5401
1988	3466470	39877	15581	0.5948
1989	19308810	21306	10614	0.5336
1990	7467920	51291	34272	1.0520
1991	27378880	30791	19634	0.9013
1992	23985640	72368	37885	0.9021
1993	12681140	82507	40293	0.7053
1994	10411890	53563	34631	0.7742
1995	14232120	43363	30115	0.8607
1996	18220110	40128	34373	1.2126
1997	28780120	46182	22337	0.5170
1998	14268800	96087	31617	0.3538
1999	25530960	77885	27259	0.3573
2000	32708580	97971	36994	0.4475
2001	4356450	126033	40564	0.3331
2002[1]	7827774	58129		0.3331
Average	16195197	60915	28765	0.6512

[1] Assumed

3.11.8.b Anchovy in Division IXa

State of stock/exploitation: No precautionary approach reference points have been proposed for this stock and the state of the stock in relation to safe biological limits is unknown.

Management objectives: There are no explicit management objectives for this stock.

Precautionary reference points: At present, there is not sufficient information to estimate appropriate reference points

Advice on management: ICES recommends that catches in 2003 be restricted to 4 700 t (mean catches from the period 1988–2001 (excluding 1995, 1998, and 2001). This level should be kept until the response of the stock to the fishery is known.

Relevant factors to be considered in management: There are large inter-annual fluctuations in the spawning stock due to the short life span of anchovy. The fishery depends largely on the incoming year class, the abundance of which cannot be estimated before it has entered the fishery. Therefore in-year monitoring and management should be considered.

Elaboration and special comments: There is a regular fishery for anchovy in Division IXa South (Gulf of Cadiz). The fleets in the northern part of Division IXa occasionally target anchovy when abundant, as occurred in 1995. The anchovy in Division IXa South has different biological characteristics and dynamics from the anchovy in other parts of Division IXa. The anchovy population in Division IXa South appears to be well established and relatively independent from populations in other parts of Division IXa. These other populations seem to be abundant only when suitable environmental conditions occur. Catch statistics for Division IXa South are available from Portugal since 1943 and from Spain since 1988. Spanish data from before 1988 include catches from other areas.

In 2000 catches in Division IXa South decreased, probably as a result of a large reduction in the fishing effort by the Barbate single-purpose purse-seine fleet. Most of these vessels accepted a tie-up scheme in 2000 and 2001 because the EU-Morocco Fishery Agreement was not renewed. ICES notes that there is a potential for a rapid increase in the effort directed towards this stock which is undesirable.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10–19 September 2002 (ICES CM 2003/ACFM:07).

Catch data (Table 3.11.8.b.1):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings
1987	Not assessed	-	4.6	n/a
1988	Not assessed	-	6	4.7
1989	Not assessed	-	6	6.0
1990	Not assessed	-	9	6.5
1991	Not assessed	-	9	5.9
1992	Not assessed	-	12	3.2
1993	If required, precautionary TAC	-	12	2.0
1994	If required, precautionary TAC	-	12	3.4
1995	If required, precautionary TAC	-	12	13.0
1996	If required, precautionary TAC	-	12	4.6
1997	If required, TAC at pre-95 catch level	-	12	5.3
1998	No advice		12	11.0
1999	If required, TAC at pre-95 catch level	4.6	13	7.4
2000	Fishery less than pre-95 level and develop and implement management plan	4.6	10	2.5
2001	Average catch excl. 95 and 98	4.9	10	9.1
2002	Average catch excl. 95 and 98	4.9	8	
2003	Average catch excl. 95, 98, and 01	4.7		

[1]TAC for Subareas IX and X and CECAF 34.1.1. n/a=not available. Weights in '000 t.

Anchovy in Division IXa

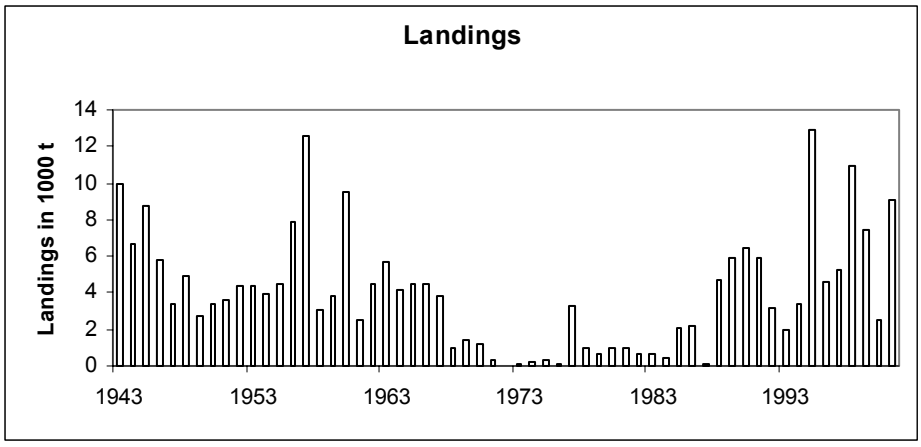


Table 3.11.8.b.1 Portuguese and Spanish annual landings (t) of Anchovy in Division IXa (From Pestana, 1989 and 1996 and Working Group members). (-) Not available. (0) Less than 1 t.

	Portugal				Spain			
Year	IXa C-N	IXa C-S	IXa South	Total	IXa North	IXa South	Total	TOTAL
1943	7121	355	2499	9975	-	-	-	-
1944	1220	55	5376	6651	-	-	-	-
1945	781	15	7983	8779	-	-	-	-
1946	0	335	5515	5850	-	-	-	-
1947	0	79	3313	3392	-	-	-	-
1948	0	75	4863	4938	-	-	-	-
1949	0	34	2684	2718	-	-	-	-
1950	31	30	3316	3377	-	-	-	-
1951	21	6	3567	3594	-	-	-	-
1952	1537	1	2877	4415	-	-	-	-
1953	1627	15	2710	4352	-	-	-	-
1954	328	18	3573	3919	-	-	-	-
1955	83	53	4387	4523	-	-	-	-
1956	12	164	7722	7898	-	-	-	-
1957	96	13	12501	12610	-	-	-	-
1958	1858	63	1109	3030	-	-	-	-
1959	12	1	3775	3788	-	-	-	-
1960	990	129	8384	9503	-	-	-	-
1961	1351	81	1060	2492	-	-	-	-
1962	542	137	3767	4446	-	-	-	-
1963	140	9	5565	5714	-	-	-	-
1964	0	0	4118	4118	-	-	-	-
1965	7	0	4452	4460	-	-	-	-
1966	23	35	4402	4460	-	-	-	-
1967	153	34	3631	3818	-	-	-	-
1968	518	5	447	970	-	-	-	-
1969	782	10	582	1375	-	-	-	-
1970	323	0	839	1162	-	-	-	-
1971	257	2	67	326	-	-	-	-
1972	-	-	-	-	-	-	-	-
1973	6	0	120	126	-	-	-	-
1974	113	1	124	238	-	-	-	-
1975	8	24	340	372	-	-	-	-
1976	32	38	18	88	-	-	-	-
1977	3027	1	233	3261	-	-	-	-
1978	640	17	354	1011	-	-	-	-
1979	194	8	453	655	-	-	-	-
1980	21	24	935	980	-	-	-	-
1981	426	117	435	978	-	-	-	-
1982	48	96	512	656	-	-	-	-
1983	283	58	332	673	-	-	-	-
1984	214	94	84	392	-	-	-	-
1985	1893	146	83	2122	-	-	-	-
1986	1892	194	95	2181	-	-	-	-
1987	84	17	11	112	-	-	-	-
1988	338	77	43	458	-	4263	4263	4721
1989	389	85	22	496	118	5336	5454	5950
1990	424	93	24	541	220	5726	5946	6487
1991	187	3	20	210	15	5697	5712	5922
1992	92	46	0	138	33	2995	3028	3166
1993	20	3	0	23	1	1960	1961	1984
1994	231	5	0	236	117	3036	3153	3389
1995	6724	332	0	7056	5329	571	5900	12956
1996	2707	13	51	2771	44	1780	1824	4595
1997	610	8	13	632	63	4600	4664	5295
1998	894	153	566	1613	371	8977	9349	10962
1999	957	96	355	1408	413	5587	6000	7408
2000	71	61	178	310	10	2182	2191	2502
2001	397	19	439	855	27	8216	8244	9098

3.11.8.c Answer to EC request on harvest strategies for anchovy

DG Fish has requested ICES to consider:

> *In relation to short lived species such as anchovy there is need to develop case specific harvest strategies, these should:*
>
> - *Take into account the specific life history of such species while at the same time allowing harvest close to long term maximum yield*
> - *The form of advice contains some but not all of the requested information and the advice could be developed further by clear statements of the nature of the risk incurred crossing the reference points, time horizon over which the risk is assessed and the consequences for the long-term yield of various Fs. It is therefore important that the advice is accompanied by statements in relation to:*
> - *The nature of the risk of immediate collapse as opposed to risks in medium or long term;*
> - *The risk created by not taking appropriate remedial actions, including the risk created by not taking action at all.*

ICES Comments:

ICES has so far not been able to address this topic in full. Partial answers have been provided by STECF, 1999 and by Uriarte and Rueda in a working paper to the ICES Mackerel Assessment Working Group in 2001. There has also been done work on improving the predictability of anchovy recruitment through monitoring of environmental variables. A simulation framework to evaluate the benefits of using environmentally-linked recruitment predictors in the management of anchovy-like stocks is being devised for 2002 (Barange, 2001).

Harvest Control Rules for Anchovy

Scientific advice for the management of the fishery through TACs rely in assumptions about future recruitment, either derived through direct surveys or by indirect forecasts of the recruitment.

The population dynamics of anchovy, with a very short lifespan and with the spawning stock and catch consisting mainly of ages 1 and 2, makes this stock difficult to manage by annual TACs because most of the stock (in some years over 90%) in the TAC year consists of year classes that are unknown at the time of the advice. The would require a mid-term stock evaluation based on fishery and survey results, which causes additional work; therefore, ICES in 2000 and again STECF in November 2000 (STCEF2000) suggested that a two-stage regime might be implemented only if the spawning biomass was below some threshold value.

To avoid the possibility of advising a TAC that could turn out to be too high resulting in excessive fishing mortality and stock depletion, the incoming recruitment will have to be assumed at a low level. This results in a cautious primary advice, but would allow an increase in the TAC in the second half of the year if a mid-year revision showed that the stock could sustain a higher TAC. This would be in accordance with the precautionary approach.

ICES continues to provide advice in accordance with its previous proposal: a two-stage regime, where a preliminary TAC is set at the beginning of the year based on an analytic assessment in the autumn, and revised according to the fishery in the first half of the year, and survey results obtained in May-June from acoustic and Daily Egg Production Method (DEPM). In order to be precautionary, the preliminary TAC set at the beginning of the year aims at keeping the stock safely above $\mathbf{B}_{lim}$ even if the incoming year class is poor.

References:

Barange, M. (Ed.) 2001: Report of the 1st meeting of the SPACC/IOC Study Group on "Use of environmental indices in the management of pelagic fish populations" (3–5 Sept. 2001, Cape Town, South Africa). GLOBEC Special Contribution No 5, 122 pp.

STECF-SGRST 1999. Report of the Meeting to provide the Commission with scientific background in order to define a managment strategy for the stock of anchovy in the Bay of Biscay (ICES Subarea VIII), Brussels 21–25 February 1999.

3.12 Widely Distributed and Migratory Stocks

3.12.1 Overview

A number of stocks assessed by ICES are not confined to the individual areas considered in other sections of this report. They include species with stock units that are distributed over much wider areas such as hake and a number of deepwater species, and migratory species such as mackerel, horse mackerel, and blue whiting.

The Northern hake is fished throughout Subareas IV, VI, VII, and VIII. The spawning stock biomass, which is estimated to be about 115 400 t in 2002, has been at a low level for a number of years and is considered to be outside safe biological limits. The landings, which are mainly taken by Spain and France, have decreased in recent years and the 2001 landings of 37 200 t were the second lowest recorded for over twenty years. Recruitment has been very poor in 1997–2000 and the stock is not expected to increase unless there is a substantial reduction in fishing mortality.

The Northeast Atlantic mackerel stock, which is considered to consist of three spawning components (North Sea, Western, and Southern), is fished over a very wide area extending throughout Subareas II, IV, VI, VII, and VIII. Considerable mixing of the components occurs at various times throughout the year. The fishery is conducted by a number of countries, but Norway, United Kingdom, Russia, Ireland, the Netherlands, and Spain take the main catches. The total catch in 2001 was estimated to be almost 678 000 t. The spawning stock has increased in recent years and in 2002 was estimated to be over 3.1 million t. This high SSB is expected to be maintained in the future if fishing mortality is reduced to below $\mathbf{F}_{pa}$.

The Western horse mackerel fishery extends throughout Subareas IV, VI, VII, and VIII. The stock is exploited by a number of countries; Netherlands and Ireland take the main catches. The catch in 2001 was estimated to be about 191 000 t, which is slightly more than in 2000. The stock is inside safe biological limits. Following the outstanding 1982 year class, which for more than a decade contributed a significant part of the catches, recruitment of horse mackerel has been weak. SSB is bound to be low as this year class is fished out and the sustainable yield is unlikely to be higher than about 130 000 t per year.

The Northern blue whiting stock is fished in Subareas II, V, VI, and VII and by a number of countries, mainly by Norway, Russia, Iceland, Denmark, Faroe Islands, United Kingdom, and Ireland. The 2001 catches were almost 1.8 million t and were the highest ever recorded from the fishery. Most of these catches were landed for industrial purposes. The spawning stock that in 2001 was estimated to be 2.7 million t, has been boosted by an excellent recruitment in recent years. However, it is expected that the stock will rapidly decline in the near future as it is unlikely that recruitment will be able to maintain the present high catches.

3.12.2 Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)

State of stock/exploitation: The stock is outside safe biological limits. Fishing mortality has been above $\mathbf{F}_{pa}$ for the entire period of the assessment, which is since 1978, and has even been above $\mathbf{F}_{lim}$ in most years since 1988. Current F is below $\mathbf{F}_{lim}$. SSB has generally declined till the early 1990s and has stabilised at a low level since. SSB has been below $\mathbf{B}_{pa}$ since 1988, and even below $\mathbf{B}_{lim}$ for most years since 1990. Recruitment estimates for 1997-2000 are the lowest recorded. Recruitment in 2001 is average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 120 000 t, the lowest observed biomass in the 1998 assessment.	$\mathbf{B}_{pa}$ be set at 165 000 t. Biomass above this affords a high probability of maintaining SSB above $\mathbf{B}_{lim}$, taking into account the uncertainty in assessments.
$\mathbf{F}_{lim}$ is 0.28, the fishing mortality above which stock dynamics are unknown.	$\mathbf{F}_{pa}$ be set at 0.20. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$ and a 50% probability of maintaining SSB above $\mathbf{B}_{pa}$ in the next 10 years, taking into account the uncertainty in assessments.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim}$ x 1.4.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$.	$\mathbf{F}_{pa} \sim \mathbf{F}_{lim}$ * 0.72, implies a less than 10% probability that ($\mathbf{SSB}_{MT} < \mathbf{B}_{pa}$).

Advice on management: In light of the general reduction in SSB and the generally poor recruitment since 1997, ICES recommends that a recovery plan be implemented to ensure safe and rapid recovery of SSB above 165 000 t. ICES considers the recovery plan identified as STECF scenario 8 ($\mathbf{F}_{pa}$ limit on annual fishing mortality, 20% annual limit on TAC change, and 20% annual biomass increase, given in the order of priority) to be consistent with the Precautionary Approach. This recovery plan requires an increase in SSB that is likely to be detectable on an annual basis given current assessment uncertainty, allows for a relative rapid recovery of the SSB to $\mathbf{B}_{pa}$ in about 7 years, and incorporates a modest degree of change in annual TAC to moderate disruption of the fisheries.

Such a recovery plan can only be implemented if there is full compliance by all fisheries harvesting Northern hake. This in turn requires strong support from the fisheries for the provision of the plan, and effective monitoring of the fisheries and enforcement of the fishery regulations. This will also require effective control of effort in these mixed species fisheries at levels reduced substantially from recent levels.

If the above recovery plan is adopted this corresponds to a catch of less than 21 600 t, and this implies an effort reduction of around 50% in 2003.

If such a recovery plan is not implemented, ICES recommends that fishing mortality on hake should be as close to zero as possible.

Rebuilding plan: Rebuilding of the hake stock can be obtained by reducing the fishing mortality, or by a reduction in F combined with an improvement of the selection pattern.

The minimum legal mesh-size was increased from 55/65 mm to 70 mm in the Bay of Biscay since 1 January 2000. An emergency plan for Northern Hake was implemented on 1 September 2001. This plan combines a low TAC for 2001 and 2002, and requires the use of mesh size of 100 mm for trawlers targeting hake in the Bay of Biscay and for trawlers operating in two non-*Nephrops* areas (one in the Bay of Biscay, one in the Celtic Sea). ICES has not been able to quantify the likely impact of these changes in mesh size, but, since hake is a late maturing fish, any improvement in the selection pattern that reduces the catch of younger fish (ages 0-2, ~ less than 30 cm) will have little short term effect on SSB and only increase SSB in the medium term. At *status quo* F and with no catch of hake of ages 0-1 in 2002 and no catch at ages 0-2 in 2003 onwards, SSB in 2007 is expected to be 18% higher above what is expected if the the current selection pattern is maintained. Even this 18 % higher SSB is still below $\mathbf{B}_{pa}$. But, such an improvement of the selection pattern would increase the probability that a reduction in fishing mortality will allow the rebuilding of SSB.

However, an improvement in the selection pattern alone is unlikely to be sufficient to reduce exploitation to the level needed to rebuild the hake stock. To reach this goal additional reductions in mortality are needed.

An update of the STECF Harvest Control Rule scenario 8 is summarised below. For 2002 it is assumed that fishing mortality will be at *status quo*; for 2003 a TAC constraint is applied, with a TAC 20% lower than that actually set for 2002, i.e. 0.8*27 000 tons =21 600 t. In 2001 landings were well above the TAC:

- In 2003, the decrease in landings between 2002 and 2003 is around 45%, and SSB is expected to increase by around 15%.

- For 2004 onwards, following the specified HCR would lead to the stock recovery in about 6 years, in more than 80% of the simulations.

ICES reiterates the statement made by STECF, "the values of the outcomes of the harvest control rules should NOT be interpreted as absolute. They are presented as values which are conditional on a number of assumptions made within the forecast model, and are better considered to be relative values to be compared one to another."

Reducing fishing mortality by setting the TAC at a low level has been shown to be ineffective due to TAC overshot and/or misreporting. ICES, therefore, recommends that in addition to TAC constraints, restrictions in effort of fleets exploiting/targeting hake should be implemented. Closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort.

Relevant factors to be considered in management: A fishing mortality of zero in 2003 is not expected to rebuild SSB to $\mathbf{B}_{pa}$ by 2004.

Given the state of the stock, and the risk of impaired recruitment, any further delay in the definition/implementation of a recovery plan will be prejudicial to the stock and the fastest possible rebuilding to $\mathbf{B}_{pa}$ is strongly advised.

The 20% constraint on annual change in TAC means that fishing mortality will not be sufficiently reduced in 2003 to produce a 20% increase in SSB in the short term. Adoption of the rebuilding plan requires a long-term commitment not to increase TAC by more than the 20% constraint once SSB begins to rebuild.

The advised recovery plan is based on a model scenario that includes a number of assumptions. These assumptions are considered reasonable given the current knowledge, but monitoring of the stock, ecosystem, and fisheries during the rebuilding period may reveal that some of the assumptions are not met. Major deviations from the assumptions may require changes to the rebuilding plan and/or expectations about the timeframe necessary for recovery.

The advised rebuilding plan is build on forecasts suggesting rebuilding in about 7 years. This is about as fast as recovery is possible without essentially implementing a total closure of the fisheries harvesting Northern hake.

Information from the fishery indicates a decrease in the amount of small hake caught in recent years. This might be explained by an improvement in the selection pattern, changes in fishing strategy, small fish becoming inaccessible to sampling, or simply a consequence of weak year classes in recent years and the enforcement of a minimum landing size.

The Spanish fleets operating in Subareas VI, VII, and VIII stopped fishing for one and a half months during the summer of 2002. Likewise in 2001, an important part of the Spanish (Basque) fleet fishing in Subarea VIII stopped its activity for one month in August.

Hake is caught in nearly all fisheries in Subareas VII and VIII. The LPUE series show different trends in different areas and between different fleets. Compared to 2000, LPUE in 2001 shows a 30% decrease for the two most important trawler fleets operating in Subarea VII (A Coruña and Vigo fleets), whilst remaining at a high level for the A Coruña fleet. In Subarea VII long-liners show an increase (+5%) in LPUE (kg/day), and gillnetters in Subarea VII+VIII (+8%). In Subarea VIII, there is no clear trend in the LPUE. However, even though there are some conflicting signals in LPUE between areas in recent years, the main concern is the overall declining trend in the stock size since the beginning of the assessment period (1978).

Catch forecast for 2003: Forecasts with an $\mathbf{F}_{sq}$ for 2002 are presented below.

Since the TAC in 2001 was overshot by more than 60%, and even though an emergency plan has been implemented since September 2001, there is no evidence that forecasts with a TAC constraint would be realistic.

Basis: F(2002) = $\mathbf{F}_{sq}$ = mean $F_{(99–01)}$ = 0.28; Landings(2002) = 40.1; Catch(2002) = 41.0; SSB(2003) = 109.4.

F(2003) Onwards	Basis	Catch (2003)	Landings (2003)	SSB (2004)
0	0	0	0	148.9
0.06	0.2*$\mathbf{F}_{sq}$	9.2	9.0	139.2
0.11	+20% SSB ~ 0.4*$\mathbf{F}_{sq}$	17.9	17.5	130.1
0.14[1]	-20%TAC~0.50*$\mathbf{F}_{sq}$	22.1	21.6	125.7
0.17	0.6*$\mathbf{F}_{sq}$	25.9	25.4	121.6
0.20	$\mathbf{F}_{pa}$	29.8	29.2	117.5
0.23	0.8*$\mathbf{F}_{sq}$	33.5	32.7	113.7
0.28	$\mathbf{F}_{sq}$	40.6	39.6	106.4

[1] Acceptable only if there is a long-term commitment to the specified recovery plan. Weights in '000 t.
Shaded scenarios are considered inconsistent with the precautionary approach.

Medium-term projections: Medium-term projections suggest that fishing at $\mathbf{F}_{pa}$ leads to a 50% probability of the stock exceeding $\mathbf{B}_{pa}$ in 2007, while fishing at the level required to allow a 15% increase in SSB per year leads to the same target in 2005-2006.

Comparison with previous assessment and advice: Estimates of fishing mortality and SSB in the current and last year's assessments are similar. This year's assessment did not consider catches of age 0 while these data were included in 2001. However, recruitment estimates remain very similar with the exception of the 1985 yearclass. This year's advice is similar to that of last year.

In this year's assessment, it was decided to remove the age 0 from the international catch-at-age matrix and from the commercial fleet data due to the enforcement of the minimum landing size and partial information on discards in recent years. Abundance indices for age 0 are available from surveys and are used in the assessment.

Elaboration and special comment: Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. In 2001, Spain took 60% of the landings, France 25%, UK about 6%, Denmark 3%, and Ireland 2%. Hake are caught throughout the year, the peak landings being made in spring-summer months. The three main gear types used by vessels fishing for hake as a target species are lines (E & W, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, a few pelagic ones (France), and recently also Very High Opening trawls (Spain).

Hake spawn from February through July along the shelf edge, the main areas extending from north of the Bay of Biscay to the south and west of Ireland. 0-groups descend to the seabed (at depths in excess of 200 m), moving to shallower water with a muddy seabed (75–120 m) by September. There are two major nursery areas: in the Bay of Biscay and off southern Ireland. Three-year-old hake begin to move into the shallower regions of the Bay of Biscay and Celtic Sea, but as they approach maturity they disperse to offshore regions.

Hake movements are indicated by the seasonal distribution of catches. From the beginning of the year until March/April hake are present in the North of the Bay of Biscay. They appear on the shelf edge in the Celtic Sea in June and July. Between August and December the hake fishery is centred to the west and southwest of Ireland, with a decline in catch rates in shallower waters.

Length composition data by fishery unit are available annually for 1978–1989 and quarterly for 1990–2001. Prior to 1992, these were converted to age compositions by numerical methods. For 1992–2001, age readings were used.

Investigations of some structural uncertainties in the assessment model have been carried out. The effects of increasing the current 8+ group to a 10+ group has been tested, even though the ageing of older fish using otoliths appears to be difficult. However, using a 10+ group reduces the sensitivity of SSB perception to model assumptions. In addition, differences in mean F trajectories between the 8+ and 10+ analyses are small, but become more pronounced as older ages are incorporated into the mean F calculation.

ACFM reiterates its May 2002 statement that: 'Revision of Biological Reference Points for northern hake would benefit from further investigations into the source of the instability in the assessment. Therefore, no revisions of the biological reference points are currently suggested even though the actual ones are considered to be possibly inappropriate'.

Source of information: Report of the Working Group on the Assessment of Hake, Monk and Megrim, May 2002 (ICES CM 2003/ACFM:01) and STECF Report.

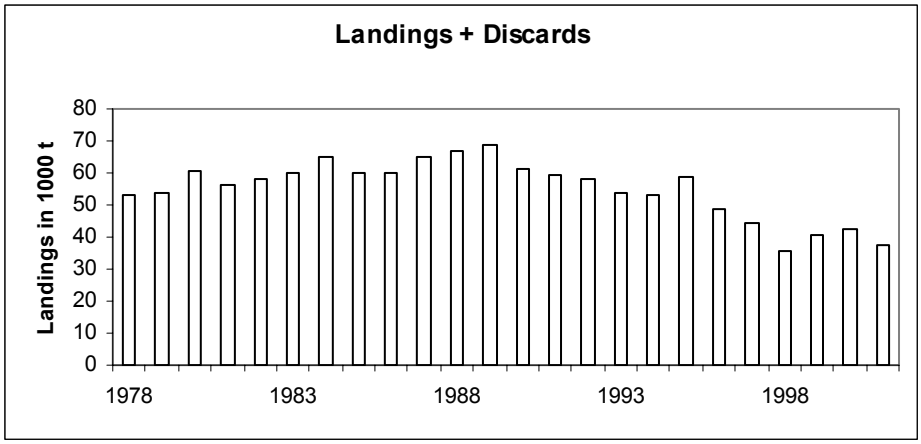
Yield and spawning biomass per Recruit
F-reference points:

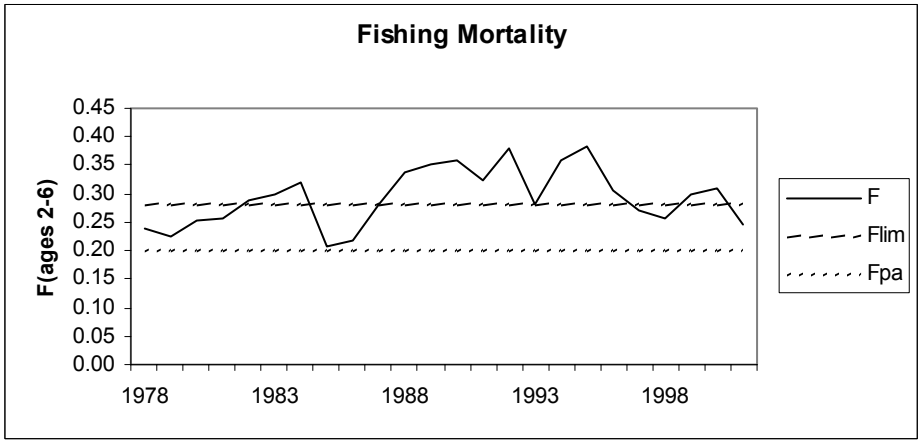
	Fish Mort Ages 2-6	Landings/R	SSB/R
Average Current	0.285	0.240	0.653
$\mathbf{F}_{max}$	0.174	0.256	1.137
$\mathbf{F}_{0.1}$	0.107	0.241	1.705
$\mathbf{F}_{med}$	0.280	0.241	0.667

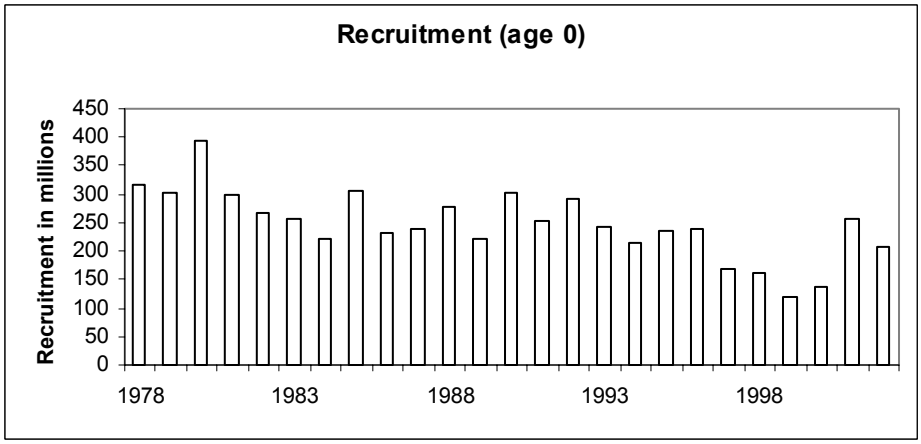
Catch data (Tables 3.12.2.1–2):

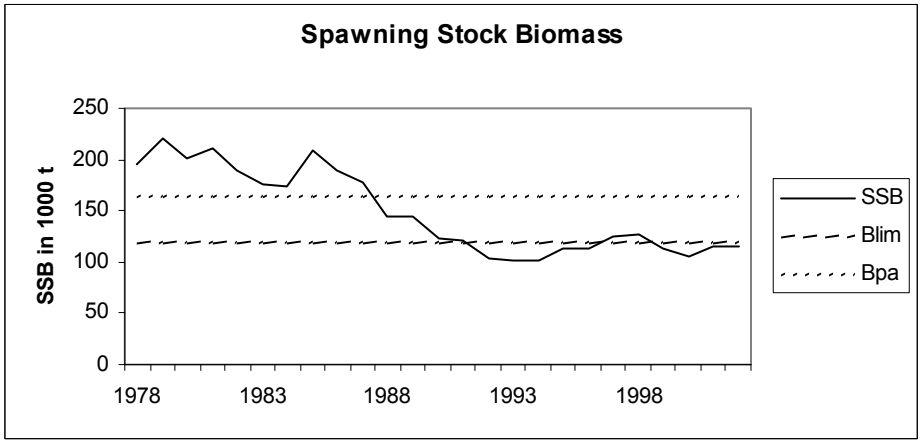
Year	ICES Advice	Predicted catch corresp to advice	Agreed TAC[1]	ACFM landings	Disc. slip.	ACFM catch
1987	Precautionary TAC; juvenile protection	-	63.5	63.4	2.0	65.3
1988	Precautionary TAC; juvenile protection	54	66.2	64.8	2.0	66.8
1989	Precautionary TAC; juvenile protection	54	59.7	66.5	2.3	68.8
1990	Precautionary TAC; juvenile protection	59	65.1	59.9	1.5	61.4
1991	Precautionary TAC; juvenile protection	59	67.0	57.6	1.7	59.3
1992	If required, precautionary TAC	61.5	69.0	56.6	1.7	58.3
1993	Enforce juvenile protection legislation	-	71.5	52.1	1.5	53.6
1994	F significantly reduced	<46	60.0	51.3	1.9	53.1
1995	30% reduction in F	31	55.1	57.6	1.2	58.9
1996	30% reduction in F	39	51.1	47.2	1.5	48.8
1997	20% reduction in F	54	60.1	42.6	1.8	44.4
1998	20% reduction in F	45[2]	59.1	35.0	0.8	35.8
1999	Reduce F below $\mathbf{F}_{pa}$	<36[2]	55.1	39.8	0.8	40.6
2000	50% reduction in F	<20[2]	42.1	42.0	0.6	42.6
2001	Lowest possible catch, rebuilding plan	-	22.6	36.7	0.5	37.2
2002	Lowest possible catch / rebuilding plan	-	27.0			
2003	Lowest possible catch / rebuilding plan	-				

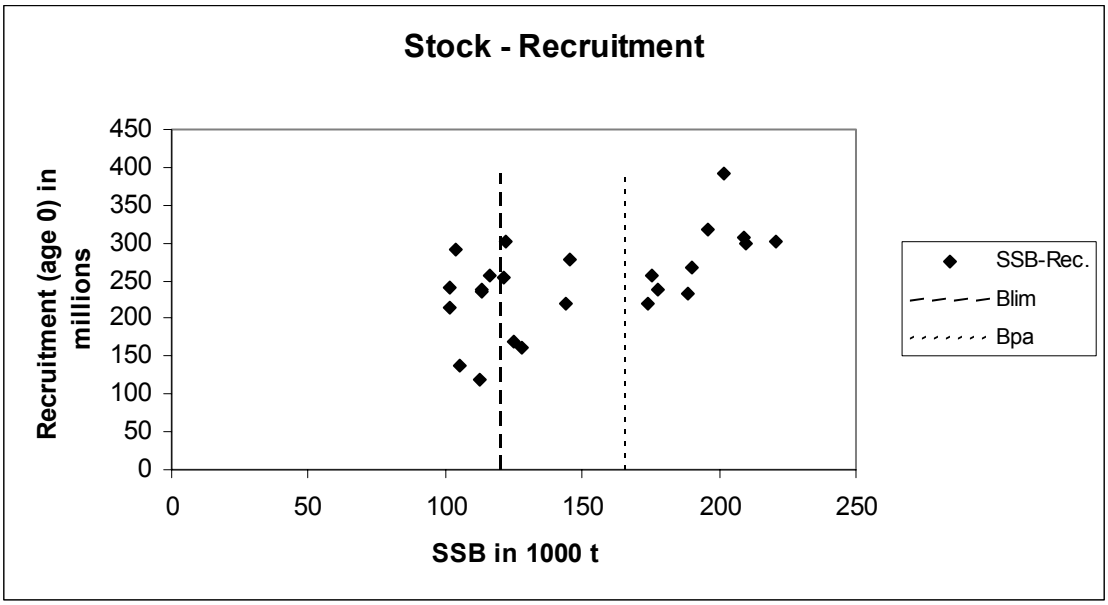
[1]Sum of area TACs corresponding to Northern stock plus Division IIa (EC zone only). [2]Landings. Weights in '000 t.

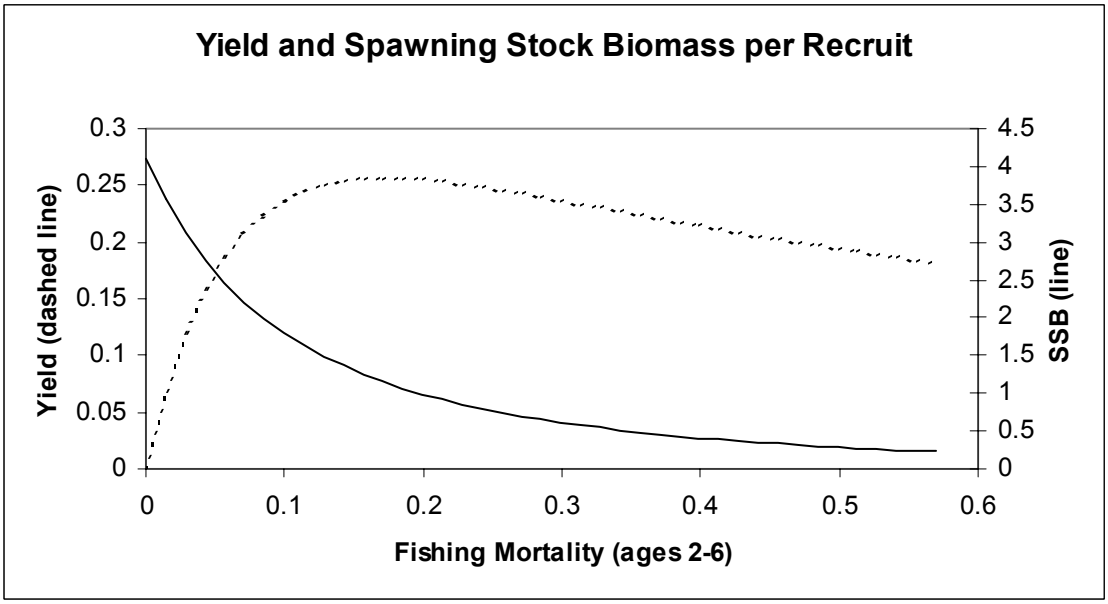

Landings + Discards
Landings in 1000 t
80
70
60
50
40
30
20
10
0
1978
1983
1988
1993
1998


Fishing Mortality
F(ages 2-6)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1978
1983
1988
1993
1998
F
Flim
Fpa


Recruitment (age 0)
Recruitment in millions
450
400
350
300
250
200
150
100
50
0
1978
1983
1988
1993
1998


Spawning Stock Biomass
SSB in 1000 t
250
200
150
100
50
0
1978
1983
1988
1993
1998
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
450
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.3
0.25
0.2
0.15
0.1
0.05
0
SSB (line)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 2-6)

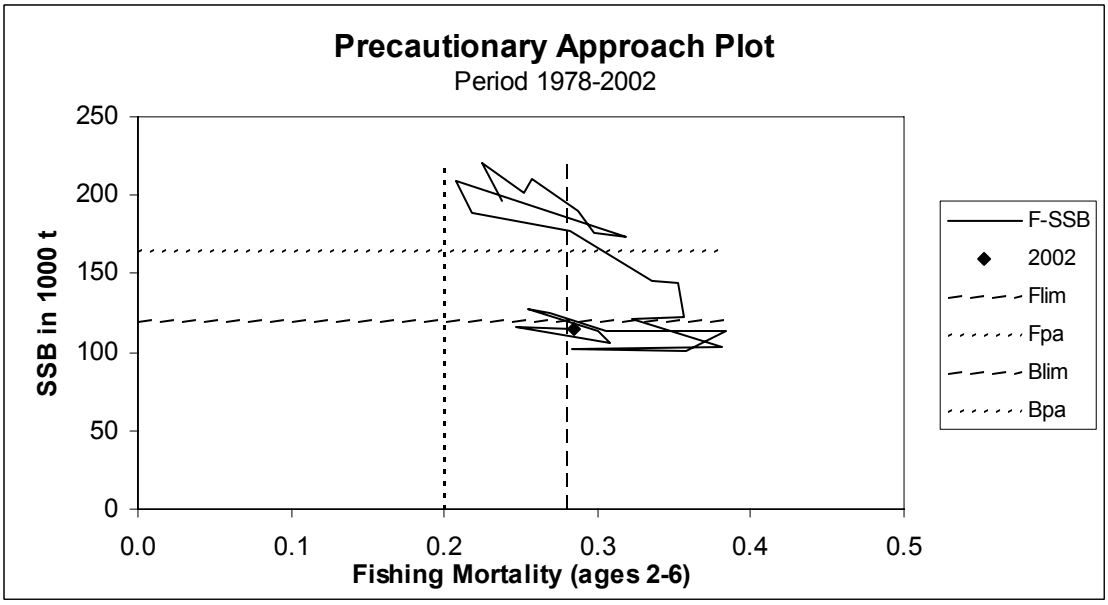

Precautionary Approach Plot
Period 1978-2002
SSB in 1000 t
250
200
150
100
50
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 2-6)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.12.2.1 Estimates of catches (‘000 t) for the Northern Hake by area for 1961–2001.

	Landings [1]					Discards [2]	Catches [3]
Year	IIIa+IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.4	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.1	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2

[1] Spanish data for 1961-1972 not revised, data for Subarea VIII for 1973-1978 include data for Divisions VIIIa,b only. Data for 1979-1981 are revised based on French surveillance data.
Includes Divisions IIIa, IVb,c from 1976.
There are some unallocated landings (moreover for the period 1961-1970).

[2] Discards have been estimated from 1978 and only for Divisions VIIIIa,b.

[3] From 1978 total catches used for the Working Group.

Table 3.12.2.2 Hake - Northern stock (IIIa, IV, VI, VII, VIIIa,b).

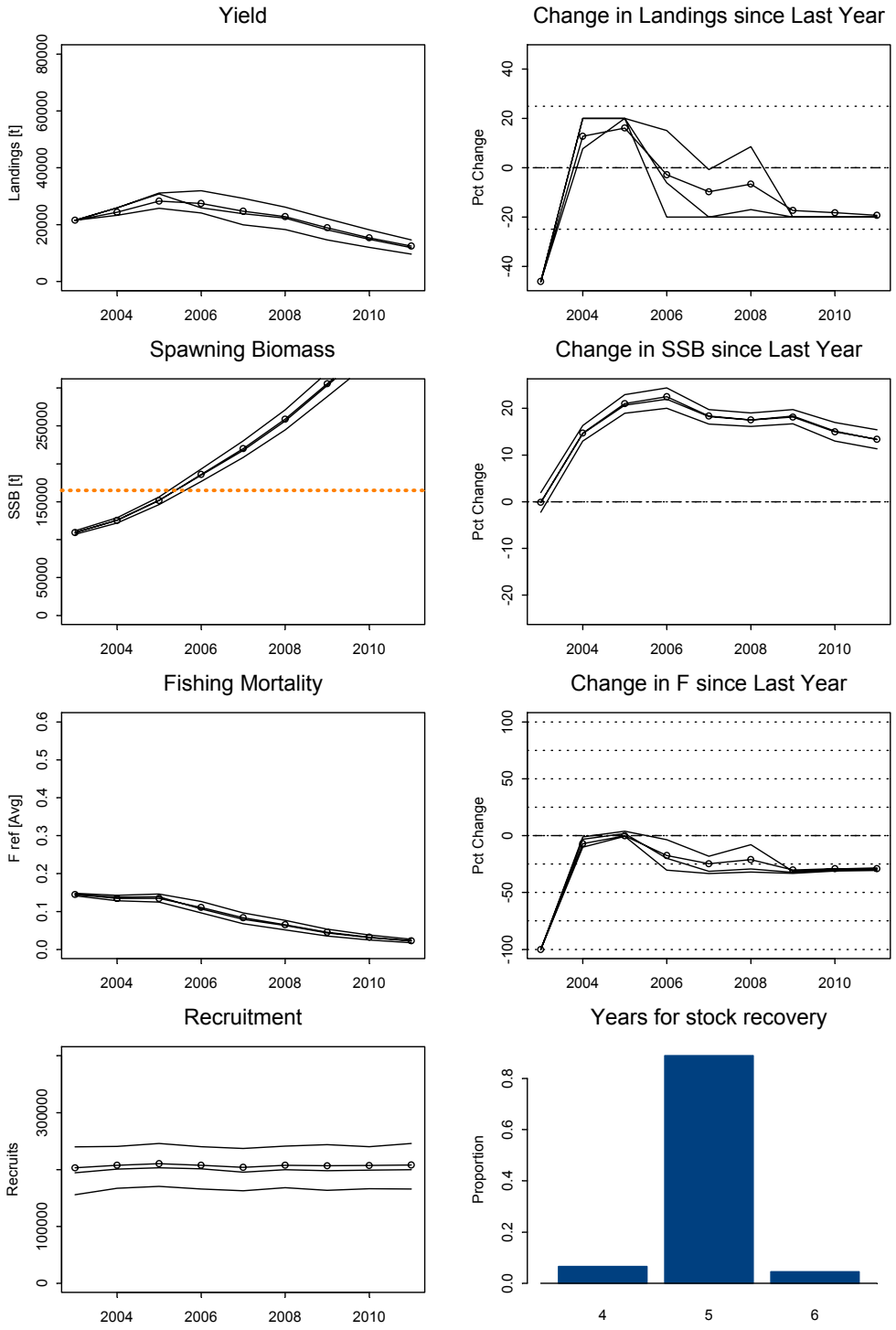
Year	Recruitment Age 0 thousands	SSB tonnes	Landings + Discards tonnes	Mean F Ages 2-6
1978	318000	196000	52900	0.238
1979	303000	221100	53800	0.224
1980	392000	202000	60500	0.252
1981	300000	210100	56300	0.257
1982	267000	190400	58100	0.287
1983	257000	175700	60100	0.298
1984	221000	173900	65100	0.319
1985	306000	209000	59900	0.207
1986	233000	188500	60100	0.218
1987	239000	177500	65300	0.282
1988	279000	145200	66800	0.336
1989	221000	143800	68800	0.353
1990	301000	122300	61400	0.357
1991	254000	121100	59300	0.323
1992	292000	103700	58300	0.381
1993	242000	101500	53600	0.283
1994	214000	101300	53100	0.358
1995	236000	113200	58900	0.384
1996	239000	113200	48800	0.306
1997	170000	125300	44400	0.269
1998	162000	127800	35900	0.255
1999	118000	112900	40600	0.300
2000	138000	105600	42600	0.308
2001	256000	116100	37200	0.247
2002	207000*	115400		0.285
Average	246600	148504	55075	0.293

* GM 89-00

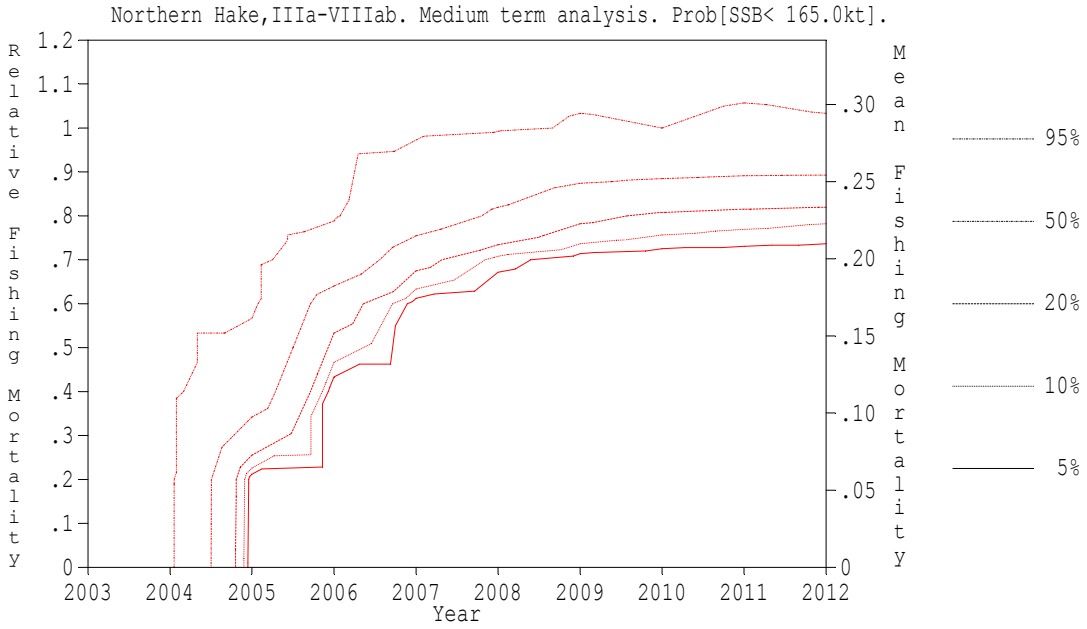
Northern Hake: CS simulation (update of STECF scenario 8):

$F<F_{pa}$
20% limit on Landings changes,
+20% in SSB

Ockham-razor S-R assumed. 10% bias.
Assuming *status quo* F in 2002
Starting simulations in 2003 with a TAC constraint of 0.8* TAC2002 (ie 21 584 t)



Note: Since the starting year is 2003, it is needed to add one year to the given 'years for stock recovery'



Medium-term projection starting in 2003 with population numbers from the status quo F catch forecast.

3.12.3 Mackerel

3.12.3.a Mackerel (combined Southern, Western and North Sea spawning components)

State of stock/exploitation: The combined stock is currently harvested outside safe biological limits. The spawning stock biomass in 2002 is estimated to be well above $\mathbf{B}_{pa}$, but the fishing mortality in 2001 is above $\mathbf{F}_{pa}$. The North Sea component remains severely depleted.

Management objectives: The agreed record of negotiations between Norway, Faroe Islands, and EU in 1999, states:

"For 2000 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality in the range of 0.15 - 0.20 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate."

"Should the SSB fall below a reference point of 2 300 000 tonnes (B_{pa}), the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions prevailing. Such adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 300 000 tonnes."

"The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES."

The rationale for ICES proposing $\mathbf{F}_{pa}$ = 0.17 is to have a high probability of avoiding exploiting the stock above $\mathbf{F}_{lim}$. In addition, projections indicate that F =0.17 will optimise long-term yield and at the same time result in a low risk for the stock to decrease below $\mathbf{B}_{pa}$. If F on average is kept below 0.17, ICES regards the management plan as meeting precautionary criteria.

Precautionary Approach reference points (established in 1998):

ICES considers that:	ICES proposes that:
There is no biological basis for defining $\mathbf{B}_{lim}$	$\mathbf{B}_{pa}$ be set at 2.3 million t
$\mathbf{F}_{lim}$ is 0.26, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$ be set at 0.17. This F is considered to provide approximately 95% probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in the assessments.

Technical basis:

	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$ in Western stock raised by 15%: = 2.3 million t.
$\mathbf{F}_{lim} = \mathbf{F}_{loss} = 0.26$	$\mathbf{F}_{pa} = \mathbf{F}_{lim}$ x 0.65. $\mathbf{F}_{0.1} = 0.17$

Advice on management: ICES advises a fishing mortality in 2003 of no more than $\mathbf{F}_{pa}$ (0.17), corresponding to landings in 2003 of less than 542 000 t. ICES advises that any agreed TAC should cover all areas where North-East Atlantic mackerel are fished.

The North Sea spawning component still needs the maximum possible protection.

- **There should be no fishing for mackerel in Divisions IIIa and IVb,c at any time of the year.**
- **There should be no fishing for mackerel in Division IVa during the period 1 February–31 July.**
- **The 30 cm minimum landing size at present in force in Subarea IV should be maintained.**

Relevant factors to be considered in management: Egg surveys were carried out in the western and southern spawning areas during February-July 2001 and in the North Sea spawning area in June 2002. The egg survey SSB estimates in 2001 of both the Western and the Southern area are lower than in 1998. The 2002 egg survey in the North Sea with limited spatial and temporal coverage indicates a higher egg production in the North Sea area than in 1999, due to a relatively strong 1999 year class.

The advised TAC for 2003 is lower than the advice for 2002. Last year ICES indicated that the catch projections for 2002 could be too optimistic. This comment was based on the observation that preliminary information from the egg surveys, carried out in 2001, showed a decline in both the Western and Southern area, indicating that the spawning stock could have been overestimated. This preliminary information has subsequently been confirmed. In the present assessment where this new egg survey information was used the estimate of the stock size is lower and the estimate of fishing mortality is higher compared to previous assessments.

The closure of the mackerel fishery in Divisions IVb,c and IIIa throughout the whole year is designed to

protect the North Sea component in this area and also the juvenile Western mackerel which are numerous, particularly in Division IVb,c during the second half of the year. This closure has unfortunately resulted in increased discards of mackerel in the non-directed fisheries (especially horse mackerel fisheries) in these areas as vessels at present are permitted to take only 10% of their catch as mackerel by-catch. No data on the actual size of mackerel by-catch are available, but the reported landings of mackerel in Divisions IIIa and IVb,c from 1997 onwards might seriously under-estimate catches due to discarded by-catch.

Closure of Division IVa for fishing during the first half of the year was recommended for several years. This was based on the perception that the western mackerel entered the North Sea in July/August, and stayed there until December before migrating back to their spawning areas. Updated observations taken in the late 1990s suggested that this return migration actually started in mid- to late February. This was believed to result in large-scale misreporting from the Northern part of the North Sea (Division IVa) to Division VIa. It was recommended that the closure date for IVa be extended to the 1st February. This was adopted for the 1999/2000 and the 2000/2001 fishing season. Misreporting from IVa to VIa occurred again in 2001. The reasons this misreporting in 2001 are unclear but are not thought to be linked to a change in the timing of the migration to spawning areas.

For mackerel, fishery independent data of the stock size becomes available only once every 3 year from egg-surveys. In the 2 years following the most recent egg-survey, the assessment is an extrapolation based on catch at age and landing data only. Inclusion of a new independent data point may result in quite large revisions of the stock size, fishing mortality and consequently catch predictions and TAC advice. In order to avoid large changes in TAC advice, ICES is investigating whether NE Atlantic mackerel is a suitable candidate to be managed by a multi-annual TAC. The spawning stock has been stable and well above $\mathbf{B}_{pa}$ over a long period. Also many age groups are well represented in the stock and annual fluctuations in recruitment are moderate. ICES has deferred from providing multi-annual advice this year because, it did not complete its work to evaluate the risks associated with specific annual TACs, but intends to consider the provision of multi-annual advice in future.

The Mackerel Box

A review of the utility of the mackerel box was undertaken. The review concluded that the loss of potential yield and the increased risk to the spawning stock of the NEA mackerel resulting from an opening of the box should be avoided. Consequently, the mackerel box should remain closed to targeted mackerel fishing. This is consistent with previous advice. For further comments see answer to special request from UK on the utility of the Western Mackerel Box.

ICES is aware that juvenile fish are sometimes taken in large quantities in other areas of the NEA mackerel stock distribution and is continually monitoring the situation. ICES will recommend management measures for those areas if appropriate.

Catch forecast for 2003:

Basis: F(2002) = F(99-01, unscaled)=$\mathbf{F}_{sq}$ = 0.20; Landings (2002) = 649;SSB(2002) = 3080.

F (2003)	Basis	SSB (2003)	Landings (2003)	Landings (2003) **N**	Landings (2003) **S**	SSB (2004)
0.15	Lower level of agreement by EU, Norway and Faroe	3007	482	452	30	3037
0.17	F=$\mathbf{F}_{pa}$	2986	542	508	34	2971
0.18		2975	568	533	35	2941
0.19		2964	597	560	37	2909
0.20	$\mathbf{F}_{sq}$=upper level of agreement by EU, Norway and Faroe	2954	629	590	39	2875

Weights in '000 t.

N: Northern area comprising the Western areas, North Sea, Skagerrak and Norwegian Sea (I, IIa, IIIa, IVa, Vb, VI, VII, VIIIa,b,d,e); catches in the international zone in IIa are included.

S: Southern area (VIIIc, IXa).

Shaded scenarios considered inconsistent with the precautionary approach.

The catches are allocated to areas according to the proportion of catch-at-age by area in recent years (1998-2000). This forecast is based on the assumption of no change in the spatial distribution of the population and stable fishing mortality levels.

Medium- and long-term projections: No medium- or long-term projections were carried out.

Comparison with previous assessment and advice: This year's assessment indicates that the recent level of the stock is significantly lower than predicted in the previous years. However, the spawning stock remains well above $\mathbf{B}_{pa}$, and is the largest in the time-series since 1977. The change in perception of recent SSB level is mainly caused by the inclusion of the 2001 egg survey biomass estimate, which required a change of a number of model parameter settings. However, comparative

assessments performed with different models resulted in similar SSB levels. This has also led to higher estimates of fishing mortalities and lower estimates of recruitments in recent years. These differences in the stock perception may reflect the uncertainty in the assessment, which was remarked by ICES in last year's advice.

Elaboration and special comment: No independent information is available on the most recent year classes before they are fully recruited to the fishery. In addition, the assessment model is sensitive to the most recent SSB estimate from the egg surveys leading to changes in the perception of the stock. Therefore a management regime, which is capable of incorporating this uncertainty in the advice is required. Specifically the management regime should consider the possibility that poor year classes are not recognised until several years later, and that the recent perception of the stock is subject to variability.

Little is known about discards in the mackerel fishery; however, sampling for discards has improved. ICES continues to recommend that observers should be placed on vessels in order to estimate discards in those fisheries where discarding of mackerel is perceived to be a problem.

The assessment data set on commercial landings was extended in 2002, including now the data series from 1972 onwards (previously it started in 1984).

Stock components: ICES currently uses the term "North East Atlantic Mackerel**"** to define the mackerel present in the area extending from ICES Division IXa in the south to Division IIa in the north, including mackerel in the North Sea and Division IIIa. The spawning areas of mackerel are widely spread, and only the area in the North Sea is sufficiently distinct to be clearly identified as a separate spawning component. Tagging experiments have demonstrated that after spawning, fish from Southern and Western areas migrate to feed in the Norwegian Sea and the North Sea during the second half of the year. In the North Sea they mix with the North Sea component. Since it is at present impossible to allocate catches to the stocks previously considered by ICES, they are at present, for practical reasons, considered as one stock: the North East Atlantic Mackerel Stock**.** Catches cannot be allocated specifically to spawning area components on biological grounds, but by convention the catches from the Southern and Western components are separated according to the area where they are taken.

In order to be able to keep track of the development of the spawning biomasses in the different spawning areas, the North East Atlantic mackerel stock is divided into three area components: the Western Spawning Component, the North Sea Spawning Component**,** and the Southern Spawning Component:

North-East Atlantic Mackerel			
Distributed and fished in ICES Subareas and Divisions IIa, IIIa, IV, Vb, VI, VII, VIII and IXa			
Spawning component	**Western**	**Southern**	**North Sea**
Spawning Areas	VI, VII, VIIIa,b,d,e.	VIIIc, IXa.	IV, IIIa.

The Western Component is defined as mackerel spawning in the western area (ICES Divisions and Subareas VI, VII, VIII a,b,d,e). This component currently comprises 85% of the entire North East Atlantic Stock (historically 61-85% (1972-2002)). Similarly, the Southern Component is defined as mackerel spawning in the southern area (ICES Divisions VIIIc and IXa). Although the North Sea component has been at an extremely low level since the early 1970s, ACFM regards the North Sea Component as still existing. This component spawns in the North Sea and Skagerrak (ICES Subarea IV and Division IIIa). Current knowledge of the state of the spawning components is summarised below:

Western Component: The catches of this component were low in the 1960s, but increased to more than 800 000 t in 1993. The main catches are taken in directed fisheries by purse seiners and mid-water trawlers. Large catches of the western component are taken in the northern North Sea and in the Norwegian Sea. The 1996 catch was reduced by about 200 000 t, compared with 1995, because of a reduction in the TAC. The catches since 1998 have been stable. The SSB of the Western Component declined in the 1970s from above 3.0 million t to 2.2 million t in 1994, but was estimated to have increased to 2.7 million t in 1999. A separate assessment for this stock component is no longer required, as a recent extension of the time-series of NEA mackerel data now allows the estimation of the mean recruitment from 1972 onwards. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of 14% between 1998 and 2001.

North Sea Component: Very large catches were taken in the 1960s in the purse seine fishery, reaching a maximum of about 1 million t in 1967. The component subsequently collapsed and catches declined to less than 100 000 t in the late 1970s. Catches during the last five years have been assumed to be about 10 000 t. The 2002 egg survey in the North Sea with limited spatial and temporal coverage indicates a higher egg production in the North Sea area than in 1999, due to a relatively strong 1999 year class. However, this component is still considered to be severely depleted and outside safe biological limits.

Southern Component: Mackerel is a target species for the hand line fleet during the spawning season in Division VIIIc, during which about one third of the total catches are taken. It is taken as a by-catch in other fleets. The highest catches (87%) from the Southern Component are taken in the first half of the year, mainly from Division VIIIc, and consist of adult fish. In the second half of the year catches consist of juveniles and are mainly taken in Division IXa. Catches from the Southern Component increased from about 20 000 t in the early 1990s to 44 000 t in 1998, and are currently at the same level. Estimates of the spawning stock biomass, derived from egg surveys, indicate a decrease of about 50% between 1998 and 2001. However, the SSB estimated in 2001 is similar to the survey estimates in 1995.

Combined Assessment: Analytic ICA assessment is based on catch numbers-at-age for the period 1972–2001 and egg survey estimates of SSB from 1992, 1995, 1998, and 2001. Exploratory assessment using different assessment models gave comparable results.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10-19 September 2002 (ICES CM 2003/ACFM:07).

Mackerel Combined
Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average Current	0.199	0.148	0.723
$\mathbf{F}_{max}$	0.656	0.171	0.298
$\mathbf{F}_{0.1}$	0.188	0.146	0.749
$\mathbf{F}_{med}$	0.204	0.149	0.712

Catch data for combined area (Tables 3.12.3.a.1-6):

Year	ICES Advice	Predicted catch corresp. to advice	Total Agreed TAC[4]	Official landings	Disc.[1] slip	ACFM landings[2]
1987	Given by stock component		442	589	11	655
1988	Given by stock component		610	621	36	676
1989	Given by stock component		532	507	7	586
1990	Given by stock component		562	574	16	626
1991	Given by stock component		612	599	31	668
1992	Given by stock component		707	723	25	760
1993	Given by stock component		767	778	18	825
1994	Given by stock component		837	792	5	823
1995	Given by stock component		645	660	8	756
1996	Significant reduction in F	-	452	493	11	564
1997	Significant reduction in F	-	470	434	19	570
1998	F between 0.15 and 0.2	498	549	647	8	667
1999	F of 0.15 consistent with PA	437	562	595	n/a	609
2000	F=0.17: $\mathbf{F}_{pa}$	642	612	579	2	667
2001	F=0.17: $\mathbf{F}_{pa}$	665	670	620	1	676
2002	F=0.17: $\mathbf{F}_{pa}$	694	683			
2003	F=0.17: $\mathbf{F}_{pa}$	542				

[1]Data on discards and slipping from only two fleets. [2]Landings and discards from IIa, IIIa, IV, Vb, VI, VII, VIII, and IXa. [4]All areas except some catches in international waters in II. n/a=not available. Weights in '000 t.

Catch data for western component (Tables 3.12.3.a.4 and 7):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	Disc. slip	ACFM landings[2]
1987	SSB = 1.5 mill. t; TAC	380	405	11	615
1988	F = $\mathbf{F}_{0.1}$; TAC; closed area; landing size	430	573[1]	36	628
1989	Halt SSB decline; TAC	355	495[1]	7	567
1990	TAC; F = $\mathbf{F}_{0.1}$	480	525[1]	16	606
1991	TAC; F = $\mathbf{F}_{0.1}$	500	575[1]	31	646
1992	TAC for both 1992 and 1993	670	670[1]	25	742
1993	TAC for both 1992 and 1993	670	730[1]	18	805
1994	No long-term gains in increased F	831[3]	800[1]	5	798
1995	20% reduction in F	530	608[1]	8	729
1996	No separate advice	-	422[1]	11	529
1997	No separate advice	-	416[1]	19	529
1998	No separate advice	-	514[1]	8	623
1999	No separate advice	-	520[1]	0	565
2000	No separate advice	-	573[1]	2	631
2001	No separate advice	-	630[1]	1	634
2002	No separate advice	-	642[1]		
2003	No separate advice	-			

[1]TAC for mackerel taken in all areas VI, VII, VIIIa,b,d, Vb, IIa, IIIa, IVa. [2]Landings and discards of Western component; includes catches of North Sea component. [3]Catch at *status quo* F. Weights in '000 t.

Catch data for North Sea component (Tables 3.12.3.a.3 and 8):

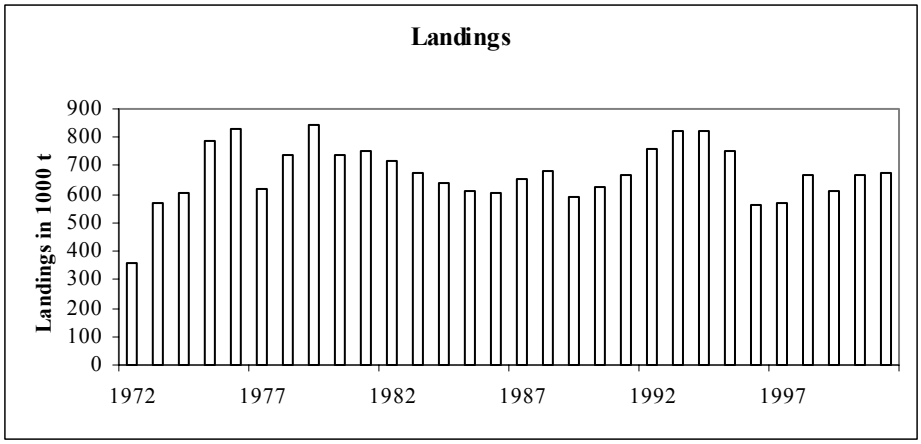
Year	ICES Advice	Predicted catch corresp. to advice[1]	Agreed TAC[2]	ACFM landings[3]
1987	Lowest practical level	LPL	55	3
1988	Closed areas and seasons; min. landing size; by-catch regulations	LPL	55	6
1989	Closed areas and seasons; min. landing size; by-catch regulations	LPL	49.2	7
1990	Closed areas and seasons; min. landing size; by-catch regulations	LPL	45.2	10
1991	Closed areas and seasons; min. landing size; by-catch regulations	LPL	65.5	-[4]
1992	Closed areas and seasons; min. landing size; by-catch regulations	LPL	76.3	[4]
1993	Maximum protection; closed areas and seasons; min landing size	LPL	83.1	-[4]
1994	Maximum protection; closed areas and seasons; min landing size	LPL	95.7	-[4]
1995	Maximum protection; closed areas and seasons; min landing size	LPL	76.3	-[4]
1996	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1997	Maximum protection; closed areas and seasons; min landing size	LPL	52.8	-[4]
1998	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
1999	Maximum protection; closed areas and seasons; min landing size	LPL	62.5	-[4]
2000	Maximum protection; closed areas and seasons; min landing size	LPL	69.7	-[4]
2001	Maximum protection; closed areas and seasons; min landing size	LPL	71.4	-[4]
2002	Maximum protection; closed areas and seasons; min landing size	LPL	72.9	-[4]
2003	Maximum protection; closed areas and seasons; min landing size	LPL		

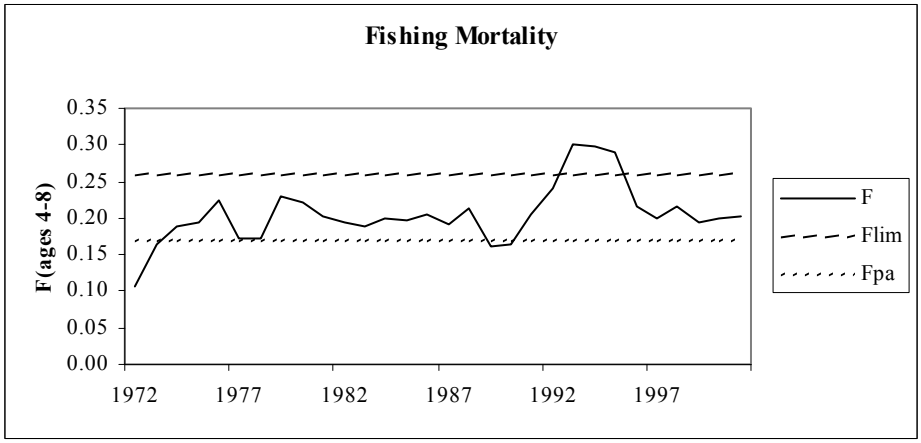
[1]Subarea IV and Division IIIa. [2]TAC for Subarea IV, Divisions IIIa, IIIb,c,d (EU zone), and Division IIa (EU zone). [3]Estimated landings of North Sea component. [4]No information. Weights in '000 t.

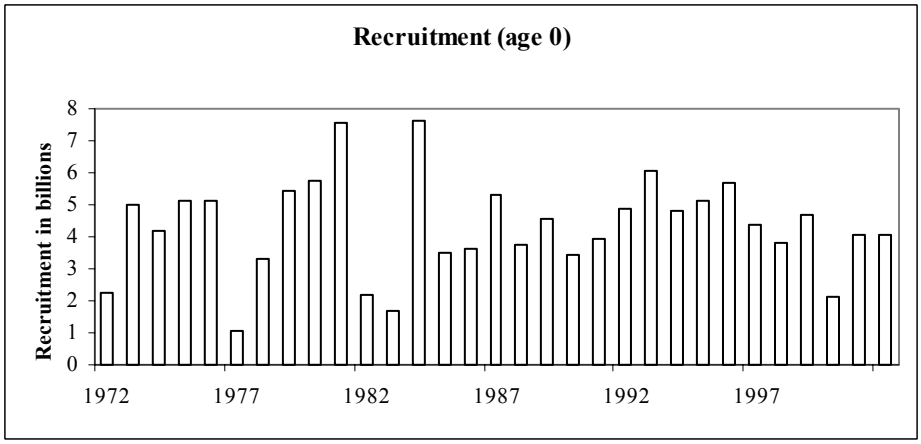
Catch data for southern component (Table 3.12.3.a.5):

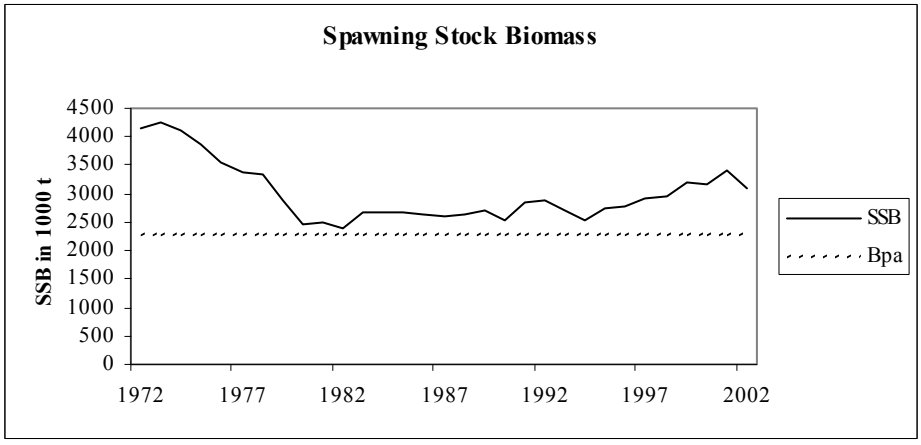
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings
1987	Reduce juvenile exploitation	-	36.57	22
1988	Reduce juvenile exploitation	-	36.57	25
1989	No advice	-	36.57	18
1990	Reduce juvenile exploitation	-	36.57	21
1991	Reduce juvenile exploitation	-	36.57	21
1992	No advice	-	36.57	18
1993	No advice	-	36.57	20
1994	No advice	-	36.57	25
1995	No advice	-	36.57	28
1996	No separate advice	-	30.00	34
1997	No separate advice	-	30.00	41
1998	No separate advice	-	35.00	44
1999	No separate advice	-	35.00	44
2000	No separate advice	-	39.20	36
2001	No separate advice	-	40.18	43
2002	No separate advice	-	41.1	
2003	No separate advice	-		

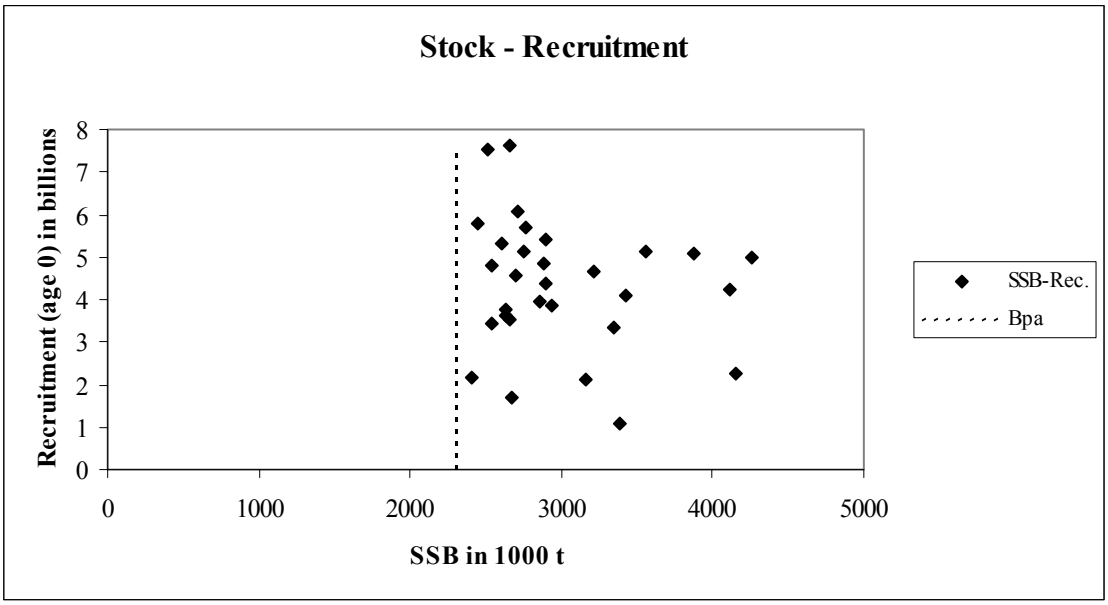
[1]Division VIIIc, Subareas IX and X, and CECAF Division 34.1.1 (EU waters only). Weights in '000 t.

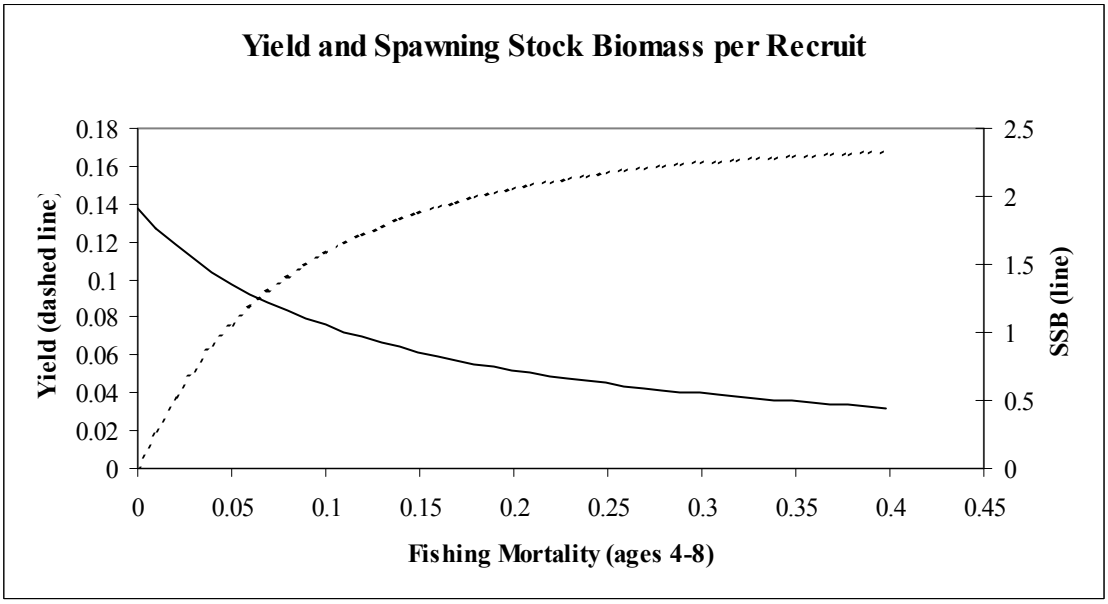

Landings
Landings in 1000 t
900
800
700
600
500
400
300
200
100
0
1972
1977
1982
1987
1992
1997


Fishing Mortality
F(ages 4-8)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1972
1977
1982
1987
1992
1997
F
Flim
Fpa


Recruitment (age 0)
Recruitment in billions
8
7
6
5
4
3
2
1
0
1972
1977
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1972
1977
1982
1987
1992
1997
2002
SSB
Bpa


Stock - Recruitment
Recruitment (age 0) in billions
0
1
2
3
4
5
6
7
8
0
1000
2000
3000
4000
5000
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0
0.5
1
1.5
2
2.5
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Fishing Mortality (ages 4-8)

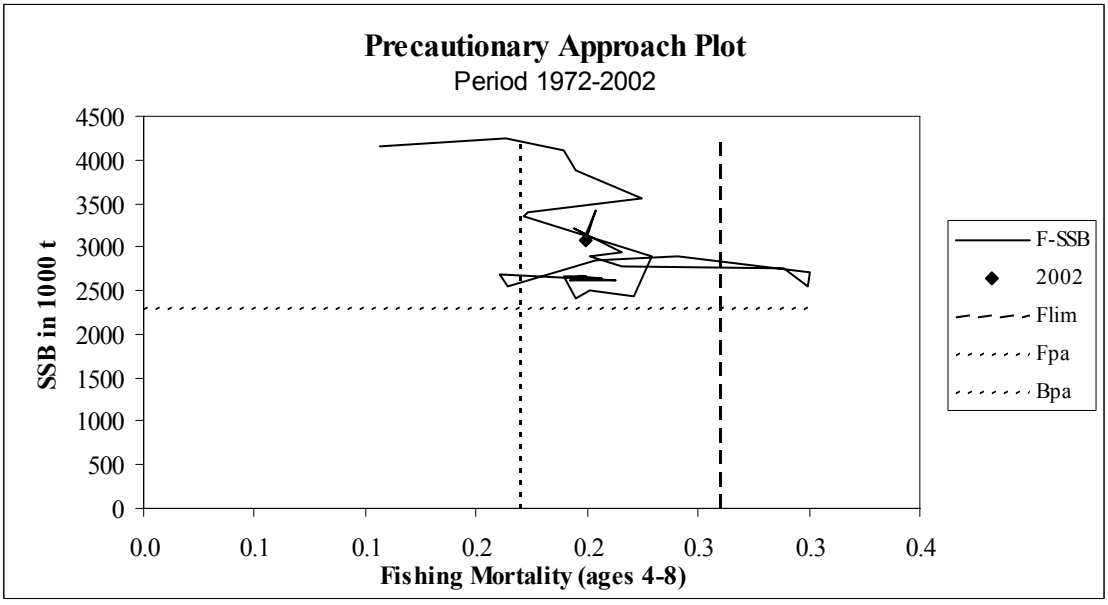

Precautionary Approach Plot
Period 1972-2002
SSB in 1000 t
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0.0
0.1
0.1
0.2
0.2
0.3
0.3
0.4
Fishing Mortality (ages 4-8)
F-SSB
2002
Flim
Fpa
Bpa

Table 3.12.3.a.1 Catches of MACKEREL by area. Discards not estimated prior to 1978. (Data submitted by Working Group members.)

Year	Subarea VI			Subarea VII and Divisions VIIIa,b,d,e			Subarea IV and III			Subarea I,II & Divs.Vb[1]	Divs. VIIIc, IXa	Total		
	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Discards	Catch	Landings	Landings	Landings	Discards	Catch
1969	4,800		4,800	47,404		47,404	739,175		739,175	7	42,526	833,912	0	833,912
1970	3,900		3,900	72,822		72,822	322,451		322,451	163	70,172	469,508	0	469,508
1971	10,200		10,200	89,745		89,745	243,673		243,673	358	32,942	376,918	0	376,918
1972	13,000		13,000	130,280		130,280	188,599		188,599	88	29,262	361,229	0	361,229
1973	52,200		52,200	144,807		144,807	326,519		326,519	21,600	25,967	571,093	0	571,093
1974	64,100		64,100	207,665		207,665	298,391		298,391	6,800	30,630	607,586	0	607,586
1975	64,800		64,800	395,995		395,995	263,062		263,062	34,700	25,457	784,014	0	784,014
1976	67,800		67,800	420,920		420,920	305,709		305,709	10,500	23,306	828,235	0	828,235
1977	74,800		74,800	259,100		259,100	259,531		259,531	1,400	25,416	620,247	0	620,247
1978	151,700	15,100	166,800	355,500	35,500	391,000	148,817		148,817	4,200	25,909	686,126	50600	736,726
1979	203,300	20,300	223,600	398,000	39,800	437,800	152,323	500	152,823	7,000	21,932	782,555	60600	843,155
1980	218,700	6,000	224,700	386,100	15,600	401,700	87,931		87,931	8,300	12,280	713,311	21600	734,911
1981	335,100	2,500	337,600	274,300	39,800	314,100	64,172	3,216	67,388	18,700	16,688	708,960	45516	754,476
1982	340,400	4,100	344,500	257,800	20,800	278,600	35,033	450	35,483	37,600	21,076	691,909	25350	717,259
1983	320,500	2,300	322,800	235,000	9,000	244,000	40,889	96	40,985	49,000	14,853	660,242	11396	671,638
1984	306,100	1,600	307,700	161,400	10,500	171,900	43,696	202	43,898	98,222	20,208	629,626	12302	641,928
1985	388,140	2,735	390,875	75,043	1,800	76,843	46,790	3,656	50,446	78,000	18,111	606,084	8191	614,275
1986	104,100		104,100	128,499		128,499	236,309	7,431	243,740	101,000	24,789	594,697	7431	602,128
1987	183,700		183,700	100,300		100,300	290,829	10,789	301,618	47,000	22,187	644,016	10789	654,805
1988	115,600	3,100	118,700	75,600	2,700	78,300	308,550	29,766	338,316	120,404	24,772	644,926	35566	680,492
1989	121,300	2,600	123,900	72,900	2,300	75,200	279,410	2,190	281,600	90,488	18,321	582,419	7090	589,509
1990	114,800	5,800	120,600	56,300	5,500	61,800	300,800	4,300	305,100	118,700	21,311	611,911	15600	627,511
1991	109,500	10,700	120,200	50,500	12,800	63,300	358,700	7,200	365,900	97,800	20,683	637,183	30700	667,883
1992	141,906	9,620	151,526	72,153	12,400	84,553	364,184	2,980	367,164	139,062	18,046	735,351	25000	760,351
1993	133,497	2,670	136,167	99,828	12,790	112,618	387,838	2,720	390,558	165,973	19,720	806,856	18180	825,036
1994	134,338	1,390	135,728	113,088	2,830	115,918	471,247	1,150	472,397	72,309	25,043	816,025	5370	821,395
1995	145,626	74	145,700	117,883	6,917	124,800	321,474	730	322,204	135,496	27,600	748,079	7721	755,800
1996	129,895	255	130,150	73,351	9,773	83,124	211,451	1,387	212,838	103,376	34,123	552,196	11415	563,611
1997	65,044	2,240	67,284	114,719	13,817	128,536	226,680	2,807	229,487	103,598	40,708	550,749	18864	569,613
1998	110141	71	110,212	105,181	3,206	108,387	264,947	4,735	269,682	134,219	44,164	658,652	8012	666,664
1999§	98,666		98,666	93,821		93,821	299,798		299,798	72,848	43,796	608,929	0	608,929
2000*	150,927	1	150,928	113,520	1,918	115,438	271,997	165	272,162	92,557	36,074	665,075	2084	667,159
2001*	113,234	83	113,317	141,012	1,081	142,093	311,979	24	312,003	67,097	43,198	676,520	1,188	677,708

*Preliminary.

[1]For 1976–1985 only Division IIa. Subarea I and Division IIb included in 2000 only.

§ Discards reported as part of unallocated catches.

NB: Figures in gray are revised, the revisions are documented in the SGDRAMA annex to this report.

Table 3.12.3.a.2 Catches (t) of MACKEREL in the Norwegian Sea (Division IIa) and off the Faroes (Division Vb). (Data submitted by Working Group members.)

Country	1984	1985	1986	1987	1988	1989	1990
Denmark	11,787	7,610	1,653	3,133	4,265	6,433	6,800
Faroe Islands	137				22	1,247	3,100
France		16				11	
Germany, Fed. Rep.			99		380		
German Dem. Rep.			16	292		2,409	
Norway	82,005	61,065	85,400	25,000	86,400	68,300	77,200
Poland							
United Kingdom			2,131	157	1,413		400
USSR	4,293	9,405	11,813	18,604	27,924	12,088	28,900
Discards							2,300
Total	98,222	78,096	101,112	47,186	120,404	90,488	118,700

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Denmark	1,098	251			4,746	3,198	37	2,090	106	1,375	7
Estonia		216		3,302	1,925	3,741	4,422	7,356	3,595	2,673	219
Faroe Islands	5,793	3,347	1,167	6,258	9,032	2,965	5,777**	2,716	3,011	5,546	3,272
France	23	6	6	5	5	0	270				
Germany						1					
Iceland						92	925	357			
Ireland									100		
Latvia		100	4,700	1,508	389	233					
Lithuania										2,085	
Netherlands						561			661		
Norway	76,760	91,900	110,500	141,114	93,315	47,992	41,000	54,477	53,821	31,778	21,971
Russia		42,440	49,600	28,041	44,537	44,545	50,207	67,201	51,003	49,100*	41,566
United Kingdom	514	802		1,706	194	48	938	199	662		54
USSR[2]	13,631[2]										
Poland							22				
Sweden											8
Misreported (IVa)				- 109,625	-18,647			-177	-40,011		
Misreported (VIa)									-100		
Discards											
Total	97,819	139,062	165,973	72,309	135,496	103,376	103,598	134,219	72,848	92,557	67,097

[2]Russia.

*Includes small by-catches in Subarea I & Iib.

** Faroese catch revised from previously reported 7,628.

Table 3.12.3.a.3 Catch (t) of MACKEREL in the North Sea, Skagerrak, and Kattegat (Subarea IV and III). (Data submitted by Working Group members).

Country	1986	1987	1988	1989	1990	1991	1992	1993
Belgium	49	14	20	37		125	102	191
Denmark	23,368	28,217	32,588	26,831	29,000	38,834	41,719	42,502
Estonia							400	
Faroe Islands				2,685	5,900	5,338		11,408
France	1,200	2,146	1,806	2,200	1,600	2,362	956	1,480
Germany, Fed. Rep.	1,853	474	177	6,312	3,500	4,173	4,610	4,940
Iceland								
Ireland				8,880	12,800	13,000	13,136	13,206
Latvia							211	
Netherlands	1,949	2,761	2,564	7,343	13,700	4,591	6,547	7,770
Norway	50,600	108,250	59,750	81,400	74,500	102,350	115,700	112,700
Sweden	1,300	3,162	1,003	6,601	6,400	4,227	5,100	5,934
United Kingdom	559	19857	1,002	38,660	30,800	36,917	35,137	41,010
USSR (Russia from 1990)								
Romania								
Misreported (IIa)								
Misreported (VIa)	148,000	117,000	180,000	92,000	126,000	130,000	127,000	146,697
Unallocated	7,391	8,948	29,630	6,461	-3,400	16,758	13,566	-
Discards	7,431	10,789	29,776	2,190	4,300	7,200	2,980	2,720
Total	243,700	301,618	338,316	281,600	305,100	365,875	367,164	390,558

Country	1994	1995	1996	1997	1998	1999	2000[1]	2001
Belgium	351	106	62	114	125	177	146	97
Denmark	47,852	30,891	24,057	21,934	25,326	29,353	27,720	21,680
Estonia				-	-			
Faroe Islands	11,027	17,883	13,886	3,288[2]	4,832	4,370	10,614	18,571
France	1,570	1,599	1,316	1,532	1,908	2,056	1,588	1,981
Germany, Fed. Rep.	1,479	712	542	213	423	473	78	4,514
Iceland						357		
Ireland	9,032	5,607	5,280	280	145	11,293	9,956	10,284
Latvia				-	-			
Netherlands	3,637	1,275	1,996	951	1,373	2,819	2,262	2,441
Norway	114,428	108,890	88,444	96,300	103,700	106,917	142,320	158,401
Sweden	7,099	6,285	5,307	4,714	5,146	5,233	4,994	5,090
United Kingdom	27,479	21,609	18,545	19,204	19,755	31,578	57,110	50,165
Russia				3,525	635	345	1,672	2
Romania	2,903			-	-			
Misreported (IIa)	109,625	18,647	-	-	-	40,000		
Misreported (VIa)	134,765	106,987	51,781	73,523	98,432	59,882	8,591	39,024
Unallocated	-	983	236	1,102	3,147	4,946	3,197	-272
Discards	1,150	730	1,387	2,807	4,753		1,912	24
Total	472,397	322,204	212,839	229,487	269,700	299,799	272,160	312,004

[1]Includes small catches in IIIb & IIId.

[2]Faroese catches revised from previously reported 1,367.

Table 3.12.3.a.4 Catch (t) of MACKEREL in the Western area (Subareas VI and VII and Divisions VIIIa,b,d,e). (Data submitted by Working Group members).

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992
Denmark	200	400	300	100		1,000		1,573	194
Faroe Islands	9,200	9,900	1,400	7,100	2,600	1,100	1,000		
France	12,500	7,400	11,200	11,100	8,900	12,700	17,400	4,095	
Germany	11,200	11,800	7,700	13,300	15,900	16,200	18,100	10,364	9,109
Ireland	84,100	91,400	74,500	89,500	85,800	61,100	61,500	17,138	21,952
Netherlands	99,000	37,000	58,900	31,700	26,100	24,000	24,500	64,827	76,313
Norway	34,700	24,300	21,000	21,600	17,300	700		29,156	32,365
Poland									
Spain	100				1,500	1,400	400	4,020	2,764
United Kingdom	198,300	205,900	156,300	200,700	208,400	149,100	162,700	162,588	196,890
USSR	200								
Unallocated	18000	75100	49299	26000	4700	18900	11,500	-3,802	1,472
Misreported (Iva)			-148,000	-117,000	-180,000	-92,000	-126,000	-130,000	-127,000
Discards	12,100	4,500			5,800	4,900	11,300	23,550	22,020
Grand Total	479,600	467,700	232,599	284,100	197,000	199,100	182,400	183,509	236,079

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Denmark		2,239	1,443	1,271	-	-	552	82	835
Estonia			361		-	-			
Faroe Islands	2,350	4,283	4,248	-	2,448[1]	3,681	4,239	4,863	2,161
France	8,296	9,998	10,178	14,347	19,114	15,927	14,311	17,857	18,975
Germany	23,776	25,011	23,703	15,685	15,161	20,989	19,476	22,901	20,793
Ireland	81,773	79,996	72,927	49,033	52,849	66,505	48,282	61,277	60,168
Netherlands	44,600	40,698	34,514	34,203	22,749	28,790	25,141	30,123	33,654
Norway	600	2,552			-	-			223
Spain	3,162	4,126	4,509	2,271	7,842	3,340	4,120	4,500	4,063
United Kingdom	215,265	208,656	190,344	127,612	128,836	165,994	127,094	126,620	139,589
USSR									
Unallocated	0	4,632	28,245	10,603	4,577	8,351	9,254	0	12,807
Misreported (IVa)	-146,697	-134,765	-106,987	-51,781	-73,523	-98,255	-59,982	-3,775	-39,024
Discards	15,660	4,220	6,991	10,028	16,057	3,277		1,920	1,164
Grand Total	248,785	251,646	270,476	213,272	196,110	218,599	192,486	266,367	255,408

[1]Faroese catches revised from 2,158.

Table 3.12.3.a.5 Landings (tonnes) of mackerel in Divisions VIIIc and IXa, 1977–2001. Data submitted by Working Group members.

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Spain[1]	19,852	18,543	15,013	11,316	12,834	15,621	10,390	13,852	11,810	16,533	15,982	16,844
Portugal[2]	1,743	1,555	1,071	1,929	3,108	3,018	2,239	2,250	4,178	6,419	5,714	4,388
Spain[2]	2,935	6,221	6,280	2,719	2,111	2,437	2,224	4,206	2,123	1,837	491	3,540
Poland[2]	8	-	-	-	-	-	-	-	-	-	-	-
USSR[2]	2,879	189	111	-	-	-	-	-	-	-	-	-
Total[2]	7,565	7,965	7,462	4,648	5,219	5,455	4,463	6,456	6,301	8,256	6,205	7,928
TOTAL	27,417	26,508	22,475	15,964	18,053	21,076	14,853	20,308	18,111	24,789	22,187	24,772

[1]Division VIIIc.
[2]Division IXa.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Spain[1]	13,446	16,086	16,940	12,043	16,675	21,146	23,631	28,386	35,015	36,174	37,631	30,061	38,205
Portugal[2]	3,112	3,819	2,789	3,576	2,015	2,158	2,893	3,023	2,080	2,897	2,002	2,253	3,119
Spain[2]	1,763	1,406	1,051	2,427	1,027	1,741	1,025	2,714	3,613	5,093	4,164	3,760	1,874
Total[2]	4,875	5,225	3,840	6,003	3,042	3,899	3,918	6,737	5,693	7,990	6,165	6,013	4,993
TOTAL	18,321	21,311	20,780	18,046	19,719	25,045	27,549	34,123	40,708	44,164	43,796	36,074	43,198

[1]Division VIIIc.
[2]Division IXa.

Table 3.12.3.a.6 Mackerel (combined Southern, Western & N.Sea spawn.comp.)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1972	2248990	4148849	361204	0.1060
1973	4976080	4255845	571011	0.1633
1974	4216500	4118121	607632	0.1898
1975	5102370	3875290	784070	0.1944
1976	5125150	3554524	828239	0.2250
1977	1060540	3388656	620276	0.1734
1978	3341640	3352920	736832	0.1718
1979	5429540	2899829	843227	0.2288
1980	5778680	2444369	734951	0.2206
1981	7538030	2508240	754438	0.2016
1982	2180520	2407086	717267	0.1946
1983	1694210	2671034	671588	0.1897
1984	7607650	2664191	637606	0.1994
1985	3515670	2654424	614371	0.1958
1986	3620300	2637758	602200	0.2064
1987	5297020	2607755	654991	0.1925
1988	3751860	2627656	680492	0.2126
1989	4552690	2694023	589509	0.1610
1990	3446630	2542161	627511	0.1639
1991	3940490	2851443	667886	0.2039
1992	4858890	2881514	760351	0.2408
1993	6084460	2717108	825036	0.3008
1994	4805880	2537184	821395	0.2992
1995	5139740	2757892	755776	0.2890
1996	5697260	2768540	563612	0.2159
1997	4353140	2902304	569613	0.2008
1998	3839570	2937605	666682	0.2154
1999	4679650	3215136	608930	0.1937
2000	2105760	3156635	667159	0.1996
2001	4084200	3423557	677708	0.2037
2002	4084200	3080000		0.1990
Average	4327655	3009085	674052	0.2049

3.12.3.b Response to the Government of the United Kingdom on the utility of the Western Mackerel Box

UK has requested ICES to evaluate:

The utility of the western mackerel box

ICES Comments:

The restrictions on fishing for mackerel inside the regulated area known as the 'Mackerel Box' are described in Council Regulation (EC) No 894/97 Article 9.

The Mackerel Box (Figure 3.12.3.b.1) is defined by the area bounded by the following co-ordinates:

- a point on the south coast of the UK at longitude 02º00' W
- latitude 49º30' N longitude 02º00' W
- latitude 49º30' N longitude 07º00' W
- latitude 52º00' N longitude 07º00' W
- a point on the West coast of the UK at latitude 52º00' W

The restrictions were introduced in order to reduce the fishing effort on juvenile mackerel (defined as ages 1, 2, and 3 in quarters 1 and 2 and ages 0, 1, and 2 in quarters 3 and 4), which are considered to be concentrated in the area and vulnerable to targeted exploitation. A seasonal closure was imposed from 1980 and the area was permanently closed in 1985 to all methods of mackerel fishing, except quota-regulated vessels using gillnets or handlines. Mackerel may also be taken legally inside the Box as a by-catch in the Danish industrial fishery for horse mackerel and sardines and the Dutch human consumption fisheries targeted at horse mackerel.

The Mackerel Box is not the only area in which there are restrictions on the fishing of mackerel. The North Sea Divisions IVb and c, in which large numbers of juvenile mackerel from the western area occur in the south during the third quarter of the year, are closed to a targeted mackerel fishery throughout the year.

The fishery in the area of the Mackerel Box

ICES Divisions VIIefgh include parts of the Mackerel Box. The average yearly total landing for the last 10 years from Divisions VIIefgh is 25 000 tonnes, with a range of 18 – 40 000 tonnes. The majority of the catches are reported from Divisions VIIe and f.

The age compositions of the commercial catch in number-at-age recorded within Divisions VIIefgh in the years 1988 – 2001 is dominated by juvenile mackerel. Juvenile fish constitute 70–85% in numbers, see Figure 3.12.3.b.2. In recent years, catches in Division VIIefgh have generated 38% of the total 1 year old and 26% of the 2 year old mackerel catches, and accordingly the same proportions of the fishing mortality at those ages,

Research surveys inside the Mackerel Box

The commercial catch proportions are in agreement with survey information collected by CEFAS, UK from within the Mackerel Box. The proportional number of immature fish within samples taken from the Mackerel Box was 91% in 1990, 60% in 1991, 76% in the winter of 1995/6, and 69% in 1998.

The potential yield and biomass contribution from mackerel taken in the area of the Mackerel Box

Figure 3.12.3.b.3 illustrates that the average weight of a fish caught in the Divisions VIIefgh is lower than in other areas.

The calculated percentage loss of yield when taking a fish in Divisions VIIefgh compared to the remainder of the areas in which mackerel are distributed, is at the current fishing mortality rate of 0.2, 15% in yield. The loss is due to the low weight of fish taken in Divisions VIIegfh and the low modal age of capture. At the current fishing mortality rate of 0.2 the loss of SSB per recruit from fish taken in the Box area is 20%.

Both the yield- and SSB-per-recruit analyses assume that the fish taken within the Mackerel Box are of similar age composition and weight as the commercial samples from Divisions VIIefgh. The Mackerel Box is known to have large schools of 1- and 2-year-old fish. Directed fishing at these schools may result in higher local fishing mortality and result in even greater losses than those calculated at the *status quo* levels.

Conclusions

ICES considers that the loss of potential yield and the increased risk to the spawning stock of the NEA mackerel from an opening of the box should be avoided. The Mackerel Box should remain closed to targeted mackerel fishing. This advice is consistent with previous studies by this Working Group and the recommendations from the EU Scientific Technical Committee for Fisheries.

Details and further results are presented in the assessment group report.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10–19 September 2002 (ICES CM 2003/ACFM:07).

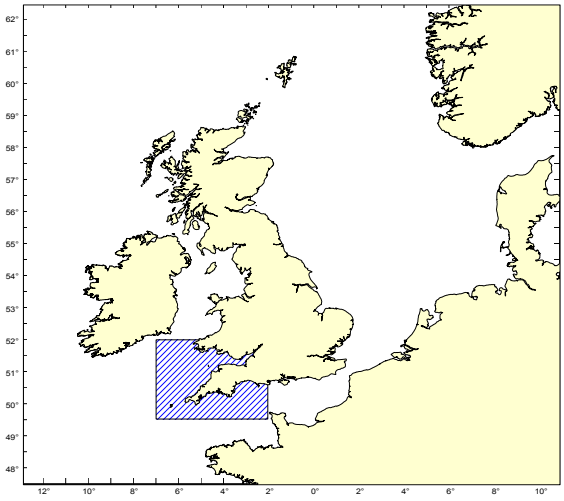


Figure 3.12.3.b.1. The Mackerel Box.

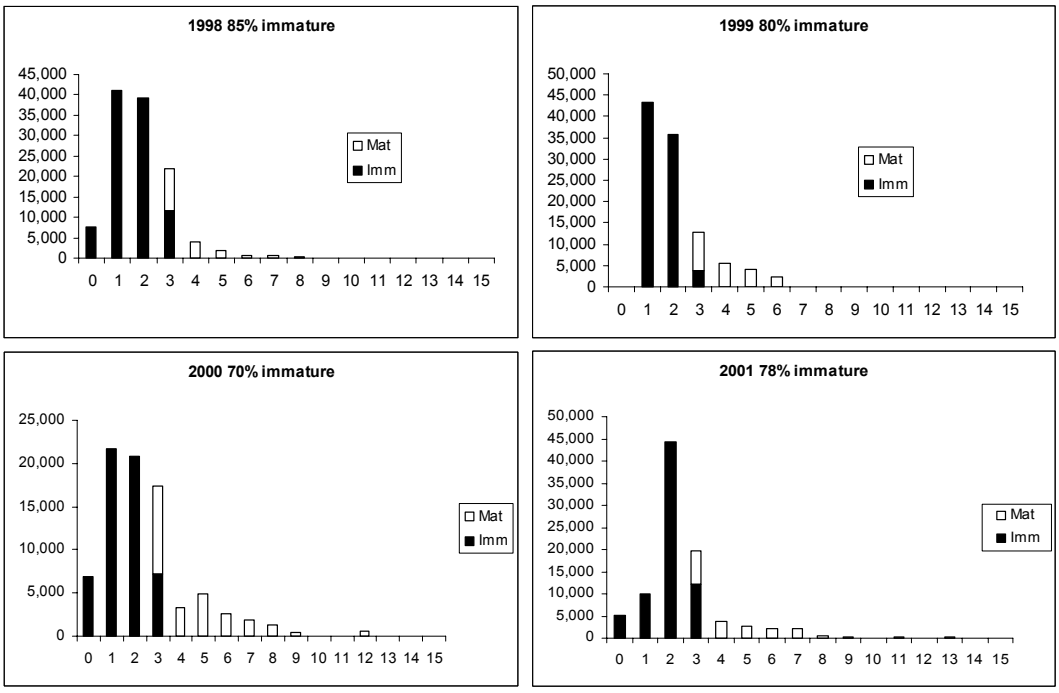


Figure 3.12.3.b.2. The percentage of mature and immature fish recorded in commercial landings from ICES Divisions VIIefgh for the years 1998–2001. Ages 0–2 are assumed to be immature, while age 3 is assumed to be immature in quarters 1 and 2 and mature in quarters 3 and 4.

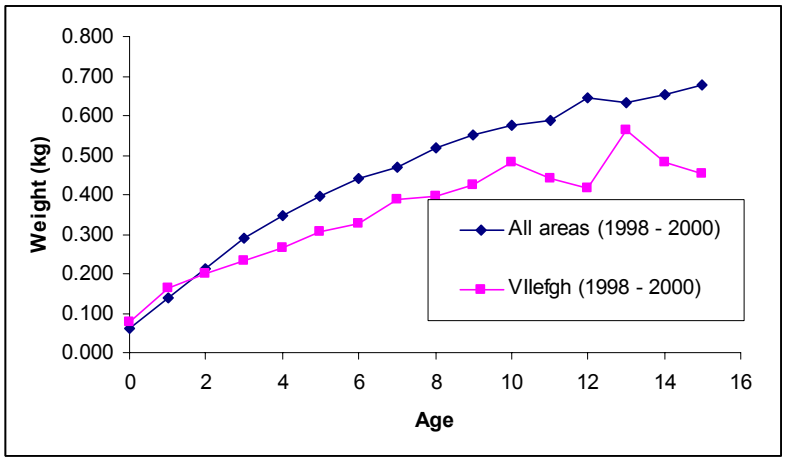


Figure 3.12.3.b.3 The average weight-at-age of mackerel caught in ICES Divisions VIIefgh and in all ICES Divisions, illustrating the relatively low weight-at-age of fish taken from Divisions VIIefgh.

3.12.4 Western horse mackerel (*Trachurus trachurus*) (Divisions IIa, IVa, Vb, VIa, VIIa–c,e–k, VIIIa,b,d,e)

State of stock/exploitation: The state of the stock relative to precautionary reference points is undefined. The current fishing mortality is above $\mathbf{F}_{0.1}$. Spawning stock biomass has decreased compared with the mid-1980s and is estimated to continue to decline at all levels of fishing mortality. Fishing mortality on the youngest ages is increasing.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: No precautionary reference points are proposed for this stock.

Advice on management: ICES advises that catches in 2003 be effectively limited to less than 113 000 t, corresponding to F = 0.15 which in 2000 was estimated to be $\mathbf{F}_{0.1}$. ICES also recommends that the TAC for this stock should apply to all areas in which Western horse mackerel are fished, i.e., Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa–c, VIIe–k, and VIIIa,b,d,e. ICES also advises that directed horse mackerel fisheries in which juveniles are abundant, and industrial fisheries in which horse mackerel is taken as a by-catch, should be restricted.

Relevant factors to be considered in management: The spawning stock has been dominated by an outstanding 1982 year class and reached a maximum of 2.7 million tonnes in 1988. This year class has been gradually fished out and since then no other outstanding year classes have appeared, while the spawning biomass has declined continuously to 0.7 million tonnes in 2002.

In the absence of outstanding year classes, sustainable yield is unlikely to be higher than about 130 000 t, dependent on the exploitation pattern. It is therefore clear that catches will have to be reduced unless another outstanding year class is produced. The assessment indicates that the more recent year classes are well below average since 1996.

Recently fisheries have taken large catches of mainly juvenile horse mackerel from the western stock, and the fishing mortality in the juveniles has increased. ICES expresses concern about this high exploitation of juvenile fish at a time when the recruitment is low, and the spawning stock is declining.

The current fishery targeting juveniles will result in reduced fishing opportunities for adult fish as well as reduced overall TACs. ICES suggests that a management strategy similar to that for North Sea herring, in which both adult and juvenile mortality are independently restricted, be explored for this stock. If the fishing mortality in 2002 is the same as in 2001 the catch in 2002 will be below the 191 000 t recorded for 2001. Continued fishing at the level estimated for 2001 is expected to result in a further reduction of catches in 2003 and the SSB will be below 500 000 tonnes in 2004.

The TAC is set for parts of the western distribution area by EU and was overshot considerably during the period 1988–1999. The two last years the catches were less than the TAC. However, the TAC has only been given for parts of the distribution and fishing areas (EU waters). ICES advises that if a TAC is set for this stock, it should apply to all areas where western horse mackerel are caught, i.e., Divisions IIa, IIIa (western part), IVa, Vb, VIa, VIIa–c, VIIe–k, and VIIIa,b,d,e.

Catch forecast for 2003:

Basis: F(2002) = F(2001) = $\mathbf{F}_{sq(4–10)}$ = 0.22; Landings (2002) = 181; SSB (2002) = 668.

F(2003)	Basis	SSB (2003)	Catch (2003)	Landings (2003)	SSB (2004)
0.15	$\mathbf{F}_{0.1}$	571	113	113	524
0.18	$0.8*\mathbf{F}_{sq}$	565	131	131	506
0.22	$\mathbf{F}_{sq}$	556	157	157	481

Weights in '000 t.

Shaded scenario considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The TAC for 2003, corresponding to a fishing mortality of 0.15 is higher than the advice of last year. This is the result of a revised assessment method and the inclusion of new information on the stock size available from egg surveys in 2001, which led to higher estimates of the poor year classes 1996 - 1999. The perception of stock trend is consistent with previous years' estimates.

Elaboration and special comment: The distributional range of this stock increased when the exceptional 1982 year class entered the fishery. This resulted in the development of unregulated fisheries outside the TAC area in the Northeast North Sea. Catches outside the TAC area have been low in recent years.

The recent history of this stock reflects the development of a single large year class within the period of 17 years for which data are available. The frequency of the occurrence of such large year classes cannot be evaluated on the basis of the short time-series.

As in previous years some countries with major catches did not carry out biological sampling programmes. Although this has improved since 1998, the lack of biological data severely hampers the assessment.

The assessment was carried out using S.A.D model, which is a combination of a Separable VPA and an ADAPT VPA-based model. Recent studies have established that horse mackerel may be an indeterminate spawner and therefore the current estimate of fecundity, used to convert survey egg production estimates to SSB, is considered to be poorly determined. The S.A.D model objective function was modified in order to estimate fecundity during fitting of the model. The assessment results are consistent with previous years' estimates derived from the model and with those of a model fitted using the ISVPA structure. The present assessment uses the results of the international horse mackerel egg surveys. Due to uncertainties about whether horse mackerel is a determinate or indeterminate spawner, only the estimated egg productions have been used in the assessment. The estimated egg production in 2001 was 35% lower than the estimate in 1998.

Source of information: Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy, 10–19 September 2002 (ICES CM 2003/ACFM:07).

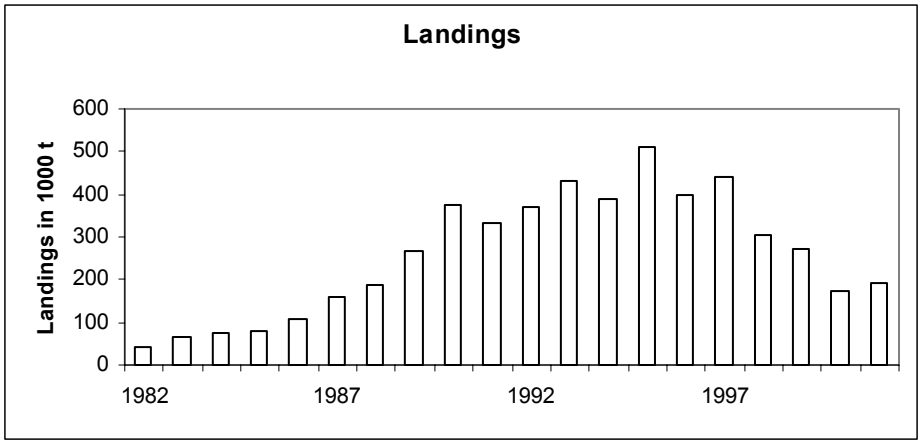
Yield and spawning biomass per Recruit F-reference points:

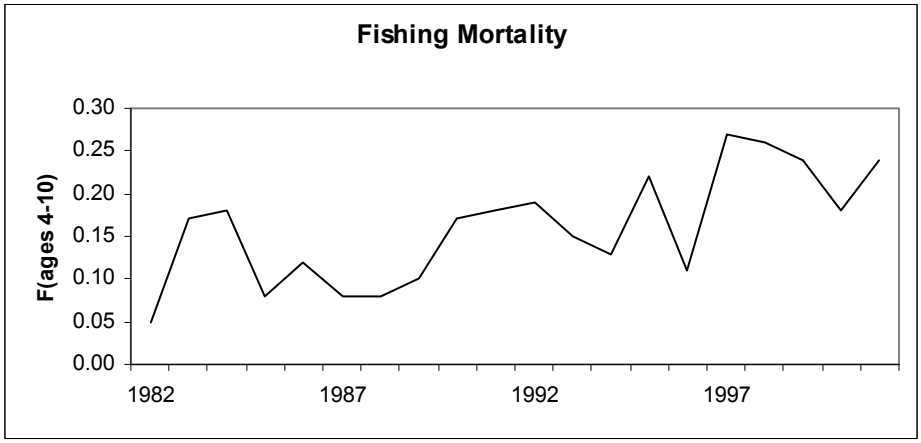
	Fish Mort Ages 4–10	Yield/R	SSB/R
Average Current	0.220	0.053	0.162
$\mathbf{F}_{max}$	0.557	0.057	0.047
$\mathbf{F}_{0.1}$	0.179	0.050	0.199
$\mathbf{F}_{med}$	N/A		

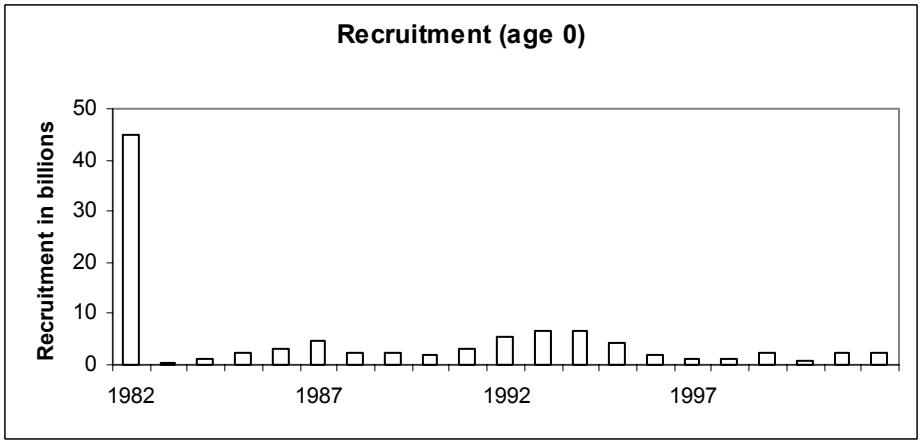
Catch data (Tables 3.5.11.1 and 3.12.4.1–6):

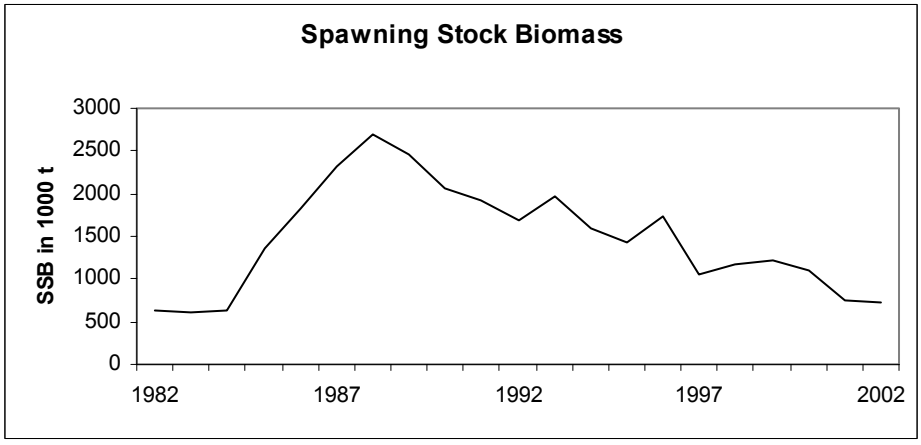
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM landings	Disc. slip	ACFM catch
1987	Not assessed	-	155	157	-	157
1988	No increase in catches	102	169	184	4	188
1989	If sustained catches required; TAC	100	153	267	1	269
1990	TAC	~200	203	363	10	373
1991	Within safe biological limits	-	230	328	5	334
1992	Within safe biological limits	-	250	369	2	371
1993	Within safe biological limits	-	250	424	9	433
1994	Prudent not to increase F	-	300	385	4	389
1995	Reduction in catch	-	300	509	2	511
1996	Reduction in catch	-	300	379	17	397
1997	Reduction in F	173	300	440	3	443
1998	Reduction in F to 0.15	150	320	296	1	304
1999	Effectively limit catches to 200 000t	<200	265	274	-	274
2000	Effectively limit catches to 200 000t	<200	240	175	-	175
2001	Effectively limit catches to 224 000t	<224	233	191	-	191
2002	Effectively limit catches to 98 000t	<98	150			
2003	Effectively limit catches to 113 000t	<113				

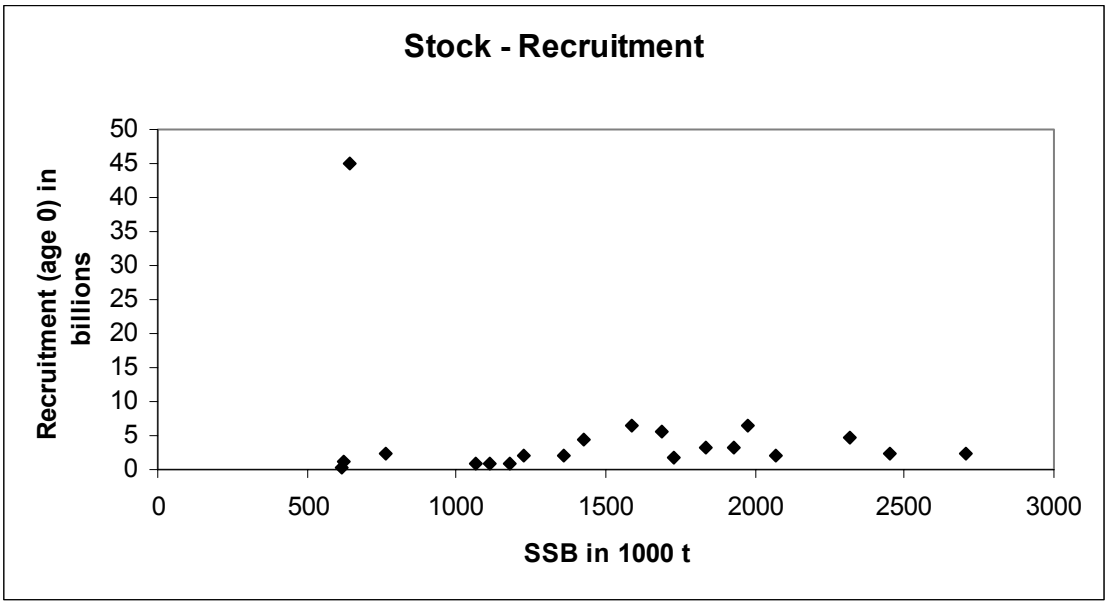
[1]Division Vb (EU waters only), Subareas VI and VII, Divisions VIIIa,b,d,e. Weights in '000 t.


Landings
Landings in 1000 t
600
500
400
300
200
100
0
1982
1987
1992
1997


Fishing Mortality
F(ages 4-10)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1982
1987
1992
1997


Recruitment (age 0)
Recruitment in billions
50
40
30
20
10
0
1982
1987
1992
1997


Spawning Stock Biomass
SSB in 1000 t
3000
2500
2000
1500
1000
500
0
1982
1987
1992
1997
2002


Stock - Recruitment
Recruitment (age 0) in billions
50
45
40
35
30
25
20
15
10
5
0
0
500
1000
1500
2000
2500
3000
SSB in 1000 t

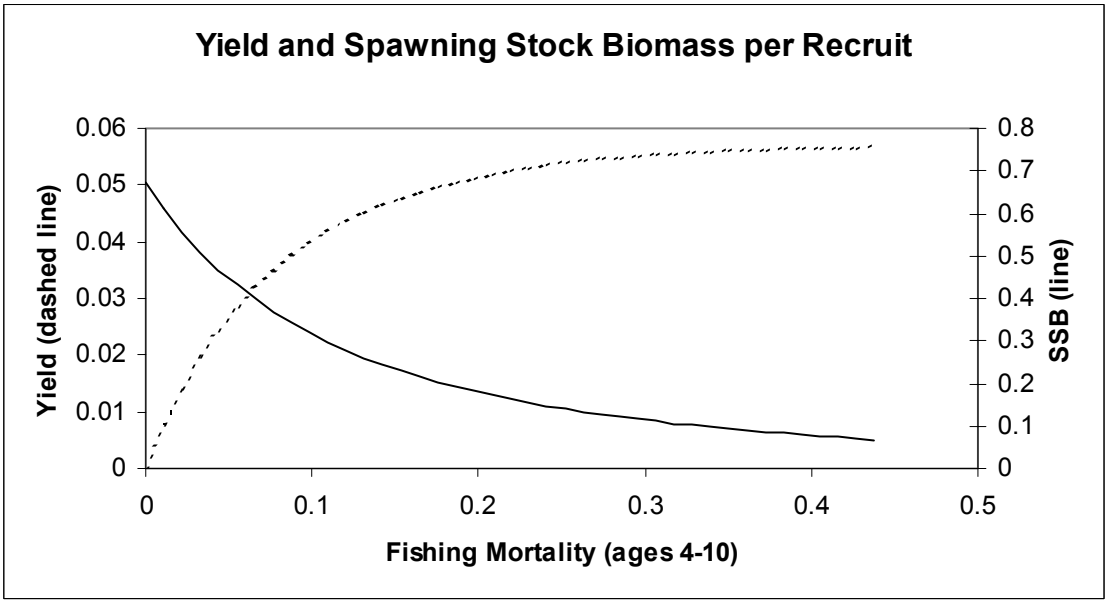

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.06
0.05
0.04
0.03
0.02
0.01
0
SSB (line)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 4-10)

Table 3.12.4.1 Landings (t) of HORSE MACKEREL in Subarea II. (Data as submitted by Working Group members.)

Country	1980	1981	1982	1983	1984	1985	1986	1987
Denmark	-	-	-	-	-	-	-	39
France	-	-	-	-	1	1	-[2]	-[2]
Germany, Fed.Rep	-	+	-	-	-	-	-	-
Norway	-	-	-	412	22	78	214	3,272
USSR	-	-	-	-	-	-	-	-
Total	-	+	-	412	23	79	214	3,311

	1988	1989	1990	1991	1992	1993	1994	1995
Faroe Islands	-	-	964[3]	1,115	9,157[3]	1,068	-	950
Denmark	-	-	-	-	-	-	-	200
France	-[2]	-	-	-	-	-	55	-
Germany, Fed. Rep.	64	12	+	-	-	-	-	-
Norway	6,285	4,770	9,135	3,200	4,300	2,100	4	11,300
USSR / Russia (1992 -)	469	27	1,298	172	-	-	700	1,633
UK (England + Wales)	-	-	17		-	-	-	-
Total	6,818	4,809	11,414	4,487	13,457	3,168	759	14,083

	1996	1997	1998	1999	2000	2001[1]
Faroe Islands	1,598	799[3]	188[3]	132[3]	250[3]	-
Denmark	-	-	1,755[3]			-
France	-	-	-			-
Germany	-	-	-			-
Norway	887	1,170	234	2304	841	44
Russia	881	648	345	121	84[3]	16
UK (England + Wales)	-	-	-			-
Estonia	-	-	22			
Total	3,366	2,617	2,544	2557	1175	60

[1]Preliminary.
[2]Included in Subarea IV.
[3]Includes catches in Division Vb.

Table 3.12.4.2 Landings (t) of HORSE MACKEREL in Subarea IV and Division IIIa by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	8	34	7	55	20	13	13	9	10
Denmark	199	3,576	1,612	1,590	23,730	22,495	18,652	7,290	20,323
Faroe Islands	260	-	-	-	-	-	-	-	-
France	292	421	567	366	827	298	231[2]	189[2]	784[2]
Germany, Fed.Rep.	+	139	30	52	+	+	-	3	153
Ireland	1,161	412	-	-	-	-	-	-	-
Netherlands	101	355	559	2,029[3]	824	160[3]	600[3]	850[4]	1,060[3]
Norway[2]	119	2,292	7	322	[3]	203	776	11,728[4]	34,425[4]
Poland	-	-	-	2	94	-	-	-	-
Sweden	-	-	-	-	-	-	2	-	-
UK (Engl. + Wales)	11	15	6	4	-	71	3	339	373
UK (Scotland)	-	-	-	-	3	998	531	487	5,749
USSR	-	-	-	-	489	-	-	-	-
Total	2,151	7,253	2,788	4,420	25,987	24,238	20,808	20,895	62,877

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium	10	13	-	+	74	57	51	28	-
Denmark	23,329	20,605	6,982	7,755	6,120	3,921	2,432	1,433	648
Estonia	-	-	-	293	-		17	-	-
Faroe Islands	-	942	340	-	360	275	-	-	296
France	248	220	174	162	302		-	-	-
Germany, Fed.Rep.	506	2,469[5]	5,995	2,801	1,570	1,014	1,600	7	7,603
Ireland	-	687	2,657	2,600	4,086	415	220	1,100	8,152
Netherlands	14,172	1,970	3,852	3,000	2,470	1,329	5,285	6,205	37,778
Norway	84,161	117,903	50,000	96,000	126,800	94,000	84,747	14,639	45,314
Poland	-	-	-	-	-	-	-	-	-
Sweden	-	102	953	800	697	2,087	-	95	232
UK (Engl. + Wales)	10	10	132	4	115	389	478	40	242
UK (N. Ireland)	-	-	350	-	-		-	-	-
UK (Scotland)	2,093	458	7,309	996	1,059	7,582	3,650	2,442	10,511
USSR / Russia (1992 -)	-	-	-						
Unallocated + discards	12,482[4]	-317[4]	-750[4]	-278[6]	-3,270	1,511	-28	136	-31,615
Total	112,047	145,062	77,904	114,133	140,383	112,580	98,452	26,125	79,161

Country	1998	1999	2000	2001[1]
Belgium	19	21	19	19
Denmark	2,048	8,006	4,409	2,288
Estonia	22	-	-	
Faroe Islands	28	908	24	-
France	379	60	49	48
Germany	4,620	4,071	3,115	230
Ireland	-	404	103	375
Netherlands	3,811	3,610	3,382	4,685
Norway	13,129	44,344	1,246	7,948
Russia	-	-	2	-
Sweden	3,411	1,957	1,141	119
UK (Engl. + Wales)	2	11	15	317
UK (Scotland)	3,041	1,658	3,465	3,161
Unallocated + discards	737	-325	14613	649
Total	31,247	64,725	31583	19,839

[1] Preliminary. [2] Includes Division IIa. [3] Estimated from biological sampling. [4] Assumed to be misreported. [5] Includes 13 t from the German Democratic Republic. [6] Includes a negative unallocated catch of -4,000 t.

Table 3.12.4.3 Landings (t) of HORSE MACKEREL in Subarea VI by country.
(Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	734	341	2,785	7	-	-	-	769	1,655
Faroe Islands	-	-	1,248	-	-	4,014	1,992	4,450[3]	4,000[3]
France	45	454	4	10	14	13	12	20	10
Germany, Fed. Rep.	5,550	10,212	2,113	4,146	130	191	354	174	615
Ireland	-	-	-	15,086	13,858	27,102	28,125	29,743	27,872
Netherlands	2,385	100	50	94	17,500	18,450	3,450	5,750	3,340
Norway	-	5	-	-	-		83	75	41
Spain	-	-	-	-	-		-[2]	-[2]	-[2]
UK (Engl. + Wales)	9	5	+	38	+	996	198	404	475
UK (N. Ireland)						-	-	-	-
UK (Scotland)	1	17	83	-	214	1,427	138	1,027	7,834
USSR	-	-	-		-	-	-	-	-
Unallocated + disc.						-19,168	-13,897	-7,255	-
Total	8,724	11,134	6,283	19,381	31,716	33,025	20,455	35,157	45,842

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	973	615	-	42	-	294	106	114	780
Faroe Islands	3,059	628	255	-	820	80	-	-	-
France	2	17	4	3	+	-	-	-	52
Germany, Fed. Rep.	1,162	2,474	2,500	6,281	10,023	1,430	1,368	943	229
Ireland	19,493	15,911	24,766	32,994	44,802	65,564	120,124	87,872	22,474
Netherlands	1,907	660	3,369	2,150	590	341	2,326	572	498
Norway	-	-	-	-	-	-	-	-	-
Spain	-[2]	-[2]	1	3	-	-	-	-	-
UK (Engl. + Wales)	44	145	1,229	577	144	109	208	612	56
UK (N.Ireland)	-	-	1,970	273	-	-	-	-	767
UK (Scotland)	1,737	267	1,640	86	4,523	1,760	789	2,669	14,452
USSR / Russia (1992 -)	-	44	-	-	-	-	-	-	-
Unallocated + disc.	6,493	143	-1,278	-1,940	-6,960[4]	-51	-41,326	-11,523	837
Total	34,870	20,904	34,456	40,469	53,942	69,527	83,595	81,259	40,145

Country	1998	1999	2000	2001[1]
Denmark	-	-	-	-
Faroe Islands	-	-	-	-
France	221	25,007	-	428
Germany	414	1,031	209	265
Ireland	21,608	31,736	15,843	20,162
Netherlands	885	1,139	687	600
Spain	-	-	-	-
UK (Engl. + Wales)	10	344	41	91
UK (N.Ireland)	1,132	-	-	
UK (Scotland)	10,447	4,544	1,839	3,111
Unallocated +disc.	98	1,507	2,038	-21
Total	34,815	65,308	20,657	24,636

[1]Preliminary.
[2]Included in Subarea VII.
[3]Includes Divisions IIIa, IVa,b and VIb.
[4]Includes a negative unallocated catch of -7,000 t.

Table 3.12.4.4 Landings (t) of HORSE MACKEREL in Subarea VII by country. Data submitted by the Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Belgium	-	1	1	-	-	+	+	2	-
Denmark	5,045	3,099	877	993	732	1,477[2]	30,408[2]	27,368	33,202
France	1,983	2,800	2,314	1,834	2,387	1,881	3,801	2,197	1,523
Germany, Fed.Rep.	2,289	1,079	12	1,977	228	-	5	374	4,705
Ireland	-	16	-	-	65	100	703	15	481
Netherlands	23,002	25,000	27,500[2]	34,350	38,700	33,550	40,750	69,400	43,560
Norway	394	-	-	-	-	-	-	-	-
Spain	50	234	104	142	560	275	137	148	150
UK (Engl. + Wales)	12,933	2,520	2,670	1,230	279	1,630	1,824	1,228	3,759
UK (Scotland)	1	-	-	-	1	1	+	2	2,873
USSR	-	-	-	-	-	120	-	-	-
Total	45,697	34,749	33,478	40,526	42,952	39,034	77,628	100,734	90,253

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Faroe Islands	-	28	-	-	-	-	-	-	-
Belgium	-	+	-	-	-	1	-	-	18
Denmark	34,474	30,594	28,888	18,984	16,978	41,605	28,300	43,330	60,412
France	4,576	2,538	1,230	1,198	1,001	-	-	-	27,201
Germany, Fed.Rep.	7,743	8,109	12,919	12,951	15,684	14,828	17,436	15,949	28,549
Ireland	12,645	17,887	19,074	15,568	16,363	15,281	58,011	38,455	43,624
Netherlands	43,582	111,900	104,107	109,197	157,110	92,903	116,126	114,692	81,464
Norway	-	-	-	-	-	-	-	-	-
Spain	14	16	113	106	54	29	25	33	-
UK (Engl. + Wales)	4,488	13,371	6,436	7,870	6,090	12,418	31,641	28,605	17,464
UK (N.Ireland)	-	-	2,026	1,690	587	119	-	-	1,093
UK (Scotland)	+	139	1,992	5,008	3,123	9,015	10,522	11,241	7,931
USSR / Russia (1992-)	-	-	-	-	-	-	-	-	-
Unallocated + discards	28,368	7,614	24,541	15,563	4,0103	14,057	68,644	26,795	58,718
Total	135,890	192,196	201,326	188,135	221,000	200,256	330,705	279,100	326,474

Country	1998	1999	2000	2001[1]
Faroe Islands	-	-	550	-
Belgium	18	-	-	-
Denmark	25,492	19,223	13,946	20,574
France	24,223	-	20,401	11,049
Germany	25,414	15,247	9,692	8,320
Ireland	51,720	25,843	32,999	30,192
Netherlands	91,946	56,223	50,120	46,196
Spain	-	-	50	7
UK (Engl. + Wales)	12,832	8,885	2,972	8,901
UK (N.Ireland)	-	-	-	-
UK (Scotland)	5,095	4,994	5,152	1,757
Unallocated + discards	12,706	31,239	1,884	11,046
Total	249,446	161,654	137,766	138,042

[1]Provisional.
[2]Includes Subarea VI.

Table 3.12.4.5 Landings (t) of HORSE MACKEREL in Subarea VIII by country. (Data submitted by Working Group members).

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988
Denmark	-	-	-	-	-	-	446	3,283	2,793
France	3,361	3,711	3.073	2,643	2,489	4,305	3,534	3,983	4,502
Netherlands	-	-	-	-	-[2]	-[2]	-[2]	-[2]	-
Spain	34,134	36,362	19,610	25,580	23,119	23,292	40,334	30,098	26,629
UK (Engl. + Wales)	-	+	1	-	1	143	392	339	253
USSR	-	-	-	-	20	-	656	-	-
Total	37,495	40,073	22,684	28,223	25,629	27,740	45,362	37,703	34,177

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997
Denmark	6,729	5,726	1,349	5,778	1,955	-	340	140	729
France	4,719	5,082	6,164	6,220	4,010	28	-	7	8,690
Germany, Fed. Rep.	-	-	80	62	-		-	-	-
Netherlands	-	6,000	12,437	9,339	19,000	7,272	-	14,187	2,944
Spain	27,170	25,182	23,733	27,688	27,921	25,409	28,349	29,428	31,081
UK (Engl. + Wales)	68	6	70	88	123	753	20	924	430
USSR/Russia (1992 -)	-	-	-	-	-	-	-	-	-
Unallocated + discards	-	1,500	2,563	5,011	700	2,038	-	3,583	-2,944
Total	38,686	43,496	46,396	54,186	53,709	35,500	28,709	48,269	40,930

Country	1998	1999	2000	2001[1]
Denmark	1,728	4,818	2,584	582
France	1,844	74	7	5,316
Germany	3,268	3,197	3,760	3,645
Ireland	-	-	6,485	1,483
Netherlands	6,604	22,479	11,768	36,106
Russia	-	-	-	-
Spain	23,599	24,190	24,154	23,531
UK (Engl. + Wales)	9	29	112	1,092
UK (Scotland)	-	-	249	-
Unallocated + discards	1,884	-8658	5,093	4,365
Total	38,936	46,129	54,212	76,120

[1]Preliminary.
[2]Included in Subarea VII.

Table 3.12.4.6 Western horse mackerel (IIa,IVa,Vb,VIa,VIIa-c,e-k,VIIIabde).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4–10
1982	44985281	640531	41587	0.05
1983	372425	615757	64862	0.17
1984	1079073	621662	73625	0.18
1985	2167673	1358069	80551	0.08
1986	3302153	1833334	105665	0.12
1987	4820702	2318144	157240	0.08
1988	2369846	2704530	188100	0.08
1989	2255342	2449473	268867	0.10
1990	1961674	2071798	373463	0.17
1991	3163768	1929564	333555	0.18
1992	5628871	1687143	370550	0.19
1993	6594782	1974281	433145	0.15
1994	6569173	1585283	388875	0.13
1995	4421001	1428589	510597	0.22
1996	1779823	1726865	396652	0.11
1997	1022526	1062891	442571	0.27
1998	1010870	1176572	303543	0.26
1999	2176244	1226129	273888	0.24
2000	924030	1109617	174927	0.18
2001	2346726	761520	191193	0.24
2002[1]	2346726	667731		0.22
Average	4823748	1476921	258673	0.16

[1]Recruitment in 2001 and 2002: geometric mean 1983–2000; SSB_{2002}: projected;
$F_{2002} = F_{status\ quo}$ ($F_{1999–2001}$)

3.12.5 Blue whiting combined stock (Subareas I–IX, XII, and XIV)

State of stock/exploitation: The stock is harvested outside safe biological limits. The spawning stock biomass for 2001 at the spawning time (April) is inside safe biological limits while the SSB for 2002 is expected to be below $\mathbf{B}_{pa}$. Fishing mortality has increased rapidly in recent years, and is estimated at 0.82 in 2001. Total landings in 2001 were almost 1.8 million t. The incoming year classes seem to be strong.

Management objectives: EU, Faroe Islands, Iceland, and Norway agreed to implement a long-term management plan for the fisheries of the blue whiting stock, which is consistent with a precautionary approach, aimed at constraining the harvest within safe biological limits and designed to provide for sustainable fisheries and a greater potential yield. The plan shall consist of the following:

1. *Every effort shall be made to prevent the stock from falling below the minimum level of Spawning Stock Biomass (SSB) of 1 500 000 tonnes.*

2. *For 2003 and subsequent years, the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality less than 0.32 for appropriate age groups as defined by ICES, unless future scientific advice requires modification of the fishing mortality rate.*

3. *Should the SSB fall below a reference point of 2 250 000 tonnes ($\mathbf{B}_{pa}$) the fishing mortality rate, referred to under paragraph 1, shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of the SSB to a level in excess of 2 250 000 tonnes.*

4. *In order to enhance the potential yield, the Parties shall implement appropriate measures, which will reduce catches of juvenile blue whiting.*

5. *The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.*

ICES has not yet evaluated the management plan with respect to its conformity to the precautionary approach.

Precautionary Approach reference points (proposed in 1998):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 1.5 mill t	$\mathbf{B}_{pa}$ be set at 2.25 million t
$\mathbf{F}_{lim}$ is 0.51	$\mathbf{F}_{pa}$ be set at 0.32

Technical basis

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$= $\mathbf{B}_{lim}$ exp(1.645*σ) σ=0.25
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$ (0.51)	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$ (1998)

Advice on management: ICES recommends that the fishing mortality be less than $\mathbf{F}_{pa}$=0.32, corresponding to landings of less than 600 000 t in 2003.

Rebuilding plan: Implementation of a rebuilding plan is not necessary since according to the current assessment the state of the stock is better than previously estimated.

Relevant factors to be considered in management: The current exploitation rate is not sustainable. The advice implies a reduction in fishing mortality by 60 % to $\mathbf{F}_{pa}$. However, it is recognised that fishing mortality will have to be reduced further in the following years in order to bring SSB back above $\mathbf{B}_{pa}$. The reduction of fishing mortality to $\mathbf{F}_{pa}$ is a first necessary step.

The spawning stock biomass reached a peak in 1999 due to the strong year classes 1995, 1996, and 1997. Even though the 1999 and 2000 year classes seem to be very strong, the SSB is expected to decline rapidly at the present level of fishing mortality.

The current exploitation rate and pattern means that few year classes support the fishery. The year classes dominating in the fishery are harvested heavily before they can reproduce or reach full growth potential. The estimate of year class strength for such young age groups is uncertain. The shift in dominance of younger ages in the stock in recent years is considered to be caused by an overall increase in fishing mortality and increased recruitment.

The proposed biological reference points for this stock may not be appropriate because even at moderate exploitation the probability that the stock drops below $\mathbf{B}_{pa}$ may be substantial. Revision of the biological reference points should be carried out based on a reliable analytical assessment of the stock.

Blue whiting is widely distributed in the eastern North Atlantic. Its distribution extends from the Strait of Gibraltar to the Barents Sea. It consists of several populations with genetic "leakage" between them, but it is treated as one stock since it has so far not been possible to define an unambiguous border between populations.

Catch forecast for 2003:

Basis: F(2002) = F(2001) = 0.82; Landings(2002) = 1505; SSB in 2002 = 2238.

F(2003) onwards	Basis	Catch (2003)	Landings (2003)	SSB in year 2003	SSB in year 2004
0.00	No fishing	0	0	2238	2756
0.08	0.1 * F(2001)	169	169	2202	2559
0.16	0.2 * F(2001)	327	327	2167	2378
0.25	0.3 * F(2001)	476	476	2132	2214
0.32	$\mathbf{F}_{pa}$ = 0.39 * F(2001)	598	598	2102	2082
0.33	0.4 * F(2001)	615	615	2098	2063
0.41	0.5 * F(2001)	747	747	2065	1924
0.82	F(2001)	1296	1296	1908	1383

Weights in '000 t, Mean F, ages 3–7.

Medium- and long-term projections: Medium-term projections were made using an F status quo assumption for the current year. The projections indicate that fishing at the current $\mathbf{F}_{pa}$ has a high probability of reducing the stock to below $\mathbf{B}_{pa}$. A revised estimate of $\mathbf{F}_{pa}$ that is more consistent with maintaining stock sizes above $\mathbf{B}_{pa}$ will have to be substantially below the current value.

Comparison with previous assessment and advice: The present assessment gives far higher estimates of the stock abundance in the most recent years compared to the assessments made in 1999 to 2001. Recruitment estimates from the 2001 surveys indicated that the 1999 and 2000 year classes were very abundant. The 2002 survey on the spawning grounds suggested that most age classes are more abundant than was indicated by earlier surveys. However, the increase is also seen in all the oldest year classes where a decrease due to mortality would be expected. This suggests that the 2002 survey values may be overestimates.

The 1999 and 2000 year classes were very abundant in the fishery in 2001 (notably in the third quarter). However, the ages 8 and 9 were also more present in the catch than could be expected from the catches of the earlier years. This has caused the selection pattern that is estimated in the model to be changed compared to the assessment from last year. Notably, the selection on the oldest ages has increased and this is carried through in the historical reconstruction of the stock by giving higher fishing mortality to the oldest age and a lower SSB over the historical period.

Both the higher abundance of most year classes in the 2002 survey and the high estimates of fishing mortality for the oldest age could be year-specific effects, and not reliable indicators of true changes in stock status relative to recent assessments.

The catch information from 2001 and the surveys from 2001 and spring 2002 indicate that the 1999 and 2000 year classes are very strong, but their actual size is still very uncertain. The survey and catch information that was available for the 2001 assessment (catch data for 2000 and survey information for 2000 and spring 2001) estimated the 1999 year class to be 50 % above average. The estimated strength of the 2000 year class was based on catches of age group 0 only and these were not abnormally high. The value used in the projections was very close to the geometric mean recruitment. The surveys do not provide precise estimates of 0 group strength and the strength of the 1 group is estimated in summer after the assessment was done. The summer survey in 2000 found the 0 group abundance to be less than that of the 1999 year class.

The change in perception of recent recruitment has led to a very different outlook for the development of the stock in the near future. Spawning biomass is estimated to be above $\mathbf{B}_{pa}$, although its exact size is highly uncertain. The trend in fishing mortality is considered to be reliably reflected in the assessment, and there is little doubt that F is very high and has increased rapidly in the recent years.

Because the stock appears to have improved due to the strong 1999 and 2000 year classes, a rebuilding plan is no longer considered imperative. Nevertheless, a substantial reduction in fishing mortality is still required. Fishing at $\mathbf{F}_{pa}$ (=0.32) will result in a declining SSB to a level below $\mathbf{B}_{pa}$ (=2.25 million tonnes) in 2003 unless another strong year class appears.

Elaboration and special comment: Most of the catches are taken in the directed pelagic trawl fishery in the spawning and post-spawning areas (Divisions Vb, VIa,b, and VIIb,c). Catches are also taken in a directed and a mixed fishery in Subarea IV and Division IIIa and in the pelagic trawl fishery in the northern areas (Subarea I and II, Divisions Va, XIVa,b). These fisheries in the northern areas have taken 340 000 –

1 390 000 t per year in the last decade, while catches in the southern areas (Subarea VIII, IX, Divisions VIId,e and g-k) have been stable in the range of 25 000–34 000 t. In Division IXa blue whiting is mainly taken as by-catch in mixed trawl fisheries.

Estimates of spawning biomass by acoustic surveys are well above the level indicated by the assessment. However, it has generally been difficult to reconcile catch data and absolute survey abundance estimates for blue whiting and although the acoustic surveys may be indicative of trends in biomass, the absolute values are not considered - representative.

The analytical assessment is based on catch data, acoustic surveys, and commercial CPUE series data.

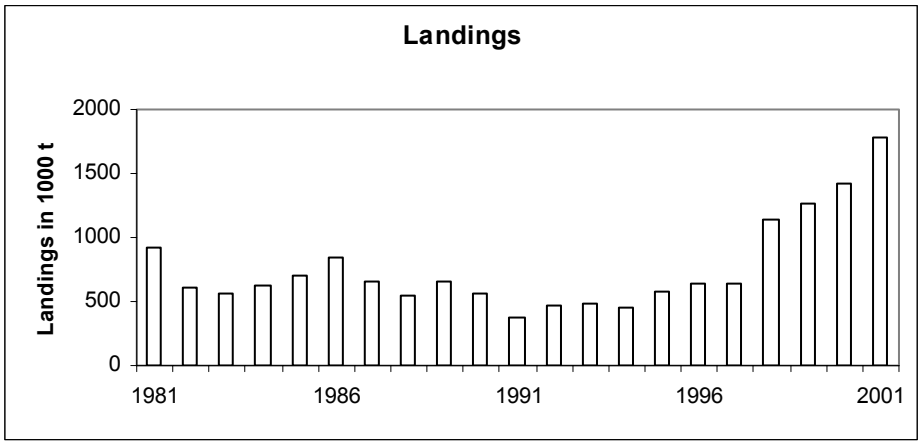
Source of information: Report of the Northern Pelagic and Blue Whiting Fisheries Working Group, 29 April – 8 May 2002 (ICES CM 2002/ACFM:19).

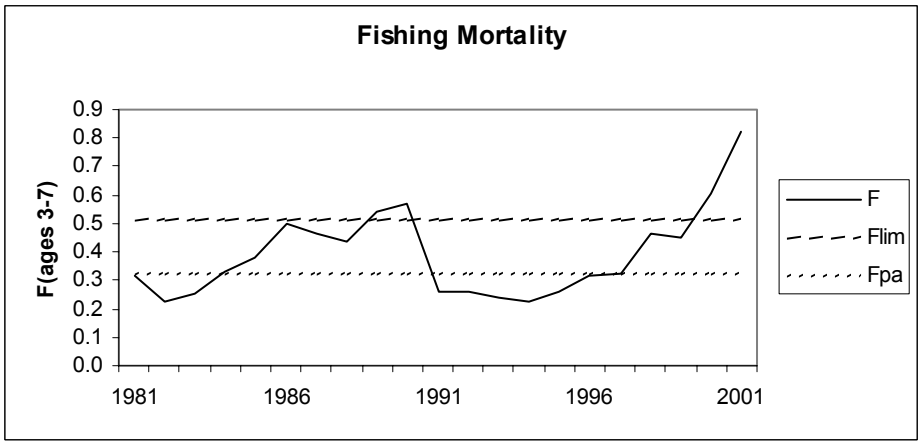
Catch data (Tables 3.12.5.1–7):

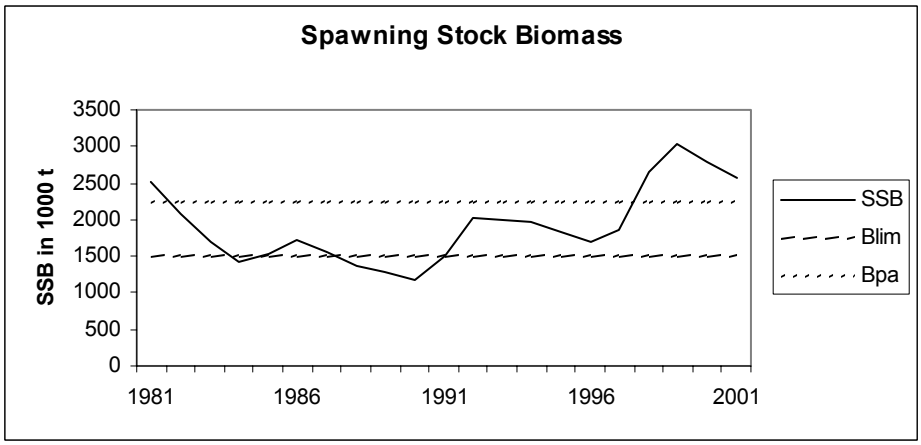
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987	TAC for northern areas; no advice for southern areas	950	-	665
1988	TAC for northern areas; no advice for southern areas	832	-	558
1989	TAC for northern areas; no advice for southern areas	630	-	627
1990	TAC for northern areas; no advice for southern areas	600	-	562
1991	TAC for northern areas; no advice for southern areas	670	-	370
1992	No advice	-	-	475
1993	Catch at *status quo* F (northern areas); no assessment for southern areas	490	-	481
1994	Precautionary TAC (northern areas); no assessment for southern areas	485	650[1]	459
1995	Precautionary TAC for combined stock	518	650[1]	579
1996	Precautionary TAC for combined stock	500	650[1]	646
1997	Precautionary TAC for combined stock	540		672
1998	Precautionary TAC for combined stock	650		1125
1999	Catches above 650 000 t may not be sustainable in the long run	650		1256
2000	F should not exceed the proposed $\mathbf{F}_{pa}$	800		1412
2001	F should not exceed the proposed $\mathbf{F}_{pa}$	628		1780
2002	Rebuilding plan	0		
2003	F should be less than the proposed $\mathbf{F}_{pa}$	600		

[1]NEAFC proposal for NEAFC regions 1 and 2. Weights in '000 t.

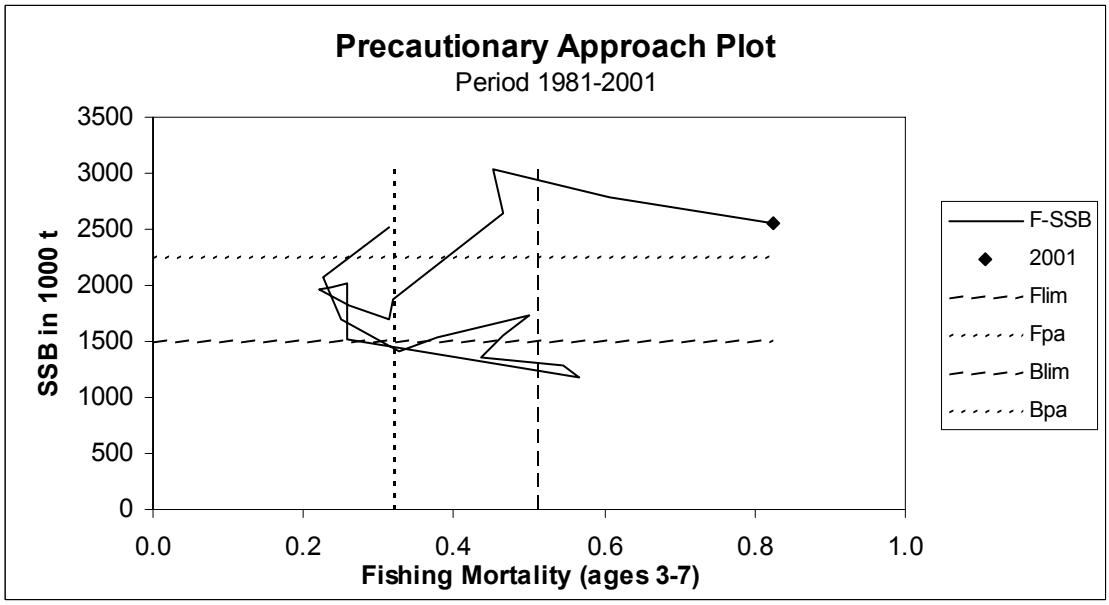
Blue whiting combined stock (Subareas I-IX, XII & XIV)

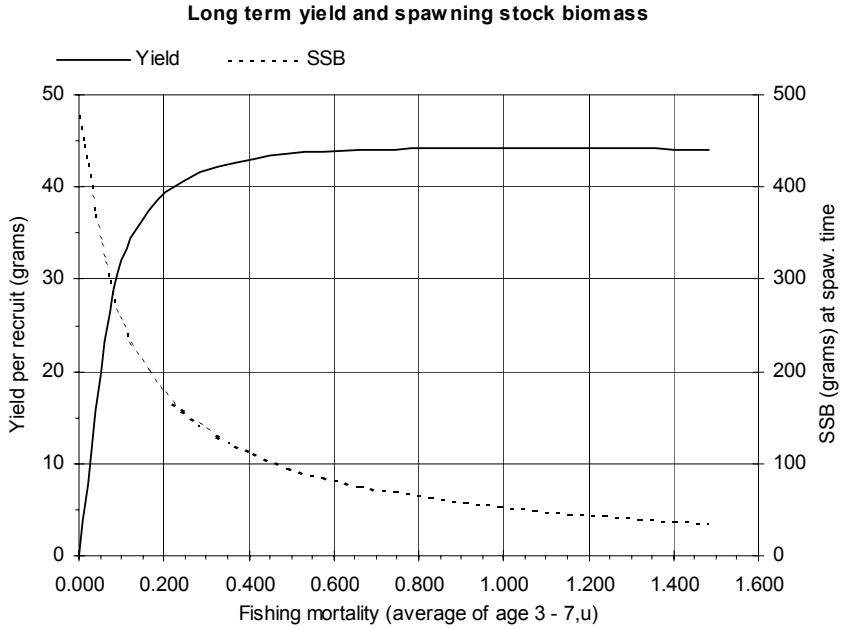


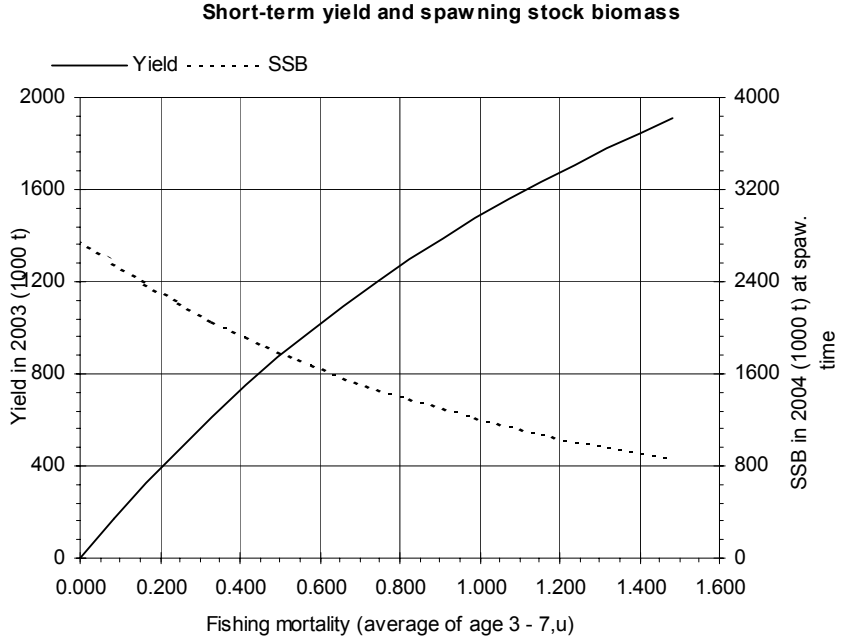




Stock - Recruitment
Recruitment (age 0) in billions
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Precautionary Approach Plot
Period 1981-2001
SSB in 1000 t
3500
3000
2500
2000
1500
1000
500
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-7)
F-SSB
2001
Flim
Fpa
Blim
Bpa


Long term yield and spawning stock biomass
Yield
SSB
Yield per recruit (grams)
SSB (grams) at spaw. time
Fishing mortality (average of age 3 - 7,u)
0
10
20
30
40
50
0
100
200
300
400
500
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600


Short-term yield and spawning stock biomass
Yield
SSB
Yield in 2003 (1000 t)
SSB in 2004 (1000 t) at spaw. time
Fishing mortality (average of age 3 - 7,u)
0
400
800
1200
1600
2000
0
800
1600
2400
3200
4000
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600

Country	1987	1988	1989 [3]	1990	1991	1992	1993	1994 [2]	1995 [3]	1996	1997	1998	1999	2000	2001
Denmark													15	7,721	5,723
Estonia	-	-	-	-	-	-	-	-	-	377	161	904	-	-	-
Faroes	9,290	-	1,047	-	-	-	-	-	-	345	-	44,594	11,507	17,980	64,496
Germany	1,010	3	1,341	-	-	-	-	2	3	32	-	78	-	-	3117
Greenland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iceland	-	-	4,977	-	-	-	-	-	369	302	10,464	64,863 [4]	99,092	146,903	245,814
Latvia	-	-	-	-	-	-	-	422	-	-	-	-	-	-	-
Netherlands	-	-	-	-	-	-	-	-	72	25	-	63	435	-	5180
Norway [5]															64,581
Norway [6]	-	-	-	566	100	912	240	-	-	58	1,386	12,132	5,455	-	28,812
Poland	56	10	-	-	-	-	-	-	-	-	-	-	-	-	-
USSR/Russia [1]	112,686	55,816	35,250	1,540	78,603	61,400	43,000	22,250	23,289	22,308	50,559	51,042	65,932	103,941	173,860
Total	123,042	55,829	42,615	2,106	78,703	62,312	43,240	22,674	23,733	23,447	62,570	173,676	182,436	276,545	591,583

[1]) From 1992 only Russia

[2]) Includes Vb for Russia.

[3]) Icelandic mixed fishery in Va.

[4]) include mixed in Va and directed in Vb.

[5]) Directed fishery

[6]) By-catches of blue whiting in other fisheries.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998 [1]	1999	2000	2001
Denmark	2,655	797	25	-	-	3,167	-	770	-	269	-	5051	19,625	11,856	18,110
Estonia	-	-	-	-	-	6,156	1,033	4,342	7754	10,605	5,517	5,416	-	-	-
Faroes	70,625	79,339	70,711	43,405	10,208	12,731	14,984	22,548	26,009	18,258	22,480	26,328	93,234	129,969	188,464
France	-	-	2,190	-	-	-	1,195	-	720	6,442	12,446	7,984	6,662	13,481	13,480
Germany	3,850	5,263	4,073	1,699	349	1,307	91	-	6,310	6,844	4,724	17,891	3,170	12,655	15,862
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	61,438	113,280	119,287
Ireland	3,706	4,646	2,014	-	-	781	-	3	222	1,709	25,785	45635	35,240	25,200	29,854
Japan	-	-	-	-	-	918	1,742	2,574	-	-	-	-	-	-	-
Latvia	-	-	-	-	-	10,742	10,626	2,160	-	-	-	-	-	-	-
Lithauen	-	-	-	-	-	-	2,046	-	-	-	-	-	-	-	-
Netherlands[2])	5,627	800	2,078	7,280	17,359	11,034	18,436	21,076	26,703	17,644	23,676	27,884	35,408	46,128	68,415
Norway	191,012	208,416	258,386	281,036	114,866	148,733	198,916	226,235	261,272	337,434	318,531	519,622	475,004	460,274	399,932
UK (Scotland)	3,315	5,071	8,020	6,006	3,541	6,849	2,032	4,465	10,583	14,325	33,398	92,383	98,853	42,478	50,147
USSR/Russia [3])	165,497	121,705	127,682	124,069	72,623	115,600	96,000	94,531	83,931	64,547	68,097	79,000	112,247	141,257	141,549
Total	446,287	426,037	475,179	463,495	218,946	318,018	347,101	378,704	423,504	478,077	514,654	827,194	940,881	996,578	1,045,100

[1]) Including some directed fishery also in Division IVa.

[2]) Revised for the years 1987, 1988, 1989, 1992, 1995,1996,1997

[3]) From 1992 only Russia

Country	1987	1988	1989	1990	1991	1992	1993 [3]	1994	1995	1996	1997	1998 [2]	1999	2000	2001
Denmark [4]	28.541	18.144	3.632	10.972	5.961	4.438	25.003	5.108	4.848	29.137	9.552	40.143	36.492	30.360	21.995
Denmark [5]			22.973	16.080	9.577	26.751	16.050	14.578	7.591	22.695	16.718	16.329	8.521	7.749	7.505
Faroes [4] [6]	7.051	492	3.325	5.281	355	705	1.522	1.794	-	6.068	6.066	-	-	-	60
Faroes [5] [6]												296	265	42	6.741
Germany [1]	115	280	3	-	-	25	9	-	-	-	-			-	81
Netherlands	-	-	-	20	-	2	46	-	-	-	793			-	-
Norway [4]	24.969	24.898	42.956	29.336	22.644	31.977	12.333	3.408	78.565	57.458	27.394	28.814	48.338	73.006	21.804
Norway [5]															58.182
Russia															69
Sweden	2.013	1.229	3.062	1.503	1.000	2.058	2.867	3.675	13.000	4.000	4.568	9.299	12.993	3.319	2.086
UK	-	100	7	-	335	18	252	-	-	1	-			-	-
Total	62.689	45.143	75.958	63.192	39.872	65.974	58.082	28.563	104.004	119.359	65.091	94.881	106.609	114.476	118.523

[1]) Including directed fishery also in Division IVa.

[2]) Including mixed industrial fishery in the Norwegian Sea

[3]) Imprecise estimates for Sweden: reported catch of 34265 t in 1993 is replaced by the mean of 1992 and 1994, i.e. 2,867 t, and used in the assessment.

[4] Directed fishery

[5] By-catches of blue whiting in other fisheries.

[6] For the periode 1987-2000 landings figures also include landings from mixed fisheries in Division Vb.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Netherlands	-	-	-	450	10	-	-	-	-	-	-	10 [1]	-	-	-
Norway	4	-	-	-	-	-	-	-	-	-	-			-	-
Portugal	9.148	5.979	3.557	2.864	2.813	4.928	1.236	1.350	2.285	3.561	2.439	1.900	2.625	2.032	1.746
Spain	23.644	24.847	30.108	29.490	29.180	23.794	31.020	28.118	25.379	21.538	27.683	27.490	23.777	22.622	23.218
UK	23	12	29	13	-	-	-	5	-	-	-	-	-	-	-
France	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Total	32.819	30.838	33.695	32.817	32.003	28.722	32.256	29.473	27.664	25.099	30.122	29.390	26.402	24.654	24.964

[1]) Directed fisheries in VIIIa

Area	Denmark	Faroes	France	Germany	Iceland	Netherlands	Ireland	Norway	Portugal	Russia	Scotland	Spain	Sweden	Grand Total
I											33			33
IIa	5,723	39,694		3,117	74,700	5,180		93,393		148,015				369,821
IIb										25,812				25,812
IIIa	2,954							22					2,040	5,016
IVa	26,546	6,801		81				79,964		69			46	113,507
IXa									1,746					1,746
Va		24,801			171,114									195,915
Vb	13,632	114,591			119,287			63,282		94,776				405,568
Vb VI VII			13,480											13,480
VIa	1,023	28,753		11,619		25,572	18,357	148,789			36,264			270,376
VIb		6,480		650		4,447	567	35,820		37,193	2,963			88,120
VIIb				51		10,595	1,563				6,816			19,025
VIIbc								75,756						75,756
VIIc	3,455	36,816		3,488		25,820	8,438				4,044			82,061
VIIgk+XII		1,824						76,285		9,580				87,689
VIIh				2										2
VIIIc+IXa												23,218		23,218
VIIj				52		1,982	929				60			3,023
Grand Total	53,333	259,761	13,480	19,060	365,101	73,595	29,854	573,310	1,746	315,478	50,147	23,218	2,086	1,780,170

Table 3.12.5.6 Blue whiting combined stock (Subareas I-IX, XII & XIV)

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3–7
1981	4055289	2524227	924804	0.3143
1982	16639719	2076892	613859	0.2262
1983	22220166	1701049	562084	0.2497
1984	14847654	1415142	630753	0.3275
1985	12544761	1543316	696998	0.3771
1986	11151699	1728281	849665	0.4990
1987	9213750	1546722	662561	0.4652
1988	9810064	1365409	553690	0.4368
1989	25384230	1293635	657602	0.5439
1990	10114204	1175685	560950	0.5676
1991	6792609	1514241	369806	0.2572
1992	5701122	2026704	475048	0.2593
1993	6554003	1987685	480733	0.2363
1994	8169103	1959444	459082	0.2217
1995	29012229	1819742	577921	0.2617
1996	49460845	1694646	636090	0.3135
1997	24158783	1870973	646242	0.3202
1998	13545724	2648888	1133373	0.4664
1999	29937139	3043905	1265898	0.4531
2000	38754471	2784253	1416451	0.6071
2001	11760000	2561316	1777957	0.8245
2002	13983000	2238000		0.8245
Average	16991389	1932734	759598	0.4115

Table 3.12.5.7 Blue whiting. Results of medium term analysis.

F in 2002 equals F in 2001 (F=0.8245)												
	Probabilities (%)				Year when	Year when	Fractiles of catch in 2002			Fractiles of catch in 2003		
F in 2003	B<Blim		B>Bpa		risk B<Blim is	prob. B>Bpa						
and after	2003	2012	2003	2012	below 5%	is above 95%	25%	50%	75%	25%	50%	75%
0.05	4.1	0.0	38.8	100.0	2003	2005	1216	1374	1558	89	102	117
0.10	4.6	0.0	36.9	100.0	2003	2005				174	200	230
0.15	5.5	0.0	35.8	99.8	2004	2006				255	294	336
0.20	5.8	0.0	34.4	97.7	2004	2008				334	384	440
0.25	6.6	0.0	32.2	89.7	2004	>2012				409	470	540
0.30	7.4	0.6	30.7	74.6	2004	>2012				481	554	635
0.32=Fpa	7.4	1.3	30.4	68.2	2004	>2012				509	586	672
0.35	7.8	2.6	29.9	58.1	2004	>2012				551	634	726
0.40	8.7	6.9	28.2	38.8	>2012	>2012				618	711	815

3.12.6 Response to Special Request from EC concerning the state of the Northern Hake stock and catch advice for 2002

EC DG Fish requested ICES for the Northern Hake stock to:

- *Evaluate any new relevant information concerning the state of the stock*

- *Review the catch advice provided for the year 2002*

ICES should take into account relevant comments by STECF, and in particular comments concerning the precautionary reference points for hake.

ICES advice October 2001:

In the light of the continued decrease in SSB and very poor recruitment since 1997, ICES recommends a recovery plan that will ensure a safe and rapid recovery of SSB to a level in excess of 165 000 t. If a recovery plan is not implemented ICES recommends that fishing mortality on hake should be reduced to the lowest possible level in 2002.

This advice was based on an assessment made in September 2001.

The ICES October 2001 advisory report presented short-term forecasts and medium term simulations based on two options of fishing mortality for 2001:The first option was based on status quo F ($\mathbf{F}_{sq}$ =$F_{98–00}$ =0.29 corresponding to an expected landing of 37·400 t) and the other option was based on the assumption that the catch in 2001 will constrained by the TAC (TAC_{2001}=22 600 t corresponding to F=0.16).

ICES Comments:

A. Evaluate new Information

1. At the time of writing (late May 2002) a new reviewed assessment based on the complete 2001 dataset is not available. ICES Advisory Committee on Fishery Management (ACFM) will review the assessment of the Northern Hake stock in October 2002. ACFM will at that time formulate ICES advice for 2003.

2. Compared to the data used for formulating the October 2001 advice, ICES can offer the following new information:

   - Landings statistics for 1999 and 2000 have been revised. The text table below compares the new estimates with those used in 2001.

Years	Preliminary statistics used in the 2001 assessment	Revised value	Difference
1999	38 518 t	39 815 t	+ 3.4%
2000	40 905 t	42 024 t	+ 2.7%

   - Preliminary landings statistics for 2001 are 36 675 t. This is very close to the value predicted for *status quo* F in 2001 (37 400 t). No information on the landings in the first months of 2002 was available.

   - The trend to increase the mean length in the landings was continued in 2001. Since 1997 the mean length in the landings has increased from 34 to 46 cm. This means that the proportion of small fish in the landings has decreased. There is reduced recruitment in recent years (leading to a general lack of small fish in the population). The fisheries have also changed: there is better enforcement of the legal minimum landing size and there are changes in the fishing strategies. The assessment includes discard data and shows that fishing generated mortality on 0–2 year old hake has decreased.

   - Compared to 2000, LPUE in 2001 show a 30% decrease for the two most important trawler fleets operating in Subarea VII (A Coruna and Vigo fleets) whilst remaining at a high level for the A Coruna fleet. In Subarea VII long-liners show an increase (+5%) in LPUE (kg/day), and gill-netters in Sub-Area VII+VIII (+8). In Sub-Area VIII, there is no clear trend in the LPUE.

   - Survey indices indicate an increase in recruitment (age 0) in 2001 both in the Bay of Biscay (French surveys EVHOE and RESSGASC) and in the Celtic Sea from the French EVHOE survey. The UK-Ground fish survey, which took place in March 2002, shows a consistent increase in the abundance at age 1 from the lowest in the time series.

3. The landings reported for 2001 suggests that the option using F(2001) = $\mathbf{F}_{sq}$ =0.29 is the more relevant among those presented in the 2001 report. Thus,

   - To achieve recovery of SSB in excess of 165 000 t in 2005 would require, in 2002, a 60% reduction in F (corresponding to landings less than 16 200 t in 2002).

- The 2002 TAC (26 960 t) corresponds to a F in 2002 that is 30% below $\mathbf{F}_{sq}$ (to $\mathbf{F}_{pa}$=0.20), and the simulations suggests that will only allow SSB to reach 165 000 t in 2008 with 50 % probability.

- To increase SSB by 15% each year as specified in the recovery plan, i.e., aiming at SSB = 113 000 t in 2003 requires that F (= 0.14) would be only 50% of $\mathbf{F}_{sq}$ (corresponding to landings less than 19 900 t in 2002).

4. Recruitment to future Spawning Stock Biomass is possibly larger than predicted because the improved selection pattern and changes in fishing strategy may reduce fishing mortality on immature hake more than assumed in the projections.

5. Recent information on abundance indices from the Northern part of the stock distribution area have not yet been taken into account in the assessment because of the short time series of these surveys.

Biological PA Reference Points

$\mathbf{B}_{lim}$ is currently based on $\mathbf{B}_{loss}$ as estimated in 1998. Since then there has been substantial revisions of both data and assessment model leading to a downwards re-evaluation of the whole series of SSB, with a new $\mathbf{B}_{loss}$ about 15 % lower than estimated in the 1998 assessment. However, preliminary results from a statistical method applied to the revised series set $\mathbf{B}_{lim}$ higher than the current value for this reference point.

At this stage, it can be considered

- either that Biomass Reference Points should be considered as relative. Thus, the absolute values should be consequently revised downwards, leading to new values of $\mathbf{B}_{lim}$ and $\mathbf{B}_{pa}$ at 102–105 kt and 140–150 kt respectively,

- or that these changes in SSB and in $\mathbf{B}_{loss}$ from year to year reflect unstability in the assessment and thus lead to a need to be more cautious.

Revision of Biological Reference Points for northern hake would benefit from further investigations into the source of the instability in the assessment. Therefore, no revisions of the biological reference points are currently suggested even though the actual ones are considered to be possibly inappropriate.

ICES advise, in line with the advice given in 2001, that:

In the light of the continued decrease in SSB and poor recruitment since 1997, ICES recommends a recovery plan that will ensure rebuilding of SSB to a level in excess of $\mathbf{B}_{pa}$ (currently under revision). If a recovery plan is not implemented, ICES recommends that the fishing mortality on hake should be reduced to the lowest possible level in 2002.

3.12.7 Answer to Icelandic Request on Behalf of EU, Norway, Iceland, Greenland, and, Faroe Islands, and Russia on Blue Whiting

Request to the International Council for the Exploration of the Sea

The European Community, the Faroe Islands, Greenland, Iceland, Norway, and the Russian Federation at the Meeting on the Management Measures for the Blue Whiting Stock held in Reykjavik on the 11 to 12 February 2002 agreed on the need to develop a multi-annual recovery plan that ensures a safe recovery of the blue whiting stock.

The parties agreed that the plan should include:

- *A harvest rule specifying the upper limits of the catches to be taken during the recovery period*
- *Measures to enhance the exploitation pattern with the aim of securing a low fishing mortality on juveniles.*

Within the above context, ICES is requested to provide advice on possible harvest rules and technical measures to be included in a recovery plan.

Harvest rules

1. *ICES is requested to identify candidate harvest rules and to evaluate them, in particular with respect to risks associated with a range of TAC's in the rebuilding phase and a range of targets for the rebuilding. In addition to the uncertainty about initial numbers and future exploitation pattern and weights and maturity rates, ICES should at least take into account:*

   - *The uncertainty in the estimates of those year classes that will enter the spawning stock in the rebuilding period, given the present lack of information about the stock at these ages,*
   - *A range of levels of exploitation on juveniles,*
   - *A range of scenarios for how the recruitment will respond to SSB being below* $\boldsymbol{B}_{lim}$*,*
   - *The robustness to bias in the assessment,*
   - *The robustness to a sequence of poor year classes.*

   The performance criteria to be evaluated should include:

   - *The probability that the SSB will be below* $\boldsymbol{B}_{lim}$*,*
   - *The probability that the stock will reach a target level within various time frames,*
   - *The year-to-year variation in the catches in the recovery period.*

2. *In order to establish realistic targets for the rebuilding and as a guideline for future harvest rules, ICES is requested to revisit the reference point. In particular, the fact that fishing at the current* $\boldsymbol{F}_{pa}$ *will lead to a substantial probability of SSB<*$\boldsymbol{B}_{pa}$ *should be considered.*

3. *As a guideline for evaluating harvest rules for the situation where the state of the stock is satisfactory, ICES is requested to provide the likely range of yearly catches in stochastic long-term simulations, for a range of combinations of fishing mortality on adult and juvenile fish.*

Exploitation pattern

ICES is requested to provide as detailed information as possible on the age/size composition in different segments of the blue whiting fishery and to evaluate the effect on the stock and the fisheries of possible measures to reduce exploitation of juveniles.

The evaluation should include but not be restricted to the effects of introducing a minimum size and closed areas/seasons."

Answer to the request on Harvest Control Rule

Due to exceptionally strong incoming year classes, ICES perception of the stock in 2002 is more optimistic than in 2001. The need for a *rebuilding plan* is, accordingly, not as urgent as it appeared in 2001. However, even if the SSB is currently above the 2001 $\mathbf{B}_{pa}$, and also above a suggested action level of SSB, as introduced below, the current high fishing mortality will, in the medium term, reduce the stock size heavily. Unless the recruitment continues to be above the long-term average also in the coming years, the current F will bring the SSB below the $\mathbf{B}_{lim}$ in 2004–2005. In this situation more effort is invested into suggesting a harvest control rule than to concentrate on a rebuilding plan.

Medium and long-term simulations based on the 2001 assessment were presented to the SGPA in March 2002 (Lisbon) and can be found in the report of that meeting. The group suggested to extend the reference point framework to a harvest control rule of the same general design as already agreed by the coastal states (May 2002).

Due to the unstable situation with regard to the perception of the state of the stock and recent recruitment, the WGNPBW did not reproduce or extend these simulations. This should be done to further refine a harvest control rule within the agreed framework.

However, this should be postponed until a more clear view of the stock dynamics has evolved.

Answer to the request on exploitation pattern

Evaluations of the risk associated with a harvest control rule will be very sensitive to the exploitation of juvenile fish. At present there is not enough information available to examine this in the required detail.

To be able to provide age/size compositions in different segments of the blue whiting fishery and to evaluate the effect on the stock, the following information is required:

- Homogeneous definition of "Fisheries", where the parameters gear, mesh size, area, and time are taken into account.
- Implementation of biological sampling schemes, which follow the above definitions.

In order to provide catch-at-age from the different fisheries, the following fisheries are defined:

In the North Sea and Skagerrak area blue whiting is taken in:

- a directed fishery for blue whiting using trawls with a mesh size of >=40 mm.
- a fishery where blue whiting is taken as by-catch. In this fishery trawls with mesh sizes less than 40 mm are used.

In the Northern areas outside the North Sea and Skagerrak blue whiting is taken in:

- a directed blue whiting fishery where trawls with mesh sizes of at least 40 mm are used.
- fisheries for Norwegian spring spawning herring where blue whiting is taken as by-catch. This fishery is carried out by purse seiners and trawlers using gears with mesh sizes of at least 36 mm.
- fisheries for other species where blue whiting is taken as by-catch, using gears with mesh sizes less than 36 mm.

Landings of blue whiting caught in the Southern area are taken in:

- a directed offshore fishery for blue whiting using trawls with a mesh size of >=55 mm.
- a more coastal fishery where blue whiting is taken as by-catch. In this fishery trawl with mesh sizes less than 65 mm is used.

In order to evaluate the effect which different fisheries have on the blue whiting stock, landing figures for at least five years should be available. These need to be disaggregated by fisheries. With the very short time notice such data could not be obtained. The respective ICES Working Group is requested to start compiling data on the basis of fishery, quarter, and area for the next Working Group meeting in 2003.

3.12.8 Answer to request from NEAFC concerning blue whiting

NEAFC request dated 16 November 2001:

"Regarding blue whiting stocks: provide medium-term projections using scenarios as considered appropriate"

The medium-term projections were carried out with a fishing mortality for 2002 assumed to be equal to the fishing mortality of 2001, *i.e.,* $F_{2002} = F_{2001}$. Based on this a median catch in 2002 of 1 374 000 t is predicted.

The risk of the SSB being below $\mathbf{B}_{lim}$ was found to be 4% - 9% in 2003 for F's between 0.05 and 0.4 in 2003. At a fishing mortality of 0.25 from 2004 onwards, the probability of SSB being below $\mathbf{B}_{lim}$ is 5% or less. However, at any higher fishing mortality the risk falling below $\mathbf{B}_{lim}$ is greater than 5%. In order to bring B above $\mathbf{B}_{lim}$ in 2003 a fishing mortality of less than 0.15 is required, based on a 5% risk level (Table 3.12.8.5). In other words, to obtain a B above $\mathbf{B}_{lim}$ in 2004 with a 95% probability, F must be less than 0.15.

At a fishing mortality of 0.25 there is a 30% probability that SSB will be above $\mathbf{B}_{pa}$ of 2 250 000 t ($\mathbf{B}_{pa}$ used until now) in 2003, and a 95% probability to be above $\mathbf{B}_{pa}$ in 2012.

Table 3.12.8.1

Blue whiting. Medium term projections

F in 2002 equals F in 2001 (F=0.8245, corresponding to a catch of 1 374 000 t)

	Probabilities (%)				Year when	Year when	Fractiles of catch in 2002			Fractiles of catch in 2003		
F in 2003	B<Blim		B>Bpa		risk B<Blim is	prob. B>Bpa						
and after	2003	2012	2003	2012	below 5%	is above 95%	25%	50%	75%	25%	50%	75%
0.05	4.1	0.0	38.8	100.0	2003	2005	1216	1374	1558	89	102	117
0.10	4.6	0.0	36.9	100.0	2003	2005				174	200	230
0.15	5.5	0.0	35.8	99.8	2004	2006				255	294	336
0.20	5.8	0.0	34.4	97.7	2004	2008				334	384	440
0.25	6.6	0.0	32.2	89.7	2004	>2012				409	470	540
0.30	7.4	0.6	30.7	74.6	2004	>2012				481	554	635
0.32	7.4	1.3	30.4	68.2	2004	>2012				509	586	672
0.35	7.8	2.6	29.9	58.1	2004	>2012				551	634	726
0.40	8.7	6.9	28.2	38.8	>2012	>2012				618	711	815

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3.13 Deepwater fisheries resources south of 63°N

3.13.1 Overview

1. Background

In some parts of the northeast Atlantic where the continental shelf is narrow, such as off Portugal (including Madeira and the Azores), there are traditional fisheries, for example for black scabbardfish (*Aphanopus carbo*) and red (=blackspot) seabream (*Pagellus bogaraveo*), which have been exploiting deepwater species for many years. Other traditional species are ling, blue ling, and tusk, which have supported large fisheries in wide areas for several decades. The existence of other potentially exploitable stocks in the ICES area has been known since the 1960s and 1970s. However, before the 1980s, with the exception of a fishery for species such as roundnose grenadier (*Coryphaenoides rupestris*) there was little interest from the fishing industry in exploiting stocks in international waters.

Since the 1980s, dwindling resources on the continental shelves of the North Atlantic have encouraged the development of fisheries in deeper waters. There has been a tendency for fisheries for species such as anglerfish and Greenland halibut to extend into deeper waters, and new fisheries have developed to target the new deepwater species that have been found there. Deepwater species such as the argentine or greater silver smelt (*Argentina silus*) and roundnose grenadier (*Coryphaenoides rupestris*), which were previously by-catch species have been targeted within the ICES area for the last two decades. Orange roughy (*Hoplostethus atlanticus*) has been a target species since the early 1990s.

While there has been increasing research activity in deep water it is of concern that fisheries on deep water species have developed rapidly and that the resources, which they exploit are generally especially vulnerable to overfishing. Also within the ICES area species/stocks have been depleted before appropriate management measures have been implemented. It is also of concern that the landings statistics that are available may not reflect the true scale of the recent fishing activity in waters outside the national EEZs.

Data availability

It continues to be a major problem for the assessment of stock status that data on landings and particularly fishing effort are limited or of relatively poor quality. Furthermore, for a range of species, effort data from major fisheries could not be updated, or directed effort data were not available for the most recent years. This prevents new assessments from being carried out for some stocks, and results from assessments using total effort may not necessarily be consistent with results reported in 2000. It must be noted that this deterioration of the available data occurred at the same time as some deepsea fisheries seemed to be expanding rapidly.

The smallest units for which data are reported at present are the ICES Subareas and Divisions. The depth range within such areas may be very wide and the size of the areas varies. Furthermore, several species show relatively isolated concentrations/sub-units of a stock and catch rates can only be maintained by sequential depletion of these concentrations. Therefore, effort and catches must be recorded at a finer temporal and geographical scale.

There is also a need to collect information on length composition of landings by species, and discard sampling programs need to be developed.

Considerable progress has been made on the collection of biological data, including age determination and length-at-age data, and it is recommended to pursue such scientific investigations.

2. The species

The term deep water is defined to include waters of depths greater than 400 m. The following were identified as some of the most important deepwater species:

DEEPWATER SPECIES LIST

Alepocephalus bairdii	Baird's smoothhead
Aphanopus carbo	Black scabbardfish
Argentina silus	Argentine, greater silver smelt
Beryx splendens	Golden eye perch
Beryx decadactylus	Red bream, alfonsino
Brosme brosme	Tusk
Chimaera monstrosa	Rabbitfish
Coryphaenoides rupestris	Roundnose grenadier
Epigonus telescopus	Big eye, deepwater cardinal fish
Helicolenus dactylopterus	Bluemouth
Hoplostethus atlanticus	Orange roughy
Hoplostethus mediterraneus	Silver roughy
Lepidopus caudatus	Silver scabbardfish
Macrourus berglax	Roughhead grenadier
Molva molva	Ling
Molva dypterygia	Blue ling
Mora moro	Mora
Pagellus bogaraveo	Red (=blackspot) seabream
Phycis blennoides	Greater forkbeard
Polyprion americanus	Wreckfish
Trachyrhynchus trachyrhynchus	Roughnose grenadier
Chaecon (Geryon) affinis	Deepwater red crab
Aristeomorpha foliacea	Giant red shrimp
	Sharks, various

The main shark species caught in deepwater fisheries are:

Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Centroscyllium fabricii	Black dogfish
Centroscymnus coelolepis	Portuguese dogfish
Centroscymnus crepidater	Longnose velvet dogfish
Dalatias licha	Kitefin shark
Deania calcea	Birdbeak dogfish
Etmopterus princeps	Great lantern shark
Etmopterus spinax	Velvetbelly
Scymnodon ringens	Knifetooth dogfish

Advice on some other species, which might be considered as deepwater species, is already provided elsewhere in the ACFM report:

Micromesistius poutassou	Blue whiting
Reinhardtius hippoglossoides	Greenland halibut
Sebastes spp	Redfish

In addition, there are other species which have been fished on the continental shelf, but whose distribution extends into deeper waters. This group includes hake (*Merluccius merluccius*), anglerfish (*Lophius* spp.), megrim (*Lepidorhombus* spp.), and conger (*Conger conger*), and recent years have seen an extension of fishing into deeper waters for these species in ICES Subareas VI, VII, VIII, and IX. Advice is provided on these species elsewhere in the ACFM report.

3. Descriptions of deepwater fisheries by Subarea

In ICES Subarea II there are directed longline and gillnet fisheries for ling and tusk. Bottom and pelagic trawl fisheries target argentine (*Argentina silus*), and there is a minor fjord fishery for roundnose grenadier. Landings of argentine rose sharply in 2001. Roughhead grenadier are taken as by-catch in the trawl, gillnet, and longline fisheries for Greenland halibut and redfish.

In ICES Subarea III there is a targeted trawl fishery for roundnose grenadier and argentine. These species are also a by-catch of the *Pandalus* and *Nephrops* fisheries, and probably only a minor part of this by-catch is landed.

In ICES Subarea IV there is a by-catch of argentine from the industrial trawl fishery. A longline fishery targets tusk and ling with forkbeard (*Phycis blennoides*) and some roughhead grenadier as a by-catch. Some deepwater species are landed as a by-catch in the trawl fisheries targeting anglerfish and Greenland halibut.

In ICES Subarea V there are trawl fisheries which target blue ling, redfish, argentine, and occasionally orange roughy. By-catch species are typically roundnose grenadier, roughhead grenadier, black scabbardfish, anglerfish, bluemouth (*Helicolenus dactylopterus*), mora (*Mora moro*), greater forkbeard (*Phycis blennoides*), argentine, deepwater cardinal fish (*Epigonus telescopus*) and rabbit fish (*Chimaera monstrosa*). There are traditional longline fisheries for ling and tusk and these species are also by-catches in trawl and gillnet fisheries. There are also targeted trawl and gillnet fisheries for Greenland halibut and anglerfish, which have a deepwater by-catch of, for example, deepwater red crab (*Chaceon affinis*). There have also been trap fisheries for the deepwater red crab.

In ICES Subareas VI and VII there are directed trawl fisheries for blue ling, roundnose grenadier, orange roughy, black scabbard fish, and the deepwater sharks *Centroscymnus coelolepis* and *Centrophorus squamosus*. By-catch species include bluemouth, mora, greater forkbeard, argentine, deepwater cardinal fish, and chimareids, of which *Chimaera monstrosa* is the most important. The orange roughy landings doubled from 2000 to 2001, most of them coming from Subarea VII. The argentine and blue ling landings increased, the former reflecting increasing target fishery. By-catch species include bluemouth, mora, greater forkbeard, argentine, deep-sea cardinal fish, and chimaerids (mostly *Chimera monstrosa*). There are directed longline fisheries for ling and tusk and also for hake, often with deepwater sharks as a by-catch. There are targeted fisheries for sharks in Subareas VI and VII and a gillnet fishery in Subarea VII for ling.

In ICES Subarea VIII there is a longline fishery, which mainly targets greater forkbeard. There are also some trawl fisheries targeting species such as hake, megrim, anglerfish, and *Nephrops,* which have a by-catch of deepwater species. These include *Molva* spp., forkbeard (*Phycis phycis*), greater forkbeard, red seabream (*Pagellus bogaraveo*), conger eel (*Conger conger*), bluemouth, wreckfish (*Polyprion americanus*), and *Beryx* spp.

In ICES Subarea IX some deepwater species are a by-catch of the trawl fisheries for crustaceans. Typical species are bluemouth, greater forkbeard, conger eel, blackmouth dogfish (*Galeus melastomus*), kitefin shark (*Dalatias licha*), and gulper shark (*Centrophorus squamosus*). There is a directed longline fishery for black scabbardfish with a by-catch of the Portuguese dogfish (*Centroscymnus coelolepis)*. There is also a artisanal longline (Voracera) fishery for red seabream.

In ICES Subarea X the main fisheries are by handline and longline near the Azores and the main species landed are red seabream, wreckfish, conger eel, bluemouth, golden eye perch (*Beryx splendens*), and alfonsino (*Beryx decadactylus*). At present the catches of kitefin shark (*Dalatias licha*) are made by the longline and handline deepwater vessels and can be considered as accidental. There are no vessels at present catching this species using gillnets. Outside the Azorean EEZ there are trawl fisheries for golden eye perch, orange roughy, cardinal fish, black scabbard fish, and wreckfish. In 1998 and 1999 two commercial longliners from Madeira targeted black scabbardfish in this Subarea. In 1998 and 1999 some commercial fishing experiments targeting deepwater crustaceans species (deepwater crabs and shrimps), were also undertaken. There are trawl fisheries for golden eye perch, orange roughy, cardinal fish, black scabbardfish, and wreckfish.

In ICES Subarea XII there are trawl fisheries on the mid-Atlantic Ridge for orange roughy, roundnose grenadier, and black scabbard fish. There is a multi-species trawl and longline fisheries on Hatton Bank, in this Subarea and in Subarea VI. There is considerable exploratory fishing on this bank, and fishing effort seems to be increasing. Smoothheads were usually discarded but a substantial fraction of the catch is now landed.

In ICES Subarea XIV there are trawl and longline fisheries for Greenland halibut and redfish that have by-catches of roundnose grenadier, roughhead grenadier, and tusk.

4. Landings data

Landings for roughhead grenadier, sharks (various), silver scabbardfish (*Lepidopus caudatus*) smoothheads (*Alepocephalidae*), and wreckfish (*Polyprion americanus*) by ICES Subarea and country are given in Tables 3.13.1.1–5. For other species landings statistics and other information is given in subsequent sub-sections.

5. Assessment

Very few time-series based on the regular sampling of commercial landings exist. Basic statistics on catches and effort are of poor quality and in some cases lacking. As indicated previously for some major fisheries, it was not possible to update effort and CPUE, or directed effort for recent years were not available. There is often insufficient information on the general biology of these species, in particular on age and growth, seasonal behaviour, migration, and stock discrimination. New data on landings, discards, and biological parameters relevant to assessment have been collected as part of the EC FAIR Deep-fisheries Project (95/655). However, many of the discard sampling programs initiated under

that project have been discontinued or continued only on an opportunistic basis. Although the necessary data are improving for certain stocks, the possibilities for traditional age-structured assessments only exist for a few stocks. Assessments using some alternative methodologies such as De Lury constant recruitment models and Schaefer production models continue to be used. CPUE analyses continue to be important for monitoring the status of stocks.

For many stocks, CPUE are the only supplementary data available, but in some fisheries where the exploitation has changed to different areas, such data are unreliable as indicators of stock abundance. There is a strong need for exploring all possible methods of monitoring the stocks. There is experience from outside the ICES region (e.g., acoustic and egg surveys), which should be considered.

Developments in acoustic survey techniques may lead to biomass estimates for some species. In the shorter term the use of trawl surveys may be the best method for monitoring some of these stocks.

There is substantial experience with developing deepwater fisheries outside the ICES region. ICES has also drawn on global experience in evaluating status and trends in deepsea species, and in formulating advice consistent with the precautionary approach.

6. Management considerations

Experience shows that deepsea stocks can be depleted very quickly and that recovery will be slow. These populations generally have a high proportion of old fish, their fecundities are low, and regeneration and growth are so slow that stock numbers do not increase in the depleted areas in the short or medium term.

The unusual body shape of many deepwater fish combined with a high age/length at maturity often means that there can be a high fishing mortality of immature fish. The survival rates of discards and of fish encountering gears and escaping are unknown, but many species are expected to be very vulnerable to injury, and therefore would be expected to die even if they escaped through meshes. Some species, such as blue ling, orange roughy, red sea bream, and alfonsino aggregate in shoals, often associated with seamounts, and can provide high catch rates once the shoals are located. Localized sub-units of the population can be quickly depleted by fisheries, even within a single season. Sub-units of some species (e.g., red sea bream, blue ling, and orange roughy) are known to have collapsed in some ICES areas.

It is evident that high catch rates can be maintained by moving from one concentration to another and progressively depleting the stock. Furthermore, many deepwater fisheries are on mixtures of species, making it difficult to manage the component species individually.

Fisheries for deepwater species are developing in areas inside and outside national jurisdictions. As a result exploitation is increasing on a number of species, as fishing extends into deeper waters or new areas, but the actual exploitation rates are often unknown. The quantities recorded are not always well estimated, and some landings are reported in grouped categories because of difficulties in separating species. In many cases significant proportions of the catch are discarded at sea and not recorded. All these factors make it difficult to determine which level of exploitation is sustainable.

The Code of Conduct for Responsible Fishing 7.5.4 (and the UN Agreement on Straddling Stocks, Article 6) states:

> *"In the case of new or exploratory fisheries, States should (shall) adopt as soon as possible cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures should (shall) remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment should (shall) be implemented. The latter measures should (shall), if appropriate, allow for the gradual development of the fisheries."*

Fisheries on deepwater species often develop and expand before sufficient information is available on which to base management advice. **Consistent with a precautionary approach, fishing should not be allowed to expand faster than the acquisition of information necessary to provide a basis for sustainable exploitation. There have been some improvements in recent years in data acquisition for some stocks while for others it has deteriorated. A comprehensive data collection system is urgently required, and research on all stocks should be increased to provide the data necessary for assessment**.

Continued fishing without biological data collection is not consistent with a precautionary approach. ICES recognised that NEAFC has established a reporting scheme providing catch statistics by detailed areas. **ICES recommends that where such schemes do not already exist, provision should be made for reporting landings to ICES at the species level for all species, including sharks. Provision should be retained, or made, for reporting at genus and higher grouped levels to allow for reports of landings which have not been sorted to the species level.** In this context the use of a hierarchical system of reporting should be encouraged.

ICES further recommends that improvements should be made in reporting landings from international waters by some states.

Management advice: **Most exploited deepwater species are at present considered to be harvested outside safe biological limits. ICES recommends immediate reduction in these fisheries unless they can be shown to be sustainable. New fisheries should be permitted only when they expand very slowly, and are accompanied by programs to collect data, which allow evaluation of stock status.**

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, April 2002 (ICES CM 2002/ACFM:16).

Table 3.13.1.1 Roughhead grenadier (*Macrourus berglax*). Working Group estimates of landings (tonnes).

ROUGHHEAD GRENADIER (*Macrourus berglax*) I and II

Year	Germany	Norway	Russia	**TOTAL**
1988				
1989				
1990	9	580		**589**
1991		829		**829**
1992		424		**424**
1993		136		**136**
1994				
1995				
1996				
1997		17		**17**
1998		55		**55**
1999				
2000		35	13	**48**
2001		74	20	**94**

ROUGHHEAD GRENADIER (*Macrourus berglax*) III and IV

Year	France	Ireland	Norway	Scotland	**TOTAL**
1988					
1989					
1990					
1991					
1992			7		**7**
1993					
1994					
1995					
1996					
1997	36				**36**
1998					
1999					
2000		1	3 +		**4**
2001	1	1	9		**11**

ROUGHHEAD GRENADIER (*Macrourus berglax*) Va

Year	Iceland	**TOTAL**
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995		
1996	15	**15**
1997	4	**4**
1998	1	**1**
1999		
2000	5	**5**
2001		

Table 3.13.1.1 (Cont'd)

ROUGHHEAD GRENADIER (*Macrourus berglax*) Vb

Year	France	Norway	**TOTAL**
1988			
1989			
1990			
1991			
1992			
1993			
1994			
1995			
1996			
1997			
1998	9		**9**
1999	58		**58**
2000	1		**1**
2001	2	2	**4**

ROUGHHEAD GRENADIER (*Macrourus berglax*) VI and VII

Year	EWN	France	Norway	Scotland	**TOTAL**
1988					
1989					
1990					
1991					
1992					
1993		18			**18**
1994		5			**5**
1995		2			**2**
1996					
1997					
1998					
1999		34			**34**
2000	+	1		8	**9**
2001		1	27		**28**

ROUGHHEAD GRENADIER *(Macrourus berglax*) X

Country	France	**TOTAL**
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999	3	**3**
2000		
2001		

Table 3.13.1.1 (Cont'd)

ROUGHHEAD GRENADIER *(Macrourus berglax*) XII

Country	Norway	**TOTAL**
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995		
1996		
1997		
1998		
1999		
2000	7	**7**
2001	9	**9**

ROUGHHEAD GRENADIER *(Macrourus berglax*) XIV

Country	Greenland	Norway	**TOTAL**
1988			
1989			
1990			
1991			
1992			
1993	18	34	**52**
1994	5		**5**
1995	2		**2**
1996			
1997			
1998		6	**6**
1999		14	**14**
2000			
2001		26	**26**

ROUGHHEAD GRENADIER *(Macrourus berglax*). All areas.

Year	I and II	III and IV	Va	Vb	VI and VII	X	XII	XIV	**TOTAL**
1988									
1989									
1990	589								**589**
1991	829								**829**
1992	424	7							**431**
1993	136				18			52	**206**
1994					5			5	**10**
1995					2			2	**4**
1996			15						**15**
1997	17	36	4						**57**
1998	55			9				6	**70**
1999				58	34	3		14	**109**
2000	48	4	4	1	9		7		**73**
2001	94	11		4	28		9	26	**172**

Table 3.13.1.2 **Sharks.** Working Group estimates of landings (tonnes).

Working Group estimates of landings of deepwater sharks, and of sharks not elsewhere identified (various) that are known to contain some landings of deepwater species. Landings data indicated as "deep" for France, Ireland, and the UK are almost exclusively *C. coelolepis* and *C. squamosus*. In the case of other countries they may contain some other species. Data for 2001 are preliminary. "Aiguillat noir" is a new category of small squalids and is considered separately from the main commercially important squalid sharks in the summary landings tables.

Shark landings in Division IVa

Year	France		Denmark	UK (E & W)	UK (Scot.)
	deep	aiguillat. noir	*E. spinax*	various	various
1991	3				
1992	133				
1993	51		27		
1994	86		0		
1995	10		10		
1996	6		8		
1997			32		
1998			359		
1999	20		128		53
2000	0	1	25	2	8
2001	0		52	0	10

Shark landings in Division Va

	Iceland		Germany
	S. microcephalus	*C. coelolepis*	various
1988			
1989	31		
1990	54		3
1991	58		133
1992	70		51
1993	39		86
1994	42		10
1995	45		6
1996	65		
1997	70		
1998	82	5	20
1999	45		0
2000	45		0
2001	56		

Table 3.13.1.2 (Cont'd)

Shark landings in Division Vb

	France	Norway	Germany	UK (E & W)		Scotland		Faroe Islands	
	deep	deep	various	deep	various	deep	various	various	*C. coelolepis*
1990	140								
1991	75							3	
1992	123				5			36	
1993	91		2		9			376	
1994	149		43						
1995	262								
1996	348		31		1				
1997	261		27		20				
1998	354								79
1999	461		1				8		
2000	306	0	0		54	11	15	2*	23
2001	297	25	0	4	93	5	119	576**	

* *Centrophorus squamosus*
** *Centrophorus squamosus* and *Centroscymnus coelolepis*.

Shark landings in Division VIa

	France		Ireland	Norway	Germany	UK (E & W)		UK (Scot.)	
	deep	*a. noir*	deep	deep	various	deep	various	deep	various
1999	1651								136
2000	2124	127	21	0	1	244	119	181	25
2001	2332	120	21	149	8	98	24	386	36

Shark landings in Division VIb

	France		Ireland	Norway	Germany	UK (E & W)		UK (Scot)	
	Siki	*C. fabricii*	deep	deep	various	deep	various	deep	various
1999	472								112
2000	346	1		41	177	26	220	24	23
2001	247	4	5	83	34	219	168	127	8

Shark landings in Division VIb taken by Spain on Hatton Bank

	C. squamosus	*C. coelolepis*	*D. calceus*	*C. repidater*	*C. fabricii*	*Etmopterus sp.*
2000	0	33	0	0	1	0
2001	0	120	0	0	0	21

Table 3.13.1.2 (Cont'd)

Shark landings reported in Subareas VI and VII

	France deep (VI only)	Spain various	Germany various	UK (E & W) various	UK (Scot.) various	Faeroe Islands various
1988		66		19		
1989				32	8	
1990				38	5	
1991	944			201	53	
1992	1953			503	133	3
1993	2454		124	821	447	
1994	2198		395	742	727	
1995	1784		2	1315	782	
1996	2374		276	1345	555	
1997	2222	152	66	2721	301	
1998	2081	645	65	1812	501	
1999		199	189	1403		
2000		8				
2001		0				

Shark landings in Subarea VII

	France deep	France *C. fabricii*	Ireland deep	Germany various	UK (E & W) deep	UK (E & W) various	UK (Scot.) deep	UK (Scot.) various
1991	265							
1992	878							
1993	857							
1994	1363							
1995	991							
1996	754							
1997	571							
1998	673							
1999	440							244
2000	506	4	92	85	23	76	0	3
2001	417	6	159	164	353	130	103	21

Deepwater shark landings taken by Portugal in Division IXa

Year	*C. granulosus*	*C. squamosus*	*C. coelolepis*	*D. licha*	*G. melastomus*
1988	995	560	na	149	21
1989	1027	507	na	57	17
1990	1056	475	na	7	17
1991	801	424	651	12	17
1992	958	422	692	11	16
1993	886	339	607	11	20
1994	344	579	576	11	37
1995	423	544	810	7	29
1996	242	412	777	4	35
1997	291	384	927	4	29
1998	187	362	858	6	22
1999	92	428	544	6	23
2000	54	438	611		
2001	93	510	620	7	35

Table 3.13.1.2 (Cont'd)

Shark landings in Subareas VIII and IX

Year	Spain various	France deep (VIII only)	UK (E& W) various	UK (Scot.) various
1988	3545			
1989	1789			
1990	na			
1991	2850			
1992	3740	15	0	0
1993		9		0
1994		8		4
1995		0	32	7
1996		1	25	0
1997	1059	1	20	
1998	1811	13		
1999	476	20		
2000	228	21		
2001	321	5		

Deepwater shark landings taken by Portugal (Azores) in Subarea X

	C. squamosus	*D. licha*
1988		549
1989		560
1990		602
1991		896
1992		761
1993		591
1994		309
1995		321
1996		216
1997		30
1998	4	34
1999	8	31
2000		31
2001		13

Shark landings in Subarea XII

	France deep	France ***C. fabricii***	Ireland deep	Norway deep	UK (E & W) various	UK (Scot) deep	UK (Scot) various
1991	1						
1992	2						
1993	6						
1994	8						
1995	139						
1996	147						
1997	32						
1998	56						
1999	50						
2000	190	3		77	35	3	3
2001	23	2	29	142		36	

Table 3.13.1.2 (Cont'd)

Shark landings in Subarea XII caught by Spain on Hatton Bank

	C. squamosus	*C. coelolepis*	*D. calceus*	*C. repidater*	*C. fabricii*	*Etmopterus* sp.
2000	34	505	12	85	84	38
2001	2	493	5	68	91	317

Summary of available landings data for large deepwater squalid sharks by Subarea. No data were available for VIII from most countries.

Year	IVa	Va	Vb	VI	VII	VIII	IX a Portugal	X Azores	XII	*Total*
1988							1704	549		**2253**
1989							1591	560		**2151**
1990			140				3129	602		**3871**
1991	3		75	944	265		3426	896	1	**5610**
1992	133		123	1953	878	15	3971	761	2	**7836**
1993	51		91	2454	857	9	3926	591	6	**7985**
1994	86		149	2198	1363	8	3353	309	8	**7474**
1995	10		262	1784	991	0	3294	321	139	**6801**
1996	6		348	2374	754	1	3219	216	147	**7065**
1997			261	2222	571	1	3041	30	32	**6158**
1998		5	433	2081	673	13	3019	38	56	**6318**
1999	20		461	2123	440	20	2483	39	50	**5636**
2000	1		342	3010	621	21	2173	31	951	**7150**
2001*	0		907	3679	1032	5	2333	13	1206	**9175**

*preliminary data

Total shark (various, including some deepwater sharks) landings by Subareas.

Year	IVa	Va	Vb	VI	VII	VI+VII*	VIII+IX	XII	***Total***
1988						85	3545		**3630**
1989		31				40	1789		**1860**
1990		54	140			43	1789		**2026**
1991	3	58	78	944	265	254	2850	1	**4453**
1992	133	70	164	1953	878	639	6590	2	**10429**
1993	78	39	478	2454	857	1392	3740	6	**9044**
1994	86	42	192	2198	1363	1864	4	8	**5757**
1995	20	45	262	1784	991	2099	43	139	**5383**
1996	14	65	380	2374	754	2176	64	147	**5974**
1997	32	70	308	2222	571	3240	1104	32	**7579**
1998	359	87	433	2081	673	3023	2890	56	**9602**
1999	201	45	470	2371	440	1791	2287	50	**7655**
2000	36	45	409	3704	789	8	704	1069	**6764**
2001*	62	57	543	4102	1353	0	549	1208	**7874**

* Preliminary.

Some countries reported data for VI and VII combined, while others reported data separately for each Subarea. The column for VI and VII combined shows data reported for both Subareas combined, but does not contain landings for VI and VII reported separately.

Table 3.13.1.3 Silver Scabbardfish (*Lepidopus caudatus*). Working Group estimates of landings (tonnes).

SILVER SCABBARDFISH (*Lepidopus caudatus*). VI and VII

Year	EWN	France	Germany	Scotland	**TOTAL**
1988					
1989					
1990					
1991					
1992					
1993			2		**2**
1994					
1995					
1996					
1997					
1998					
1999		18			**18**
2000	+		3	12	**15**
2001					

SILVER SCABBARDFISH *(Lepidopus caudatus)*. VIII and IX

Year	France	Portugal	Spain	Russia/USSR	**TOTAL**
1988		2666			**2666**
1989		1385			**1385**
1990		547		37	**584**
1991		808			**808**
1992		1264		110	**1374**
1993		2397			**2397**
1994		1054			**1054**
1995		5672			**5672**
1996		1237			**1237**
1997		1725			**1725**
1998		966			**966**
1999	2	3067	1584		**4653**
2000	1	15	14		**30**
2001	2	22			**24**

SILVER SCABBARDFISH (*Lepidopus caudatus*). X

Year	Latvia	Portugal	**TOTAL**
1988		70	**70**
1989		91	**91**
1990		120	**120**
1991		166	**166**
1992	1905	255	**2160**
1993	1458	264	**1722**
1994		373	**373**
1995	8	781	**789**
1996		815	**815**
1997		1115	**1115**
1998		1186	**1186**
1999		86	**86**
2000		28	**28**
2001		14	**14**

Table 3.13.1.3 (Cont'd)

SILVER SCABBARDFISH (*Lepidopus caudatus*). XII

Country	Russia/USSR	**TOTAL**
1988		
1989	102	**102**
1990	20	**20**
1991		
1992		
1993	19	**19**
1994		
1995		
1996		
1997*		
1998		
1999		
2000		
2001		

SILVER SCABBARDFISH (*Lepidopus caudatus*). All areas

	VI and VII	VIII and IX	X	XII	**TOTAL**
1988		2666	70		**2736**
1989		1385	91	102	**1578**
1990		584	120	20	**724**
1991		808	166		**974**
1992		1374	2160		**3534**
1993	2	2397	1722	19	**4140**
1994		1054	373		**1427**
1995		5672	789		**6461**
1996		1237	815		**2052**
1997		1725	1115		**2840**
1998		966	1186		**2152**
1999	18	4653	86		**4757**
2000	15	30	28		**73**
2001		24	14		**38**

Table 3.13.1.4 Smoothheads (Alepocephalidae). Working Group estimates of landings (tonnes).

SMOOTHHEAD *(Alepocephalus* spp.) Va

Year	Iceland	**TOTAL**
1988		
1989		
1990		
1991		
1992	10	**10**
1993	3	**3**
1994	1	**1**
1995	1	**1**
1996		
1997	+	
1998		
1999		
2000		
2001		

SMOOTHHEAD (*Alepocephalus* spp.) XII

Year	Spain	**TOTAL**
1988		
1989		
1990		
1991		
1992		
1993		
1994		
1995		
1996	230	**230**
1997	3692	**3692**
1999	4643	**4643**
1999	6549	**6549**
2000	978	**978**
2001	3902	**3902**

SMOOTHHEAD (*Alepocephalus* spp.) XIV

Year	Germany	Spain	**TOTAL**
1988			
1989			
1990			
1991			
1992			
1993			
1994			
1995			
1996			
1997			
1999			
1999			
2000	12	4146	**4158**
2001		4121	**4121**

Table 3.13.1.4 (Cont'd)

SMOOTHHEAD (*Alepocephalus* spp.). All areas

Year	Va	XII	XIV	**TOTAL**
1988				
1989				
1990				
1991				
1992	10			**10**
1993	3			**3**
1994	1			**1**
1995	1			**1**
1996		230		**230**
1997		3692		**3692**
1999		4643		**4643**
1999		6549		**6549**
2000		978	4158	**5136**
2001		3902	4121	**8023**

Table 3.13.1.5 Wreckfish (*Polyprion americanus*). Working Group estimates of landings (tonnes).

WRECKFISH (*Polyprion americanus*). VI and VII

Year	France	Ireland	Spain	**TOTAL**
1988	7			**7**
1989				
1990	2			**2**
1991	10			**10**
1992	15			**15**
1993	0			
1994				
1995				
1996	4		79	**83**
1997				
1998			12	**12**
1999	9		5	**14**
2000	13		1	**14**
2001	15	1	1	**17**

WRECKFISH (*Polyprion americanus*). VIII and IX

Year	France	Portugal	Spain	UK (EW)	**TOTAL**
1988	1	188	9		**198**
1989	1	283			**284**
1990	2	161			**163**
1991	3	191			**194**
1992	1	268			**269**
1993		338			**338**
1994		406	3		**409**
1995		372	19	2	**393**
1996	3	214	69	8	**294**
1997		170	44		**214**
1998		164	63		**227**
1999	7	137	7		**151**
2000	12	72	37		**121**
2001	3	77	85		**165**

WRECKFISH (*Polyprion americanus*) X

Year	France	Portugal	Norway	**TOTAL**
1988		191		**191**
1989		235		**235**
1990		224		**224**
1991		170		**170**
1992	3	234		**237**
1993		308	3	**311**
1994		428		**428**
1995		240		**240**
1996		240		**240**
1997		177		**177**
1998		139		**139**
1999		133		**133**
2000		268		**268**
2001		232		**232**

Table 3.13.1.5 (Cont'd)

WRECKFISH (*Polyprion americanus*). All areas

	VI and VII	VIII and IX	X	**TOTAL**
1988	7	198	191	**396**
1989		284	235	**519**
1990	2	163	224	**389**
1991	10	194	170	**374**
1992	15	269	237	**521**
1993		338	311	**649**
1994	0	409	428	**837**
1995	0	393	240	**633**
1996	83	294	240	**617**
1997	0	214	177	**391**
1998	12	227	139	**378**
1999	14	151	133	**298**
2000	14	121	268	**403**
2001	17	165	232	**414**

3.13.2 Blue Ling (*Molva dypterygia*)

State of the stock/exploitation: The stock of blue ling in the North Atlantic is outside safe biological limits. Although the stock structure is uncertain, catches and CPUE series (Figures 3.13.2.1 and 3.13.2.2) show declining trends in Divisions Va and Vb and in Subareas VI and VII, where more than 85% of catches of blue ling have been taken over the past five years. Using trawl and survey CPUE as indices, the exploitable biomass at the end of 2001 is considered to be below 20% of the maximum observed biomass. The proportion of large fish in the landings from Divisions Va, Vb and Subareas VI and VII has decreased in the most recent years.

The state of the stock in other areas is not known; however, it is believed that the stock development is similar, as represented by the CPUE index. The increase in total catches in 1995–2001 is almost exclusively accounted for by Subarea VI and XII, where effort has increased.

Advice on management: ICES recommends that there be no directed fisheries for this stock and that technical measures such as closed areas on spawning aggregations be implemented to minimise catches of this stock in mixed fisheries.

Relevant factors to be considered in management: A major part of this fishery is on spawning aggregations. Experience in Divisions Va and Vb indicates that once stocks are fished down they do not recover, even when fishing pressure has been low for up to about seven years. Age estimation is still a problem in this species.

Comparison with previous assessment and advice: There is no change in the perception of the stock compared to previous assessment.

Elaboration and special comments: The indicators of the stock status come from Division Va, Vb and Subareas VI and VII. Together these have contributed at least 85% of the catch in recent years.

The French commercial trawl CPUE time-series in Subareas VI, VII, and Division Vb, which is based on a reference fleet of strictly deepwater trawlers, was updated. Icelandic CPUE series from commercial trawlers and longliners from Area Va were provided, as well as indices on blue ling from the Icelandic groundfish survey. Spanish CPUE series for trawl and longliners in Subareas VI and VII were provided. The Faroese commercial trawl CPUE series in Division Vb was not updated. Attempts to use a modified DeLury constant recruitment model and a Schaeffer production model on the CPUE data were unsuccessful. All the available evidence from trends in catches and CPUE series indicate that blue ling abundance in these areas is at a low level.

Little is known of the early life history of this species.

Landings from Division IIa are mainly taken in a gillnet fishery off mid-Norway. The relatively minor landings from Subarea III and Division IVa are by-catches in trawl fisheries. In Division Va blue ling have mainly been taken by trawlers in the redfish and Greenland halibut fisheries in recent years. In this division a directed fishery on spawning concentrations was carried out from 1980 to 1984 in a very limited area. Between 1993 and 1996 a fishery on spawning concentrations was conducted on the Reykjanes Ridge at the border between Division Va and Subarea XIV. The fishery in Division Vb is mainly a bottom trawl fishery on spawning aggregations. The trawl fishery is also predominant in Subarea VI.

Landings by ICES Subareas and Division by country are given in Table 3.13.2.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.2.1):

Year	ACFM Catch
1988	25
1989	20
1990	16
1991	16
1992	17
1993	19
1994	10
1995	11
1996	11
1997	13
1998	13
1999	16
2000	14
2001*	16

*Preliminary. Weights in '000 t.

Blue ling (*Molva dypterygia*)

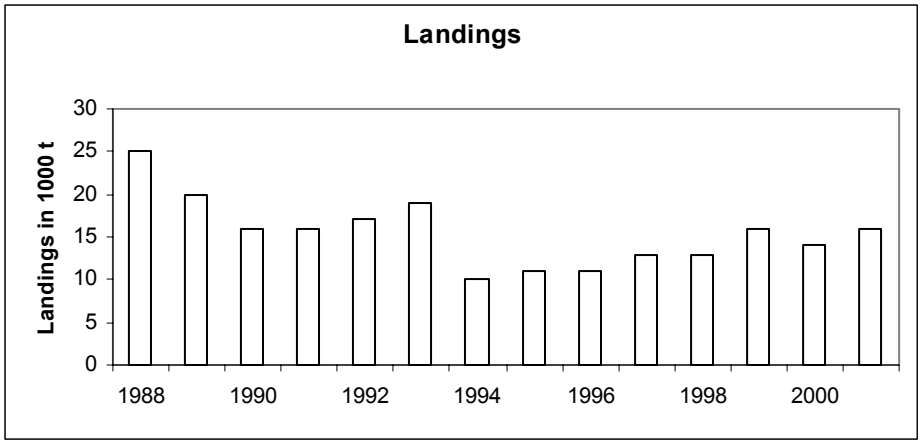

Table 3.13.2.1 Blue ling (*Molva dypterygia*). Working Group estimates of landings (tonnes).

Blue ling in Subarea I

Year	Iceland	Norway	Germany	Total
1988	-	-	-	-
1989	-	-	-	-
1990	-	-	-	-
1991	-	-	-	-
1992	-	-	-	-
1993	-	-	-	-
1994	-	3	-	3
1995	+	5	-	5
1996	-	+	-	+
1997	+	1	-	1
1998	-	1	-	1
1999	-	1	-	1
2000	-	3	+	3
2001*	-	1	-	1

*Preliminary.

Blue ling in Divisions IIa and b

Year	Faroes	France	Germany	Greenland	Norway	E & W	Scotland	Total
1988	77	37	5	-	3,416	2	-	3,537
1989	126	42	5	-	1,883	2	-	2,058
1990	228	48	4	-	1,128	4	-	1,412
1991	47	23	1	-	1,408	-	-	1,479
1992	28	19	+	3	987	2	-	1,039
1993	-	12	2	3	1,003	+	+	1,020
1994	-	9	2	-	399	9	-	419
1995	0	12	2	2	342	1	-	359
1996	0	8	1	-	254	2	2	267
1997	0	10	1	-	280	+	-	291
1998	0	3	+	-	272	+	3	278
1999	0	1	1	-	287	+	2	291
2000	-	2	4	-	240	1	2	249
2001*	-	6	+	-	190	1	2	199

*Preliminary.

Blue ling in Subarea III

Year	Denmark	Norway	Sweden	Total
1988	10	11	1	22
1989	7	15	1	23
1990	8	12	1	21
1991	9	9	3	21
1992	29	8	1	38
1993	16	6	1	23
1994	14	4	+	18
1995	16	4		20
1996	9	3		12
1997	14	5	2	21
1998	4	2		6
1999	5	1		6
2000	13	1		14
2001*	20	4		24

*Preliminary.

Continued …

Table 3.13.2.1 Continued

Blue ling in Division IVa

Year	Denmark	Faroes	France [1]	Germany	Norway	E & W	Scotland	Ireland	Total
1988	1	13	223	6	116	2	2	-	363
1989	1	-	244	4	196	12	+	-	457
1990	+	-	321	8	162	4	+	-	495
1991	1	31	369	7	178	2	32	-	620
1992	1	-	236	9	263	8	36	-	553
1993	2	101	76	2	186	1	44	-	412
1994	+		144	3	241	14	19	-	421
1995	+	2	73	+	201	8	193	-	477
1996	+	0	52	4	67	4	52	-	179
1997	+	0	36	+	61	0	172	-	269
1998	+	1	31	-	55	2	191	-	280
1999	2		21	+	94	25	120	2	264
2000	2		15	1	53	10	46	2	129
2001*	7		9	+	75	7	145	9	252

*Preliminary. [1] Included in VI.

Blue ling in Division IVb

Year	France	E & W	Norway	Faroes	Denmark	Germany	Scotland	Total
1988	-	-	-	-	-	-	-	-
1989	2	-	-	-	-	-	-	2
1990	6	-	-	-	-	-	-	6
1991	7	-	-	-	-	-	-	7
1992	1	-	-	-	-	-	-	1
1993	0	3	-	-	-	-	-	3
1994	0	-	+	+	-	-	-	0
1995	3	3	+	-	+	-	-	6
1996	5	5	1	-	+	-	-	11
1997	1	-	+	-	-	-	-	1
1998	5	-	1	-	-	-	-	6
1999	(1)	1	0	-	-	+	+	1
2000	1	-	-	-	-	+	-	1
2001*	0	-	-	-	+	+	+	0

*Preliminary.

Blue ling in Division IVc

Year	E & W	Norway	Total
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	3	-	3
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	0	-
2000	-	-	-
2001*	-	-	-

*Preliminary.

Continued …

Table 3.13.2.1 Continued

Blue ling in Division Va

Year	Faroes	Germany	Iceland	Norway	E & W	Scotland	Total
1988	271	-	1,893	7	-	-	2,171
1989	403	-	2,125	5	-	-	2,533
1990	1,029	-	1,992	-	-	-	3,021
1991	241	-	1,582	1	-	-	1,824
1992	321	-	2,584	1	-	-	2,906
1993	40	-	2,193	-	-	-	2,233
1994	89	1	1,542	-	-	-	1,632
1995	113	3	1,519	-	-	-	1,635
1996	36	3	1,284	-	-	-	1,323
1997	25	+	1,319	-	-	-	1,344
1998	59	9	1,086	-	-	-	1,154
1999	31	8	1,525	8	8	3	1,583
2000	36	7	1,605	25	7	+	1,680
2001*	69	12	753	49	1	1	885

*Preliminary.

Blue ling in Sub-division Vb_1

Year	Faroes	France [3]	Germany [2]	Norway	E & W	Scotland [1]	Ireland	Russia	Total
1988	3,487	3,036	49	94	-	…	-	-	6,666
1989	2,468	1,800	51	228	-	…	-	-	4,547
1990	946	3,073	71	450	-	…	-	-	4,540
1991	1,573	1,013	36	196	1	…	-	-	2,819
1992	1,918	407	21	390	4	…	-	-	2,740
1993	2,088	192	24	218	19	…	-	-	2,541
1994	1065	147	3	173	-	…	-	-	1,388
1995	1,606	588	2	38	4	…	-	-	2,238
1996	1,100	301	3	82	+	…	-	-	1,486
1997	778	1,656	+	65	11	…	-	-	2,510
1998	1,026	1,411	0	24	1	…	-	-	2,462
1999	1,730	1,068	4	38	4	…	-	-	2,844
2000	1,561	575	1	163	33	…	-	1	2,334
2001*	1,547	344	4	130	8	…	2	-	2,035

*Preliminary. [1] Included in Vb_2. [2] Includes Vb_2. [3] Reported as Vb.

Blue ling in Sub-divisionVb_2

Year	Faroes	Norway	Scotland [1]	E & W	Total
1988	2,788	72	-	-	2,860
1989	622	95	-	-	717
1990	68	191	-	-	259
1991	71	51	21	-	143
1992	1,705	256	1	-	1,962
1993	182	22	91	-	295
1994	239	16	1	-	256
1995	162	36	4	-	202
1996	42	62	12	-	116
1997	229	48	11	-	288
1998	64	29	29	-	122
1999	15	49	24	-	88
2000	107	37	37	-	181
2001*	147	69	63	1	280

*Preliminary. [1] Includes Vb_1.

Continued …

Table 3.13.2.1 Continued

Blue ling in Division VIa

Year	Faroes	France	Germany	Ireland	Norway	Spain [1]	E & W	Scotland	Total
1988	14	6,614	2	-	29	-	2	1	6,662
1989	6	7,382	2	-	143	-	-	+	7,533
1990	-	4,882	44	-	54	-	-	1	4,981
1991	8	4,261	18	-	63	-	1	35	4,386
1992	4	5,483	4	-	129	-	-	24	5,644
1993	-	4,311	48	3	27	-	13	42	4,444
1994	-	2,999	24	73	90	433	1	91	3,711
1995	0	2,835	+	11	96	392	34	738	4,106
1996	0	4,115	4	-	50	681	9	1,407	6,266
1997	0	3,845	+	1	29	190	789	1,021	5,875
1998	0	4,644	3	1	21	142	11	1,416	6,238
1999	0	3,730	+	10	55	119	5	1,105	5,024
2000	-	4,441	94	9	102	57	24	1,300	6,027
2001*	-	2,550	6	52	117	1,009	116	2,136	5,986

*Preliminary. [1] Includes VIb.

Blue ling in Division VIb

Year	Faroes	France	Germany	Norway	E & W	Scotland	Iceland	Ireland	Estonia	Total
1988	2,000	499	37	42	9	14	-	-	-	2,601
1989	1,292	61	22	217	-	16	-	-	-	1,608
1990	360	703	-	127	-	2	-	-	-	1,192
1991	111	2,482	6	102	5	15	-	-	-	2,721
1992	231	348	2	50	2	14	-	-	-	647
1993	51	373	109	50	66	57	-	-	-	706
1994	5	89[1]	104	33	3	25	-	-	-	259
1995	1	305	189	12	11	38	-	-	-	556
1996	0	87[1]	92	7	37	74	-	-	-	297
1997	138	331	-	6	65	562	1	-	-	1,103
1998	76	469	-	13	190	287	122	11	-	1,168
1999	204	690	-[2]	9	168	2,411	610	4	-	4,096
2000	+	508	-	184	500	966	-	7	-	2,165
2001*	-	202	1	256	1,499	1,803	-	4	85	3,850

*Preliminary. [1] Includes XII. [2] Included in VIa.

Blue ling in Division VIIa

Year	France [1]	Scotland	**Total**
1988	…	-	**-**
1989	…	-	**-**
1990	…	-	**-**
1991	…	1	1
1992	…	-	**-**
1993	…	-	**-**
1994	…	-	**-**
1995	…	-	**-**
1996	…	-	**-**
1997	…	-	**-**
1998	…	-	**-**
1999	…	-	**-**
2000	…	-	**-**
2001*	…	-	**-**

*Preliminary. [1] Included in VIa.

Continued …

Table 3.13.2.1 Continued

Blue ling in Divisions VIIb,c

Year	France	Germany	Ireland	Norway	Spain [1]	E & W	Scotland	Total
1988	21	1	-	-	…	-	-	22
1989	269	-	-	2	…	-	-	271
1990	177	-	-	-	…	-	-	177
1991	157	-	-	-	…	-	-	157
1992	126	-	-	3	…	-	6	135
1993	106	-	-	2	…	11	28	147
1994	100	-	1	1	…	6	22	130
1995	95	-	3	-	…	3	11	112
1996	118	-	-	1	…	15	57	191
1997	113	-	0	2	…	36	3	154
1998	157	-	-	1	…	60	6	224
1999	36	-	3	1	…	24	7	71
2000	45	1	45	5	…	9	2	107
2001*	31	+	169	5	…	16	3	224

*Preliminary. [1] Included in VIIg-k.

Blue ling in Divisions VIId,e

Year	France	Total
1988	0	0
1989	1	1
1990	0	0
1991	10	10
1992	15	15
1993	3	3
1994	8	8
1995	4	4
1996	4	4
1997	1	1
1998	3	3
1999	-	-
2000	-	-
2001*	-	-

*Preliminary.

Blue ling in Divisions VIIg-k

Year	France [1]	Germany	Spain [1]	E & W	Scotland	Ireland	Total
1988	-	-	-	-	-	-	-
1989	21	-	-	-	-	-	21
1990	46	-	-	-	-	-	46
1991	44	-	-	-	-	-	44
1992	256	-	-	-	-	-	256
1993	164	-	-	5	2	-	171
1994	190	-	4	3	4	-	201
1995	56	-	13	40	5	-	114
1996	67	-	21	42	40	-	170
1997	65	8	0 [2]	134	12	9	228
1998	92	-	22 [2]	223	24	10	371
1999	40	2[2]	59 [2]	144	11	24	280
2000	39	1	63 [2]	22	15	30	170
2001*	41	2	59 [2]	14	14	325	455

*Preliminary. [1] Included in VIIb,c. [2] Reported as VII. Continued …

Table 3.13.2.1 Continued

Blue ling in Subarea XII

Year	Faroes	France	Germany	Spain	E & W	Scotland	Norway	Iceland	Total
1988	-	263	-	-	-	-	-	-	263
1989	-	70	-	-	-	-	-	-	70
1990	-	5	-	-	-	-	-	-	5
1991	-	1,147	-	-	-	-	-	-	1,147
1992	-	971	-	-	-	-	-	-	971
1993	654	2,591	90	-	-	-	-	-	3,335
1994	382	345(1)	25	-	-	-	-	-	752
1995	514	47	-	-	12	-	-	-	573
1996	445	60(1)	-	264	-	19	-	-	788
1997	1	1	-	411	4	-	-	-	417
1998	36	26	-	375	1	-	-	-	438
1999	156	17	-	943	8	43	-	186	1,353
2000	-	23	-	406	18	23	21	14	505
2001*	-	26	-	585	32	91	103	2	839

*Preliminary. (1) Included in VIa.

Blue ling in Subarea XIV

Year	Faroes	France	Germany	Greenland	Iceland	Norway	E & W	Scotland	Spain	Total
1988	21	-	218	3	-	-	-	-	-	242
1989	13	-	58	-	-	-	-	-	-	71
1990	-	-	64	5	-	-	10	-	-	79
1991	-	-	105	5	-	+	45	-	-	155
1992	-	-	27	2	-	50	27	4	-	110
1993	-	390	16	-	3,124	173	21	1	-	3,725
1994	1	-	15	-	300	11	57	-	-	384
1995	0	-	5	-	117	+	16	3	-	141
1996	0	(1)	12	-	-	+	2	+	-	14
1997	1	-	1	-	-	+	2	-	-	4
1998	48	-	-	-	-	1	6	-	-	55
1999	-	-	+	-	-	1	7	-	-	8
2000	+	-	-	-	4	-	2	-	526	532
2001*	-	-	-	-	-	-	6	-	1,175	1,181

*Preliminary.

BLUE LING - Total landings by area/division and grand total

Year	I	II	III	III	IV	Va	Vb	VI	VII	XII	XIV	Total
1988	0	3,537	218	22	363	2,171	9,526	9,263	22	263	242	25,409
1989	0	2,058	58	23	459	2,533	5,264	9,141	293	70	71	19,912
1990	0	1,412	64	21	501	3,021	4,799	6,173	223	5	79	16,234
1991	0	1,479	105	21	627	1,824	2,962	7,107	212	1,147	155	15,534
1992	0	1,039	27	38	554	2,906	4,702	6,291	406	971	110	17,017
1993	0	1,020	16	23	415	2,233	2,836	5,150	321	3,335	3,725	19,058
1994	3	419	15	18	424	1,632	1,644	3,970	339	752	384	9,585
1995	5	359	5	20	483	1,635	2,440	4,662	230	573	141	10,548
1996	0	267	12	12	190	1,323	1,602	6,563	365	788	14	11,124
1997	1	291	1	21	270	1,344	2,798	6,978	383	417	4	12,507
1998	1	278	-	6	286	1,154	2,584	7,406	598	438	55	12,806
1999	1	291	+	6	265	1,583	2,932	9,120	351	1,353	8	15,910
2000	3	249	-	14	130	1,680	2,515	8,192	277	505	532	14,097
2001*	1	199	-	24	252	816	2,311	9,836	679	839	1,181	16,211

*Preliminary.

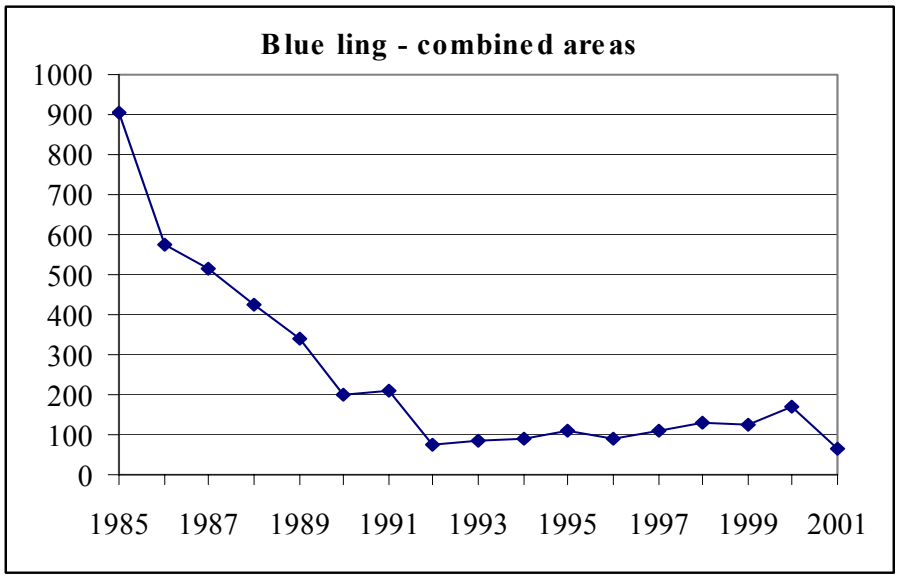

Figure 3.13.2.1 Blue ling in Division Vb and Subareas VI-VII combined. CPUE from total catch and effort 1985–2001 of French trawlers.

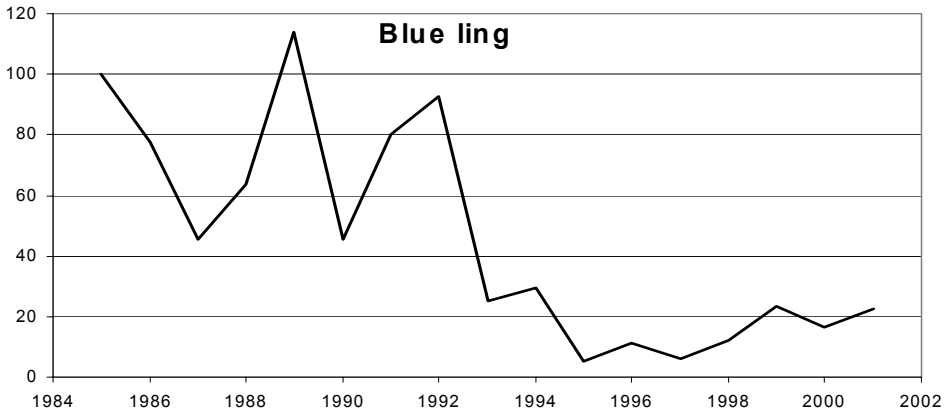

Figure 3.13.2.2 Blue ling. Index on fishable biomass calculated from the Icelandic groundfish survey on the Icelandic shelf.

3.13.3 Ling (*Molva molva*)

State of the stock/exploitation: The state of the stock is highly uncertain due to the lack of updated information. In previous years it was considered to be outside safe biological limits in at least some parts of its range, and there are no reasons to believe that the situation has changed. The CPUE series for many important fishing areas have not been updated, and the abundance trends are unclear. Previously presented estimates of Z for the last decade are about 0.7 to 0.8 for several areas. The only new information is the updated series from the groundfish survey in Division Va that suggests a decline also in this area.

Advice on management: ICES recommends that the overall fishing effort be reduced by 30%.

Relevant factors to be considered in management: The reduction in effort is expected to reduce total mortality to values, which are considered sustainable for species with similar life histories.

Comparison with previous assessment and advice: No comparison of assessments was possible. In Division Va, the survey index from the Icelandic groundfish survey suggests declining abundance.

Elaboration and special comment: For fleets which target ling the advised effort reduction can be applied directly. For fleets which take ling as by-catch the advised effort reduction will help to achieve the reductions in catch and effort that ICES has advised for many years for the species they target.

The major fishery in Division IIa is the Norwegian longline fishery. This fishery also operates in other Subareas and Divisions, such as IVa, V, and VI. The catches in Division Va are by-catches in longline, gillnet, and bottom trawl fisheries. In Division Vb the majority of the catch is taken by longliners rather than trawlers. In Subareas VI and VII trawl fisheries are predominant.

With the exception of data from the Spanish trawlers in Subareas VI and VII, none of the other CPUE series have been updated since 2000 or even earlier. New series were presented for French and Danish fisheries, but these represent relatively minor by-catches and are of limited value for assessments. Future advice on stock status would benefit significantly by updating the CPUE data series from the major fisheries. No new mortality estimates were available after 1999. An improvement in the reporting of catch and effort and biological information should be encouraged for all fisheries.

There is currently no evidence of separate stocks within the ICES area; however, the distribution is unlikely to be homogeneous across its entire range and deep channels may present barriers to movement. These factors, combined with different histories of fishing activity in the different Subareas, mean that the status of the stock is likely to be variable across its range. Localised population units may respond differently to management measures applied on various geographic scales.

Ling (*Molva molva*) and tusk (*Brosme brosme*) are not generally regarded as "true" deep-water fish species although they are found in waters on the upper continental slope between the depths of ca. 200 m-600 m. However, this depth range has some species, including ling and tusk, that are also found in waters less than 200 m deep on the outer continental shelf. Other commercial fish species caught at this depth range that are also found commonly in shallower shelf-sea waters include anglerfish (*Lophius* spp.) and megrim (*Lepidorhombus* spp.).

For the quota-year starting 1 September 2001 and ending 31 August 2002 the agreed national TAC by Iceland is 3 000 t in Division Va.

Landings by ICES Subarea, Division, and nation are given in Table 3.13.3.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.3.1):

Year	ACFM catch
1988	58
1989	52
1990	45
1991	45
1992	41
1993	43
1994	44
1995	50
1996	52
1997	45
1998	55
1999	39
2000*	38
2001*	33

* Preliminary. Weights in '000 t.

Ling (*Molva molva*)

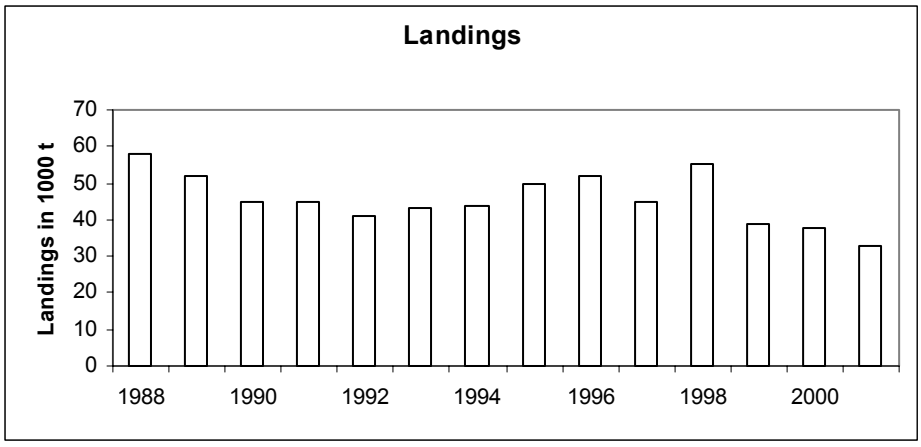

Table 3.13.3.1 Ling (*Molva molva*). Working Group estimates of landings (tonnes).

Ling in Subarea I

Year	Norway	Iceland	Total
1996	136	-	136
1997	31	-	31
1998	123	-	123
1999	64	-	64
2000*	68	1	69
2001*	65	1	66

*Preliminary.

Ling in Division IIa

Year	Faroes	France	Germany	Norway	E & W	Scotland	Total
1988	3	29	10	6,070	4	3	6,119
1989	2	19	11	7,326	10	-	7,368
1990	14	20	17	7,549	25	3	7,628
1991	17	12	5	7,755	4	+	7,793
1992	3	9	6	6,495	8	+	6,521
1993	-	9	13	7,032	39	-	7,093
1994	101	n/a	9	6,169	30	-	6,309
1995	14	6	8	5,921	3	2	5,954
1996	0	2	17	6,059	2	3	6,083
1997	0	15	7	5,343	6	2	5,373
1998	-	13	6	9,049	3	1	9,072
1999	-	11	7	7,557	2	4	7,581
2000*	-	9	39	5,836	5	2	5,891
2001*	-	9	34	4,805	0	3	4,851

*Preliminary.

Ling in Division IIb

Year	Norway	E & W	Total
1988	-	7	7
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	-	13	13
1995	-	-	-
1996	127	-	127
1997	5	-	5
1998	5	+	5
1999	6	-	6
2000*	4	-	4
2001*	33	-	33

*Preliminary.

Continued …

Table 3.13.3.1 Continued

Ling in Subarea III

Year	Belgium	Denmark	Germany	Norway	Sweden	E & W	Total
1988	2	165	-	135	29	-	331
1989	1	246	-	140	35	-	422
1990	4	375	3	131	30	-	543
1991	1	278	-	161	44	-	484
1992	4	325	-	120	100	-	549
1993	3	343	-	150	131	15	642
1994	2	239	+	116	112	-	469
1995	4	212	-	113	83	-	412
1996	-	212	1	124	65	-	402
1997	-	159	+	105	47	-	311
1998	-	103	-	111	-	-	214
1999	-	101	-	115	-	-	216
2000*	-	101	+	96	31	-	228
2001*	-	125	+	102	25	-	252

*Preliminary.

Ling in Division IVa

Year	Belgium	Denmark	Faroes	France	Germany	Neth.	Norway	Sweden [1]	E&W	NI	Scot.	**Total**
1988	3	408	13	1,143	262	4	6,473	5	55	1	2,856	**11,223**
1989	1	578	3	751	217	16	7,239	29	136	14	2,693	**11,677**
1990	1	610	9	655	241	-	6,290	13	213	-	1,995	**10,027**
1991	4	609	6	847	223	-	5,799	24	197	+	2,260	**9,969**
1992	9	623	2	414	200	-	5,945	28	330	4	3,208	**10,763**
1993	9	630	14	395	726	-	6,522	13	363	-	4,138	**12,810**
1994	20	530	25	n/a	770	-	5,355	3	148	+	4,645	**11,496**
1995	17	407	51	290	425	-	6,148	5	181	-	5,517	**13,041**
1996	8	514	25	241	448	-	6,622	4	193	-	4,650	**12,705**
1997	3	643	6	206	320	-	4,715	5	242	-	5,175	**11,315**
1998	8	558	19	175	176	-	7,069	-	125	-	5,501	**13,631**
1999	16	596	n.a.	293	141	-	5,077	-	240	-	3,447	**9,810**
2000*	20	538	2	146	103	-	4,780	7	74	-	3,576	**9,246**
2001*	-	702	1	115	54	-	3,613	6	60	-	3,290	**7,841**

*Preliminary. [1] Includes IVb 1988-1993.

Ling in Divisions IVb,c

Year	Belgium	Denmark	France	Sweden	Norway	E & W	Scotland	Germany	Total
1988	-	-	-	-	100	173	106	-	379
1989	-	-	-	-	43	236	108	-	387
1990	-	-	-	-	59	268	128	-	455
1991	-	-	-	-	51	274	165	-	490
1992	-	261	-	-	56	392	133	-	842
1993	-	263	-	-	26	412	96	-	797
1994	-	177	-	-	42	40	64	-	323
1995	-	161	-	-	39	301	135	23	659
1996	-	986	-	-	100	187	106	45	1424
1997	33	166	1	9	57	215	170	48	699
1998	47	164	5	-	129	128	136	18	627
1999	35	138	-	-	51	106	106	10	446
2000*	59	101	0	8	45	77	90	4	384
2001*	47	81	0	3	23	62	60	6	282

* Preliminary.

Continued …

Table 3.13.3.1 Continued

Ling in Division Va

Year	Belgium	Faroes	Germany	Iceland	Norway	E & W	Scotland	Total
1988	134	619	-	5,098	10	-	-	5,861
1989	95	614	-	4,898	5	-	-	5,612
1990	42	399	-	5,157	-	-	-	5,598
1991	69	530	-	5,206	-	-	-	5,805
1992	34	526	-	4,556	-	-	-	5,116
1993	20	501	-	4,333	-	-	-	4,854
1994	3	548	+	4,053	-	-	-	4,604
1995	-	463	+	3,729	-	-	-	4,192
1996	-	358	-	3,670	20	12	-	4,060
1997	-	299	-	3,634	0	-	-	3,933
1998	-	699	-	3,603	-	-	-	4,302
1999	-	542	+	3,980	120	4	1	4.647
2000*	-	452	+	3,221	67	3	+	3,743
2001*	-	333	2	2,864	117	4	+	3,320

*Preliminary.

Ling in Subdivision Vb_1

Year	Denmark	Faroes	France [2]	Germany	Norway	E&W [1]	Scotland [1]	Total
1988	42	1,383	53	4	884	1	5	2,372
1989	-	1,498	44	2	1,415	-	3	2,962
1990	-	1,575	36	1	1,441	+	9	3,062
1991	-	1,828	37	2	1,594	-	4	3,465
1992	-	1,218	3	+	1,153	15	11	2,400
1993	-	1,242	5	1	921	62	11	2,242
1994	-	1,541	6	13	1,047	30	20	2,657
1995	-	2,789	4	13	446	2	32	3,286
1996	-	2,672	-	-	1,284	12	28	3,996
1997	-	3,224	7	-	1,428	34	40	4,733
1998	-	2,422	6	-	1,452	4	145	4,029
1999	-	2,446	22	3	2,034	0	71	4,576
2000*	-	1,942	9	1	1,305	2	61	3,320
2001*	-	2,206	17	3	1,496	0	99	3,821

*Preliminary. [1] Includes Vb_2. [2] Includes Vb_2 and Va. [3] Reported as Vb.

Ling in Subdivision Vb_2

Year	Faroes	Norway	Total
1988	832	1,284	2,116
1989	362	1,328	1,690
1990	162	633	795
1991	492	555	1,047
1992	577	637	1,214
1993	282	332	614
1994	479	486	965
1995	281	503	784
1996	102	798	900
1997	526	398	924
1998	511	819	1,330
1999	164	498	662
2000*	-	399	399
2001*	182	497	679

*Preliminary. [1] Included in Vb_1.

Continued …

Table 3.13.3.1 Continued

Ling in Division VIa

Year	Belgium	Denmark	Faroes	France [1]	Germany	Ireland	Norway	Spain [2]	E&W	IOM	N.I.	Scot.	Total
1988	4	+	-	5,381	6	196	3,392	3,575	1,075	-	53	874	14,556
1989	6	1	6	3,417	11	138	3,858	-	307	+	6	881	8,631
1990	-	+	8	2,568	1	41	3,263	-	111	-	2	736	6,730
1991	3	+	3	1,777	2	57	2,029	-	260	-	10	654	4,795
1992	-	1	-	1,297	2	38	2,305	-	259	+	6	680	4,588
1993	+	+	-	1,513	92	171	1,937	-	442	-	13	1,133	5,301
1994	1	1	-	1,713	134	133	2,034	1,027	551	-	10	1,126	6,730
1995	-	2	0	1,970	130	108	3,156	927	560	n/a	-	1,994	8,847
1996	-	-	0	1,762	370	106	2,809	1,064	269	-	-	2,197	8,577
1997	-	-	0	1,631	135	113	2,229	37	151	-	-	2,450	6,746
1998	-	-	-	1,531	9	72	2,910	292	154	-	-	2,394	7,362
1999	-	-	-	941	4	73	2,997	468	152	-	-	2,264	6,899
2000*	+	+	-	717	3	75	2,956	359	143	-	-	2,287	6,240
2001*	-	-	-	720	3	70	1,869	129	106	-	-	2,179	5,076

*Preliminary. [1] Includes VIb until 1996. [2] Includes minor landings from VIb.

Ling in Division VIb

Year	Faroes	France [1]	Germany	Ireland	Norway	Spain [2]	E & W	N.I.	Scotland	Russia	Total
1988	196	-	-	-	1,253	…	93	-	223	-	1,765
1989	17	-	-	-	3,616	…	26	-	84	-	3,743
1990	3	-	-	26	1,315	…	10	+	151	-	1,505
1991	-	-	-	31	2,489	…	29	2	111	-	2,662
1992	35	-	+	23	1,713	…	28	2	90	-	1,891
1993	4	-	+	60	1,179	…	43	4	232	-	1,522
1994	104	-	-	44	2,116	…	52	4	220	-	2,540
1995	66	-	+	57	1,308	…	84	-	123	-	1,638
1996	0	-	124	70	679	…	150	-	101	-	1,124
1997	0	-	46	29	504	…	103	-	132	-	814
1998	-	1	10	44	944	…	71	-	324	-	1,394
1999	-	26	25	41	498	…	86	-	499	-	1,175
2000*	+	18	31	19	1,172	…	157	-	475	7	1,879
2001*	-	16	3	18	328	…	116	-	307	-	788

*Preliminary. [1] Until 1966 included in VIa. [2] Included in VIa.

Ling in Subarea VII

Year	France	Total
1988	5,057	5,057
1989	5,261	5,261
1990	4,575	4,575
1991	3,977	3,977
1992	2,552	2,552
1993	2,294	2,294
1994	2,185	2,185
1995	[1]	
1996	[1]	
1997	[1]	
1998	[1]	
1999	[1]	
2000	[1]	
2001	[1]	

[1] Reported by Division.

Continued …

Table 3.13.3.1 Continued

Ling in Division VIIa

Year	Belgium	France	Ireland	E & W	IOM	N.I.	Scotland	**Total**
1988	14	(1)	100	49	-	38	10	**211**
1989	10	(1)	138	112	1	43	7	**311**
1990	11	(1)	8	63	1	59	27	**169**
1991	4	(1)	10	31	2	60	18	**125**
1992	4	(1)	7	43	1	40	10	**105**
1993	10	(1)	51	81	2	60	15	**219**
1994	8	(1)	136	46	2	76	16	**284**
1995	12	9	143	106	1	(2)	34	**305**
1996	11	6	147	29	-	(2)	17	**210**
1997	8	6	179	59	2	(2)	10	**264**
1998	7	7	89	69	1	(2)	25	**198**
1999	7	3	32	29	-	(2)	13	**84**
2000*	3	2	18	25	-	(2)	25	**73**
2001*	-	3	33	20	-	(2)	31	**87**

*Preliminary. (1) French catches in VII not split into divisions, see Subarea VII. (2) Included with E & W.

Ling in Divisions VIIb,c

Year	France	Germany	Ireland	Norway	Spain (3)	E & W	N.I.	Scotland	Total
1988	(1)	-	50	57	…	750	-	8	865
1989	(1)	+	43	368	…	161	-	5	577
1990	(1)	-	51	463	…	133	-	31	678
1991	(1)	-	62	326	…	294	8	59	749
1992	(1)	-	44	610	…	485	4	143	1,286
1993	(1)	97	224	145	…	550	9	409	1,434
1994	(1)	98	225	306	…	530	2	434	1,595
1995	78	161	465	295	…	630	(2)	315	1,944
1996	57	234	283	168	…	1,117	(2)	342	2,201
1997	65	252	184	418	…	635	(2)	226	1,780
1998	32	1	190	89	…	393	(2)	329	1,034
1999	50	4	377	288	…	488	(2)	159	1,366
2000*	116	21	401	170	…	327	(2)	140	1,175
2001*	71	2	413	515	…	94	(2)	122	1,217

*Preliminary. (1) See Subarea VII. (2) Included with E & W. (3) Included in VIIg-k.

Ling in Divisions VIId,e

Year	Belgium	Denmark	France	Ireland	E & W	Scotland	Ch. Islands	Total
1988	36	+	(1)	-	743	-	-	779
1989	52	-	(1)	-	644	4	-	700
1990	31	-	(1)	22	743	3	-	799
1991	7	-	(1)	25	647	1	-	680
1992	10	+	(1)	16	493	+	-	519
1993	15	-	(1)	-	421	+	-	436
1994	14	+	(1)	-	437	0	-	451
1995	10	-	885	2	492	0	-	1,389
1996	15	-	960	-	499	3	-	1,477
1997	12	-	1,049	1	372	1	37	1,472
1998	10	-	953	-	510	1	26	1,500
1999	7	-	538	-	507	1	-	1,053
2000*	5	-	446	1	372	+	14	837
2001*	-	-	384	-	399	-	-	783

*Preliminary. (1) See Subarea VII.

Continued …

Table 3.13.3.1 Continued

Ling in Division VIIf

Year	Belgium	France	Ireland	E & W	Scotland	Total
1988	77	(1)	-	367	-	444
1989	42	(1)	-	265	3	310
1990	23	(1)	3	207	-	233
1991	34	(1)	5	259	4	302
1992	9	(1)	1	127	-	137
1993	8	(1)	-	215	+	223
1994	21	(1)	-	379	-	400
1995	36	110	-	456	0	602
1996	40	121	-	238	0	399
1997	30	204	-	313	-	547
1998	29	204	-	328	-	561
1999	16	108	-	188	-	312
2000*	15	90	1	111	-	217
2001*	-	110	-	92	-	202

*Preliminary. (1) See SubareaVII.

Ling in Divisions VIIg-k

Year	Belgium	Denmark	France	Germany	Ireland	Norway	Spain (2)	E&W	IOM	N.I.	Scotland	Total
1988	35	1	(1)	-	286	-	2,652	1,439	-	-	2	4,415
1989	23	-	(1)	-	301	163	-	518	-	+	7	1,012
1990	20	+	(1)	-	356	260	-	434	+	-	7	1,077
1991	10	+	(1)	-	454	-	-	830	-	-	100	1,394
1992	10	-	(1)	-	323	-	-	1,130	-	+	130	1,593
1993	9	+	(1)	35	374	-	-	1,551	-	1	364	2,334
1994	19	-	(1)	10	620	-	184	2,143	-	1	277	3,254
1995	33	-	1,597	40	766	-	195	3,046	-	(3)	454	6,131
1996	45	-	1,626	169	771	-	583	3,209	-	(3)	447	6,850
1997	37	-	1,574	156	674	-	33	2,112	-	(3)	459	5,045
1998	18	-	1,362	88	877	-	1,669	3,465	-	(3)	335	7,814
1999	-	-	1,229	49	554	-	455	1,619	-	(3)	292	4,198
2000*	17	-	1,006	12	624	-	518	921	-	(3)	303	3,401
2001*	-	-	963	4	727	24	490	591	-	(3)	285	3,084

*Preliminary. (1) See Subarea VII. (2) Includes VIIb,c. (3) Included in E & W.

Ling in Subarea VIII

Year	Belgium	France	Germany	Spain	E & W	Scotland	Total
1988	-	1,018	-	-	10	-	1,028
1989	-	1,214	-	-	7	-	1,221
1990	-	1,371	-	-	1	-	1,372
1991	-	1,127	-	-	12	-	1,139
1992	-	801	-	-	1	-	802
1993	-	508	-	-	2	-	510
1994	-	n/a	-	77	8	-	85
1995	-	693	-	106	46	-	845
1996	-	825	23	170	23	-	1,041
1997	1	705	+	290	38	-	1,034
1998	5	1,220	-	543	29	-	1,797
1999	22	232	-	188	8	-	450
2000*	1	218	-	56	5	-	280
2001*	-	167	-	333	7	2	509

*Preliminary.

Continued …

Table 3.13.3.1 Continued

Ling in Subarea IX

Year	Spain	Total
1997	0	0
1998	2	2
1999	1	1
2000*	1	1
2001*	0	0

*Preliminary.

Ling in Subarea XII

Year	Faroes	France	Norway	E & W	Scotland	Germany	Ireland	Total
1988	-	-	-	-	-	-	-	0
1989	-	-	-	-	-	-	-	0
1990	-	-	-	3	-	-	-	3
1991	-	-	-	10	-	-	-	10
1992	-	-	-	-	-	-	-	0
1993	-	-	-	-	-	-	-	0
1994	-	-	-	5	-	-	-	5
1995	5	-	-	45	-	-	-	50
1996	-	-	2	-	-	-	-	2
1997	-	-	+	9	-	-	-	9
1998	-	1	-	1	-	-	-	2
1999	-	0	-	-	+	2	-	2
2000*	-	1	-	-	6	-	-	7
2001*	-	0	29	2	24	-	4	59

*Preliminary.

Ling in Subarea XIV

Year	Faroes	Germany	Iceland	Norway	E & W	Scotland	Total
1988	-	3	-	-	-	-	3
1989	-	1	-	-	-	-	1
1990	-	1	-	2	6	-	9
1991	-	+	-	+	1	-	1
1992	-	9	-	7	1	-	17
1993	-	-	+	1	8	-	9
1994	-	+	-	4	1	1	6
1995	-	-	-	14	3	0	17
1996	-	-	-	0	-	-	0
1997	1	-	-	60	-	-	61
1998	-	-	-	6	-	-	6
1999	-	-	-	1	-	-	1
2000*	-	-	26	-	-	-	26
2001*	-	-	-	35	-	-	35

*Preliminary.

Table 3.13.3.1. Continued

LING, total landings by Subareas or Division.

Year	I	IIa	IIb	III	IVa	IVb,c	Va	Vb1	Vb2	VIa	VIb	VII**	VIIa	VIIb,c	VIId,e	VIIf	VIIg-k	VIII	IX	XII	XIV	All areas
1988		6,119	7	331	11,223	379	5,861	2,372	2,116	14,556	1,765	5,057	211	865	779	444	4,415	1,028		0	3	57,531
1989		7,368		422	11,677	387	5,612	2,962	1,690	8,631	3,743	5,261	311	577	700	310	1,012	1,221		0	1	51,885
1990		7,628		543	10,027	455	5,598	3,062	795	6,730	1,505	4,575	169	678	799	233	1,077	1,372		3	9	45,258
1991		7,793		484	9,969	490	5,805	3,465	1,047	4,795	2,662	3,977	125	749	680	302	1,394	1,139		10	1	44,887
1992		6,521		549	10,763	842	5,116	2,400	1,214	4,588	1,891	2,552	105	1,286	519	137	1,593	802		0	17	40,895
1993		7,093		642	12,810	797	4,854	2,242	614	5,301	1,522	2,294	219	1,434	436	223	2,334	510		0	9	43,334
1994		6,309	13	469	11,496	323	4,604	2,657	965	6,730	2,540	2,185	284	1,595	451	400	3,254	85		5	6	44,371
1995		5,954		412	13,041	659	4,192	3,286	784	8,847	1,638		305	1,944	1,389	602	6,131	845		50	17	50,096
1996	136	6,083	127	402	12,705	1,424	4,060	3,996	900	8,577	1,124		210	2,201	1,477	399	6,850	1,041		2	0	51,714
1997	31	5,373	5	311	11,315	699	3,933	4,733	924	6,746	814		264	1,780	1,472	547	5,045	1,034	0	9	61	45,096
1998	123	9,072	5	214	13,631	627	4,302	4,029	1,330	7,362	1,394		198	1,034	1,500	561	7,814	1,797	2	2	6	55,003
1999	64	7,581	6	216	9,810	446	4.647	4,576	662	6,899	1,175		84	1,366	1,053	312	4,198	450	1	2	1	38,907
2000*	69	5,891	4	228	9,246	384	3,743	3,320	399	6,540	1,879		73	1,175	838	217	3,401	280	1	7	26	37,721
2001*	66	4,851	33	252	7,841	282	3,320	3,821	679	5,076	788		87	1,217	783	202	3,084	509	0	59	35	32,985

*Preliminary.

** Fraction of landings
from VII not given by Division

3.13.4 Tusk (*Brosme brosme*)

State of the stock/exploitation: The state of the stock is highly uncertain due to the lack of relevant CPUE data for the major fisheries in the most recent years. Previously presented mortality estimates from several areas for the last decade were high. The fleet and the catches have increased and the fishing areas and practices are the same, therefore it is unlikely that the exploitation rate has decreased in recent years. The stock may therefore remain outside safe biological limits. In 2000, it was concluded that the exploitable stock biomass would appear to be less than 20% of virgin biomass and fishing mortality was relatively high. CPUE series from the fishery and groundfish survey in Division Va presented in 2002 suggests a pronounced decline in recent years also in that area (Figures 3.13.4.1–2).

Advice on management: ICES recommends that the overall fishing effort be reduced by 30%.

Relevant factors to be considered in management: Tusk is more vulnerable to over-exploitation than ling, due to a slower growth rate and high age at maturity. Most of the tusk landings are by-catch in ling fisheries and therefore the reductions recommended for that species should facilitate the advised reductions for tusk.

Landings are mainly by-catches in longline fisheries directed at ling and blue ling in Divisions IIa, Va, Vb and VIa. In Division Vb tusk is also taken as a by-catch in trawl fisheries.

Comparison with previous assessment and advice: No comparison of assessments was possible. In Division Va, the survey index from the Icelandic groundfish survey suggests a pronounced declining abundance.

Elaboration and special comment: Landings by Subarea/Division and nation are given in Table 3.13.4.1.

Ling (*Molva molva*) and tusk (*Brosme brosme*) are not generally regarded as "true" deep-water fish species although they are found in waters on the upper continental slope between the depths of ca. 200 m-600 m. However, this depth range has some species, including ling and tusk, that are also found in waters less than 200 m deep on the outer continental shelf. Other commercial fish species caught in this depth range that are also found commonly in shallower shelf-sea waters include anglerfish (*Lophius* spp.) and megrim (*Lepidorhombus* spp.).

For the quota-year starting 1 September 2001 and ending 31 August 2002 the agreed national TAC by Iceland is 4 500 t in Division Va.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.4.1):

Year	ACFM Catch
1988	34
1989	42
1990	40
1991	41
1992	37
1993	35
1994	29
1995	28
1996	29
1997	23
1998	29
1999	33
2000*	31
2001*	27

[1]Preliminary. Weights in '000 t.

Tusk (*Brosme brosme*)

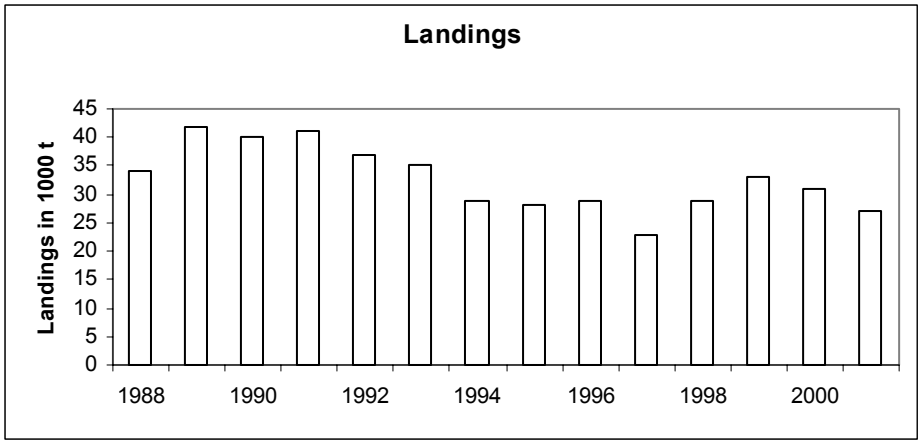

Table 3.13.4.1 Tusk (*Brosme brosme*). Working Group estimates of landings (tonnes).

Tusk in Subarea I

Year	Norway	Russia	Faroes	Iceland	Total
1996	587	-	-	-	587
1997	665	-	-	-	665
1998	805	-	-	-	805
1999	907	-	-	-	907
2000*	738	43	1	16	798
2001*	595	6	-	13	614

* Preliminary.

Tusk in Division IIa

Year	Faroes	France	Germany	Greenland	Norway	E & W	Scotland	Russia	Ireland	Total
1988	115	32	13	-	14,241	2	-	-	-	14,403
1989	75	55	10	-	19,206	4	-	-	-	19,350
1990	153	63	13	-	18,387	12	+	-	-	18,628
1991	38	32	6	-	18,227	3	+	-	-	18,306
1992	33	21	2	-	15,908	10	-	-	-	15,974
1993	-	23	2	11	17,545	3	+	-	-	17,584
1994	281	14	2	-	12,266	3	-	-	-	12,566
1995	77	16	3	20	11,271	1	-	-	-	11,388
1996	0	12	5	-	12,029	1	-	-	-	12,047
1997	1	21	1	-	8,642	2	+	-	-	8,667
1998	-	9	1	-	14,463	1	1	-	-	14,475
1999	-	7	+	-	16,213	-	2	28	-	16,250
2000*	-	8	1	-	13,120	3	2	58	-	13,192
2001*	-	15	+	-	11,200	1	3	66	5	11,290

* Preliminary.

Tusk in Division IIb

Year	Norway	E & W	Russia	Total
1988	-	-	-	0
1989	-	-	-	0
1990	-	-	-	0
1991	-	-	-	0
1992	-	-	-	0
1993	-	1	-	1
1994	-	-	-	0
1995	229	-	-	229
1996	161		-	161
1997	92	2	-	94
1998	73	+	-	73
1999	26	-	4	26
2000*	15	-	3	18
2001*	141	-	5	146

* Preliminary.

Continued …

Table 3.13.4.1 Continued

Tusk in Division IIIa

Year	Denmark	Norway	Sweden	Total
1988	8	51	2	61
1989	18	71	4	93
1990	9	45	6	60
1991	14	43	27	84
1992	24	46	15	85
1993	19	48	12	79
1994	6	33	12	51
1995	4	33	5	42
1996	6	32	6	44
1997	3	25	3	31
1998	2	19	-	21
1999	4	25	-	29
2000*	8	23	5	36
2001*	10	41	-	51

*Preliminary.

Tusk in Division Iva

Year	Denmark	Faroes	France	Germany	Norway	Sweden[(1)]	E & W	N.I.	Scotland	Ireland	Total
1988	83	1	201	62	3,998	-	12	-	72	-	4,429
1989	86	1	148	53	6,050	+	18	+	62	-	6,418
1990	136	1	144	48	3,838	1	29	-	57	-	4,254
1991	142	12	212	47	4,008	1	26	-	89	-	4,537
1992	169	-	119	42	4,435	2	34	-	131	-	4,932
1993	102	4	82	29	4,768	+	9	-	147	-	5,141
1994	82	4	86	27	3,001	+	24	-	151	-	3,375
1995	81	6	68	24	2,988	-	10	-	171	-	3,348
1996	120	8	49	47	2,970	-	11	-	164	-	3,369
1997	189	0	47	19	1,763	+	16	-	238	-	2,272
1998	114	3	38	12	2,943	-	11	-	266	-	3,387
1999	165	7	44	10	1,983	-	12	-	213	1	2,435
2000*	208	+	32	10	2,651	2	12	-	343	1	3,259
2001*	258	-	26	8	2,443	-	10	-	343	1	3,089

* Preliminary. [(1)] Includes IVb 1988–1993.

Tusk in Division IVb

Year	Denmark	France	Norway	Germany	E & W	Scotland	Total
1988	-	n/a	-	-	-	-	-
1989	-	3	-	-	1	-	4
1990	-	5	-	-	-	-	5
1991	-	2	-	-	-	-	2
1992	10	1	-	-	1	-	12
1993	13	1	-	-	-	-	14
1994	4	1	-	-	2	-	7
1995	4	-	5	1	3	2	15
1996	134[(1)]	-	21	4	3	1	163
1997	6	1	24	2	2	3	38
1998	4	0	55	1	3	3	66
1999	8	-	21	1	1	3	34
2000*	8	-	106	+	-	2	116
2001*	6	-	45[(1)]	1	1	3	56

* Preliminary. [(1)] Includes IVc.

Continued …

Table 3.13.4.1 Continued

Tusk in Division Va

Year	Faroes	Germany	Iceland	Norway	Scotland	E & W	Total
1988	3,757	-	3,078	20	-	-	6,855
1989	3,908	-	3,143	10	-	-	7,061
1990	2,475	-	4,816	-	-	-	7,291
1991	2,286	-	6,446	-	-	-	8,732
1992	1,567	-	6,442	-	-	-	8,009
1993	1,329	-	4,746	-	-	-	6,075
1994	1,212	-	4,612	-	-	-	5,824
1995	979	1	5,245	-	-	-	6,225
1996	872	1	5,226	3	-	-	6,102
1997	575	-	4,819	-	-	-	5,394
1998	1,052	1	4,118	0	-	-	5,171
1999	1,075	2	5,795	391	1	-	7,264
2000*	1,302	+	4,714	374	+	1	6,391
2001*	1,049	1	3,407	285	+	1	4,743

*Preliminary.

Tusk in Subdivision Vb_1

Year	Denmark	Faroes	France	Germany	Norway	E & W	Scotland [1]	Russia	Total
1988	+	2,827	81	8	1,143	-	-	-	4,059
1989	-	1,828	64	2	1,828	-	-	-	3,722
1990	-	3,065	66	26	2,045	-	-	-	5,202
1991	-	3,829	19	1	1,321	-	-	-	5,170
1992	-	2,796	11	2	1,590	-	-	-	4,399
1993	-	1,647	9	2	1,202	2	-	-	2,862
1994	-	2,649	8	1 [2]	747	2	-	-	3,407
1995	-	3,059	16	1 [2]	270	1	-	-	3,347
1996	-	1,636	8	1	1,083	-	-	-	2,728
1997	-	1,849	11	+	869	-	13	-	2,742
1998	-	1,272	20	-	753	1	27	-	2,073
1999	-	1,956	27	1	1,522	-	11[3]	-	3,517
2000*	-	1,316	13	1	1,191	1	11[3]	1	2,534
2001*	-	1,779	13	1	1,572	-	20[3]	-	3,385

* Preliminary. [1] Included in Vb_2 until 1996. [2]) Includes Vb_2. [3] Reported as Vb.

Tusk in Subdivision Vb_2

Year	Faroes	Norway	E & W	Scotland [1]	Total
1988	545	1,061	-	+	1,606
1989	163	1,237	-	+	1,400
1990	128	851	-	+	979
1991	375	721	-	+	1,096
1992	541	450	-	1	992
1993	292	285	-	+	577
1994	445	462	+	2	909
1995	225	404	[2]	2	631
1996	46	536	-	-	582
1997	157	420	-	-	577
1998	107	530	-	-	637
1999	132	315	-	-	447
2000*	108	333	-	-	441
2001*	150	469	-	-	619

* Preliminary. [1] Includes Vb_1. [2] See Vb_1.

Continued …

Table 3.13.4.1 Continued

Tusk in Division VIa

Year	Denmark	Faroes	France [1]	Germany	Ireland	Norway	E & W	N.I.	Scotland	Spain	Total
1988	-	-	766	1	-	1,310	30	-	13	-	2,120
1989	+	6	694	3	2	1,583	3	-	6	-	2,297
1990	-	9	723	+	-	1,506	7	+	11	-	2,256
1991	-	5	514	+	-	998	9	+	17	-	1,543
1992	-	-	532	+	-	1,124	5	-	21	-	1,682
1993	-	-	400	4	3	783	2	+	31	-	1,223
1994	+	-	345	6	1	865	5	-	40	-	1,262
1995	-	0	332	+	33	990	1	-	79	-	1,435
1996	-	0	368	1	5	890	1	-	126	-	1,391
1997	-	0	359	+	3	750	1	-	137	11	1,261
1998	-	-	395	+	-	715	-	-	163	8	1,281
1999	-	-	193	+	3	113	1	-	182	47	539
2000*	-	-	238	+	20	1,327	8	-	231	75	1,899
2001*	-	-	162	+	31	1,201	8	-	279	33	1,714

* Preliminary. [1] Not allocated by divisions before 1993.

Tusk in Division VIb

Year	Faroes	France	Germany	Ireland	Iceland	Norway	E & W	N.I.	Scotland	Russia	Total
1988	217	-	-	-	-	601	8	-	34	-	860
1989	41	1	-	-	-	1,537	2	-	12	-	1,593
1990	6	3	-	-	-	738	2	+	19	-	768
1991	-	7	+	5	-	1,068	3	-	25	-	1,108
1992	63	2	+	5	-	763	3	1	30	-	867
1993	12	3	+	32	-	899	3	+	54	-	1,003
1994	70	1	+	30	-	1,673	6	-	66	-	1,846
1995	79	1	+	33	-	1,415	1	-	35	-	1,564
1996	0	1	-	30	-	836	3	-	69	-	939
1997	1	1	-	23	-	359	2	-	90	-	476
1998	-	1	-	24	18	630	9	-	233	-	915
1999	-	-	-	26	-	591	5	-	331	-	953
2000*	-	2	-	22	-	1,933	14	-	372	1	2,344
2001*	-	1	-	31	-	476	10	-	157	5	680

* Preliminary.

Tusk in Division VIIa

Year	France	E & W	Scotland	Total
1988	n/a	-	+	+
1989	2	-	+	2
1990	4	+	+	4
1991	1	-	1	2
1992	1	+	2	3
1993	-	+	+	+
1994	-	-	+	+
1995	-	-	1	1
1996	-	-	-	-
1997	-	-	1	1
1998	-	-	1	1
1999	-	-	+	+
2000*	-	-	+	+
2001*	-	-	1	+

* Preliminary. Continued …

Table 3.13.4.1 Continued

Tusk in Divisions VIIb,c

Year	France	Ireland	Norway	E & W	N.I.	Scotland	Total
1988	n/a	-	12	5	-	+	17
1989	17	-	91	-	-	-	108
1990	11	3	138	1	-	2	155
1991	11	7	30	2	1	1	52
1992	6	8	167	33	1	3	218
1993	6	15	70	17	+	12	120
1994	5	9	63	9	-	8	94
1995	3	20	18	6	-	1	48
1996	4	11	38	4	-	1	58
1997	4	8	61	1	-	1	75
1998	3	-	28	-	-	2	33
1999	-	16	130	-	-	1	147
2000*	3	58	88	12	-	3	164
2001*	3	54	177	4	-	25	263

*Preliminary.

Tusk in Divisions VIIg-k

Year	France	Germany	Ireland	Norway	E & W	Scotland	Spain	Total
1988	n/a	-	-	-	5	-	-	5
1989	3	-	-	82	1	-	-	86
1990	6	-	-	27	0	+	-	33
1991	4	-	-	-	8	2	-	14
1992	9	-	-	-	38	-	-	47
1993	5	-	17	-	7	3	-	32
1994	4	-	12	-	12	3	-	31
1995	3	-	8	-	18	8	-	37
1996	3	-	20	-	3	3	-	29
1997	4	4	11	-	-	+	0	19
1998	2	3	4	-	-	1	0	10
1999	1	1	-	-	-	+	6	8
2000*	3	-	5	-	-	+	3	11
2001*	3	-	-	9	-	+	2	14

* Preliminary.

Tusk in Division VIIIa

Year	E & W	France	Total
1988	1	n/a	1
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	+	+	+
1998	-	1	1
1999	-	-	0
2000*	-	-	-
2001*	-	-	-

* Preliminary.

Continued …

Table 3.13.4.1 Continued

Tusk in Subarea XII

Year	Faroes	France	Iceland	Norway	Scotland	Total
1988		1				1
1989		1				1
1990		0				0
1991		1				1
1992		1				1
1993		12	+			12
1994		1	+			1
1995	8	-	10			18
1996	7	-	9	142		158
1997	11	-	+	19		30
1998		1		-		1
1999		1		+	1	1
2000*				5	+	5
2001*				51	+	51

*Preliminary.

Tusk in Division XIVa

Year	Germany	Norway	Total
1988	2	-	2
1989	1	-	1
1990	2	-	2
1991	2	-	2
1992	+	-	+
1993	+	-	+
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	+	+
2000*	-	-	-
2001*	-	0	0

* Preliminary.

Tusk in Division XIVb

Year	Faroes	Iceland	Norway	E & W	Total
1988	-		-	-	-
1989	19	3	-	-	22
1990	13	10	7	-	30
1991	-	64	68	1	133
1992	-	82	120	+	202
1993	-	27	53	+	80
1994	-	9	16	+	25
1995	-	57	30	+	87
1996	-	139	142	-	281
1997	-	10	108	-	118
1998	1	-	14	-	15
1999	-	n/a	9	-	9
2000*	-	-	11	-	11
2001*	-	-	69	-	69

*Preliminary.

Continued …

Table 3.13.4.1 Continued

TUSK - Total landings by area/division and grand total

Year	I	IIa	IIb	III	IVa	IVb	Va	Vb_1	Vb_2	VIa	VIb	VIIa	VIIb,c	VIIg-k	VIIIa	XII	XIVa	XIVb	Total
1988	-	14403	0	61	4429	0	6855	4059	1606	2120	860	-	17	5	1	1	2	0	34,419
1989	-	19350	0	93	6418	4	7061	3722	1400	2297	1593	2	108	86	-	1	1	22	42,158
1990	-	18628	0	60	4254	5	7291	5202	979	2256	768	4	155	33	-	0	2	30	39,667
1991	-	18306	0	84	4537	2	8732	5170	1096	1543	1108	2	52	14	-	1	2	133	40,782
1992	-	15974	0	85	4932	12	8009	4399	992	1682	867	3	218	47	-	1	-	202	37,423
1993	-	17584	1	79	5141	14	6075	2862	577	1223	1003	-	120	32	-	12	-	80	34,803
1994	-	12566	0	51	3375	7	5824	3407	909	1262	1846	-	94	31	-	1	-	25	29,398
1995	-	11388	229	42	3348	15	6225	3347	631	1435	1564	1	48	37	-	18	-	87	28,415
1996	587	12047	161	44	3369	163	6102	2728	582	1391	939	-	58	29	-	158	-	281	28,639
1997	665	8667	94	31	2272	38	5394	2742	577	1261	476	1	75	19	-	30	-	118	22,460
1998	805	14475	73	21	3387	66	5171	2073	637	1281	915	1	33	10	1	1	-	15	28,965
1999	907	16250	26	29	2435	34	7264	3517	447	539	953	-	147	15	0	1	-	9	32,573
2000*	798	13192	18	36	3259	116	6391	2534	441	1899	2344	-	164	8	-	5	-	11	31,216
2001*	614	11290	146	51	3089	56	4743	3385	619	1714	680	1	263	11	-	51	-	69	26,782

* Preliminary

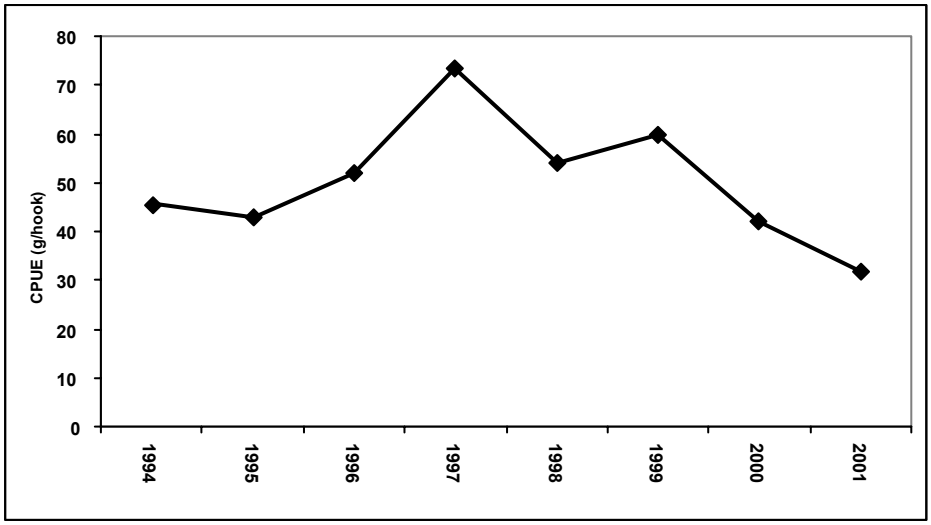

Figure 3.13.4.1. Tusk CPUE from Icelandic longline fishery.

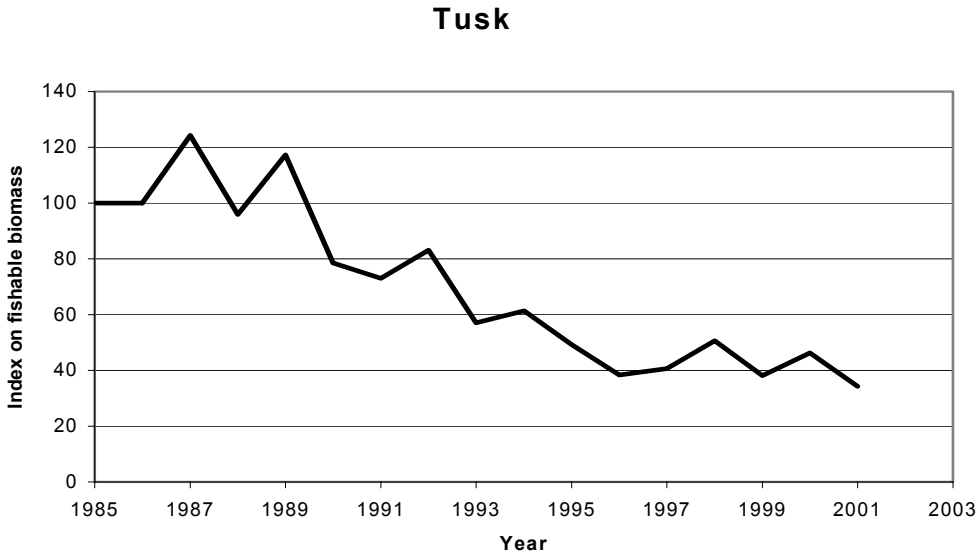

Figure 3.13.4.2 Tusk. Index on fishable biomass calculated from the Icelandic groundfish survey at the Icelandic shelf.

3.13.5 Roundnose grenadier (*Coryphaenoides rupestris*)

State of the stock/exploitation: The state of the stock in Subareas VI and VII and Division Vb is uncertain. The state of the stock in other Subareas or Divisions, including IIIa, is also unknown. The observed increasing CPUE over recent years in Division Va and Subareas VI and VII is believed to reflect a change in the fleet distribution and not an increase of the stock size. Since 1997, a major component of the landings have come from Subarea XII where no CPUE data series were available.

Advice on management: ICES recommends regulation of the fishery in all areas in order to control fishing effort. For Subareas VI and VII and Divisions Vb and IIIa significant reductions on effort are necessary. In all other areas, the expansion of fisheries should not be allowed until reliable assessments indicate that increased harvests are sustainable.

Relevant factors to be considered in management: The current interpretation of recent changes in the CPUE series mean that the CPUE series are not informative about the size of the effort reduction necessary to allow rebuilding to commence. However, for a species with the low productivity, characteristic for the roundnose grenadier, a reduction in the effort of 50%, as advised in 2000, would be appropriate to provide a likelihood of allowing rebuilding to commence.

The fishing effort directed to deep waters varies with time between areas. The recent increase in CPUE in Division Vb and Subareas VI and VII is likely to reflect a change in the fishing strategy, in the geographical distribution of effort, or in the fish accessibility.

Over time the average size and the proportion of large individuals in the landings have decreased.

In most areas, roundnose grenadier is the target species of a mixed trawl fishery.

The distribution of the species extends beyond the depths exploited by the commercial fisheries.

Due to its biological parameters, the species can only sustain a low fishing mortality and recovery of depleted stock(s) is expected to be slow. Therefore, the lack of assessment should not delay the implementation of a management regime for roundnose grenadier.

Comparison with previous assessment and advice: In Subareas VI and VII and Division Vb, the previous assessment lead to the conclusion that the stock was below U_{pa} and possibly close to U_{lim}. No new analytical assessment was accepted and increases in CPUE were believed to be the consequence of changes in the fleet strategy, geographical distribution of effort, or fish accessibility.

Elaboration and special comment: No production model could be fit to the time-series in Subareas VI and VII and Division Vb, due to a new point in the CPUE data. The reasons for the changes in the CPUE should be clarified and further analysis of trends in the fishery are required.

Landings by Subarea/Division and nation are given in Tables 3.13.5.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.5.1):

Year	ACFM Catch
1988	11
1989	13
1990	12
1991	20
1992	17
1993	16
1994	11
1995	10
1996	12
1997	17
1998	22
1999	22
2000	23
2001*	25

* Preliminary. Weights in '000 t

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Roundnose grenadier (*Coryphaenoides rupestris*)

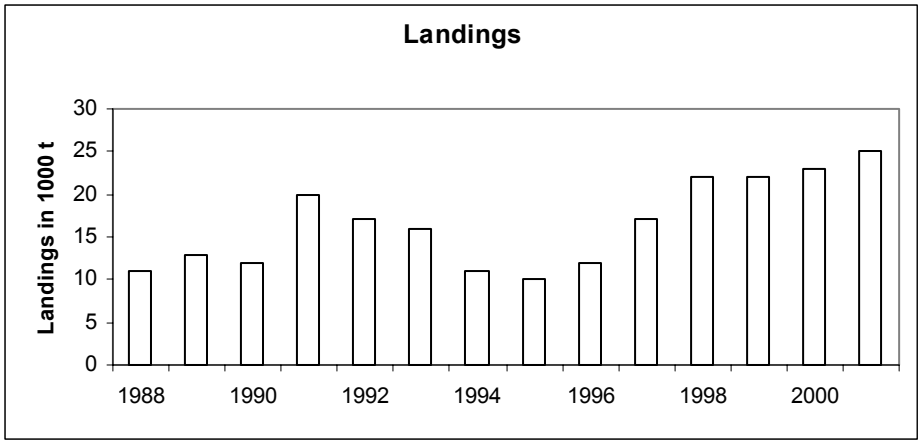


Table 3.13.5.1 Roundnose grenadier (*Coryphaenoides rupestris*). Working Group estimates of landings (tonnes).

Roundnose grenadier in Subarea I and II

Year	Faroe	Denmark	France	Germany	Norway	Russia	GDR	E & W	Scotland	Total
1988	-	-	-	-	-	-	-	-	-	-
1989	-	-	1	2	-	16	3	-	-	22
1990	-	-	32	2	-	12	3	-	-	49
1991	-	-	41	3	28	-	-	-	-	72
1992	-	1	22	0	29	-	-	-	-	52
1993	-	-	13	0	2	-	-	-	-	15
1994	-	-	3	12	-	-	-	-	-	15
1995	-	-	7	-	-	-	-	-	-	7
1996	-	-	2	-	-	-	-	-	-	2
1997	1	-	5	-	100	-	-	-	-	106
1998	-	-	0	-	87	13	-	-	-	100
1999	-	-	0	-	44	2	-	-	-	46
2000	-	-	0	-	-	-	-	-	0	0
2001*	-	-	0	-	-	-	-	2	0	2

* Preliminary.

Roundnose grenadier in Subarea III

Year	Denmark	Norway	Sweden	Total
1988	612	-	5	617
1989	884	-	1	885
1990	785	280	2	1,067
1991	1,214	304	10	1,528
1992	1,362	211	755	2,328
1993	1,103	55	-	1,158
1994	517	-	42	559
1995	0	-	1	1
1996	2,213	-	-	2,213
1997	0	124	42	166
1998	1,490	329	-	1,819
1999	3,113	13	-	3,126
2000	2,400	4	-	2,404
2001*	3,067	35	-	3,102

* Preliminary.

Roundnose grenadier in Subarea IV

Year	France	Germany	Norway	Scotland	Denmark	Total
1988	-	1	-	-	-	1
1989	167	1	-	2	-	170
1990	370	2	-	-	-	372
1991	521	4	-	-	-	525
1992	421	-	-	4	1	426
1993	279	4	-	-	0	283
1994	185	2	-	-	25	212
1995	68	1	-	15	0	84
1996	59	-	-	5	7	71
1997	1	-	-	10	0	11
1998	35	-	0	-	0	35
1999	56	-	5	-	0	61
2000	2	-	-	-	0	2
2001*	2	-	-	-	17	19

* Preliminary.

Continued …

Table 3.13.5.1 Continued

Roundnose grenadier in Division Va

Year	Faroes	Iceland [1]	Germany	E & W	Total
1988	-	2	-	-	2
1989	2	2	-	-	4
1990	-	7	-	-	7
1991	-	48	-	-	48
1992	-	210	-	-	210
1993	-	276	-	-	276
1994	-	210	-	-	210
1995	0	398	-	-	398
1996	1	139	-	-	140
1997	0	198	-	-	198
1998	-	120	0	-	120
1999	-	129	0	-	129
2000	-	67	-	-	67
2001*	-	57	-	0	57

* Preliminary. [1] Includes other grenadiers from 1988 to 1996.

Roundnose grenadier in Division Vb

Year	Faroes	France	Norway	Germany	Russia	U.K.	Total
1988	-	-	-	1	-	-	1
1989	20	181	-	5	52	-	258
1990	75	1,470	-	4	-	-	1,549
1991	22	2,281	7	1	-	-	2,311
1992	551	3,259	1	6	-	-	3,817
1993	339	1,328	-	14	-	-	1,681
1994	286	381	-	1	-	-	668
1995	405	818	-	-	-	-	1,223
1996	93	983	-	2	-	-	1,078
1997	53	1,059	-	-	-	-	1,112
1998	50	1,617	-	-	-	-	1,667
1999	104	1,861	2	0	-	29	1,996
2000	44	1,699	-	1	1	43	1,788
2001*	-	1,719	-	-	-	-	1,719

* Preliminary.

Roundnose grenadier in Subarea VI

Year	Faroes	France	Germany	Ireland	Norway	Spain	E & W	Scotland	Russia	Total
1988	27	-	4	-	-	-	1	-		32
1989	2	2,211	3	-	-	-	-	2		2,218
1990	29	5,484	2	-	-	-	-	-	-	5,515
1991	-	7,297	7	-	-	-	-	-	-	7,304
1992	99	6,422	142	-	5	-	2	112	-	6,782
1993	263	7,940	1	-	-	-	-	1	-	8,205
1994	-	5,898	15	14	-	-	-	11	-	5,938
1995	0	6,329	2	59	-	-	-	82	-	6,472
1996	0	5,888	-	-	-	-	-	156	-	6,044
1997	15	5,795	-	4	-	-	-	218	-	6,032
1998	13	5,170	-	-	21	3	-	-	-	5,207
1999	-	5,637	3	1	-	1	-	-	-	5,642
2000	-	7,423	-	41	1	1,002	1	433	-	8,901
2001*	-	5,587	6	31	32	2,166	21	955	3	8,801

* Preliminary.

Continued …

Table 3.13.5.1 Continued

Roundnose grenadier in Subarea VII

Year	France	Ireland	Spain	Total
1988	-	-	-	0
1989	222	-	-	222
1990	215	-	-	215
1991	489	-	-	489
1992	1,556	-	-	1,556
1993	1,916	-	-	1,916
1994	1,922	-	-	1,922
1995	1,295	-	-	1,295
1996	1,051	-	-	1,051
1997	1,033	-	5	1,038
1998	1,146	-	11	1,157
1999	892	-	4	896
2000	889	-	0	889
2001*	914	416	0	1,330

* Preliminary

Roundnose grenadier in Subareas VIII and IX

Year	France	Spain	Total
1988	-	-	0
1989	0	-	0
1990	5	-	5
1991	1	-	1
1992	12	-	12
1993	18	-	18
1994	5	-	5
1995	0	-	0
1996	1	-	1
1997	0	0	0
1998	1	19	20
1999	9	7	16
2000	4	5	9
2001*	7	3	10

* Preliminary.

Roundnose grenadier in Subarea X

Year	Faroes	France	E & W	Total
1988	-	-	-	-
1989	-	-	-	0
1990	-	-	-	0
1991	-	-	-	0
1992	-	-	-	0
1993	-	-	-	0
1994	-	-	-	0
1995	0	-	-	0
1996	3	-	-	3
1997	1	-	-	1
1998	1	-	-	1
1999	3	3		6
2000	0	0	74	74
2001*	0	-	-	0

* Preliminary.

Continued …

Table 3.13.5.1 Continued

Roundnose grenadier in Subarea XII

Year	Faroes	France	Germ.	Iceland	Ireland	Latvia	Russia	Poland	Spain	E & W	Scot.	Norway	Total
1988	-	-	-	-	-	-	10,600	-	-	-	-	-	10,600
1989	-	0	-	-	-	-	9,500	-	-	-	-	-	9,500
1990	-	0	-	-	-	-	2,800	-	-	-	-	-	2,800
1991	-	14	-	-	-	4,296	3,200	-	-	-	-	-	7,510
1992	-	13	-	-	-	1,684	300	-	-	-	-	-	1,997
1993	-	26	39	-	-	2,176	500	-	-	-	-	-	2,741
1994	457	20	9	-	-	675	-	-	-	-	-	-	1,161
1995	359[(1)]	285	-	-	-	-	-	-	-	-	-	-	644
1996	136	179	-	77	-	-	200	-	1,136	-	-	-	1,728
1997	138	111	-	-	-	-	700	5,867	1,800	-	-	-	8,676
1998	19	116	-	-	-	-	800	6,769	4,262	-	-	-	11,978
1999	-	287	-	-	-	-[(2)]	576	546	8,251	-	-	-	9,660
2000	-	391	-	-	-	-	2,325	-	5,791	9	6	-	8,522
2001*	-	156	-	-	3	-	1,714	-	7,670	-	7	1	9,551

* Preliminary. [(1)] Includes some from VIb. [(2)] Provisional, indication of important catches from Latvia in 1999, without official report.

Roundnose grenadier in Subarea XIV

Year	Faroes	Germany	Greenland	Iceland [(1)]	Norway	E & W	Scotland	Russia	Total
1988	-	45	7	-	-	-	-	-	52
1989	3	42	-	-	-	-	-	-	45
1990	-	45	1	-	-	1	-	-	47
1991	-	23	4	-	-	2	-	-	29
1992	-	19	1	4	6	-	1	-	31
1993	-	4	18	4	-	-	-	-	26
1994	-	10	5	-	-	-	-	-	15
1995	0	13	14	-	-	-	-	-	27
1996	0	6	19	-	-	-	-	-	25
1997	6	34	12	-	7	-	-	-	59
1998	1	116	3	-	6	-	-	-	126
1999	-	105	0	-	19	-	-	-	124
2000	-	41	-	-	5	-	-	-	46
2001*	-	11	-	-	7	2	-	72	92

* Preliminary. [(1)] Includes other grenadiers.

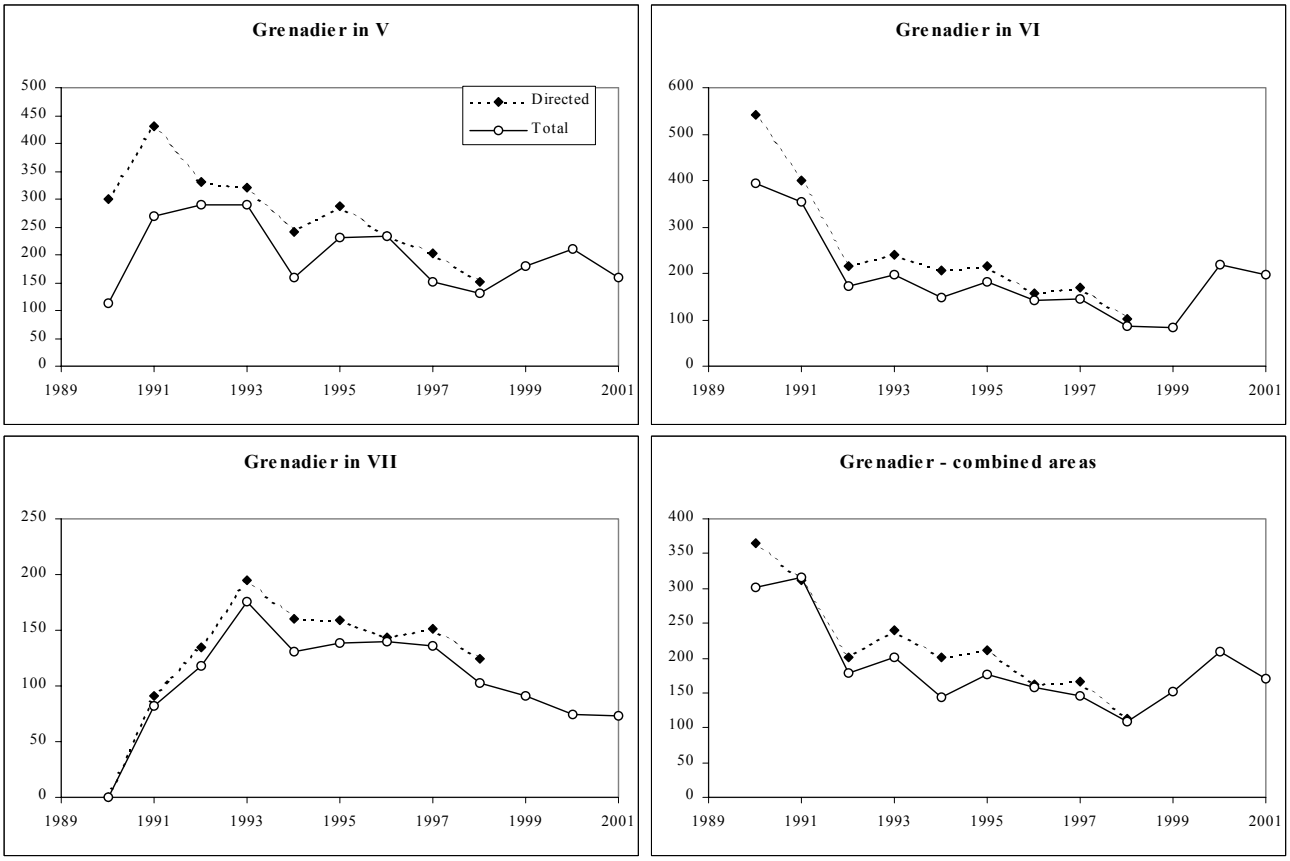
Continued …

Table 3.13.5.1 Continued

ROUNDNOSE GRENADIER - Total landings by area/division and grand total

Year	I & II	III	IV	Va	Vb	VI	VII	VIII & IX	X	XII	XIV	**Total**
1988	-	617	1	2	1	32	0	0		10,600	52	**11,305**
1989	22	885	170	4	258	2,218	222	0	0	9,500	45	**13,324**
1990	49	1,067	372	7	1,549	5,515	215	5	0	2,800	47	**11,626**
1991	72	1,528	525	48	2,311	7,304	489	1	0	7,510	29	**19,817**
1992	52	2,328	426	210	3,817	6,782	1,556	12	0	1,997	31	**17,211**
1993	15	1,158	283	276	1,681	8,205	1,916	18	0	2,741	26	**16,319**
1994	15	559	212	210	668	5,938	1,922	5	0	1,161	15	**10,705**
1995	7	1	84	398	1,223	6,472	1,295	0	0	644	27	**10,151**
1996	2	2,213	71	140	1,078	6,044	1,051	1	3	1,728	25	**12,356**
1997	106	166	11	198	1,112	6,032	1,038	0	1	8,676	59	**17,399**
1998	100	1,819	35	120	1,667	5,207	1,157	20	1	11,978	126	**22,230**
1999	46	3,126	61	129	1,996	5,642	896	16	6	9,660	124	**21,702**
2000	0	2,404	2	67	1,788	8,901	889	9	74	8,522	46	**22,702**
2001*	2	3,102	19	57	1,719	8,801	1,330	10	0	9,551	92	**24,683**

* Preliminary.



French trawler CPUE, comparisons using directed and total effort

3.13.6 Black scabbardfish (*Aphanopus carbo*)

State of the stock/exploitation: The stock structure of this species is still unknown. CPUE trends differ between the northern Subareas V, VI, VII, and XII and Subareas VIII and IX. In the northern areas trawl CPUE shows a consistent decline to a historically low level in 1999, a slight increase in 2000, and then a very considerable increase in 2001. While it is possible that this increase reflects some improvement in stock status, it is unlikely that the magnitude of the increase between 2000 and 2001 reflects a corresponding increase in stock abundance. CPUE data from the longliners in Division IXa suggest that the abundance in the southern area has remained relatively stable during the past decade, but the fishery has expanded its area of operation and this could be contributing to maintaining the catch rates.

Advice on management: ICES recommends a significant reduction in the fishing effort in the northern areas. The contradicting trends of the CPUE series make it difficult to advise on the need for effort reduction in the southern area, but certainly no expansion of the effort should be allowed and fisheries should not be allowed to expand until reliable assessments indicate that increased harvests are sustainable.

Relevant factors to be considered in management: It should be noted that black scabbardfish is caught in two very different fisheries, in waters off the Mainland of Portugal (Division IXa) and to the west of the British Isles. In the waters off Mainland of Portugal it is taken in a targeted artisanal longline fishery and CPUE data have been relatively stable over the years. To the west of the British Isles it is taken in a mixed species, mainly French trawl fishery along with roundnose grenadier and sharks.

Comparison with previous assessment and advice: No reliable analytical assessment of black scabbardfish was made in 2002.

Elaboration and special comment: Landings in Table 3.13.6.1. French trawl CPUE and longline CPUE data series are presented in Figures 3.13.6.1 and 3.13.6.2, respectively.

The advice of this year is based on fleets whose dynamics do not appear to be the same, and whether these fleets explain the different stock structure remains unknown.

There is detailed information available on the "artisanal" fishery in Subarea IX. CPUE from this fishery is unlikely to reflect stock trends because the fishery is very localised. CPUE data from the more recently developed fishery in the northern areas are presented in Figure 3.13.6.1, but data of the effort exerted and the geographical distribution of effort over time are missing. Therefore, its validity as a stock indicator is also unknown. In addition, time-series of the size distribution of landings would be very useful.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.6.1):

Year	ACFM catch
1988	3
1989	4
1990	5
1991	7
1992	9
1993	9
1994	8
1995	8
1996	8
1997	7
1998	6
1999	5
2000	7
2001*	8

*Preliminary. Weights in '000 t.

Black scabbardfish *(Aphanopus carbo)*

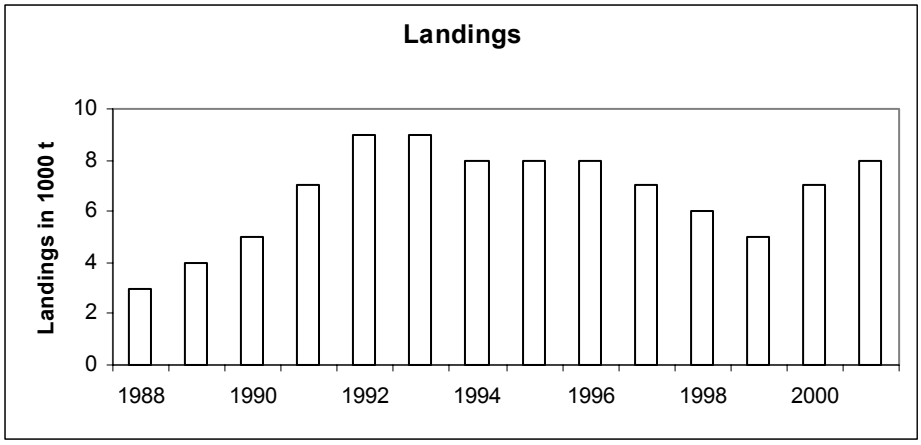


Table 3.13.6.1 Black scabbardfish (*Aphanopus carbo*). Working Group estimates of landings (tonnes).

Black scabbardfish in Subareas III and IV

Year	France	Germany	Scotland	E&W&NI	Total
1988	2	-	-	-	2
1989	0	-	-	-	0
1990	57	-	-	-	57
1991	0	-	-	-	0
1992	0	-	-	-	0
1993	0	-	-	-	0
1994	13	3	-	-	16
1995	-	-	2	-	2
1996	3	-	1	-	4
1997	0	-	2	-	2
1998	-	-	9	-	9
1999	4	-	3	-	6
2000	2	0	3	-	5
2001*	1	0	10	1	12

* Preliminary.

Black scabbardfish in Division Va

Year	Iceland	Total
1988	-	0
1989	-	0
1990	-	0
1991	-	0
1992	-	0
1993	0	0
1994	1	1
1995	+	+
1996	0	0
1997	1	1
1998	0	0
1999	9	9
2000	18	18
2001*	8	8

* Preliminary.

Continued …

Table 3.13.6.1 Continued

Black scabbardfish in Division Vb

Year	Faroes	France	Germany	Scotland	E&W&NI	Total
1988	-	-	-	-	-	0
1989	-	166	-	-	-	166
1990	12	407	-	-	-	419
1991	1	151	-	-	-	152
1992	4	29	-	-	-	33
1993	202	76	9	-	-	287
1994	114	45	1	-	-	160
1995	249	175	-	-	-	424
1996	57	129	-	-	-	186
1997	18	50	-	-	-	68
1998	36	144	-	-	-	180
1999	31	135	-	6	-	172
2000	117	186	0	9	-	313
2001*	189	371	0	20	0	581

* Preliminary.

Black scabbardfish in Subareas VI and VII

Year	Faroes	France	Germany	Ireland	Spain	Scotland	E&W&NI	Total
1988								0
1989	46	108						154
1990		1060						1060
1991		2759						2759
1992	3	3433						3436
1993	62	3411	48	8				3529
1994		3050	46	3		2		3101
1995		3257	3			18		3278
1996		3650	2			36	1	3689
1997	3	2754		0	1	235	2	2995
1998		1815		0	3	148	1	1967
1999		1973		1	0	191	1	2166
2000		3235	0	59	1	377	40	3712
2001*		3692	0	68	158	673	34	4625

* Preliminary.

Continued …

Table 3.13.6.1 Continued

Black scabbardfish in Subareas VIII and IX

Year	France	Portugal	Spain	Total
1988	-	2,602	-	2,602
1989	-	3,473	-	3,473
1990	0	3,274	-	3,274
1991	1	3,978	-	3,979
1992	0	4,389	-	4,389
1993	0	4,513	-	4,513
1994	0	3,429	-	3,429
1995	-	4,272	-	4,272
1996	126	3,686	3	3,815
1997	2	3,553	1	3,556
1998	2	3,147	3	3,152
1999	11	2,741	0	2,752
2000	32	2,371	1	2,404
2001*	22	2,744	1	2,767

* Preliminary.

Black scabbardfish in Subarea X

Year	Faroes	Portugal	France	Total
1988	-	-	-	0
1989	-	-	-	0
1990	-	-	-	0
1991	-	166	-	166
1992	370	-	-	370
1993	-	2	-	2
1994	-	-	-	0
1995	-	3	-	3
1996	11	0	-	11
1997	3	0	-	3
1998	31	68	-	99
1999	-	46	66	112
2000	-	112	1	113
2001*	-	0	0	0

* Preliminary.

Continued …

Table 3.13.6.1 Continued

Black scabbardfish in Subarea XII

Year	Faroes	France	Germany	Spain	Scotland	Total
1988	-	-	-	-	-	0
1989	-	-	-	-	-	0
1990	-	-	-	-	-	0
1991	-	-	-	-	-	0
1992	-	512	-	-	-	512
1993	1051	-	93	-	-	1,144
1994	779	-	45	-	-	824
1995	301[(1)]	-	-	-	-	301
1996	187	4	-	253	-	444
1997	102	-	-	98	-	200
1998	20	-	-	134	-	154
1999	-	3	-	109	0	112
2000	1	6	0	237	-	244
2001	-	3	0	159	-	162

* Preliminary. [(1)] Includes VIb.

Black scabbardfish in Subarea XIV

Year	Faroes	Spain	Total
1988	-	-	0
1989	-	-	0
1990	-	-	0
1991	-	-	0
1992	-	-	0
1993	-	-	0
1994	-	-	0
1995	-	-	0
1996	-	-	0
1997	-	-	0
1998	2	-	2
1999	-	-	0
2000	-	90	90
2001	-	12	12

* Preliminary. Continued …

Table 3.13.6.1 Continued

BLACK SCABBARDFISH - Total landings by area/division and grand total

Year	III & IV	Va	Vb	VI & VII	VIII & IX	XII	XIV	Total
1988	2	0	0	0	2,602	0	0	2,604
1989	0	0	166	154	3,473	0	0	3,793
1990	57	0	419	1,060	3,274	0	0	4,810
1991	0	0	152	2,759	3,979	0	0	6,890
1992	0	0	33	3,436	4,389	512	0	8,370
1993	0	0	287	3,529	4,513	1,144	0	9,473
1994	16	1	160	3,101	3,429	824	0	7,531
1995	2	+	424	3,278	4,272	301	0	8,277
1996	4	0	186	3,689	3,815	444	0	8,138
1997	2	1	68	2,995	3,556	200	0	6,822
1998	9	0	180	1,967	3,152	154	2	5,464
1999	6	9	172	2,166	2,752	112	0	5,217
2000	5	18	313	3,712	2,404	244	90	6,786
2001*	12	8	581	4,625	2,767	162	12	8,166

* Preliminary.

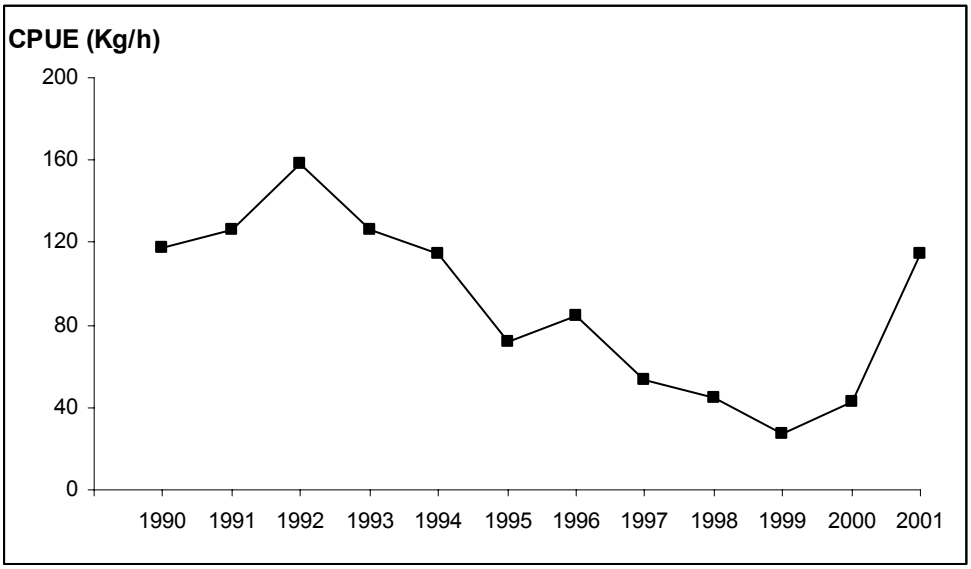


Figure 3.13.6.1 French trawl CPUE data series for combined ICES Subareas V,VI and VII (1990–2001).

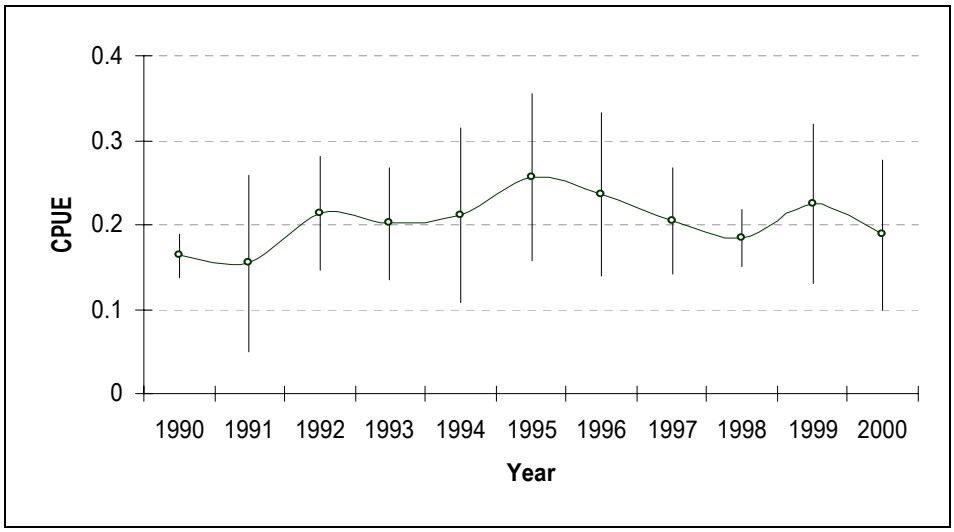


Figure 3.13.6.2 Annual CPUE average estimates from longline fishery in ICES Subarea IXa (1990 and 2000).

3.13.7 Greater silver smelt or argentine (*Argentina silus*)

State of the stock/exploitation: The state of the stock(s) is unknown. Landings have increased considerably in recent years, particularly in Subareas II, VI, and VII.

Advice on management: Greater silver smelt stocks can only sustain very low rates of exploitation. **ICES repeats its general recommendation that fisheries on such species, also as by-catch, should only be permitted when they are accompanied by programs to collect data and expand very slowly until reliable assessment indicates that increased harvests are sustainable.**

Relevant factors to be considered in management: At least in Subarea VI, the abundance of 20 years and older fish has decreased in recent years, which may suggest high levels of exploitation.

Comparison with previous assessment and advice: No significant changes to the perception of the stock.

Elaboration and special comment: CPUE data may not reflect stock trends, because this is a semi-pelagic shoaling species.

In Subareas I and II the decline in landings in the mid-1990s probably represents a change in target species. In Subareas III and IV the argentine is both targeted and a by-catch fishery. Some preliminary CPUE data are available for Division IIIa but they require further elaboration. In Divisions Va and Vb the fishery has changed from a by-catch to a targeted fishery. The fishery in Subareas VI and VII is on spawning aggregations, but the effort varies according to the availability of other species such as horse mackerel and blue whiting. There has been a marked increase in landings since 1997.

Landings by Subarea/Division and nation are given in Table 3.13.7.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16)

Catch data (Table 3.13.7.1):

Year	ACFM Catch
1988	25
1989	38
1990	22
1991	16
1992	21
1993	15
1994	16
1995	28
1996	26
1997	26
1998	49
1999	34
2000	36
2001*	45

* Preliminary. Weights in '000 t.

Greater silver smelt or argentine (*Argentina silus*

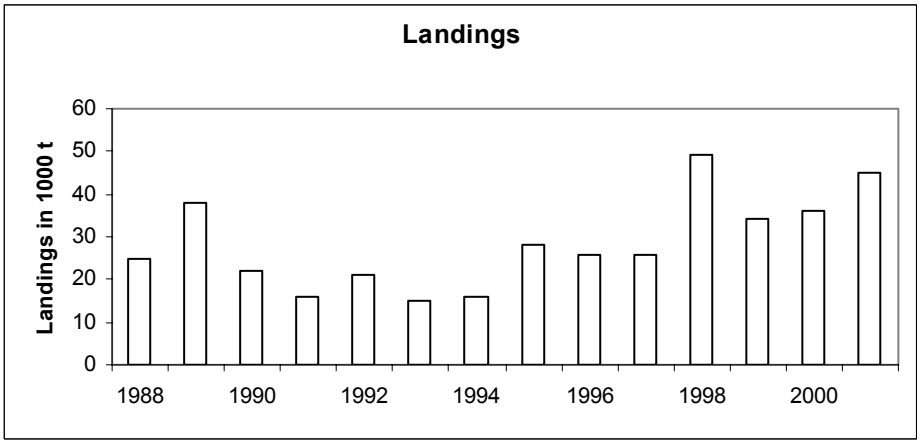


Table 3.13.7.1 Argentines (*Argentina silus)*. Working Group estimates of landings (tonnes).

Argentines in Subareas I and II

Year	Germany	Netherlands	Norway	Poland	Russia	Scotland	France	Total
1988	-	-	11,332	5	14	-	-	11,351
1989	-	-	8,367	-	23	-	-	8,390
1990	-	5	9,115	-	-	-	-	9,120
1991	-	-	7,741	-	-	-	-	7,741
1992	-	-	8,234	-	-	-	-	8,234
1993	-	-	7,913	-	-	-	-	7,913
1994	-	-	6,217	-	-	590	-	6,807
1995	357	-	6,418	-	-	-	-	6,775
1996	-	-	6,604	-	-	-	-	6,604
1997	-	-	4,463	-	-	-	-	4,463
1998	40	-	8,221	-	-	-	-	8,261
1999	-	-	7,145	-	-	18	-	7,163
2000	-	3	6,075	-	195	18	2	6,293
2001*	-	-	14,357	-	7	5	-	14,363

* Preliminary

Argentines in Subareas III and IV

Year	Denmark	Faroes	France	Germany	Netherlands	Norway	Scotland	Sweden	Ireland	Total
1988	1,062	-	-	1	-	1655	-	-	-	2,718
1989	1,322	-	-	-	335	2128	1	-	-	3,786
1990	737	-	-	13	-	1571	-	-	-	2,321
1991	1,421	-	1	-	3	1123	6	-	-	2,554
1992	4,449	-	-	1	70	698	101	-	-	5,319
1993	2,347	-	-	-	298	568	56	-	-	3,269
1994	1,480	-	-	-	-	4	24	-	-	1,508
1995	1,061	-	-	-	-	1	20	-	-	1,082
1996	2,695	370	-	-	-	213	22	-	-	3,300
1997	1,332	-	-	1	-	704	19	542	-	2,598
1998	2,716	-	-	128	277	434	-	427	-	3,982
1999	3,772	-	82	-	6	5	452	-	2	4,319
2000	1,806	-	270	-	-	32	78	273	12	2,471
2001*	1,653	-	28	-	-	3	227	-	3	1,914

* Preliminary.

Continued …

Table 3.13.7.1 Continued

Argentines in Division Va

Year	Iceland	E & W	Total
1988	206	-	206
1989	8	-	8
1990	112	-	112
1991	247	-	247
1992	657	-	657
1993	1,255	-	1,255
1994	613	-	613
1995	492	-	492
1996	808	-	808
1997	3,367	-	3,367
1998	13,387	-	13,387
1999	5,495	23	5,518
2000	4,593	-	4,593
2001*	3,046	-	3,046

* Preliminary.

Argentines in Division Vb

Year	Faroes	Russia	Scotland	E&W&NI	Ireland	France	Total
1988	287	-	-	-	-	-	287
1989	111	116	-	-	-	-	227
1990	2,885	3	-	-	-	-	2,888
1991	59	-	1	-	-	-	60
1992	1,439	4	-	-	-	-	1,443
1993	1,063	-	-	-	-	-	1,063
1994	960	-	-	-	-	-	960
1995	5,534	6,752	-	-	-	-	12,286
1996	9,495	-	3	-	-	-	9,498
1997	8,433	-	-	-	-	-	8,433
1998	17,570	-	-	-	-	-	17,570
1999	8,186	-	15	23	-	5	8,214
2000	7,094	1,185	247	-	-	64	8,343
2001*	9,952	414	94	-	1	-	10,460

* Preliminary.

Continued …

Table 3.13.7.1 Continued

Argentines in Subareas VI and VII

Year	Faroes	France	Germany	Ireland	Neth.	Norway	E & W	Scotland	N.I.	Russia	Spain[(1)]	Total
1988	-	-	-	5,454	-	4,984	-	-	-	-	-	10,438
1989	188	-	-	6,103	3,715	12,184	198	3,171	-	-	-	25,559
1990	689	-	37	585	5,871	-	-	112	-	-	-	7,294
1991	-	7	-	453	4,723	-	-	10	4	-	-	5,197
1992	-	1	-	320	5,118	-	-	467	-	-	-	5,906
1993	-	-	-	-	1,168	-	-	409	-	-	-	1,577
1994	-	-	43	150	4,137	-	-	1,377	-	-	-	5,707
1995	1,597	-	357	6	5,440	-	-	146	-	-	-	7,546
1996	-	-	1,394	295	3,953	-	-	221	-	-	-	5,863
1997	-	-	1,496	1,089	4,696	-	-	20	-	-	-	7,301
1998	-	-	463	405	4,687	-	-	-	-	-	-	5,555
1999	-	21	24	394	8,025	-	-	387	-	5	-	8,856
2000	-	17	482	4,703	3,633	-	-	4,965	-	29	34	13,863
2001*	-	12	189	7,494	6,882	-	-	7,620	-	76	-	22,273

* Preliminary. [(1)] Working Group data zero in all years 1997-2001.

Argentines in Subarea XII

Year	Faroes	Iceland	**Total**
1988	-	-	-
1989	-	-	-
1990	-	-	-
1991	-	-	-
1992	-	-	-
1993	6	-	**6**
1994	-	-	-
1995	-	-	-
1996	1	-	**1**
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-	2	**2**
2001*	-	-	-

* Preliminary.

Continued …

Table 3.13.7.1 Continued

Argentines in Subarea XIV

Year	Norway	Iceland	Total
1988	-	-	-
1989	-	-	-
1990	6	-	6
1991	-	-	-
1992	-	-	-
1993	-	-	-
1994	-	-	-
1995	-	-	-
1996	-	-	-
1997	-	-	-
1998	-	-	-
1999	-	-	-
2000	-	217	217
2001*	66	-	66

* Preliminary.

ARGENTINES - Total landings by area/division and grand total

Year	I & II	III & IV	Va	Vb	VI & VII	XII	XIV	Total
1988	11,351	2,718	206	287	10,438	-	-	25,000
1989	8,390	3,786	8	227	25,559	-	-	37,970
1990	9,120	2,321	112	2,888	7,294	-	6	21,741
1991	7,741	2,554	247	60	5,197	-	-	15,799
1992	8,234	5,319	657	1,443	5,906	-	-	21,559
1993	7,913	3,269	1,255	1,063	1,577	6	-	15,083
1994	6,807	1,508	613	960	5,707	-	-	15,595
1995	6,775	1,082	492	12,286	7,546	-	-	28,181
1996	6,604	3,300	808	9,498	5,863	1	-	26,074
1997	4,463	2,598	3,367	8,433	7,301	-	-	26,162
1998	8,261	3,982	13,387	17,570	5,555	-	-	48,755
1999	7,163	4,319	5,518	8,214	8,856	2	-	34,087
2000	6,293	2,471	4,593	8,343	13,863	-	217	36,027
2001*	14,363	1,914	3,046	10,460	15,391	-	66	45,174

* Preliminary.

3.13.8 Orange roughy (*Hoplostethus atlanticus*)

State of the stock/exploitation: The last analytical assessment for orange roughy in Subarea VI was carried out in 2000. Based on updated CPUE data it is concluded that orange roughy in Subarea VI is outside safe biological limits. The catch has been very low since 1993 and the stock is depleted. The lack of development of this fishery in the most recent years suggests that this stock has not shown any sign of recovery. Moreover, the remaining catches in the area are likely to adversely affect the recovery of the stock. The situation in Subarea VII is highly uncertain. International landings have increased while catch rates have stabilised in recent years, but these features may reflect the sequential discovery and subsequent fishing of previously unexploited aggregations. The state of orange roughy in other areas is unknown. CPUE trends are shown in Figure 3.13.8.1.

Advice on management: Orange roughy stocks cannot sustain high rates of exploitation. Newly-discovered aggregations are often overexploited before enough information is available to provide timely advice on management. Considering recent observations on the fishery developments, the exploitation of orange roughy should be strictly limited and the stocks/populations closely monitored. Data obtained should be incorporated into appropriate management measures. These recommendations should also apply to areas where there is currently no exploitation on orange roughy. There should be no directed fishery in Subarea VI.

Relevant factors to be considered in management: Orange roughy are known to grow to be very old (estimated > 100 years). Another biological characteristic of this species is that it aggregates in local concentrations. Experience in other areas (e.g. South Pacific) has shown that these characteristics make this species especially vulnerable to exploitation. There is concern that the fleets may exploit local aggregations one after the other. Once an aggregation is fished out, these fleets could explore and harvest other concentrations. In that context, the CPUE of such fleets would not reflect the subsequent depletion of the overall stock.

Elaboration and special comment: There are currently four fisheries for orange roughy in the Northeast Atlantic. The main fishery up to 2000 was conducted by French trawlers in Subareas VI and VII. In 2001, an Irish fishery has rapidly developed in Subarea VII, taking the bulk of the landings (2 400 t). The other fisheries include a Faroese fleet, which mainly operates in Division Vb and international waters (Hatton Bank and mid-Atlantic ridge) and a small Icelandic coastal fleet conducted in Division Va. The French fishery in Subarea VI started in 1991 and, after an initial peak of 3 500 t, landings declined rapidly to less than 200 t per annum. French landings in Subarea VII peaked in 1992 at around 3 100 t and in recent years have stabilised at around 1 000 t per annum. The main fishery is on spawning aggregations.

Landings by Subarea/Division and nation are given in Tables 3.13.8.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.8.1):

Year	ACFM Catch
1988	0
1989	+
1990	+
1991	5
1992	5
1993	3
1994	2
1995	2
1996	2
1997	2
1998	2
1999	2
2000	2
2001*	4

*Preliminary. Weights in '000 t.

Orange roughy (*Hoplostethus atlanticus*)

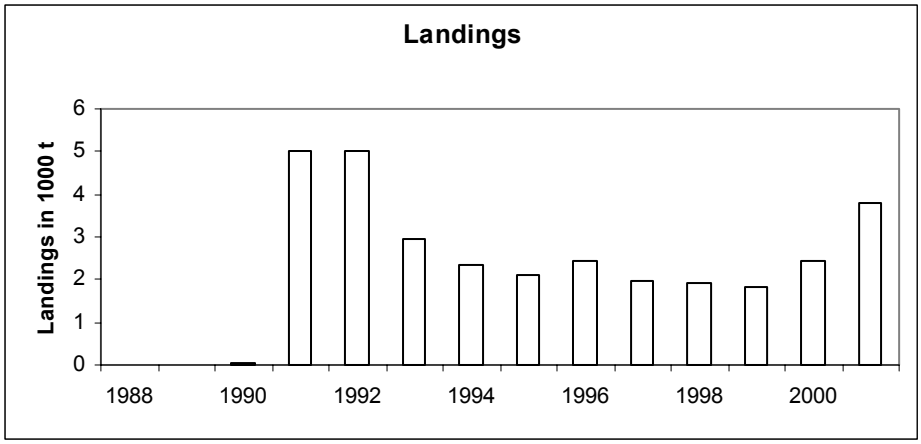


Table 3.13.8.1 Orange roughy (*Hoplostethus atlanticus*). Working Group estimates of landings (tonnes).

Orange roughy in Division Va

Year	Iceland	Total
1988	-	0
1989	-	0
1990	-	0
1991	65	65
1992	382	382
1993	717	717
1994	158	158
1995	64	64
1996	40	40
1997	79	79
1998	28	28
1999	14	14
2000	68	68
2001*	19	19

*Preliminary.

Orange roughy in Division Vb

Year	Faroes	France	Total
1988	-	-	0
1989	-	-	0
1990	-	22	22
1991	-	48	48
1992	1	12	13
1993	36	1	37
1994	170	+	170
1995	419	1	420
1996	77	2	79
1997	17	1	18
1998	-	3	3
1999	4	1	5
2000	155	0	155
2001*	1	4	5

*Preliminary.

Continued …

Table 3.13.8.1 Continued

Orange roughy in Subarea VI

Year	Faroes	France	E & W	Scotland	Ireland	Spain	Total
1988	-	-	-	-	-	-	0
1989	-	5	-	-	-	-	5
1990	-	15	-	-	-	-	15
1991	-	3,502	-	-	-	-	3,502
1992	-	1,422	-	-	-	-	1,422
1993	-	429	-	-	-	-	429
1994	-	179	-	-	-	-	179
1995	40	74	-	2	-	-	116
1996	0	116	-	0	-	-	116
1997	29	116	1	-	-	-	146
1998	-	100	-	-	-	2	102
1999	-	175	-	-	0	1	176
2000	-	136	-	-	2	-	138
2001*	-	159	-	11	110	-	280

* Preliminary.

Orange roughy in Subarea VII

Year	France	Spain	E & W	Ireland	Scotland	Total
1988	-	-	-	-	-	0
1989	3	-	-	-	-	3
1990	2	-	-	-	-	2
1991	1,406	-	-	-	-	1,406
1992	3,101	-	-	-	-	3,101
1993	1,668	-	-	-	-	1,668
1994	1,722	-	-	-	-	1,722
1995	831	-	-	-	-	831
1996	879	-	-	-	-	879
1997	893	-	-	-	-	893
1998	963	6	-	-	-	969
1999	1,157	4	-	-	-	1,161
2000	1,019	-	729	1		1,749
2001*	1,022	-	-	2,367	22	3,411

*Preliminary.

Continued …

Table 3.13.8.1 Continued

Orange roughy in Subarea VIII

Year	France	Spain VIII&IX	E & W	Total
1988	-	-	-	0
1989	0	-	-	0
1990	0	-	-	0
1991	0	-	-	0
1992	83	-	-	83
1993	68	-	-	68
1994	31	-	-	31
1995	7	-	-	7
1996	22	-	-	22
1997	1	22	-	23
1998	4	10	-	14
1999	33	6	-	39
2000	47	-	5	52
2001*	20	-	-	20

*Preliminary.

Orange roughy in Subarea IX

Year	Spain	Total
1988	-	0
1989	-	0
1990	-	0
1991	-	0
1992	-	0
1993	-	0
1994	-	0
1995	-	0
1996	-	0
1997	1	1
1998	1	1
1999	1	1
2000	0	0
2001*	0	0

*Preliminary.

Continued …

Table 3.13.8.1 Continued

Orange roughy in Subarea X

Year	Faroes	France	Norway	E & W	Portugal	Total
1988	-		-	-	-	0
1989	-	-	-	-	-	0
1990	-	-	-	-	-	0
1991	-	-	-	-	-	0
1992	-	-	-	-	-	0
1993	-	-	1	-	-	1
1994	-	-	-	-	-	0
1995	-	-	-	-	-	0
1996	470	1	-	-	-	471
1997	6	-	-	-	-	6
1998	177	-	-	-	-	177
1999	-	10	-	-	-	10
2000	-	3	-	28	157	188
2001*	-	-	-	28	-	28

*Preliminary.

Orange roughy in Subarea XII

Year	Faroes	France	Iceland	Spain	E & W	Total
1988	-	-	-	-	-	0
1989	-	0	-	-	-	0
1990	-	0	-	-	-	0
1991	-	0	-	-	-	0
1992	-	8	-	-	-	8
1993	24	8	-	-	-	32
1994	89	4	-	-	-	93
1995	580	96	-	-	-	676
1996	779	36	3	-	-	818
1997	802	6	-	-	-	808
1998	570	59	-	-	-	629
1999	345	43	-	43	-	431
2000	69	21	-	-	2	92
2001*	-	14	-	-	2	16

*Preliminary.

Continued …

Table3.13.8.1 Continued

ORANGE ROUGHY - Total landings by area/division and grand total

Year	Va	Vb	VI	VII	VIII	X	XII	Total
1988	0	0	0	0	0	0	0	0
1989	0	0	5	3	0	0	0	8
1990	0	22	15	2	0	0	0	39
1991	65	48	3,502	1,406	0	0	0	5,021
1992	382	13	1,422	3,101	83	0	8	5,009
1993	717	37	429	1,668	68	1	32	2,952
1994	158	170	179	1,722	31	0	93	2,353
1995	64	420	116	831	7	0	676	2,114
1996	40	79	116	879	22	471	818	2,425
1997	79	18	146	893	23	6	808	1,973
1998	28	3	102	969	14	177	629	1,922
1999	14	5	176	1,161	39	10	431	1,836
2000	68	155	138	1,749	52	188	92	2,442
2001*	19	5	280	3,411	20	28	16	3,779

*Preliminary.

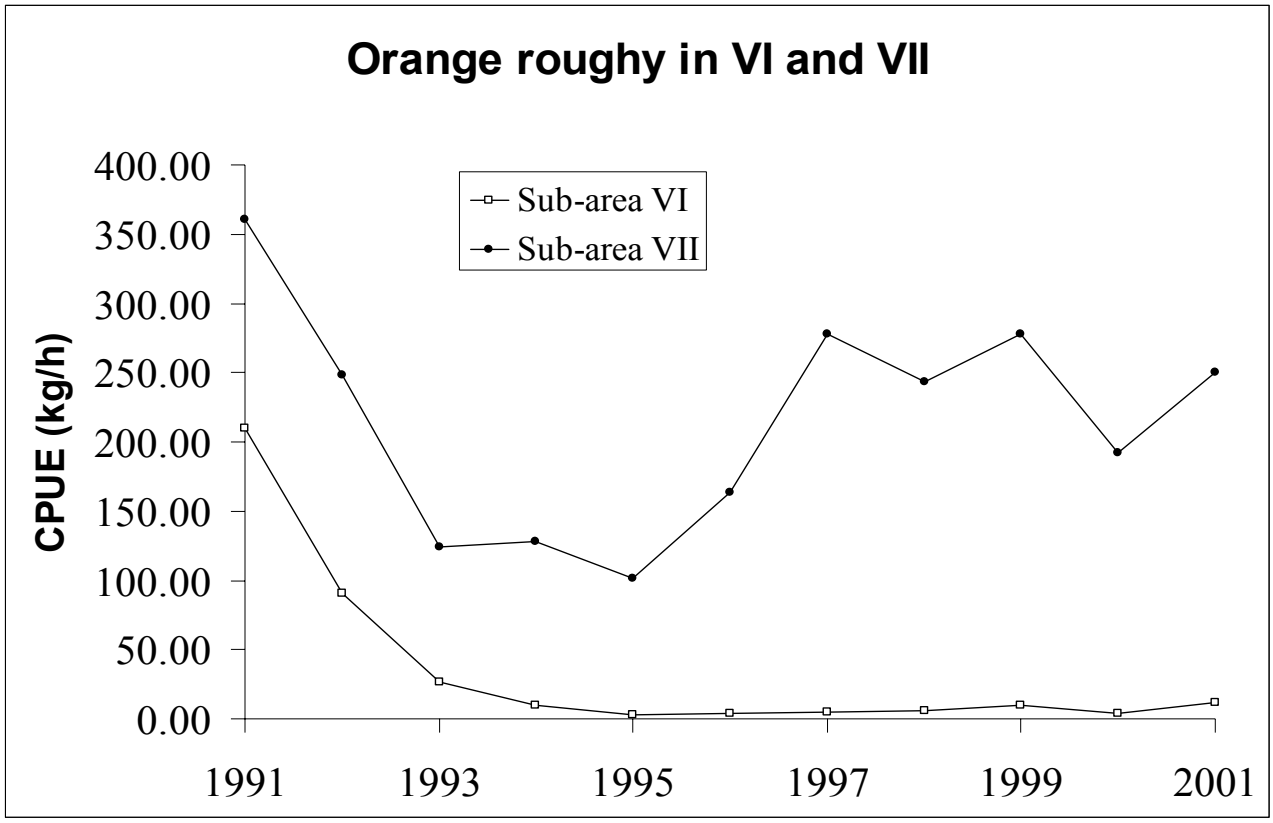


Figure 3.13.8.1 CPUE (kg/h) from the French reference fleet in Subareas VI and VII.

3.13.9 Red (=blackspot) seabream (*Pagellus bogaraveo*)

State of the stock/exploitation: The state of the stock in Subareas X and IX is unknown and in other areas (VI, VII, and VIII) seems to be severely depleted judging from comparisons between current and historical landings data, which indicate that the fishery started in the 1970s with a CPUE of 20-24 000 t/year, while since the late 1980s the CPUE has been in the range of 1-2 000 t/year.

Advice on management: Red seabream stocks can only sustain very low rates of exploitation. ICES repeats its general recommendation that fisheries on such species be permitted only when they are accompanied by programs to collect data and expand very slowly until reliable assessments indicate that increased harvests are sustainable.

Comparison with previous assessment and advice: The perception of the state of the stock has not changed significantly since last year.

Elaboration and special comment: There is a directed handline and longline fishery in Subareas IX and X. Red seabream appears as by-catch in the longline and trawl fishery on hake, megrim, angler, and *Nephrops* in Subareas VI, VII, and VIII.

Landings by Subarea/Division and nation are given in Table 3.13.9.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.9.1)

Year	ACFM Catch
1988	1,715
1989	2,061
1990	1,929
1991	1,663
1992	2,071
1993	2,026
1994	2,203
1995	2,046
1996	2,066
1997	2,104
1998	2,112
1999	1,884
2000	1,655
2001*	1,629

*Preliminary. Weights in t.

Red (=blackspot) seabream (*Pagellus bogaraveo*

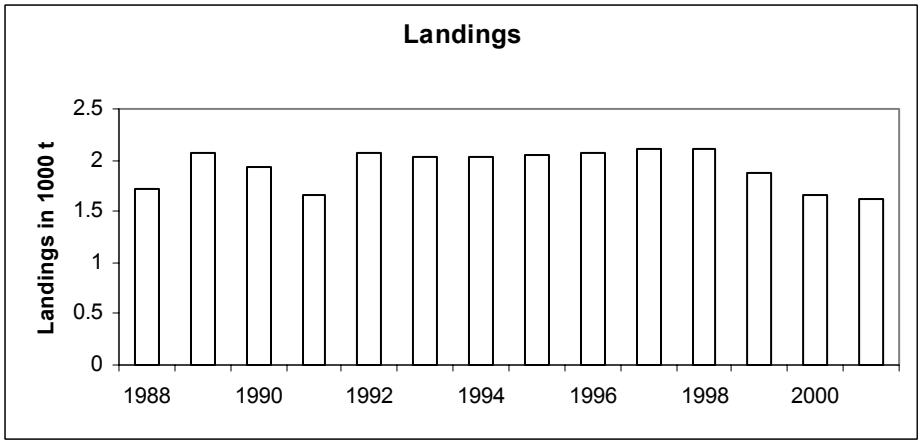


Table 3.13.9.1 Red (=blackspot) seabream (*Pagellus bogaraveo*): Working Group estimates of landings (tonnes).

Red (=blackspot) seabream in Subareas VI and VII

Year	France	Ireland	Spain	E & W	Ch. Islands	Total
1988	52	0	47	153	0	252
1989	44	0	69	76	0	189
1990	22	3	73	36	0	134
1991	13	10	30	56	14	123
1992	6	16	18	0	0	40
1993	5	7	10	0	0	22
1994	0	0	9	0	1	10
1995	0	6	5	0	0	11
1996	0	4	24	1	0	29
1997	0	20	0	36	-	56
1998	0	4	7	6	-	17
1999	0	8	0	15	-	25
2000	4	n/a	3	13	-	20
2001*	1	11	1	37	-	50

* Preliminary.

Red (=blackspot) seabream in Subarea VIII

Year	France	Spain	England	Total
1988	37	91	9	137
1989	31	234	7	272
1990	15	280	17	312
1991	10	124	0	134
1992	5	119	0	124
1993	3	172	0	175
1994	0	131	0	131
1995	0	110	0	110
1996	0	23	0	23
1997	18	7	0	25
1998	18	86	0	104
1999	20	84	0	104
2000	81	187	0	268
2001*	11	159	0	170

* Preliminary.

Red (=blackspot) seabream in Subarea IX

Year	Portugal	Spain	Total
1988	370	319	689
1989	260	416	676
1990	166	428	594
1991	109	423	532
1992	166	631	797
1993	235	765	1,000
1994	150	854	1,004
1995	204	625	829
1996	209	769	978
1997	203	808	1,011
1998	357	520	877
1999	265	278	543
2000	83	338	421
2001*	97	278	375

* Preliminary.

Continued …

Table 3.13.9.1 Continued

Red (=blackspot) seabream in Subarea X

Year	Portugal	Total
1988	637	637
1989	924	924
1990	889	889
1991	874	874
1992	1,110	1,110
1993	829	829
1994	983	983
1995	1,096	1,096
1996	1,036	1,036
1997	1,012	1,012
1998	1,114	1,114
1999	1,222	1,222
2000	947	947
2001*	1,034	1,034

*Preliminary.

Red (=blackspot) seabream in Subarea XII

Year	Latvia	Total
1988	-	0
1989	-	0
1990	-	0
1991	-	0
1992	-	0
1993	-	0
1994	75	75
1995	-	0
1996	-	0
1997	-	0
1998	-	0
1999	-	0
2000	-	0
2001*	-	0

* Preliminary.

Red (=blackspot) seabream in Madeira (Portugal)

Year	Portugal	Total
1988		0
1989		0
1990	6	6
1991	8	8
1992	7	7
1993	8	8
1994	7	7
1995	8	8
1996	4	4
1997	5	5
1998	14	14
1999	13	13
2000		
2001*		

*Preliminary.

Continued …

Table 3.13.9.1 Continued

RED (=BLACKSPOT) SEABREAM in ICES Subareas

Year	VI &VII	VIII	IX	X	XII	Total
1988	252	137	689	637	0	1,715
1989	189	272	676	924	0	2,061
1990	134	312	594	889	0	1,929
1991	123	134	532	874	0	1,663
1992	40	124	797	1,110	0	2,071
1993	22	175	1,000	829	0	2,026
1994	10	131	1,004	983	75	2,203
1995	11	110	829	1,096	0	2,046
1996	29	23	978	1,036	0	2,066
1997	56	25	1,011	1,012	0	2,104
1998	17	104	877	1,114	0	2,112
1999	25	104	543	1,222	0	1,884
2000	20	268	421	947	0	1,655
2001*	50	170	275	1,034	0	1,629

* Preliminary.

3.13.10 Greater forkbeard (*Phycis blennoides*)

State of the stock/exploitation: The state of the stocks in the various ICES Subareas where this species occurs is unknown.

Advice on management: Greater forkbeard stocks can probably only sustain very low rates of exploitation. ICES repeats its general recommendation that fisheries on such species, also as by-catch, should be permitted only when they are accompanied by programs to collect data and expand very slowly until reliable assessments indicate that increased harvests are sustainable.

Relevant factors to be considered in management: The general character of the fishery for this species makes the fishery difficult to manage in a single-species context.

Comparison with previous assessment and advice: The perception of the state of the stock has not changed significantly since last year.

Catch data (Table 3.13.10.1)

Year	ACFM Catch
1988	2,025
1989	2,015
1990	2,381
1991	2,045
1992	2,128
1993	2,035
1994	2,045
1995	2,609
1996	4,118
1997	2,742
1998	3,764
1999	3,913
2000	5,092
2001*	4,790

*Preliminary. Weights in t.

Elaboration and special comment: The landings of greater forkbeard are mainly by-catch from both trawl and longline fisheries. Subareas VI and VII comprise around 85% of the species' total landings in ICES area. Fluctuations in landings are probably the result of changing effort on different target species and/or market prices. The increase in landings in Subareas VIII and IX probably stems from a directed longline fishery.

Landings by Subarea/Division and nation are given in Table 3.13.10.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4 – 10 April 2002 (ICES CM 2002/ACFM:16).

Greater forkbeard (*Phycis blennoides*)

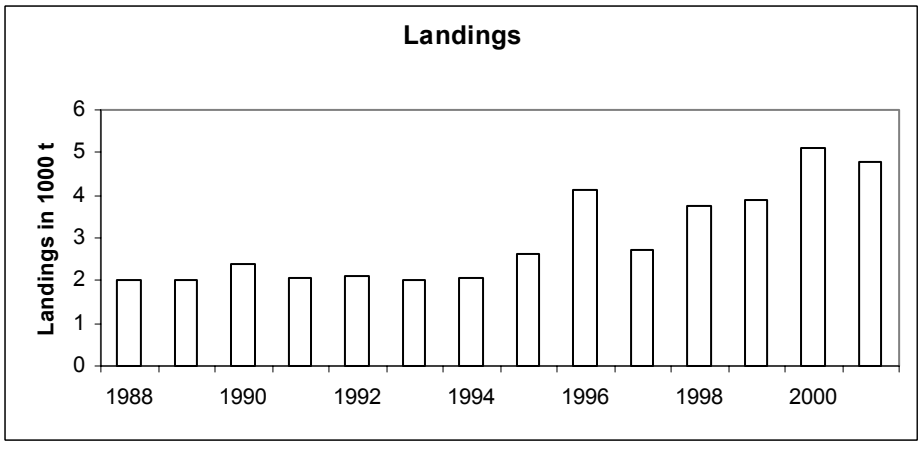


Table 3.13.10.1 Greater forkbeard (*Phycis blennoides*). Working Group estimates of landings (tonnes).

Greater forkbeard in Subareas I and II

Year	Norway	France	Russia	Total
1988	0	-	-	0
1989	0	-	-	0
1990	23	-	-	23
1991	39	-	-	39
1992	33	-	-	33
1993	1	-	-	1
1994	0	-	-	0
1995	0	-	-	0
1996	0	-	-	0
1997	0	-	-	0
1998	0	-	-	0
1999	0	0	-	0
2000	0	0	-	0
2001*	0	1	7	8

*Preliminary.

Greater forkbeard in Subareas III and IV

Year	France	Norway	E&W&NI	Scotland [1]	Germany	Total
1988	12	0	3	0	-	15
1989	12	0	0	0	-	12
1990	18	92	5	0	-	115
1991	20	161	0	0	-	181
1992	13	130	0	2	-	145
1993	6	28	0	0	-	34
1994	11	-	-	1	-	12
1995	2	-	-	1	-	3
1996	2	10	-	6	-	18
1997	2	-	-	5	-	7
1998	1	-	0	11	-	12
1999	3	-	5	23	-	31
2000	3	-	0	7	-	11
2001*	5	-	1	19	2	26

*Preliminary.
[1] Includes Moridae.

Greater forkbeard in Division Vb

Year	France	Norway	E&W&NI	Scotland [1]	Total
1988	2	0	-	-	2
1989	1	0	-	-	1
1990	10	28	-	-	38
1991	9	44	-	-	53
1992	16	33	-	-	49
1993	5	22	-	-	27
1994	4	-	-	-	4
1995	9	-	-	-	9
1996	7	-	-	-	7
1997	7	-	-	-	7
1998	4	4	-	-	8
1999	6	28	-	0	34
2000	4	26	0	1	32
2001*	5	92	-	1	98

*Preliminary.
Continued …
[1] Includes Moridae.

Table 3.13.10.1 Continued

Greater forkbeard in Subareas VI and VII

Year	France	Ireland	Norway	Spain	E&W&NI	Scotland [1]	Germany	Russia	Total
1988	252	0	0	1,584	62	0	-	-	1,898
1989	342	14	0	1,446	13	0	-	-	1,815
1990	454	0	88	1,372	6	1	-	-	1,921
1991	476	1	126	953	13	5	-	-	1,574
1992	646	4	244	745	0	1	-	-	1,640
1993	582	0	53	824	0	3	-	-	1,462
1994	451	111	-	1,002	0	7	-	-	1,571
1995	430	163	-	722	808	15	-	-	2,138
1996	519	154	-	1,428	1,434	55	-	-	3,590
1997	512	131	5	46	1,460	181	-	-	2,335
1998	357	530	162	530	1,364	97	-	-	3,040
1999	317	686	183	796	929	518	1	-	3,430
2000	622	743	380	1,263	731	820	8	2	4,568
2001*	587	663	536	1,138	538	640	10	4	4,116

*Preliminary.
[1] Includes Moridae.

Greater forkbeard in Subareas VIII and IX

Year	France	Portugal	Spain	Total
1988	7	0	74	81
1989	7	0	138	145
1990	16	0	218	234
1991	18	4	108	130
1992	9	8	162	179
1993	0	8	387	395
1994	-	0	320	320
1995	54	0	330	384
1996	25	2	429	456
1997	4	1	356	361
1998	3	6	656	665
1999	6	10	361	377
2000	31	6	346	383
2001*	22	8	421	451

*Preliminary.

Greater forkbeard in Subarea X

Year	Portugal [1]	Total
1988	29	29
1989	42	42
1990	50	50
1991	68	68
1992	81	81
1993	115	115
1994	135	135
1995	71	71
1996	45	45
1997	30	30
1998	38	38
1999	41	41
2000	94	94
2001*	83	83

*Preliminary.
Continued …
[1] Includes Moridae.

Table 3.13.10.1 Continued

Greater forkbeard in Subarea XII

Year	France	Norway	E&W&NI	Scotland [(1)]	Total
1988	-	-	-	-	-
1989	-	-	-	-	-
1990	-	-	-	-	-
1991	-	-	-	-	-
1992	1	-	-	-	1
1993	1	-	-	-	1
1994	3	-	-	-	3
1995	4	-	-	-	4
1996	2	-	-	-	2
1997	2	-	-	-	2
1998	1	-	-	-	1
1999	0	-	-	0	0
2000	2	-	-	4	6
2001*	0	6	1	1	8

*Preliminary.
(1) Includes Moridae.

Greater forkbeard in ICES Subareas

Year	I & II	III & IV	Vb	VI & VII	VIII & IX	X	XII	Total
1988	0	15	2	1,898	81	29	0	2,025
1989	0	12	1	1,815	145	42	0	2,015
1990	23	115	38	1,921	234	50	0	2,381
1991	39	181	53	1,574	130	68	0	2,045
1992	33	145	49	1,640	179	81	1	2,128
1993	1	34	27	1,462	395	115	1	2,035
1994	0	12	4	1,571	320	135	3	2,045
1995	0	3	9	2,138	384	71	4	2,609
1996	0	18	7	3,590	456	45	2	4,118
1997	0	7	7	2,335	361	30	2	2,742
1998	0	12	8	3,040	665	38	1	3,764
1999	0	31	34	3,430	377	41	0	3,913
2000	0	11	32	4,568	383	94	6	5,092
2001*	8	26	98	4,116	451	83	8	4,790

*Preliminary.

3.13.11 Alfonsinos/Golden eye perch (*Beryx* spp.)

State of the stock/exploitation: The state of the stocks in the various Subareas where these species occur is unknown.

Advice on management: According to the spatial distribution of the species and their aggregating behaviour alfonsinos are very susceptible to exploitation. ICES repeats its general recommendation that fisheries on such species be permitted only when they are accompanied by programs to collect data and expand very slowly until reliable assessments indicate that increased harvests are sustainable.

Relevant factors to be considered in management: Management of these species must take into account their limited spatial scale of distribution on seamounts, and the uncontrolled fishing activities in international waters.

Comparison with previous assessment and advice: The perception of the state of the stock has not changed significantly since last year.

Elaboration and special comment: In most cases the landings refer to both species combined (*Beryx splendens* and *B. decadactylus*). Most of the landings of *Beryx* are from handlines and longlines within the Azorean EEZ of Subarea X and by trawl outside the EEZ on the Mid-Atlantic Ridge.

In various seamounts of the Subarea X there are some indications that the stocks were intensely exploited during the last decade.

Landings by Subarea/Division and nation are given in Table 3.13.11.1.

Source of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16).

Catch data (Table 3.13.11.1)

Year	ACFM Catch
1988	225
1989	272
1990	353
1991	371
1992	460
1993	729
1994	1,507
1995	711
1996	802
1997	1,143
1998	578
1999	460
2000	489
2001*	526

*Preliminary. Weights in t.

Alfonsinos/Golden eye perch (Beryx spp.)

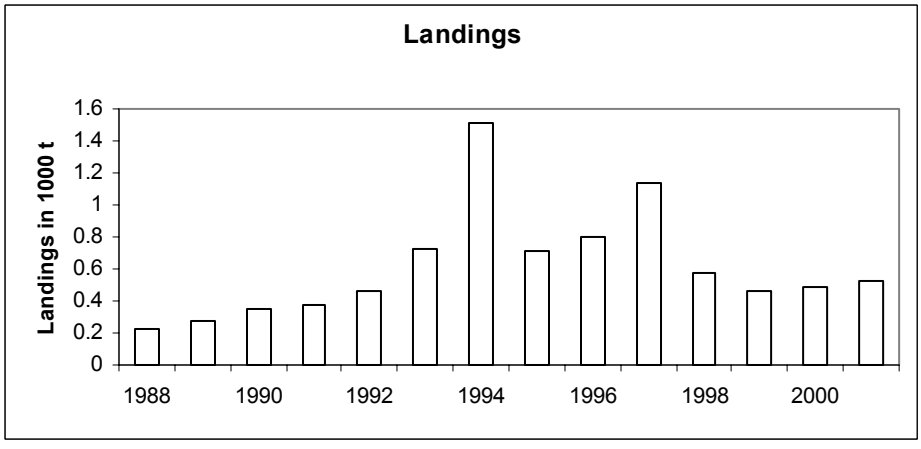


Table 3.13.11.1 Alfonsinos/Golden eye perch (*Beryx* spp). Working Group estimates of landings (tonnes).

Alfonsinos in Subarea IV

Year	France	**Total**
1988	0	**0**
1989	0	**0**
1990	1	**1**
1991	0	**0**
1992	2	**2**
1993	0	**0**
1994	0	**0**
1995	0	**0**
1996	0	**0**
1997	0	**0**
1998	0	**0**
1999	0	**0**
2000	0	**0**
2001*	0	**0**

* Preliminary.

Alfonsinos in Division Vb

Year	Faroes	France	**Total**
1988	-	-	**0**
1989	-	-	**0**
1990	-	5	**5**
1991	-	0	**0**
1992	-	4	**4**
1993	-	0	**0**
1994	-	0	**0**
1995	1	0	**1**
1996	0	0	**0**
1997	0	0	**0**
1998	0	0	**0**
1999	0	0	**0**
2000	0	0	**0**
2001*	0	0	**0**

* Preliminary.

Continued …

Table 3.13.11.1 Continued

Alfonsinos in Subareas VI and VII

Year	France	E & W	Spain	**Total**
1988	-	-	-	-
1989	12	-	-	**12**
1990	8	-	-	**8**
1991	-	-	-	**0**
1992	3	-	-	**3**
1993	0	-	1	**1**
1994	0	-	5	**5**
1995	0	-	3	**3**
1996	0	-	178	**178**
1997	17	4	4	**25**
1998	10	0	71	**81**
1999	67	0	20	**87**
2000	-	2	98	**100**
2001*	-	-	103	**103**

* Preliminary.

Alfonsinos in Subareas VIII and IX

Year	France	Portugal	Spain	E & W	**Total**
1988	-	-	-	-	-
1989	-	-	-	-	-
1990	1	-	-	-	**1**
1991	-	-	-	-	**0**
1992	1	-	-	-	**1**
1993	0	-	-	-	**0**
1994	0	-	2	-	**2**
1995	0	75	7	-	**82**
1996	0	43	45	-	**88**
1997	69	35	31	-	**135**
1998	1	9	259	-	**269**
1999	8	29	161	-	**198**
2000	-	40	116	4	**160**
2001*	-	43	181	-	**224**

* Preliminary.

Continued …

Table 3.13.11.1 Continued

Alfonsinos in Subarea X

Year	Faroes	Norway	Portugal	Russia	E & W	**Total**
1988			225			**225**
1989			260			**260**
1990			338			**338**
1991			371			**371**
1992			450			**450**
1993		195	533			**728**
1994		0	636	864		**1,500**
1995	0	0	523	100		**623**
1996	0		536			**536**
1997	5		378	600		**983**
1998	0		228			**228**
1999	0		175			**175**
2000			209	5	15	**229**
2001*			199			**199**

* Preliminary.

Alfonsinos in Subarea XII

Year	Faroes	**Total**
1988	-	**0**
1989	-	**0**
1990	-	**0**
1991	-	**0**
1992	-	**0**
1993	-	**0**
1994	-	**0**
1995	2	**2**
1996	0	**0**
1997	0	**0**
1998	0	**0**
1999	0	**0**
2000	0	**0**
2001*	0	**0**

* Preliminary.

Continued …

Table 3.13.11.1 Continued

Alfonsinos in Madeira (Portugal)

Year	Portugal	**Total**
1988	-	**0**
1989	-	**0**
1990	-	**0**
1991	-	**0**
1992	-	**0**
1993	-	**0**
1994	-	**0**
1995	1	**1**
1996	11	**11**
1997	4	**4**
1998	3	**3**
1999	2	**2**
2000	-	**0**
2001*	-	**0**

* Preliminary.

Alfonsinos in ICES Subareas

Year	IV	Vb	VI & VII	VIII & IX	X	XII	**Total**
1988	0	0	0	0	225	0	**225**
1989	0	0	12	0	260	0	**272**
1990	1	5	8	1	338	0	**353**
1991	0	0	0	0	371	0	**371**
1992	2	4	3	1	450	0	**460**
1993	0	0	1	0	728	0	**729**
1994	0	0	5	2	1,500	0	**1,507**
1995	0	1	3	82	623	2	**711**
1996	0	0	178	88	536	0	**802**
1997	0	0	25	135	983	0	**1,143**
1998	0	0	81	269	228	0	**578**
1999	0	0	87	198	175	0	**460**
2000	0	0	100	160	229	0	**489**
2001*	0	0	103	224	199	0	**526**

* Preliminary.

3.13.12 Deepwater sharks

State of the stock/exploitation: The state of these species is unknown. Mixed species CPUE are declining, which is consistent with decreasing abundance of the complex of deepwater shark species as a whole, and particularly with a deteriorating state of species preferred or most vulnerable when the deepwater fisheries for sharks expanded/commenced.

Some amounts of deepwater sharks are reported together with other sharks under the heading "various sharks". It is not possible to identify which proportion of these are deepwater sharks and the statistics provided in Table 3.13.12.1 do not include any account of these sharks. Therefore, Table 3.13.12.1 provides an underestimate of the catch of deepwater sharks.

Advice on management: Deepwater sharks can sustain only very low exploitation rates. They are taken in mixed fisheries, which makes it difficult to manage them in a single-species context. Due to the declining trends in CPUE, despite the mixed nature of the catches, ICES recommends that the overall exploitation be reduced. ICES further advises that species-specific landings data be collected for all deepwater sharks to allow better understanding and quantification of the status of exploited shark species.

Relevant factors to be considered in management: Without information on trajectories of individual species' abundances, it is not possible to advise on the size of the reduction in exploitation necessary for the fisheries to be sustainable, but it is more likely to be large (e.g. 50%) than small (e.g. 10%). Moreover, due to the biology of these species, such reductions would have to be maintained for several years before the status of the more heavily exploited stocks will show evidence of recovery.

Elaboration and special comment: Deepwater sharks are taken in mixed species trawl fisheries in Subareas V, VI, VII, and XII. Furthermore, deepwater sharks are taken in longline fisheries. In these fisheries it is not possible to target squalids without a by-catch of other species.

Mixed species trawl fisheries take a substantial catch of sharks. Other species in this fishery include black scabbardfish, roundnose grenadier, forkbeard, and blue ling.

The various longline fisheries taking deepwater sharks also take forkbeards, mora, Greenland halibut, and rabbitfish. However, the species diversity in such fisheries is lower than in the trawl fisheries and sharks tend to be a more dominant proportion of the catch. The mixed species character of these trawl and longline fisheries makes them difficult to manage based on single-species advice. The multi-species nature of the fisheries also makes it hard to interpret CPUE figures, because preferred shark species may be depleted by fishing while mixed species catches may be maintained by landing of new species that previously may have been discarded, or are encountered as the fleets expand areas of operation in search of the targeted species in the complex.

There is no information on gillnet fisheries for deepwater sharks, though it is known that there are such fisheries. There is a general wish for more data on the deepwater sharks, but information on the gillnet fisheries is particularly needed.

The trawl fishery in Subareas VI and VII is dominating in exploiting deepwater sharks. In this fishery the deepwater squalids Portuguese dogfish and leafscale gulper shark are taken together with black scabbardfish, greater forkbeard, and roundnose grenadier. Catches have increased from the early 1990s to the present. There are also mixed-species longline fisheries in these Subareas.

There are fisheries for deepwater sharks also taking place in Subarea VIII, though data are limited. In Subarea IX there are directed artisanal longline fisheries and there have been declines in catches in recent years for gulper shark.

A directed longline fishery in Subarea X for the kitefin shark has ceased to exist. Market prices, rather than stock declines are thought to be the reasons for this.

The ICES Study Group in Elasmobranch Fishes met in May 2002 and, largely based on work within the EU financed project DELASS continued the development of shark assessment methodologies. Although considerable progress has been made in making input data for stock assessment of elasmobranch species available it is still the lack of data that is the main obstacle for providing adequate advice. Therefore, focus should continue to be on the collection of catch and effort data, survey data, and biological data. At this moment the best assessments are based on CPUE data in the commercial fisheries and in surveys. However, these assessments may indicate trends but do not provide the required absolute estimates.

Landings by Subarea/Division and nation are given in Table 3.13.12.1.

Sources of information: Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources, 4–10 April 2002 (ICES CM 2002/ACFM:16), Report of the Study Group on Elasmobranch Fishes, 6-10 May 2002 (ICES CM2002/G:8, ref: ACFM), Report of the Symposium on Elasmobranch Fisheries: Managing for Sustainable Use and Biodiversity Conservation.

Catch data (Table 3.13.12.1)

Year	ACFM Catch (Deepwater squalids)	ACFM Catch (Various sharks, including some deepwater squalids)
1988	2,253	5,904
1989	2,151	4,028
1990	3,871	2,394
1991	5,610	7,254
1992	7,836	10,454
1993	7,985	7,767
1994	7,474	7,621
1995	6,801	7,513
1996	7,065	7,622
1997	6,158	9,220
1998	6,318	10,009
1999	636	6,996
2000	6,392	7,443
2001*	8,199	8,929

*Preliminary. Weights in t.

Table 3.13.12.1 Working Group estimates of landings of deepwater sharks, and of sharks not elsewhere identified (various) that are known to contain some landings of deepwater species. Landings data indicated as "deep" for France, Ireland, and the UK are almost exclusively *C. coelolepis* and *C. squamosus*. In the case of other countries they may contain some other species. Data for 2001 are preliminary. "Aiguillat noir" is a new category of small squalids and are considered separately from the main commercially important squalid sharks in the summary landings tables.

Shark landings in Division IVa

Year	France		Denmark	E & W	Scotland
	Deep	Aiguillat noir	*E. spinax*	Various	Various
1991	3	-	-	-	-
1992	133	-	-	-	-
1993	51	-	27	-	-
1994	86	-	0	-	-
1995	10	-	10	-	-
1996	6	-	8	-	-
1997	-	-	32	-	-
1998	-	-	359	-	-
1999	20	-	128	-	53
2000	0	1	25	2	8
2001	0	-	52	0	10

Shark landings in Division Va

Year	Iceland		Germany
	S. microcephalus	*C. coelolepis*	Various
1989	31	-	-
1990	54	-	3
1991	58	-	133
1992	70	-	51
1993	39	-	86
1994	42	-	10
1995	45	-	6
1996	65	-	-
1997	70	-	-
1998	82	5	20
1999	45	-	0
2000	45	-	0
2001	56	-	-

Shark landings in Division Vb

Year	France	Norway	Germany	E & W		Scotland		Faroe Islands	
	Deep	Deep	Various	Deep	Various	Deep	Various	Various	*C. coelolepis*
1990	140	-	-	-	-	-	-	-	-
1991	75	-	-	-	-	-	-	3	-
1992	123	-	-	-	5	-	-	36	-
1993	91	-	2	-	9	-	-	376	-
1994	149	-	43	-	-	-	-	-	-
1995	262	-	-	-	-	-	-	-	-
1996	348	-	31	-	1	-	-	-	-
1997	261	-	27	-	20	-	-	-	-
1998	354	-	-	-	-	-	-	-	79
1999	461	-	1	-	-	-	8	-	-
2000	306	0	0	-	54	11	15	2[(1)]	23
2001	297	25	0	4	93	5	119	576[(2)]	-

[(1)] *Centrophorus squamosus*

[(2)] *Centrophorus squamosus* and *Centroscymnus coelolepis*.

Table 3.13.12.1 continued

Shark landings in Division VIa

Year	France		Ireland	Norway	Germany	E & W		Scotland	
	Deep	*A. noir*	Deep	Deep	Various	Deep	Various	Deep	Various
1999	1,651	-	-	-	-	-	-	-	136
2000	2,124	127	21	0	1	244	119	181	25
2001	2,332	120	21	149	8	98	24	386	36

Shark landings in Division VIb

Year	France		Ireland	Norway	Germany	E & W		Scotland	
	Siki	*C. fabricii*	Deep	Deep	Various	Deep	Various	Deep	Various
1999	472	-	-	-	-	-	-	-	112
2000	346	1	-	41	177	26	220	24	23
2001	247	4	5	83	34	219	168	127	8

Shark landings in Division VIb taken by Spain on Hatton Bank

Year	*C. squamosus*	*C. coelolepis*	*D. calceus*	*C. repidater*	*C.fabricii*	*Etmopterus sp.*
2000	0	33	0	0	1	0
2001	0	120	0	0	0	21

Shark landings in Subareas VI and VII

Year	France	Spain	Germany	E & W	Scotland	Faroe Islands
	Deep (VI only)	Various	Various	Various	Various	Various
1988	-	66	-	19	-	-
1989	-	-	-	32	8	-
1990	-	-	-	38	5	-
1991	944	-	-	201	53	-
1992	1,953	-	-	503	133	3
1993	2,454	-	124	821	447	-
1994	2,198	-	395	742	727	-
1995	1,784	-	2	1,315	782	-
1996	2,374	-	276	1,345	555	-
1997	2,222	152	66	2,721	301	-
1998	2,081	645	65	1,812	501	-
1999	-	199	189	1,403	-	-
2000	-	8	-	-	-	-
2001	-	0	-	-	-	-

Shark landings in Subarea VII

Year	France	France	Ireland	Germany	E & W		Scotland	
	Deep	*C. fabricii*	Deep	Various	Deep	Various	Deep	Various
1991	265	-	-	-	-	-	-	-
1992	878	-	-	-	-	-	-	-
1993	857	-	-	-	-	-	-	-
1994	1,363	-	-	-	-	-	-	-
1995	991	-	-	-	-	-	-	-
1996	754	-	-	-	-	-	-	-
1997	571	-	-	-	-	-	-	-
1998	673	-	-	-	-	-	-	-
1999	440	-	-	-	-	-	-	244
2000	506	4	92	85	23	76	0	3
2001	417	6	159	164	353	130	103	21

Table 3.13.12.1 Continued

Deepwater shark landings taken by Portugal in Division IXa

Year	*C. granulosus*	*C. squamosus*	*C. coelolepis*	*D. licha*	*G. melastomus*
1988	995	560	n/a	149	21
1989	1,027	507	n/a	57	17
1990	1,056	475	n/a	7	17
1991	801	424	651	12	17
1992	958	422	692	11	16
1993	886	339	607	11	20
1994	344	579	576	11	37
1995	423	544	810	7	29
1996	242	412	777	4	35
1997	291	384	927	4	29
1998	187	362	858	6	22
1999	92	428	544	6	23
2000	54	438	611	-	-
2001	93	510	620	7	35

Shark landings in Subareas VIII and IX

Year	Spain	France	E & W	Scotland
	Various	Deep (VIII only)	Various	Various
1988	3,545	-	-	-
1989	1,789	-	-	-
1990	n/a	-	-	-
1991	2,850	-	-	-
1992	3,740	15	0	0
1993	-	9	-	0
1994	-	8	-	4
1995	-	0	32	7
1996	-	1	25	0
1997	1,059	1	20	-
1998	1,811	13	-	-
1999	476	20	-	-
2000	228	21	-	-
2001	321	5	-	-

Deepwater shark landings taken by Portugal (Azores) in Subarea X

Year	*C. squamosus*	*D. licha*
1988	-	549
1989	-	560
1990	-	602
1991	-	896
1992	-	761
1993	-	591
1994	-	309
1995	-	321
1996	-	216
1997	-	30
1998	4	34
1999	8	31
2000	-	31
2001	-	13

Table 3.13.12.1 Continued

Shark landings in Subarea XII

Year	France Deep	France *C. fabricii*	Ireland Deep	Norway Deep	E & W Various	Scotland Deep	Scotland Various
1991	1	-	-	-	-	-	-
1992	2	-	-	-	-	-	-
1993	6	-	-	-	-	-	-
1994	8	-	-	-	-	-	-
1995	139	-	-	-	-	-	-
1996	147	-	-	-	-	-	-
1997	32	-	-	-	-	-	-
1998	56	-	-	-	-	-	-
1999	50	-	-	-	-	-	-
2000	190	3	-	77	35	3	3
2001	23	2	29	142	-	36	-

Shark landings in Subarea XII caught by Spain on Hatton Bank

Year	*C. squamosus*	*C. coelolepis*	*D. calceus*	*C. repidater*	*C.fabricii*	*Etmopterus* sp
2000	34	505	12	85	84	38
2001	2	493	5	68	91	317

Summary of available landings data for large deepwater squalid sharks by Subarea/Divisions.
No data were available for VIII from most countries.

Year	IVa	Va	Vb	VI	VII	VIII	IXa Portugal	X Azores	XII	**Total**
1988	-	-	-	-	-	-	1,704	549	-	**2,253**
1989	-	-	-	-	-	-	1,591	560	-	**2,151**
1990	-	-	140	-	-	-	3,129	602	-	**3,871**
1991	3	-	75	944	265	-	3,426	896	1	**5,610**
1992	133	-	123	1,953	878	15	3,971	761	2	**7,836**
1993	51	-	91	2,454	857	9	3,926	591	6	**7,985**
1994	86	-	149	2,198	1,363	8	3,353	309	8	**7,474**
1995	10	-	262	1,784	991	0	3,294	321	139	**6,801**
1996	6	-	348	2,374	754	1	3,219	216	147	**7,065**
1997	-	-	261	2,222	571	1	3,041	30	32	**6,158**
1998	-	5	433	2,081	673	13	3,019	38	56	**6,318**
1999	20	-	461	2,123	440	20	2,483	39	50	**636**
2000	1	-	342	3,010	621	21	2,173	31	951	**6,392**
2001*	0	-	907	3,679	1,032	5	2,333	13	1,206	**8,199**

* Preliminary.

Total sharks (various, including some deepwater sharks) landings by Subareas/Divisions.

Year	IVa	Va	Vb	VI	VII	VI&VII	VIII&IX	XII	**Total**
1988						85	3,545		**5,904**
1989		31				40	1,789		**4,028**
1990		54	140			43	1,789		**2,394**
1991	3	58	78	944	265	254	2,850	1	**7,254**
1992	133	70	164	1,953	878	639	6,590	2	**10,454**
1993	78	39	478	2,454	857	1,392	3,740	6	**7,767**
1994	86	42	192	2,198	1,363	1,864	4	8	**7,621**
1995	20	45	262	1,784	991	2,099	43	139	**7,513**
1996	14	65	380	2,374	754	2,176	64	147	**7,622**
1997	32	70	308	2,222	571	3,240	1,104	32	**9,220**
1998	359	87	433	2,081	673	3,023	2,890	56	**10,009**
1999	201	45	470	2,371	440	1,791	2,287	50	**6,996**
2000	36	45	409	3,704	789	8	704	1,069	**7,443**
2001*	62	57	543	4,102	1,353	0	549	1,208	**8,929**

* Preliminary.

3.14 Stocks in the Baltic

3.14.1 Overview (Including overview of Salmon and Sea trout)

The main fisheries for cod in the Baltic use demersal trawls, high opening trawls (operating both pelagically and demersally), and gillnets. There has been an increase in gillnet fisheries in the 1990s and the share of the total catch of cod taken by gillnets has in recent years been about 35-50%. The Baltic herring is exploited mainly by pelagic trawls and demersal trawls and, during the spawning season, by trapnets/pound-nets in coastal areas. The herring trawl fishery is largely a mixed herring and sprat fishery where the share of herring varies significantly by Subdivisions and seasons. The main part of the sprat catch is taken by pelagic pair trawling and are used for industrial purposes. There has been an increase in catches of sprat in the most recent years, and 1997 catches were at a record high of 529 000 t for the whole Baltic. The sprat catches have since decreased continuously to 342 000 t in 2001. Baltic salmon is exploited by drift net, trapnet, and longline fisheries.

An overview of catches of fish in the Baltic until 2000 as officially reported to ICES, is given in Section 3.14.2.

For Baltic **cod** there is one management unit covering all Subdivisions 22–32. ICES considers the stocks in Subdivisions 22–24 and Subdivisions 25–32 as separate stocks, however, and advice is provided on them separately.

ICES reiterates its advice that the cod stocks should be managed separately in order to better adapt the exploitation to the present development in the two stocks.

IBSFC has in September 1999 adopted a **Long-Term Management Strategy for the Cod Stocks in the Baltic Sea:**

The IBSFC agreed to implement a long-term management plan for the two cod stocks, Eastern and Western stocks, as defined by ICES, which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yield. The plan shall consist of the following elements:

1. *Every effort shall be made to maintain a minimum level of Spawning Stock Biomass (SSB) greater than 160 000 tonnes for the Eastern stock and 9 000 tonnes for the Western stock.*

2. *A long-term management plan shall be implemented, by which annual quotas shall be set for the fishery on the Eastern stock, reflecting a fishing mortality rate of 0.6, and for the Western stock 1.0, both for appropriate age groups as defined by ICES.*

3. *Should the SSB fall below a reference point of 240 000 tonnes for the Eastern stock and 23 000 tonnes for the Western stock, the fishing mortality rates referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of spawning stock biomasses to levels in excess of 240 000 tonnes and 23 000 tonnes, respectively, for the Eastern and Western stocks.*

4. *For allocation purposes, a combined TAC will be established. The Contracting Parties agree to further collaborate, inter alia, through bilateral agreements to ensure an efficient management of the cod stocks.*

5. *The exploitation pattern in the fisheries for cod and in particular, the selectivity shall be improved in the light of new scientific advice from ICES with the objective to enhance the spawning biomass of cod and reduce discards.*

6. *Additional technical measures including, inter alia, further limitation on effort, restrictions on fishing days, closing of areas and/or seasons, obligation to change fishing ground in case of high abundance of juveniles, special reporting requirements, and other appropriate control measures should be considered.*

7. *The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.*

A review of this arrangement shall take place no later than year 2003.

IBSFC has in September 2001 adopted a **Recovery Plan for the Baltic Cod:**

In conformity with the Long Term Management Strategy for Baltic Cod the Contracting Parties agree to establish a recovery plan for the Baltic cod. They also took note that the spawning biomass of the Western stock is above the agreed $\boldsymbol{B}_{pa}$*. The plan shall include the following elements.*

I

1. *For 2002 the fishing mortality for the Eastern stock shall be reduced to below F_{pa} and shall not be greater than 0.55 within a global TAC of 76 000 tonnes;*

2. *Manage the fishery for Eastern cod stock in year 2003 and subsequent years with the objective of reducing the fishing mortality for Eastern cod stock to below F_{pa} in order to ensure safe and rapid recovery of the spawning stock to levels in excess of 240 000 tonnes;*

3. *Request ICES to evaluate the findings of the IBSFC Scientific Meeting on Technical Measures for the Fisheries on Baltic Cod (Brussels 20 - 24 August 2001) and to provide advice and catch options for 2003 and subsequent years taking into account improved selectivity and additional technical measures;*

II

1. *Extend the summer ban to the period from 1 June to 31 August;*

2. *Establish spawning area closures in the Bornholm Deep;*

3. *Establish additional spawning area closures in the Gdansk Deep and the Gotland Deep in the case of new scientific information;*

4. *Fix the minimum mesh size for gill nets to 110 mm to be implemented from 1 September 2002;*

5. *Establish the maximum length of gill nets per vessel fishing for cod :*

   A. *For vessels with an overall length of up to and including 12 m limit the use of nets to a maximum length of 12 km;*

   B. *For vessels with an overall length of more than 12 m limit the use of nets to a maximum length of 24 km;*

6. *Establish a soak time when fishing with gillnets of a maximum of 48 hours, the start and recovery time to be recorded in the fishing logbook;*

7. *Improve the marking system and introduce a tagging system for gillnets;*

8. *Review the minimum landing size for Cod in the Baltic in the light of experience with the use of fishing gears with improved selectivity*

9. *Set the by-catch of cod (in weight) in the herring and sprat fisheries at 3 per cent of which a maximum of 5 per cent may be of undersized cod,*

10. *Delete Fishing Rule 8.2, thereby prohibiting the landing of undersized cod;*

11. *Request ICES to review all relevant data related to the selectivity of cod in the Baltic sea and to revisit the mesh size of the diamond 130 mm mesh size with a view to establishing a mesh size ensuring a similar selectivity as the 120 mm BACOMA window;*

12. *Request the Working Group on Fisheries Rules to consider additional technical measures and provide proposals for amendments relating to fisheries rules that have an impact on cod with the view to improving the recovery plan;*

III

1. *Establish a comprehensive and efficient Control and Enforcement scheme (Action Plan) to support the cod recovery plan consisting of the following main elements:*

   a. *Inspection Strategy.*

   b. *Co-operation which will include, where practical, an exchange of fisheries inspectors on a bilateral basis in 2002 and in subsequent years.*

   c. *Evaluation of the efficiency of the measures taken.*

2. *In order to enforce the implementation of the cod recovery plan the Parties will notify the Secretariat of IBSFC of the results of the Action Plan. The IBSFC Secretariat will present a Report of the Action Plan at the 28th Session of IBSFC.*

For **cod**, unusually strong year classes in 1976, 1979, and 1980 formed the basis for an increase in the stock in the eastern Baltic and an expansion in the fisheries. Catch levels more than doubled and the fishery attracted vessels from other Baltic fisheries and from fleets normally operating outside the Baltic Sea. , In almost all years landings have been far above the levels recommended by ICES. The decline in stock size and landings started around 1985 and continued up to 1992. Fleet capacity and fishing effort have now been reduced to some extent, but fishing mortality increased as the stocks declined. Improved recruitment in the early 1990s has resulted in spawning stock biomasses increasing above the 1992 minimum, and this increase has been seen especially in the western Baltic cod stock. After a slight increase in 1994–1995, the SSB of the eastern Baltic cod stock has decreased again in 1999-2001 to a historically low level.

The success of cod reproduction is, among other things, dependent on certain minimum levels of salinity and oxygen concentration for the fertilisation and survival of the eggs and larvae. The unusually long period with low influx of North Sea water from the late 1970s to the early 1990s was in general a period of low recruitment. The influx in 1993 resulted in improved environmental conditions, which allowed the possibility of improved recruitment but did not secure it. Since 1993 there have not been major influxes. The effect of an intrusion of North Sea water into the Baltic Sea is usually sufficient to support better environmental conditions for two spawning seasons (about 1.5 years) at the most, because after that period the salinity and oxygen levels in the deep water layers decrease below the level at which cod eggs can survive.

The recent improvement in recruitment and the reversal of the downward trend in spawning stock biomass has been seen in both the Western (Subdivisions 22 and 24) in 1994–1997 and Eastern (Subdivisions 25–32) cod stocks in 1994–1995. However, fishing mortalities are still estimated to be high in the Western stock and have increased in the Eastern stock from a lower level. In the Western stock the increase in spawning stock biomass in recent years was caused mainly by the 1994 year class, and it is expected that the spawning stock biomass will increase with the present exploitation pattern, due to the 1997 year class, which is estimated to be above average. The Eastern stock has been below the long-term average since 1986, and thus a recovery of the stock can hardly be expected with the present exploitation pattern and tendency for fishing mortality to increase. It is therefore considered that reductions in fishing effort is needed if these stocks are to recover on a more permanent basis.

The landings of **sprat** for industrial purposes have increased markedly during the last decade. **Herring** and sprat are used mainly for human consumption when landed in the countries on the eastern Baltic coasts, but for production of fishmeal and oil in the countries on the west coast.

Herring in the Baltic is assessed as five stocks. This is to be regarded as a compromise between using the larger number of stocks/populations that have been identified for biological reasons and the practical constraints, e.g. in what units are catch figures available, and what are the possibilities for correctly allocating individual fish to particular stocks.

Sprat is assessed as one unit for the entire Baltic.

The exploitation rate of pelagic stocks in the Baltic has increased since the mid-1990s. Due to the low abundance of cod the natural mortality of Baltic herring and sprat is low at present. The Baltic sprat is considered to be harvested inside safe biological limits. A sharp decrease in mean weight at age of sprat has been observed since 1993. A continuous decreasing trend in mean weight at age has been observed in most herring stocks in the Baltic since the mid-1980s. This decline in mean weight at age partly explains the declining trend in biomass of the herring stock in Central Baltic herring in Subdivisions 25–29, 32. At the present the mean weight of herring remains at a low level. Still, there have been some indications in the last few years that the decreasing trend of the mean weight is slowing down. Due to the decreasing SSB and increasing trend in fishing mortality the Central Baltic herring is assumed to be outside of biological limits. Different trends of stock development have been observed for herring in the Gulf of Riga and for herring in the Bothian Sea (Subdivision 30). Based on prevalence of abundant year classes during the 1990s SSB of the Gulf of Riga herring has increased significantly and presently is historically high (120-130 thousand t). Herring in Bothnian Sea after increase of recruitment abundance during the 1990s also remains at a relatively high level of 240 000 t. It has, for several reasons, been difficult to estimate the absolute stock size for the pelagic stocks, although the development of stock size in relative terms is better described. Inconsistencies between years in the results from acoustic surveys and low precision in the estimates of species composition in the mixed fisheries have contributed to the variation in stock estimates given during the latest years. However, a fourfold increase in sprat catches between 1991 and 1997 has been observed and the development of this fishery, and consequently the rate of fishing mortality, should be closely monitored.

The multispecies interactions may periodically have a strong influence on the state of fish stocks in the Baltic, depending on the abundance of cod as the main predator in the Baltic Sea ecosystem. To take into account the multispecies effects, the data from multispecies assessment methods are used in the assessment of pelagic stocks. However, interactions with other potential top predators, such as salmon and seal that are potentially important in the northern Baltic Sea, are not yet quantified and are therefore not directly included in the present ICES advice.

The spring-spawning herring stock in Subdivisions 22–24 and Division IIIa migrates after the spawning season into the Kattegat, the Skagerrak, and the eastern parts of the North Sea, where it mixes with the North Sea autumn-spawning herring stock during the feeding period. Difficulties in allocating catches to the Baltic spring-spawning stock and to the considerably larger North Sea stock, uncertain catch statistics, and conflicting trends in survey indices have resulted in unreliable assessments for the spring-spawning stock of herring in Subdivisions 22–24 and Division IIIa. Improvements in methods of stock separation applied for 1991-2001 have, however, resulted in an acceptable assessment in 2002.

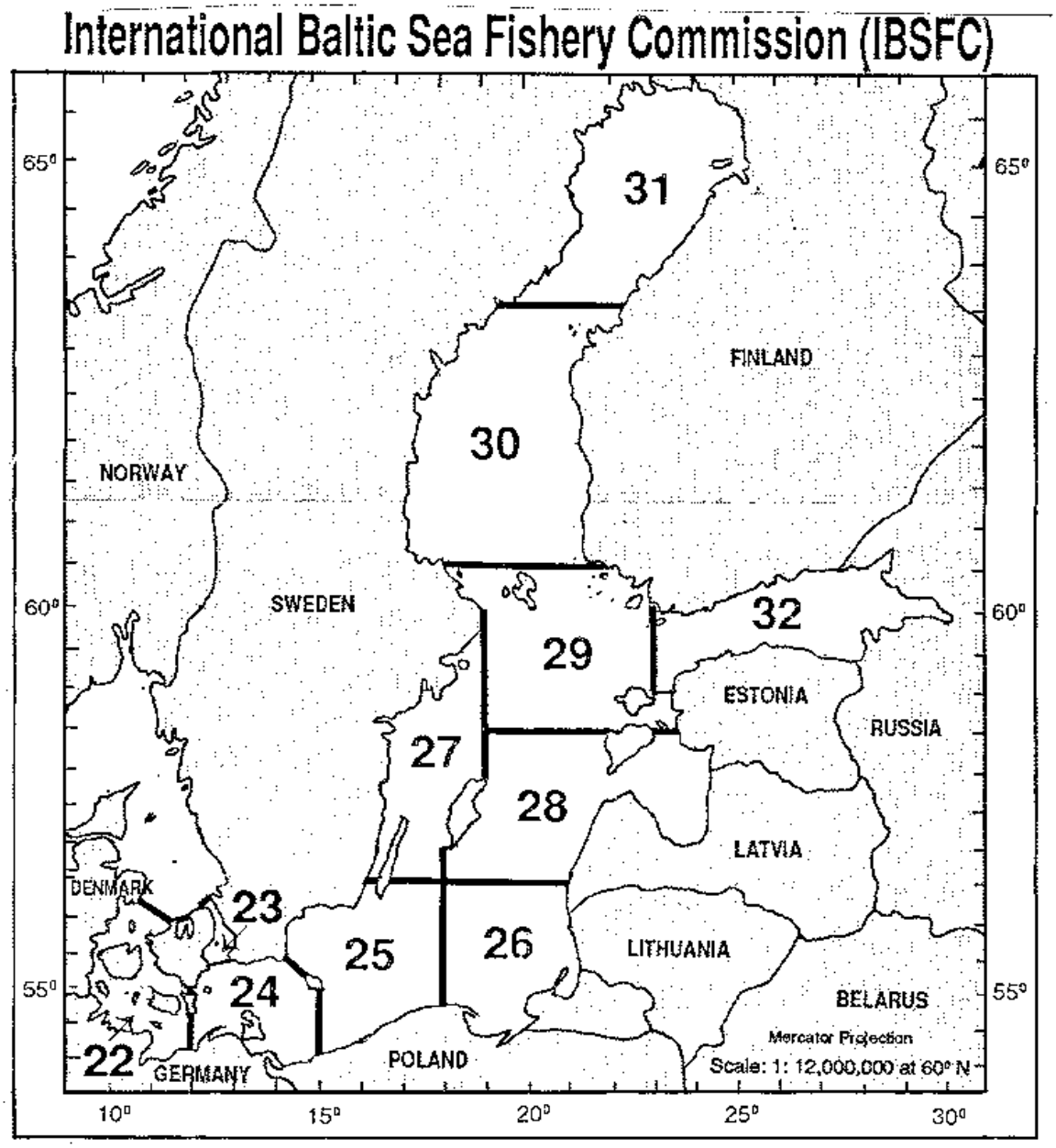


Figure 3.14.1.1

Salmon and Sea Trout

Salmon

There are 40–50 rivers in the Baltic Sea with wild salmon smolt production (Figure 3.14.1.2). Many rivers have been dammed and spawning and nursery areas have been completely or partially destroyed. To compensate, hatcheries have been built on these rivers where fish are reared to the smolt stage before release. These fish feed in the sea mainly in the Baltic Main Basin and migrate back to rivers as spawners, where they are used as broodstock to a varying extent. In some rivers with compensatory releases, some homing salmon succeed to reproduce so that there is small amount of natural reproduction. A major part of wild and reared smolt production takes place in the Gulf of Bothnia.

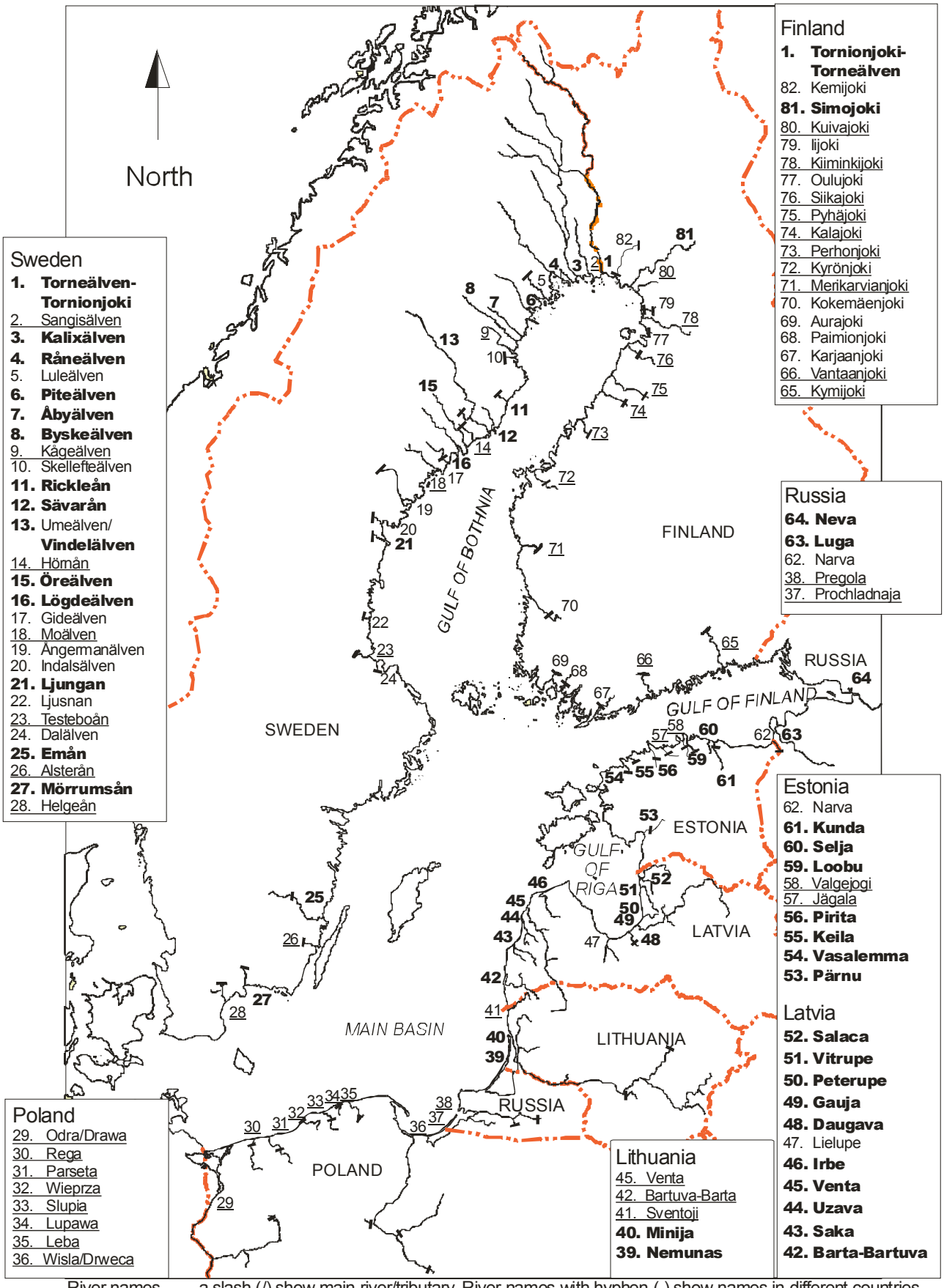
While feeding in the sea, salmon are caught by driftnets and longlines and, during the spawning run, they are caught along the coast, mainly in trap nets and fixed gillnets and, to a minor extent, in a trolling fishery. Where fisheries are allowed in the river mouths, set gillnets and trapnets are used. In Sweden and Finland, there is also a traditional recreational angling and gillnet fishery in some of the rivers. In Sweden, there is a considerable broodstock fishery in rivers having reared populations. The offshore fishery and most of the coastal fisheries exploit both wild and reared salmon. Wild salmon can normally not be distinguished from reared fish in the fisheries.

There are two IBSFC management areas for salmon in the Baltic Sea: (1) Main Basin and Gulf of Bothnia (Subdivisions 22-29 and 30–31, respectively) and (2) Gulf of Finland (Subdivision 32). The offshore and coastal fisheries have been managed by a single TAC since 1991. The overall management objective of IBSFC to increase the production of wild Baltic salmon is to attain at least 50% of the natural production capacity of each river with current or potential production of salmon by 2010, while maintaining the catch level as high as possible.

Sea trout

There are wild sea trout populations in approximately 400 rivers and streams in the Baltic Sea. Similar to the situation for salmon rivers, sea trout rivers have been dammed and natural reproductive capacity has ceased. Reared smolts are released to compensate for these losses. Sea trout are also in many cases released to provide recreational fishery on returning spawners. Most of the stocks remain in the coastal area within about 150 km of the point of release, but a high proportion of those from Poland and some from southern Sweden migrate further into offshore areas. Coastal populations are mainly taken as by-catch in gillnets or trapnets. The stocks entering the offshore area are exploited by salmon drift netting and longlines. Sea trout are important for the recreational fishery in coastal areas and rivers.

The populations in the Gulf of Bothnia, particularly those in Subdivision 31, are in a poor state. Several of these populations are overexploited in the sea to the extent that they now exist mainly as non-migratory brown trout populations. The state of the populations in the remainder of the Baltic Sea is variable, but in general better than in the Gulf of Bothnia. IBSFC has not established any management objectives for sea trout.



River names a slash (/) show main river/tributary. River names with hyphen (-) show names in different countries.

Figure 3.14.1.2 Baltic salmon rivers divided into three categories (see above figure). Only lower parts of rivers with current salmon production or potential for production of wild salmon are shown. The presence of dams, which prevents access to areas, is indicated by lines across rivers. *Notation:* **river name in bold** = *river with wild smolt production*; river name underlined = *river with potential for establishment of wild salmon*; normal font = *river with releases, no natural reproduction*.

3.14.2 Nominal catches in the Baltic Area

Officially reported catches in the Baltic until 2000 are given in Tables 3.14.2.1–5. These are the catches officially reported to ICES by national statistical offices for publication in the *ICES Fishery Statistics.*

In the assessments, the working groups try to estimate discards and slipped fish, landings which are not officially reported, and the composition of by-catches. These amounts are included in the estimates of total catch for each stock and are used in the assessments; thus, they appear in the tables and figures produced by working groups. These estimates vary considerably between different stocks and fisheries, being negligible in some cases and constituting important parts of the total removals from other stocks. Further, the catches used by the working groups are broken down into subdivisions, whereas the officially reported catches by some countries are reported by the larger Divisions IIIb, c, and d. The trends in Tables 3.14.2.1–5 may, therefore, not correspond to those on which assessments have been based, and are presented for information only, without any comment from ACFM.

The 1990 catches listed under the Federal Republic of Germany and the German Democratic Republic refer to catches by vessels from the respective former territories during the whole of 1990, before and after political union. Thus, catches taken by vessels registered in the former German Democratic Republic in the months after unification are included in the German Democratic Republic figures.

The catch data used in the assessments are given in other tables.

Table 3.14.2.1 Nominal fish catches in the Baltic from 1973-2000 (in '000 t). Anadromous species, except salmon, are not included. (Data as officially reported to ICES.)

Year	Species							Total
	Cod	Herring	Sprat	Flatfish	Salmon	Freshwater species	Others	
1973	189	404	213	18	2.7	23	55	905
1974	189	407	242	21	2.9	21	54	937
1975	234	415	201	24	2.9	20	60	957
1976	255	393	195	19	3.1	21	46	932
1977	213	413	211	22	2.4	22	42	925
1978	196	420	132	23	2.0	22	44	839
1979	273	459	78	24	2.3	20	47	903
1980	388	453	57	18	2.4	14	29	961
1981	380	419	47	16	2.4	13	31	908
1982	361	442	45	17	2.2	13	30	910
1983	376	459	31	16	2.4	13	20	917
1984	442	426	52	15	3.7	13	17	969
1985	344	431	69	17	4.0	11	16	892
1986	271	401	75	18	3.5	12	19	800
1987	238	373	91	16	3.8	13	24	759
1988	225	407	86	14	3.2	13	31	779
1989	192	414	89	14	4.2	14	18	745
1990	167	360	92	12	5.6	11	18	666
1991[1]	139	295	111	14	4.6	17	19	600
1992[1]	72	339	146	12	4.7	8	13	595
1993[1]	41	352	194	12	3.4	10	7	619
1994[1]	75	353	301	18	2.9	9	8	767
1995[1]	117	343	326	22	2.7	9	17	837
1996[1]	164	326	464	22	2.6	9	6	994
1997[1]	134	370	520	20	2.6	12	7	1,066
1998[1]	103	383	446	18	2.1	11	3	966
1999	117	343	408	18	1.7	11	4	903
2000[2]	105	371	369	20	2.0	20	13	900

[1]Preliminary
[2]Includes recreational catches from Finland

Table 3.14.2.2 Nominal catch (tonnes) of HERRING in Divisions IIIb,c,d 1963-2000. (Data as officially reported to ICES.)

Year	Denmark	Finland	German Dem.Rep.	Germany, Fed.Rep.	Poland	Sweden	USSR	Total
1963	14,991	48,632	10,900	16,588	28,370	27,691	78,580[1]	225,752
1964	29,329	34,904	7,600	16,355	19,160	31,297	84,956	223,601
1965	20,058	44,916	11,300	14,971	20,724	31,082[2]	83,265	226,216
1966	22,950	41,141	18,600	18,252	27,743	30,511	92,112	251,309
1967	23,550	42,931	42,900	23,546	32,143	36,900	108,154	310,124
1968	21,516	58,700	39,300	16,367	41,186	53,256	124,627	354,952
1969	18,508	56,252	19,100	15,116	37,085	30,167	118,974	295,202
1970	16,682	51,205	38,000	18,392	46,018	31,757	110,040	312,094
1971	23,087	57,188	41,800	16,509	43,022	32,351	120,728	334,685
1972	16,081	53,758	58,100	10,793	45,343	41,721	118,860	344,656
1973	24,834	67,071	65,605	8,779	51,213	59,546	127,124	404,172
1974	19,509	73,066	70,855	9,446	55,957	60,352	117,896	407,081
1975	18,295	69,581	71,726	10,147	68,533	62,791	113,684	414,757
1976	23,087	75,581	58,077	6,573	63,850	41,841	124,479	393,488
1977	25,467	78,051	62,450	7,660	60,212	52,871	126,000	412,711
1978	26,620	89,792	46,261	7,808	63,850	54,629	130,642	419,602
1979	33,761	83,130	50,241	7,786	79,168	86,078	118,655	458,819
1980	29,350	74,852	59,187	9,873	68,614	92,923	118,074	452,873
1981	28,424	65,389	56,643	9,124	64,005	84,500	110,782	418,867
1982	40,289	73,501	50,868	8,928	76,329	92,675	99,175	441,765
1983	32,657	83,679	51,991	9,273	82,329	86,561	112,370	458,860
1984	32,272	86,545	50,073	8,166	78,326	65,519	105,577	426,478
1985	27,847	88,702	51,607	9,079	85,865	57,554	110,783	431,437
1986	21,598	83,800	53,061	9,382	77,109	39,909	115,665	400,524
1987	23,283	82,522[3]	50,037	6,199	60,616	36,446	113,844	372,947
1988	29,950	92,824[3]	53,539	5,699	60,624	41,828	122,849	407,313
1989	26,654	81,122[3]	54,828	5,777	58,328	65,032	121,784	413,525
1990	16,237	66,078[3]	40,187	5,152	60,919	55,174	116,478	360,225

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	23,995	27,034[4]	51,546[3]	16,022	33,270	6,468[5]	45,991	59,176	31,755	295,257[6]
1992	33,855	29,556	72,171[3]	17,746	25,965	3,237[6]	52,864	75,907	27,979	339,280[6]
1993	34,945	32,982	77,353[3]	20,143	21,949	3,912[6]	50,833	86,497	23,545	352,159[6]
1994	45,190	34,493	97,674[3]	12,367	22,676	4,988[6]	49,111	70,886	15,904	353,411[6,7]
1995	37,762	43,482	94,613[3]	7,898	24,972	3,706[6]	45,676	68,019	16,970	343,099[6]
1996	34,340	45,296	93,337[3]	7,737	27,523	4,257[6]	31,246	67,116	14,780	325,632[6]
1997	30,876	52,436	90,334[3]	12,755	29,330	3,321[6]	28,939	110,463	11,801	370,255[6]
1998	38,800	42,721	85,545[3]	9,514	24,417	2,368[6]	21,873	147,706	10,544	383,488[6]
1999	37,974	44,039	82,237[3]	10,115	27,163	1,313	19,229	108,316	12,756	343,142
2000	49,727	41,735	81,648[3,8]	9,475	26,768	1,198	24,516	120,887	15,063	371,017

[1]Including Division IIIa.
[2]Large quantity of herring used for industrial purposes is included with "Unsorted and Unidentified Fish".
[3]Includes some by-catch of sprat.
[4]As reported by Estonian authorities; 32,683 t reported by Russian authorities.
[5]As reported by Lithuanian authorities; 6,456 t reported by Russian authorities.
[6]Preliminary.
[7]Includes catches from the Faroe Islands of 122 t.
[8]Includes recreational catches of 951 t.

Table 3.14.2.3 Nominal catch (tonnes) of SPRAT in Divisions IIIb,c,d 1963–2000. (Data as officially reported to ICES.)

Year	Denmark	Finland	German Dem.Rep.	Germany, Fed.Rep.	Poland	Sweden	USSR	Total
1963	2,525	1,399	8,000	507	10,693	101	45,820[1]	69,045
1964	3,890	2,111	14,700	1,575	17,431	58	55,753	95,518
1965	1,805	1,637	11,200	518	16,863	46	52,829	84,898
1966	1,816	2,048	21,200	66	13,579	38	52,407	91,454
1967	3,614	1,896	11,100	2,930	12,410	55	40,582	72,587
1968	3,108	1,291	10,200	1,054	14,741	112	55,050	85,556
1969	1,917	1,118	7,500	377	17,308	134	90,525	118,879
1970	2,948	1,265	8,000	161	20,171	31	120,478	153,054
1971	1,833	994	16,100	113	31,855	69	133,850	184,814
1972	1,602	972	14,000	297	38,861	102	151,460	207,294
1973	4,128	1,854	13,001	1,150	49,835	6,310	136,510	212,788
1974	10,246	1,035	12,506	864	61,969	5,497	149,535	241,652
1975	9,076	2,854	11,840	580	62,445	31	114,608	201,434
1976	13,046	3,778	7,493	449	56,079	713	113,217	194,775
1977	16,933	3,213	17,241	713	50,502	433	121,700	210,735
1978	10,797	2,373	13,710	570	28,574	807	75,529	132,360
1979	8,897	3,125	4,019	489	13,868	2,240	45,727	78,365
1980	4,714	2,137	151	706	16,033	2,388	31,359	57,488
1981	8,415	1,895	78	505	11,205	1,510	23,881	47,489
1982	6,663	1,468	1,086	581	14,188	1,890	18,866	44,742
1983	2,861	828	2,693	550	8,492	1,747	13,725	30,896
1984	3,450	374	2,762	642	10,954	7,807	25,891	51,880
1985	2,417	364	1,950	638	22,156	7,111	34,003	68,639
1986	5,693	705	2,514	392	26,967	2,573	36,484	75,328
1987	8,617	287[2]	1,308	392	34,887	870	44,888	91,249
1988	6,869	495[2]	1,234	254	25,359	7,307	44,181	85,699
1989	9,235	222[2]	1,166	576	20,597	3,453	53,995	89,244
1990	8,858	162[2]	518	905	14,299	7,485	59,737	91,964

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	21,781	14,124[3]	99[2]	736	17,996[4]	3,569	23,200	8,328	20,736	110,569[5]
1992	28,210	4,140	893[2]	608	17,388	1,697[5]	30,126	53,558	9,851	146,471[5]
1993	27,435	5,763	206[2]	8,267	12,553	2,798[5]	33,701	92,416	10,745	193,884[5]
1994	69,644	9,079	497[2]	374	20,132	2,789[5]	44,556	135,779	16,719	300,535[5,6]
1995	76,420	13,052	4,103[2]	230	24,383	4,799[5]	37,280	150,435	14,934	325,636[5]
1996	123,549	22,493	14,351[2]	161	34,211	10,165[5]	77,472	163,087	18,287	463,776[5]
1997	153,765	39,692	19,852[2]	428	49,314	6,000[5]	105,298	123,207	22,194	519,750[5]
1998	111,003	32,165	27,014	4,551	44,858	5,132[5]	59,091	141,209	21,078	446,122[5,7]
1999	97,686	36,407	18,886[2]	182	42,834	3,117	71,705	106,000	31,627	408,444
2000	55,521	41,394	23,242[2,8]	22	46,186	1,682	84,325	85,981	30,369	368,722

[1]Including Division IIIa.
[2]Some by-catch of sprat included in herring.
[3]As reported by Estonian authorities; 17,893 t reported by Russian authorities.
[4]As reported by Latvian authorities; 17,672 t reported by Russian authorities.
[5]Preliminary.
[6]Includes catches from the Faroe Islands of 966 t.
[7] Includes catches from the Faroe Islands of 21 t.
[8]Includes recreational catches of 108 t.

Table 3.14.2.4 Nominal catch (tonnes) of COD in Divisions IIIb,c,d 1963–2000. (Data as officially reported to ICES.)

Year	Denmark	Faroe Islands	Finland	German Dem.Rep.	Germany Fed.Rep.	Poland	Sweden	USSR	Total
1963	35,851		12	7,800	10,077	47,514	22,827	30,550[1]	154,631
1964	34,539		16	5,100	13,105	39,735	16,222	24,494	133,211
1965	35,990		23	5,300	12,682	41,498	15,736	22,420	133,649
1966	37,693		26	6,000	10,534	56,007	16,182	38,269	164,711
1967	39,844		27	12,800	11,173	56,003	17,784	42,975	180,606
1968	45,024		70	18,700	13,573	63,245	18,508	43,611	202,731
1969	45,164		58	21,500	14,849	60,749	16,656	41,582	200,558
1970	43,443		70	17,000	17,621	68,440	13,664	32,248	192,486
1971	47,563		3	9,800	14,333	54,151	12,945	20,906	159,701
1972	60,331		8	11,500	13,814	56,746	13,762	30,140	186,301
1973	66,846		95	11,268	25,081	49,790	16,134	20,083	189,297
1974	58,659		160	9,013	20,101	48,650	14,184	38,131	188,898
1975	63,860		298	14,740	21,483	69,318	15,168	49,289	234,156
1976	77,570		278	8,548	24,096	70,466	22,802	51,516	255,276
1977	74,495		310	10,967	31,560	47,703	18,327	29,680	213,042
1978	50,907		1,446	9,345	16,918	64,113	15,996	37,200	195,925
1979	60,071		2,938	8,997	18,083	79,697	24,003	78,730	272,519
1980	76,015	1,250	2,317	7,406	16,363	123,486	34,089	124,359	388,186[2]
1981	93,155	2,765	3,249	12,938	15,082	120,942	44,300	87,746	380,177
1982	98,230	4,300	3,904	11,368	19,247	92,541	44,807	86,906	361,303
1983	108,862	6,065	4,677	10,521	22,051	76,474	54,876	92,248	375,774
1984	121,297	6,354	5,257	9,886	39,632	93,429	65,788	100,761	442,404
1985	107,614	5,890	3,793	6,593	24,199	63,260	54,723	78,127	344,199
1986	98,081	4,596	2,917	3,179	18,243	43,237	48,804	52,148	271,205
1987	85,544	5,567	2,309	5,114	17,127	32,667	50,186	39,203	237,717
1988	75,019	6,915	2,903	4,634	16,388	33,351	58,027	28,137	225,374
1989	66,235	4,499	1,913	2,147	14,637	31,855	55,919	14,722	191,927
1990	56,702	3,558	1,667	1,630	7,225	28,730	54,473	13,461	167,446

Year	Denmark	Estonia	Faroe Islands	Finland	Germany	Latvia	Lithuania	Poland	Sweden	Russia	Total
1991	50,640	1,805[3]	2,992	1,662	8,637	2,627	1,849	25,748	39,552	3,196	138,708[4]
1992	30,418	1,369	593	460	6,668	1,250	874[4]	13,314	16,244	404	71,594[4]
1993	10,919	70	558	203	5,127	1,333	904[4]	8,909	12,201	483	40,707[4]
1994	19,822	905	779	520	7,088	2,379	1,886[4]	14,426	25,685	1,114	74,604[4]
1995	34,612	1,049	777	1,851	14,681	6,471	3,629[4]	25,001	27,289	1,612	117,265[4,5]
1996	48,505	1,392	714	3,132	20,607	8,741	5,521[4]	34,856	36,932	3,304	163,993[4,5]
1997	42,581	1,173	33	1,537	14,483	6,187	4,497[4]	31,659	29,329	2,803	134,282[4]
1998	29,476	1,070	-	1,033	10,989	7,778	4,187[4]	25,778	17,665	4,599	102,575[4]
1999	38,169	1,060	-	1,570	15,439	6,914	4,371	26,581	17,476	5,211	116,791
2000	32,049	513	n/a	1,824[6]	13,079	6,280	4,721	22,120	19,801	4,669	105,056

[1]Including Division IIIa.
[2]Includes catches from United Kingdom (England & Wales) of 2,901 t.
[3]As reported by Estonian authorities; 1,812 t reported by Russian authorities.
[4]Preliminary.
[5]Includes preliminary catches from Norway of 293 t for 1995 and 289 t for 1996.
[6]Includes recreational catches of 6 t.

3.14.3 Herring in Subdivisions 22–24 and Division IIIa (spring spawners)

State of stock/exploitation: SSB has been relatively stable over the last five years, but the stock is being harvested outside of biological limits. Fishing mortality is 0.50 for adults and 0.25 for the juveniles (0- and 1-ringers), which is substantially greater than $\mathbf{F}_{max}$. The age structure in the catch appears to be relatively stable over the last four years.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: Precautionary Approach reference points have not been defined. The continued development of an analytical assessment may allow definition of PA reference points in the near future. Based on a comparison to other herring stocks all likely candidates of $\mathbf{F}_{pa}$ will be less than $\mathbf{F}_{max}$.

Advice on management: ICES recommends that the fishing mortality be reduced to less than $\mathbf{F}_{max}$, corresponding to catches in 2003 of less than 84 000 t. According to the recent geographic distribution of catches, approximately half of the total catch should be taken from the Subdivisions 22–24.

Relevant factors to be considered in management: Section (3.5.8) on North Sea herring (autumn spawners) states: "The fisheries on herring in Division IIIa should be managed in accordance with the management advice given on spring spawning herring", and the North Sea stock is now above $\mathbf{B}_{pa}$. A considerable part of the landings of juvenile herring in Division IIIa originates from the North Sea stock. An abundant 2000 year class of North Sea autumn spawner herring is expected to be present in the area as one-winter-ringers in 2002. The 2001 North Sea autumn spawner year class also appears to be abundant and this year-class will be present in Div. IIIa as 0-ringers in 2002. Recently, this fishery has been managed in a manner consistent with the management of the herring in the North Sea. As the North Sea stock recovers, the need for a separate management of Subdivisions 22–24 + Division IIIa herring stock increases.

In the Baltic the TACs for herring apply to several herring stocks, including the component of this stock in Subdivisions 22–24, and there is no specific instrument that allows control over the exploitation of spring-spawning herring in Division IIIa and Subdivisions 22–24. The herring TAC for the Baltic should be split and individual TACs applied to the stocks, i.e. Subdivisions 22–24, Subdivisions 25–29 + 32 (excluding Gulf of Riga herring), Gulf of Riga herring, Subdivision 30 and Subdivision 31.

Catch forecast for 2003: Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999–2001) = 0.498; Landings (2002) = 107; SSB(2002) = 140.

F(2003 onwards)	Basis	SSB (2003)	Landings (2003)	SSB (2004)
0	$0\mathbf{F}_{sq}$	141	0	224
0.202	$\mathbf{F}_{0.1}$	139	48	183
0.3	$0.6\mathbf{F}_{sq}$	136	69	166
0.372	$\mathbf{F}_{max}$	136	84	154
0.398	$0.8\mathbf{F}_{sq}$	135	89	150
0.448	$0.9\ \mathbf{F}_{sq}$	135	98	143
0.498	$\mathbf{F}_{sq}$	134	107	136
0.547	$1.1\ \mathbf{F}_{sq}$	133	116	129

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The assessment carried out in 2002 is the first accepted analytical assessment. The results are very similar to a provisional assessment provided last year.

Elaboration and special comments: Herring of this stock are taken in the Northeastern part of the North Sea, Division IIIa, and Subdivisions 22–24. Division IIIa has directed fisheries by trawlers and purse seiners (fleet C), while Subdivisions 22–24 have directed trawl, gillnet, and trapnet fisheries (fleet F). The herring by-catches taken in Division IIIa in the small mesh trawl fishery for Norway pout, sandeel, and sprat (fleet D) are mainly autumn spawners from the North Sea stock. After a period of high landings in the early 1980s the combined landings of all fleets have decreased to below the long-term average.

The TACs in Division IIIa in 2001 were: 1) for the directed fishery 80 000 t, and 2) for by-catch in the small mesh fisheries 21 000 t. The TAC comprises both the autumn- and spring-spawning stocks in the area. The spring spawners are also fished in the Baltic, under the overall IBSFC herring TAC of 300 000 t (Subdivisions 22–32). The TACs in Div. IIIa for 2002 are 80 000 t for directed fishery and a total of 21 000 t for by-catches in the small mesh fisheries.

The otolith microstructure method to calculate the proportion of spring and autumn spawners caught in these areas has been implemented, all catch and IBTS data for the period 1991–1999 has been revised. Continued development of the stock identification methods should be applied to explore the importance of local stock components in the area.

Analytical assessment is based on catch data and acoustic and trawl survey results. In order to continue to improve the assessment, a comprehensive survey covering the whole stock is needed.

Source of information: Report of the Herring Assessment Working Group for the Area South of 62°N, March 2002 (ICES CM 2002/ACFM:12).

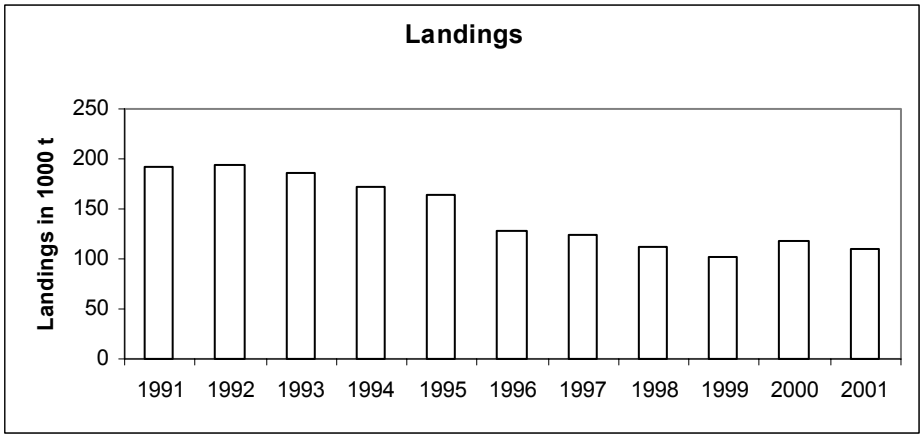
Yield and spawning biomass per Recruit F-reference points:

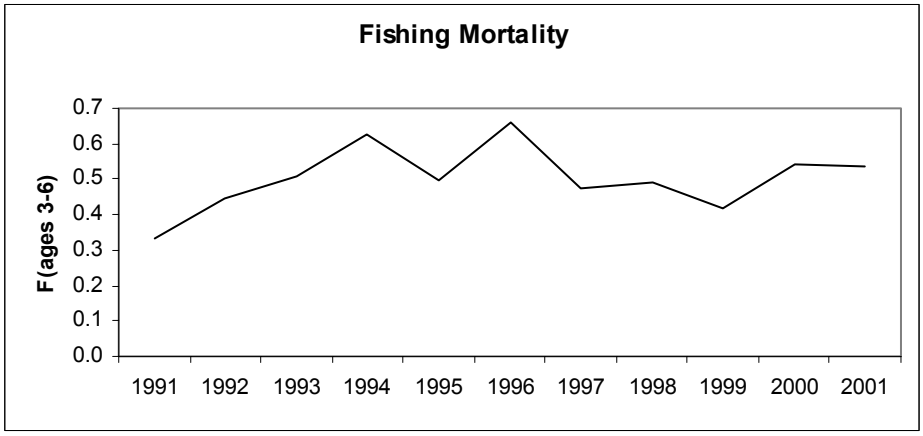
	Fish Mort Ages 3–6	Yield/R	SSB/R
Average Current	0.498	0.024	0.030
F_{max}	0.372	0.024	0.046
$F_{0.1}$	0.202	0.022	0.089
F_{med}	N/A		

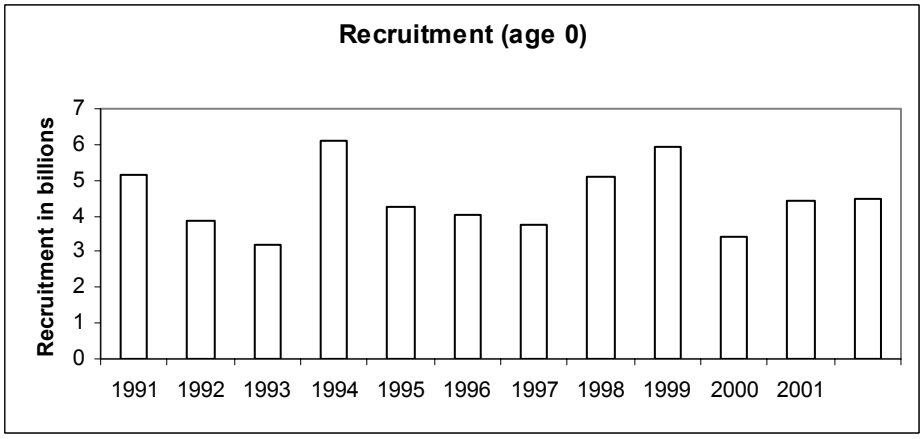
Catch data: (Tables 3.14.3.1–2)

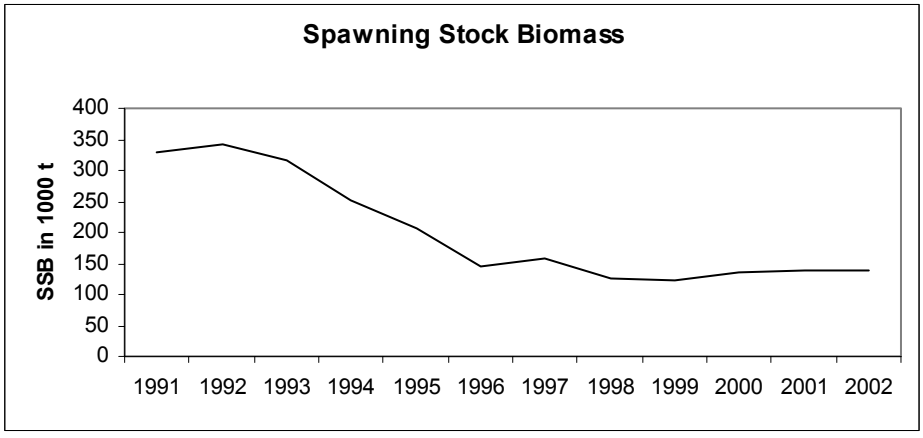
Year	ICES Advice	Pred. Catch Corresp. to advice	Agreed TAC	ACFM catch of Stock			
				22–24	IIIa	IV	Total
1987	Reduction in F	224		102	59	14	175
1988	No increase in F	196		99	129	23	251
1989	TAC	174		95	71	20	186
1990	TAC	131		78	118	8	204
1991	TAC	180		70	112	10	192
1992	TAC	180		85	101	9	195
1993	Increased yield from reduction in F; reduction in juvenile catches	188		81	95	10	186
1994	TAC	130–180		66	92	14	172
1995	If required, TAC not exceeding recent catches	168–192		74	80	10	164
1996	If required, TAC not exceeding recent catches	164–171		58	71	1	130
1997	IIIa: managed together with autumn-spawners 22–24: if required, TAC not exceeding recent catches	66–85[1]		68	55	1	124
1998	Should be managed in accordance with North Sea autumn spawners	-		51	53	8	112
1999	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	-		50	43	5	98
2000	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~60 for Sub-divs. 22–24		54	57	7	118
2001	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24		62	42	6	110
2002	IIIa: managed together with autumn spawners 22–24: if required, TAC not exceeding recent catches	~50 for Sub-divs. 22–24					
2003	Decrease F	<80					

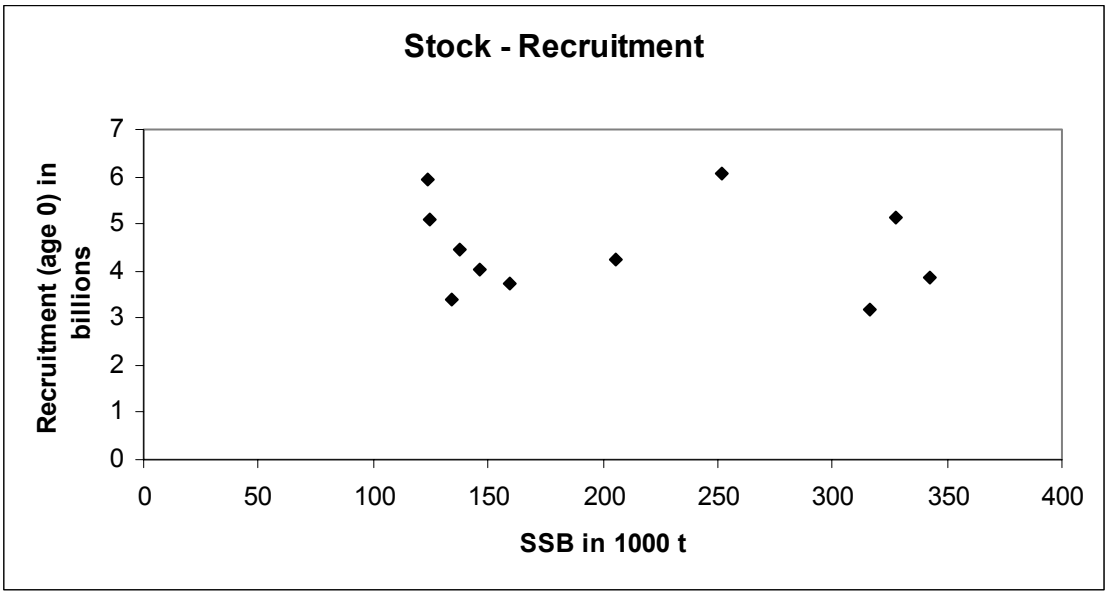
[1]Catch in Subdivisions 22–24. Weights in '000 t.


Landings
Landings in 1000 t
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Fishing Mortality
F (ages 3-6)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Recruitment (age 0)
Recruitment in billions
7
6
5
4
3
2
1
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001


Spawning Stock Biomass
SSB in 1000 t
400
350
300
250
200
150
100
50
0
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002


Stock - Recruitment
Recruitment (age 0) in billions
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
SSB in 1000 t

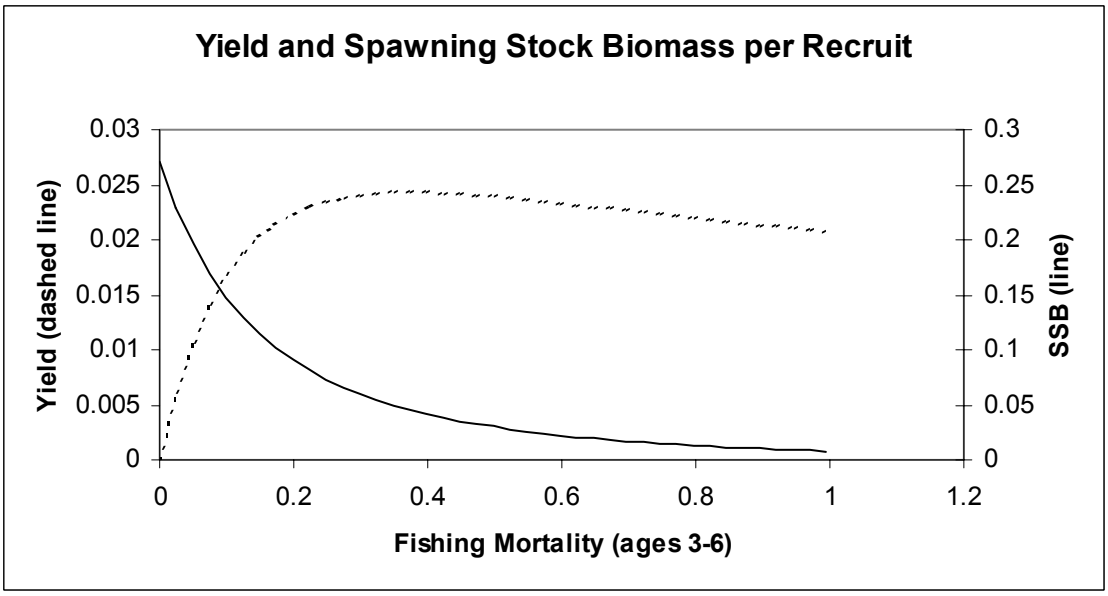

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.005
0.01
0.015
0.02
0.025
0.03
SSB (line)
0
0.05
0.1
0.15
0.2
0.25
0.3
0
0.2
0.4
0.6
0.8
1
1.2
Fishing Mortality (ages 3-6)

Table 3.14.3.1 HERRING in Division IIIa and Subdivisions 22–24. 1985–2001. Landings in thousands of tonnes. Autumn and spring spawners in Division IIIa. (Data provided by Working Group members 2001).

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Skagerrak										
Denmark	88.2	94.0	105.0	144.4	47.4	62.3	58.7	64.7	87.8	44.9
Faroe Islands	0.5	0.5								
Norway	4.5	1.6	1.2	5.7	1.6	5.6	8.1	13.9	24.2	17.7
Sweden	40.3	43.0	51.2	57.2	47.9	56.5	54.7	88.0	56.4	66.4
Total	133.5	139.1	157.4	207.3	96.9	124.4	121.5	166.6	168.4	129.0
Kattegat										
Denmark	69.2	37.4	46.6	76.2	57.1	32.2	29.7	33.5	28.7	23.6
Sweden	39.8	35.9	29.8	49.7	37.9	45.2	36.7	26.4	16.7	15.4
Total	109.0	73.3	76.4	125.9	95.0	77.4	66.4	59.9	45.4	39.0
Sub. Div. 22+24										
Denmark	15.9	14.0	32.5	33.1	21.7	13.6	25.2	26.9	38.0	39.5
Germany	54.6	60.0	53.1	54.7	56.4	45.5	15.8	15.6	11.1	11.4
Poland	16.7	12.3	8.0	6.6	8.5	9.7	5.6	15.5	11.8	6.3
Sweden	11.4	5.9	7.8	4.6	6.3	8.1	19.3	22.3	16.2	7.4
Total	98.6	92.2	101.4	99.0	92.9	76.9	65.9	80.3	77.1	64.6
Sub. Div. 23										
Denmark	6.8	1.5	0.8	0.1	1.5	1.1	1.7	2.9	3.3	1.5
Sweden	1.1	1.4	0.2	0.1	0.1	0.1	2.3	1.7	0.7	0.3
Total	7.9	2.9	1.0	0.2	1.6	1.2	4.0	4.6	4.0	1.8
Grand Total	349.0	307.5	336.2	432.4	286.4	279.9	257.8	311.4	294.9	234.4

Year	1995	1996	1997	1998	1999	2000	2001[1]
Skagerrak							
Denmark	43.7	28.7	14.3	10.3	10.1	16.0	16.2
Faroe Islands							
Norway	16.7	9.4	8.8	8.0	7.4	9.7	8.3
Sweden	48.5	32.7	32.9	46.9	36.4	45.8	30.8
Total	108.9	70.8	56.0	65.2	53.9	71.5	55.3
Kattegat							
Denmark	16.9	17.2	8.8	23.7	17.9	18.9	18.8
Sweden	30.8	27.0	18.0	29.9	14.6	17.3	16.2
Total	47.7	44.2	26.8	53.6	32.5	36.2	35.0
Sub. Div. 22+24							
Denmark	36.8	34.4	30.5	30.1	32.5	32.6	28.3
Germany	13.4	7.3	12.8	9.0	9.8	9.3	9.9
Poland	7.3	6.0	6.9	6.5	5.3	6.6	9.3
Sweden	15.8	9.0	14.5	4.3	2.6	4.8	13.9
Total	73.3	56.7	64.7	49.9	50.2	53.3	61.4
Sub. Div. 23							
Denmark	0.9	0.7	2.2	0.4	0.5	0.9	0.6
Sweden	0.2	0.3	0.1	0.3	0.1	0.1	0.2
Total	1.1	1.0	2.3	0.7	0.6	1.0	0.8
Grand Total	231.0	172.7	149.8	169.4	137.2	162.0	152.5

[1] Preliminary.

Table 3.14.3.2 Herring in Subdivisions 22–24 and Division IIIa (spring spawners).

Year	Recruitment Age 0 thousands	SSB Tonnes	Landings tonnes	Mean F Ages 3–6
1991	5152960	327477	191573	0.3358
1992	3870880	342905	194411	0.4441
1993	3167210	316405	185010	0.5061
1994	6087790	251977	172438	0.6243
1995	4260820	205460	164284	0.4942
1996	4014880	146638	128243	0.6621
1997	3749770	159142	123199	0.4738
1998	5080980	124774	112386	0.4905
1999	5928180	123367	101573	0.4161
2000	3393080	134518	118278	0.5416
2001	4446510	137931	110192	0.5351
2002	4490961	139690		
Average	4470335	200857	145599	0.5022

3.14.4 Central Baltic Herring (Subdivisions 25–29 (including Gulf of Riga) and 32)

The best way to assess the herring in Subdivisions 25-29 and 32 has been reviewed once more. The information on the various stock components or spawning types of herring is still insufficient to make a total revision of the assessment structure (see section on research programme in this report). However, available information indicate that the Gulf herring in Gulf of Riga can be treated as a separate stock. These herring can be separated in the catches and the stock shows a clearly different pattern in recruitment and in stock size development.

Therefore, ICES decided to provide separate advice for the herring in Central Baltic (Subdivisions 25-29, 32 exclusive Gulf of Riga herring) and for the Gulf herring in the Gulf of Riga. As requested by IBSFC ICES presents assessments and catch options for the following stock components: combined in Subdivisions 25-29+32 (excluding Gulf of Riga herring), see Section 3.14.4.a; the Gulf of Riga herring for the stock, see Section 3.14.4.b; and combined in Subdivisions 25-29+32 (including Gulf of Riga herring), see Section 3.14.4.c.

ICES recommends that the herring in the Baltic should be managed according to stock, i.e:

Herring Unit	**Proposed Management Area**
Herring in Subdivisions 22-24	South-western Baltic, Subdivisions 22,23,24
Central Baltic Herring	Subdivisions 25, 26, 27, 28, 29 and 32 (excl. Gulf of Riga)
Gulf of Riga herring	Gulf of Riga (part of Subdivision 28)
Herring in Subdivision 30	Bothnian Sea (Subdivision 30)
Herring in Subdivision 31	Bothnian Bay (Subdivision 31).

Table 3.14.4.1 Herring catches in Subdivisions 25-29, 32 (thousand tonnes).

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia[1)]	Sweden	Total
1977	11.9		33.7	0.0			57.2	137.0	48.7	313.7
1978	13.9		38.3	0.1			61.3	130.6	55.4	305.2
1979	19.4		40.4	0.0			70.4	118.1	71.3	323.1
1980	10.6		44.0	0.0			58.3	118.0	72.5	304.4
1981	14.1		42.5	1.0			51.2	110.2	72.9	294.0
1982	15.3		47.5	1.3			63.0	99.2	83.8	311.1
1983	10.5		59.1	1.0			67.1	84.6	78.6	302.0
1984	6.5		54.1	0.0			65.8	105.6	56.9	289.9
1985	7.6		54.2	0.0			72.8	110.8	42.5	289.5
1986	3.9		49.4	0.0			67.8	115.7	29.7	268.3
1987	4.2		50.4	0.0			55.5	113.8	25.4	251.9
1988	10.8		58.1	0.0			57.2	122.8	33.4	286.3
1989	7.3		50.0	0.0			51.8	121.8	55.4	289.9
1990	4.6		26.9	0.0			52.3	116.2	44.2	244.2
1991	6.8	32.7	18.1	0.0	33.3	6.5	47.1	31.9	36.5	212.8
1992	8.1	29.7	30.0	0.0	25.8	4.6	39.2	29.5	43.0	209.9
1993	8.9	32.7	32.3	0.0	25.4	3.0	41.1	21.6	66.4	231.4
1994	11.3	33.7	38.2	3.7	26.2	4.9	46.1	16.7	61.6	242.4
1995	11.4	42.9	31.4	0.0	28.4	3.6	38.7	17.0	47.2	220.6
1996	12.1	44.9	31.5	0.0	31.0	4.2	30.7	14.6	25.9	195.1
1997	9.4	54.7	23.7	0.0	33.8	3.3	26.2	12.5	44.1	207.8
1998	13.9	42.9	24.8	0.0	27.6	2.4	19.3	10.5	71.0	212.4
1999	6.2	43.1	17.9	0.0	30.2	1.3	18.1	12.7	48.9	178.3
2000	15.8	39.7	23.2	0.0	30.0	1.1	23.1	14.8	60.2	207.8
2001*	15.8	40.2	26.1	0.0	30.1	1.6	28.4	15.8	29.8	187.8

* Preliminary.
[1)] In 1977-1990 sum of catches by Estonia, Latvia, Lithuania, and Russia

3.14.4.a Herring in Subdivisions 25–29 and 32 (excluding Gulf of Riga herring)

State of stock/exploitation: Although the exact stock size is uncertain, there is high confidence that the spawning biomass is close to the historic low. The fishing mortality increased throughout the late 1990s and the stock is currently harvested outside safe biological limits. Current fishing mortality is above $\mathbf{F}_{pa}$ and even above $\mathbf{F}_{lim}$.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the precautionary criteria, F should be less than the proposed $\mathbf{F}_{pa}$ and spawning stock biomass should be maintained above $\mathbf{B}_{pa}$ once an appropriate value is identified.

Precautionary Approach reference points (proposed in 2002):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ not defined	$\mathbf{B}_{pa}$ not defined
$\mathbf{F}_{lim}$ is 0.33	$\mathbf{F}_{pa}$ be set at 0.19

Technical basis:

$\mathbf{B}_{lim}$ not defined	$\mathbf{B}_{pa}$ not defined
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$

There is no biological basis at present for determining biomass reference points.

Advice on management: ICES recommends that fishing mortality in 2003 should be reduced below the $\mathbf{F}_{pa}$ = 0.19 to allow the SSB to increase, corresponding to a catch of less than 72 000 t.

Relevant factors to be considered in management: The TAC for herring in the Central Baltic has been kept far above the reported landings since 1989. Herring and sprat are mostly caught in mixed fisheries, but directed fisheries exist in some countries.

The implication of a substantially reduced harvest of the herring stock as advised should be considered when implementing the management plan for sprat fisheries.

Catch forecast for 2003:

Basis: F(2002) =$\mathbf{F}_{sq}$= F(1999–2001) =0.4333; Landings(2002) =148; SSB(2002) =362.

F(2003)	Basis	SSB(2003)	Landings (2003)	SSB (2004)
0.00	0.0	416	0	560
0.043	0.1*$\mathbf{F}_{sq}$	411	17	537
0.087	0.2*$\mathbf{F}_{sq}$	406	34	515
0.130	0.3*$\mathbf{F}_{sq}$	401	51	494
0.173	0.4*$\mathbf{F}_{sq}$	396	66	474
0.19	0.44*$\mathbf{F}_{sq}$ ($\mathbf{F}_{pa}$)	394	72	467
0.217	0.5*$\mathbf{F}_{sq}$	391	82	455
0.260	$\mathbf{F}_{0.1}$	386	86	436
0.347	0.8*$\mathbf{F}_{sq}$	376	124	402
0.433	$\mathbf{F}_{sq}$	367	151	371

Weights in '000 t.

Shaded scenario considered inconsistent with the precautionary approach.

Comparison with previous assessment and advice: The present assessment gives 4% lower estimate of SSB(1999) and 2% higher fishing mortality (1999) than the assessment performed two years ago.

Medium- and long-term projections: Medium-term predictions given in Figure 3.14.4.a.1, are based on the assumption of a 25% reduction in F for year 2002. The fishing mortality is kept at 0.4*$\mathbf{F}_{sq}$ = 0.17, which is below $\mathbf{F}_{pa}$ for the remaining years 2003-2010. The results show a slow increase in SSB to slightly above 400 000 t in the medium-term. After an initial decrease in landings in the short term to just above 70 000 t, landings will stabilise around 100 000 t in the medium-term.

Elaboration and special comment: The assessment is uncertain, due to the complexity of the stock structure and the uncertain split between herring and sprat in most pelagic fisheries in the area.

Much of the estimated decline in SSB has been attributed to the overall decrease in mean weights-at-age, as the numbers of mature herring (spawning stock in numbers) have remained stable during 1986–1996. The decrease in SSB since 1997 has, however, been associated with a marked decline in numbers.

The decrease of the stock could be connected with the reproduction decline in the last 15 years. The recruitment has been mainly low and occasionally average since 1986. However, no information on a worsening situation on the spawning grounds or on unfavourable feeding conditions for herring larvae is available.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	0.433	0.011	0.028
$\mathbf{F}_{max}$	1.582	0.012	0.007
$\mathbf{F}_{0.1}$	0.258	0.010	0.041
$\mathbf{F}_{med}$	0.189	0.009	0.051

Catch data :

Year	ICES Advice	Predicted catch Corresp. to advice	Agreed TAC[1]	ACFM Catch		
	1987-2002 incl. Gulf of Riga herring			22–24	25–29+32	Total
1987		200	399	102	252	354
1988		204	399	99	286	385
1989		176	399	95	290	385
1990		112	399	78	244	322
1991	TAC for entire area	293	402	70	213	283
1992	F near present level	343	402	85	210	295
1993	Increase in yield at higher F	371	560	81	231	312
1994	Increase in yield at higher F	317–463	560	66	242	308
1995	TAC	394	560	74	221	295
1996	TAC	394	560	58	195	253
1997	No advice	-	560	68	208	276
1998	No advice	-	560	51	212	263
1999	Proposed $\mathbf{F}_{pa =}$ (0.17)	117	476	50	178	228
2000	Proposed $\mathbf{F}_{pa =}$ (0.17)	95	405	54	208	262
2001	Proposed $\mathbf{F}_{pa =}$ (0.17)	60	300	62	188	250
2002	$< \mathbf{F}_{pa}$	73	No agreed			
2003	$< \mathbf{F}_{pa}$	72				

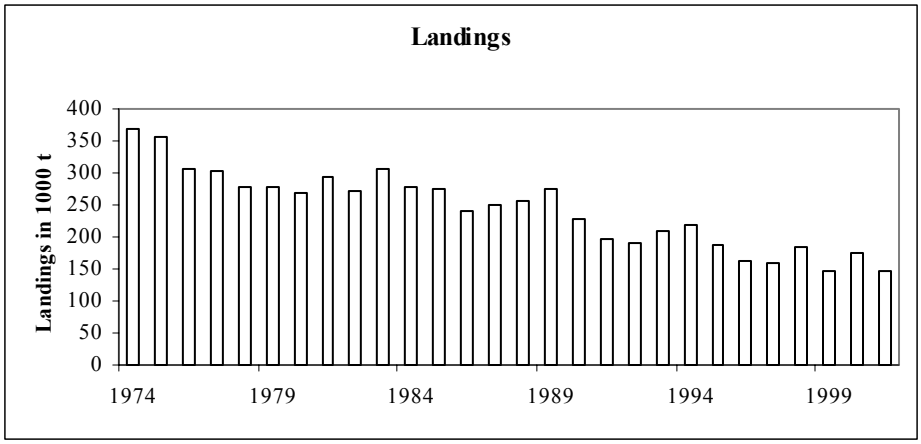
[1] TAC is for Subdivisions 22–29, 32. Weights in '000 t.

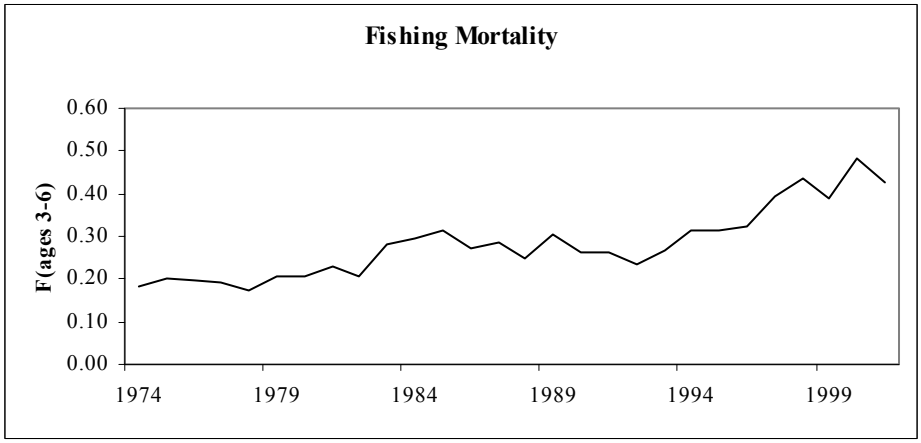
Table 13.14.4.a.1 Herring catches ('000 t) in Subdivisions 25-29 and 32 excl. Gulf of Riga herring but incl. catches of open-sea herring in the Gulf of Riga.

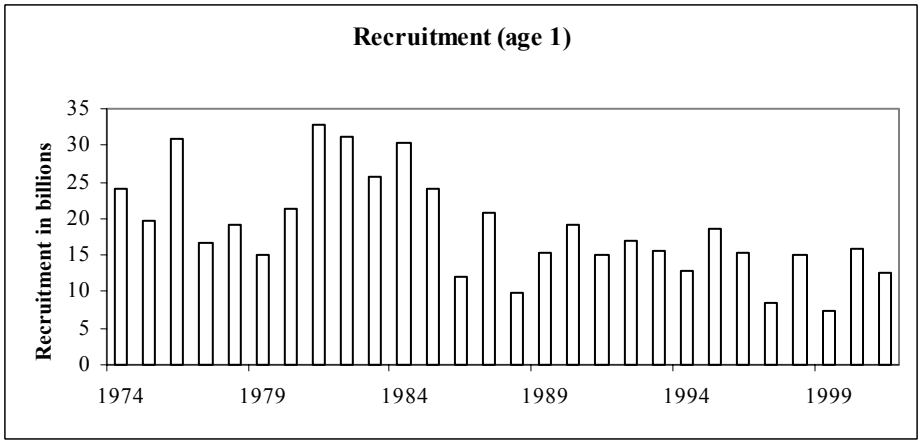
Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia**	Sweden	Total
1977	11.9		33.7	0.0			57.2	112.8	48.7	264.3
1978	13.9		38.3	0.1			61.3	113.9	55.4	282.9
1979	19.4		40.4	0.0			70.4	101.0	71.3	302.5
1980	10.6		44.0	0.0			58.3	103.0	72.5	288.4
1981	14.1		42.5	1.0			51.2	93.4	72.9	275.1
1982	15.3		47.5	1.3			63.0	86.4	83.8	297.3
1983	10.5		59.1	1.0			67.1	69.1	78.6	285.4
1984	6.5		54.1	0.0			65.8	89.8	56.9	273.1
1985	7.6		54.2	0.0			72.8	95.2	42.5	272.3
1986	3.9		49.4	0.0			67.8	98.8	29.7	249.6
1987	4.2		50.4	0.0			55.5	100.9	25.4	236.4
1988	10.8		58.1	0.0			57.2	106.0	33.4	265.5
1989	7.3		50.0	0.0			51.8	105.0	55.4	269.5
1990	4.6		26.9	0.0			52.3	101.4	44.2	229.4
1991	6.8	29.7	18.1	0.0	21.5	6.5	47.1	31.9	36.5	198.1
1992	8.1	22.4	30.0	0.0	11.6	4.6	39.2	29.5	43.0	188.4
1993	8.9	25.3	32.3	0.0	9.3	3.0	41.1	21.6	66.4	207.9
1994	11.3	28.2	38.2	3.7	7.4	4.9	46.1	16.7	61.6	218.1
1995	11.4	30.8	31.4	0.0	7.8	3.6	38.7	17.0	47.2	187.9
1996	12.1	35.8	31.5	0.0	7.6	4.2	30.7	14.6	25.9	162.4
1997	9.4	41.7	23.7	0.0	6.8	3.3	26.2	12.5	44.1	167.7
1998	13.9	34.0	24.8	0.0	7.1	2.4	19.3	10.5	71.0	183.0
1999	6.2	35.5	17.9	0.0	6.4	1.3	18.1	12.7	48.9	147.0
2000	15.8	30.1	23.3	0.0	5.5	1.1	23.1	14.8	60.2	173.9
2001	15.8	27.4	26.1	0.0	4.1	1.6	28.4	15.8	29.8	149.0

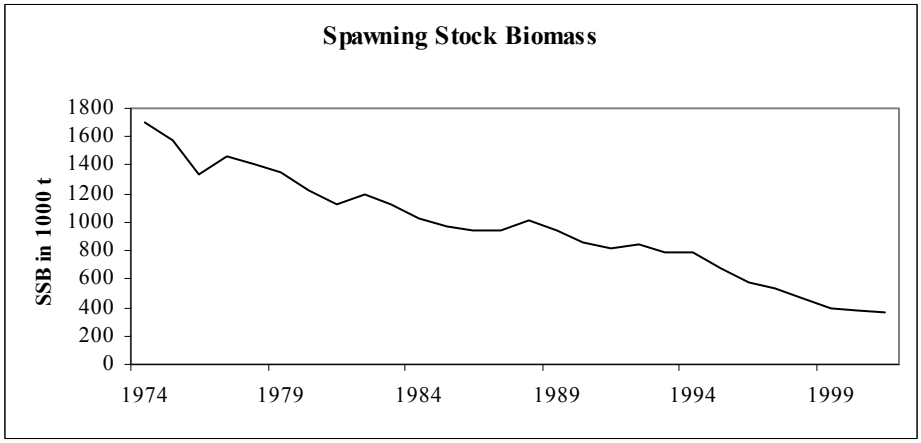
* preliminary

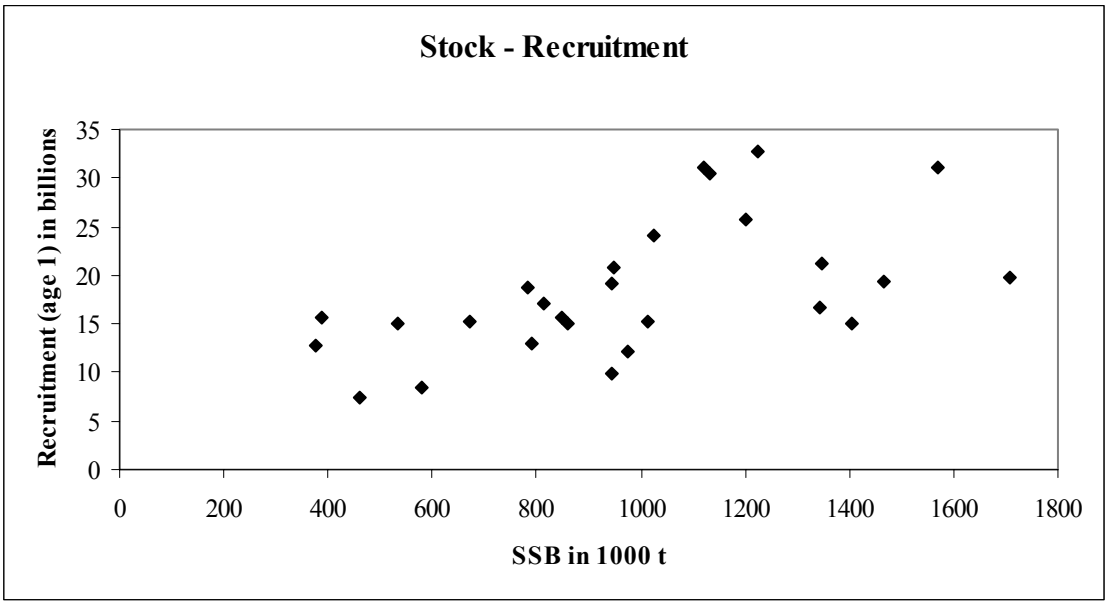
** in 1977-1990 sum of catches by Estonia, Latvia, Lithuania, and Russia

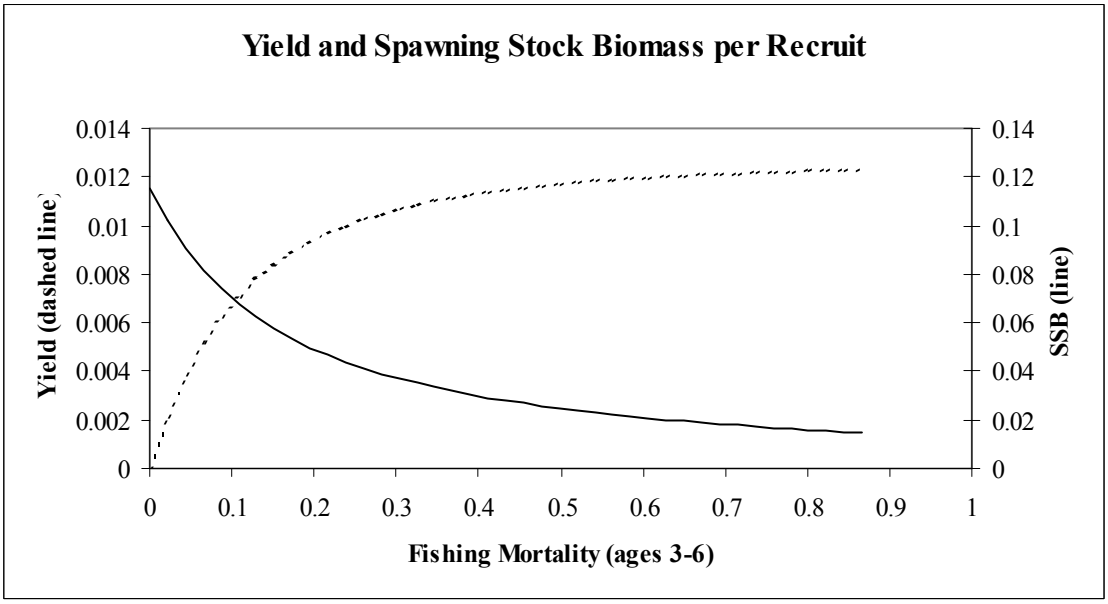

Landings
Landings in 1000 t
400
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-6)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1979
1984
1989
1994
1999


Recruitment (age 1)
Recruitment in billions
35
30
25
20
15
10
5
0
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
1800
1600
1400
1200
1000
800
600
400
200
0
1974
1979
1984
1989
1994
1999


Stock - Recruitment
Recruitment (age 1) in billions
0
5
10
15
20
25
30
35
0
200
400
600
800
1000
1200
1400
1600
1800
SSB in 1000 t


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
SSB (line)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Fishing Mortality (ages 3-6)

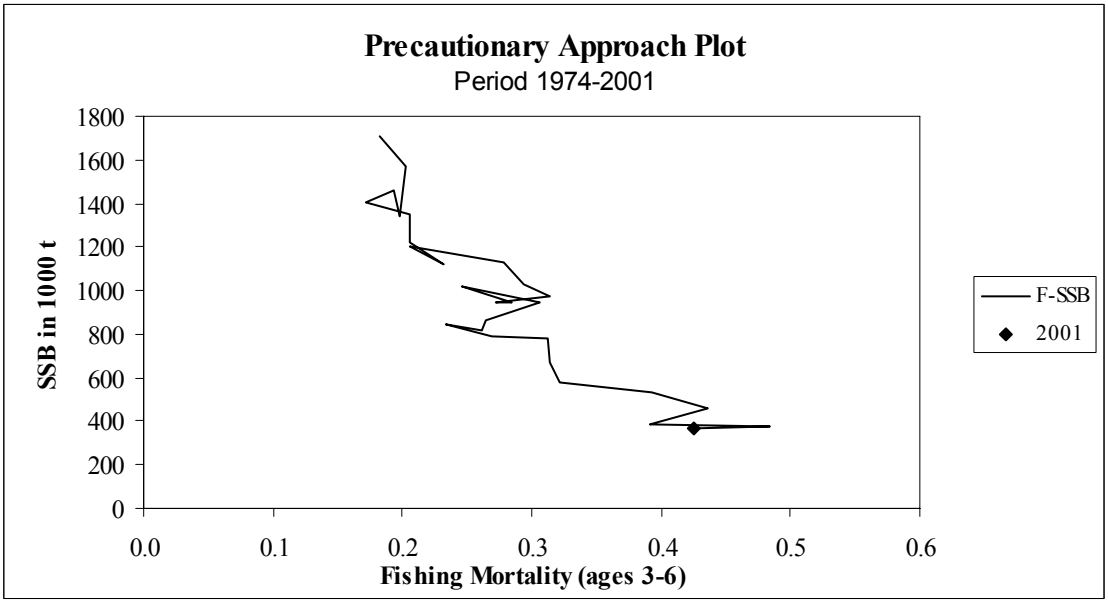

Precautionary Approach Plot
Period 1974-2001
SSB in 1000 t
0
200
400
600
800
1000
1200
1400
1600
1800
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 3-6)
F-SSB
2001

Table 3.14.4.a.2 Herring in Subdivisions 25 to 29 and 32 excl. Gulf of Riga.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1974	24048128	1707089	368652	0.1828
1975	19814050	1570917	354851	0.2023
1976	31014348	1342492	305420	0.1982
1977	16666728	1464260	301952	0.1937
1978	19273218	1404393	278966	0.1715
1979	14943418	1347676	278182	0.2049
1980	21221916	1225202	270282	0.2060
1981	32777548	1119343	293615	0.2312
1982	31152340	1199368	273134	0.2051
1983	25709262	1130397	307601	0.2791
1984	30424876	1024608	277926	0.2945
1985	24012544	974228	275760	0.3145
1986	12065035	948179	240516	0.2724
1987	20699780	944231	248653	0.2840
1988	9864868	1015054	255734	0.2464
1989	15199737	943707	275501	0.3055
1990	19080818	859572	228572	0.2643
1991	15083874	814420	197676	0.2620
1992	17082376	849193	189781	0.2330
1993	15595961	790635	209094	0.2695
1994	12917901	784857	218260	0.3130
1995	18707596	671108	188181	0.3138
1996	15302025	578652	162578	0.3221
1997	8408537	534446	160002	0.3921
1998	15019580	459148	185780	0.4358
1999	7339230	387855	145922	0.3909
2000	15730943	377248	175646	0.4835
2001	12668111	368023	148404	0.4253
Average	18636598	958439	243451	0.2821

g

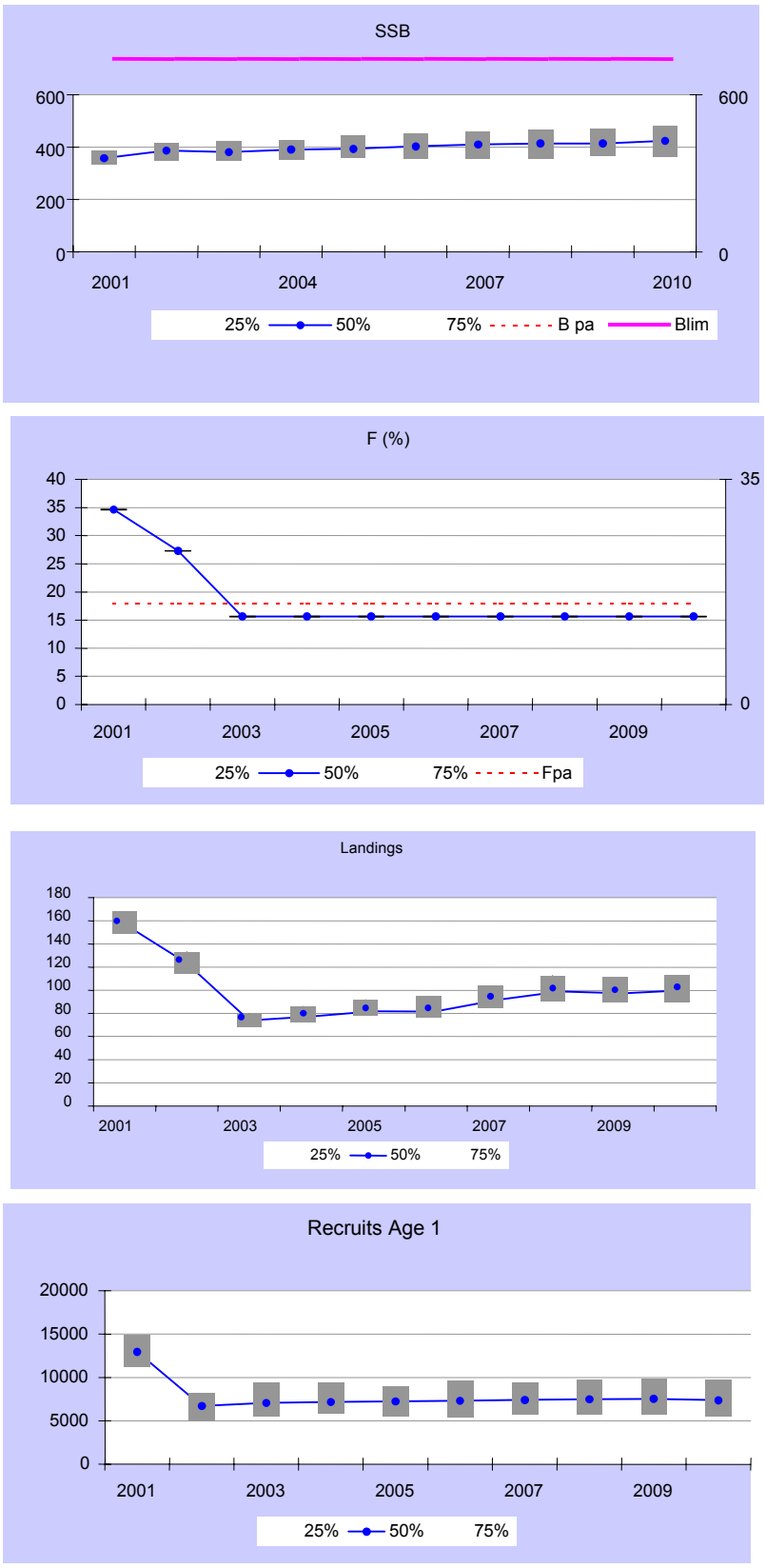


Figure 3.14.4.a.1 Herring in 25-29, 32 excl. GoRiga. Medium-term projections assuming $\mathbf{F_{pa}}$ from 2003

3.14.4.b Herring in the Gulf of Riga

State of stock/exploitation: The stock is within safe biological limits. SSB and recruitment have been high since 1990, with the exception of the 1996 year class. Fishing mortality was below $\mathbf{F}_{pa}$ during the 1990s, except for 1997–1998.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the precautionary criteria, F should be less than the $\mathbf{F}_{pa}$ and spawning stock biomass should be maintained above the $\mathbf{B}_{pa}$.

Precautionary Approach reference points (proposed in 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 36 500 t	$\mathbf{B}_{pa}$ be set at 50 000 t
$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ be set at 0.4

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{pa}$/exp (1.65*0.2)	$\mathbf{B}_{pa}$: = MBAL=50 000 t
$\mathbf{F}_{lim}$: not defined	$\mathbf{F}_{pa}$: from medium-term projections

Advice on management: ICES recommends that fishing mortality should be kept below $\mathbf{F}_{pa}$, corresponding to catches of less than 41 000 t.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999-2001) = 0.28; Landings(2002) = 31 ; SSB(2002) = 121.

F (2003)	Basis	SSB (2003)	Catch (2003)	SSB (2004)	Medium-term effect of fishing at given level
0.23	0.8*$\mathbf{F}_{sq}$	129	25.2	125	Slow increase of SSB
0.28	$\mathbf{F}_{sq}$	128	31.0	119	Stable SSB
0.34	1.2* $\mathbf{F}_{sq}$	125	36.1	113	Stable SSB
0.39	1.4*$\mathbf{F}_{sq}$($\mathbf{F}_{pa}$)	124	41.0	107	Slow decrease of SSB
0.45	1.6*$\mathbf{F}_{sq}$	123	46.0	102	Decrease of SSB

Weights in '000 t.
Shaded scenarios considered inconsistent with the precautionary approach

Relevant factors to be considered in management: Management measures for Gulf of Riga herring should take into account that approximately 7% of the herring is taken outside the Gulf of Riga and approximately 12% of the catches in the Gulf of Riga consist open-sea herring from the Main Basin. In 2001 the catch of open-sea herring in the Gulf of Riga was approximately 3 000 t.

Comparison with previous assessment and advice: The present assessment gives 4% higher estimates of SSB(2000) and 3% lower estimate of F(2000) than last year's assessment.

Elaboration and special comment: Herring catches in the Gulf of Riga include both Gulf herring and open-sea herring, which enter the Gulf of Riga from April to June for spawning. The herring in the Gulf of Riga is fished by Estonia and Latvia. The structure of the fishery has remained unchanged in recent decades: approximately 70% of the catches are taken by the trawl fishery and 30% by the trapnet fishery on the spawning grounds.

Analytical assessment is based on catch data and trapnet CPUE series. Gulf of Riga herring is separated in the landings by means of otolith structure.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15-24 April 2002 (ICES CM 2002/ACFM:17).

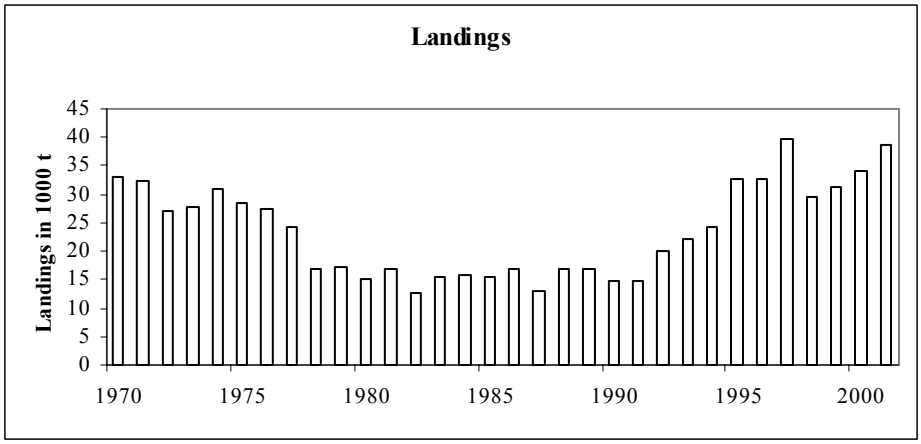
Yield and spawning biomass per Recruit F-reference points:

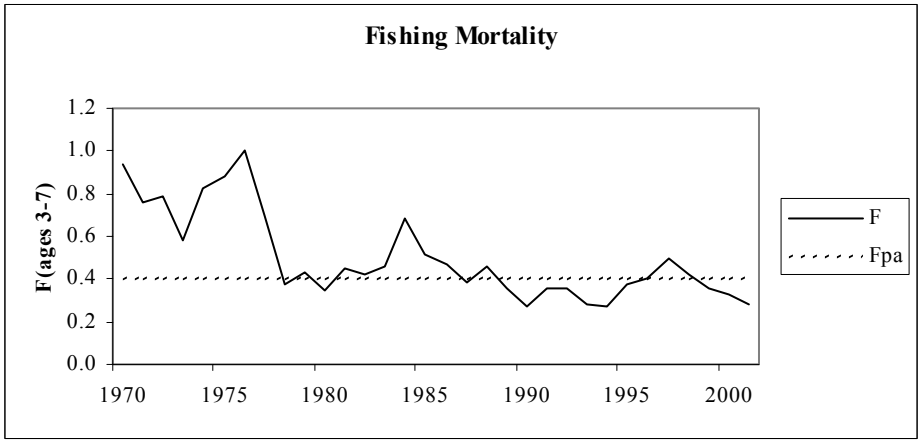
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.323	0.010	0.035
$\mathbf{F}_{max}$	1.548	0.012	0.008
$\mathbf{F}_{0.1}$	0.265	0.009	0.040
$\mathbf{F}_{med}$	0.377	0.010	0.032

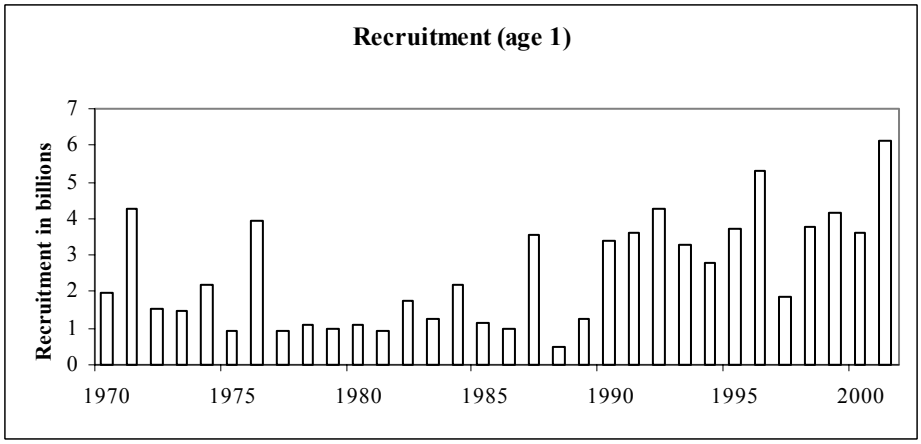
Catch data (Tables 3.14.4.b.1-3):

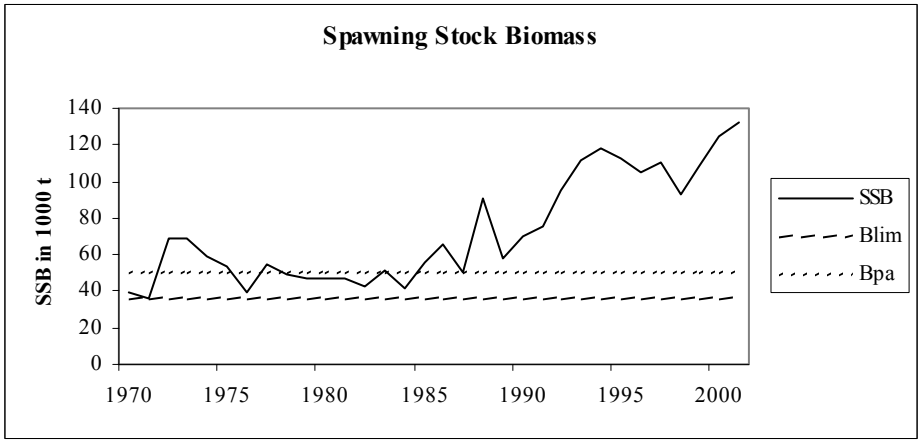
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{0.1}$	8	-	13
1988	Reduce F towards $\mathbf{F}_{0.1}$	6	-	17
1989	F should not exceed present level	20	-	17
1990	F should not exceed present level	20	-	15
1991	No separate advice for this stock	-	-	15
1992	No separate advice for this stock	-	-	20
1993	No separate advice for this stock	-	-	22
1994	No separate advice for this stock	-	-	24
1995	No separate advice for this stock	-	-	33
1996	No separate advice for this stock	-	-	33
1997	Current exploitation rate within safe biological limits	35	-	40
1998	Current exploitation rate within safe biological limits	35	-	29
1999	Current exploitation rate within safe biological limits	34	-	31
2000	Current exploitation rate within safe biological limits	37	-	34
2001	Current exploitation rate within safe biological limits	34.1	-	39
2002	Current exploitation rate within safe biological limits	33.2	-	
2003	$F=\mathbf{F}_{pa}$	41		

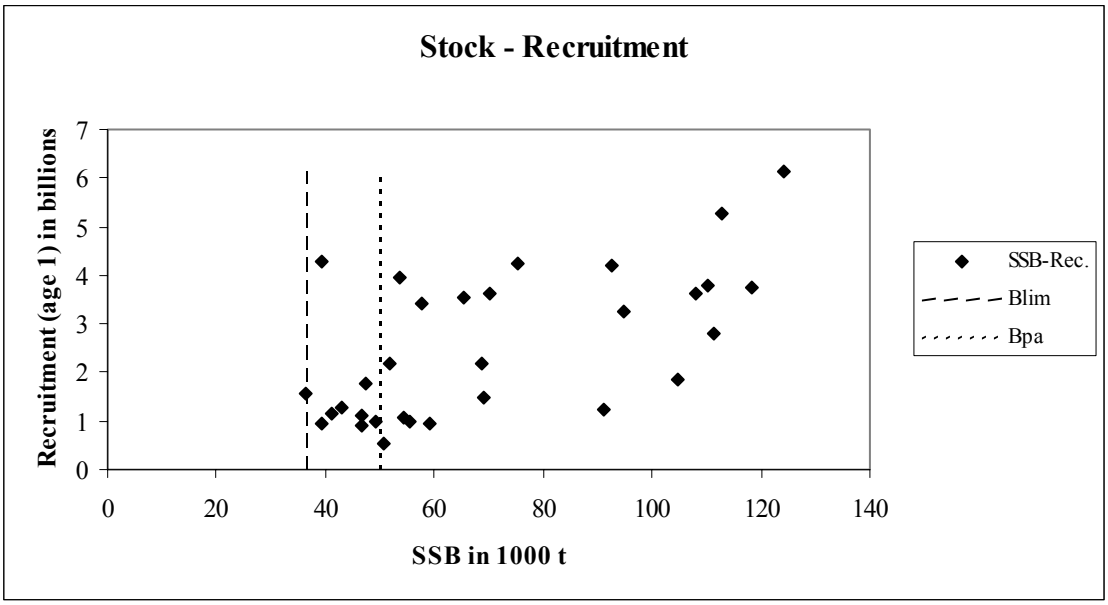
Weights in '000 t.

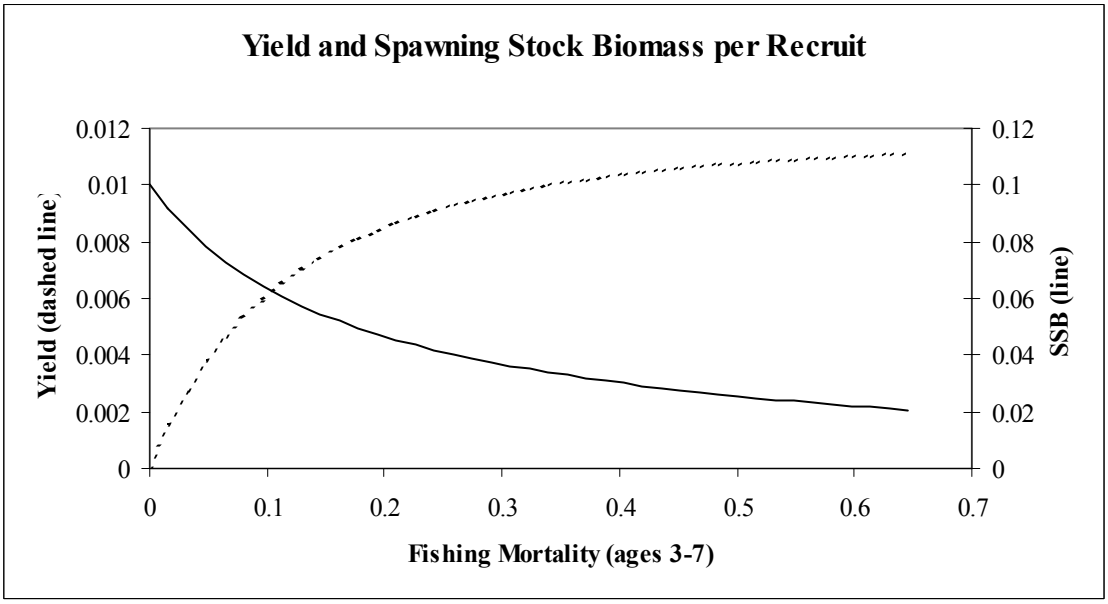

Landings
Landings in 1000 t
0
5
10
15
20
25
30
35
40
45
1970
1975
1980
1985
1990
1995
2000


Fishing Mortality
F(ages 3-7)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1970
1975
1980
1985
1990
1995
2000
F
Fpa


Recruitment (age 1)
Recruitment in billions
0
1
2
3
4
5
6
7
1970
1975
1980
1985
1990
1995
2000


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
140
1970
1975
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
0
1
2
3
4
5
6
7
0
20
40
60
80
100
120
140
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0
0.002
0.004
0.006
0.008
0.01
0.012
SSB (line)
0
0.02
0.04
0.06
0.08
0.1
0.12
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 3-7)

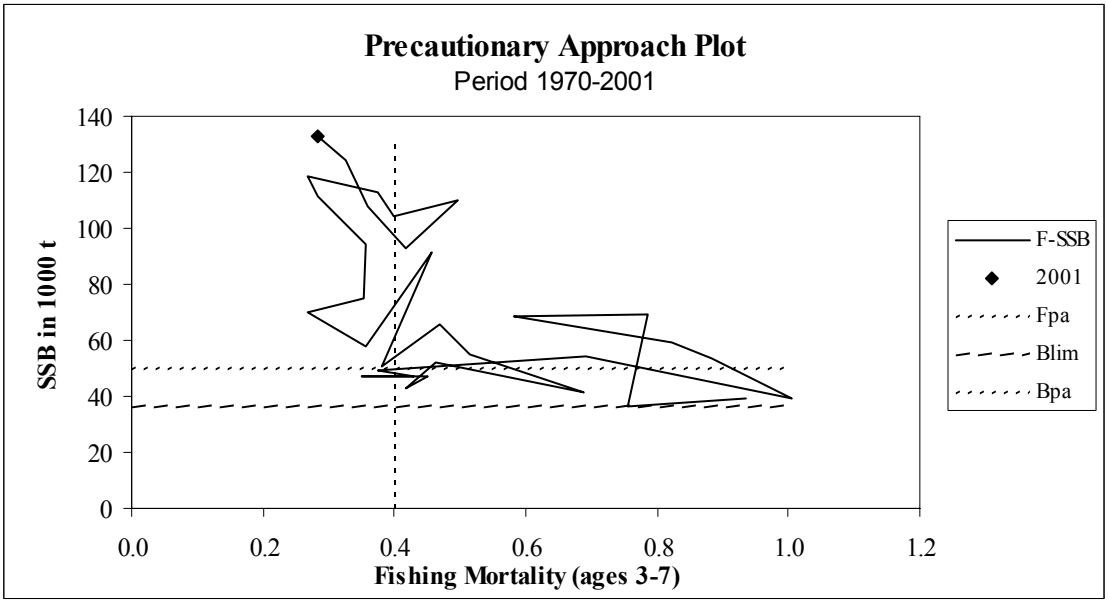

Precautionary Approach Plot
Period 1970-2001
SSB in 1000 t
0
20
40
60
80
100
120
140
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 3-7)
F-SSB
2001
Fpa
Blim
Bpa

Table 3.14.4.b.1 Herring catches in the Gulf of Riga by population and catches of Gulf of Riga herring outside the Gulf of Riga in the Latvian economical zone (Subdivision 28). The catch data corresponds to the official reported data until 1992 included. Data from 1993 onwards are scientific best estimates and differ from the officially reported catches. All catches in '000 t.

Year	Total catch in the Gulf of Riga	Total catch of the Gulf of Riga herring	Catch of Gulf of Riga herring in the Gulf of Riga	Catch of Gulf of Riga herring outside the Gulf of Riga*	Catch of Open sea herring in the Gulf of Riga
1976	31.9	27.4	27.4		4.5
1977	26.6	24.2	24.2		2.4
1978	23.0	16.7	16.7		6.3
1979	21.8	17.1	17.1		4.7
1980	20.7	15.0	15.0		5.7
1981	22.7	16.8	16.8		5.9
1982	17.5	12.8	12.8		4.7
1983	20.3	15.5	15.5		4.8
1984	19.6	15.8	15.8		3.8
1985	20.2	15.6	15.6		4.6
1986	18.2	16.9	16.9		1.3
1987	17.7	12.9	12.9		4.8
1988	19.8	16.8	16.8		3.0
1989	22.7	16.8	16.8		5.9
1990	20.8	14.8	14.8		6.0
1991	20.8	14.7	14.7		6.1
1992	23.9	21.5	20.2	1.3	3.8
1993	26.5	23.5	22.3	1.2	4.3
1994	27.2	24.3	22.2	2.1	5.0
1995	36.4	32.7	30.3	2.4	6.1
1996	32.7	32.6	28.3	4.3	4.4
1997	41.2	39.8	36.9	2.9	4.3
1998	30.7	29.4	26.6	2.8	4.1
1999	33.8	31.4	29.5	1.9	4.3
2000	37.4	34.1	32.9	1.2	4.5
2001	40.5	38.8	37.6	1.2	2.9

* Landings of the Gulf of Riga herring outside the Gulf were negligible and not estimated before 1992.

Table 3.14.4.b.2 Total catches (t) of herring in the Gulf of Riga by country (official statistics).

Year	Estonia	Latvia	Total
1991	7420	13481	20901
1992	9742	14204	23946
1993	9537	13554	23091
1994	9636	14050	23686
1995	16008	17016	33024
1996	11788	17362	29150
1997	15819	21116	36935
1998	11313	16125	27438
1999	10245	20511	30756
2000	12514	21624	34138
2001	14311	22775	37086

Table 3.14.4.b.3 Gulf of Riga Herring.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1970	1983435	39488	33196	0.9345
1971	4282819	36328	32178	0.7561
1972	1553087	68934	27145	0.7857
1973	1484788	68607	27895	0.5826
1974	2173737	59327	30850	0.8225
1975	926694	53830	28523	0.8826
1976	3937407	39317	27422	1.0036
1977	943528	54548	24186	0.6899
1978	1077902	49388	16728	0.3748
1979	980827	46788	17142	0.4304
1980	1112491	46822	14998	0.3491
1981	916628	47368	16769	0.4509
1982	1752200	43159	12777	0.4176
1983	1273872	51917	15541	0.4637
1984	2195633	41092	15843	0.6888
1985	1172161	55308	15575	0.5143
1986	1007459	65358	16927	0.4705
1987	3532145	50817	12884	0.3799
1988	517057	91136	16791	0.4555
1989	1240577	57724	16783	0.3558
1990	3416619	70004	14931	0.2689
1991	3610404	75195	14791	0.3526
1992	4243930	94638	20000	0.3552
1993	3259439	111515	22200	0.2844
1994	2801310	118341	24300	0.2691
1995	3735211	112681	32656	0.3738
1996	5287380	104588	32584	0.3994
1997	1837661	110332	39843	0.4955
1998	3771040	92651	29443	0.4176
1999	4181828	108032	31403	0.3609
2000	3614071	124245	34069	0.3246
2001	6130414	132587	38785	0.2834
Average	2498555	72565	23599	0.4998

3.14.4.c Herring in Subdivisions 25–29 (including Gulf of Riga herring) and 32

State of stock/exploitation: The combined spawning biomass in these areas has continued to decrease and is close to the historic low. The fishing mortality increased throughout the late 1990s.

Management objectives: There are no explicit management objectives for these herring.

Catch forecast for 2003:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1999–2001) = 0.44**,** Landings(2002) = 182, SSB(2002) = 425.

F(2003)	Basis	SSB(2003)	Landings (2003)	SSB (2004)
0	0 * $\mathbf{F}_{sq}$	491	0	665
0.09	0.2 * $\mathbf{F}_{sq}$	478	42	609
0.13	0.3 * $\mathbf{F}_{sq}$	472	62	584
0.18	0.4* $\mathbf{F}_{sq}$	466	81	559
0.22	0.5 * $\mathbf{F}_{sq}$	460	100	536
0.26	0.6 * $\mathbf{F}_{sq}$	454	118	513
0.35	0.8 * $\mathbf{F}_{sq}$	443	153	472
0.44	1.0 * $\mathbf{F}_{sq}$	432	185	434

Weights in '000 t.

Comparison with previous assessment and advice: The present assessment gives about 3% lower estimates of SSB(2001) and 1% higher fishing mortality for 2000 than last year's assessment.

Elaboration and special comment: The assessment is uncertain, due to the complexity of the stock structure and the uncertain split between herring and sprat in most pelagic fisheries in the area.

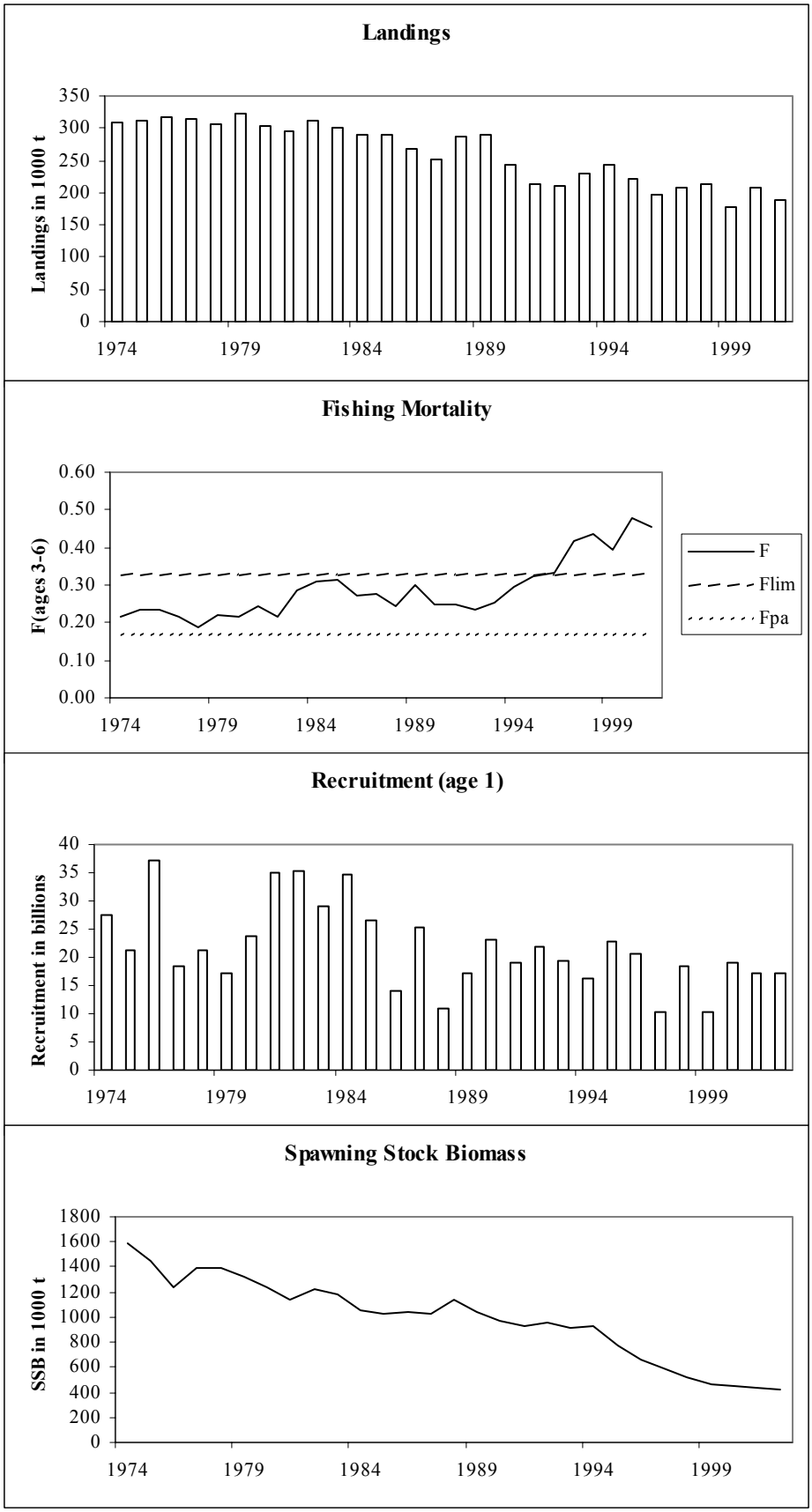

Landings
Landings in 1000 t
350
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999
Fishing Mortality
F(ages 3-6)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
F
Flim
Fpa
Recruitment (age 1)
Recruitment in billions
40
35
30
25
20
15
10
5
0
Spawning Stock Biomass
SSB in 1000 t
1800
1600
1400
1200
1000
800
600
400
200
0

Table 3.14.4.c.1 Herring in Subdivisions 25 to 29 and 32 plus Gulf of Riga.

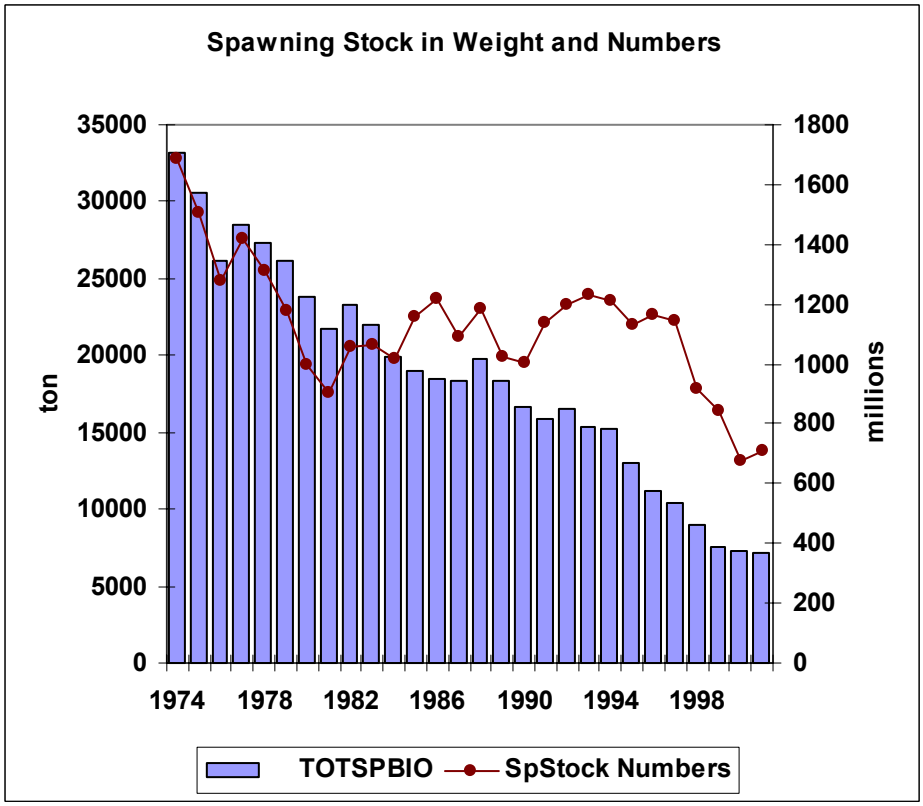
Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1974	27383982	1586486	310000	0.2149
1975	21372180	1453671	313000	0.2363
1976	37112264	1243231	318000	0.2357
1977	18290166	1386430	314000	0.2160
1978	21295118	1391947	305000	0.1860
1979	17124404	1324719	323000	0.2207
1980	23788634	1240449	304000	0.2149
1981	34896916	1140344	294000	0.2432
1982	35410124	1222342	311000	0.2153
1983	29098356	1187938	302000	0.2836
1984	34698268	1055205	290000	0.3077
1985	26654396	1033082	290000	0.3149
1986	14004717	1036510	268000	0.2712
1987	25351026	1029799	252000	0.2774
1988	11092530	1135061	286000	0.2450
1989	17157618	1034475	290000	0.2979
1990	23020378	974983	244000	0.2490
1991	19064116	924571	213000	0.2479
1992	21764566	961744	210000	0.2332
1993	19322722	910375	231000	0.2514
1994	16296616	927017	244000	0.2944
1995	22915582	772342	221000	0.3237
1996	20525910	659632	196113	0.3347
1997	10295328	587281	207770	0.4160
1998	18434040	522147	214560	0.4354
1999	10246587	462357	178302	0.3929
2000	19006386	448379	207913	0.4767
2001	17308484	431142	187730	0.4544
2002	17309000	424880		0.4413
Average	21732428	983053	261621	0.2942

3.14.4.d Comparison between the Assessments

In order to illustrate the degree of consistency in the way that the separate assessments have been performed comparisons were made between the result from the whole area (Subdivisions 25-29, 32) and the sum of the results from Subdivisions 25-29 and 32 (Gulf of Riga excluded) and Gulf of Riga. The agreement between the sum of the parts and the whole is generally good for total stock biomass, average weight in the stock, spawning stock biomass, yield/SSB, and fishing mortality. However, differences are apparent in the numbers of recruits estimated in the earlier assessment years where the sum is smaller than the result from the whole area. The trends in stock development are similar for the two larger stock units where there is a declining trend, whilst the Gulf of Riga exhibits an increasing trend. Fishing mortalities in the earlier years of the assessment are higher in the Gulf of Riga than for the whole area; whilst for the most recent years they are lower.

SSB has steadily decreased in the stock complex for the time period for which an assessment is available. This is due to decreasing mean weight for a given age and in the latter part of the period also a decrease in the recruitment in numbers. The decrease in mean weights is partly because the stock centre shifted towards the north where herring have always been smaller than in more southerly areas, and partly because there was a direct decrease in growth rate. Figure 3.14.4.d.1 shows SSB in weight and in numbers. At the start of the period of decline it was the biomass that decreased while the number of fish was rather constant. In the latter part of the period the number of fish in the SSB also decreased. Figure 3.14.4.d.2 shows that mean age in the population has remained constant while the overall mean weight has decreased.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15–24 April 2002 (ICES CM 2002/ACFM:17).



3.14.5 Herring in Subdivision 30, Bothnian Sea

State of stock/exploitation: The stock is harvested outside safe biological limits. The spawning stock biomass has been high since the early 1990s, and is presently above $\mathbf{B}_{pa}$. The fishing mortality has increased since 1993, being above $\mathbf{F}_{pa}$ since 1997. The 1997, 1999, and 2000 year classes have been well above the long-term average.

Management objectives: There are no explicit management objectives for this stock. However, for any management objective to meet the precautionary criteria, F should be less than the $\mathbf{F}_{pa}$ and the spawning stock biomass should be maintained above the $\mathbf{B}_{pa}$.

Precautionary Approach reference points (unchanged since 2000):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 145 000 t	$\mathbf{B}_{pa}$ be set at 200 000 t
$\mathbf{F}_{lim}$ is 0.30	$\mathbf{F}_{pa}$ be set at 0.21

Technical basis:

$\mathbf{B}_{lim}$: spawning stock biomass, where probability of lower recruitment increases	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *exp(1.645*0.2)
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$

Catch forecasts and advice on management for 2002, recommended by ICES in June 2001 and in March 2002:

Advice on management in June 2001: ICES recommends to reduce the fishing mortality to no more than $\mathbf{F}_{pa,}$ corresponding to landings of less than 39 500 t in 2002.

Advice on management in March 2002: The updated catch forecast suggests that the TAC for 2002 corresponding to $\mathbf{F}_{pa}$ is revised upwards from 39 500 t to 53 000 t. ICES maintains its advice to restrict fishing mortality to no more than $\mathbf{F}_{pa}$[=0.21].

The revised advice is based on the catch forecast and information supplied to ACFM in January 2002.

Advice on management for 2003: ICES recommends to reduce the fishing mortality to or below $\mathbf{F}_{pa}$, corresponding to landings of 50 000 t or less in 2003.

This advice is based on the catch forecast and information supplied to ACFM in May 2002:

Catch forecast for 2003:

Basis: F(2002) = F(1999–2001)= 0.24, Landings(2002) = 56, SSB(2002) = 258.

F(2002)	Basis	SSB(2003)	Landings (2003)	SSB (2004)	Medium-term effects of fishing at a given level
0.00	No fishing	260	0	298	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.19	0.8*F(99–01)	253	45	247	Stable SSB
0.21	$\mathbf{F}_{pa}$=0.90*F(99-01)	252	50	242	Slowly decreasing SSB
0.24	$\mathbf{F}_{sq}$=1.00*F(99-01)	251	55	236	High probability of SSB will fall below $\mathbf{B}_{pa}$
0.26	1.1.*F(99–01)	250	60	231	High probability of SSB will fall below $\mathbf{B}_{pa}$
0.30	$\mathbf{F}_{lim}$=1.30*F(99–01)	249	69	221	High probability of SSB will fall below $\mathbf{B}_{pa}$

Weights in '000 t.
Shaded scenario considered inconsistent with the precautionary approach.

Relevant factors to be considered in management: This stock is part of the IBSFC management unit 3. The exploitation of the stock has increased in the 1990s, and according to medium-term projections (see figures below) the present fishing mortality is not sustainable. A reduction in fishing mortality to or below $\mathbf{F}_{pa}$ will give a high probability of keeping the spawning stock biomass above $\mathbf{B}_{pa}$.

Medium-term projections: Medium-term projections were calculated for a 10-year period. With the present fishing mortality (F = 0.24) there is a high probability that the stock will fall below $\mathbf{B}_{pa}$ in the medium-term and thus the present fishing mortality is not sustainable. With a reduction of 12 % to $\mathbf{F}_{pa}$ = 0.21, there is a high probability that the stock will stay above $\mathbf{B}_{pa}$ and catches will stay around 45 000 t in the medium-term.

Comparison with previous assessment and advice: This year's assessment gives about 17% higher estimates of spawning stock biomass (2000) than last years assessment and about 17 % decrease in fishing mortality compared to the 2001 assessment. This is largely due to revisions of the CPUE and catch data for 2000. The January 2002 assessment only used revised data up to and including 2000. The new assessment also included data for 2001. Compared to the January 2002 assessment the change in SSB(2000) is +5 % and +2 % in fishing mortality.

Elaboration and special comment: On average 90% of the total catch is taken by trawl fishery. Trapnet fishery is of minor importance. In the trawl fishery more effective and larger trawls have been introduced in the 1990s.

Source of information: Report of the Baltic Fisheries Assessment Working Group, April 2002 (ICES CM 2002/ACFM:17).

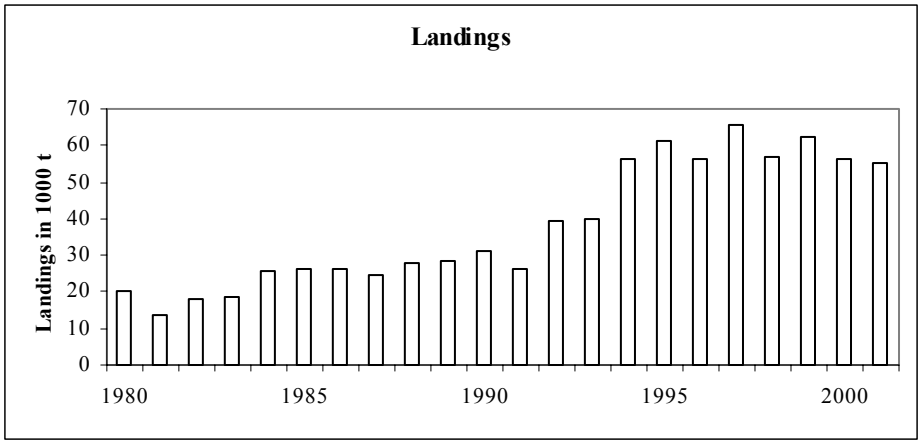
Yield and spawning biomass per Recruit F-reference points:

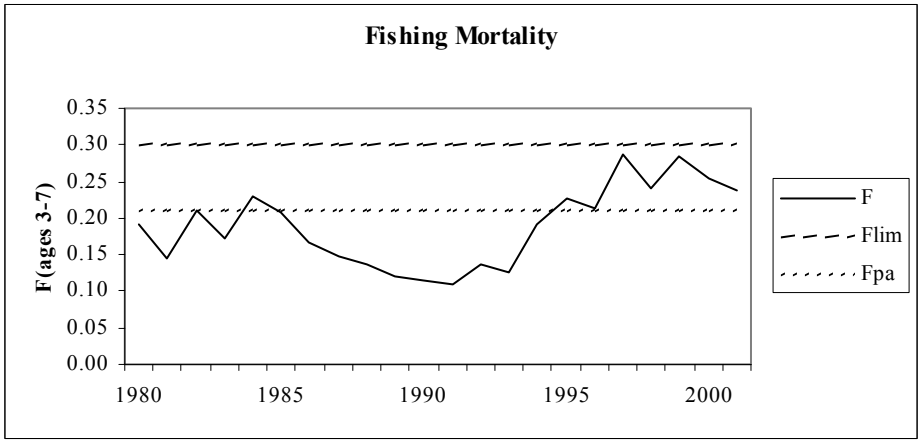
	Fish Mort Ages 3-7	Yield/R	SSB/R
Average Current	0.237	0.012	0.054
$\mathbf{F}_{max}$	0.546	0.013	0.029
$\mathbf{F}_{0.1}$	0.173	0.011	0.065
$\mathbf{F}_{med}$	0.222	0.012	0.056

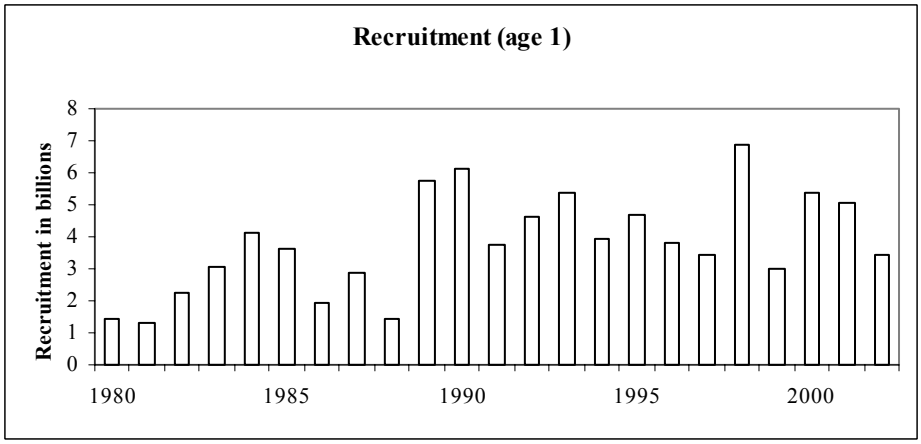
Catch data (Tables 3.14.5.1–2):

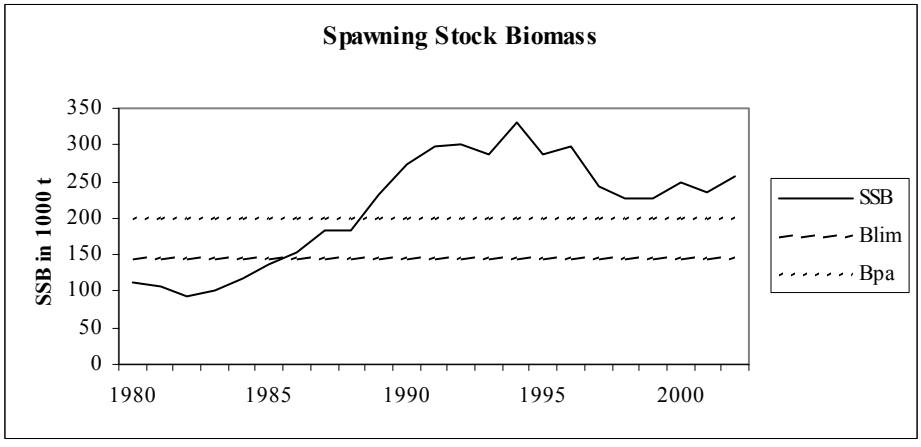
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[2]	ACFM Catch
1987				25
1988				28
1989				29
1990				31
1991	TAC for eastern part of SD, allowance for western part	32+	84	26
1992	*Status quo* F	39	84	39
1993	*Status quo* F	39	90	40
1994	No specific advice	41[1]	90	56
1995	TAC	73	110	61
1996	TAC	73	110	56
1997	F(97) = 1.4 * F(95)	78	110	61
1998	*Status quo* F	50	110	57
1999	Reduce catches	-	94	62
2000	Reduce catches	-	85	61
2001	$\mathbf{F}_{pa}$ = 0.21	36	72	55
2002	F below $\mathbf{F}_{pa}$	53	60	
2003	F below $\mathbf{F}_{pa}$	50		

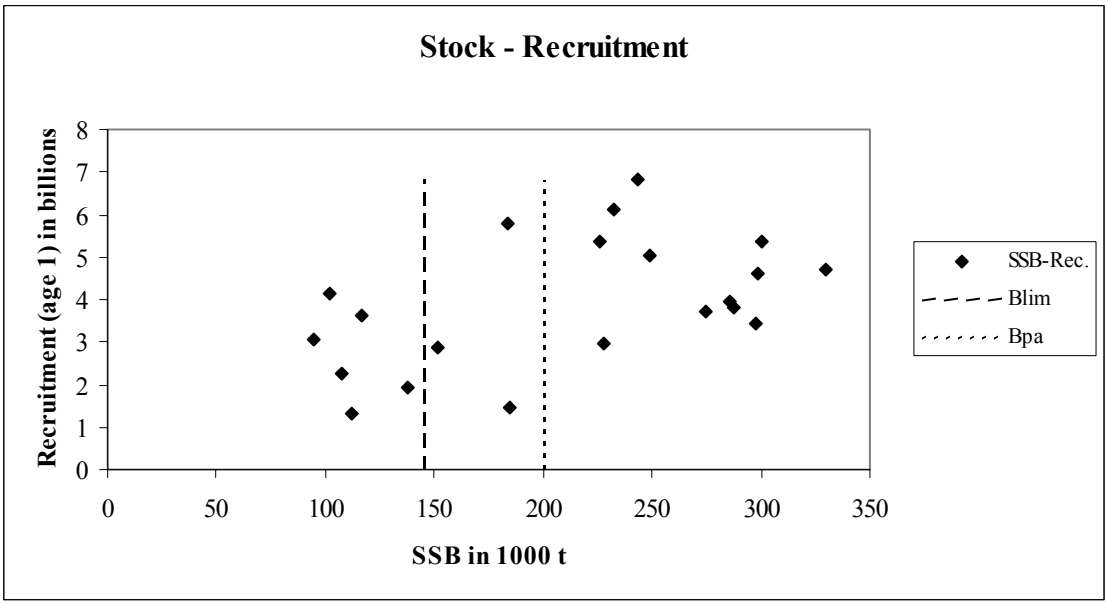
[1]Catch at F_{01}. [2]TAC for the area 29N, 30, 31, Management Unit 3. Weights in '000 t

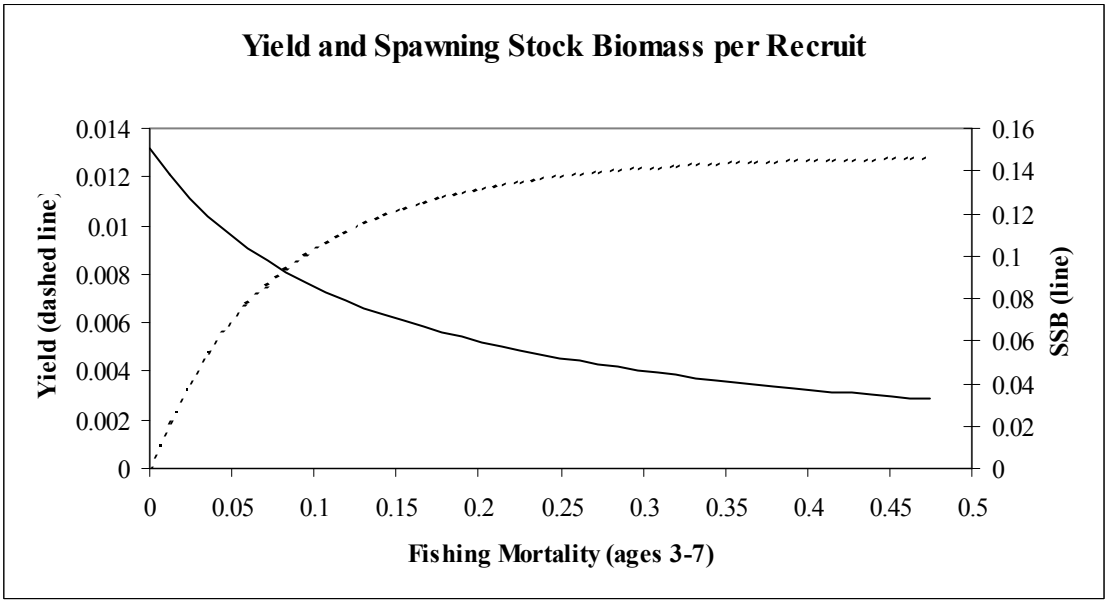

Landings
Landings in 1000 t
70
60
50
40
30
20
10
0
1980
1985
1990
1995
2000

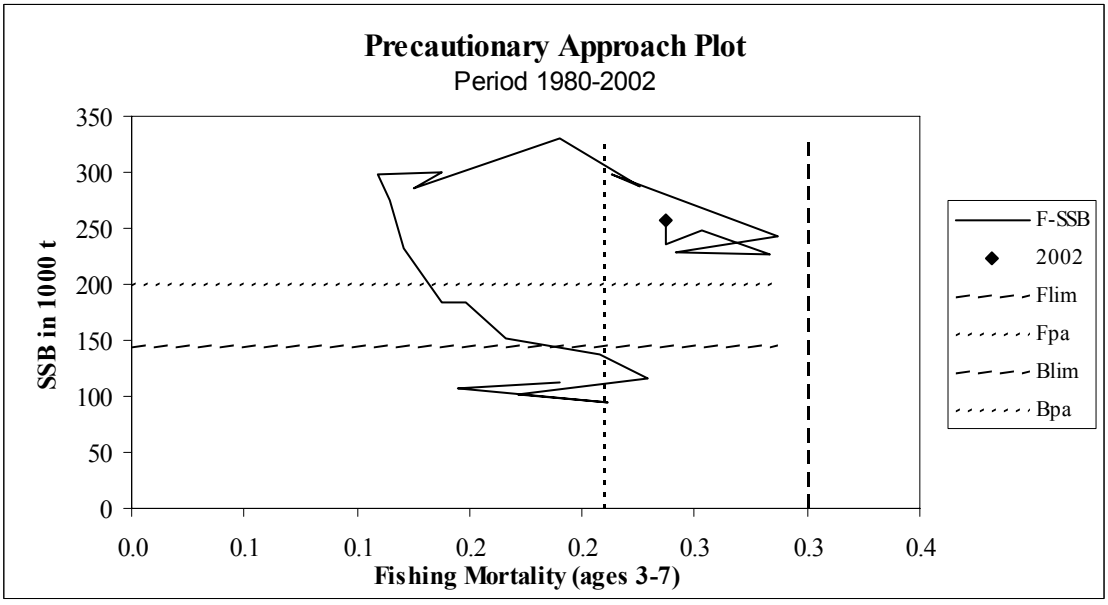

Fishing Mortality
F(ages 3-7)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1980
1985
1990
1995
2000
F
Flim
Fpa


Recruitment (age 1)
Recruitment in billions
8
7
6
5
4
3
2
1
0
1980
1985
1990
1995
2000

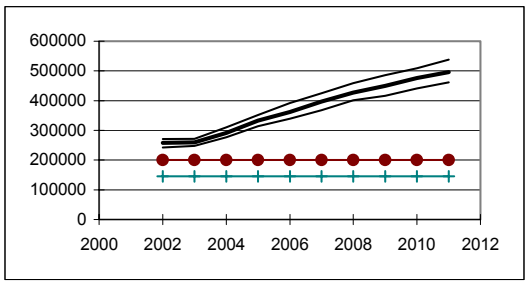

Spawning Stock Biomass
SSB in 1000 t
350
300
250
200
150
100
50
0
1980
1985
1990
1995
2000
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 3-7)


Precautionary Approach Plot
Period 1980-2002
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

F=0.1



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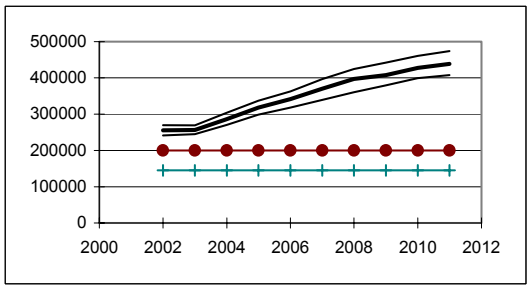

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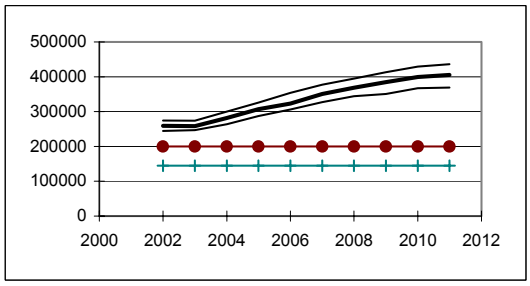
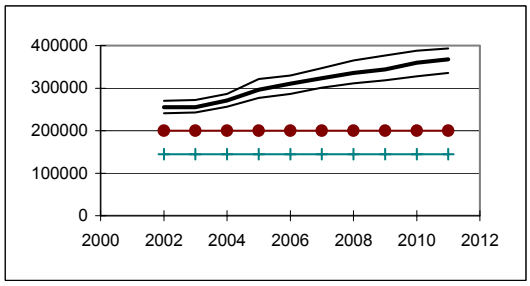
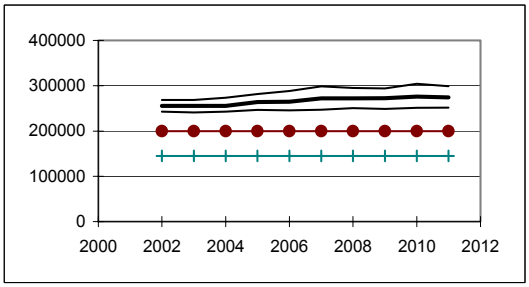


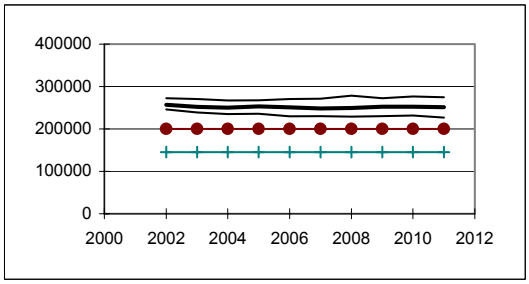
F=0.4



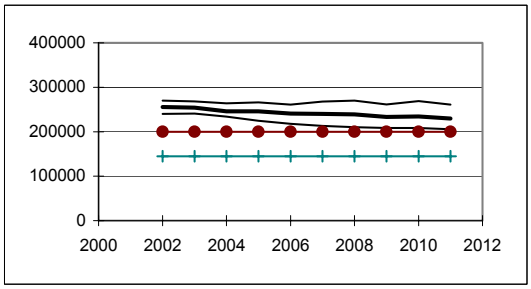
F=0.7



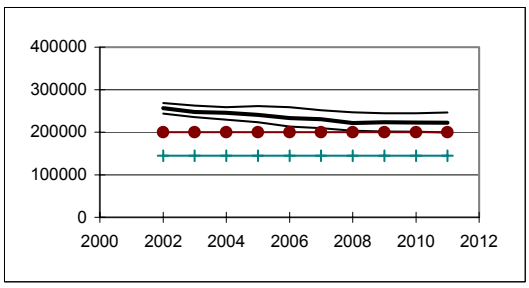
F=0.8



F=0.885 (Proposed Fpa = 0.21)



F=0.9



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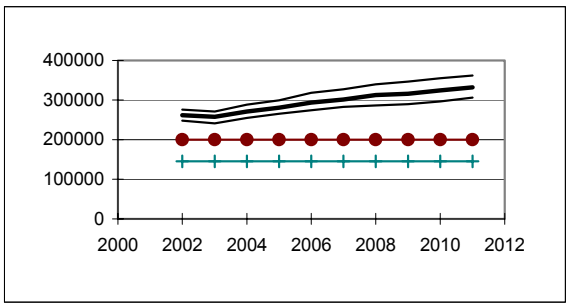
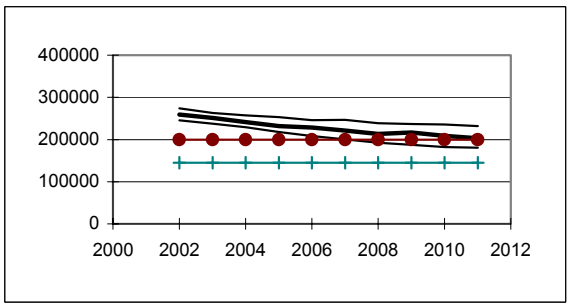
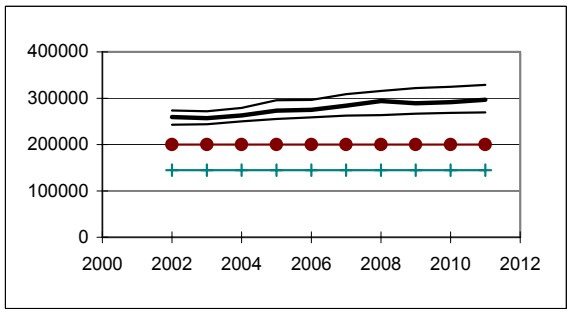


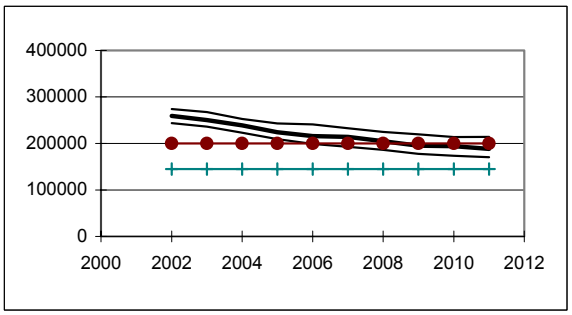
F=1.0 (Present situation, F = 0.237)



F=.0.6



F=1.1



F=1.265 (Proposed Flim = 0.30)

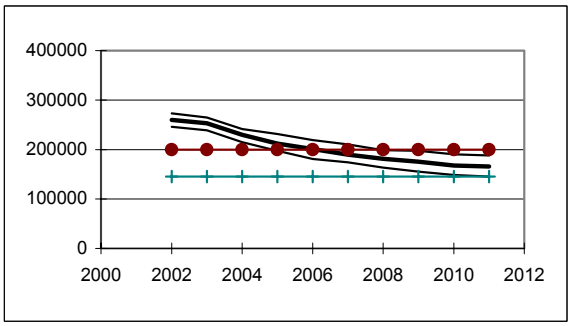


Table 3.14.5.1 Herring catches in Subdivision 30 (tonnes).

Year	Finland	Sweden	Total
1971	24,284	5,100	29,384
1972	24,027	5,700	29,727
1973	20,027	6,944	26,971
1974	17,597	6,321	23,918
1975	13,567	6,000	19,567
1976	19,315	4,455	23,770
1977	22,694	3,610	26,304
1978	22,215	2,890	25,105
1979	17,459	1,590	19,049
1980	18,758	1,392	20,150
1981	12,410	1,290	13,700
1982	16,117	1,730	17,847
1983	16,104	2,397	18,501
1984	23,228	2,401	25,629
1985	24,235	1,885	26,120
1986	23,988	2,501	26,489
1987	22,615	1,905	24,520
1988	24,478	3,172	27,650
1989	25,453	3,205	28,658
1990	28,815	2,467	31,282
1991	23,219	3,000	26,219
1992	35,610	3,700	39,310
1993	36,600	3,579	40,179
1994	53,860	2,520	56,380
1995	58,806	2,280	61,086
1996	54,372	1,737	56,109
1997	63,532	1,995	65,527
1998	54,115	2,777	56,892
1999	60,483	1,862	62,345
2000	54,886	1,374	56,261
2001*	52,987	1,997	54,984

* Preliminary.

Table 3.14.5.2 Herring in Subdivision 30, Bothnian Sea

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1980	1431119	112350	20150	0.1902
1981	1327299	107833	13700	0.1449
1982	2242894	94268	17847	0.2115
1983	3040281	101846	18501	0.1716
1984	4155972	116729	25629	0.2292
1985	3605147	138010	26120	0.2075
1986	1943887	151849	26489	0.1665
1987	2867795	184551	24520	0.1480
1988	1438384	183738	27650	0.1379
1989	5775958	232589	28658	0.1212
1990	6104184	274529	31282	0.1144
1991	3733040	298139	26219	0.1096
1992	4624036	300055	39310	0.1377
1993	5356150	285834	40179	0.1250
1994	3930684	329729	56380	0.1903
1995	4702399	287699	61086	0.2257
1996	3828827	297783	56109	0.2130
1997	3447903	243496	65527	0.2873
1998	6845491	228110	56892	0.2419
1999	2980171	226244	62345	0.2834
2000	5383043	248962	56261	0.2535
2001	5039921	235264	54984	0.2372
2002	3451343	257953		0.2372
Average	3793736	214677	37993	0.1906

Herring in Subdivision 30 (Bothnia Sea)

The Finnish Delegate to the same DG Fish meeting indicated that the catch in 2002 from this herring stock would be lower than the 56 000 tons on which ACFM has based its projections; they considered that a catch of 46 000 tons would be realistic. This downward adjustment was considered as the result of a closure of this fisheries in the summer months. A catch of 10 000 tons less than expected will increase the predicted catch in 2003 by approximately 2 000 tons and the expected SSB (2004) would increase by 7 000 tons if fishing at $\mathbf{F}_{pa}$ in 2003. The expected F(2002) will be lower at 0.19 (below $\mathbf{F}_{pa}$ (=0.21)) compared to the previously expected F(2002) of 0.24.

3.14.6 Herring in Subdivision 31, Bothnian Bay

State of stock/exploitation: The state of the stock is unknown, but the current assessment, although uncertain, indicates that the spawning stock biomass was high in the 1980s and has declined considerably since the mid-1990s to a very low level. Preliminary information suggests that year class 2000 is above average.

Management objectives: There are no explicit management objectives for this stock.

Precautionary Approach reference points: There are no Precautionary Reference points proposed for this stock.

Advice on management: ICES advises that the catch should not be allowed to increase above recent levels. This corresponds to catches of 3000 t in 2003.

Relevant factors to be considered in management: This stock is part of the IBSFC management unit 3. The herring TAC is set for IBSFC management unit 3, which includes Subdivisions 29N, 30, and 31.

Comparison with previous assessment and advice: Due to unreliable input data, this year's analytical assessment is considered exploratory only. Advice is based on CPUE series.

Elaboration and special comment: The main part of the total catch is taken by trawl fishery. Fluctuations in total trawl catches and the length of fishing seasons depend upon the onset of winter and ice cover in the autumn. Normally, the trawl fishing season starts in late April and stops for the spawning season in late May to July. Trawl fishery starts again in August/September. The ice cover usually appears in early November.

Recruitment is influenced not only by the size of the spawning stock, but to a large extent by the environmental conditions.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 - 24 April 2002 (ICES CM 2002/ACFM:17).

Catch data (Tables 3.14.6.1–2):

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch
1987		9		8.1
1988		13		8.8
1989		7		4.4
1990		9		7.8
1991	TAC for eastern part of SD, allowance for western part	9+		6.8
1992	*Status quo* F	8		6.5
1993	Increase in yield by increasing F	-		9.2
1994	Increase in yield by increasing F	-		5.8
1995	Increase in yield by increasing F	18.4		4.7
1996	Increase in yield by increasing F	18.4		5.2
1997	Increase in yield by increasing F	-		4.3
1998	Increase in yield by increasing F	-		5.6
1999	Increase in yield by increasing F	-		4.2
2000	Increase in yield by increasing F	-		2.5
2001	Exploitation rate should not be increased.	-		2.8
2002	Exploitation rate should be decreased	-		
2003	No increase in catches	3		

[1]TAC for the area 29N, 30, 31, Management Unit 3. Weights in ‘000 t.

Herring in Subdivision 31, Bothnian Bay

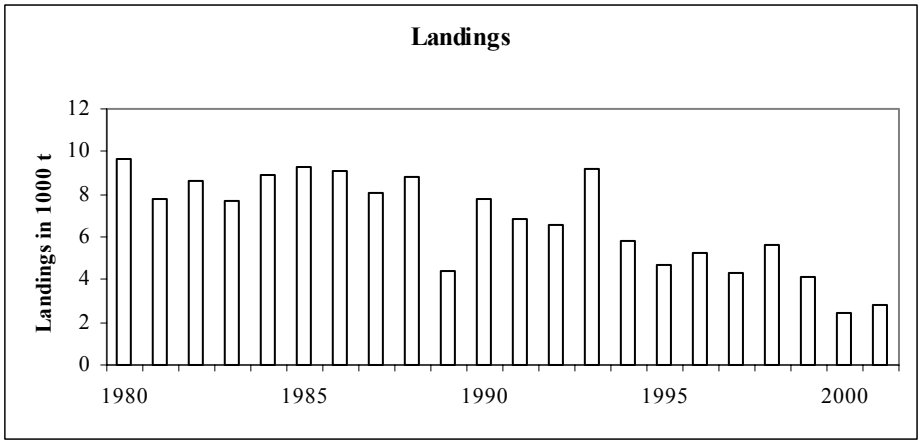


Table 3.14.6.1 Herring catches in Subdivision 31 (tonnes).

Year	Finland	Sweden	Total
1971	6,143	820	6,963
1972	3,550	770	4,320
1973	3,152	727	3,976
1974	5,737	665	6,482
1975	4,802	800	5,547
1976	7,763	750	8,508
1977	6,580	750	7,330
1978	9,068	700	9,768
1979	6,275	785	7,060
1980	8,899	760	9,659
1981	7,206	620	7,826
1982	7,982	670	8,652
1983	7,011	696	7,707
1984	8,322	594	8,916
1985	8,595	717	9,312
1986	8,754	336	9,090
1987	7,788	320	8,108
1988	8,501	267	8,768
1989	4,005	423	4,437
1990	7,603	295	7,818
1991	6,800	400	6,800
1992	6,900	400	6,540
1993	8,752	383	9,167
1994	5,195	411	5,825
1995	3,898	563	4,681
1996	5,080	114	5,249
1997	4,195	86	4,281
1998	5,358	224	5,582
1999	3,909	248	4,156
2000	2,479	113	2,592
2001*	2,755	67	2,821

* Preliminary.

Table 3.14.6.2 Herring in Subdivision 31, Bothnian Bay

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1980	789292	35327	9659	0.1740
1981	229612	32093	7826	0.2078
1982	169806	36716	8652	0.2331
1983	797531	31521	7707	0.2470
1984	553886	28773	8916	0.2311
1985	250989	31655	9312	0.2561
1986	217010	29929	9090	0.3562
1987	266634	26611	8108	0.3152
1988	91939	23898	8768	0.4003
1989	865780	19110	4437	0.2478
1990	386098	19430	7818	0.3264
1991	166079	22267	6800	0.2796
1992	256460	19503	6540	0.3421
1993	246069	17686	9167	0.5651
1994	143751	13164	5825	0.4413
1995	540155	10066	4681	0.4767
1996	365126	11355	5249	0.5244
1997	248972	10967	4281	0.5153
1998	182552	11857	5582	0.6591
1999	106147	9854	4153	0.7041
2000	663352	8514	2479	0.3161
2001	488187	11549	2821	0.2302
Average	364792	20993	6721	0.3659

3.14.7 Sprat in Subdivisions 22–32

State of stock/exploitation: The stock is within safe biological limits. SSB has decreased to 1 million t in 2002, and is slightly above the long-term average. In the most recent years the fishing mortality has almost doubled compared to the early 1990s and is close to $\mathbf{F}_{pa}$. The 1999 year class is estimated to be very strong, whereas the 2000 year class is estimated well below average. The 2001 year class is predicted to be below average.

Management objectives: In Resolution XIII, September 2000, the IBSFC agreed to implement a long-term management plan for sprat in the Baltic:

"The IBSFC agreed to implement a long-term management plan for the sprat stock which is consistent with a precautionary approach and designed to ensure a rational exploitation pattern and provide for stable and high yields. This plan shall consist of the following elements:

1. *Every effort shall be made to maintain a level of spawning stock biomass (SSB) greater than 200 000 t.*
2. *A long-term management plan, by which annual quotas shall be set for the fishery, reflecting a fishing mortality rate of 0.4 for relevant age groups as defined by ICES shall be implemented.*
3. *Should the SSB fall below a reference point of 275 000 t, the fishing mortality rate referred to under paragraph 2 will be adapted in the light of scientific estimates of the conditions then prevailing, to ensure safe and rapid recovery of the spawning stock biomass to levels in excess of 275 000 t.*
4. *The IBSFC shall, as appropriate, adjust management measures and elements of the plan on the basis of any new advice provided by ICES.*

A review of this arrangement shall take place not later than in the year 2003."

ICES considers that the agreed management plan is consistent with the precautionary approach, provided the reference points are used as upper bounds on F and lower bounds on SSB, and not as targets.

Precautionary Approach reference points (unchanged since 2000):

ICES considers that:	**ICES proposes that:**
$\mathbf{B}_{lim}$ is 200 000 t	$\mathbf{B}_{pa}$ be set at 275 000 t
$\mathbf{F}_{lim}$ is not yet defined	$\mathbf{F}_{pa}$ be set at 0.40

Technical basis:

$\mathbf{B}_{lim}$: MBAL	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$*1.38; some sources of uncertainty in assessment taken into account
$\mathbf{F}_{lim}$: –	$\mathbf{F}_{pa}$:~ average $\mathbf{F}_{med}$ in recent years, allowing for variable natural mortality

Advice on management: The fishing mortality in 2003 should remain below $\mathbf{F}_{pa}$ corresponding to catches of less than 300 000 t. Such a TAC will only be in accordance with the Precautionary Approach if accompanied with measures that ensure a low by-catch of herring(< 15 %) in the mixed pelagic fishery.

Relevant factors to be considered in management: Landings increased from 1983, reaching a record high in 1997, and decreased thereafter. The increase in landings since 1992 is due to the development of an industrial pelagic fishery.

Most sprat are taken in mixed pelagic fisheries together with herring. If the status of the Central Baltic herring (in Subdivisions 25–29 and 32 (excluding Gulf of Riga)) is the dominating concern then management should ensure that herring catches in the mixed pelagic fisheries do not contribute to an overexploitation. Because of the technological interaction between sprat and herring in the mixed pelagic fishery such concerns imply a sprat TAC lower than 300,000 t and/or effective restrictions on the herring by-catch in the mixed pelagic fishery. There are indications that herring at present constitute about 35 % of the catches in the mixed pelagic fishery. Therefore, a sprat catch as low as 200 000 t in the mixed pelagic fishery in 2003 may use all available herring in Subdivisions 22-29+32 (72 000 t + 42 000 t= 114 000 t), Gulf of Riga excluded. However, there are also important herring fisheries in these Subdivisions that take little sprat by-catch.

The strong 1997 and 1999 year classes will still contribute to the yield, constituting ca. 36% of catches in 2003. The future of the fishery will depend greatly on the strength of future recruiting year classes. At present the year classes of 2000-2001 are estimated or predicted as below the average. The fishing mortality this stock can sustain is dependent on natural mortality, which is linked to the abundance of cod. Strong recruitment and low predation in recent years contributed to the high SSB in the mid-1990s. If the cod stock is to recover a much lower exploitation rate on sprat is necessary.

Catch forecast for 2003:

Basis: TAC; Landings(2002) = 380; F(2002) = 0.40, $\mathbf{F}_{sq}$ = 0.33.

F (2003)	Basis	Landings (2003)	SSB (2003)	SSB (2004)	Medium-term effect of fishing at given level
0.20	0.6 $\mathbf{F}_{sq}$	158	907	1074	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.26	0.8 $\mathbf{F}_{sq}$	206	889	1014	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.33	1.0 $\mathbf{F}_{sq}$	252	871	958	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.36	1.1 $\mathbf{F}_{sq}$	274	862	931	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.39	1.2. $\mathbf{F}_{sq}$	295	853	905	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.40	$\mathbf{F}_{pa}$	300	855	899	High probability of SSB remaining above $\mathbf{B}_{pa}$
0.43	1.3 $\mathbf{F}_{sq}$	316	844	880	No medium projections for that F
0.46	1.4 $\mathbf{F}_{sq}$	337	836	856	No medium projections for that F

Weights in '000 t.

Shaded scenarios are considered to be inconsistent with the precautionary approach.

Medium- and long-term projections: The medians of spawning stock biomass under *status quo* fishing mortality tend to result in an equilibrium of about 870 000 t SSB (see figure below). Fisheries in 2005 and onwards will depend very heavily on the strengths of future recruitment.

Comparison with previous assessment and advice: This year's assessment gives about 30% higher estimates of spawning stock biomass for recent years than last year's assessment did, mostly as a result of applying new estimates of maturity-at-age. In terms of total stock biomass the difference is only 4%. The trend in stock development is similar in both assessments.

Elaboration and special comment: The assessment is based on catch data and acoustic surveys. Better sampling of industrial fisheries has improved the quality of the data input to the assessment.

Natural mortality is expected to vary over time as abundance of predators varies. Hence annual estimates of $\mathbf{F}_{med}$ are expected to continue to be variable, and multispecies interactions should be considered in setting precautionary reference points.

Sprat is fished with pelagic trawls during the first half and in the last few months of the year.

Source of information: Report of the Working Group on Baltic Fisheries Assessment, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

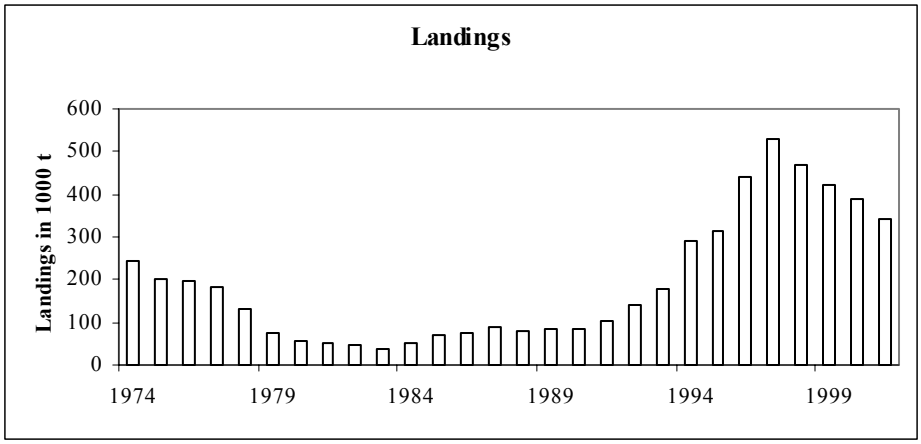
Yield and spawning biomass per Recruit F-reference points:

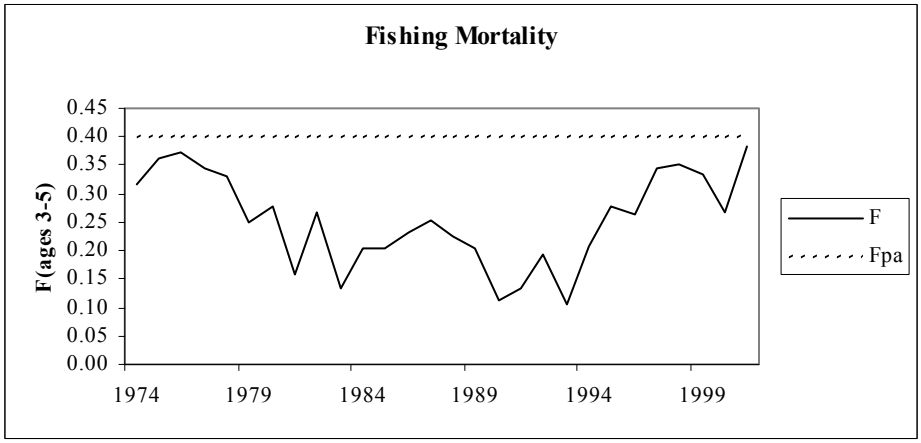
	Fish Mort Ages 3-5	Yield/R	SSB/R
Average Current	0.329	0.004	0.012
$\mathbf{F}_{max}$	2.388	0.005	0.002
$\mathbf{F}_{0.1}$	0.516	0.004	0.009
$\mathbf{F}_{med}$	0.297	0.003	0.013

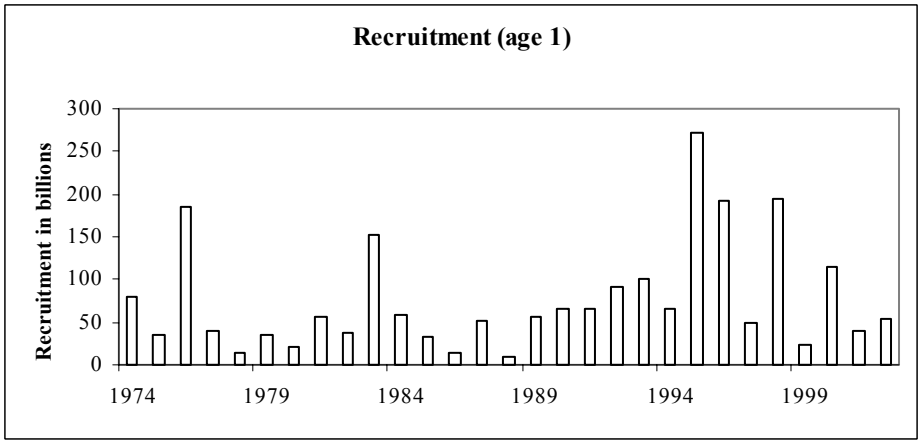
Catch data (Tables 3.14.7.1–3):

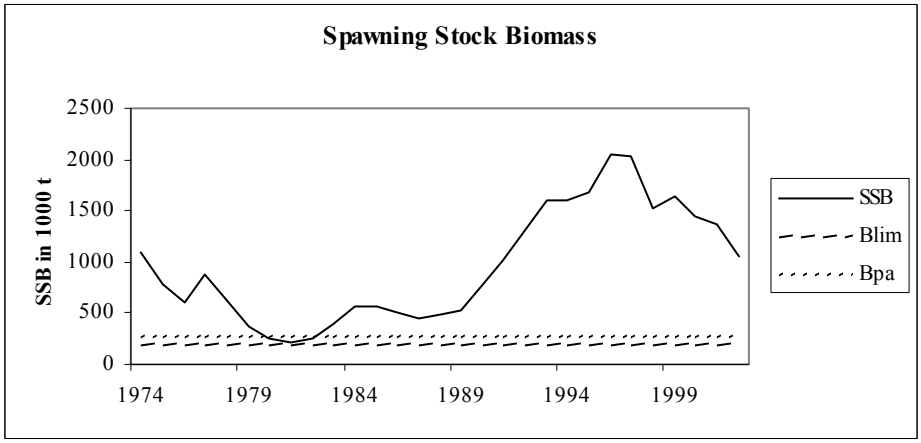
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	ACFM catch
1987			117.2	88
1988	Catch could be increased in SD 22–25	-	117.2	80
1989		72	142	86
1990		72	150	86
1991	TAC	150	163	103
1992	*Status quo* F	143	290	142
1993	Increase in yield by increasing F	-	415	178
1994	Increase in yield by increasing F	-	700	289
1995	TAC	205	500	313
1996	Little gain in long-term yield at higher F	279	550	441
1997	No advice	-	550	529
1998	*Status quo* F	343	550	471
1999	Proposed $\mathbf{F}_{pa}$	304	467.5	421
2000	Proposed $\mathbf{F}_{pa}$	192	400	389
2001	Proposed $\mathbf{F}_{pa}$	314	355	342
2002	Proposed $\mathbf{F}_{pa}$	369	380	
2003	Below proposed $\mathbf{F}_{pa}$	300		

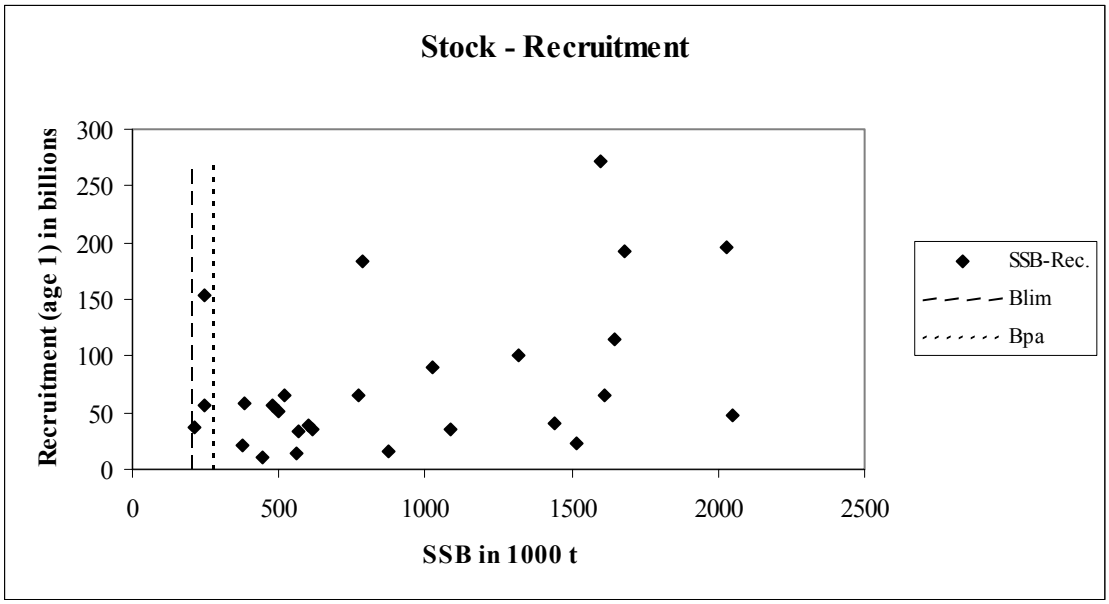
Weights in ‘000 t.

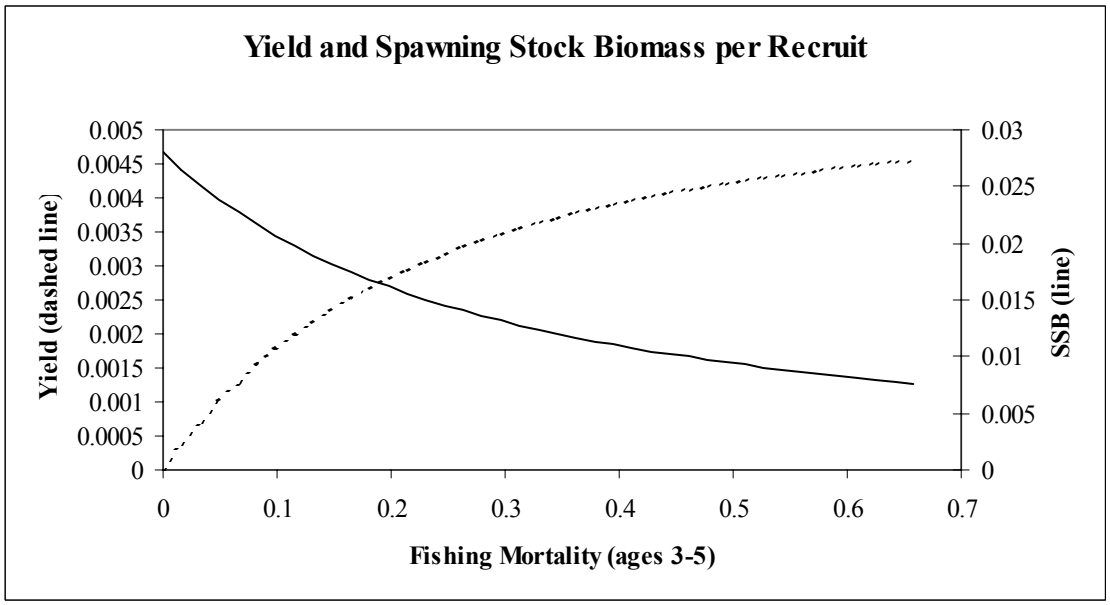

Landings
Landings in 1000 t
600
500
400
300
200
100
0
1974
1979
1984
1989
1994
1999


Fishing Mortality
F(ages 3-5)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1974
1979
1984
1989
1994
1999
F
Fpa


Recruitment (age 1)
Recruitment in billions
300
250
200
150
100
50
0
1974
1979
1984
1989
1994
1999


Spawning Stock Biomass
SSB in 1000 t
2500
2000
1500
1000
500
0
1974
1979
1984
1989
1994
1999
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billions
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
SSB (line)
0.03
0.025
0.02
0.015
0.01
0.005
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Fishing Mortality (ages 3-5)

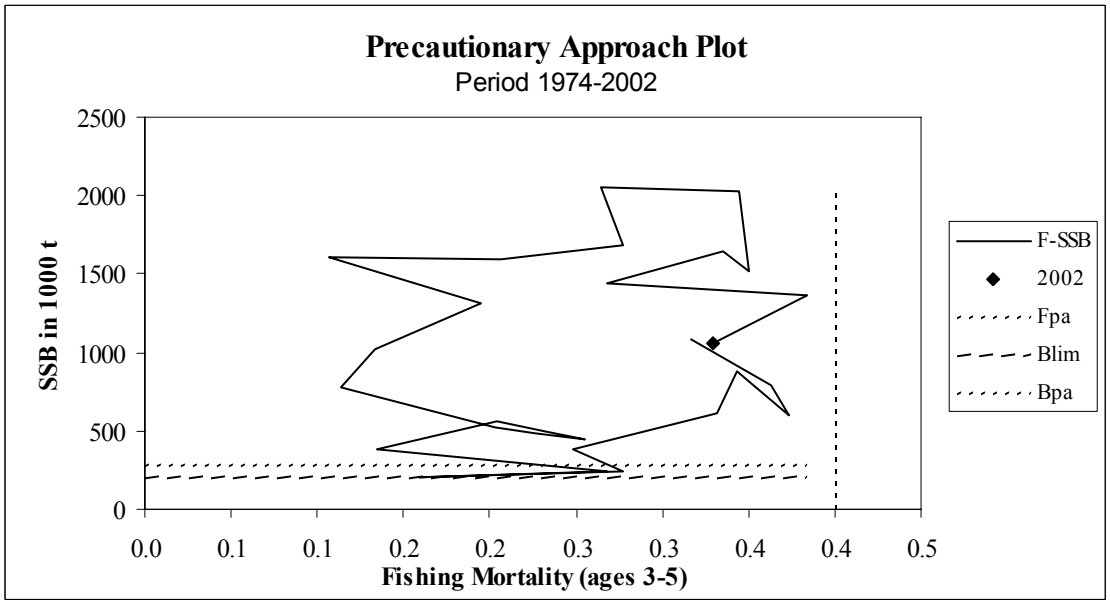

Precautionary Approach Plot
Period 1974-2002
SSB in 1000 t
2500
2000
1500
1000
500
0
0.0
0.1
0.1
0.2
0.2
0.3
0.3
0.4
0.4
0.5
Fishing Mortality (ages 3-5)
F-SSB
2002
Fpa
Blim
Bpa

Table 3.14.7.1 Sprat catches in Subdivisions 22-32 (thousand tonnes).

Year	Denmark	Finland	German Dem. Rep.	Germany Fed. Rep.	Poland	Sweden	USSR	Total
1977	7.2	6.7	17.2	0.8	38.8	0.4	109.7	180.8
1978	10.8	6.1	13.7	0.8	24.7	0.8	75.5	132.4
1979	5.5	7.1	4.0	0.7	12.4	2.2	45.1	77.1
1980	4.7	6.2	0.1	0.5	12.7	2.8	31.4	58.1
1981	8.4	6.0	0.1	0.6	8.9	1.6	23.9	49.3
1982	6.7	4.5	1.0	0.6	14.2	2.8	18.9	48.7
1983	6.2	3.4	2.7	0.6	7.1	3.6	13.7	37.3
1984	3.2	2.4	2.8	0.7	9.3	8.4	25.9	52.5
1985	4.1	3.0	2.0	0.9	18.5	7.1	34.0	69.5
1986	6.0	3.2	2.5	0.5	23.7	3.5	36.5	75.8
1987	2.6	2.8	1.3	1.1	32.0	3.5	44.9	88.2
1988	2.0	3.0	1.2	0.3	22.2	7.3	44.2	80.3
1989	5.2	2.8	1.2	0.6	18.6	3.5	54.0	85.8
1990	0.8	2.7	0.5	0.8	13.3	7.5	60.0	85.6
1991	10.0	1.6		0.7	22.5	8.7	59.7*	103.2

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia	Sweden	Total
1992	24.3	4.1	1.8	0.6	17.4	3.3	28.3	8.1	54.2	142.1
1993	18.4	5.8	1.7	0.6	12.6	3.3	31.8	11.2	92.7	178.1
1994	60.6	9.6	1.9	0.3	20.1	2.3	41.2	17.6	135.2	288.8
1995	64.1	13.1	5.2	0.2	24.4	2.9	44.2	14.8	143.7	312.6
1996	109.1	21.1	17.4	0.2	34.2	10.2	72.4	18.2	158.2	441.0
1997	137.4	38.9	24.4	0.4	49.3	4.8	99.9	22.4	151.9	529.4
1998	91.8	32.3	25.7	4.6	44.9	4.5	55.1	20.9	191.1	470.8
1999	90.2	33.2	18.9	0.2	42.8	2.3	66.3	31.5	137.3	422.6
2000	51.5	39.4	20.2	0.0	46.2	1.7	79.2	30.4	120.6	389.1
2001	39.7	37.5	15.4	0.8	42.8	3.0	85.8	32.0	85.4	342.2

* Sum of catches by Estonia, Latvia, Lithuania, and Russia.

Table 3.14.7.2 Sprat catches in the Baltic Sea by country and Subdivision (thousand tonnes).

Year 2000

Country	**Total**	22	24	25	26	27	28	29	30	31	32
Denmark	**51.5**	9.4	0.8	41.2[1)]	-	-	-	-	-	-	-
Estonia	**39.4**	-	-	-	-	-	6.1	13.9	-	-	19.4
Finland	**20.2**	-	-	-	-	-	-	3.6	4.8	0.0	11.9
Germany	**0.0**	0.0		-	-	-	-	-	-	-	-
Latvia	**46.2**	-	-	2.6	7.3	-	36.3	-	-	-	-
Lithuania	**1.7**	-	-	-	1.7	-	-	-	-	-	-
Poland	**79.2**	-	0.8	40.5	37.9	-	-	-	-	-	-
Russia	**30.4**	-	-	-	28.3	-	2.0	-	-	-	-
Sweden	**120.6**	-	2.1	31.7	13.2	31.5	23.9	18.1	-	-	-
Total	**389.1**	**9.5**	**3.7**	**116.0**	**88.4**	**31.5**	**68.3**	**35.5**	**4.8**	**0.0**	**31.4**

[1)] Danish catches in Subdivision 25 include catches in Subdivision 22 and 24.

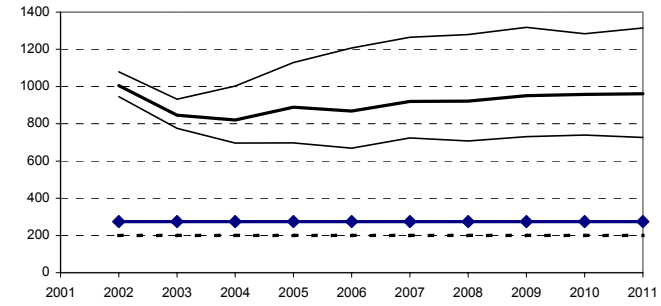
Year 2001

Country	**Total**	22	24	25	26	27	28	29	30	31	32
Denmark	**39.7**	-	-	39.7	-	-	-	-	-	-	-
Estonia	**37.5**	-	-	-	-	-	6.3	16.1	-	-	15.1
Finland	**15.4**	-	-	-	-	-	-	4.5	3.2	0.001	7.6
Germany	**0.8**	0.02	0.8	-	-	-	-	-	-	-	-
Latvia	**42.8**	-	-	1.1	7.0	-	34.7	-	-	-	-
Lithuania	**3.0**	-	-	-	3.0	-	-	-	-	-	-
Poland	**85.8**	-	0.4	46.3	39.1	-	-	-	-	-	-
Russia	**32.0**	-	-	-	29.6	-	2.3	-	-	-	-
Sweden	**85.4**	-	1.0	2.9	4.8	27.8	30.2	18.1	-	-	0.5
Total	**342.2**	**0.02**	**2.1**	**90.0**	**83.5**	**27.8**	**73.5**	**38.7**	**3.2**	**0.001**	**23.2**

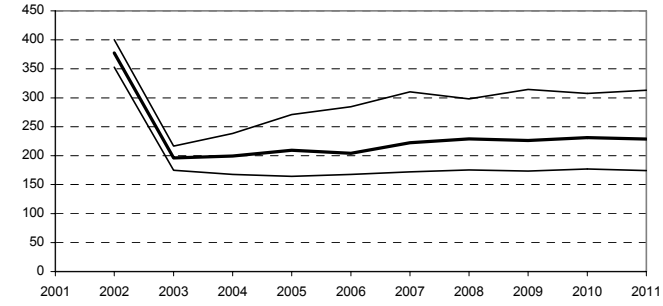
Table 3.14.7.3 Sprat in Subdivisions 22 to 32.

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-5
1974	80739784	1085562	241700	0.3171
1975	34969544	788091	201434	0.3627
1976	184219024	603117	194775	0.3730
1977	38712492	876202	180800	0.3433
1978	15139242	616397	132360	0.3321
1979	34679796	377036	77100	0.2480
1980	21271416	245430	58100	0.2771
1981	57217320	209428	49300	0.1588
1982	36682008	246146	48700	0.2680
1983	152834096	382517	37320	0.1350
1984	58809696	563605	52560	0.2045
1985	33702176	557726	69497	0.2040
1986	14178983	500816	75800	0.2324
1987	50610848	441995	88276	0.2547
1988	10390906	479152	80300	0.2259
1989	56788788	521374	85817	0.2033
1990	64922852	771931	85578	0.1140
1991	65201312	1021711	103200	0.1329
1992	90605040	1318050	142195	0.1946
1993	100316200	1610706	178100	0.1067
1994	65220188	1596946	288700	0.2067
1995	271201344	1682829	313000	0.2777
1996	192472800	2051117	441100	0.2644
1997	48403188	2031208	529400	0.3442
1998	195520512	1516159	470770	0.3508
1999	23591778	1642891	421397	0.3348
2000	115018096	1441311	389140	0.2683
2001	40859168	1369864	342200	0.3838
2002	54828000	1052855		0.3290
Average	76176090	951799	192094	0.2568

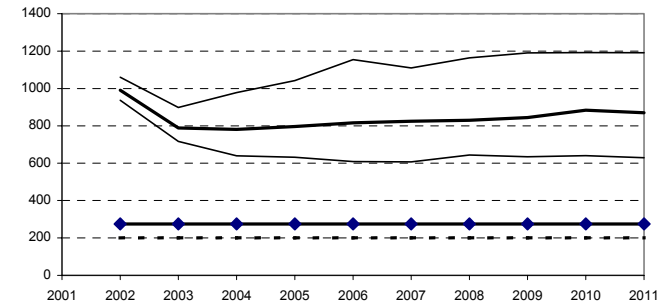
Ffactor=0.8 SSB (1000 t) for sprat in SD 22-32



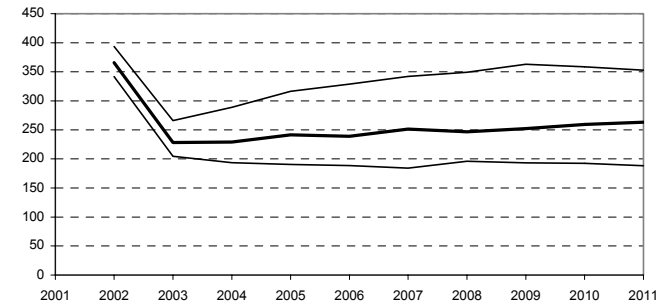
Ffactor=0.8 Catches (1000 t) for sprat in SD 22-32



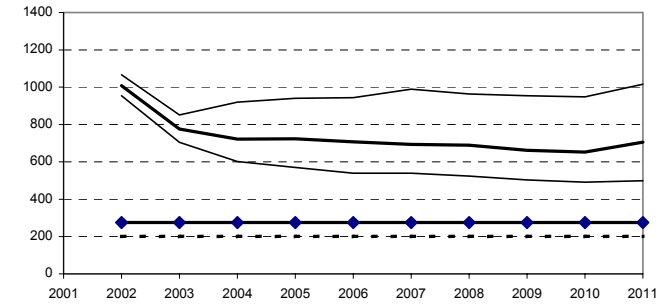
Ffactor=1



Ffactor=1



Ffactor=1.2



Ffactor=1.2

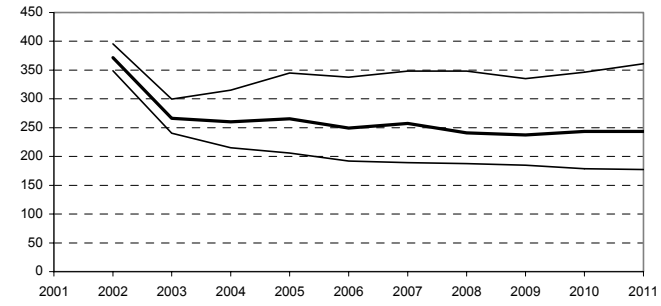


Fig. 12.3.13.1a Sprat in SD 22-32. Medium-term projections. 25% and 50% percentiles projected for 2008, 2009 and 2010 (dotted lines). Effects of ca
represent F_{sq}=0.25.

Fig. 12.3.13.1b Sprat in SD 22-32. B_{pa} = 275 000 t and B_{lim} = 200 000 t. Projection of t

Sprat in Subdivisions 22-29

A misprint in SSB for 2002 (Table 3.14..7.3) has been identified in the summary table for SSB for 2002. This number given in the table is not used anywhere in the calculations. The correct figure is given in the catch option table and should be SSB (2002) = 1 025 120 tons and not as given in Table 3.14.7.3, 1 052 855 tons.

3.14.8 Cod in Subdivisions 22–24 (including Subdivision 23)

State of the stock/exploitation: The stock is outside safe biological limits. The present fishing mortality is 1.2, above the fishing mortality of 1.0 agreed by IBSFC. SSB is estimated to be 20 800 t in 2002, below the $\mathbf{B}_{pa}$ (23 000 t). The 2001 year class is estimated to be close to average strength.

Management objectives: IBSFC have adopted a long-term management strategy for cod in the Baltic (Section 3.14.1). For Baltic cod there is one management unit covering all Subdivisions 22–32. ICES considers the stocks in Subdivisions 22–24 and Subdivisions 25–32 as separate stocks, however, and advice is provided on them separately. ICES reiterates its advice that the cod stocks should be managed separately in order to better adapt the exploitation to the present development in the two stocks. With this caveat ICES considers that the agreed management plan is consistent with the precautionary approach, provided the reference points are used as upper bounds on F and lower bounds on SSB, and not as targets.

Reference points: There is doubt about whether these cod form a closed population, as there may be substantial exchange with adjacent cod stocks. Such exchange could inflate R/SSB reference points, which are very high for this stock, e.g. $\mathbf{F}_{med}$ = 1.08, and the high fishing mortality estimates may not accurately represent the exploitation rate for the unit stock. Further consideration of the magnitude and consequences of exchange is needed before establishing an appropriate $\mathbf{F}_{lim.}$.

Precautionary Approach reference points (Unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is not yet defined	$\mathbf{B}_{pa}$ be set at 23 000 t
$\mathbf{F}_{lim}$ is not yet defined	$\mathbf{F}_{pa}$ is not yet defined

Technical basis:

-	Previous MBAL
-	-

Advice on management: ICES recommends that the fishing mortality in 2003 should be reduced below the F of 1.0 agreed by IBSFC. The corresponding landings depend on whether the new fishing rule will improve the exploitation pattern. Catch options for both scenarios are presented. This cod stock should be managed separately from the stock in Sub-divisions 25-32 in order to better adapt the exploitation to the present development in the stock.

Relevant factors to be considered in management: Whether the potential improvement of the exploitation pattern from the new fishing rule will be realized is questioned. It has been observed that technical manipulations of the gear can negate the effectiveness of the new fishing rules. If this practice is widespread the exploitation pattern will not improve.

The fishery is largely based on recruiting year classes, and discarding is substantial. An increase in the minimum trawl mesh size, as agreed by IBSFC to be implemented during 2002, may significantly reduce the amount of discards.

The catch forecast is sensitive to the estimated size of the 2001 year class, which will account for about 50% of the yield in 2003. This year class is estimated to be of around average strength.

The stock has been rebuilt from the low SSBs of the early 1990s as a result of strong recruitment, especially from the 1994, 1996, and 1997 year classes. The patterns of recruitment to this stock over time and relative to spawning biomass suggest that there may be recruitment dispersal and/or migration between this stock and adjacent cod stocks in the Baltic and/or Kattegat.

Catch forecast for 2003:

A; Assuming no selectivity change.

Basis: F(2002) = $\mathbf{F}_{sq}$ = 1.23; Landings(2002) = 29.3; SSB(2003) = 28.8.

F (2003)	Basis	Landings (2003)	Discards (2003)	SSB (2004)
0	0	0	0	58.5
0.25	0.2 $\mathbf{F}_{sq}$	9.2	1.0	47.7
0.49	0.4 $\mathbf{F}_{sq}$	16.8	1.9	39.6
0.74	0.6 $\mathbf{F}_{sq}$	23.1	2.7	33.1
0.98	0.8 $\mathbf{F}_{sq}$	28.4	3.4	27.9
1.0	F_{IBSFC} (0.82 $\mathbf{F}_{sq}$)	28.8	3.4	27.5
1.23	$\mathbf{F}_{sq}$	32.9	4.0	23.6

Weights in 000 t.

Shaded scenarios considered inconsistent with the precautionary approach.

B; Assuming an effective change in selectivity (introduced at start of 2003):

Basis: F(2002) = $\mathbf{F}_{sq}$ = 1.23; Landings(2002) = 29.3; SSB(2003) = 28.8.

F (2003)	Basis	Landings (2003)	Discards (2003)	SSB (2004)
0	0	0	0	58.5
0.22	0.2 $\mathbf{F}_{sq}$	6.4	0.4	50.8
0.44	0.4 $\mathbf{F}_{sq}$	11.8	0.8	45.1
0.66	0.6 $\mathbf{F}_{sq}$	16.6	1.2	40.4
0.88	0.8 $\mathbf{F}_{sq}$	20.7	1.6	36.4
1.0	F_{IBSFC} (0.9 $\mathbf{F}_{sq}$)	22.6	1.7	34.7
1.10	$\mathbf{F}_{sq}$	24.3	1.9	33.1

Weights in 000 t.
Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections were simulated over 10 years, using the IBSFC agreed F of 1.0. The outcome show a high probability of SSB increasing above the $\mathbf{B}_{pa}$ of 23 000 t. The long-term projection reference points are estimated as $\mathbf{F}_{0.1}$=0.16 and $\mathbf{F}_{max}$=0.26. The input and results from the yield-per-recruit analysis estimates S/R reference points at $\mathbf{F}_{med}$= 1.04, $\mathbf{F}_{high}$=1.74, and $\mathbf{F}_{low}$=0.43.

Comparison with previous assessment and advice: The current assessment now includes discard data. The current assessment has revised the estimate of the SSB in 2000 7% downwards. The state of the stock has changed with respect to safe biological limits due to the reduced influence of strong year classes. The advice is consistent with last year's advice.

Elaboration and special comment: As a result of the high fishing mortality, SSBs and yield are dependent on ages 2–4. The contribution of ages 2 and 3 in the yield has for recent years been around 70% of the landings. The estimates of the size of the year classes attaining these ages in the forecast are uncertain, being based in part on recruited fish or solely on research survey information. For the period 1992–1994 landings are uncertain due to incomplete reporting; however, the data quality has improved significantly since then.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17), and Technical Minutes of ACFM, May 2002.

Yield and spawning biomass per Recruit F-reference points:

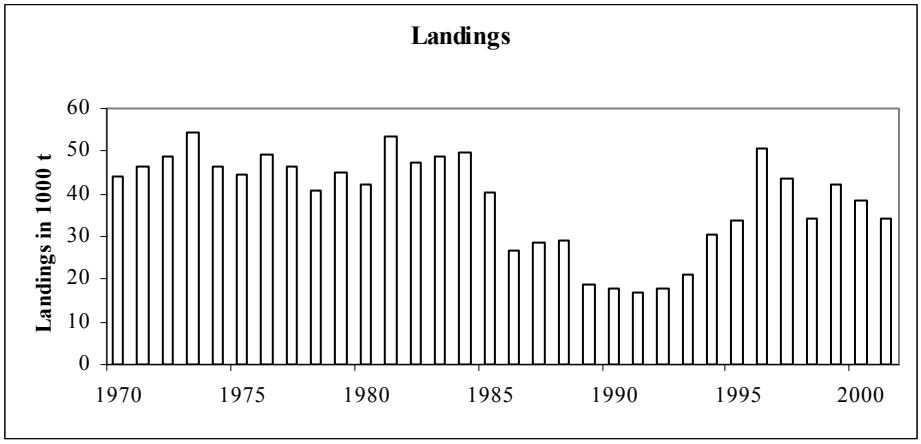
	Fish Mort Ages 3-6	Yield/R	SSB/R
Average Current	1.211	0.603	0.389
$\mathbf{F}_{max}$	0.263	0.855	2.839
$\mathbf{F}_{0.1}$	0.162	0.804	4.343
$\mathbf{F}_{med}$	1.043	0.625	0.480

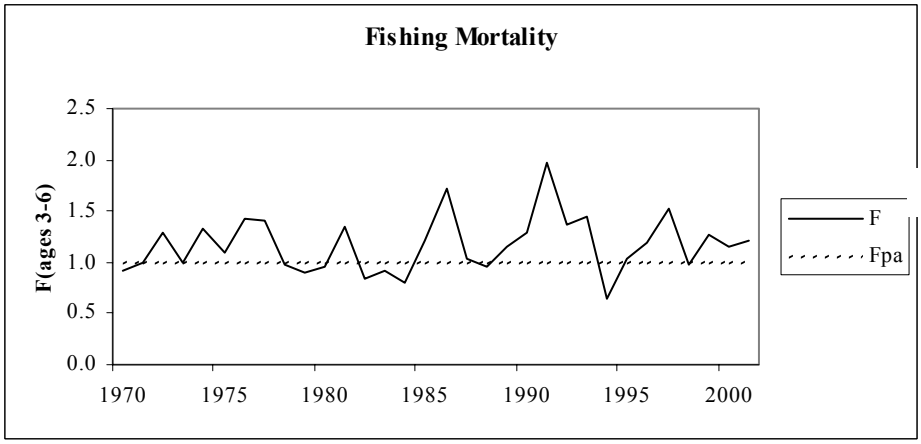
Catch data (Tables 3.14.8.1–2):

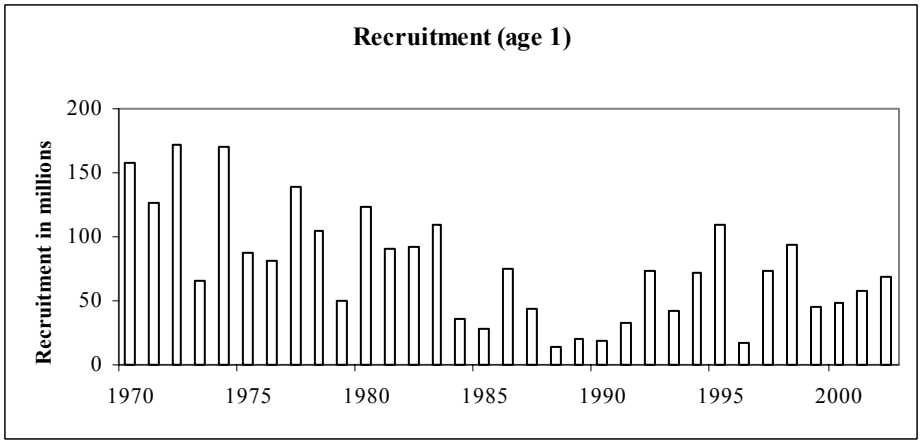
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch (22–24)	ACFM Catch (22–32)
1987	TAC	9		29	236
1988	TAC	16		29	223
1989	TAC	14	220	19	198
1990	TAC	8	210	18	171
1991	TAC	11	171	17	140
1992	Substantial reduction in F	-	100	18	73[2]
1993	F at lowest possible level	-	40	21	66[2]
1994	TAC	22	60	31	124[2]
1995	30% reduction in fishing effort from 1994 level	-	120	34	142[2]
1996	30 % reduction in fishing effort from 1994 level	-	165	51	173
1997	Fishing effort should not be allowed to increase above level in recent years	-	180	44	132
1998	20% reduction in F from 1996	35	160	34	102
1999	At or below $\mathbf{F}_{sq}$ with 50% probability	38	126	42	115
2000	Reduce F by 20%	44.6	105	38	104
2001	Reduce F by 20%	48.6	105	34	102
2002	Reduce F to below 1.0	36.3	76		
2003	Reduce F to below 1.0	See option table			

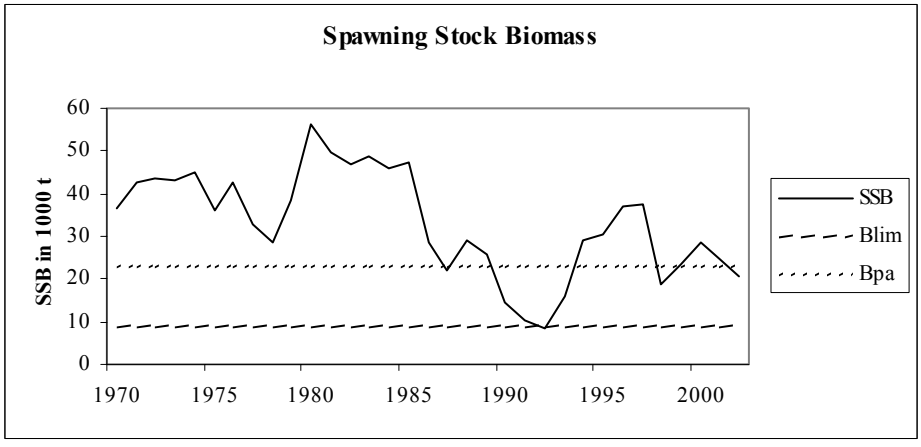
[1] Included in TAC for total Baltic. [2] The reported landings in 1992–1995 are known to be incorrect due to incomplete reporting. Weights in '000 t.

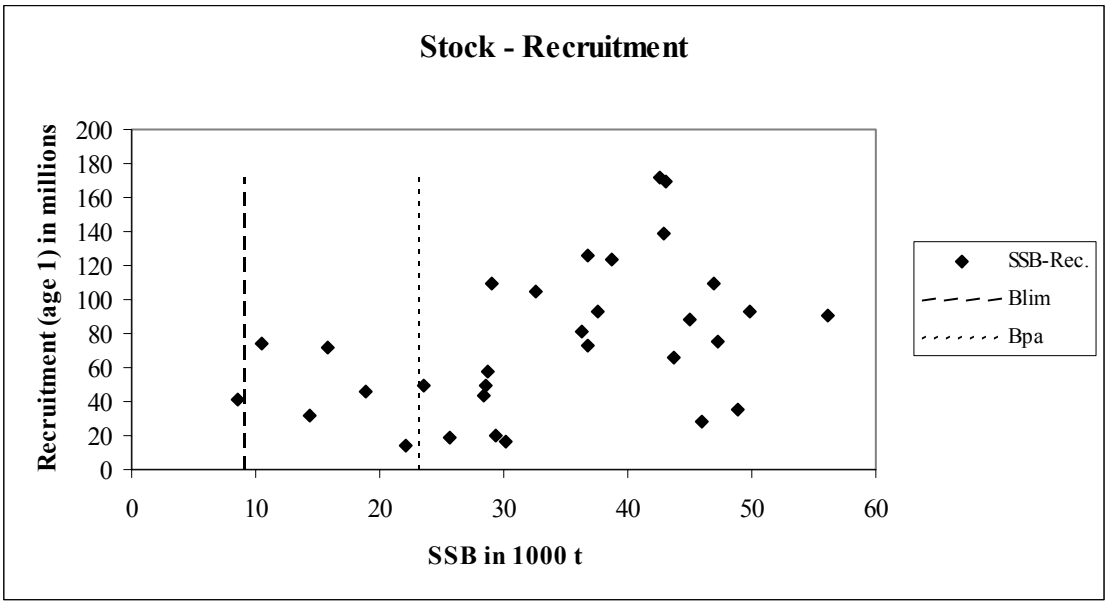
Cod in Subdivisions 22 to 24

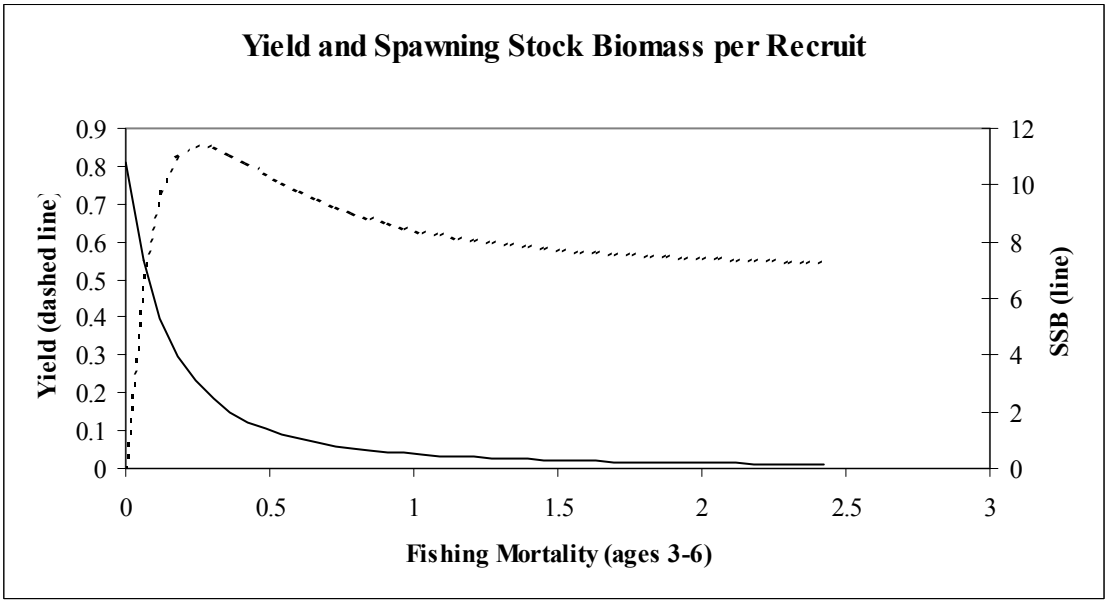


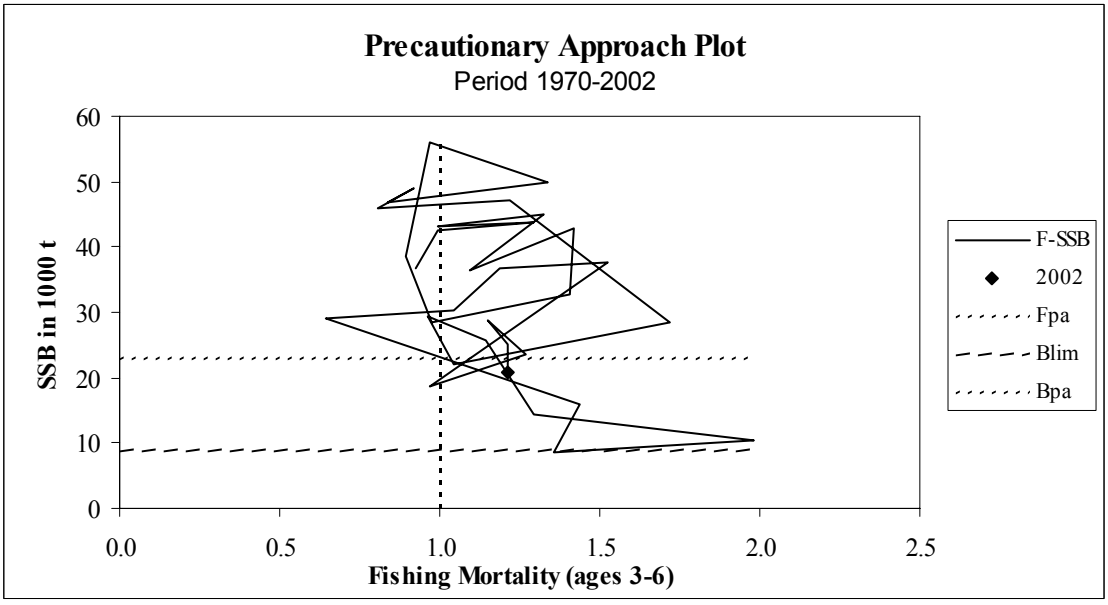







Stock - Recruitment
Recruitment (age 1) in millions
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Blim
Bpa

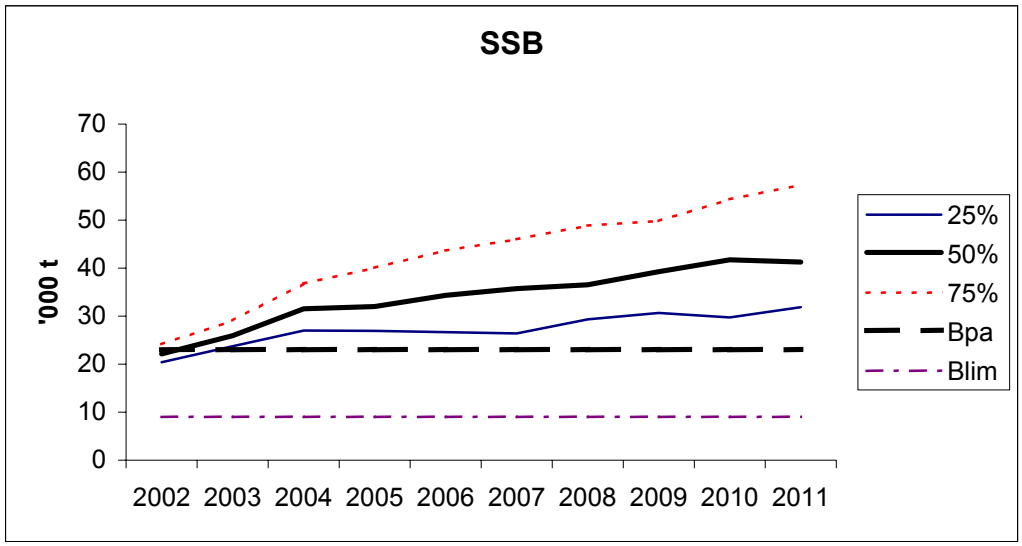

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
3
Fishing Mortality (ages 3-6)

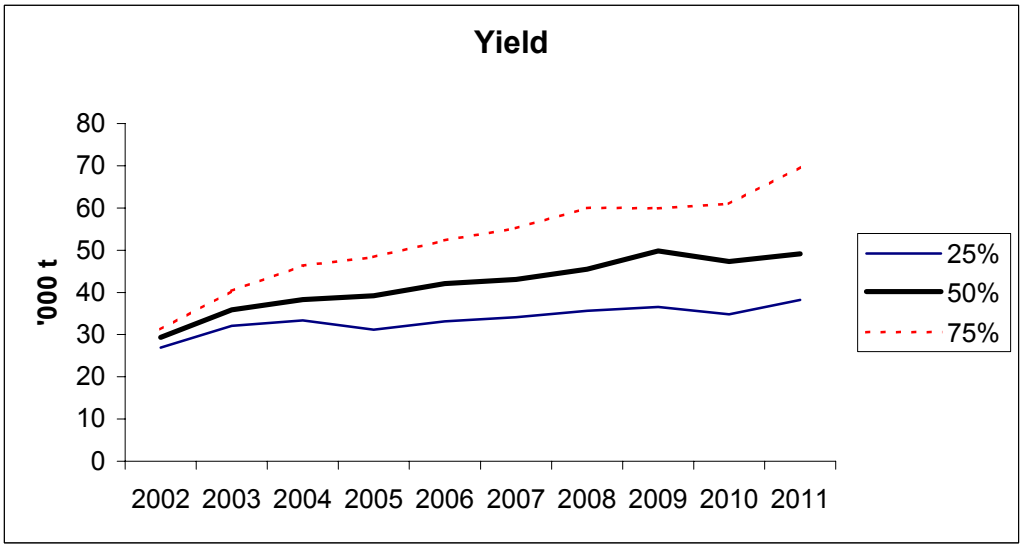

Precautionary Approach Plot
Period 1970-2002
SSB in 1000 t
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
2.0
2.5
Fishing Mortality (ages 3-6)
F-SSB
2002
Fpa
Blim
Bpa

Cod in 22-24

Medium term projections

F = Fpa = 1.0





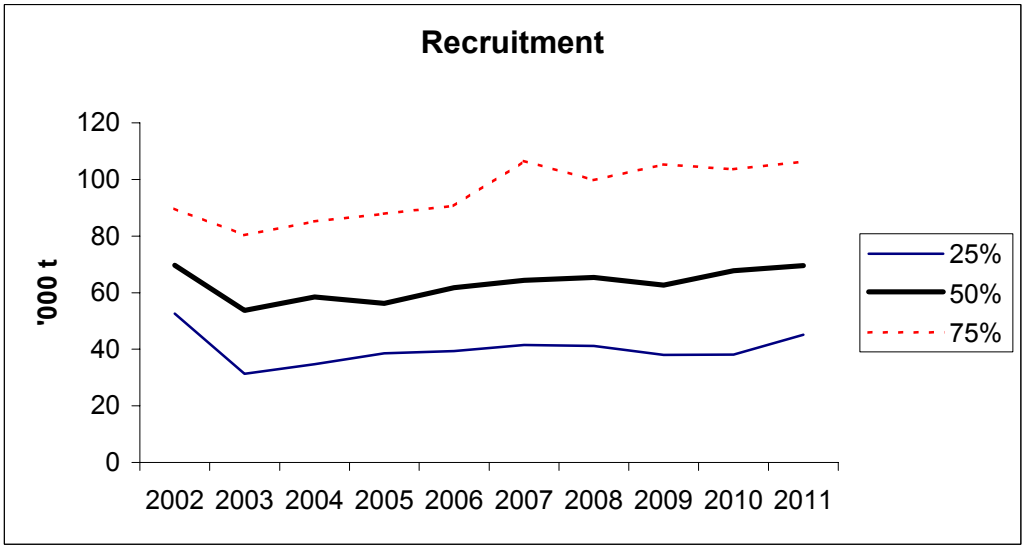


Table 3.14.8.1 Total landings of cod in Subdivisions 22, 23 and 24 (t).

Year	Denmark		Finland	German Dem.Rep.[2]	Germany, Fed. Rep.	Estonia	Latvia	Poland	Sweden	
	23	22+24	24	22+24	22+24	24	24	24	23	24
1965		19,457		9,705	13,350					2,182
1966		20,500		8,393	11,448					2,110
1967		19,181		10,007	12,884					1,996
1968		22,593		12,360	14,815					2,113
1969		20,602		7,519	12,717					1,413
1970		20,085		7,996	14,589					1,289
1971		23,715		8,007	13,482					1,419
1972		25,645		9,665	12,313					1,277
1973		30,595		8,374	13,733					1,655
1974		25,782		8,459	10,393					1,937
1975		23,481		6,042	12,912					1,932
1976	712	29,446		4,582	12,893					1,800
1977	1,166	27,939		3,448	11,686				550	1,516
1978	1,177	19,168		7,085	10,852				600	1,730
1979	2,029	23,325		7,594	9,598				700	1,800
1980	2,425	23,400		5,580	6,657				1,300	2,610
1981	1,473	22,654		11,659	11,260				900	5,700
1982	1,638	19,138		10,615	8,060				140	7,933
1983	1,257	21,961		9,097	9,260				120	6,910
1984	1,703	21,909		8,093	11,548				228	6,014
1985	1,076	23,024		5,378	5,523				263	4,895
1986	748	16,195		2,998	2,902				227	3,622
1987	1,503	13,460		4,896	4,256				137	4,314
1988	1,121	13,185		4,632	4,217				155	5,849
1989	636	8,059		2,144	2,498				192	4,987
1990	722	8,584		1,629	3,054				120	3,671
1991	1,431	9,383			2,879				232	2,768
1992	2,449	9,946			3,656				290	1,655
1993	1,001	8,666			4,084				274	1,675
1994	1,073	13,831			4,023				555	3,711
1995	2,547	18,762	132		9,196		15		611	2,632
1996	2,999	27,946	50		12,018	50	32		1,032	4,418
1997	1,886	28,887	11		9,269	6		263	777	2,525
1998	2,467	19,192	13		9,722	8	13	623	607	1,571
1999	2,839	23,074	116		13,224	10	25	660	682	1,525
2000	2,451	19,876	171		11,572	5	84	926	698	2,564
2001[1)]	2,124	17,446	191		10,579	40	46	646	693	2,479

[1)] Provisional data.

Continued …

Table 3.14.8.1 Continued

Year	Total						
	22	23	24	Unalloc.	22 & 24	22 & 24 & Unalloc.	22-24 & Unalloc.
1965	27,867		17,007		44,874	44,874	44,874
1966	27,864		14,587		42,451	42,451	42,451
1967	28,875		15,193		44,068	44,068	44,068
1968	32,911		18,970		51,881	51,881	51,881
1969	29,082		13,169		42,251	42,251	42,251
1970	31,363		12,596		43,959	43,959	43,959
1971	32,119		14,504		46,623	46,623	46,623
1972	32,808		16,092		48,900	48,900	48,900
1973	38,237		16,120		54,357	54,357	54,357
1974	31,326		15,245		46,571	46,571	46,571
1975	31,867		12,500		44,367	44,367	44,367
1976	33,368	712	15,353		48,721	48,721	49,433
1977	29,510	1,716	15,079		44,589	44,589	46,305
1978	24,232	1,777	14,603		38,835	38,835	40,612
1979	26,027	2,729	16,290		42,317	42,317	45,046
1980	22,881	3,725	15,366		38,247	38,247	41,972
1981	26,340	2,373	24,933		51,273	51,273	53,646
1982	20,971	1,778	24,775		45,746	45,746	47,524
1983	24,478	1,377	22,750		47,228	47,228	48,605
1984	27,058	1,931	20,506		47,564	47,564	49,495
1985	22,063	1,339	16,757		38,820	38,820	40,159
1986	11,975	975	13,742		25,717	25,717	26,692
1987	12,105	1,640	14,821		26,926	26,926	28,566
1988	9,680	1,276	18,203		27,883	27,883	29,159
1989	5,738	828	11,950		17,688	17,688	18,516
1990	5,361	842	11,577		16,938	16,938	17,780
1991	7,184	1,663	7,846		15,030	15,030	16,693
1992	9,887	2,739	5,370		15,257	15,257	17,996
1993	7,296	1,275	7,129	5,528	14,425	19,953	21,228
1994	8,229	1,628	13,336	7,502	21,565	29,067	30,695
1995	16,936	3,158	13,801		30,737	30,737	33,895
1996	21,417	4,031	23,097	2,300	44,514	46,814	50,845
1997	21,966	2,663	18,995		40,961	40,961	43,624
1998	15,093	3,074	16,049		31,142	31,142	34,216
1999	20,409	3,521	18,225		38,634	38,634	42,155
2000	18,934	3,149	16,264		35,198	35,198	38,347
2001[1)]	14,976	2,817	16,451		31,427	31,427	34,244

[1)] Provisional data.

Table 3.14.8.2 Cod in Subdivisions 22 to 24

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1970	157127	36748	43959	0.9266
1971	125916	42545	46623	0.9960
1972	172095	43702	48900	1.2948
1973	66253	43138	54357	0.9921
1974	169799	44950	46571	1.3257
1975	87785	36281	44367	1.0962
1976	81450	42845	49433	1.4190
1977	139281	32633	46305	1.4050
1978	104511	28604	40612	0.9733
1979	49961	38667	45046	0.8922
1980	124040	56101	41972	0.9658
1981	90185	49800	53646	1.3404
1982	92464	46931	47524	0.8398
1983	109580	48921	48605	0.9168
1984	35635	46041	49495	0.8058
1985	28150	47280	40159	1.2157
1986	75617	28466	26692	1.7182
1987	43337	22122	28566	1.0438
1988	13726	29292	29159	0.9650
1989	20391	25710	18516	1.1431
1990	18382	14430	17780	1.2918
1991	32247	10422	16693	1.9787
1992	73924	8525	17996	1.3575
1993	41449	15844	21228	1.4361
1994	71380	29002	30695	0.6415
1995	109299	30239	33895	1.0421
1996	17007	36848	50845	1.1903
1997	73162	37552	43621	1.5235
1998	93285	18802	34208	0.9686
1999	46077	23616	42149	1.2712
2000	49165	28645	38357	1.1506
2001	57172	25022	34199	1.2110
2002	68975	20818		1.2109
Average	76934	33047	38505	1.1682

3.14.9 Cod in Subdivisions 25–32

State of stock/exploitation: The stock is outside safe biological limits. Although the actual state of the stock cannot be estimated precisely the available information indicates that SSB in 2002 is well below $\mathbf{B}_{pa}$ and $\mathbf{B}_{lim}$. The fishing mortality is poorly estimated, but is well above $\mathbf{F}_{pa}$. In the most recent years the stock has been below $\mathbf{B}_{lim}$ and the fishing mortality has been fluctuating around $\mathbf{F}_{lim.}$ Recruitment since the late 1980s has been below average.

Management objectives: IBSFC have adopted a long-term management strategy for cod in the Baltic (Section 3.14.1) and a cod recovery plan for eastern Baltic cod. For Baltic cod there is one management unit covering all Subdivisions 22–32. ICES considers the stocks in Subdivisions 22–24 and Subdivisions 25–32 as separate stocks, however, and advice is provided on them separately. ICES reiterates its advice that the cod stocks should be managed separately in order to better adapt the exploitation to the present development in the two stocks. With this caveat ICES considers that the agreed management plan may be consistent with the precautionary approach, provided the reductions in F are sufficiently large to allow rapid and secure rebuilding, and that the biomass reference points are used as lower bounds on SSB, and not as targets.

The cod recovery plan states that:

1. For 2002 the fishing mortality for the Eastern stock shall be reduced to below $\mathbf{F}_{pa}$ and shall not be greater than 0.55 within a global TAC of 76 000 tons;

2. Management of the fishery for the Eastern cod stock in year 2003 and subsequent years with the objective of reducing the fishing mortality for the Eastern cod stock to below $\mathbf{F}_{pa}$ is necessary in order to ensure safe and rapid recovery of the spawning stock to levels in excess of 240 000 tons.

In addition the recovery plan establishes a number of technical measures and closures. ICES considers that this recovery plan is consistent with the precautionary approach.

Precautionary Approach reference points (unchanged since 1999):

ICES considers that:	ICES proposes that:
$\mathbf{B}_{lim}$ is 160 000 t	$\mathbf{B}_{pa}$ be set at 240 000 t
$\mathbf{F}_{lim}$ is 0.96	$\mathbf{F}_{pa}$ be set at 0.6

Technical basis:

$\mathbf{B}_{lim}$: SSB below which recruitment is impaired	$\mathbf{B}_{pa}$: MBAL
$\mathbf{F}_{lim}$: Fmed98	$\mathbf{F}_{pa}$: 5 percentile of $\mathbf{F}_{med}$

Advice on management: The state of the stock has not improved since 2001 and the biological justifications for advising no fishing remain. Under the recovery plan fishing mortality in 2003 and subsequent years must be reduced by 70% (F < 0.32) to rebuild the SSB above $\mathbf{B}_{pa}$ in the medium term. Rebuilding of SSB to above $\mathbf{B}_{pa}$ could be slightly faster, if the technical measures improve the exploitation pattern of the fishery. A reduction in F to below 0.10 is necessary in order to rebuild the SSB above $\mathbf{B}_{pa}$ in 3-5 years (depending on the effectiveness of the technical measures at improving the exploitation pattern). The corresponding landings in 2003 for any F depend on whether the new fishing rule will improve the exploitation pattern. Catch options for the scenarios are presented.

Rebuilding plan: This includes TAC restrictions as well as technical measures and seasonal and area closures. The area and seasonal closures are not considered in themselves to be sufficiently effective to achieve rapid and safe rebuilding. Large closed areas and seasons may contribute to stock recovery, but only if accompanied by major reductions in effort or catch. The increases in minimum mesh size in trawls to be introduced during 2002 will help improve the exploitation pattern and reduce discards, but also these measures are not in themselves sufficient to reduce the fishing mortality to the desired level.

Rebuilding the SSB above $\mathbf{B}_{pa}$ in 3-5 years requires a reduction in fishing mortality to below 0.10 in 2003 and subsequent years. If the new fishing rules are effective then the rebuilding period will be shorter.

Relevant factors to be considered in management: In 2001 this stock was below $\mathbf{B}_{lim}$ and ICES advised that no fishing should take place on it. The state of the stock has not improved since 2001 and the biological justifications for advising no fishing remain. However, IBSFC in September 2001 agreed to implement a rebuilding plan, and rebuilding plans may include some

fishing, if the exploitation is low enough, and management controls effective enough, to allow safe and rapid rebuilding.

Whether the potential improvement of the exploitation pattern from the new fishing rule will be realized is questioned. It has been observed that technical manipulations of the gear can negate the effectiveness of the new fishing rules. If this practice is widespread the exploitation pattern will not improve.

Cod in the Baltic have traditionally been taken in a directed fishery with very few cod occurring as by-catch in other fisheries. It should therefore be possible for managers to effectively reduce fishing mortality on cod without disrupting fisheries on other species.

There are no indications of substantial movements of fish from this stock to areas outside of Subdivisions 25–32, so management measures do not need to consider migration effects in relation to this stock. However, management measures should consider the possible displacement of effort onto the western Baltic cod stock, where ICES advice is also for a reduction of F in 2002.

Recruitment is influenced not only by the size of the spawning stock, but to a large extent by the environmental conditions (e.g., volume of water with high salinity and high oxygen content). Since the early 1980s fewer and smaller influxes of saline North Sea water were observed than in earlier years. This is reflected in the recruitment pattern, with most recent year classes below the long-term average. It is not possible to predict if and when the present regime of saltwater movements will change. Even though it is not possible to predict these environmental changes precisely, they need to be taken into account in both short-term management and medium-term recovery plans, to ensure that SSB does not become further depleted during the current period of low recruitment, and that rebuilding schedules are realistic. There have been no recent major inflows of saline water to the eastern Baltic, and there are no indications of such an inflow during 2001/2002.

Baltic Cod population dynamics with two well separated stocks indicates that proper management should be based on two separate TACs: one for the western stock (Subdivisions 22-24) and one for the eastern stock (Subdivisions 25-29+32).

Catch forecast for 2003:

No change in selectivity assumed:

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1998-2001) = 1.05; Landings (2002) = 83.0; SSB(2003) = 87.6.

F (2003)	Basis	Landings (2003)	Discards (2003)	SSB (2004)
0	0	0	0	174.8
0.1	0.1 $\mathbf{F}_{sq}$	11.4	0.3	156.4
0.21	0.2 $\mathbf{F}_{sq}$	22.0	0.6	142.7
0.32	0.3 $\mathbf{F}_{sq}$	31.6	0.9	131.3
0.42	0.4 $\mathbf{F}_{sq}$	40.5	1.1	121.5
0.6	$\mathbf{F}_{pa}$ (0.58 $\mathbf{F}_{sq}$)	54.5	1.6	106.9
0.84	0.8 $\mathbf{F}_{sq}$	69.8	2.1	91.5
1.05	$\mathbf{F}_{sq}$	81.4	2.6	80.4

Weights in '000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Change in selectivity assumed (introduced at start of 2003):

Basis: F(2002) = $\mathbf{F}_{sq}$ = F(1998-2001) = 1.05; Landings (2002) = 83.0; SSB(2003) = 87.6.

F (2003)	Basis	Landings (2003)	Discards (2003)	SSB (2004)
0	0	0	0	174.8
0.09	0.1 $\mathbf{F}_{sq}$	8.9	0	159.6
0.18	0.2 $\mathbf{F}_{sq}$	17.1	0.1	148.7
0.28	0.3 $\mathbf{F}_{sq}$	24.9	0.1	139.7
0.32	0.35 $\mathbf{F}_{sq}$	28.6	0.2	135.7
0.6	$\mathbf{F}_{pa}$ (0.65 $\mathbf{F}_{sq}$)	48.6	0.3	115.7
0.73	0.8 $\mathbf{F}_{sq}$	56.9	0.4	107.9
0.92	$\mathbf{F}_{sq}$	67.2	0.5	98.6

Weights in '000t.

Shaded scenarios considered inconsistent with the precautionary approach.

Medium- and long-term projections: Medium-term projections are necessary to evaluate options for implementing the rebuilding plan agreed to by IBFSC. ICES had serious reservations about the reliability of the point estimates and probabilities from recent assessments, because of concerns about the quality of input data. The medium-term projections must use the point estimates and probabilities from the assessment, and therefore are also highly uncertain. They may provide overly optimistic views of the rebuilding potential of the stock.

Comparison with previous assessment and advice: The current assessment now includes discard data. Fishing mortality has consistently been under-estimated and stock size over-estimated in the previous assessments.

Elaboration and special comment: The catch forecast for 2002 assumes status quo fishing mortality in 2002 or a catch in 2002 of 83 000 t. This is higher than the total TAC for Baltic cod but recent experience with this assessment suggests that the F_{sq} assumption is realistic in terms of generated F. The TAC has not been overshot according to the official statistics in recent years but non-reported catches or landings can be part of this problem.

In recent years catches from eastern Baltic have been approximately 2/3 of the total cod landings.

Age-reading problems and uncertainty in assessing the maturity have resulted in considerable uncertainty about the absolute level of SSB and F. Nevertheless, annual trends, and the perception of the state of the stock with respect to precautionary reference points, are robust to these uncertain data.

Misreporting caused severe problems in the quality of the data in the early 1990s. This is still thought to occur but at a reduced level.

The earlier surveys were not adequately coordinated. Recent work on standardizing surveys has implied that surveys today are coordinated and use similar gears. Calibrations of the historical time series information to the new gear standards add uncertainty to their use as tuning indices.

The landings increased from about 150 000 t in the mid-1970s to around 360 000 t in the early 1980s, but decreased thereafter. The fisheries developed during the 1970s with more fleets entering in the early 1980s, and the intensity of the fishery increased further with the introduction of a gillnet fishery at the end of the 1980s and the beginning of the 1990s. The size of the gillnet fleet has decreased in recent years, and the majority of catches is now taken by mobile gears.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

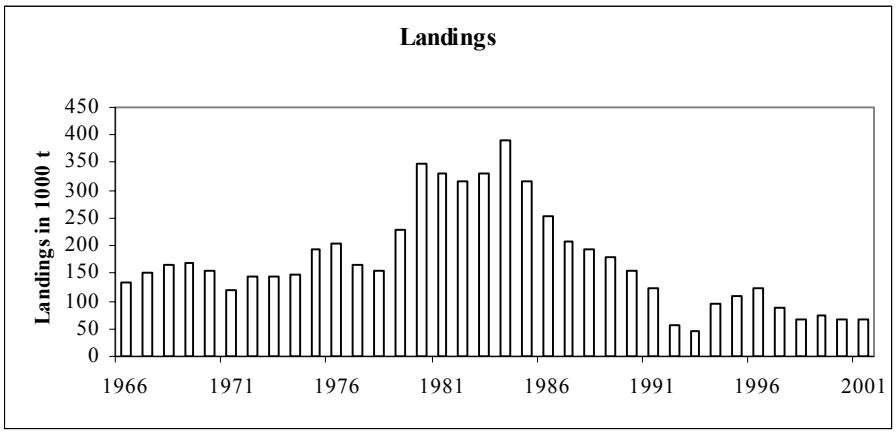
Yield and spawning biomass per Recruit F-reference points:

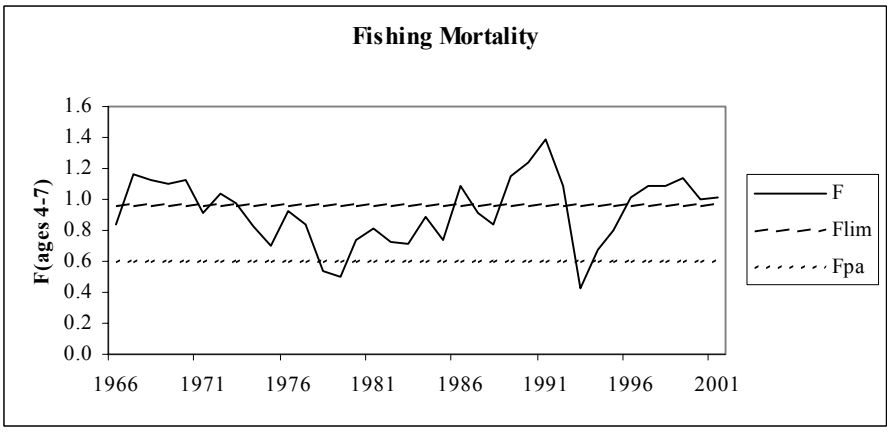
	Fish Mort Ages 4-7	Yield/R	SSB/R
Average Current	1.047	0.606	0.636
$\mathbf{F}_{max}$	0.256	0.808	3.058
$\mathbf{F}_{0.1}$	0.157	0.760	4.615
$\mathbf{F}_{med}$	0.726	0.662	0.955

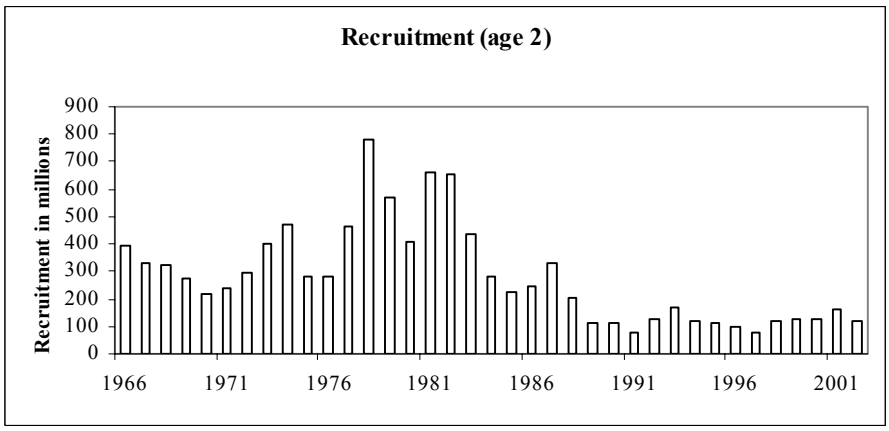
Catch data (Tables 3.14.9.1-2):

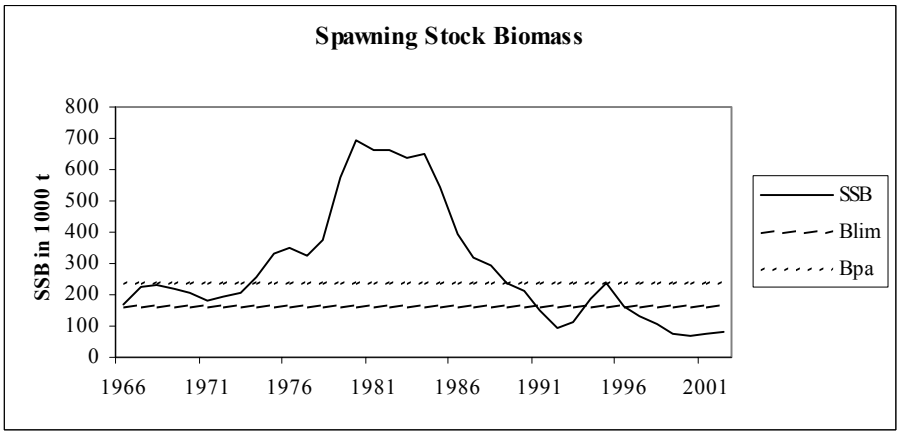
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Catch (25–32)	ACFM Catch (22–32)
1987	Reduce towards $\mathbf{F}_{max}$	245		207	236
1988	TAC	150		194	223
1989	TAC	179	220	179	198
1990	TAC	129	210	153	171
1991	TAC	122	171	123	140
1992	Lowest possible level	-	100	55[2]	73[2]
1993	No fishing	0	40	45[2]	66[2]
1994	TAC	25	60	93[2]	124[2]
1995	30% reduction in fishing effort from 1994	-	120	108[2]	142[2]
1996	30% reduction in fishing effort from 1994	-	165	122	173
1997	20% reduction in fishing mortality from 1995	130	180	89	132
1998	40% reduction in fishing mortality from 1996	60	140	67	102
1999	Proposed $\mathbf{F}_{pa}$ (= 0.6)	88	126	72	115
2000	40% reduction in F from 96–98 level	60	105	66	104
2001	Fishing mortality of 0.30	39	105	67.7	102
2002	No fishing	0	76		
2003	70% reduction in F	See option table			

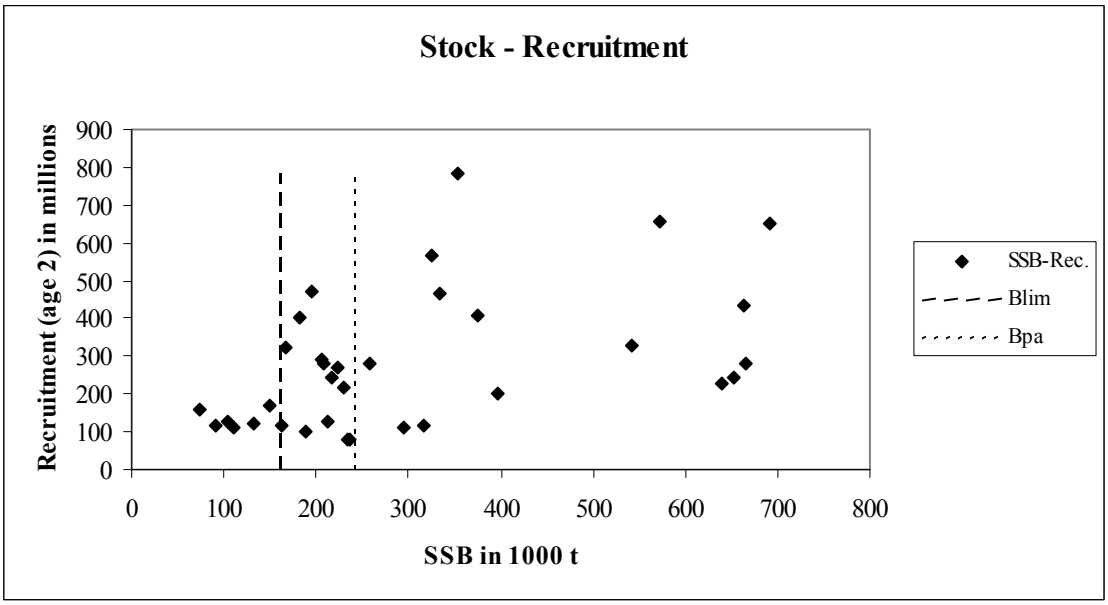
[1]For total Baltic. [2] The reported landings in 1992–1995 are known to be incorrect due to incomplete reporting. Weights in '000 t.

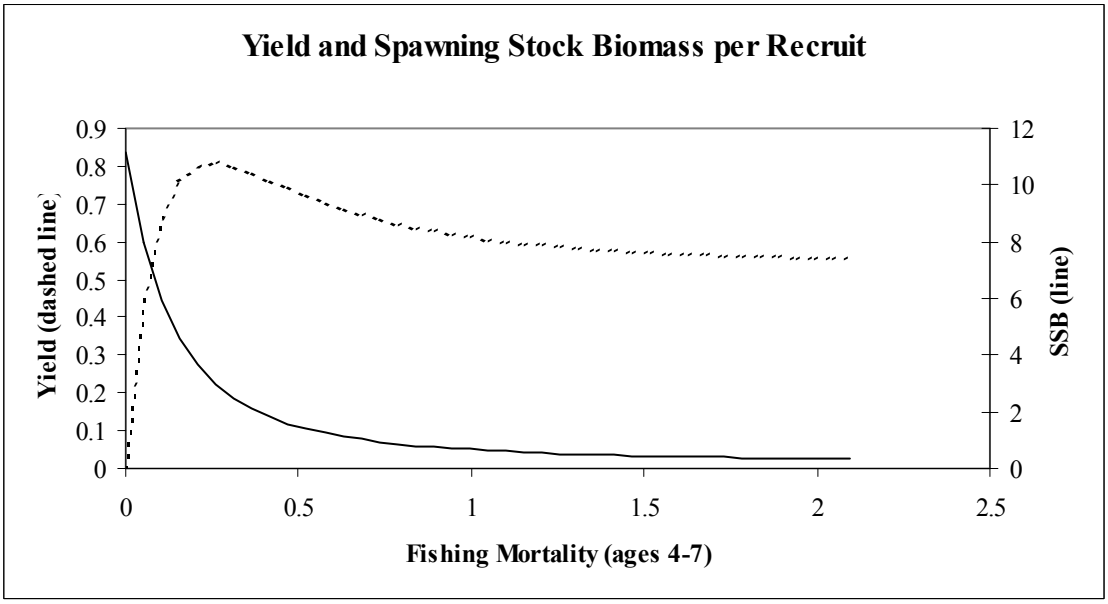

Landings
Landings in 1000 t
450
400
350
300
250
200
150
100
50
0
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F (ages 4-7)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1966
1971
1976
1981
1986
1991
1996
2001
F
Flim
Fpa


Recruitment (age 2)
Recruitment in millions
900
800
700
600
500
400
300
200
100
0
1966
1971
1976
1981
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
800
700
600
500
400
300
200
100
0
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
900
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
SSB in 1000 t
SSB-Rec.
Blim
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SSB (line)
12
10
8
6
4
2
0
0
0.5
1
1.5
2
2.5
Fishing Mortality (ages 4-7)

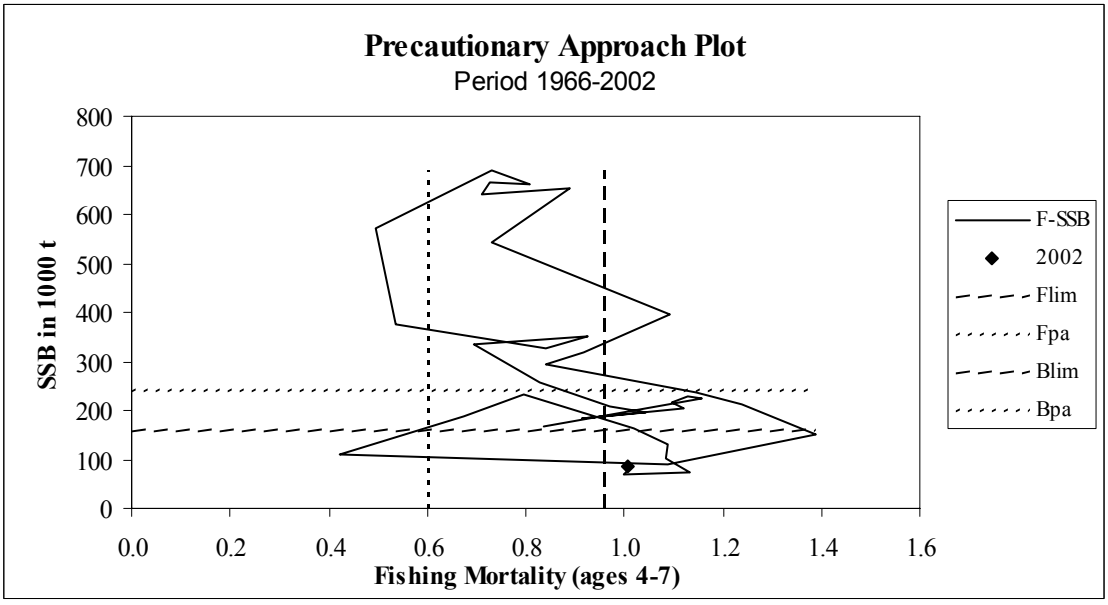

Precautionary Approach Plot
Period 1966-2002
SSB in 1000 t
800
700
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
Fishing Mortality (ages 4-7)
F-SSB
2002
Flim
Fpa
Blim
Bpa

Table 3.14.9.1 Total landings (t) of COD in Subdivisions 25–32 by country.

Year	Denmark	Estonia	Finland	German Dem.Rep.[2]	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands[4]	Norway	Unallo-cated[3]	Total
1965	15856		23	975	2183			41498		19523	22420				102478
1966	16570		26	2196	1383			56007		20415	38270				134867
1967	19924		27	11020	1057			56003		21367	42980				152378
1968	21516		70	12118	2018			63245		21895	43610				164472
1969	23459		58	18460	4715			60749		20888	41580				169909
1970	22307		70	10103	4855			68440		16467	32250				154492
1971	23116		53	2970	2766			54151		14251	20910				118217
1972	34072		76	4055	3203			57093		15194	30140				143833
1973	35455		95	6034	14973			49790		16734	20083				143164
1974	32028		160	2517	11831			48650		14498	38131				147815
1975	39043		298	8700	11968			69318		16033	49289				194649
1976	47412		287	3970	13733			70466		18388	49047				203303
1977	44400		310	7519	19120			47702		16061	29680				164792
1978	30266		1437	2260	4270			64113		14463	37200				154009
1979	34350		2938	1403	9777			79754		20593	75034	3850			227699
1980	49704		5962	1826	11750			123486		29291	124350	1250			347619
1981	68521		5681	1277	7021			120001		37730	87746	2765			330742
1982	71151		8126	753	13800			92541		38475	86906	4300			316052
1983	84406		8927	1424	15894			76474		46710	92248	6065			332148
1984	90089		9358	1793	30483			93429		59685	100761	6354			391952
1985	83527		7224	1215	26275			63260		49565	78127	5890			315083
1986	81521		5633	181	19520			43236		45723	52148	4596			252558
1987	68881		3007	218	14560			32667		42978	39203	5567			207081
1988	60436		2904	2	14078			33351		48964	28137	6915			194787
1989	57240		2254	3	12844			36855		50740	14722	4520			179178
1990	47394		1731		4691			32028		50683	13461	3558			153546
1991	39792	1810	1711		6564	2627	1865	25748	3299	36490		2611			122517
1992	18025	1368	485		2793	1250	1266	13314	1793	13995		593			54882
1993	8000	70	225		1042	1333	605	8909	892	10099		558		13450	45183
1994	9901	952	594		3056	2831	1887	14335	1257	21264		779		36498	93354
1995	16895	1049	1729		5496	6638	4513	25000	1612	24723		777	293	18993	107718
1996	17549	1338	3089		7340	8709	5524	34855	3306	30669		706	289	8515	121889
1997	9776	1414	1536		5215	6187	4601	31396	2803	25072		600			88600
1998	7818	1188	1026		1270	7765	4176	25155	4599	14431					67428
1999	12170	1052	1456		2215	6889	4371	25920	5202	13720					72995
2000	9715	604	1648		1508	6196	5165	21194	4231	15910					66171
2001[1]	9580	765	1526		2159	6252	3137	21346	5032	17854					67651

[1] Provisional data. [2]Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany.
[3] Working group estimates. No information available for years prior to 1993. [4] For 1997 landings not officially reported, estimated by the Working Group.

Table 3.14.9.2 Cod in Subdivisions 25 to 32

Year	Recruitment Age 2 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-7
1966	392574	167655	134867	0.8358
1967	332904	222639	152378	1.1574
1968	320464	228855	164472	1.1289
1969	272324	217804	169909	1.0948
1970	217939	205062	154492	1.1227
1971	242104	181671	118217	0.9119
1972	292775	195547	143833	1.0419
1973	400791	208707	143164	0.9717
1974	471918	258454	147815	0.8296
1975	280924	333519	194649	0.6944
1976	281520	352442	203303	0.9245
1977	463577	324716	164792	0.8423
1978	782245	375328	154009	0.5345
1979	567984	572771	227699	0.4943
1980	405226	691113	347619	0.7329
1981	657536	662796	330742	0.8077
1982	653782	665064	316052	0.7289
1983	434331	639512	332148	0.7112
1984	279926	652353	391952	0.8882
1985	227799	540966	315083	0.7323
1986	244371	396825	252558	1.0921
1987	330244	316802	207081	0.9181
1988	202642	294733	194787	0.8387
1989	114900	237196	179178	1.1461
1990	112431	213308	153546	1.2401
1991	76970	149199	122517	1.3878
1992	128858	91707	54882	1.0872
1993	170594	111354	45183	0.4224
1994	117558	188416	93354	0.6726
1995	113269	234674	107718	0.7956
1996	98936	161682	121889	1.0177
1997	77335	131297	88600	1.0894
1998	117110	103882	67429	1.0837
1999	124122	74349	72989	1.1341
2000	128544	68201	66051	0.9999
2001	160953	76158	67648	1.0079
2002	116137	84238		1.0079
Average	281449	287324	172295	0.9224

Following a recent discussion with DG Fish on the ICES advice on Baltic Cod I have prepared some supplementary catch options for Eastern Baltic cod. The question raised concerns the assumption on the catch in 2002 made by ICES in the forecasts. It has been argued that the catch of 83 000 tons used in the calculations is well above what might be taken even allowing for non-reporting of some catches.

IBSFC informs that catches for the first half of 2002 have been reported as 44,405 tons and that in a normal year this corresponds to 60-65 % of total annual catch. Hence, it is expected that the total for 2002 will be around 75,000 tons corresponding to the TAC of 76,000 tons. IBSFC has no information on the split between the catches taken east and west but based on the split observed in previous years and the present status of the two cod stocks the catch in 2002 for Eastern Baltic cod would be 45-50,000 tons and for Western Baltic cod 25-30,000 tons.

The ACFM Catch Options are based on a catch in 2002 of 29,300 t of Western Baltic Cod and 83,000 t of Eastern Baltic Cod. The catch of eastern Baltic Cod therefore seems to be overestimated.

The reported catch figures are probably underestimates, EU control and inspection has reported on possible non-reported landings but not to the extent that a removal of 83,000 t is likely.

The assessment has suffered from a tendency to overestimate SSB and consequently underestimate the fishing mortality for the most recent year. ICES has investigated this problem and hopes that the changes introduced in the assessment alleviates this problem. Even taking non-reported landings and upward bias in estimated SSB into account, F in 2002 will probably be lower than the assumed F_{sq} of 1.05. Consequently, more cod will survive in 2002 than is indicated.

Based on this information, it appears that management may want to consider other catch options based on different assumed catches for 2002. Therefore, ICES provides three extra catch option tables for eastern Baltic cod based on a catch in 2002 of 50,000 60,000 and 70,000 tons. The tables are for the full implementation of the BACOMA window (or similar improvement in the selectivity) for 2003.

Because of the possible underestimate of fishing mortality it might be prudent to assume that F in 2002 corresponding to a given catch in 2002 will be higher than indicated in the catch option tables.

ICES notes that its advice is unchanged.

ICES also notes that the catch in 2002 has little effect on the trends in SSB indicated by the medium terms prognoses.

Annex II: Effect of 2002 catch on Projection for 2003 for eastern Baltic Cod assuming full effect of selectivity measures in 2003

Eastern Baltic Cod F2003 = 0.6	Landings 2003	SSB 2004
50 000	65.7	140
60 000	60.0	133
70 000	55.0	125
83 000	48.6	115.7

For F_{2003} = 0.6 and full BACOMA selectivity in 2003 other options can be calculated from

Yield (2003) =-0.5156*Catch(2002) + 91.225 ('000 tons)

SSB(2004) = -0.7418*Catch (2002) + 177.2 ('000 tons)

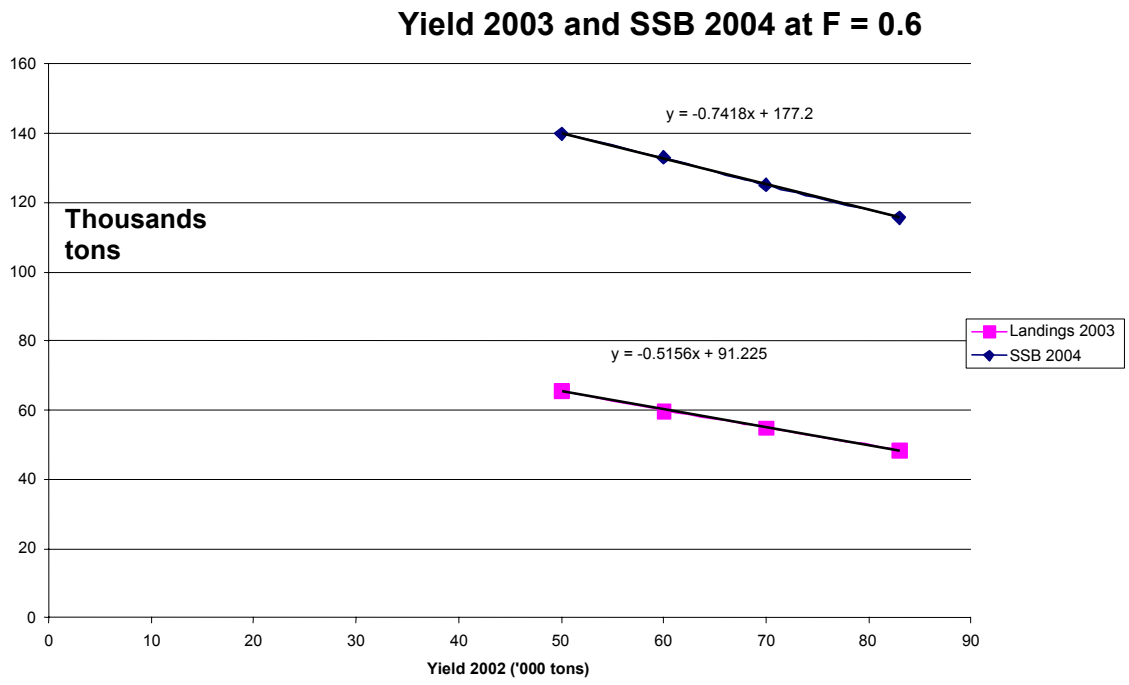
The accuracy is to the nearest 1 000 tons.

Example:

Catch (2002) = 65 000 tons (including allowance for non-reporting)

Yield (2003) = -0.5156*65 + 91.225 = 57.7 ('000 tons)

SSB (2004) = -0.7418* 65 + 177.2 = 129.0 ('000 tons)



Eastern Baltic Cod

Catch Option Tables based on the assumption that the catch of eastern Baltic Cod in 2002 is 50 000, 60 000 or 70 000 tons respectively. All three scenarios are based on the assumption that the measures introduced to improve selectivity will take full in 2003.

Scenario I: Catch Eastern Stock = 50 000 tons Total cod catch 79 300 tons

2002				2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F(4-7)	Landing	SSB
0.507893	0.53	84839	50000	119186	0.40	0.367	43959	160806
					0.45	0.413	48626	156447
					0.50	0.459	53134	152252
					0.55	0.505	57489	148213
					0.60	0.551	61698	144325
					0.65	0.597	65766	140580
					0.70	0.642	69699	136972
					0.75	0.688	73503	133496
					0.80	0.734	77182	130146
					0.85	0.780	80743	126917
					0.90	0.826	84188	123803
					0.95	0.872	87524	120800
					1.00	0.918	90754	117904

Scenario II: Catch 2002 Eastern Stock = 60 000 tons Total catch 89 300 tons

2002				2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F(4-7)	Landing	SSB
0.638935	0.67	84839	60000	109576	0.40	0.367	40336	151511
					0.45	0.413	44632	147524
					0.50	0.459	48783	143684
					0.55	0.505	52797	139986
					0.60	0.551	56678	136422
					0.65	0.597	60431	132988
					0.70	0.642	64063	129677
					0.75	0.688	67578	126485
					0.80	0.734	70980	123407
					0.85	0.780	74274	120438
					0.90	0.826	77464	117574
					0.95	0.872	80554	114809
					1.00	0.918	83549	112141

Scenario III: Catch 2002 Eastern Stock = 70 000 tons Total catch 99 300 tons

2002				2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F(4-7)	Landing	SSB
0.784219	0.82	84839	70000	100068	0.40	0.367	36763	142233
					0.45	0.413	40691	138612
					0.50	0.459	44490	135123
					0.55	0.505	48166	131759
					0.60	0.551	51722	128516
					0.65	0.597	55165	125388
					0.70	0.642	58499	122370
					0.75	0.688	61727	119459
					0.80	0.734	64854	116650
					0.85	0.780	67884	113938
					0.90	0.826	70821	111319
					0.95	0.872	73667	108790
					1.00	0.918	76428	106347

Eastern Baltic Cod Stock - Additional Catch Options

2002	With Selectivity changes in 2003			2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F	Landing	SSB
0.507893	0.53	84839	**50000**	119186	0.30	0.275	34120	170045
					0.35	0.321	39126	165336
					0.40	0.367	43959	160806
					0.45	0.413	48626	156447
					0.50	0.459	53134	152252
					0.60	0.551	61698	144325
					0.70	0.642	69699	136972
					0.75	0.688	73503	133496
					0.80	0.734	77182	130146
					0.85	0.780	80743	126917
					0.90	0.826	84188	123803
					0.95	0.872	87524	120800
					1.00	0.918	90754	117904

2002	With Selectivity changes in 2003			2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F	Landing	SSB
0.638935	0.67	84839	**60000**	109576	0.30	0.275	31290	159954
					0.35	0.321	35891	155652
					0.40	0.367	40336	151511
					0.45	0.413	44632	147524
					0.50	0.459	48783	143684
					0.60	0.551	56678	136422
					0.70	0.642	64063	129677
					0.75	0.688	67578	126485
					0.80	0.734	70980	123407
					0.85	0.780	74274	120438
					0.90	0.826	77464	117574
					0.95	0.872	80554	114809
					1.00	0.918	83549	112141

2002	No Selectivity changes in 2003			2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F	Landing	SSB
0.507893	0.53	84839	**50000**	119186	0.30	0.314	42110	159829
					0.35	0.366	48117	153811
					0.40	0.419	53872	148067
					0.45	0.471	59385	142584
					0.50	0.523	64669	137347
					0.60	0.628	74593	127568
					0.70	0.732	83722	118640
					0.75	0.785	88011	114470
					0.80	0.837	92129	110482
					0.85	0.889	96083	106669
					0.90	0.942	99881	103022
					0.95	0.994	103529	99533
					1.00	1.046	107035	96194

2002	No Selectivity changes in 2003			2003				2004
F-factor	F	SSB	Landing	SSB	F-Factor	F	Landing	SSB
0.638935	0.67	84839	**60000**	109576	0.30	0.314	38917	150282
					0.35	0.366	44479	144736
					0.40	0.419	49811	139439
					0.45	0.471	54923	134379
					0.50	0.523	59825	129545
					0.60	0.628	69038	120510
					0.70	0.732	77524	112252
					0.75	0.785	81516	108391
					0.80	0.837	85349	104698
					0.85	0.889	89033	101164
					0.90	0.942	92572	97781
					0.95	0.994	95975	94544
					1.00	1.046	99247	91444

3.14.10 Flounder

State of stock/exploitation: The total landings of flounder were quite stable from the early 1970s until 1994, when reported landings increased markedly. Reported catches in 1995 and 1996 were well above the previous average, but have decreased thereafter. The 2001 landings were the highest observed.

Results from a tentative assessment of the stock in Subdivisions 24 and 25 suggest a downward trend of the spawning stock since the late 1970s.

Comparison with previous assessment and advice: The tentative assessment shows the same trends as last years assessment.

Elaboration and special comment: Flounder is taken as a by-catch in the cod trawl and gillnet as well as in coastal fisheries. There are also directed trawl fisheries for this species in Subdivisions 24 and 25. For 1994–1998 high total landings of flounder were recorded, likely due to misreporting of other fish species as flounder (Table 3.14.10.1).

The majority of the landings are caught in Subdivisions 24, 25 and 26. The amount of discarded flounder is not known, but it is assumed to be high.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

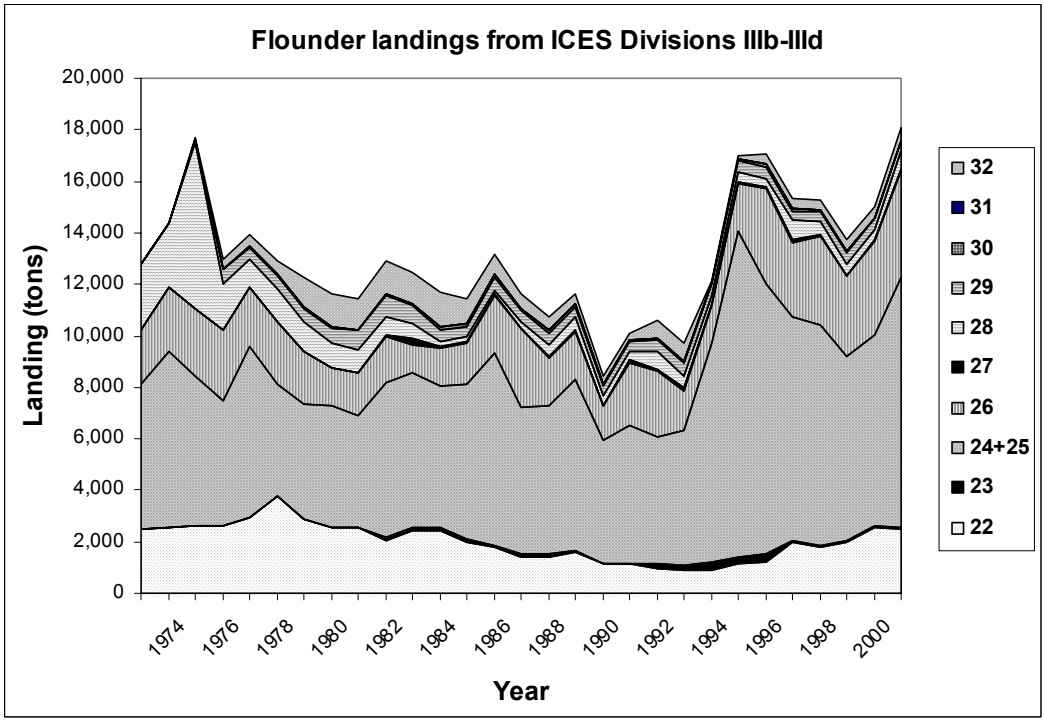


Table 3.14.10.1 Total landings (tons) of FLOUNDER in the Baltic by sub-division and country.(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark[1]					Finland					German Dem. Rep.[2]			Germany, Fed. Rep.				Poland		Sweden[3]							
	22	23	24.25	26	28(29)	24	25	29[6]	30[7]	32	22	24	25(+26)	22	24(+25)	26	28	25(+24)	26	22	23	24	25	26	27	28	29
1973	1,983		386								181	1,624	1,516	349	4			1,580	2,070				502				
1974	2,097		2,578								165	1,482	654	304	3			1,635	2,473				470				
1975	1,992		1,678					113	22	47	163	1,469	406	469	1			1,871	2,585				400				
1976	2,038		482					118	23	59	174	1,556	901	392	2			1,549	2,289				400				
1977	1,974		389					115	32	56	555	2,708	1,096	393	4			2,071	2,089				416				
1978	2,965		415					174	61	155	348	2,572		477	1			996	2,106				346				
1979	2,451		405					192	54	153	189	2,509		259	3			1,230	1,860				315				
1980	2,185		286					194	69	165	138	2,775		212	1			1,613	1,380			16	46		20	181	32
1981	1,964		548					227	56	135	271	2,595		351	1			1,151	1,541			21	30		21	194	34
1982	1,563	104	257					219	58	144	263	3,202		248	1			2,484	1,623			22	33		65	16	3
1983	1,714	115	450					181	67	120	280	3,572		418	1			1,828	905			72	108		212	52	9
1984	1,733	85	306					174	108	135	349	2,719		371	1			2,471	1,288			18	27		53	13	2
1985	1,561	130	649					157	97	137	236	3,253		199	4			2,063	1,302			16	24		47	12	2
1986	1,525	65	1,558					199	128	181	127	2,838		125	10			3,030	1,784			20	31		60	15	3
1987	1,208	122	1,007					159	106	143	71	2,096		114	11			2,530	1,745			17	26		51	13	2
1988	1,162	125	990					177	118	159	92	2,981		133	5			1,728	1,292			23	35		68	17	3
1989	1,321	83	1,062					175	122	163	126	3,616		122	2			1,896	1,089			22	34		66	16	3
1990	941		1,389					219	81	161	52	1,622		183	10			1,617	599				120				
1991	925		1,497					236	81	167				246	1,814			2,008	1,905			24	31		88	20	
1992	713	185	975					405	40	627				227	1,972			1,877	1,869			41	88	3	86	11	3
1993	649	194	635					438	57	683				235	1,230			3,276	1,229		26	27	63	1	83	10	
1994	882	181	1,016					445	33	87				44	4,262	2	3	3,177	1,266		84	20	18	37	33	55	10
1995	859	231	2,110					398	28	131				286	2,825	4	40	7,437	1,482		58	28	186	7	81	18	
1996	1,041	227	2,306				1	365	78	271				189	1,322	10	9	6,069	2,556	2	58	101	718	48	114	31	
1997	1,356		2,421	31	10		1	283	69	299				655	1,982	12	4	3,877	1,730		42	62	308	31	105	370	
1998	1,372		2,393				4	284	59	297				411	1,729	2		4,215	1,370		61	49	187	18	70	117	
1999	1,473		1,206				1	286	57	276				510	1,825			4,015	1,435		37	24	87	47	15		
2000	1,896		1,757			15	6	276	43	275				660	2,089			3,423	1,668		41	49	122		73	28	
2001[5]	2,030		3,048			9	69	224	28	267				458	1,886			4,608	1,433		52	31	96	3	90	178	

continued

Table 3.14.10.1 Continued

Year	USSR				Estonia					Latvia			Lithuania[8]		Russia		Total							
	26	28	29	32	25	26	28	29	32	25	26	28	25	26	26	28	22	23[1]	24	25[4]	26	27	28	29
1973		2610															2,513		2,014	3,598	2,070		2,610	
1974		2510															2,566		4,063	2,759	2,473		2,510	
1975		6455															2,624		3,148	2,677	2,585		6,455	113
1976	471	1779	409	359													2,604		2,040	2,850	2,760		1,779	527
1977	210	1081	321	414													2,922		3,101	3,583	2,299		1,081	436
1978	288	1290	334	395													3,790		2,988	1,342	2,394		1,290	508
1979	158	1170	330	1012													2,899		2,917	1,545	2,018		1,170	522
1980	93	798	334	1080													2,535		3,078	1,659	1,473	20	979	560
1981	58	742	445	1078													2,586		3,165	1,181	1,599	21	936	706
1982	195	665	615	1121													2,074	104	3,482	2,517	1,818	65	681	837
1983	209	551	497	1114													2,412	115	4,095	1,936	1,114	212	603	687
1984	145	202	286	1226													2,453	85	3,044	2,498	1,433	53	215	462
1985	268	189	265	806													1,996	130	3,922	2,087	1,570	47	201	424
1986	442	159	281	556													1,777	65	4,426	3,061	2,226	60	174	483
1987	1315	203	279	397													1,393	122	3,131	2,556	3,060	51	216	440
1988	578	439	257	331													1,387	125	3,999	1,763	1,870	68	456	437
1989	783	512	214	214													1,569	83	4,702	1,930	1,872	66	528	392
1990	752	390	144	141													1,176		3,021	1,737	1,351		390	363
1991						49	1	135	51		123	323		125	216	10	1,171		3,335	2,039	2,418	88	354	371
1992							47	47	46		26	664		483	146		940	185	2,988	1,965	2,527	86	722	455
1993							52	86	55		99	389			225		884	220	1,892	3,339	1,554	83	451	524
1994								3	4		31	276			167		926	265	5,298	3,195	1,503	33	334	458
1995					8		16	52	35		39	322	8	53	271		1,145	289	4,963	7,639	1,856	81	396	450
1996							44	99	145		74	215		231	740		1,232	285	3,729	6,788	3,659	114	299	464
1997					15		101	96	125		78	284			1,001		2,011	42	4,465	4,201	2,883	105	769	379
1998					10		146	79	87	2	88	274		737	1,188		1,783	61	4,171	4,418	3,403	70	537	363
1999					8		92	150	164		140	365		547	964		1,983	37	3,055	4,111	3,133	15	457	436
2000					2	1	65	150	126	3	113	302		575	1,236		2,556	41	3,910	3,556	3,593	73	395	426
2001[5]							100	161	221		201	412		1,127	1,355		2,488	52	4,974	4,773	4,119	90	690	385

[1] For the years 1973-1981 the catches of Sub-division 23 are included in Subdi
For the years 1973-1981 the catches of Subdivision 23 are included in Subdivision 22.
[2] From October-December 1990 landings of former German Fed. Rep. are included.
[3] For the years 1973-1979 and 1990 the catches of Subdivisions 24-29 are included in Subdivision 25.
[4] For the years 1973-1979 and 1990 the catches of Sub-divisions 24-29 are included in Sub-
For the years 1973-1979 and 1990 the Swedish catches of Sub-divisions 24-29 are included in Sub
[5] Provisional
Provisiona
[6] Landings of Subdivision 27 are included
[7] Landings of Subdivision 31 are included
Landings of Sub-division 31 are included
Lithuania, for 1993, 1994, 1997 and 1998 no data reported
[8] Lithuania, for 1993, 1994, 1997 and 1998 no data rep

3.14.11 Plaice

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: Subdivisions 22 and 24 are the most important areas for plaice fishery in the Baltic. The total landings of plaice (Table 3.14.11.1) were high in the 1970s, but have decreased since the 1980s to the lowest on record in 1993 (269 t). Since then the landings have increased above 2 500 t, mainly due to increased landings from Subdivision 22.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

Plaice in Subdivisions 22 to 32

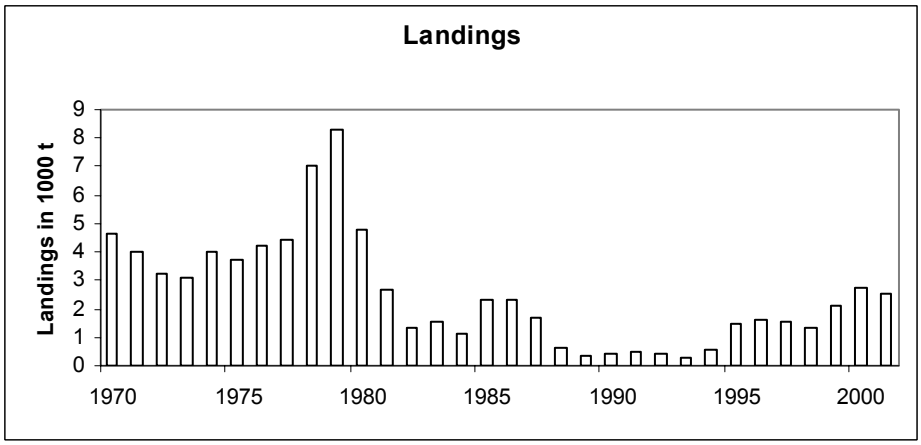


Table3.14.11.1 Total landings (tonnes) of PLAICE in the Baltic by subdivision and country.
(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germ.Dem. R.[1]		Germany, Fed. Rep.				Poland		Sweden[2]							
	22	23	24(25)	22	24	22	24(+25)	26	28	25(+24)	26	22	23	24	25	26	27	28	29
1970	3,757		494			202	16							149					
1971	3,435		314			160	2							107					
1972	2,726		290			154	2							78					
1973	2,399		203	2	44	163	1			174	30			75					
1974	3,440		126	36	10	166	2			114	86			60					
1975	2,814		184	11	67	302	1			158	142			45					
1976	3,328		178	11	82	302	3			164	76			44					
1977	3,452		221	5	36	348	2			265	26			41					
1978	3,848		681	33	1,198	346	3			633	290			32					
1979	3,554		2,027	10	1,604	195	7			555	224			113					
1980	2,216		1,652	5	303	84	5			383	53			113					
1981	1,193		937	6	52	74	31			239	27			118					
1982	716		393	6	25	39	6			43	64			40	6		7	1	
1983	901		297	5	12	37	14			64	12			133	20		24	2	
1984	803		166	7	2	23	8			106				23	3		4	1	
1985	648		771	68	593	26	40			119	49			25	4		5	1	
1986	570		1,019	34	372	25	7			171	59			48	7		9	1	
1987	414		794	4	142	14	16			188	5			68	10		12	1	
1988	234		323	3	16	7	1			9	1			49	7		9	1	
1989	167		149		5	7				10				34	5		6	1	
1990	236		100		1	9	1			6				50					
1991	328		112			15	9			2	1			5	2		2		
1992	316		74			11	4			6				3	1		1		
1993	171		66			16	6			4			2	4					
1994	355		159			1				43	4		6	4	7				
1995	601	64	343			75	91		1	233	2		12	13	10	1			
1996	859	81	263			43	77			183	5	1	13	28	23	10	1		
1997	902		201			51	56			308	3		13	7	8		1		
1998	642		278			213	41			101	14		13	6	17		1		
1999	1,456		183			244	46			145	1	1	13	5	10				
2000	1,932		161			140	37			408	3		26	9	12				
2001 [4]	1,627		173			58	43			549	3		39	9	13				

continued

Table 3.14.11.1 continued

Year	Total								Total
	22	23	24[3]	25	26	27	28	29	22-29
1970	3,959		659						4,618
1971	3,595		423						4,018
1972	2,880		370						3,250
1973	2,564		323	174	30				3,091
1974	3,642		198	114	86				4,040
1975	3,127		297	158	142				3,724
1976	3,641		307	164	76				4,188
1977	3,805		300	265	26				4,396
1978	4,227		1,914	633	290				7,064
1979	3,759		3,751	555	224				8,289
1980	2,305		2,073	383	53				4,814
1981	1,273		1,138	239	27				2,677
1982	761		464	49	64	7	1		1,346
1983	943		456	84	12	24	2		1,521
1984	833		199	109		4	1		1,146
1985	742		1,429	123	49	5	1		2,349
1986	629		1,446	178	59	9	1		2,322
1987	432		1,020	198	5	12	1		1,668
1988	244		389	16	1	9	1		660
1989	174		188	15		6	1		384
1990	245		152	6					403
1991	343		126	4	1	2			476
1992	327		81	7		1			416
1993	187	2	76	4					269
1994	356	6	163	50	4				579
1995	676	76	447	243	3		1		1,446
1996	903	94	368	206	15	1			1,587
1997	953	13	264	316	3	1			1,550
1998	855	13	325	118	14	1			1,326
1999	1,701	13	234	155	1				2,104
2000[4]	2,072	26	207	420	3				2,728
2001	1,685	39	225	562	3				2,514

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.

[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24.

[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24.

[4] Provisional.

3.14.12 Dab

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The total landings of dab (Table 3.14.12.1) were stable at around 2 000 t per year in the 1980s and the early 1990s. The reported catches in 1994 and 1995 increased to 3 000 t, but in 1996 they returned to the previous level. From 1997 onwards the landings decreased and in 2000 and 2001 are on the lowest level (850-900 t).

The temporary increase in landings reported for 1994 and 1995 is influenced by misreporting of other species as dab.

Most catches were taken from Subdivision 22 (90-91% of total landings), followed by Subdivision 24 with only up to 7-9% of the total landings.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

Dab in Subdivisions 22 to 32

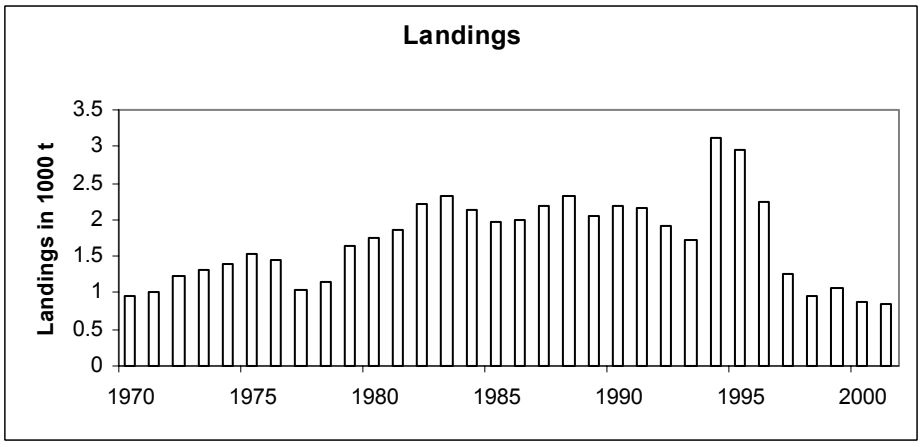


Table 3.14.12.1 Total landings (tonnes) of DAB in the Baltic by Subdivision and country. (There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark				G. Dem. Rep.[1]		Germany, Fed. Rep.				Sweden[2]								Total									Total
	22	23	24(+25)	25-28	22	24	22	24	25	26	22	23	24	25	27	28	29	30	22	23	24[3]	25[5]	26	27	28	29	30	22-30
1970	845		20		11		74												930		20							950
1971	911		26		10		64												985		26							1,011
1972	1110		30		9		63						23						1,182		53							1,235
1973	1087		58		18		118						30						1,223		88							1,311
1974	1178		51		18		118						34						1,314		85							1,399
1975	1273		74		20		131						32						1,424		106							1,530
1976	1238		60		17		114						27						1,369		87							1,456
1977	889		32		13		89						25						991		57							1,048
1978	928		51		19	14	128	4											1,075		69							1,144
1979	1413		50		18	25	123	1					9						1,554		85							1,639
1980	1593		21		15	25	101						3						1,709		49							1,758
1981	1601		32		24	39	164						5						1,789		76							1,865
1982	1863		50		46	38	182	4					6	5	8	6		1	2,091		98	5		8	6		1	2,209
1983	1920		42		46	28	198						24	20	32	22		2	2,164		94	20		32	22		2	2,334
1984	1796		65		30	47	175	2					4	3	5	4		1	2,001		118	3		5	4		1	2,132
1985	1593		58		52	51	187	2					3	3	5	3		1	1,832		114	3		5	3		1	1,958
1986	1655		85		36	35	185	1					1	1	1	1			1,876		122	1		1	1			2,001
1987	1706		93		14	87	276	4					1	1	1	1			1,996		185	1		1	1			2,184
1988	1846		75		22	91	281	1					1	1	1	1			2,149		168	1		1	1			2,320
1989	1722		48		26	19	218	1					1	1	2	1			1,966		69	1		2	1			2,039
1990	1743		146		14	11	252	1					8						2,009		166							2,175
1991	1731		95				340	5					1						2,071		101							2,172
1992	1406		81				409	6						1	1		4		1,815		87	1		1		4		1,908
1993	996		155				556	10				7	1	1			1		1,552	7	166	1				1		1,727
1994	1621		163				1190	80	45			5	1	1					2,811	5	244	46						3,106
1995	1510	47	127	10			1185	49	3			5	1	5		1			2,695	52	177	18			1			2,943
1996	913	37	128				991	134	13	2	3		3	4	1				1,907	37	265	17	2	1				2,229
1997	728		60				413	21	2			5	5	10	3	1			1,141	5	86	12		3	1			1,248
1998	569		89				280	6	2			7	3	3	1				849	7	98	5		1				960
1999	664		59				339	4				3	1	1					1,003	3	64	1						1,071
2000	612		46				212	3				2		1					824	2	49	1						876
2001 [1]	586		72				191	5				4	1	2					777	4	78	2						861

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.

[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24.

[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24.

[4] Provisional.

[5] In 1995 Danish landings of Subdivisions 25-28 are included.

3.14.13 Turbot

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The landings of turbot in the Baltic increased from less than 100 t in the 1960s and 1970s to nearly 500 t in the early 1990s, and again to above 1 000 t in the mid-1990s. Catches declined after 1996, and are now about 500 t (Table 3.14.13.1).

The main turbot fishery takes place in Subdivisions 22, 24, 25, 26, and 28. Due to the high market demand a directed turbot gillnet fishery developed in the 1990s.

At present the IBSFC regulations of the turbot fishery are minimum landing size and a temporary closure of fishing during the spawning season. There are also additional national regulations, for example, a minimum mesh size for some fisheries.

Although there are ongoing study programs in several countries focusing on the status of turbot stocks in the Baltic, the data available are insufficient to allow evaluation of the appropriateness of the present management measures in respect to the precautionary approach.

The landings are uncertain due to incomplete reporting, especially for the early years.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:18).

Turbot in Subdivisions 22 to 32

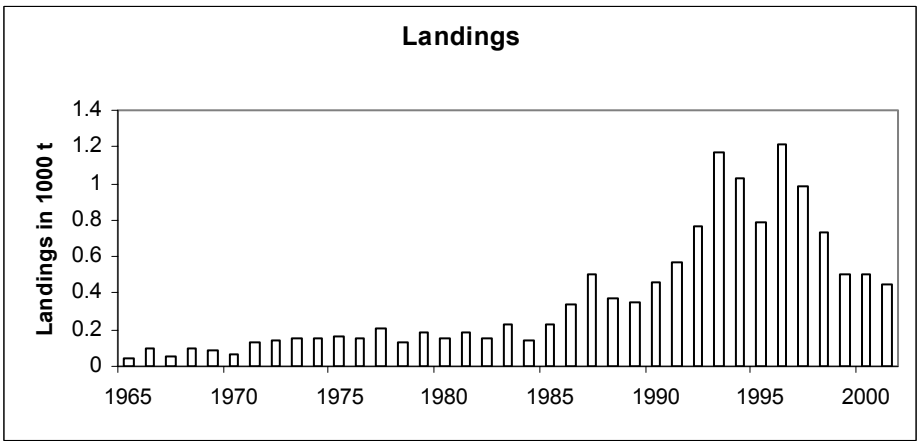


Table 3.14.13.1 Total landings (tonnes) of TURBOT in the Baltic by Subdivision and country.(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germ.	Dem.R.[1]	Germany, Fed. Rep.						Poland		Sweden[2]							Latvia		Lithuania[5]	Russia
	22	23	24(25)	22	24	22	24	25	26	27	28	25(+24)	26	22	23	24	25	26	27	28(+29)	26	28	26	26
1966	16		21	5	53																			
1967	14		20	7	10																			
1968	14		18	3	67																			
1969	13		13	4	57																			
1970	11		13	5	40											2								
1971	11		26	4	86											2								
1972	10		26	3	100											3								
1973	11		30	3	33							58	13			5								
1974	14		40	2	23							34	36			6								
1975	27		48	3	38	15						23	6			7								
1976	29		24		52	11						14	12			7								
1977	32		37		55	9						12	55			8								
1978	33		37	2	27	9						7	3			10								
1979	23		38	3	39	6						29	34			12								
1980	28		38		30	9						12	20			15								
1981	28		62	1	46	8						10	19			7								
1982	31		51	1	27	7						2	17			3	4		4	3				
1983	33		40	3	9	8						5	4			31	41		35	24				
1984	41		45	4	8	12						13	2			3	4		3	2				
1985	56		34	5	22	15						67	15			4	5		4	3				
1986	99		81	6	32	25						32	37			6	8		7	5				
1987	134		93	4	34	30						155	21			8	11		9	6				
1988	117		117	3	28	34						7	10			12	16		14	9				
1989	135		109	7	22	20							11			11	15		13	9				
1990	178		181	4	2	26						24	25			14								
1991	228		137			44	39					73	20			2	12		16					
1992	267		127			55	68					80	55			12	12		21	36				30
1993	159	29	152			74	56					520	72		2	4	14		13	38				34
1994	211	18	166			52	57	10				380	30		2	3	18	1	17	44				15
1995	257	11	94			65	53	4				30	15		2	3	54	9	31	83	34	27		20
1996	207	12	95			36	47	4			1	288	92	1	3	15	100	5	54	104	42	3	76	25
1997	151		68			60	52	3				290	70		2	6	70	1	53	86	33	14		25
1998	138		80			44	55	1				66	68		2	4	58	1	18	69	12	24		96
1999	106		59			23	48					18	15		2	4	41	3	17	60	20	34		48
2000	97		58			23	54					90	12		2	3	39		16	39	7	9		53
2001[4]	76		53			19	31					121	10		2	5	16		9	29	5	1		69

Table 3.14.13.1 continued

Year	Total	Total

	22	23	24[3]	25	26	27	28(+29)	22-28(+29)
1965	3		39					42
1966	21		74					95
1967	21		30					51
1968	17		85					102
1969	17		70					87
1970	16		55					71
1971	15		114					129
1972	13		129					142
1973	14		68	58	13			153
1974	16		69	34	36			155
1975	45		93	23	6			167
1976	40		83	14	12			149
1977	41		100	12	55			208
1978	44		74	7	3			128
1979	32		89	29	34			184
1980	37		83	12	20			152
1981	37		115	10	19			181
1982	39		81	6	17	4	3	150
1983	44		80	46	4	35	24	233
1984	57		56	17	2	3	2	137
1985	76		60	72	15	4	3	230
1986	130		119	40	37	7	5	338
1987	168		135	166	21	9	6	505
1988	154		157	23	10	14	9	367
1989	162		142	15	11	13	9	352
1990	208		197	24	25			454
1991	272		178	85	20	16		571
1992	322		207	92	85	21	36	763
1993	233	31	212	534	106	13	38	1,167
1994	263	20	226	408	46	17	44	1,024
1995	322	13	150	88	78	31	110	792
1996	244	15	157	392	240	55	107	1,210
1997	211	2	126	363	129	53	100	984
1998	182	2	139	125	177	18	93	736
1999	129	2	111	59	86	17	94	498
2000	120	2	115	129	72	16	48	502
2001[4]	95	2	89	137	84	9	30	446

[1] From October-December 1990 landings of Germany, Fed. Rep. are included

[2] For the years 1970-1981 and 1990 the catches of Subdivisions 25-28 are included in Subdivision 24

[3] For the years 1970-1981 and 1990 the Swedish catches of Subdivisions 25-28 are included in Subdivision 24

[4] Provisional.

[5] Lithuania, for 1995,1997,1998,1999 and 2000 no data reported

3.14.14 Brill

State of stock/exploitation: The available data are insufficient for assessing the current stock size and exploitation.

Elaboration and special comment: The landings of brill in the Baltic are low and are typically less than 50 t (Table 3.14.14.1) and are mainly taken in Subdivision 22.

The reported total landings of brill, especially in 1994-1996 are overestimated due to the misreporting of species in the landings of the directed cod fishery.

Source of information: Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

Brill in Subdivisions 22 to 32

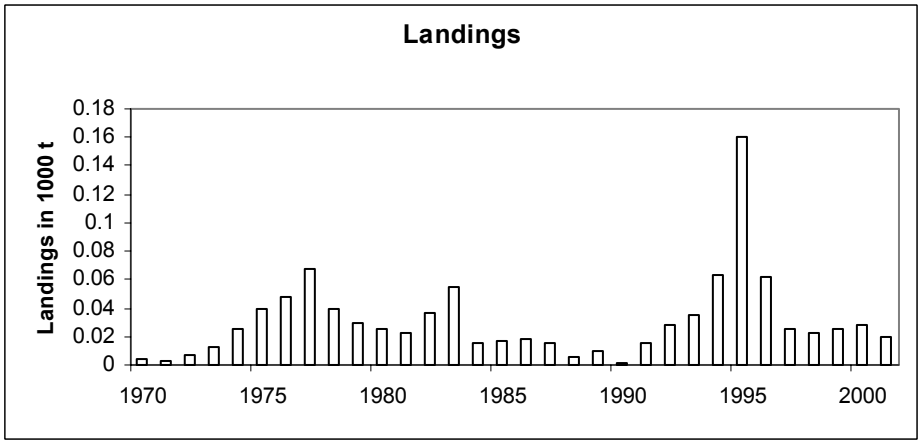


Table 3.14.14.1 Total landings (tonnes) of BRILL in the Baltic by subdivision and country.
(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germany Fed. Rep.	Sweden		Total			Total 22-28
	22	23	24-28	22	23	24-28	22	23	24-28	
1970	4						4			4
1971	3						3			3
1972	7						7			7
1973	11		2				11		2	13
1974	25		1				25		1	26
1975	38		1	1			39		1	40
1976	45		1	2			47		1	48
1977	60		2	5			65		2	67
1978	37			3			40			40
1979	30						30			30
1980	26						26			26
1981	22			1			23			23
1982	19					17	19		17	36
1983	13					42	13		42	55
1984	12					3	12		3	15
1985	16					1	16		1	17
1986	15					3	15		3	18
1987	12					3	12		3	15
1988	5					1	5		1	6
1989	9					1	9		1	10
1990						1			1	1
1991	15						15			15
1992	28						28			28
1993	29	5	1				29	5	1	35
1994	57	4	1			1	57	4	2	63
1995	134	12	1		5	8	134	17	9	160
1996	56	6					56	6		62
1997	25				1		25	1		26
1998	21				1		21	1		22
1999	24				1		24	1		25
2000	27				1		27	1		28
2001 [1]	19						19			19

[1] Provisional.

3.14.15 Salmon in the Main Basin and the Gulf of Bothnia (Subdivisions 22–31)

State of stocks/exploitation: Parr densities in most rivers being monitored in the Gulf of Bothnia have been improving and contributed to good wild smolt runs in 2000 and 2001. The survival rate of smolt to adult was low in the late 1990s (Figure 3.14.15.1). The status of the wild stock as a whole, although unquestionably improved, remains uncertain because the survival of smolt to adult in 2000 and 2001 is unknown. Catches of salmon are given in Tables 3.14.15.1 and 3.14.15.2. Decreased catches in the 1990s are largely explained by reduced TACs and strong regulations in coastal fisheries. Decreases are also considered to result from reduced survival of released salmon in post-smolt phase.

The proportion of wild salmon in the catch has increased since 1998, which is consistent with higher smolt production. Salmon smolt production estimates in the Gulf of Bothnia and Baltic Main Basin are shown below (in millions):

Year	Wild[1]	Reared	Total
1987	0.43	5.55	5.98
1988	0.42	5.67	6.09
1989	0.43	5.23	5.66
1990	0.42	4.39	4.81
1991	0.43	4.09	4.52
1992	0.47	4.70	5.17
1993	0.51	5.37	5.88
1994	0.60	3.95	4.55
1995	0.30	4.49	4.79
1996	0.31	4.74	5.05
1997	0.35	5.20	5.55
1998	0.46	5.61	6.07
1999	0.56	5.51	6.07
2000	1.27	5.67	6.94
2001	1.34	5.46	6.80
2002[2]	1.21	5.61	6.82

[1]Data on wild smolt production since the early 1990s is to a large extent based on annual parr surveys and applied estimation models. Smolt production estimates based on counts only for rivers Tornionjoki and Simojoki (20–30% of total natural production). [2]Preliminary data.

*Wild stock*s: Today about 90% of the total natural salmon production of the Baltic Sea occurs in the Gulf of Bothnia (Subdivisions 30-31) where 13 rivers are carrying wild salmon populations. In the early 1990s, most populations in this area were depleted. The management measures taken, including the reduction in TAC and the national regulatory measures in coastal areas, coincided with the occurrence of a strong brood-year class in 1990 and increased parr densities in almost all of these rivers in 1996–2001. Improved parr densities gave high smolt runs in 2000-2001 (3–4 year old smolts) and are expected to give good smolt runs still in 2002. (Table 3.14.15.3). The recent high smolt runs are expected to give good spawning runs in 2002–2005, provided that harvest rates and other sources of mortality will not exceed the rates which have occurred in the last few years. Fish counts in the fish ladders in a couple of the Swedish rivers in the Gulf of Bothnia indicated a good spawning run in 2001. In a small number of rivers entering into the Gulf of Bothnia, populations are improving only slowly, often from returning numbers of spawners so low that the stocks were at risk of collapse.

In the Main Basin area, the status of populations is good in terms of parr densities. However, the status of individual rivers is generally uncertain due to incomplete monitoring.

The proportion of wild smolt in total production has increased, being about 20% in 2001. Harvest rate analysis suggests an increasing trend in wild post-smolt natural mortality during the last ten years (Figure 3.14.15.1).

Reared stocks: Most of the salmon smolt recruitment originates from the releases (80% in 2001). About 70% of the total releases are carried out in the Gulf of Bothnia. Harvest rate analysis and tagging results suggest that pre-fishery survival of reared smolts has declined since the early 1990s (Figures 3.14.15.1 and 3.14.15.2). Despite reduced survival, more salmon are returning to the release sites (Figure 3.14.15.7), likely as a result of reduced fishing pressure resulting from stringent management measures in the coastal and offshore areas.

Management objectives: The IBSFC objective is to increase the natural production of wild Baltic salmon to at least 50% of the natural production capacity of each river by 2010, while retaining the catch level as high as possible.

The management objective is linked to the potential production of each individual river. However, an expert analysis suggests that the smolt production capacity estimates have been underestimated in particular for the biggest salmon rivers (Figure 3.14.15.3). Also the smolt production capacity estimates contain significant uncertainty.

Precautionary Approach reference points: Provisional fishing mortality reference points are now proposed for the first time for the Baltic salmon. $\mathbf{F}_{MSY}$ was calculated for the wild Baltic salmon population using the outputs of a harvest rate model and was taken as $\mathbf{F}_{lim}$. The stock-recruit function assumed was a

Beverton-Holt type, parameterised in terms of steepness and unfished smolt abundance.

The value for steepness was obtained from a meta-analysis of eight North-Atlantic salmon stocks due to the lack of corresponding data from any of the Baltic stocks. This analysis produced a potential distribution of values for steepness applicable to Baltic stocks. M74 was incorporated into the model by adjusting the steepness parameter.

The provisional $\mathbf{F}_{MSY}$ obtained was subject to the constraint that the relative amount of fishing effort in the longline, driftnet, coastal, and river fisheries remained constant and was kept the same as the average of the values observed in 2000 and 2001. The total cumulative fishing mortality rate at MSY for 2SW fish was used as the reference value for $\mathbf{F}_{MSY}$. The provisional $\mathbf{F}_{pa}$ was computed based on $\mathbf{F}_{lim}$ and its estimated uncertainty (including an estimate of implementation uncertainty).

For these stocks, $\mathbf{F}_{lim}$ (=0.49, cumulative F on 2SW fish until entrance to the river) gives a smolt production of 72% of that maximum possible production, as estimated in an expert opinion analysis (Table 3.14.15.4.). In the long run, fishing at $\mathbf{F}_{pa}$ (=0.31) decreases the combined yield on wild and reared stocks by 12 % but increases the wild smolt production to 81 % of maximum. In the current situation, the fishing mortality of the mixed stock fishery is higher than the provisional $\mathbf{F}_{pa}$ (Figure 3.14.15.5). For the less resilient stocks, the simulations suggest that the maximum yield would be obtained by much lower fishing mortality and, with the provisional $\mathbf{F}_{pa}$, there is still a risk for less productive populations to remain in their current poor state.

Nevertheless, adopting $\mathbf{F}_{pa}$ would be an improvement upon the current situation and, accordingly, ICES suggests that this provisional $\mathbf{F}_{pa}$ value be adopted and applied to guide management actions in the near future. Providing advice in terms of a catch corresponding to a fishing mortality reference point such as $\mathbf{F}_{pa}$ is more consistent with the current management practice of controlling the fisheries through TAC (and fleet quotas).

Advice on management: ICES advises that the national and international measures in place in 1997-2001, with the TAC for 2003 of 410 000 salmon, be continued. ICES also advises that the objective of meeting the 50% smolt production be revisited in the context of the proposed $\mathbf{F}_{pa}$ reference point. That will require discussions between ICES and IBSFC, as well as interactions to explain the underlying models and revise or refine them if needed.

ICES further advises that the exploitation close to the river mouths and in rivers should be closely monitored and kept sufficiently low to allow the number of spawning fish to increase.

Relevant factors to be considered in management: Improvement in many of the Gulf of Bothnian wild salmon stocks since the mid-1990s is a consequence of the favourable coincidences in mortality factors (i.e. lower incidence of M74) associated with the salmon life cycle, together with the regulatory measures in the fisheries. The factors influencing the development of M74 are poorly understood. The M74 mortality has varied over the years (Table 3.14.15.5) and sudden unpredictable changes in the incidence of the disease may occur. The speed and direction of development in stock status will depend both on the fishing mortality and variations in natural mortality. Parr densities and smolt production in most rivers have improved; however, salmon stocks in some rivers have not shown improvement despite the measures in place in the fisheries (Figures 3.14.15.4 and 3.14.15.6).

Simulations showed that, to protect 95% of all stocks, including those with lower resilience, the reference fishing mortality would have to be much lower than the provisional $\mathbf{F}_{pa}$ proposed above. Such a reference point would give a greater likelihood of recovering and maintaining the weak stocks close to their $\mathbf{B}_{MSY}$ levels. However, this would require that all Baltic fisheries be restricted in order to maintain this very low fishing mortality rate. The consequence of this strategy would be that a large percentage of the yield from the more productive Baltic salmon stocks would be forgone in any mixed stock fisheries.

Mark-recapture studies indicated that, from releases of 1.7 million reared fish per year in Subdivisions 30-31, an additional 35 000-45 000 spawners are available for catching in Swedish rivers or close to the river mouths. Analysis indicated differences in levels and trends between different parts of the Gulf of Bothnia, therefore these figures can not be generalized to rivers in Finland. No data suggest the existence of a large non-exploited amount of salmon in rivers in the Main Basin. Regarding the possible utilisation of these fish, ICES is aware that current harvest advice would result in a certain amount of reared fish returning to their release site, and would not be harvested with current management measures. If river-specific measures could be developed to harvest such surplus without by-catch of wild salmon, such harvesting could proceed, and be incremental to the TAC without causing a conservation concern. However, any such harvesting programs should be reviewed by ICES prior to implementation, to ensure that they provide protection to wild stocks. The data presented here are in contrast with the popular belief of a large (half-a-million or more) non-exploited surplus of reared salmon in many rivers.

TAC is an effective tool to safeguard salmon in the Main Basin to allow them to begin their spawning run. However, to restrict fishing mortality in coastal fisheries

directed at homing wild salmon, complementary technical measures are essential and should be maintained.

Non-reported catches and discards are estimated to be about 20% of the reported landings (in numbers), each being about of the same magnitude. About 70% of discards are caused by seal damages. Catch losses have continued to increase and the most serious damage occurs in the Subdivisions 29–31. These losses are not included in the TAC.

Catch forecast for 2003 and short-term projection for fishing mortality and escapement:

A catch forecast model was developed and allowed the exploration of various fishing scenarios under two options for wild smolt production (recruitment) and a constant release of reared smolt. These provided insight on relative changes in yield at sea and in coastal areas (but river catches are not included), as well as relative changes in escapement, when effort was reduced by 0%-50% per year until $\mathbf{F}_{pa}$ was reached. For instance, with a 20% annual reduction in effort starting in 2003, $\mathbf{F}_{pa}$ would be reached by 2007 and give an improvement in relative survival to the river of 46%. With increasing smolt numbers, the F and relative survival would be the same, but yield and escapement in numbers would be higher.

Basis: Constant releases of 4.7 million reared smolts; relative survival, escapement and yield (reared+wild) are relative to 2002; the harvest rate (F) is given as a cumulative rate for the 2SW salmon by the entrance to the river, $\mathbf{F}_{lim}$=0.49, $\mathbf{F}_{pa}$=0.31**:**

Constant wild smolt production in 1996-2007 (0.3 million smolts – as seen in 1995 and 1996 when production was poor):

Change in effort	Yield (2003)	F(2007)	Relative survival to the river (2007)	Escapement in numbers (2007)	Yield (2007)
constant effort	1.00	0.63	0.99	0.99	1.00
10% annual decrease	0.92	0.45	1.24	1.24	0.69
20% annual decrease	**0.83**	**0.31**	**1.46**	**1.46**	**0.43**

With a 10% annual increase in wild smolt production in 1996-2007 (starting from 0.3 million smolts – believed to be more representative, but still below recent estimates):

Change in effort	Yield (2003)	F(2007)	Relative survival to the river (2007)	Escapement in numbers (2007)	Yield (2007)
Constant effort	1.09	0.63	0.99	1.59	1.60
10% annual decrease	1.00	0.45	1.24	2.00	1.09
20% annual decrease	**0.91**	**0.31**	**1.46**	**2.35**	**0.68**

Wild stocks: Based on parr densities in rivers, it is estimated that the natural smolt production will be 1.23 million smolts in 2002 (Table 3.14.15.3).

Reared stocks: The production of reared smolts is expected to be 5.61 million in 2002.

Medium- and long-term projections:
Not available.

Comparison with previous assessment and advice: There were no analytical assessments in previous years. In this assessment, a harvest model integrating the information on life history parameters and their uncertainties was developed to allow the evaluation of the response of the stock to a fishery closely matching the exploitation pattern in the Baltic salmon fishery. Production capacity was estimated from an expert opinion analysis using data from 13 rivers and these estimates, together with their uncertainties, were used to estimate the total production capacity for wild Baltic salmon stocks. This analysis, while preliminary, suggests that the total production capacity could be much higher than previously thought. A Monte-Carlo simulation was used to determine precautionary reference points ($\mathbf{F}_{lim}$, $\mathbf{F}_{pa}$) and to evaluate their relation to the new perception of the production capacity. A catch forecast model was also developed to evaluate the impact of various fishing scenarios in relative terms.

There is no change in the basis for the catch advice, but there is a need to engage in a discussion on the implications of the results from the new models on the objectives set in the current management plan.

Elaboration and special comment: To support management needs, the monitoring and assessment system of the Baltic salmon should enable the evaluation of the stock status and give answers to the management questions with an adequate precision and at reasonable costs. The balance between the costs and precision is not easy to achieve, and when applying the precautionary approach, higher uncertainty should lead to lower exploitation. In this sense, the specification of the needed precision in assessment is as much a management decision as a scientific decision.

In the current management approach, smolt production of wild stocks has been chosen as an operational objective. Behind this objective, there are more fundamental aims, e.g. to safeguard the genetic diversity of the wild and reared salmon stocks. In addition, catches are to be kept as high as possible. If the proposed $\mathbf{F}_{pa}$ was followed, these objectives could in part be met, but more conservative fishing mortality values would be needed to protect the weak stocks, so catches would not be kept as high as possible. These results are based on the current pattern of fishing mortality, which is mostly coastal and at sea.

At present, smolt production is estimated for several rivers from parr densities by regression models derived from the parr-to-smolt relationships in two rivers. The extrapolated estimates are uncertain, and there are no confidence limits available for these estimates. When monitoring the system, there will still be uncertainty caused by the unknown rate of post-smolt survival before these fish recruit to the fishery. In addition, as discussed earlier (Figure 3.14.15.3), the fulfilment of the objectives is very difficult to assess. For these reasons, IBSFC should consider setting alternative operational objectives (e.g. escapement, adherence to $\mathbf{F}_{pa}$, etc.).

ICES emphasises that several indicators (e.g. indicators of density and abundance at various stages of the life cycle from several rivers, indicators of fishing effort or fishing mortality) should be used when evaluating the state of the stocks and the data requirements for management actions. The current assessment procedure is flexible and can potentially utilise data from specific field studies, which could provide information that can be expanded to cover all populations. When assessing the state of the stocks, the following variables and criteria are probably the most important ones in the future:

1) Fishing mortality of wild stocks (to be close to $\mathbf{F}_{pa}$). This is assumed to be the rate of mortality where most of the stocks would have a good productivity with high probability and the total yield obtained would be close to maximum.

2) Parr density measurements from each wild salmon river would indicate the relative change in production (parr densities are observed after M74 mortality and have predictive power for the future state of stocks).

3) Stock composition of adult standing stock, with proportion of individual wild stocks. However, this is an estimate after the recruitment to the fisheries, and does not have very much predictive power due to the short life cycle of the salmon (short time between the data year and target year). When applying the new assessment methodology, these estimates can be obtained either by tagging of wild smolts or by genetic analysis.

These three variables cover different parts of the life cycle and would provide the information required for international management decisions. Fishing mortalities and parr densities can be measured by current monitoring, and they support the assessment system with reasonable accuracy. The monitoring of stock composition should be started and the required methodology should be developed.

In addition to these basic elements, there is a need to monitor other biological characteristics in order to get an overall view of the stock status. It is important that the local management needs and local interests be taken into account in field surveys. The information gained through monitoring must be understandable to all interested parties, from the local people (e.g. the owners of river fishing rights), to national management agencies and international commissions to get them committed to the objectives and make the management successful. Improvement in local surveys leads to better stock assessments across the whole Baltic Sea and allows a better appreciation of the impact of fishing.

Managers and ICES together should consider these aspects of monitoring and development of management strategies, and include them, if considered to be relevant, in the terms of reference for future assessment working group meetings.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group, 3 – 12 April 2002 (ICES CM 2002/ACFM:13).

Catch data (Tables 3.14.15.1–2):

TACs

Year	ICES Advice	Catch corresp. to advice '000 t	Rec TAC '000 fish	Agreed TAC[1] '000 t	Agreed TAC[1] '000 fish
1987	No increase in effort	-	-		
1988	Reduce effort	<3.00			
1989	TAC	2.90	850		
1990	TAC	1.68			
1991	Lower TAC	-[2]	-[2]	3.35	
1992	TAC		688	3.35	
1993	TAC		500[3]		650
1994	TAC		500[3]		600
1995	Catch as low as possible in offshore and coastal fisheries	-	-		500
1996	Catch as low as possible in offshore and coastal fisheries	-	-		450
1997	Catch as low as possible in offshore and coastal fisheries	-	-		410
1998	Offshore and coastal fisheries should be closed	-	-		410
1999	Same TAC and other management measures as in 1998		410		410
2000	Same TAC and other management measures as in 1999		410		450
2001	Same TAC and other management measures as in 2000		410		450
2002	Same TAC and other management measures as in 2001		410		450
2003	Same TAC and other management measures as in 2001		410		

Landings

Year	Rivers		Coast			Offshore	Coast and Offshore[4]		Total	
	'000 t	'000 fish	'000 t	'000 fish	'000 t	'000 fish	'000 t	'000 fish[5]	'000 t	'000 fish[5]
1987	0.05		0.39		3.21		3.59	891	3.64	897
1988	0.06		0.41		2.43		2.85	784	2.90	791
1989	0.08		0.65		3.27		3.92	1035	4.00	1049
1990	0.13		1.31		3.65		4.96	1113	5.08	1131
1991	0.12		1.03		3.00		4.03	757	4.15	776
1992	0.12		1.24		2.66		3.90	710	4.02	727
1993	0.11		0.83		2.57		3.40	679	3.52	657
1994	0.10		0.58		2.25		2.83	584	2.93	595
1995	0.12		0.67		1.98		2.65	553	2.77	571
1996	0.21	36	0.73	168	1.77	366	2.50	534	2.65	570
1997	0.28	45	0.78	149	1.53	282	2.31	431	2.59	476
1998	0.19	30	0.55	104	1.56	314	2.11	418	2.30	449
1999	0.17	30	0.57	104	1.25	256	1.82	360	1.99	390
2000	0.18	30	0.52	100	1.45	313	1.97	413	2.15	443
2001[6]	0.16	30	0.57	122	1.19	261	1.76	383	1.92	413

[1]TAC does not include river catch. [2]TAC much below present levels. [3]Equivalent to 2.25–2.70 thousand t.
[4]For comparison with TAC. [5]Catch in numbers before 1993 based on estimates. [6]Preliminary.

Table 3.14.15.1 Nominal catches of Baltic Salmon in tonnes round fresh weight, from sea, coast and river by country and region in 1972 - 2001. (2001 provisional figures). S=sea, C=coast, R=river.

Year	Main Basin (Subdivisions 22-29)										
	Denmark	Finland	Germany	Poland	Sweden		USSR		Total		
	S	S+C	S	S	S	R	S	C+R	S	C+R	GT
1972	1034	122	117	13	277	0	0	107	1563	107	1670
1973	1107	190	107	17	407	3	0	122	1828	125	1953
1974	1224	282	52	20	403	3	21	155	2002	158	2160
1975	1112	211	67	10	352	3	43	194	1795	197	1992
1976	1372	181	58	7	332	2	84	123	2034	125	2159
1977	951	134	77	6	317	3	68	96	1553	99	1652
1978	810	191	22	4	252	2	90	48	1369	50	1419
1979	854	199	31	4	264	1	167	29	1519	30	1549
1980	886	305	40	22	325	1	303	16	1881	17	1898

Year	Main Basin (Subdivisions 22-29)																							
	Denmark		Estonia		Finland			Germany	Latvia		Lithuania		Poland			Russia	Sweden				Total			
	S	C	S	C	S	C	R	S	S	C	S	C	S	C	R	S		S	C	R	S	C	R	GT
1981	844	*	23	0	310	18	0	43	167	17	36	na	45	na	na	56		401	0	1	1925	35	1	1961
1982	604	*	45	0	184	16	0	20	143	31	30	na	38	na	na	57		376	0	1	1497	47	1	1545
1983	697	*	55	0	134	18	0	25	181	105	33	na	76	na	na	93		370	0	2	1664	123	2	1789
1984	1145	*	92	0	208	29	0	32	275	89	43	na	72	na	na	81		549	0	4	2497	118	4	2619
1985	1345	*	87	0	280	26	0	30	234	90	41	na	162	na	na	64		842	0	5	3085	116	5	3206
1986	848	*	52	0	306	38	0	41	279	130	57	na	137	na	na	46		764	0	4	2530	168	4	2702
1987	955	*	82	0	446	40	0	26	327	68	62	na	267	na	na	81		887	0	4	3133	108	4	3245
1988	778	*	60	0	305	30	0	41	250	96	48	na	93	na	na	74		710	0	6	2359	126	6	2491
1989	850	*	67	0	365	35	0	52	392	131	70	na	80	na	na	104		1053	0	4	3033	166	4	3203
1990	729	*	68	0	467	46	1	36	419	188	66	na	195	na	na	109		949	0	9	3038	234	10	3282
1991	625	*	64	0	478	35	1	28	361	120	62	na	77	na	na	86		641	0	14	2422	155	15	2592
1992	645	*	19	4	354	25	1	27	204	74	20	na	170	na	na	37		694	0	7	2170	103	8	2281
1993	575	*	23	4	425	76	1	31	204	52	15	na	191	na	na	49		754	7	5	2283	139	6	2428
1994	737	*	2	4	372	80	1	10	97	33	5	na	184	na	na	29		574	11	8	2010	128	9	2147
1995	556	*	4	3	613	86	1	19	100	39	2	na	121	12	na	36		464	13	6	1915	153	7	2075
1996	525	*	2	4	306	53	1	12	97	53	14	na	124	1	na	35		551	8	5	1666	119	6	1791
1997	489	*	1	5	359	44	0	38	106	64	1	4	110	0	0	23		354	9	7	1481	126	7	1614
1998	485	10	0	4	324	14	0	42	65	60	1	4	105	9	4	33		442	3	7	1497	104	11	1612
1999	385	10	0	4	234	108	0	29	107	59	1	5	122	9	4	22		334	2	7	1234	197	11	1442
2000	411	10	1	7	282	87	0	44	91	58	0	5	125	13	6	23		461	2	8	1438	182	14	1634
2001	433	10	0	4	135	76	0	39	66	71	1	4	162	12	6	33		313	2	7	1181	178	13	1373
Mean 96-00	459	10	1	5	301	61	0	33	93	59	3	4	117	6	4	27	#DIV/0!	428	5	7	1463	146	10	1619

Table 3.14.15.1 (Cont'd)

Year	Gulf of Bothnia (Subdivisions 30-31)											Main Basin+Gulf of Bothnia (Subdivs. 22-31) Total		
	Denmark	Finland			Sweden			Total						
	S	S	S+C	C	S	C	R	S	C	R	GT	S	C+R	GT
1972	11	0	143	0	9	126	65	163	126	65	354	1726	298	2024
1973	12	0	191	0	13	166	134	216	166	134	516	2044	425	2469
1974	0	0	310	0	15	180	155	325	180	155	660	2327	493	2820
1975	98	0	412	0	33	272	127	543	272	127	942	2338	596	2934
1976	38	271	0	155	22	229	80	331	384	80	795	2365	589	2954
1977	60	348	0	142	49	240	60	457	382	60	899	2010	541	2551
1978	0	127	0	145	18	212	40	145	357	40	542	1514	447	1961
1979	0	172	0	121	20	171	35	192	292	35	519	1711	357	2068
1980	0	162	0	148	23	172	35	185	320	35	540	2066	372	2438

Year	Gulf of Bothnia (Subdivisions 30-31)										Main Basin + Gulf of Bothnia (Subdivisions 22-31) Total			
	Finland			Sweden			Total							
	S	C	R	S	C	R	S	C	R	GT	S	C	R	GT
1981	125	157	6	26	242	35	151	399	41	591	2076	434	42	2552
1982	131	111	3	0	135	30	131	246	33	410	1628	293	34	1955
1983	176	118	4	0	140	32	176	258	36	470	1840	381	38	2259
1984	401	178	5	0	140	52	401	318	57	776	2898	436	61	3395
1985	247	151	4	0	114	38	247	265	42	554	3332	381	47	3760
1986	124	176	5	11	146	41	135	322	46	503	2665	490	50	3205
1987	66	173	6	8	106	38	74	279	44	397	3207	387	48	3642
1988	74	146	6	1	141	48	75	287	54	416	2434	413	60	2907
1989	225	207	6	10	281	68	235	488	74	797	3268	654	78	4000
1990	597	680	14	12	395	103	609	1075	117	1801	3647	1309	127	5083
1991	580	523	14	1	350	90	581	873	104	1558	3003	1028	119	4150
1992	487	746	14	7	386	95	494	1132	109	1735	2664	1235	117	4016
1993	279	426	16	10	267	91	289	693	107	1089	2572	832	113	3517
1994	238	269	14	0	185	73	238	454	87	779	2248	582	96	2926
1995	66	302	20	0	214	97	66	516	117	699	1981	669	124	2774
1996	96	350	93	5	261	110	101	611	203	915	1767	730	209	2706
1997	44	360	110	1	295	158	45	655	268	968	1526	781	275	2582
1998	57	225	43	2	224	137	59	449	180	688	1556	553	191	2300
1999	17	175	23	1	195	133	18	370	156	544	1252	567	167	1986
2000	11	170	30	0	167	133	11	337	163	511	1450	519	177	2146
2001	9	218	26	1	175	117	10	393	143	546	1191	571	157	1919
Mean 96-00	45	256	60	2	228	134	47	484	194	725	1510	630	204	2344

Table 3.14.15.1 (Cont'd)

Year	Gulf of Finland (Sub-division 32)					Sub-division 22-32		
	Finland			USSR		Total		
	S	S+C	C	S	C+R	S	C+R	GT
1972	0	138	0	0	0	1864	298	2162
1973	0	135	0	0	0	2179	425	2604
1974	0	111	0	0	0	2438	493	2931
1975	0	74	0	0	0	2412	596	3008
1976	81	0	0	0	14	2446	603	3049
1977	75	0	0	0	13	2085	554	2639
1978	68	0	1	0	6	1582	454	2036
1979	63	0	3	0	4	1774	364	2138
1980	51	0	2	0	7	2117	381	2498

Year	Gulf of Finland (Sub-division 32)												Sub-division 22-32			
	Estonia			Finland			Russia		Total				Total			
	S	C	R	S	C	R	C	R	S	C	R	GT	S	C	R	GT
1981	0	2	0	46	1	0	5	0	51	3	0	54	2127	437	42	2606
1982	0	5	0	91	7	0	0	0	91	12	0	103	1719	305	34	2058
1983	0	3	0	163	32	0	0	0	163	35	0	198	2003	416	38	2457
1984	0	5	0	210	42	0	7	0	217	47	0	264	3115	483	61	3659
1985	0	4	0	219	34	2	20	0	239	38	2	279	3571	419	49	4039
1986	24	0	0	270	79	2	28	0	322	79	2	403	2987	569	52	3608
1987	10	0	0	257	61	2	23	0	290	61	2	353	3497	448	50	3995
1988	19	0	0	122	112	2	15	0	156	112	2	270	2590	525	62	3177
1989	36	0	0	181	145	2	37	0	254	145	2	401	3522	799	80	4401
1990	25	0	0	118	369	2	35	4	178	369	6	553	3825	1678	133	5636
1991	22	0	0	140	398	2	88	3	250	398	5	653	3253	1426	124	4803
1992	6	3	0	77	415	2	28	1	111	418	3	532	2775	1653	120	4548
1993 1)	3	1	1	91	309	3	39	2	133	310	6	449	2705	1142	119	3966
1994	3	1	0	88	141	6	15	1	106	142	7	255	2354	724	103	3181
1995	1	1	0	32	200	5	25	2	58	201	7	266	2039	870	131	3040
1996	0	3	0	83	324	10	10	2	93	327	12	432	1860	1057	221	3138
1997	0	4	0	89	341	10	4	0	93	345	10	448	1619	1126	285	3030
1998	0	4	0	21	156	10	0	3	21	160	13	194	1577	713	204	2494
1999	0	10	0	29	127	7	0	3	29	137	10	176	1281	704	177	2162
2000	0	14	1	37	130	11	0	4	37	144	16	196	1486	663	193	2342
2001	0	10	2	19	111	11	0	3	20	121	16	157	1211	693	173	2076
Mean 96-00	0	7	0	52	216	10	3	2	55	223	12	289	1565	853	216	2633

* No fishery occurr

All data from 1972-1994 includes sub-divisions 24-32, while it is more uncertain in which years sub-divisions 22-23 are includ
sub-divisions 22-32 are normally less than one tonnes. From 1995 data includes
Catches from the recreational fishery are included as follows: Finland
Other countries have no, or very low recreational
Danish, Finnish, German, Polish and Swedish catc u d m
Estonian, Latvian, Lithuanian and Russian catches before 1981 are summarized as USSR
Estonian, Latvian, Lithuanian and Russian catches are reported as hole fresh
Since about 1981 included in the sea catches in the order of 3 % for Denmark (
and about 5% for Poland (before
Estonian sea catches in Sub-division 32 in 1986-1991 include a small quantity of coastal
Estimated non-reported coastal catches in Sub-division 25 has from 1993 been includ in i
Danish coast catches are non-profesional trolling

1) In 1993 fishermen from the Faroe Islands caught 16 tonnes, which are included in total Danish catches.

All data from 1972-1994 includes sub-divisions 24-32, while it is more uncertain in which years sub-divisions 22-23 are includ sub-divisions 22-32 are normally less than one tonnes. From 1995 data includes
Catches from the recreational fishery are included as follows: Finland from 1980, Sweden from 1988, Denmark from 1998. a
Other countries have no, or very low recreational catches.
Danish, Finnish, German, Polish and Swedish catches are converted from gutted to round fresh weight w by multiplying by 1.1.
Estonian, Latvian, Lithuanian and Russian catches before 1981 are summarized as USSR catches.
Estonian, Latvian, Lithuanian and Russian catches are reported as hole fresh
Since about 1981 included in the sea catches in the order of 3 % for Denmark (before 1983), 3% for Estonia, Germany, Latvia, Lithuania, Russia, L
and about 5% for Poland (before 1993).
Estonian sea catches in Sub-division 32 in 1986-1991 include a small quantity of coastal catches.
Estimated non-reported coastal catches in Sub-division 25 has from 1993 been included in the Swedish statistics.
Danish coast catches are non-profesional trolling catches.

Table 3.14.15.2 Nominal catches of Baltic Salmon in numbers, from sea, coast and river by country and region in 1996-2001 (2001 provisional figures). S=sea, C=coast, R=river.

Year	Main Basin (Subdivisions 22-29)															
	Denmark		Estonia		Finland			Germany	Latvia		Lithuania		Poland			Russia
	S	C	S	C	S	C	R	S	S	C	S	C	S	C	R	S
1996	105934	0	263	528	58844	8337	200	2400	19400	10577	1485	1059	27479	222	0	5199
1997	87746	0	205	1023	61469	7018	0	6840	20033	12095	214	665	24436	0	65	4098
1998	90687	2000	0	770	60248	2368	0	8379	13605	8098	288	781	23305	1927	890	6522
1999	73956	2000	28	741	45652	15007	0	5805	24309	9059	166	1132	24435	1835	860	4330
2000	82938	2000	129	1190	56141	12747	0	8810	24735	9106	78	1382	25051	2679	1195	4648
2001	88388	2000	122	819	26617	10706	0	7717	18194	10808	152	1053	32305	2471	825	6584

Year	Gulf of Bothnia (Subdivisions 30-31)										Main Basin + Gulf of Bothnia (Subdivisions 22-31) Total			
	Finland			Sweden			Total							
	S	C	R	S	C	R	S	C	R	GT	SEA	COAST	RIVER	GT
1996	22196	84940	14000	1181	61239	20571	23377	146179	34571	204127	366012	168224	35404	569640
1997	8205	76683	17000	251	49724	27159	8456	126407	44159	179022	282048	148623	45034	475705
1998	11105	46269	5100	329	41487	23438	11434	87756	28538	127728	313875	104273	30368	448516
1999	3529	35348	3100	89	38447	25546	3618	73795	28646	106059	256491	103977	30382	390850
2000	2423	37755	4150	13	32588	23291	2436	70343	27441	100220	312685	99847	29641	442173
2001	1904	49497	3750	122	44077	25022	2026	93574	28772	124372	260978	121838	30487	413303

Year	Gulf of Finland (Subdivision 32)												Subdivisions 22-32 Total			
	Estonia			Finland			Russia		Total							
	S	C	R	S	C	R	C 1)	R	S	C	R	GT	SEA	COAST	RIVER	GT
1996	0	396	0	20664	55840	1500	1485	296	20664	57721	1796	80181	386676	225945	37200	649821
1997	0	819	0	19577	54493	1500	1023	0	19577	56335	1500	77412	301625	204958	46534	553117
1998	22	761	76	4210	23876	1500	65	650	4232	24702	2226	31160	318107	128975	32594	479676
1999	12	1904	132	6234	19306	1100	95	915	6246	21305	2147	29698	262737	125282	32529	420548
2000	79	2833	254	8105	21040	1900	79	835	8184	23952	2989	35125	320869	123799	32630	477298
2001	62	1965	317	3804	17578	1900	82	726	3866	19625	2943	26434	264844	141463	33430	439737

Data from the recreational fishery are included in Swedish and Finnish data. Recreational fishery are included in Danish data from 1998. Other countries have no, or very low recreational catches.
In 1996 sea trout are included in the Polish catches in the order of 5%.
1) Russian coastal catches have in earlier reports been recorded as sea catches.

Region, Sub-div. country and river	Category	Reprod. area ha	1993	1994	1995	1996	1997	1998	1999	2000	2001	Pred 2002	Pred 2003	Method of estimate Pot.prod.	Method of estimate Pres.prod.	Reared 2001
Gulf of Bothnia, Sub-div. 31																
Finland																
Kiiminkijoki	potential	90	+	+	+	+	+	+	1	0.1	0.1	+	0.1	3	4	65
Pyhäjoki	potential	100	+	+	+	+	+	+	+	0.1	0.1	+	0.1	3	4	150
Simojoki	wild	255	10	12	1.4	1.3	2.5	9.4	9	57.4	47.3	47.2	43.5	3	2	55
Finland/Sweden																
Tornionjoki;Torne älv	wild	5000	123	199	75	71	50	144	175	500	620	594	370	3	2	40
Sweden																
Kalix älv	wild	2500	88	130	42	48	61	55	83.7	236	287	212	218	3	4	
Råne älv	wild	390	+	3.2	2.1	2.2	0.5	1	2	8.1	8.8	7.1	3.5	3	4	
Pite älv	wild	435	+	+	3	3	5	5.6	4.2	5.1	18	11.6	6.8	3	5	
Åby älv	wild	80	+	5.8	1.9	2.3	3	6	6.5	9.9	16.3	18.2	9.9	3	4	
Byske älv	wild	530	23	35	11	12	40	33	49	140	106	117	87.5	3	4	
Sävarån	wild	20	+	+	0.5	0.2	0.4	0.7	0.7	1.1	1.5	1.5		3	4	
Rickleån	wild	15	+	+	0.3	0.1	0.3	0.3	0.4	0.2	0.9	1		3	1 and 3	
Ume/Vindelälven	wild	1000	23	39	15	14	13	24	52	116	75	36.5	44.3	3	4	
Öre älv	wild	100	+	1.4	1.4	1.4	0.1	0.7	0.4	0.5	0.9	0.9		3	4	
Lögde älv	wild	95	+	3.8	1.4	1.7	1.1	3.5	4.6	0.6	4.1	5.9		3	4	
Sum of +			20	4	4	4										
Total Sub-div. 31		**10610**	**287**	**433**	**159**	**161**	**177**	**283**	**389**	**1075**	**1186**	**1053**	**784**			**310**
Gulf of Bothnia, Sub-div. 30																
Ljungan	mixed	20	15	4	4	4	5	10	10	10	10	10	10	3	4	
Total Gulf of B., Sub-divs.30-31			**302**	**437**	**163**	**165**	**182**	**293**	**399**	**1085**	**1196**	**1063**	**794**			**310**
Main Basin, Sub-divs. 22-29																
Sweden																
Emån	wild	21.7	5	4.5	3	2.5	4	3.5	4	5	3	3		3	4	
Mörrumsån	wild	44	90	60	30	35	60	60	76	98	70	67.7		3	4	
Total Sweden			95	64.5	33	37.5	64	63.5	80	103	73	70.7	0	6	8	
Estonia																
Pärnu	wild	3					3	2	1	0.1	0.1	0.1	0.1	4	3 and 4	
Latvia (1)																
Salaca	wild		22	15	15	20	20	29	27	19	29	29	25	3	2	
Vitrupe	wild		5	5	5	5	5	4	4	4	2	2	2	6	5	
Peterupe	wild		5	5	5	5	5	4	4	4	2	2	2	6	2 and 5	
Gauja	mixed		17	13	13	14	14	13	13	13	12	15	15	6	2 and 5	277
Daugava	mixed		5	5	5	5	5	5	5	5	2	5	5	6	5 and 7	643
Irbe	wild		10	10	8	7	7	7	7	7	5	5	5	6	5	
Venta	mixed		15	15	15	15	12	12	12	12	10	12	12	6	2 and 5	85
Saka	wild		10	10	10	10	8	7	7	7	2	7	5	6	5	
Uzava	wild		2	2	2	2	2	1	2	2	2	1	2	6	5	
Barta	wild		2	2	2	2	2	1	1	1	2	1	2	6	5	
Total Latvia			93	82	80	85	80	83	82	74	68	79	75			1004

Table 3.14.15.3 (Cont'd)

Lithuania																
Nemunas river basin	wild		20	20	20	20	20	20	2.2	5	4.2	n/a		7	10	
Total Main B., Sub-divs. 22-29			**208**	**167**	**133**	**143**	**167**	**169**	**165**	**182**	**145**	**149.8**	**75.1**			**1004**
Gulf of B.+Main B., Sub-divs. 22-31			**510**	**604**	**296**	**308**	**349**	**462**	**564**	**1267**	**1341**	**1213**	**869**			**1314**
Gulf of Finland, Sub-div. 32																
Finland																
Kymijoki	mixed	50			3	3	4	4	4	4	4	4	4	3	4	
Total Finland		60			3	3	4	4	4	4	4	4	4	3	4	0
Russia																
Neva	mixed	20			7	7	7	7	7	7	6	7		7	6 and 8	
Luga	mixed	40			4	4	4	4	4	5	2.5	5		7	6 and 8	
Total Russia		60			11	11	11	11	11	12	8	12				0
Estonia																
Kunda	wild	1.5	+	+	+	+	+	+	+	1.8	0.8	0.4	2.1	3	3 and 4	
Selja	mixed	9	+	+	+	+	+	0	0	1.4	0.2	0.11	0.2	3	3 and 4	
Loobu	wild	6	+	+	+	+	+	+	0	0.3	0.3	0.4	0	3	3 and 4	
Pirita	mixed	10	+	+	+	+	+	0	0	0	0.6	0	0.2	3	3 and 4	
Vasalemma	wild	1	+	+	+	+	+	+	+	0	0.1	0.1	0.1	3	3 and 4	
Keila	wild	3.5	+	+	+	+	+	+	+	0.3	1.5	0.2	0	3	3 and 4	
Valgejõgi	mixed	1.5	0	0	0	0	0	0	0	0	0.1	0.1	0.2	3	3 and 4	
Jägala	mixed	0.3	0	0	0	0	0	0	0	0	0	0	0.2	3	3 and 4	
Vääna	mixed	3.5	0	0	0	0	0	0	0	0	0	0.004	0	3	3 and 4	
Total Estonia		36.3	15	15	7	7	8	6	2	3.8	3.6	1.314	3			
Total Gulf of F., Sub-div. 32		**156.3**	**15**	**15**	**21**	**21**	**23**	**21**	**17**	**20**	**16**	**17**	**7**			**0**
Total Baltic, Sub-divs. 22-32 (1)			**525**	**619**	**317**	**329**	**372**	**483**	**581**	**1287**	**1357**	**1230**	**876**			**1314**

+ = Low and uncertain production. (1) Estimate of potential production in Latvia is missing. n/a No data available.

Methods of estimating production

Potential production

1. Stock-recruitment curve.
2. Estimate of reproduction area, quality gradation of them and estimate of peak production per area from other source.
3. Estimate of reproduction area and peak production per area from other sources.
4. Accessible linear stream length and peak production per area from other sources.
5. Salmon catch series, exploitation and survival estimates.
6. No data.

Present production

1. Complete count of smolts.
2. Sampling of smolts and estimate of total smolt run size.
3. Estimate of smolt run from parr production by relation developed in the same river.
4. Estimate of smolt run from parr production by relation developed in another river.
5. Inference of smolt production from data derived from similar rivers in the region.
6. Count of spawners.
7. Estimate inferred from stocking of reared fish in the river.
8. Salmon catch, exploitation and survival estimate.
9. No data.
10. Not known.

Table 3.14.15.4 Effect of following of reference points on the yield and smolt production of wild salmon population in the long run.
The F(lim) is based on median of F (msy) and mean M74 variability. F (msy) is calculated by keeping the same relative efforts in various fisheries.
The fishing mortality for each age is cumulative until the given age (all fishing before spawning, selectivity effects included).
Relative smolt production is given in respect to maximum.

F(lim) using median value of steepness and mean trend of M74							
Age	F(msy) = F (lim)	Relative Yield	Relative smolt prod	Age	F(pa)	Relative Yield	Relative smolt prod
1SW	0.2	100%	72%	1SW	0.126181	88%	81%
2SW	0.49			2SW	0.309143		
3SW	0.77			3SW	0.485797		
4SW	1			4SW	0.630905		
5SW	1.31			5SW	0.826486		

Table 3.14.15.5. M74-mortality (in %) of searun female spawners belonging to reared populations of Baltic salmon in hatching years 1985-2000 with projections for year 2001. All data originate from hatcheries.

River	Subdiv.	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Simojoki (2)	31		6	2	6	3	*12*	0	53	74	*53*	92	*86*	91	31	59	38	42	
Torne älv (2)	31				5	6	1	29	70	76	89	76			25	61	32	30	
Lule älv	31								58	66	62	50	52	38	6	34	21	29	37
Skellefteälven	31								40	49	69	49	77	16	5	42	12	14	
Ume/Vindeläl ven	30	40	20	25	19	16	31	45	77	88	90	69	78	37	16	53	45	39	
Ångermanälve n	30								50	77	66	46	63	21	4	28	21	25	
Indalsälven	30	4	7	8	7	3	8	7	45	72	68	41	64	22	1	20	22	7	
Ljungan	30								64	*96*	*50*	56	28	*29*	10	25	10	0	
Ljusnan	30							17	33	75	64	56	72	22	9	41	25	46	
Dalälven	30	28	8	9	20	11	9	21	79	85	56	55	57	38	17	33	20	33	37
Mörrumsån	25	47	49	65	46	58	72	65	55	90	*80*	63	*56*	23					
Neva/Åland	29									70	50								
Neva/Kymi	32								45	60-70		57	*40*	*79*	42	20	28		
Mean River Indalsälven, Dalälven		16.0	7.5	8.5	13.5	7.0	8.5	14.0	60.7	74.3	62.0	48.7	57.7	32.7	8.0	29.0	21.0	23.0	
Mean total		29.8	18.0	21.8	17.2	16.2	22.2	26.3	55.8	76.5	66.4	59.2	61.2	37.8	15.1	37.8	24.9	26.5	

1.) River Lule älv missing before 1992 and River Indalsälven in year 2000.

All estimates known to be based on material from less than 20 females in italics.

2.)The estimates in the rivers Simojoki and Tornionjoki/Torne älv are if possible given as the percentage of females affected by M74 and secondly, percentage of yolk-sac-fry mortality.

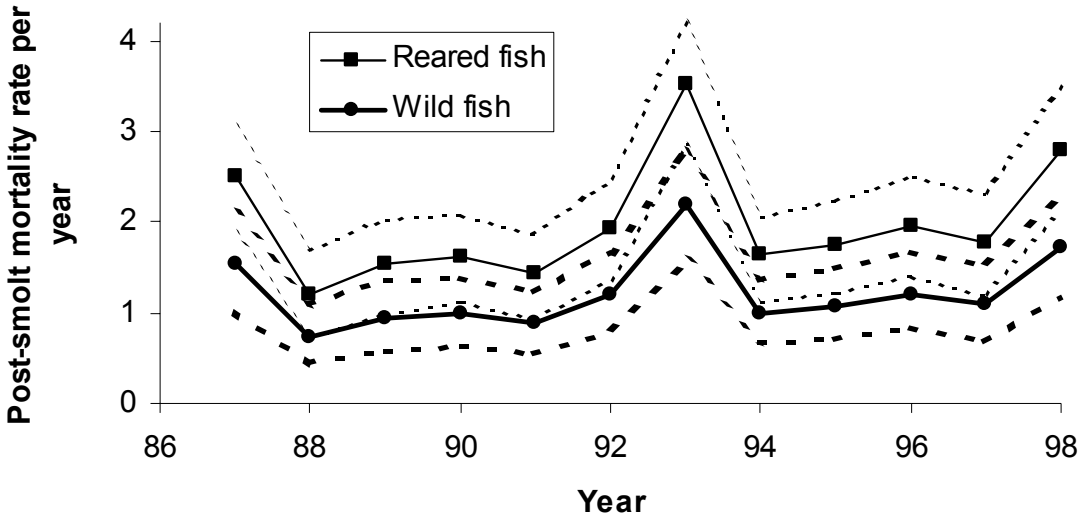


Figure 3.14.15.1. Post-smolt mortality rate per year for wild and hatchery-reared fish (median and 95% probability interval).

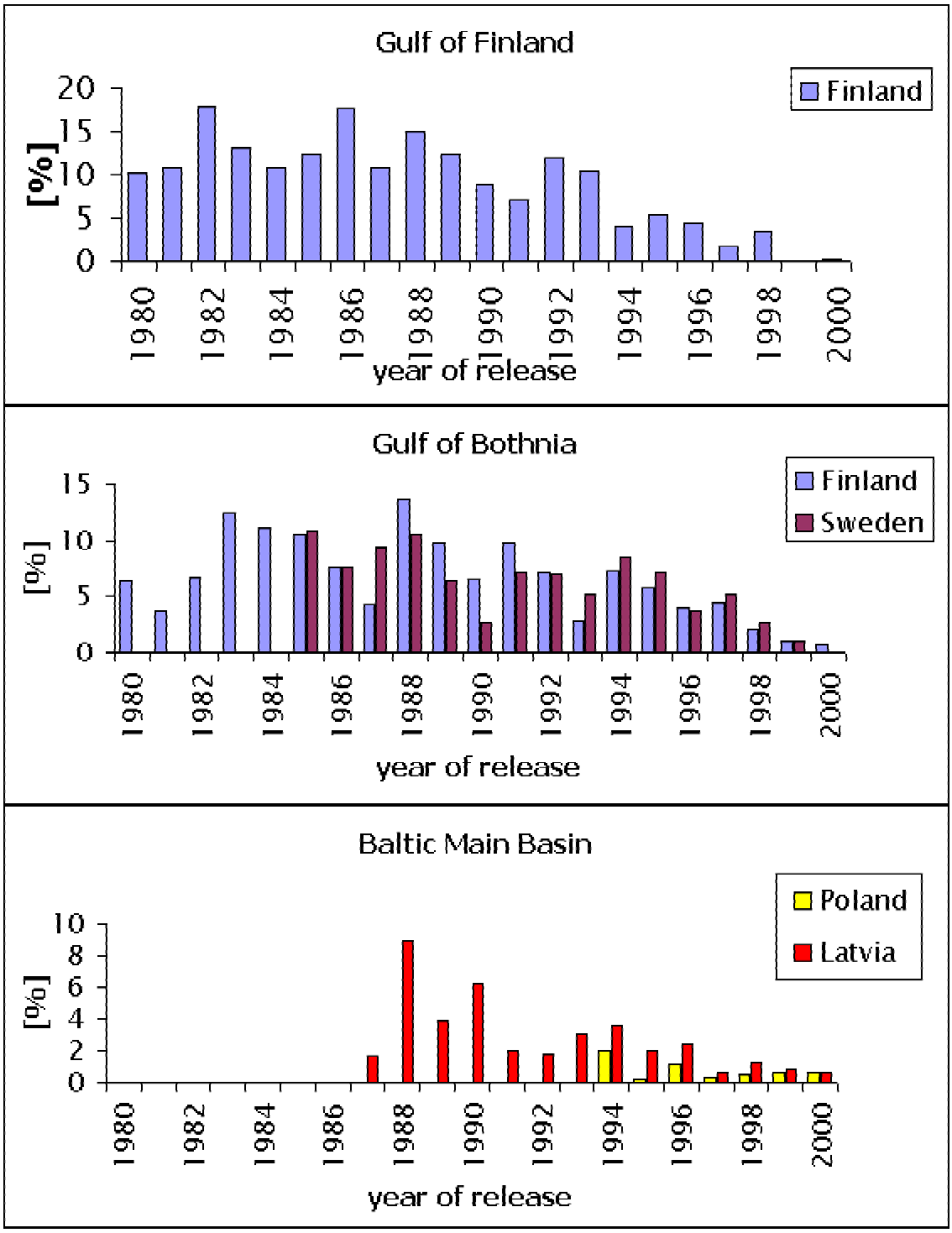


Figure 3.14.15.2 Recapture rate (in percent) of the tagged reared salmon smolts in Gulf of Finland, Gulf of Bothnia, and Baltic Main Basin.

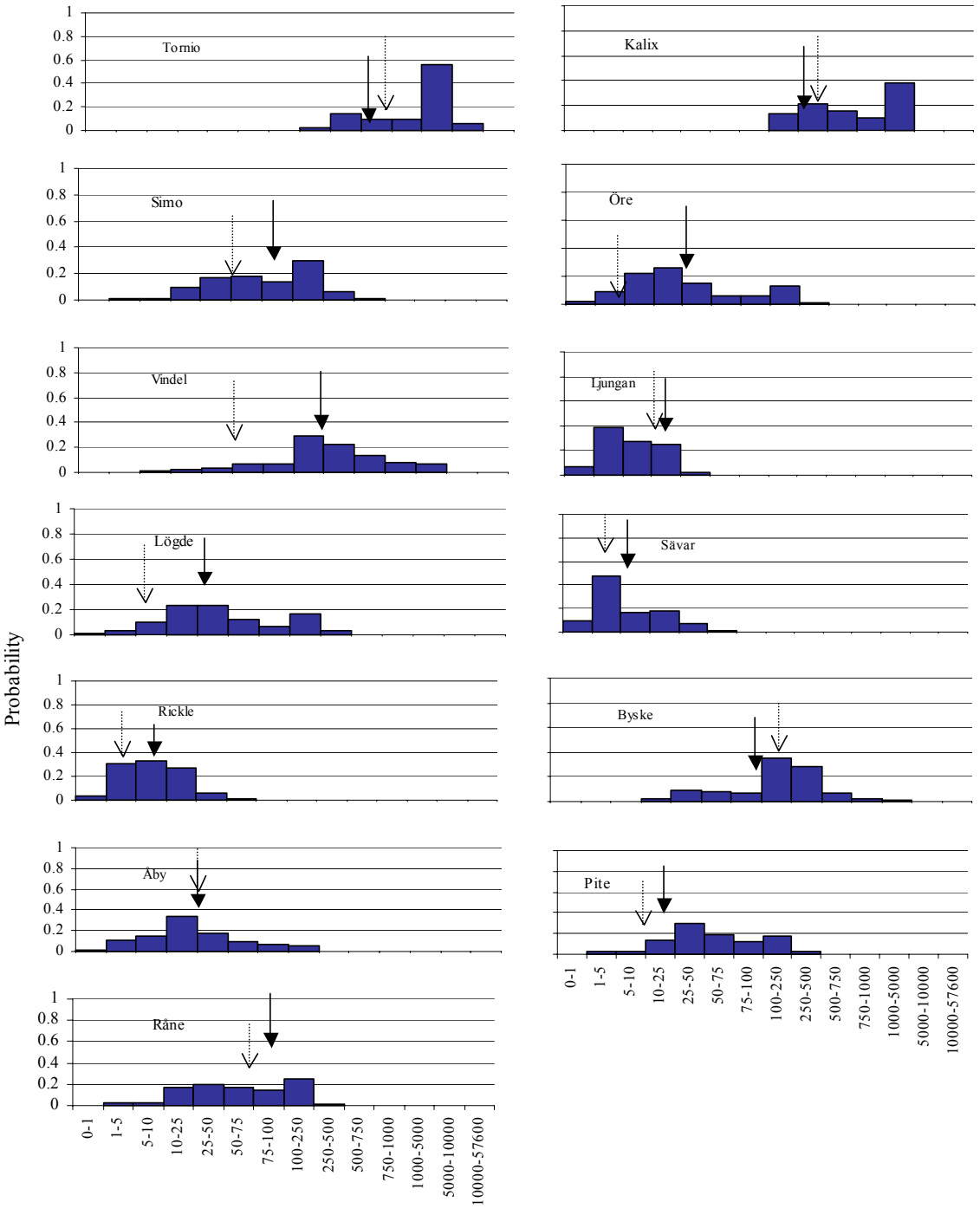


Figure 3.14.15.3. Probability distributions for smolt production capacities in the Gulf of Bothnia wild salmon rivers based on an expert analysis (Uusitalo *et al*, unpubl.). Numbers of smolts in thousands. Solid arrows indicate previously estimated production potential and dashed arrows indicate the predicted smolt production in 2001. Note that x-axis is not linear.

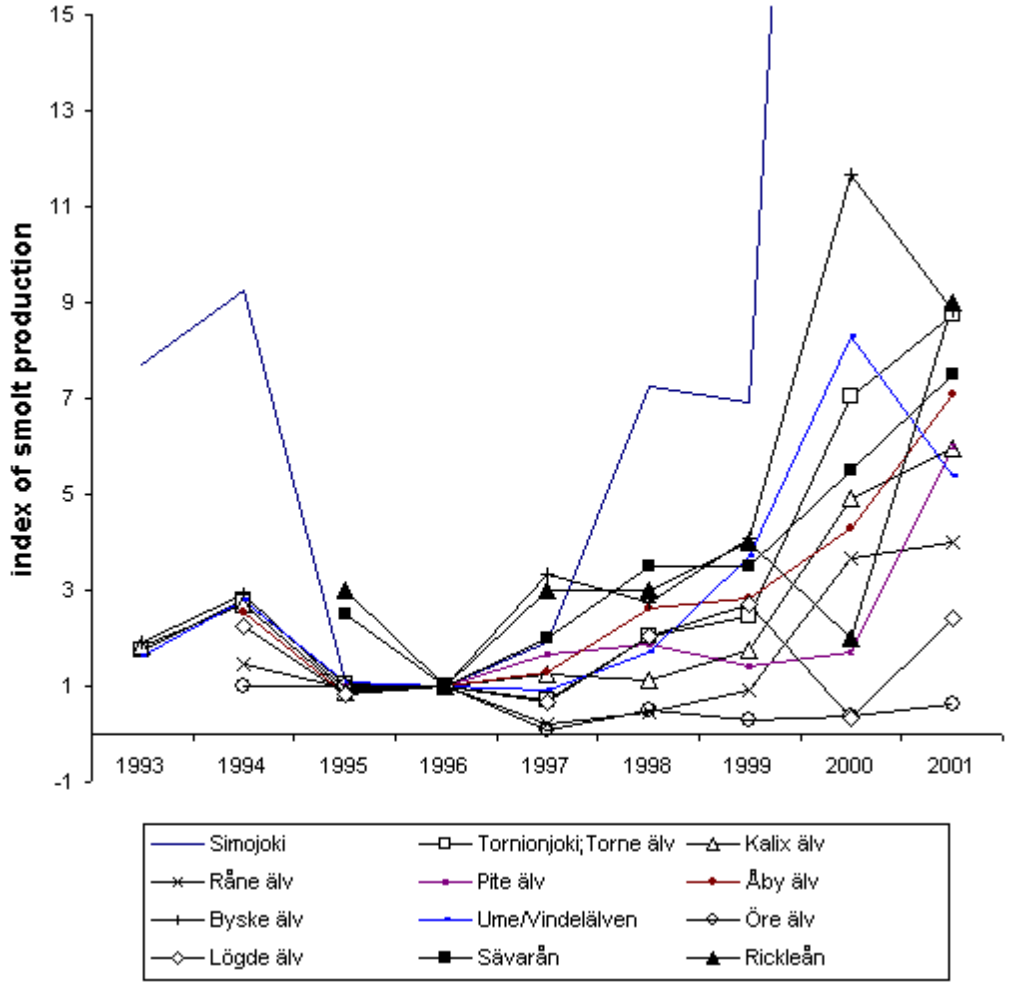


Figure 3.14.15.4. The development of smolt production in some Finnish and Swedish rivers expressed as an index. The different years have been compared to the year 1996, which was selected a starting point and was given a value of 1. In the river Simojoki the index reached the values of 44 and 36 in 2000 and 2001, respectively. Only in the rivers Simojoki and Tornionjoki the smolt production had been estimated by smolt trapping, in other rivers the smolt production estimates are based on parr densities and egg deposition calculations

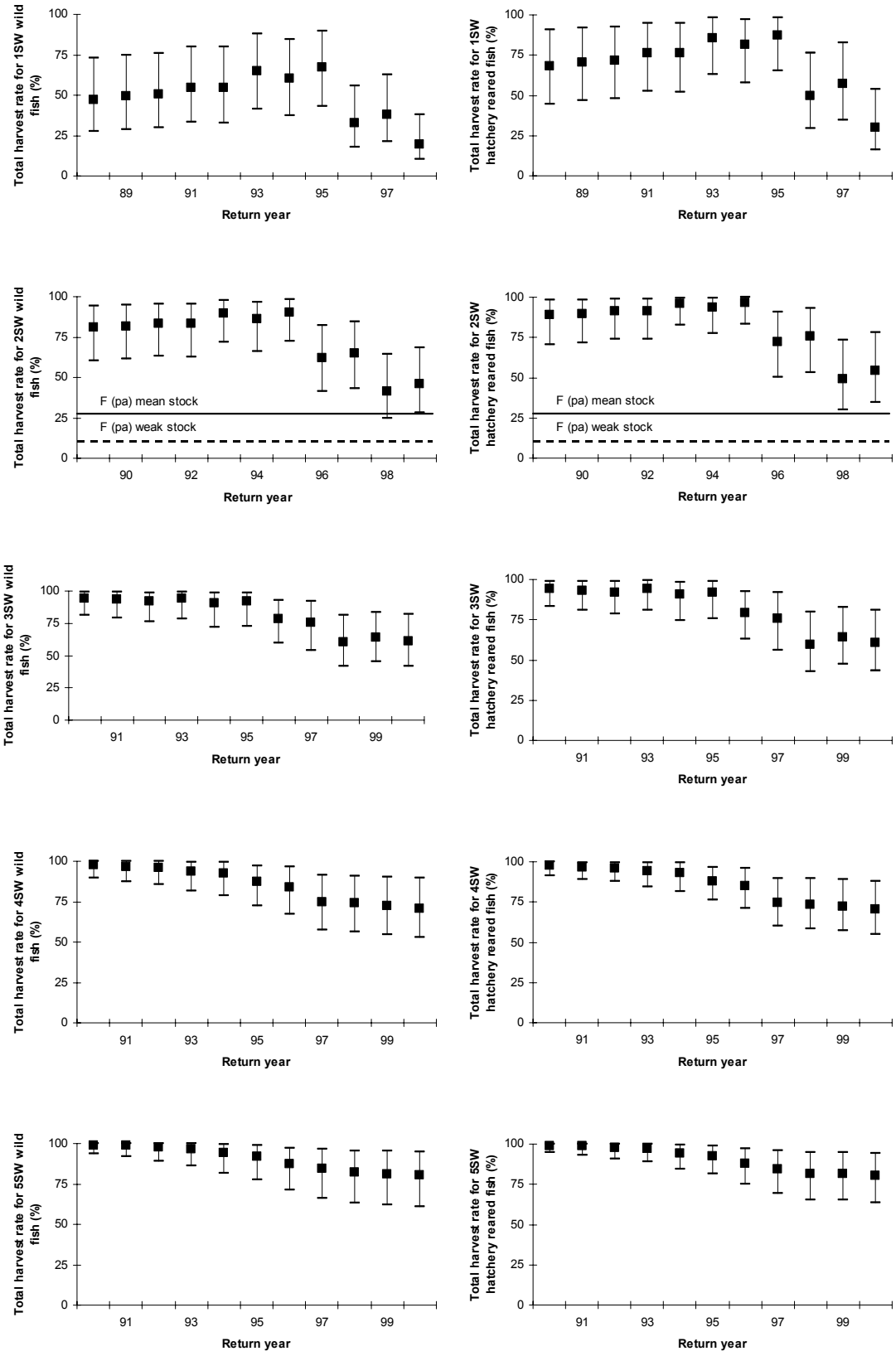


Figure 3.14.15.5. Median and 95% probability interval for the total harvest rate (cumulated by the given age) for wild and hatchery-reared salmon of the river Torne, the river Simo, the river Kemijoki and the river Iijoki, returning to the rivers between 1989 and 1999. The figures for 2SW fish indicate the level of provisional $\mathbf{F}_{pa}$ for the mean stock and $\mathbf{F}_{pa}$ for the weak stock.

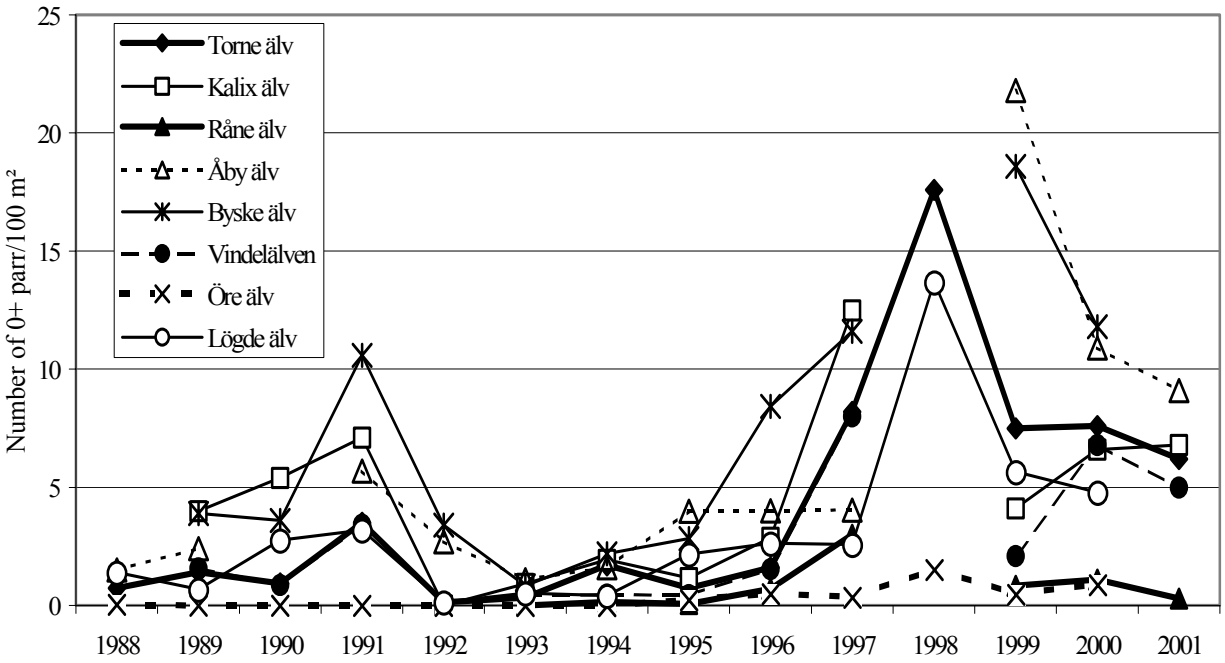


Figure 3.14.15.6 – Densities of 0+ parr in rivers in the Gulf of Bothnia (Subdivision 31) in 1998-2001.

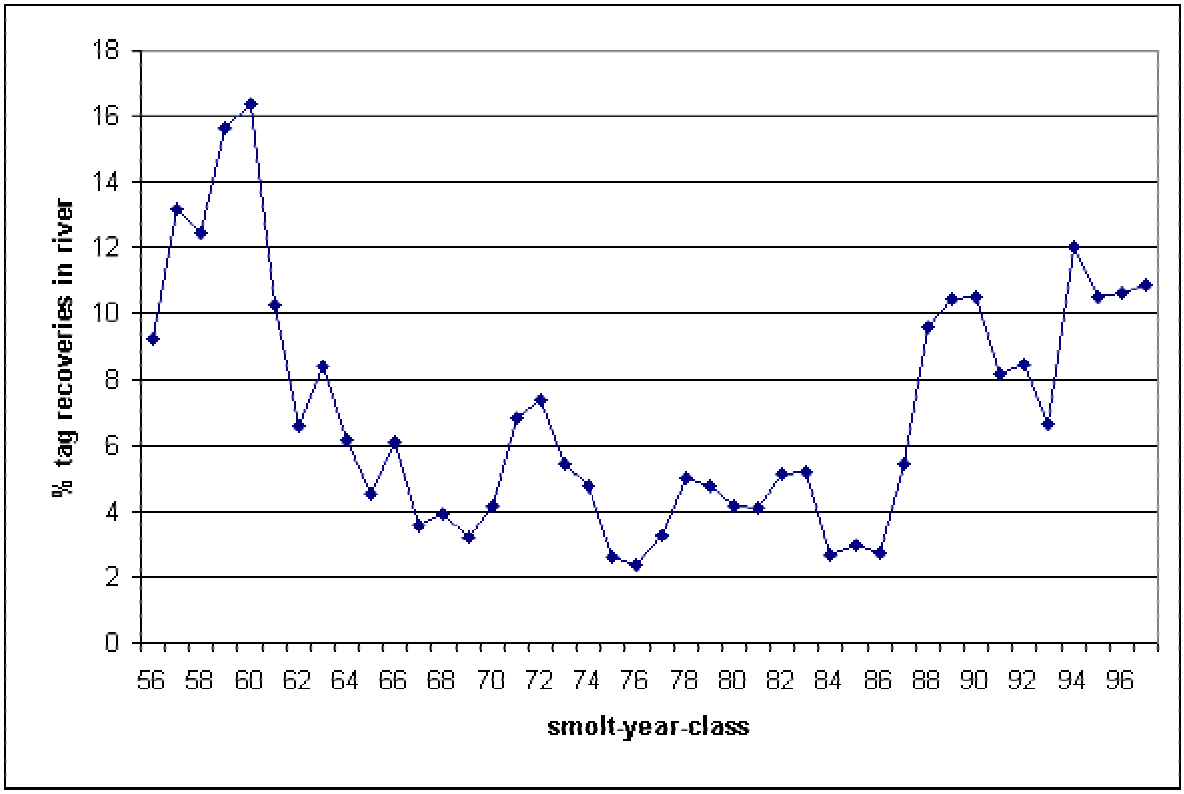


Figure 3.14.15.7 Percent of total tag recoveries in rivers from Swedish smolt releases in Gulf of Bothnia by year of release in years 1956-1997.

3.14.16 Salmon in the Gulf of Finland (Subdivision 32)

State of stocks/exploitation: ICES considers that the wild stocks are outside safe biological limits. Parr densities are very low in many rivers carrying wild salmon populations (Table 3.14.16.1). Catches of salmon in the area are low (Table 3.14.16.1-2).

Salmon smolt production in the Gulf of Finland is shown below (in thousands):

Year	Wild[1]	Reared	Total
1987	15	593	608
1988	15	569	584
1989	15	432	447
1990	15	573	588
1991	15	501	516
1992	15	415	430
1993	15	558	573
1994	15	633	648
1995	10[3]	710	720
1996	10[3]	661	671
1997	12[3]	690	702
1998	10[3]	722	732
1999	6[3]	891	897
2000	8[3]	826	834
2001	8[3]	1121	1129
2002[2]	5[3]	1064	1069

[1]Data on wild smolt production assumed until 1994. 1995 figures based on surveys. [2]Preliminary data. [3]Data on wild production in Russia reported for 1995–2000: 11 000 smolts annually. Not included in table.

Wild stocks: Based on earlier evidence there are wild salmon populations in 9 Estonian rivers in the Gulf of Finland. Surveys indicate that parr densities vary strongly in these rivers, and densities are much lower than in rivers of similar type at these latitudes in average (Table 3.14.16.1). Five of these populations have been supported by smolt releases in the last few years.

Minor natural reproduction occurs as a consequence of large long-term releases in one Finnish river in the area. Surveys also indicate that some natural reproduction occurs in one or two Russian rivers. Also these two populations are supported by long-term releases (Table 3.14.15.3). However, there are no national plans to attain self-sustainable populations in these rivers.

Reared stocks: Most of the salmon catch in the Gulf of Finland originates from smolt releases. Despite increases in releases, the catches have decreased considerably in the last few years, which indicate a lowered initial smolt survival of released salmon (Figure 3.14.16.1). Also tagging results give evidence for decreased survival of reared smolts (Figure 3.14.15.2).

Management objectives: The IBSFC objective is to increase the natural production of wild Baltic salmon to at least 50% of the natural production capacity of each river by 2010, while retaining the catch as high as possible.

Precautionary Approach reference points:
Not established.

Advice on management: ICES recommends that, in light of the precarious state of wild stocks in the Gulf of Finland and the very low wild smolt production in 2001, fisheries should only be permitted at sites where there is virtually no chance of taking wild salmon along with reared salmon. It is particularly urgent that national conservation programmes to protect wild salmon be enforced around the Gulf of Finland.

Relevant factors to be considered in management: At present wild salmon populations occur in nine Estonian rivers and many of these populations are at risk of extinction. The potential smolt production is very small compared to all other wild salmon populations in the Baltic Sea. It is uncertain whether a much reduced TAC would affect the status of these stocks. The TAC has been reduced 5 times since 1996 but, in 2001, it was still about 3 times the catch, and not restrictive on harvests. Coastal fisheries at sites likely to be on migration paths of wild salmon from Estonian rivers present a particular threat to the biological viability of these wild stocks. Coastal and river fisheries intercepting these populations should be prohibited. All possible means should be used to prevent all fishing in rivers and river mouths supporting these wild stocks. Additionally, enhancement releases should be continued and expanded to avoid possible extinction of these stocks.

M74 caused high mortality among offspring of sea-run females in Finnish hatcheries in 1992–1997, but the M74-related mortality has lowered since 1998. No estimates are available for the mortality in 2002 (Table 3.14.15.5). Hatchery experiments suggest that M74-related mortality is low in Estonian salmon populations.

Tagged Latvian salmon recovered in the Gulf of Finland suggest that reared Latvian salmon to some extent are also exploited in this area.

Catch forecast for 2003: A *status quo* projection for Subdivision 32 gives a catch prediction for 2002 and 2003 of 32 000 and 39 000 fish, respectively, to be compared to the catch in 2001 of 26 000 fish. The TAC for 2002 of 60 000 salmon is therefore not restrictive to the fishery.

Wild stocks: Based on parr densities, it is estimated that smolt production of Estonian rivers will be about 3000 salmon in 2002.

Reared stocks: The smolt production is expected to be about 1.06 million smolts in 2002.

Comparison with previous assessment and advice: No change in basis.

Elaboration and special comment: Considering that, at present, released smolts are estimated to outnumber wild smolts by approximately 200:1 in this area, the current management measures may be insufficient to ensure preservation of these stocks. Under these circumstances, it would be appropriate to adopt additional measures specifically intended to prevent the biological extinction of wild salmon in the Gulf of Finland.

Small reproduction areas and unpredictable variation in the size of year-classes is characteristic of Estonian wild salmon rivers. Electrofishing surveys since the 1970s indicate that there has been no spawning in some years. In spite of improvement in the water quality in the 1990s, the natural reproduction has not increased in these rivers.

Fishing effort off the Estonian coast increased significantly in the 1990s. This partly-illegal fishery developed quickly because the coastal fish stocks, salmonids included, had been under-exploited and catches were relatively good. The decline of agriculture and other industries in the region that resulted in decreased pollution of the streams should have had a positive effect on the salmon stocks. However, the decrease in the offshore fishery and improvement of water quality did not compensate for the effect of the increased coastal fishery, which exploits salmon and sea trout populations as by-catch.

The Finnish offshore and, especially, coastal fishery catch the major part of the total landings in the Gulf of Finland. However, the total effort has decreased in the last few years because of the low catch per unit of effort combined with low price and, in particular, increased seal damages. Damage caused by seals is most severe at fishing sites furthest away from the coast, which has caused the trapnet fishing to move closer to the shoreline.

There was no Russian commercial salmon fishery in the Gulf of Finland in year 2000, but the catch consisted of by-catch from other fisheries.

The assessment shows a very low initial survival for released smolts in the last four years compared to the early 1990s.

The assessment is based on catch -at-age estimated from tag recoveries and catch samples. Estimates of wild production are based on limited surveys and do not include all rivers. Lack of data on the productivity in the freshwater phase prevents calculation of the appropriate TAC strategy to meet any target based on smolt production.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group, 3 – 12 April 2002 (ICES CM 2002/ACFM:13).

Catch data (Table 3.14.16.1-2):
TACs

Year	ICES Advice	Catch corresp. to advice '000 fish	Agreed TAC	
			'000 t	'000 fish
1987	No advice	-		
1988	No advice	-		
1989	No advice			
1990	No advice			
1991	No advice		0.43	
1992	No advice		0.43	
1993	TAC for reared stock	109[1]		109
1994	TAC for reared stock	65[2]		120
1995	Catch as low as possible in offshore and coastal fisheries	-		120
1996	Catch as low as possible in offshore and coastal fisheries	-		120
1997	Offshore and coastal fisheries should be closed	-		110
1998	Offshore and coastal fisheries should be closed	-		110
1999	Offshore and coastal fisheries should be closed	-		100
2000	Only fishery on released salmon should be permitted	-		90
2001	Only fishery on released salmon should be permitted	-		70
2002	Only fishery on released salmon should be permitted	-		60
2003	Only fishery on released salmon should be permitted			

[1]Equivalent of 600 t. [2]Equivalent of 400 t.

Landings

Year	River	Coast	Offshore	Coastal and offshore[2]		Total	
	t	t	t	t	'000 fish	t	'000 fish
1987	2	61	290	351		353	
1988	2	112	156	268		270	
1989	2	145	254	399		401	
1990	6	369	178	347		553	
1991	5	398	250	648		653	
1992	3	418	111	529		532	
1993	6	310	133	443		449	111
1994	7	142	106	248		255	57
1995	7	201	58	259	38	266	39
1996	12	327	93	420	78	432	80
1997	10	345	93	438	76	448	77
1998	13	160	21	181	29	194	31
1999	10	137	29	166	28	176	30
2000	16	144	37	181	32	197	35
2001[1]	16	121	20	141	23	157	26

[1]Preliminary. Table revised because of additional data.
[2] For comparison with TAC.

Table 3.14.16.1. Densities of wild salmon parr in electrofishing surveys at permanent stations in rivers discharging into the Gulf of Finland, Subdivision 32.

River	Year	Number of parr/100m2		Number of parr
		0+	1+ and older	
Kunda				
	1992	7.4	12.9	118
	1993	0	4.5	26
	1994	2.4	0.0	7
	1995	15.4	3.1	60
	1996	22.6	13.7	98
	1997	1.2	21.5	78
	1998	13.8	0.9	68
	1999	6.4	18.1	103
	2000	20.8	7.6	75
	2001	30.3	14.7	156
Selja				
	1995	1.3	6.5	18
	1996	0.0	0.4	1
	1997	0.0	0.0	0
	1998	0.0	0.0	0
	1999	0.1	2.3	26
	2000	1.2	0.4	32
	2001	1.4	3.7	33
Loobu				
	1994	1.2	2.8	23
	1995	0.2	0.2	2
	1996	0.0	0.4	2
	1997	0.0	0.3	3
	1998	0.2	0.0	1
	1999	10.5	0.8	70
	2000	0.6	0.8	17
	2001	0.0	0.5	3
Valgejõgi				
	1998	0	0	0
	1999	2.4	0	26
	2000	0.4	1	14
	2001	4.4	1.6	58
Jägala				
	1998	0	0	0
	1999	0.5	0	2
	2000	0	0	0
	2001	16.2	0	38
Pirita				
	1992	1.9	0.7	11
	1993*)			
	1994	0	0	0
	1995	0	0	0
	1996	0	+	1
	1997*)			
	1998	0	0	0
	1999	6.5	0	55
	2000	0	0.9	13
	2001	1.2	0.3	18
Vääna				
	1998	0	0.1	1
	1999	0	0	0
	2000	0.1	0	1
	2001	0	0	0
Keila				
	1994	1.1	1.1	12

Table 3.14.16.1 (Cont'd)

	1995	6.9	0.3	105
	1996	11.7	1.1	115
	1997	0	5.2	47
	1998	0	1.1	10
	1999**)	95	1.3	154
	2000	3.8	6.6	52
	2001	0	2.2	21
Vasalemma				
	1992	3.4	2.6	23
	1993*)			
	1994	1.9	0	7
	1995	18.7	0.4	99
	1996	4.8	5	51
	1997	0	1.5	8
	1998	0	0.2	2
	1999	13.5	0	80
	2000	3.5	1.7	27
	2001	0.4	0.9	3

*) = no electrofishing
**)= Flow was extremely small and fish were concentrated on little area
+ = minor production.

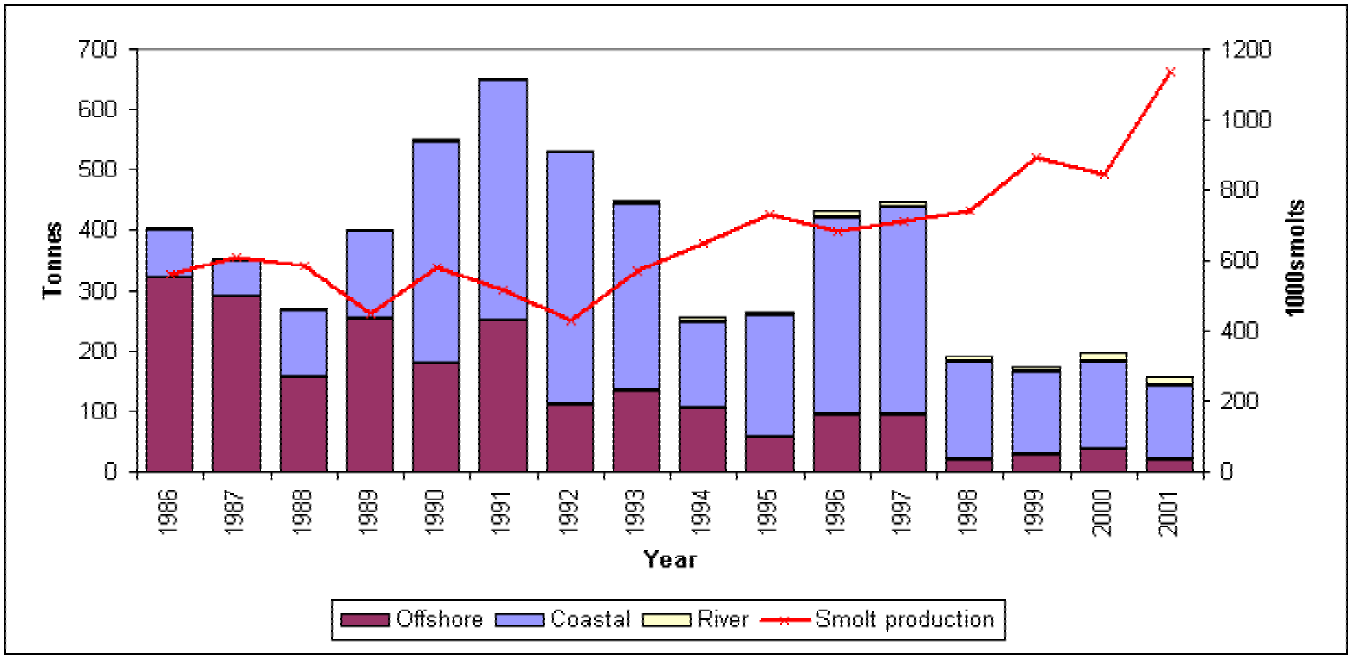


Figure 3.14.16.1. Salmon catches and smolt production in the Gulf of Finland in 1987-2000.

3.14.17 Sea trout

State of stocks/exploitation:

Wild stocks: Currently approximately 400 rivers in the Baltic Sea support wild populations of sea trout. There are no estimates of the original number of sea trout populations or quantitative estimates of the total natural smolt production. Stocks in several rivers in the Main Basin are considered to be in good or satisfactory condition with nursery areas well utilised. However, populations in numerous small Danish brooks are assessed to be in poor condition. In the Gulf of Bothnia the status of most stocks, particularly in Subdivision 31, is poor or unknown (Table 3.14.17.1). Several of these populations are probably overexploited to the extent that they now mainly exist as non-migratory brown trout.

Reared stocks: Sea trout smolt production is shown below (in thousands):

Year	Baltic Main Basin	Gulf of Bothnia	Gulf of Finland	Total
1987	994	1081	358	2433
1988	1312	1083	226	2621
1989	1537	906	198	2641
1990	1237	1035	237	2509
1991	665	1186	259	2110
1992	1023	1247	314	2584
1993	1576	1171	251	2998
1994	1485	985	285	2755
1995	1967	1243	378	3588
1996	1509	1416	139	3064
1997	2726	970	220	3916
1998	2545	943	378	3866
1999	2506	971	355	3832
2000	1825	987	353	3164
2001	2397	1076	488	3961

Elaboration and special comment: The production of sea trout in the Baltic Sea is dominated by reared production to an extent similar to the production of salmon.

Sea trout stocks in the Baltic Sea exhibit two types of migration pattern. Most of the stocks migrate in the coastal area within about 150 km of the point of release, but particularly those from Poland and some from southern Sweden migrate further into offshore areas. The fish that migrate only short distances are mainly exploited in coastal and river fisheries, and they are also affected by the coastal salmon fisheries. Fish that migrate offshore are to a large extent taken as a by-catch in the offshore salmon fishery. The stocks remaining in coastal waters are only exploited in local fisheries and may therefore be managed on a national or local basis, but the stocks migrating into offshore areas would benefit from international management measures. It is not known to what extent stocks in southern Sweden migrate to offshore areas. The management of many of these populations would benefit from knowledge of their migration pattern.

The exploitation pattern is rather variable in different areas. In the Gulf of Bothnia and Gulf of Finland sea trout are to a large extent caught in gillnets for whitefish, and to a minor extent in a recreational net fishery or in trapnets. National management agencies around the Gulf of Bothnia and Gulf of Finland should consider changes in local fishery regulations as well as implementation of restoration programs to improve the status of these sea trout populations, which are in a poor state.

Source of information: Report of the Baltic Salmon and Trout Assessment Working Group. 3 – 12 April 2002 (ICES CM 2002/ACFM:13).

Catch data[2] (Table 3.14.17.2):

Year	Baltic Main Basin t	Gulf of Bothnia t	Gulf of Finland t	Total t
1987	319	150	184	653
1988	331	282	290	903
1989	460	331	298	1089
1990	794	432	337	1563
1991	613	463	297	1373
1992	611	469	322	1402
1993	901	250	718	1869
1994	769	190	648	1607
1995	647	227	119	993
1996	511	238	95	844
1997	474	238	93	805
1998	741	252	159	1152
1999	898	319	104	1321
2000[1]	1046	325	93	1464
2001	864	288	79	1231

[1]Preliminary data. [2]No catch advice is given for sea trout. Catch figures do include recreational fisheries only for some countries.

Table 3.14.17.1 Status of monitored wild and mixed sea trout population in 2001.

	Poor	Satisfactory	Good	Not known	Total number
Gulf of Bothnia					
Subdiv 31					
Finland	1	1			2
Finland/Sweden		1			1
Sweden	10	2			12
Subdiv 30					
Sweden	13	9	1	15	38
Finland		1			1
Main Basin					
Sweden	25	23	11	15	74
Estonia	2	5	1	13	21
Latvia	2	5	8		15
Lithuania					
Poland	9	9	5	1	24
Danmark (Subdiv 22-25)	77	53	20		150
Russia				5	5
Gulf of Finland					
Finland	5				5
Russia				15	15
Estonia	7	5	4	23	39
Total	**151**	**114**	**50**	**87**	**402**

Table 3.14.17.2 Nominal catches (tonnes) of sea trout in the Baltic Sea. S=Sea, C=Coast and R=River.

Year	Baltic Main Basin													Gulf of Bothnia					Gulf of Finland			Total
	Denmark[1,4]	Estonia	Finland[2]	Germany[4]	Latvia	Lithuania		Poland			Sweden[4]			Finland[2]		Sweden			Estonia	Finland[2]		
	S + C	C	S + C	C	C	S	C	S[9]	S + C	R	S[6]	C[6]	R	S+C	R	S[6]	C[6]	R	C	C	R	
1979	3	na	10	na	na	na	na	na	81[3]	24	na	na	3	6	na	na	na	na	na	73	0	200
1980	3	na	11	na	na	na	na	na	48[3]	26	na	na	3	87	na	na	na	na	na	75	0	253
1981	6	na	51	na	5	na	na	na	45[3]	21	na	na	3	131	na	na	na	na	2	128	0	392
1982	17	na	52	1	13	na	na	na	80	31	na	na	3	134	na	na	na	na	4	140	0	475
1983	19	na	50	na	14	na	na	na	108	25	na	na	3	134	na	na	na	na	3	148	0	504
1984	29	na	66	na	9	na	na	na	155	30	na	na	5	110	na	na	na	na	2	211	0	617
1985	40	na	62	na	9	na	na	na	140	26	na	na	13	103	na	na	na	na	3	203	0	599
1986	18	na	53	na	8	na	na	na	91	49	7	9	8	118	na	1	24	na	2	178	0	566
1987	31	na	66	na	2	na	na	na	163	37	6	9	5	123	na	1	26	na	na	184	0	653
1988	28	na	99	na	8	na	na	na	137	33	7	12	7	196	na	na	44	42	3	287	0	903
1989	39	na	156	18	10	na	na	na	149	35	30	17	6	215	na	1	78	37	3	295	0	1,089
1990	48[3]	na	189	21	7	na	na	na	388	100	15	15	10	318	na	na	71	43	4	334	0	1,563
1991	48[3]	1	185	7	6	na	na	na	272	37	26	24	7	349	na	na	60	54	2	295	0	1,373
1992	27[3]	1	173	na	6	na	na	na	221	60	103	26	1	350	na	na	71	48	8	314	0	1,402
1993	59[3]	1	386	14	17	na	na	na	202	70	125	21	2	160	na	na	47	43	14	704[7]	0	1,865
1994	33[8,3]	2	384	15[8]	18	+	+	na	152	70	76	16	3	124	na	na	24	42	6	642	0	1,607
1995	69[8,3]	1	226	13	13	+	3	na	187	75	44	5	11	162	na	na	33	32	5	114	0	993
1996	71[8,3]	2	76	6	10	+	2	na	150	90	93	2	9	151	25	na	20	42	14	78	3	844
1997	53[8,3]	2	44	+	7	na	2	na	200	80	72	7	7	156	12	na	16	54	8	82	3	805
1998	60	2	103	4	7	na	na	208	184	76	88	3	6	192	12	0	9	39	6	150	3	1,152
1999	110[8,3]	2	84	9	10	0	1	384	126	116	51	2	3	248	12	0	18	41	8	93	3	1,321
2000	58	4	92	9	14	0	1	443	299	70	42	4	3	263	12	0	14	36	10	75	3	1,452
2001[5]	54	2	62	na	2	0	1	462	243	11	23	1	3	223	7	0	14	44	8	68	3	1,231

[1]Additional sea trout catches are included in the salmon statistics for Denmark until 1982 (Table 3.1.2).
[2]Finnish catches include about 70 % non-commercial catches in 1979 - 1995, 50 % in 1996-1997, 75% in 2000-2001.
[3]Rainbow trout included.
[4]Sea trout are also caught in the Western Baltic in Subdivisions 22 and 23 by Denmark, Germany, and Sweden.
[5] Preliminary data.
[6]Catches reported by licensed fishermen and from 1985 also catches in trapnets used by nonlicensed fishermen.
[7]Finnish catches include about 85 % non-commercial catches in 1993.
[8]ICES Subdiv. 22 and 24.
+ Catch less than 1 tonne.
[9]Catches in 1979-1997 included sea and coastal catches,since 1998 costal (C) and sea (S) catches are registered separately
na=Data not available.

3.14.18 Answer to Special Request from IBSFC on selectivity in Cod trawls

IBSFC has requested ICES to:

Evaluate the findings of the IBSFC Scientific Meeting on Technical Measures for the Cod Fisheries in the Baltic (Brussels, August 2001) and inter alia.

- *Review all information relevant to selectivity of gears used for cod fishing in the Baltic Sea*
- *Revisit the selection properties of the 130 mm diamond mesh size and the 125 mm polyamide diamond mesh size codends*
- *Estimate the codend mesh size of a diamond mesh and of a polyamide diamond mesh giving selectivity properties corresponding to the 120 mm BACOMA window trawl*
- *Assess the consequences of the improvements in gear selectivity and of other technical measures as adopted by IBSFC in March and in September 2001*
- *Revise the precautionary reference points for cod, taking into account the changed exploitation pattern*

ICES reviewed the report referred to in the request. There are more data available than were reviewed at the Brussels meeting; however, conclusions on selectivity properties of the cod trawl were not appreciably changed. The Brussels report is based on a standard approach to such assessments, and the approaches and methodology used in the calculations of gains and losses presented below are the same.

ICES considers that in assessing the possible consequences of the new IBSFC fishing rules, only the changes, which apply to towed gears, should be considered. The changes to gillnet regulations are small and little information is available on current practices by the gillnet fleet; so it is not possible to evaluate whether the changes in gillnet regulation will have any practical effect. The effects of other technical measures such as area and seasonal closures are also considered to give little effect on the overall annual fishing mortality. The effects of these measures are therefore not considered further in this answer.

As was done in the Brussels report the assessments, which included discard data are used in the calculations. Compared to the Brussels report these assessments were updated with data for 2001 and benefited from a critical review of the discard data done by ICES in February 2002.

There is considerable uncertainty about how effective the gear regulations measures will be in practice, and how they will improve the exploitation patterns in the Eastern and Western Baltic cod fisheries. ICES will revisit all the reference points in a consistent manner during 2003 and it is therefore considered to be ill-advised to propose a change now. Furthermore, with regard to the existing reference points for both Baltic cod stocks, IBSFC has proposed that all reference points be reviewed on a three-year cycle, which implies that a full review will be done during 2003. It is highly unlikely that it will be possible to evaluate the effects of the new IBSFC fishing rules during 2003, but it may be possible to review other information, which may influence reference points. This includes updated information on the environmental effects on recruitment in the eastern cod stock, which should be available when the STORE project is completed in 2002.

In particular for the eastern Baltic cod even an upward revised $\mathbf{F}_{pa}$ would still be significantly lower than the current fishing mortality. The SSB for eastern Baltic cod is low and is in urgent need of improvement, something that can only be achieved by reducing the overall fishing mortality.

The calculations of losses and gains can only be used as comparisons to no change in selectivity, and not as absolute estimates of any particular stock situation.

It should be stressed that any calculations, which assume the experimentally-derived L50 estimate, must be regarded as an extreme upper limit of the possible effect.

The actual numbers calculated in the Brussels report are not appreciably different from those found in this revisit of the calculations. If, and only if, the new gear regulations are effectively implemented and enforced, they may:

- result in a reduction of discards in both cod stocks
- help in rebuilding the eastern Baltic cod stock
- lead to losses in yield for 2003, but this applies to 2003 only as deemed from simulations. These losses will be balanced by longer-term gains in yield.

Furthermore, this present report discusses the biological reference points and concludes that if the new fishing rules lead to a sustained and substantial improvement to the exploitation pattern, then it may be appropriate to:

- increase the PA fishing mortality reference points, but leave the biomass PA reference points largely unchanged.

But the improved selectivity will not, even when accepting the most optimistic projections be sufficient on its own to achieve the desired rebuilding of the eastern Baltic cod stock, nor will it on its own bring the fishing mortality below what could be expected to be a revised $\mathbf{F}_{pa}$.

Review of all information relevant to selectivity of gears used for cod fishing in the Baltic Sea

ICES compiled the existing information. This is tabulated in the report of the ICES Working Group on Fishing Technology and Fish Behaviour - Review of the Size Selectivity of Baltic Cod Trawls, 7-9 February 2002, available on the ICES website (under the Fishing Technology Committee) and upon request from the IBSFC or ICES Secretariats, use the e-mail address info@ices.dk for ordering copies.

Selection properties of a 120 mm BACOMA window

ICES scrutinised the existing information (all of which was available to the Brussels meeting) and estimated L50 for a 120 mm BACOMA window at 45.24 cm. This value is very similar to that used at the Brussels meeting (45.96 cm).

Selection properties of the 130 mm diamond mesh size

ICES scrutinised the existing information and constructed the analysis presented in Figure 3.14.18.1. In total 24 experiments is included in this analysis while the analysis presented in the Brussels report was based on only 10 of these experiments. The estimated L50 for 130 mm diamond mesh size cod end was 40.85 cm. This value is very similar to that used at the Brussels meeting (40.3 cm).

The BACOMA experiment showed that the selectivity varies with vessel type and the analysis presented above include all vessels categories. The analysis was therefore repeated restricting the data to only stern trawlers. This gave an L50 at 130 mm at 40.33 cm.

Selection properties of the 125 mm polyamide diamond mesh size

Data were available for 6 experiments, but these data included such a variety of nominal twine sizes that it was considered impossible to model the selectivity of these codends in terms of twine and mesh size. As a consequence, the selectivity of a 125mm mesh, 4.5mm, single-strand, polyamid codend cannot be determined with the available data.

Codend mesh size of a diamond mesh giving selectivity properties corresponding to the 120 mm BACOMA window trawl

See results in Table 3.14.18.1. and Figure 3.4.18.1.

Table 3.14.18.1 Estimated diamond mesh size needed to produce the same L50 as a trawl with a 120-mm BACOMA window.

Vessel type	Mesh size (mm)	Standard deviation	95% Confidence Interval (mm)
Combined trawlers	140	3.19	134-147
Stern trawlers	142	3.4	135-149

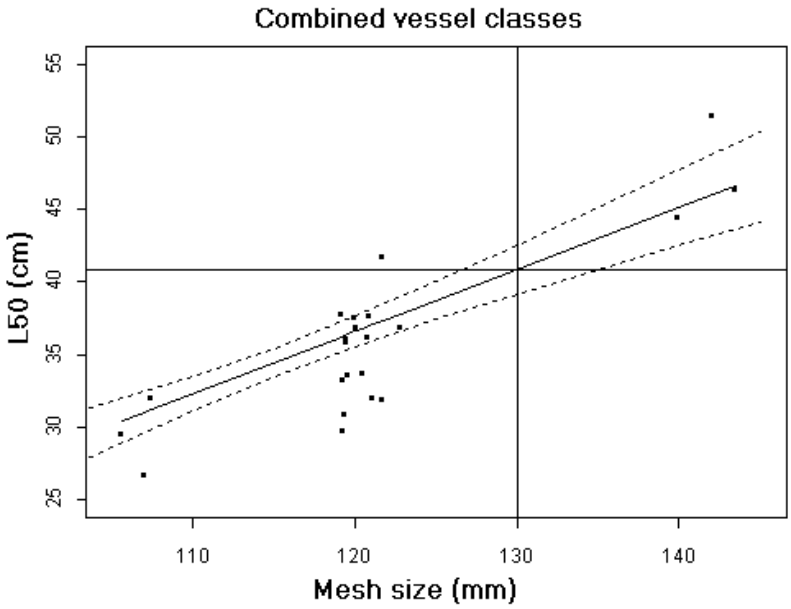


Figure 3.4.18.1 L50 versus codend mesh size for diamond mesh experiments – All vessel classes combined. The solid line represents the predicted mean value of L50; the dashed line indicates the 95% confidence intervals. Also shown is the value of L50 at a codend mesh size of 130 mm.

Consequences of the improvements in gear selectivity and of other technical measures as adopted by IBSFC in March and in September 2001

In assessing the possible consequences of the new IBSFC fishing rules, only the changes, which apply to towed gears, were considered. The changes to gillnet regulations are small and little information is available on current practices by the gillnet fleet; so it is not possible to evaluate whether the changes in gillnet regulation will have any practical effect.

The possible effects of the new gears were evaluated in detail at the scientific meeting in Brussels, and the approaches and methodology used here are the same. Side trawlers take most of the catch of cod.

It should be stressed that any calculations, which assume the experimentally derived L50 estimate, must be regarded as an extreme upper limit of the possible effect.

To evaluate the possible effects of changes in gear on the Baltic cod stocks and fisheries, it is necessary to model the relevant population and selection processes, and to then run the models using appropriate parameter estimates, including estimates of both the selectivity of the new gears and of the gears currently in use.

Selectivity estimates for the new gears are available from selectivity trials (see above). However, information about the effective selectivity of the gears currently in use by the trawl fleet is not readily available as it is not clear to what extent the selectivity of gears actually in use reflects the experimental results obtained using the current minimum mesh size. Although estimates of the effective selectivity of current gears are not available, it is possible to determine the bounds within which the current selectivity may lie. At one extreme, the gears may be highly unselective, with the exploitation pattern effectively determined only by the relative availability of each age group. At the other extreme, the selectivity of the current legal minimum mesh size, as estimated in experimental trials, represents the upper bound on the effective selectivity of current gears. As the actual effects are likely to lie somewhere between these two extremes, the run was made assuming the median position that 50% of trawlers are effectively unregulated in terms of their selectivity, and that the other 50% are using gears with selectivity characteristics corresponding to the experimental estimates for 120 mm diamond mesh (i.e. L50 = 37.2 cm, SR = 9 cm). To represent the selectivity of the new gears, it has been assumed that all trawlers adopt the 120 mm BACOMA gear; hence a run has been made assuming that from 2003 100% of trawlers use the 120 mm BACOMA window (L50 = 45.2 cm, SR = 6.7 cm). It is assumed in both cases that these measures are fully implemented and enforced. In all cases the selectivity of the gillnet fleet is assumed to be unchanged. In the absence of information on the proportion of stern and side trawlers in the Baltic fleets, and on the selectivity of the BACOMA gear when operated by side trawlers, the BACOMA value estimated for stern trawlers has been assumed to apply for all trawlers.

The runs can only be used as comparisons to the baseline (i.e. no change in selectivity).

The assessments, which included discard data are used in the calculations.

Cod in the Western Baltic (Subdivisions 22-24)

The forecast, assuming the selectivity change takes place at the beginning of 2003, indicates that 2003 landings would be 26% lower, but that 2004 landings would be about the same as if no selectivity change was introduced. The 2004 SSB would be 40% higher in the case of a selectivity change.

Cod in the Western Baltic (Subdivisions 22-24)

Summary of results of technical measure forecast compared to baseline

	Short-term percentage changes				
	2003	**2004**	**2005**	**2006**	**2007**
Landings (weight)	-26.20%	2.99%	26.62%	36.61%	40.38%
Discards (weight)	-52.99%	-44.66%	-43.66%	-43.63%	-43.63%
Discards (Nos.)	-62.60%	-57.18%	-56.66%	-56.65%	-56.65%
SSB	0.00%	40.05%	78.01%	95.25%	101.12%

	Long-term (eqm) change
Landings-per recruit (weight)	42.33%
Discards per recruit (weight)	-43.63%
SSB per recruit	104.25%

Fishing Mortality

Before selectivity change

Age	**Landings**	**Discards**	**total**
1	0.046	0.109	0.155
2	0.492	0.201	0.693
3	1.153	0.064	1.217
4	1.346	0.003	1.349
5	1.205	0.000	1.205
6	1.140	0.000	1.140
7	1.140	0.000	1.140
8	1.140	0.000	1.140
Fbar (3-6)			1.228
Fbar (1-3)			0.688

After selectivity change

Age	**Landings**	**Discards**	**total**
1	0.010	0.023	0.033
2	0.208	0.082	0.291
3	0.780	0.041	0.820
4	1.252	0.003	1.255
5	1.181	0.000	1.181
6	1.139	0.000	1.139
7	1.140	0.000	1.140
8	1.140	0.000	1.140
Fbar (3-6)			1.099
Fbar (1-3)			0.381

	Fbar (3-6)	**Fbar (1-3)**
Before	1.228	0.688
After	1.099	0.381
% change	-11.74%	-80.52%

Cod in the Eastern Baltic (Subdivisions 25-32)

The forecast, assuming the selectivity change takes place at the beginning of 2003, indicates that 2003 landings would be 17% lower, but that 2004 landings would be about the same as if no selectivity change was introduced. The 2004 SSB would be 23% higher in the case of a selectivity change.

Summary of results of technical measure forecast compared to baseline

	Short-term percentage changes				
	2003	**2004**	**2005**	**2006**	**2007**
Landings (weight)	-17.52%	1.47%	13.43%	20.16%	23.45%
Discards (weight)	-82.34%	-81.73%	-81.70%	-81.60%	-81.60%
Discards (Nos.)	-83.53%	-83.26%	-83.25%	-83.22%	-83.22%
SSB	0.00%	22.66%	38.83%	47.61%	52.06%

	Long-term (eqm) change
Landings-per recruit (weight)	25.08%
Discards per recruit (weight)	-81.60%
SSB per recruit	54.55%

Fishing Mortality

Before

Age	**Landings**	**Discards**	**total**
2	0.077	0.052	0.129
3	0.455	0.039	0.494
4	0.915	0.002	0.917
5	1.287	0.002	1.289
6	1.001	0.000	1.001
7	0.982	0.000	0.982
8	0.982	0.000	0.982
Fbar (4-7)			1.047
Fbar (2-4)			0.513

After

Age	**Landings**	**Discards**	**total**
2	0.024	0.011	0.035
3	0.264	0.001	0.266
4	0.613	0.001	0.614
5	1.100	0.002	1.102
6	0.979	0.000	0.979
7	0.979	0.000	0.979
8	0.982	0.000	0.982
Fbar (4-7)			0.918
Fbar (2-4)			0.305

	Fbar (4-7)	**Fbar (2-4)**
Before	1.047	0.513
After	0.918	0.305
% change	-14.02%	-68.44%

Revise the precautionary reference points for cod taking into account the changed exploitation pattern

There is considerable uncertainty about how effective the new gear regulations will be in practice. Furthermore, it will not be possible to evaluate whether they have had any effect until after the regulations have been in force for a number of years. As a result it would be premature to propose revisions to reference points, which account for these possible effects. In addition, ICES will revisit all the reference points in a consistent manner during 2003 and therefore it is considered to be inappropriate to propose a change now. However, some considerations on how the reference points could change if the estimated possible improvement in exploitation pattern is achieved are presented below for illustration.

ICES uses reference points defined in terms of spawning stock biomass and of fishing mortality.

The $\mathbf{B}_{lim}$ reference points are not affected by the selectivity change as these represent estimates of SSB when recruitment will be impaired. Discards are expected to be much reduced and this will increase the estimates of recruitment in absolute terms, but not the point when the recruitment is impaired.

The $\mathbf{B}_{pa}$ reference point is the $\mathbf{B}_{lim}$ plus a buffer added to the $\mathbf{B}_{lim}$ reference point to reflect assessment uncertainty and stock variability. Assessment uncertainty is largely determined by the accuracy of the fisheries statistics, the amount of sampling made from the landings and catches, and the accuracy and precision of the abundance surveys. The elements are not affected by the improved selectivity. Stock variability may be reduced at higher spawning stock biomasses, but this is speculative and is not demonstrated for the cod stocks. Hence, the $\mathbf{B}_{pa}$ reference point will not change as a primary effect from the selectivity change.

The fishing mortality reference points $\mathbf{F}_{lim}$ and $\mathbf{F}_{pa}$ both depend on the exploitation pattern, which in turn is affected by the gear selectivity. Depending on the assumptions made about how the exploitation pattern will alter, the estimated change in F reference points will vary. Some insight into the general magnitude of possible effects can be obtained by examining the SSB-per-recruit at a range of F's under various assumed selectivity patterns, and finding the cases matching the SSB-pre-recruit from the existing reference points and exploitation pattern. The analyses suggest that F reference points could increase by 20-50%, depending on how the exploitation pattern will change. A revision of reference points on this basis would only be appropriate if the new fishing rules lead to a sustained and substantial improvement in the exploitation pattern. It will not be possible to evaluate this until after the new regulations have been in place for a number of years. However, the improvement in exploitation pattern would require that the more selective trawls are accepted and effectively implemented by all trawlers. There are strong indications that the new gears have not been accepted, so their implementation has not been effective.

Final Comment

With regard to the existing reference points for both Baltic cod stocks, IBSFC has proposed that all reference points be reviewed on a three-year cycle, which implies that a full review will be done during 2003. It is highly unlikely that it will be possible to evaluate the effects of the new IBSFC fishing rules during 2003, but it may be possible to review other information, which may influence reference points.

Source of information: Report of the IBSFC Scientific Meeting on Technical Measures for the Cod Fisheries in the Baltic, Brussels, August 2001.

Report of the ICES Working Group on Fishing Technology and Fish Behaviour - Review of the size selectivity of Baltic cod trawls, 7-9 February 2002 (ICES CM 2002/B:1).

Report of the Baltic Fisheries Assessment Working Group, 15 – 24 April 2002 (ICES CM 2002/ACFM:17).

3.14.19 Answer to special request from IBSFC on Pelagic Fisheries

Regarding pelagic fishery catches in the Baltic IBSFC requested ICES to:

- *Review national sampling programmes of these catches and by fleet evaluate the uncertainties of the estimated species composition and age compositions.*

- *Provide an overview of the spatial and seasonal distribution of these catches by species and by fleet.*

- *Consider and evaluate the impact on SSB and yield by introducing minimum landing size for herring and sprat (herring – 16 cm, sprat – 10 cm) and the by catches of juvenile herring in herring-directed fishery (15%), the by-catches of juvenile sprat in sprat-directed fishery (15%), and by-catches of herring in sprat-directed fishery (15%).*

The answers to the first two points have been delayed and an answer is expected in mid-June 2002.

Impact on SSB and yield by introducing a minimum landing size for herring and sprat (herring 16 cm, sprat 10 cm) and the by-catches of juvenile herring in herring-directed fishery (15%), the by-catches of juvenile sprat in sprat-directed fishery (15%) and by catch of herring in sprat-directed fishery (15%).

A minimum landing size for herring and sprat will only affect SSB if the small herring and sprat that are not landed are also not caught. Generally, herring and sprat do not survive once brought on deck and returned to the sea. Therefore, a minimum landing size rule in itself will not affect SSB. Obviously the amount of herring and sprat discarded would be lost to the yield.

Mesh size regulations in the trawl fishery cannot be used effectively to regulate mortality of herring and sprat due to the poor survival of escapees. A mortality of 80% or higher for herring has been observed. No survival experiments have been carried out for gillnet fishing. However, even in this case it is likely that the survival of the herring escaping from the gillnet is not 100 %.

Closed areas or closed seasons are only effective management measures if there are areas that can be closed and that contain relatively large numbers of small fish. Such areas have only been identified in parts of the Baltic Sea.

Concerning sprat, there is large variability in area distribution both during the year and between years. This means, that a fixed closed area system cannot be used to manage the fishing mortality of the sprat stock.

Concerning herring the differences in length distributions between the different areas are more stable than in the case of sprat. An effective way to decrease the fishing mortality of young herring would be to fish only during the spawning migration on or near spawning grounds. This implies, however, a closed season for herring for more than 3/4 of the year.

A possible implementation of improving the selectivity of the fishery would be to prohibit landings when and where the proportion of fish under a certain size is too high. In such a system the fishermen are responsible for finding areas where small herring and sprat do not occur in the catches. This type of regulation has been applied in Poland. However, no analysis has been made to support the implementation of such a management measure.

Herring spawns on the coast, and during that time of the year the fishery is targeted on the spawning migrating fish on the coast (e.g. trapnet fishery). This fishery is more beneficial from the conservation point of view than the fishery which targets the immature part of the stock.

Table 3.14.19.1 gives the theoretical upper limit on the long-term maximum gain that could be obtained if fishing mortality on age 0 or age 1 herring could be reduced to zero. This would have the effect of increasing the SSB by 20%, but the possibility of increasing the yield-per-recruit is very small. The likely gain from any regulation that reduces the catch of juvenile herring and sprat are less than the theoretical maximum gains indicated.

How much of the fishery is conducted with by-catches outside the limits indicated?

There are significant fluctuations between years in the amounts of immature sprat, varying between 10 and 65% of the total catch. The fluctuations are determined by the strength of the sprat year classes that may fluctuate considerably in different years. The share of immature sprat varies significantly by Subdivisions as well, and reaches the greatest values in Subdivision 22. The share of immature herring in the total stock is more stable compared to sprat as a result of lower fluctuations of herring year class strength. The smallest proportion of immature herring is observed in Subdivision 27 and the highest proportion in Subdivision 32.

Juvenile fish are especially abundant in industrial catches. In Subdivision 26 up to 63% in weight of catch has been observed to be juvenile herring. Juveniles are unevenly distributed; the amount of juveniles was approximately 2–3 times higher in catches on coastal fishing grounds compared to the open sea catches. Occurrence of juvenile herring increases especially in the IV and I quarter of the year, when young and older fish form mixed shoals and the sprat fishery intensifies.

Conclusions and advice

In the case of sprat, there seems to be no realistic way to implement a change in exploitation pattern without detailed and locally adapted rules. In the case of herring, a fishery targeted on the spawning migrating fish would theoretically offer a possibility to manipulate the exploitation pattern.

Table 3.14.19.1 The relative changes in spawning biomass and yield of herring if fishing could be closed for age groups 0 and 1. Calculation based on the Central Baltic herring stock (Subdivisions 25-29 and 32 excl. Gulf of Riga).

Variable	No change	No fishing in age 0	No fishing in ages 0 and 1
SSB	1	1.06	1.20
Yield	1	1.05	1.06

3.14.20 Answer to Special Request from IBSFC on Research Plan for Central Baltic Herring

IBSFC has requested ICES to:

Develop a research programme aimed to improve management of Central Baltic herring stocks through enhancing our knowledge regarding their structure and dynamics. The programme should include:

1. *Review the existing information on stock structure and migration patterns and plan a sampling programme of the commercial fisheries for splitting their catches into stock components;*

2. *Review stock separation methodologies and draw up a research plan for a sampling and analysis programme. The programme should include a validation component of the stock separation procedures;*

3. *Adapt surveys to provide abundance indicators for use in the stock assessment of individual stocks;*

4. *Develop stock assessment models of individual stocks, taking into account fleet behaviour and fish migrations. Based on such models compile relevant time series;*

5. *Evaluate alternative management systems, e.g., effort limitation, closed areas, which reflect individual trends among populations. Propose a monitoring system of the commercial fisheries for splitting catches into stock components.*

The IBSFC request contains several sub-components related to the Baltic herring stocks, and these topics can potentially be addressed by a wide range of activities. These activities will require an allocation of resources (e. g., shiptime, manpower, improved technologies) from national laboratories and funding agencies. The resources available in the future will therefore determine the scope of any such research programme that can be established. At the present time it is unclear what those resources might be and when they will become available. In the absence of this information it is not possible to define the specifics of a new research programme.

Nevertheless, it is possible to identify research activities that would address the topics in the request when such resources become available. This information could be used to highlight important research needs and priorities to national laboratories and funding agencies (e.g., EU), and might encourage those organisations to allocate the resources required to conduct such a research programme.

The five topics raised in the IBSFC request are to some extent linked and cannot be conducted simultaneously in an effective manner. This is because results and information from some of the topics are needed to address some other topics. This means that the topics must be addressed sequentially. It is proposed that the first three topics be addressed first, and that results and information from these be used to investigate the last two topics.

It is also recognized that the issue of stock separation methodology is a topic of investigation in the wider ICES community and is being investigated by a dedicated study group (Study Group on Stock Identification Methods; Chair: Kevin Friedland). This Study Group will produce a manual on stock separation methodologies and techniques in 2003. Its guidelines and recommendations should be considered when attempting to define new stock units for Baltic herring.

Elements of the new research programme:

Topics 1 and 2:

Topics 1 and 2 of the research programme suggested by IBSFC have been addressed by the Study Group on Herring Assessment Units in the Baltic Sea (SGHAUB). This Study Group identified several gaps in the present knowledge of the herring stock structure in the Baltic, and some actions that could be taken to close those gaps. These actions would address in particular topics 1 and 2 in the research programme and therefore could form the basis of such a research programme. The actions proposed by the Study Group are given in Section 4 of its report and were used to answer this request.

Ongoing and new genetic studies will also address issues, including the validation, of stock separation and structure/dynamics. The results of genetic research initiated recently on Baltic herring using microsatellite markers are important for planning any future programmes and could serve as a platform for future investigations, on an international scale. National laboratories are already contributing biological material to these investigations, and results from these studies could be used to develop specific sampling methods for identifying particular stocks and stock subcomponents, and their dynamics.

The Study Group has outlined a sampling and analysis strategy for stock separation purposes. This strategy is given in Section 5 of the Study Group report and addresses topic 2.

In addition to these activities, knowledge of factors affecting the reproductive success in different spawning areas would be useful for stock separation purposes and understanding. The following topics should be investigated:

a) the state of the spawning grounds and the success of embryonic development;
b) the utilization of the spawning grounds by analyzing information on herring coastal fishery during the spawning period (e.g., in trapnet fishery the number of trapnets, landings);
c) representative herring otolith samples from the spawning grounds and their further analysis by modern methods that could give new possibilities for stock separation and validation. It should be pointed out that embedded otoliths, which are an adopted preparation practice in some laboratories, are not useful for these purposes.

The above activities, if implemented, would address in particular the first 2 topics of the research programme request from IBSFC.

Topic 3:

The following activities address topic 3:

1) Expand the International Hydro-Acoustic Survey to SD 29 North and SD 32. This would be useful both for the assessment in SD 25–29, 32 (Gulf of Riga herring excluded) and potential assessment in SD 28, 29, and 32.

2) SGHAUB should finalize the compilation of data for the assessment of southern coast herring in SD 25–26 and Swedish coast herring in SD 25–27. For these two assessments the separation of catches by population is performed only by Poland and Russia; catches of other countries are split on the base of age and population composition in Polish and Russian catches. Therefore SGHAUB has recommended that samples from Danish and Swedish herring fishery in these subdivisions are submitted to Poland (SD 25) and Russia (SD 26) for direct determination of population structure. SGHAUB should carry out exploratory assessments of these herring stocks as well as for herring in SD 28 (Gulf of Riga herring excluded), 29, and 32, and present the results to the ICES Baltic Fisheries Assessment Working Group. Besides, it is important that for these assessments the national data are prepared and data series are checked.

3) The data on fish abundances from the International Hydro-Acoustic Survey could be used for the analysis of the herring distribution pattern during feeding migrations, detecting regularities in the distribution, and the influence of hydrological peculiarities and stock size on the distribution pattern. Biological sampling from the surveys could be used for judging whether the migration pattern inferred by the old tagging experiments is still valid. This information will also provide background information for topic 4.

Topics 4 and 5:

These topics depend on an improved understanding of stock structure and dynamics that will be developed over the next several years, if the research to address topics 1–3 is conducted.

The results of the studies addressing topics 1–3 would provide the necessary information for evaluating topics 4 and 5 (e.g., assessment models accounting for migrations, management systems including closed areas and effort limitation).

3.14.21 Response to request from Finland concerning revision of the assessment of herring in Subdivision 30 (Bothnian Sea)

ICES has been asked to consider:

- Evaluation of the quality and correctness of the new stock assessment of Baltic herring stock in the Bothnian Sea (ICES subdivision 30, IBSFC Management unit 3)
- Revision of advice, if necessary on catch options for 2002 based on fishing mortalities in the fishing mortality range F=0.15 to 0.30, as considered appropriate
- Guidance on management strategies in terms of spawning stock biomass and mortality rates under different management scenarios in medium term

Finland requested a response by 15 March 2002.

1.Background

The fishery is virtually entirely Finnish. The re-assessment is based on revised data for 2000 for Finland but maintains the basic approach adopted by the Working Group on Baltic Fisheries Assessment (WGBFAS) and as accepted by ACFM. The basis for the updates is that final Finnish data for 2000 only became available after ACFM met in May 2001. Compared with the data used in the assessment on which ACFM based its advice in May 2001, catches for 2000 were decreased by about 9%, age compositions were unchanged while CPUE data for the three tuning fleets were increased with 20–25%.

2. Evaluation of the correctness of the new stock Assessment

The assessment is based on catch at age in numbers and CPUE series from commercial fisheries for three fleets. The effort data were updated as follows, the relative changes given below were calculated as the difference between new -old of the effort estimates have been changed (%) as shown below.

	Pel. Trawl	Bottom Trawl	Trap nets
% change of effort (new-old)*100/[(new+old)/2]	-26.9	-21.8	-22.4

This means that CPUE is increased thus indicating a larger stock than hitherto estimated.

Maris Plishs (chair WGBFAS) and Hans Lassen (ICES Fisheries Adviser) have confirmed the Finnish calculations.

The estimated fishing mortality and recruitment differ between the old (ACFM May 2001) assessment and the revised assessment as illustrated below (changes before 1993 are all less than 1 %).

Year	Recruitment (age 1)			Fishing Mortality (F-bar)		
	Old Assessment (Table 11.7.2)	New Assessment	Rel. Difference % (=(new-old)*100/[(old+new)/2]	Old Assessment (Table 11.7.2)	New Assessment	Rel. Difference % (=(new-old)*100/[(old+new)/2]
1993	5,476,167	5,539,460	1.1	0.1251	0.1248	-0.2
1994	3,630,441	3,732,809	2.8	0.1881	0.1873	-0.4
1995	4,671,458	4,788,830	2.5	0.2089	0.2076	-0.6
1996	3,884,651	4,086,477	5.1	0.1891	0.1865	-1.4
1997	3,446,769	3,762,311	8.8	0.2373	0.2323	-2.1
1998	6,123,975	7,070,230	14.3	0.2219	0.2147	-3.3
1999	2,579,859	3,058,594	17.0	0.2857	0.2691	-6.0
2000	4,664,747	4,832,528	3.5	0.3021	0.2473	-19.9

The new assessment gives higher estimates of spawning stock biomass for 2001. The SSB (2001) estimate is 203 000 t in the June 2001 assessment while the revised data suggest an estimate of 264 000 t. Correspondingly, the fishing mortality for 2000 is found to be lower in the revised assessment compared to the assessment made in June 2001.

The precautionary approach reference points are $\mathbf{F}_{pa}$ = 0.21 and $\mathbf{B}_{pa}$ = 200,000 t.

3. Revision of advice, if necessary on catch options for 2002 based on fishing mortalities in the fishing mortality range F=0.15 to 0.30, as considered appropriate

The June 2001 ICES advice for management of the fishery in 2002 is given below including the catch option table.

Advice on management (June 2001): ICES recommends to reduce the fishing mortality to no more than $F_{pa,}$ [F_{pa} = 0.21] corresponding to landings of less than 39 500 t in 2002.

Catch forecast for 2002: Basis: F(2001) = F(98–00) = 0.30, Landings(2001) = 60, SSB(2001) = 203

F (2002)	Basis	SSB (2002)	Landings (2002)	SSB (2003)
0.00	No fishing	201	0	251
0.21	$\mathbf{F}_{pa}$ =0.7*F(98–00)	195	39	206
0. 24	0.8*F(98–00)	194	44	200
0.27	0.9*F(98–00)	194	49	194
0.30	$\mathbf{F}_{lim}$ =F(98–00)	193	54	189

Weights in '000 t.

Shaded scenario considered inconsistent with the precautionary approach.

The following table gives the revision of short term forecast using new estimates of stock composition as of 1st January 2001 together with fishing mortality, landings and spawning stock biomass for 2001.

Catch forecast for 2002: Basis: F(2001) = F(98–00)= 0.25, Landings(2001) = 54, SSB(2001) = 264

F (2002)	**Basis**	**SSB (2002)**	**Landings (2002)**	**SSB (2003)**
0.00	No fishing	276	0	336
0.19	0.8*F(98–00)	268	50	279
0.21	$\mathbf{F}_{pa}$ =0.85*F(98–00)	267	53	275
0.22	0.9*F(98–00)	267	56	273
0.25	1.0*F(98–00)	266	62	267
0.27	1.1.*F(98–00)	265	67	261
0.30	$\mathbf{F}_{lim}$ =1.22*F(98–00)	264	72	255

Weights in '000 t.

Shaded scenario considered inconsistent with the precautionary approach.

The updated catch forecast suggests that the TAC for 2002 corresponding to F_{pa} is revised upwards from 39 500 t to 53 000 t. ICES maintains its advice to restrict fishing mortality to no more than F_{pa}[=0.21].

4. Medium Term projections

The medium term projections presented in June 2001 were based on a lower initial stock situation than suggested by the revised assessment. The revision only concerns the present state of the stock and not the entire time series hence the stock recruitment relationship and the perception of the uncertainties in the assessment remain unchanged. The basic features of the medium term projections therefore remains unchanged except for the initial higher starting point.

ICES has not finalised this analysis; the upward revision of the assessment makes the medium term projections for some fishing mortalities dependent on extrapolation of the stock-recruitment relationship to SSB levels for which there are little or no data. WGBFAS will re-analyse these projections and in late May 2002 ACFM will review the results.

5. Management Considerations

This stock is regulated by IBSFC as part of Management unit 3 (= subdivisions 29N+30+31). The central Baltic herring of which only a proportion is found in Subdivision 29N, is decreasing. The herring stock in Subdivision 31 is at a low level with too high fishing mortality.

ICES advice given in June 2001 for the Central Baltic herring and herring in Subdivision 31 is unchanged and not affected by the revision presented above. For convenience these advices are repeated below

Central Baltic Herring

Advice on management: ICES recommends that fishing mortality in 2002 should be reduced below the F_{pa} = 0.17 to allow the SSB to increase. The TAC for herring in Sub-divisions 25–29, 32 should be set so that the catch of this stock in 2002 is less than 73 000 t. To allow the SSB to rebuild to historic sizes associated with good recruitment, a rebuilding plan should be developed.

Herring in Subdivision 31

Advice on management: ICES advises that exploitation rates should be decreased from their recent high levels.

3.15 *Nephrops* Stocks

3.15.1 Overview of *Nephrops* Stocks

Functional Units and Management Areas

Functional Units are defined by groupings of statistical rectangles according to the present knowledge of the distribution of *Nephrops* stocks. Management Areas are defined using, as far as possible, existing ICES Subarea and Division boundaries. ICES provides catch advice by Functional Units. However, under the existing quota system, a TAC is often set for an area that is larger than the Management Area that is considered appropriate. Therefore, the present TAC areas do not allow management of the stocks in individual Functional Units in a way that takes the different levels of exploitation into account. While for some Management Areas it may be advisable to reduce exploitation, it may be admissible to increase catches in other Management Areas included within the same TAC area. If the sum of the recommended catches for the separate areas is taken as the basis for setting the TAC for the whole area, this could lead to unsustainable increases in exploitation in individual Management Areas within the TAC area.

The advice in this report is limited to Subareas VIII and IX, within which the TAC areas are identical to Management Areas. However, ICES takes this opportunity to reiterate the recommendation given in previous years that management should take place at the Management Area level as defined in Figures 3.15.1.1-3.15.1.3 and Table 3.15.1.1. As an alternative, specific management tools could be developed aimed at controlling fishing effort on a much smaller geographical scale than is the case in the existing system. This problem is relevant mainly to the more northern Management Areas, notably those in Subareas IV and VII.

Assessment Methods Employed

The assessment of the stocks was based on a variety of methods:

- Analysis of long-term trends in fishery data (landings, effort, CPUE, LPUE, etc.);
- Age-based analytical assessments (VPA);
- Short-term stock projections based on the output of the VPA;
- Y/R analyses based on the output of the VPA; and
- Fishery-independent surveys (trawl surveys).

The examination of trends in fishery data remains an important element of *Nephrops* assessments, especially for stocks with few biological or sampling data. For most stocks, available information now extends over many years.

Age-based VPAs are performed for all stocks for which there are biological data and a sufficiently long time-series of fishery sampling data. It should be recognised that these assessments suffer from several limitations, including:

- uncertainties in the slicing of length into 'age' distributions;
- the year-to-year variations in emergence of *Nephrops* (which may result in unrealistic estimates of stock biomass, particularly for the females); and
- in a number of cases, the lack of discard data (which results in levelling off the estimates of the recruits and leads to a false impression of stability in recruitment).

Fishery-independent survey data are available for a number of stocks. For the stocks considered in this report, these are trawl surveys, which suffer from two principal limitations:

- low catch rates, owing to the surveys often being directed at monitoring other species, such as hake; and
- catch rates dependent on time of day fished, owing to diurnal activity rhythms of *Nephrops* determining their availability to trawls.

Despite these limitations, trawl surveys can provide useful corroboration of trends observed in commercial catch rates and in the outputs of analytical assessments.

Male vs. Female Exploitation

Female *Nephrops* are less available for exploitation than males. Females are mainly caught in the summer months, but when berried (usually between early autumn and spring of the next year) they stay in the burrows and cannot be caught by trawls. In most stocks, this is reflected by much lower fishing mortality rates and much more optimistic Y/R predictions for females than for males. However, in fisheries where there is a high proportion of effort in the summer, fishing mortality can be as high on females as on males. These stocks are more vulnerable to spawning stock depletion, and there is a greater risk that they will go outside safe biological limits.

Males are the most vulnerable component of the stock (while at the same time accounting for the majority of the landings). Therefore, overall evaluation of the state of exploitation of the stocks, and hence the management advice, is largely based on consideration of the male portions of the stock.

The differences in exploitation pattern between males and females, and the uncertainty about the reliability of the nominal VPA estimates of female stock biomass and recruitment (the trends in these however, are believed to be reliable), are the main reasons why stock biomass and recruitment are given for males and females separately, and not for the sexes combined.

Advice for 2003

ICES provides advice in this report for 2003 only.

Advice is limited to the southern stocks, i.e. stocks in Subareas VIII and IX. In recent years *Nephrops* assessments have been performed biennially, and advice has been given for two-year periods. In the case of these southern stocks, however, the results of assessments performed in 2001 showed serious reasons for concern, and the need was seen to revise the assessments and advice on an annual basis. For all northern stocks, i.e. those to the north of the Bay of Biscay, no such need was identified, and the advice previously given for 2003 remains applicable.

Assessments were performed this year for stocks in the Bay of Biscay (FUs 23+24) and around the Iberian Peninsula (FUs 25, 26+27, 28+29, 30, and 31). These confirm the results of last year's assessments, showing that there is serious reason for concern. At least in Division VIIIc and Subareas IX there is evidence of declining trends in LPUE/CPUE and/or biomass and recruitment, and ICES again proposes that drastic management action should be taken. In view of the continuing alarming state of exploitation of these stocks, advice is given for the year 2003 only, and ICES recommends that these stocks be re-assessed (along with the northern stocks) in 2003.

Table 3.15.1.1 Description of Management Areas together with their *Nephrops* Working Group labels and the Functional Units contained within them.

WG label	ICES description	Functional Units (FUs) or groupings thereof when treated as one in assessments	
A	Va	1	Iceland
B	Vb (non EC)	2	Faeroe Islands
C	VIa	11	North Minch
		12	South Minch
		13	Clyde
D	Vb (EC) + VIb		None
E	IIIa	3	Skagerrak
		4	Kattegat
F	IVa, rect. 44-48 E6-E7 + 44E8	9	Moray Firth
		10	Noup
G	IVa, West of 2° E excl. MA F	7	Fladen
H	IVb,c, East of 1° E excl. rect. 43F5-F7	5	Botney Gut
		33	Off Horn Reef
I	IVb,c, West of 1° E	6	Farn Deeps
		8	Firth of Forth
J	VIIa, North of 53° N	14	Irish Sea East
		15	Irish Sea West
K	VIId,e		None
L	VIIb,c,j,k	16	Porcupine Bank
		17	Aran Grounds
		18	Ireland NW coast
		19	Ireland SW and SE coast
M	VIIf,g,h, excl. rect. 31E1 32E1-E2 + VIIa, South of 53° N	20+21+22	Celtic Sea
N	VIIIa,b	23+24	Bay of Biscay
O	VIIIc	25	North Galicia
		31	Cantabrian Sea
P	VIIId,e		None
Q	IXa	26	West Galicia
		27	North Portugal
		28+29	South-West and South Portugal
		30	Gulf of Cadiz
R	IXb + X		None
S	IVa, East of 2° E + rect. 43F5-F7	32	Norwegian Deep

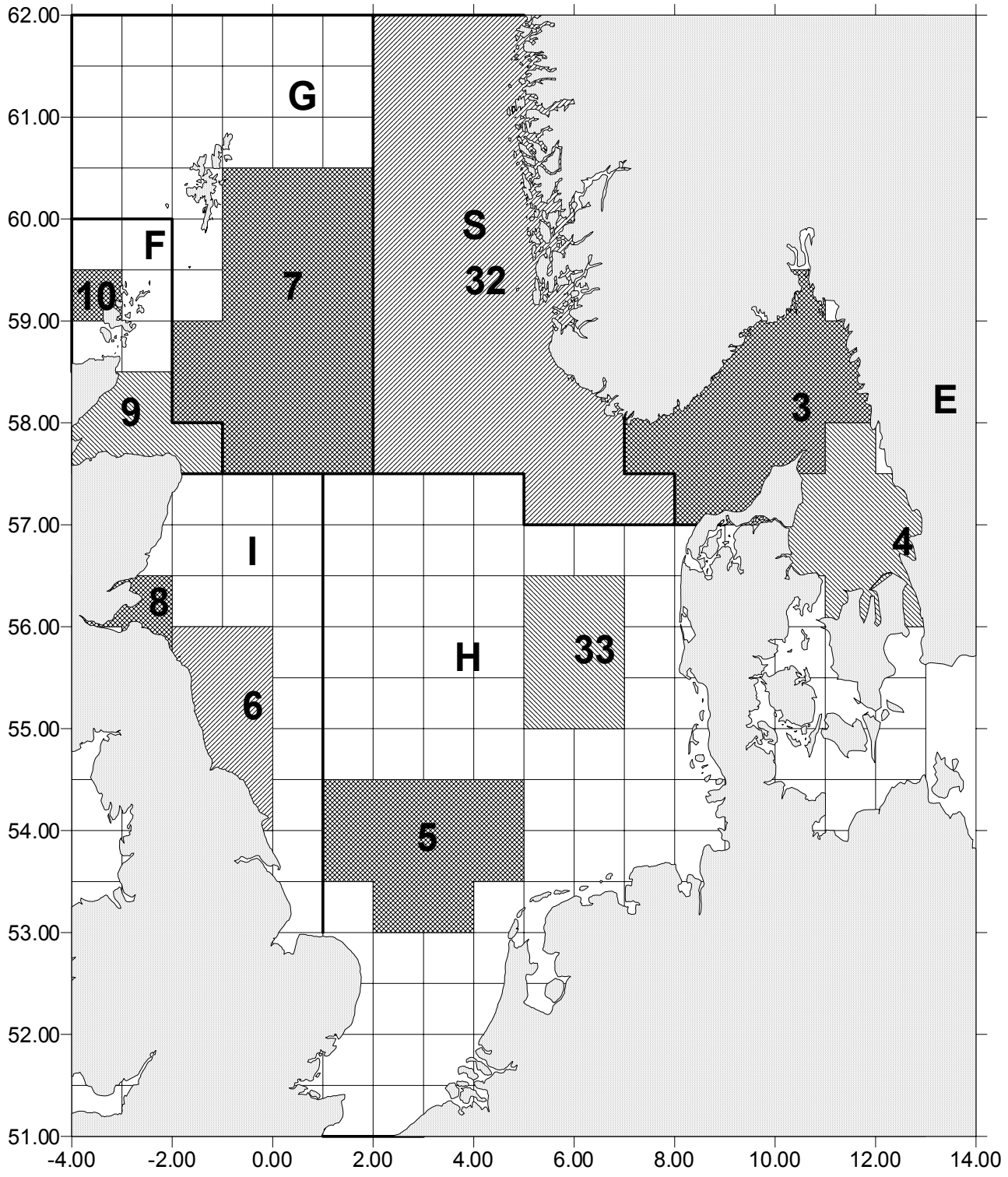


Figure 3.15.1.1 *Nephrops* Functional Units and Management Areas in Division IIIa and Subarea IV (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).

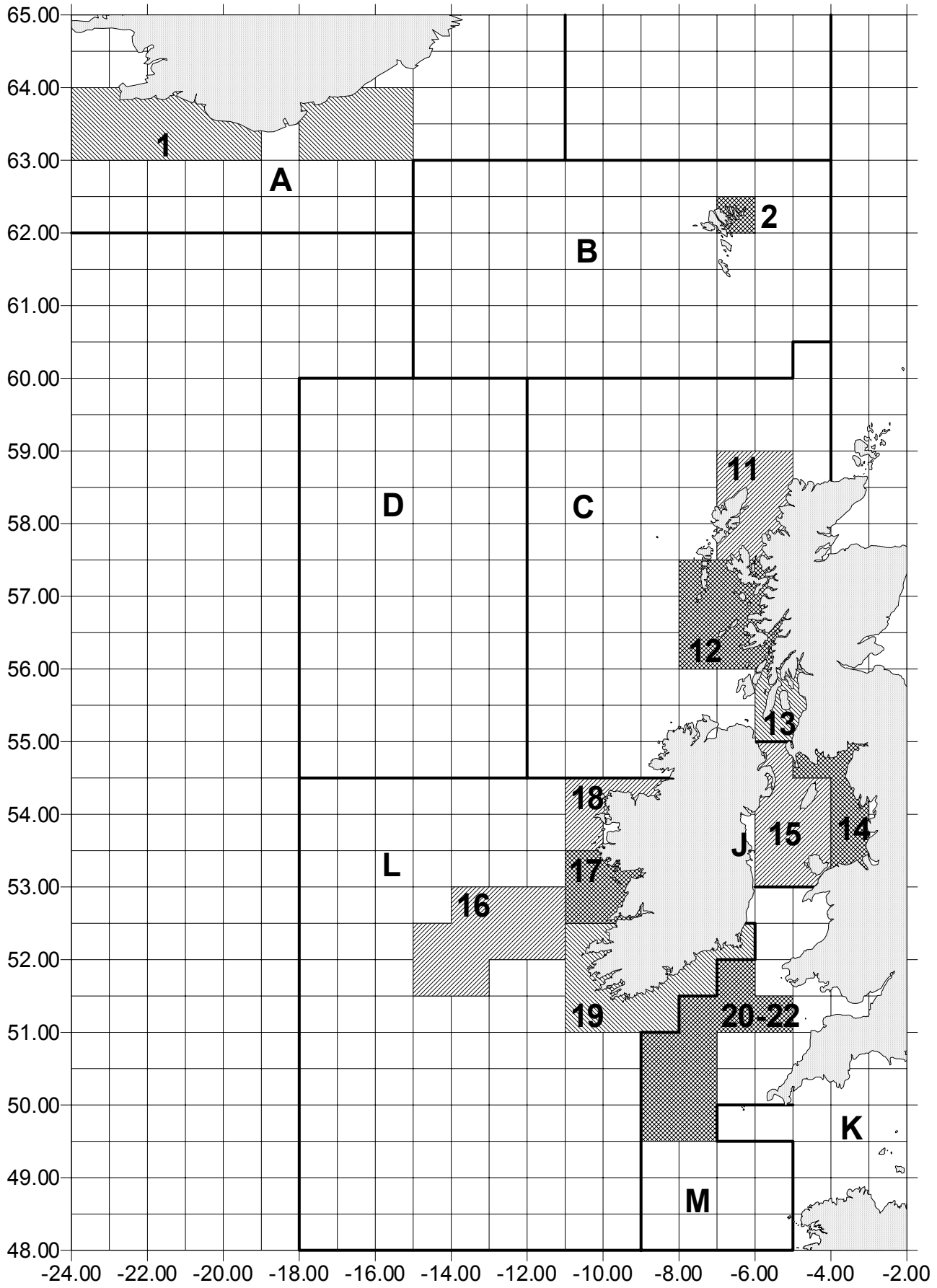


Figure 3.15.1.2 *Nephrops* Functional Units and Management Areas in Subareas V, VI and VII (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).

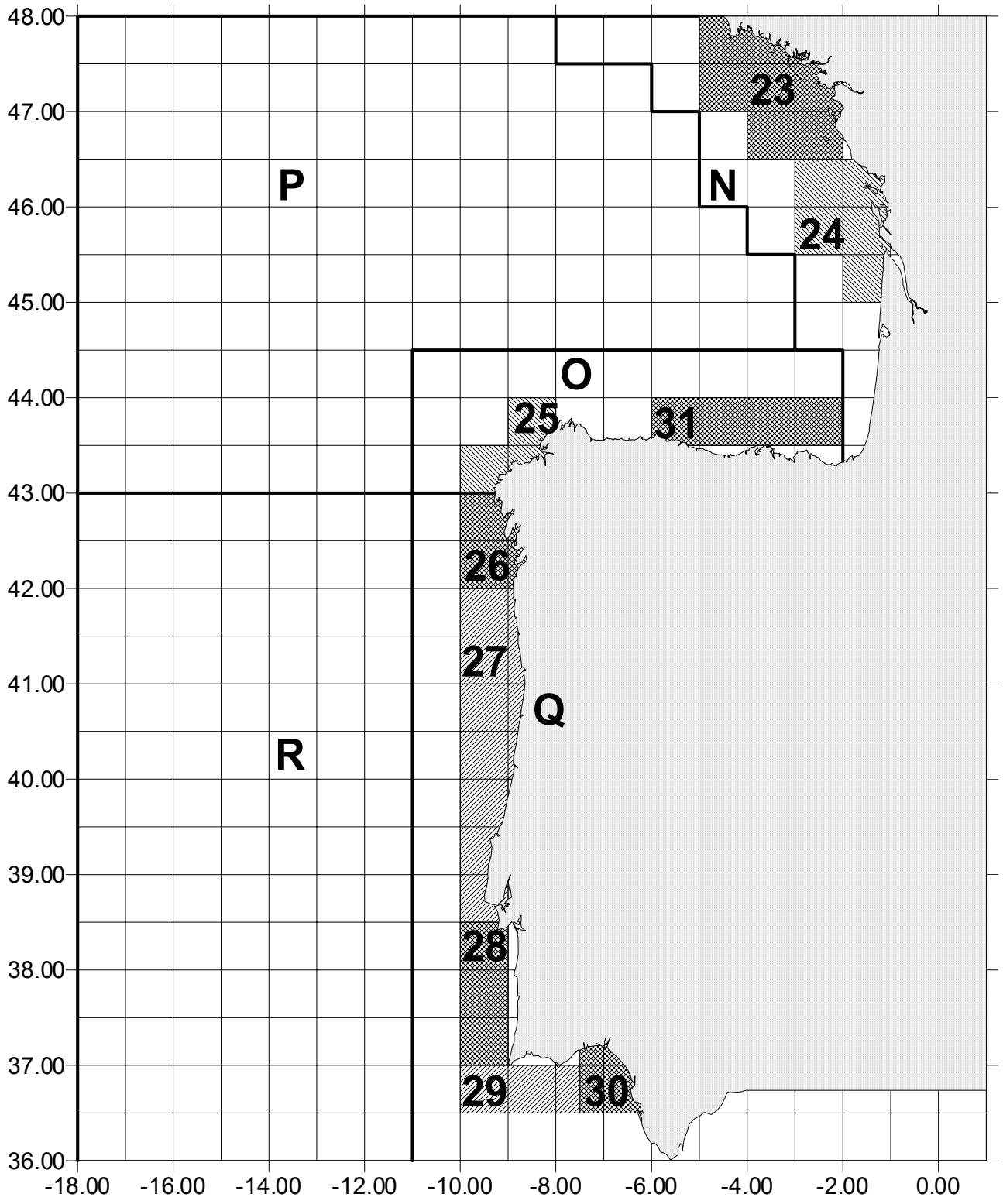


Figure 3.15.1.3 *Nephrops* Functional Units and Management Areas in Subareas VIII, IX and X (letters and figures refer to Management Areas and Functional Units given in Table 3.14.1.1).

3.15.2 *Nephrops* in Divisions VIIIa, b (Management Area N)

There are two Functional Units in this Management Area: a) Bay of Biscay North (FU 23) and b) Bay of Biscay South (FU 24), together called Bay of Biscay.

State of stock/exploitation: The stock biomass in this Management Area is at or near the lowest level of the series. This is attributed to the exploitation rate being too high and/or an inadequate fishing pattern causing high mortality of juveniles.

a+b) Annual LPUEs have been fairly stable, but with an upward trend since 1994 which is considered to indicate increased gear efficiency. Increased efficiency in recent years, even though not fully quantified, results from the use of twin trawls and rockhopper gear on single trawls. The latter and use of GPS has allowed exploitation of previously inaccessible areas. Age-based assessment indicates that biomass levels of males decreased in the late 1980s up to 1998. Despite a slight recovery in the last 3–4 years, male biomass remains at a low level. Female biomass has remained fairly stable from 1987 to 2001, but these estimates are considered to be less reliable than for males. Recruitment estimates show a trend of decline from the late 1980s up to the late 1990s. In males, there appears to have been some recovery since 1998. However, this is poorly estimated. In females, there has been a continuous trend of decline in recruitment up to 2001. $\mathbf{F}_{bar}$ has fluctuated without trend over the assessment time-series for both sexes. Y/R analysis based on outputs of VPA shows that current F is well above $\mathbf{F}_{max}$ for both males and females.

Management objectives: There are no management objectives set for this fishery.

Advice on management: In order to achieve a significant increase of the stock in the short term, ICES advises a 50% reduction in the exploitation rate. This corresponds to landings of 2200 t in 2003. Alternatively, a recovery plan could be implemented. Examples are presented below (see medium term projections).

Relevant factors to be considered in management: A mesh size increase was implemented in the year 2000, but there is no evidence that the exploitation pattern has been significantly improved. Simulations indicate that substantial increases in stock biomass could be achieved by improving the selection pattern. Any measure implying no catch of *Nephrops* at ages 1 and 2 (i.e., less than 26 mm CL) would bring about similar improvements in biomass in the medium term as a 30% reduction in F over all ages without any change in the exploitation pattern. It is worth noting that a difference of outcome between the two scenarios is that higher landings would be possible under the improved selection pattern.

The assessments, and consequently the short-term catch forecasts, are considered to be overoptimistic with respect to recent years, owing to the likely increase in effective effort. Increases in CPUE since 1994 are interpreted by the age-based assessments as increases in stock abundance and recruitment, whereas it is possible that they reflect (unquantified) increases in efficiency. Trial assessments tuned with a survey CPUE series only give a less optimistic picture of recent stock trends than when the commercial CPUE data are included as a tuning series. It is worth noting that there has been a deterioration in the quality of effort data since 1999. This results from a switch in the source of effort data from IFREMER fishing forms to the compulsory log books, for which there has been very low compliance.

Catch forecast for 2003: Catch options for FUs 23–24 (Bay of Biscay), males and females combined. $\mathbf{F}_{sq}$ for 2002 = $F_{1999\text{-}2001}$ (unscaled). Last column gives % change in SSB_{2004} vs SSB_{2002}.

F basis 2002	SSB 2002	Landings 2002	SSB 2003	F factor 2003	Landings 2003	SSB 2004	% change
F_{sq}	13080	3523	13628	0.0	0	20399	56
				0.2	952	18763	43
				0.4	1786	17321	32
				0.5	2165	16666	27
				0.6	2520	16050	23
				0.8	3165	14925	14
				1.0	3734	13927	6
				1.2	4236	13042	0
				1.4	4681	12253	-6
				1.6	5076	11549	-12
				1.8	5426	10921	-17
				2.0	5738	10359	-21

Medium-term projections: results for some scenarios are given below.

Year	Status quo F		50% reduction F		30% reduction F	
	SSB	Landings	SSB	Landings	SSB	Landings
2003	13333	3504	13333	2165	13333	2650
2004	13894	3699	16461	2669	15353	3220
2005	14261	3848	18957	3249	16800	3666
2006	14462	3929	20760	3668	17729	3951
2007	14574	3975	21983	3953	18297	4127

In the absence of any measure (*status quo* scenario), SSB and landings are predicted to remain stable around the lowest value of the time series. An immediate reduction of 50% of the fishing mortality is expected to increase SSB in 2004/2005 to the level of the early 90's. An immediate reduction of 30% of the fishing mortality would allow the same increase in SSB in 2007.

Comparison with previous assessment and advice: The results of this year's assessment confirm the assessments performed in 2001 and indicate that the Bay of Biscay *Nephrops* stock is at or near the lowest observed level during the assessed period. The stock biomass at the start of the series has been revised downwards in comparison with previous assessments.

Elaboration and special comment: Nearly all landings from FUs 23 and 24 are taken by French trawlers. Landings have been generally high, though fluctuating (typically between 4500 and 7000 t), until the early 1990s, but have decreased to a much lower level since then. Number of fishing days has decreased since 1994, owing to changes in fishing practices and decommissioning of vessels. Despite the decommissioning programme, it is likely that effective effort has been stabilised or even increased in recent years, owing to increased gear efficiency. The effort data used in the assessment do not take these efficiency gains into account, so that it is likely that there is some overestimation of recent abundance.

LPUE, mean sizes, and length compositions of the landings are available for the two FUs combined. Discard data are available for some years only. The VPA estimates of recruitment should be treated cautiously, owing to the lack of adequate discard data for most years in the timeseries.

Source of information: Report of the Working Group on *Nephrops* Stocks, 3 – 9 April 2002 (ICES CM 2002/ACFM:15).

Catch data (Tables 3.15.2.1–3.15.2.2)

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				5.7
1988				6.8
1989				5.4
1990				5.1
1991				4.8
1992		~6.8	6.8	5.7
1993		6.8	6.8	5.0
1994		6.8	6.8	4.1
1995		6.8	6.8	4.5
1996		6.8	6.8	4.3
1997		6.8	6.8	3.6
1998		4.2	5.5	3.3
1999		4.2	5.5	3.3
2000		4.2	4.44	3.3
2001		4.2	4.0	3.9
2002	*40 % reduction of current exploitation rate*	2.0	3.2	
2003	*50% reduction of current exploitation rate*	2.2		
2004				

(Weights in '000 t).

Table 3.15.2.1 *Nephrops* Landings (tonnes) by Functional Unit plus other rectangles in Management Area N (VIIIa,b).

Year	FU 23	FU 24	FUs 23-24 **	Other	Total
1992	5123	558	0	47	***5728***
1993	4404	512	0	49	***4965***
1994	3687	368	0	27	***4082***
1995	4060	379	0	14	***4453***
1996	4205	88	0	15	***4308***
1997	3451	147	2	43	***3643***
1998	2899	244	2	121	***3266***
1999	2872	337	2	127	***3338***
2000	2956	229	0	101	***3286***
2001*	3470	313	0	77	***3860***

* provisional
** countries reporting only aggregated landings for FUs 23-24

Table 3.15.2.2 *Nephrops* landings (tonnes) by country in Management Area N (VIIIa,b).

Year	Belgium	France	Spain	Total
1992	0	5681	47	***5728***
1993	0	4916	49	***4965***
1994	0	4055	27	***4082***
1995	0	4439	14	***4453***
1996	0	4293	15	***4308***
1997	2	3600	41	***3643***
1998	2	3224	40	***3266***
1999	2	3310	26	***3338***
2000	0	3250	36	***3286***
2001*	0	3838	22	***3860***

* provisional

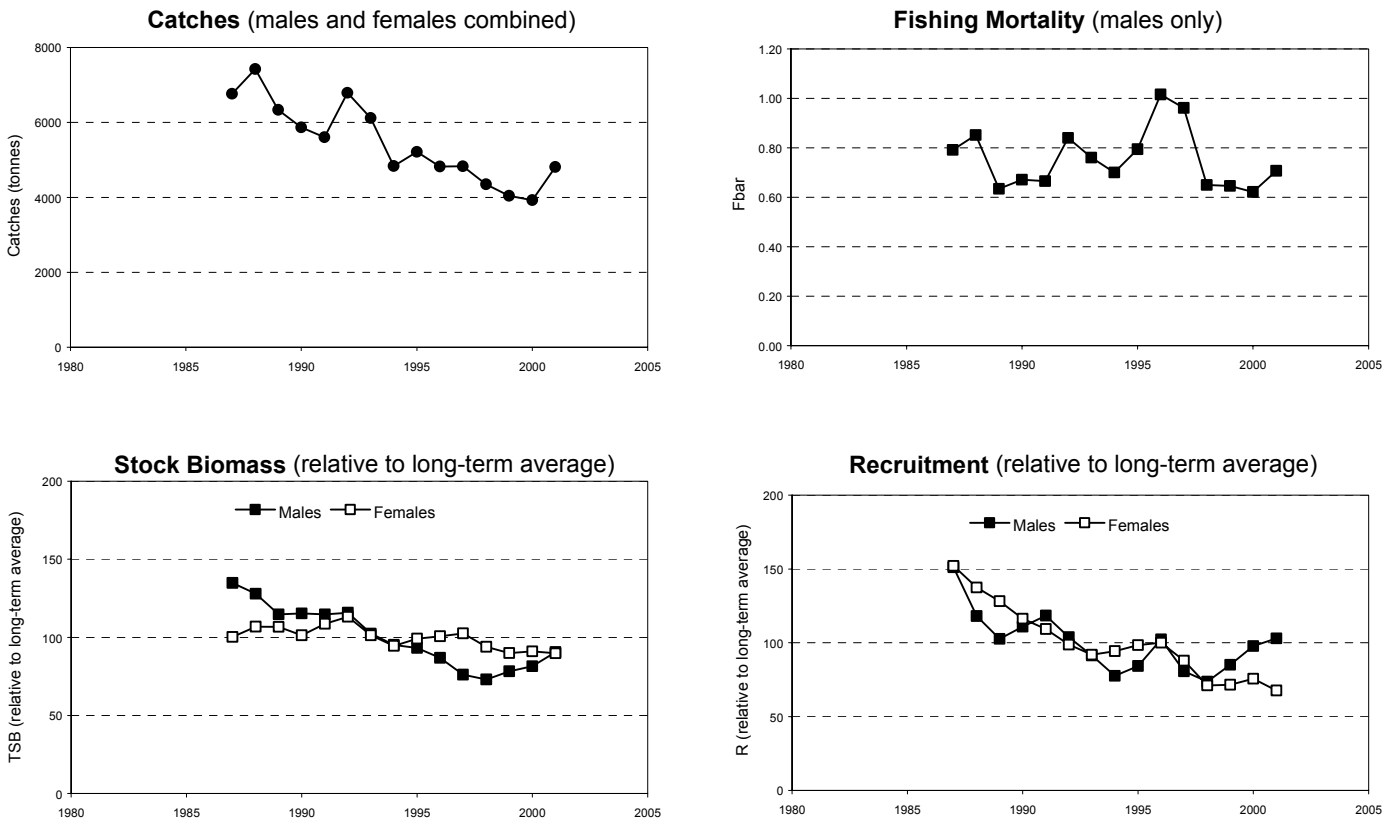


Figure 3.15.2.1 Bay of Biscay (FUs 23–24): VPA output: trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment.

3.15.3 *Nephrops* in Division VIIIc (Management Area O)

There are two Functional Units in this Management Area: a) North Galicia (FU 25) and b) Cantabrian Sea (FU 31).

State of stock/exploitation: All stocks in this Management Area are seriously over-exploited.

a) North Galicia: Annual LPUEs and landings fluctuate along a marked downward trend. A slight increase in landings in 2001 was due to landings in the fourth quarter of the year. Age-based assessment gives evidence of sharp declines in stock biomass and recruitment for both males and females. Current levels of stock biomass and recruitment are about 70% lower than in the late 1980s. $\mathbf{F}_{bar}$ values for males and females are fluctuating. Bottom trawl survey indices of abundance confirm the overall picture of a declining stock.

b) Cantabrian Sea: LPUEs are strongly fluctuating, with high values in 1988-90 and 1997-98, and much lower values in the other years. LPUEs for both Santander and Avilés fleets were at very low values in 1999-2001 compared to previous years. Mean landed sizes of both males and females were higher in 1999-2001 than in any previous year in the assessment series. Age-based assessments give evidence of drastic declines in recruitment and biomass of both males and females, at least since the early 1990s. Combined recruitment has fallen by almost 90% over this period, and stock biomass by almost 60%. $\mathbf{F}_{bar}$ values are fluctuating, but estimates for both males and females have declined since the mid-1990s, in line with effort. Bottom trawl survey indices of abundance also suggest a decline in the stock.

Management objectives: There are no management objectives set for this fishery.

Advice on management: ICES repeats its advice that fishing mortality on these stocks should be reduced to zero. If the by-catch of *Nephrops* in fisheries targeting other species makes this impossible, ICES recommends that suitable technical measures (closed areas, closed seasons, etc.) be investigated for implementation at the earliest possible opportunity in order to help rebuild the stocks.

Relevant factors to be considered in management: The mixed nature of the demersal fisheries in this Management Area has meant that historically the management measures for the target fish species have defined the levels of exploitation of *Nephrops*. This has prevented directed management of the *Nephrops* stocks in the area. However, to prevent further declines of the *Nephrops* stocks in Division VIIIc, fishing pressure on *Nephrops* must be substantially reduced. It is worth noticing that the agreed *Nephrops* TAC for Division VIIIc has never been restrictive.

F levels are higher in males than in females. There is no information on limiting sex ratios in *Nephrops*, but in principle the fertilisation success of females could be compromised by lack of mating opportunities at low stock densities.

Catch forecast for 2003: Pooled catch options for FU 25 (North Galicia) and FU 31 (Cantabrian Sea), males and females combined. FU 25: $\mathbf{F}_{sq} = F_{1999\text{-}2001}$, unscaled. FU 31: $\mathbf{F}_{sq} = F_{1999\text{-}2001}$, scaled to 2001. Last column gives % change in SSB_{2004} vs SSB_{2002}.

F basis 2002	SSB 2002	Landings 2002	SSB 2003	F factor 2003	Landings 2003	SSB 2004	% change
$\mathbf{F}_{sq}$	909	144	900	0.0	0	1061	17
				0.2	33	1022	12
				0.4	64	986	8
				0.6	93	952	5
				0.8	119	922	1
				1.0	143	893	-2
				1.2	167	865	-5
				1.4	188	841	-7
				1.6	209	819	-10
				1.8	227	797	-12
				2.0	244	776	-15

Comparison with previous assessment and advice: The assessment results from this year confirm those from last year and corroborate conclusions drawn previously from fishery statistics. All these sources of information point to severe overexploitation of stocks in Management Area O.

Elaboration and special comments: All catches from these FUs are taken by Spain. Landings and effort in both FUs have declined and are now at extremely low levels compared to earlier years.

LPUE and mean size data are available for both FUs. Length-frequency data has been available for FU 25 since 1986 and for FU 31 since 1989. Discarding in these fisheries is marginal. Abundance indices are available for both FUs, derived from bottom trawl surveys to estimate hake recruitment and to collect information on the relative abundance of demersal species in general.

Source of information: Report of the Working Group on *Nephrops* Stocks, 3 – 9 April 2002 (ICES CM 2002/ACFM:15).

Catch data (Tables 3.15.3.1–3.15.3.2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				0.53
1988				0.60
1989				0.52
1990				0.46
1991				0.56
1992		0.51	0.8	0.52
1993		0.51	1.0	0.37
1994		0.51	1.0	0.39
1995		0.51	1.0	0.37
1996		0.51	1.0	0.34
1997		0.51	1.0	0.32
1998		0.51	1.0	0.18
1999		0.51	1.0	0.17
2000		0.51	0.8	0.12
2001		0.51	0.72	0.17
2002	*Reduce catches to zero*	0	0.36	
2003	*Reduce catches to zero*	0		

Weights in '000 t.

Table 3.15.3.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area O (VIIIc).

Year	FU 25	FU 31	Other	Total
1992	428	94	0	***522***
1993	274	91	0	***365***
1994	245	148	0	***393***
1995	273	94	0	***367***
1996	209	129	0	***338***
1997	219	98	0	***317***
1998	103	72	0	***175***
1999	124	48	0	***172***
2000	81	34	0	***115***
2001 *	147	26	0	***173***
* provisional				

Table 3.15.3.2 *Nephrops* landings (tonnes) by country in Management Area O (VIIIc).

Year	Spain	Total
1992	522	***522***
1993	365	***365***
1994	393	***393***
1995	367	***367***
1996	338	***338***
1997	317	***317***
1998	175	***175***
1999	172	***172***
2000	115	***115***
2001*	173	***173***
* provisional		

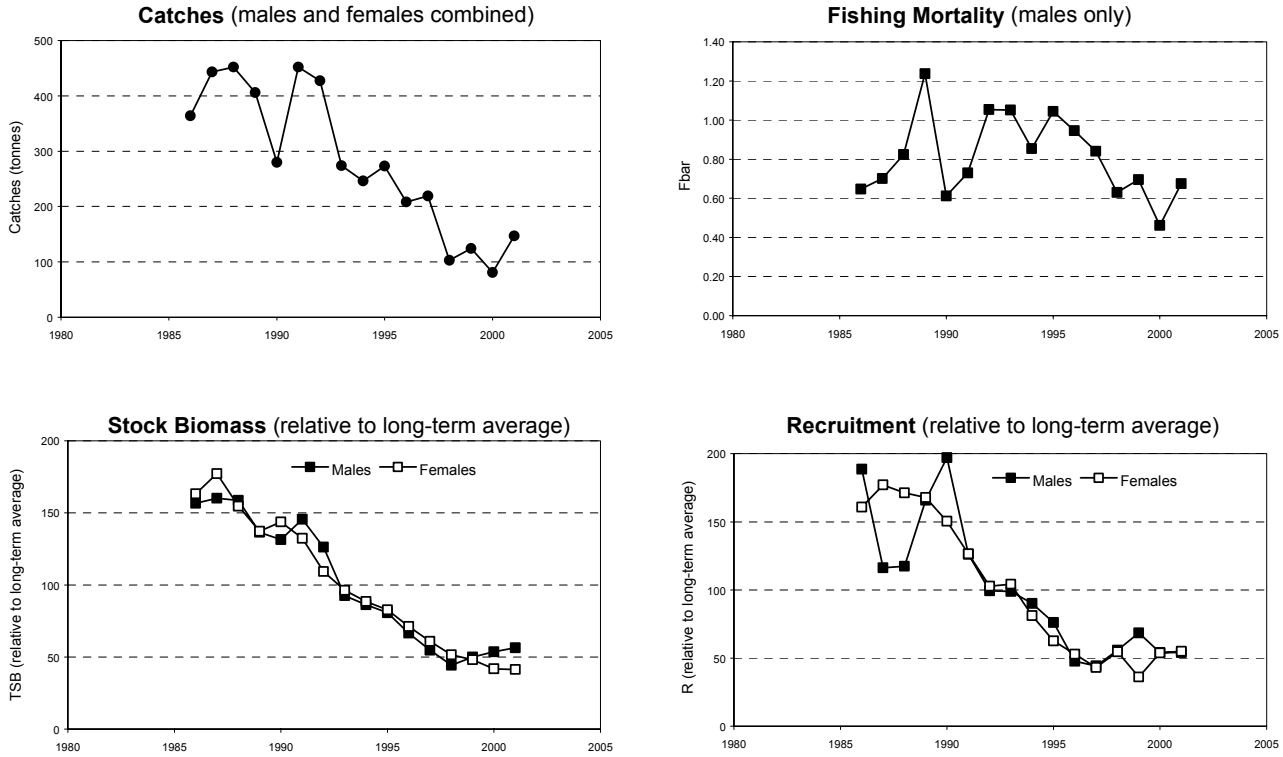


Figure 3.15.3.1 North Galicia (FU 25): VPA output: trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment. Recruitment values for males in 2000 and 2001 are the GM of the VPA estimates for 1996-99. Recruitment value for females in 2001 is the GM of the VPA estimates for 1994-2000. Stock biomass estimates in 2000 and 2001 are adjusted accordingly.

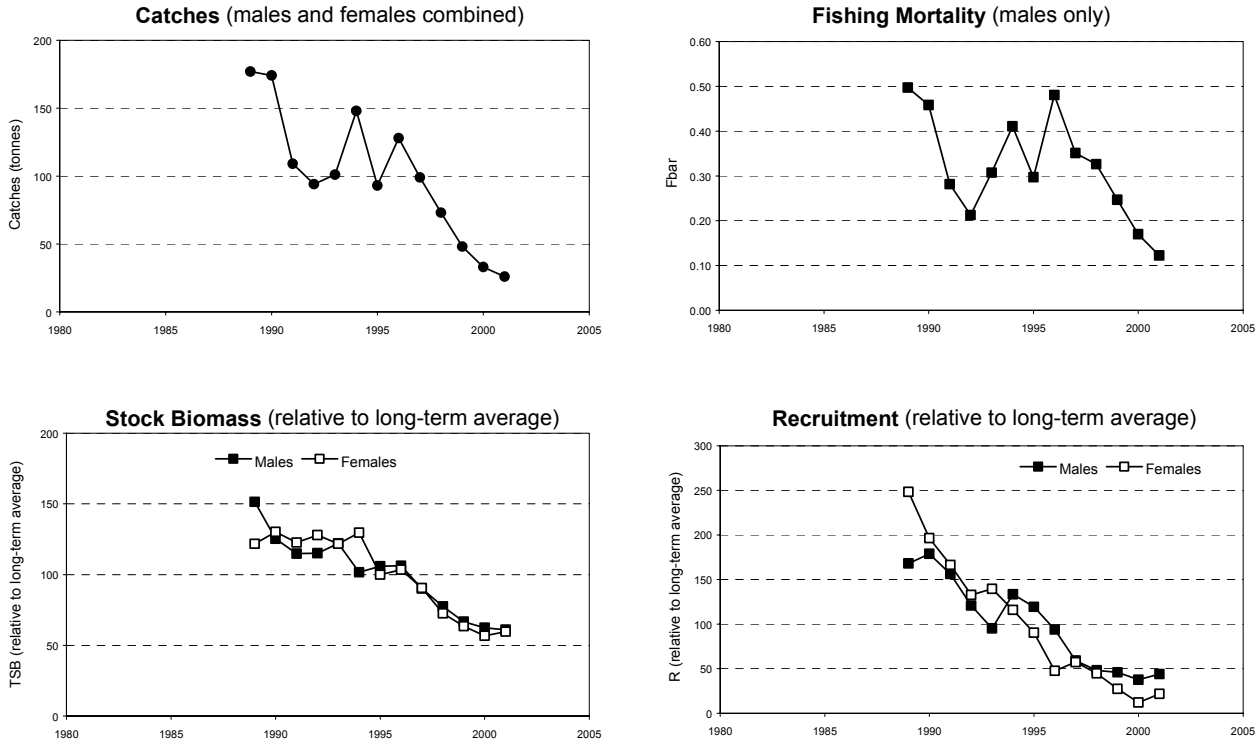


Figure 3.15.3.2 Cantabrian Sea (FU 31): VPA output: trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment. Recruitment value for males in 2001 is the GM of the VPA estimates for 1998-2000. Male stock biomass in 2001 is adjusted accordingly.

3.15.4 *Nephrops* in Division IXa (Management Area Q)

There are five Functional Units in this Management Area: a) West Galicia (FU 26), b) North Portugal (FU 27), c) Southwest Portugal (FU 28), d) South Portugal (FU 29), and e) Gulf of Cádiz (FU 30).

State of stocks/exploitation: All stocks in this Management Area are seriously over-exploited.

a+b) West Galicia and North Portugal: LPUEs for FU 26 are declining from relatively high levels for two ports and declining from already low levels for two other ports. The mean landed sizes of both males and females fluctuate widely, but are declining from relatively large sizes over the last two years. Age-based assessment for the two FUs combined gives evidence of sharp declines in stock biomass and recruitment in both males and females. Recruitment estimates for 2000 and 2001 need confirmation from later assessments and are discounted for the purposes of stock projection. Up to 1999, combined recruitment had fallen by 80% compared with the late 1980s, and stock biomass had fallen by 70%. $\mathbf{F}_{bar}$ is fluctuating without a long-term trend. Bottom trawl survey indices of abundance confirm the picture of a declining stock.

c+d) SW and S Portugal: Annualised CPUEs for Portuguese trawlers sharply declined in 1989–96, but have remained relatively stable since then. The age-based assessment indicates that stock biomass and recruitment of both males and females have sharply declined during the early 1990s, remaining at a very low level since the mid-1990s in males and continuing to decline in females. $\mathbf{F}_{bar}$ for males was high in the early 1990s, then decreased till 1997, but increased again to an even higher level in 2001. $\mathbf{F}_{bar}$ for females is fluctuating, without evidence of a long-term trend. The results of crustacean directed trawl surveys, usually carried out in June-August, support the perception of a declining stock.

e) Gulf of Cádiz: Limited data only are available for this FU. There is an overall trend of decrease in landings, with a decline from a peak in 1987 to a record low in 1996. Landings have increased somewhat in recent years and were almost doubled in 2001 compared to 2000. There are insufficient data to allow length- or age-based assessments.

Management objectives: There are no management objectives set for this fishery.

Advice on management: For FUs 26+27, ICES again advises a zero TAC in order to allow the stock to rebuild from the current low biomass levels. ICES also advises a zero TAC for FUs 28+29, in order to halt the deterioration of the stock. In both areas, however, this may not be possible, because of the mixed nature of the fisheries. Therefore, ICES recommends that suitable technical measures (closed areas, closed seasons, etc.) be investigated for implementation at the earliest possible opportunity in order to help rebuild the stocks.

For FU 30, ICES recommends that in order to constrain the effort landings are kept at the low level of the most recent years, i.e., 50 t.

Relevant factors to be considered in management: ICES notes that TACs agreed for recent years have been far in excess of ICES advice and achievable landings levels, even after the reduction in TAC from 1200 t in 2001 to 800 t in 2002. This is despite the strong signs that the further depletion of the stocks in this area can only be stopped by substantial reductions in fishing mortality.

F levels are higher in males than females. There is no information on limiting sex ratios in *Nephrops*, but in principle the fertilisation success of females could be compromised by lack of mating opportunities at low stock densities.

Catch options:

1. Catch option for FUs 26+27 (West Galicia and North Portugal), males and females combined. $\mathbf{F}_{sq} = F_{1999\text{-}2001}$ scaled to F_{2001}. Last column gives % change in SSB_{2004} vs. SSB_{2002}. Note that the stock projections were conservative with respect to recruitment in 2000.

F basis 2002	SSB 2002	Landings 2002	SSB 2003	F factor 2003	Landings 2003	SSB 2004	% change
F_{sq}	463	105	501	0.0	0	677	46
				0.2	28	641	38
				0.4	54	608	31
				0.6	77	579	25
				0.8	99	551	19
				1.0	118	525	13
				1.2	137	502	8
				1.4	153	481	4
				1.6	169	462	0
				1.8	183	445	-4
				2.0	196	427	-8

2. Catch option for FUs 28+29 (SW and S Portugal), males and females combined. $\mathbf{F}_{sq} = F_{1999\text{-}2001}$, scaled to F_{2001} in males, unscaled in females. Last column gives % change in SSB_{2004} vs SSB_{2002}.

F basis 2002	SSB 2002	Landings 2002	SSB 2003	F factor 2003	Landings 2003	SSB 2004	% change
F_{sq}	486	163	389	0.0	0	479	-1
				0.2	29	446	-8
				0.4	55	415	-15
				0.6	79	389	-20
				0.8	99	365	-25
				1.0	117	344	-29
				1.2	134	325	-33
				1.4	150	308	-37
				1.6	163	293	-40
				1.8	176	279	-43
				2.0	187	266	-45

Comparison with previous assessment and advice: Previous age-based assessments of the West Galicia and North Portugal stocks (FUs 26+27) and of the SW and S Portugal stocks (FUs 28+29) indicated strong declines in biomass and recruitment in both cases. This year's advice for FU 28+29 differs from the one provided last year, due to a further decline in recruitment and downward revision of forecasted recruitment. As a result now, to stop further stock decline, no fishery should be allowed, while in last year's assessment the same goal could be achieved with a 40% reduction in fishing mortality.

Elaboration and special comments: The fishery in FUs 26, 27, and 30 is mainly conducted by Spain, and that in FUs 28 and 29 by Portugal, on deep-water grounds (200–750 m). The Portuguese fleet comprises two components: demersal fish trawlers and crustacean trawlers. Landings from all FUs within this Management

Area have declined significantly in recent years. Effort in FUs 26 and 27 in general is declining. In FUs 28 and 29, effort fell in the late 1980s, and has since remained at a low level despite a slight increase from 1999 to 2001.

The advice for Management Area Q given by ICES in 2001 incorporated a 40% reduction in F in FUs 28–29 in order to halt the deterioration of the stock. Stock projections based on this year's assessments indicate that if the same advice was followed in 2003 the stock biomass would continue to decline. Only zero catches will achieve the end of halting the current trend of decline.

CPUEs and/or LPUEs, effort data, and mean size data are available for most FUs, except FU 30 (Gulf of Cádiz). Length-composition data are available for FUs 26+27 combined and for FUs 28+29 combined. Discarding is marginal in these fisheries. Research trawl survey data are available for FU 26 and for FUs 28+29. Mean sizes of both males and females in landings and trawl survey catches show weak overall trends of increase in FUs 28+29.

Age-based assessments indicate a possible recovery of recruitment of both males and females in FUs 26+27 in 2000. This will need to be confirmed by subsequent assessments before it can be accepted as a real feature of the stock. The 2000 recruitment estimates were discounted for the purposes of stock projection.

Source of information: Report of the Working Group on *Nephrops* Stocks, 3 – 9 April 2002 (ICES CM 2002/ACFM:15).

Catch data (Tables 3.15.4.1–3.15.4.2):

Year	ICES advice	Recommended TAC	Agreed TAC	ACFM Landings
1987				1.55
1988				1.29
1989				1.35
1990				1.19
1991				1.31
1992		1.3	2.5	1.35
1993		1.3	2.5	1.06
1994		1.3	2.5	0.79
1995		1.3	2.5	0.92
1996		1.3	2.5	0.51
1997		1.3	2.5	0.67
1998		0.5	2.5	0.60
1999		0.5	2.0	0.58
2000		0.5	1.5	0.43
2001		0.5	1.2	0.58
2002		0.17	0.8	
2003		0.05		

Weights in '000 t.

Table 3.15.4.1 *Nephrops* landings (tonnes) by Functional Unit plus Other rectangles in Management Area Q (IXa).

Year	FU 26 **	FU 27 **	FU 26-27 **	FU 28-29	FU 30	Other	Total
1992	199	52	385	470	243	0	***1349***
1993	162	50	310	377	160	0	***1059***
1994	120	22	306	237	107	0	***792***
1995	117	10	384	273	132	0	***916***
1996	264	67		132	49	0	***512***
1997	359	74		136	99	0	***668***
1998	295	50		161	89	0	***595***
1999	194	54		211	123	0	***581***
2000	102	30		201	92	0	***425***
2001*	105	27		271	178	0	***582***

* provisional
** disaggregated data by FU not available for all countries in all years

Table 3.15.4.2 *Nephrops* landings (tonnes) by country in Management Area Q (IXa).

Year	Portugal	Spain	Total
1992	522	827	***1349***
1993	427	632	***1059***
1994	259	533	***792***
1995	283	633	***916***
1996	149	363	***512***
1997	142	526	***668***
1998	169	426	***595***
1999	216	365	***581***
2000	210	215	***425***
2001*	278	304	***582***

* provisional

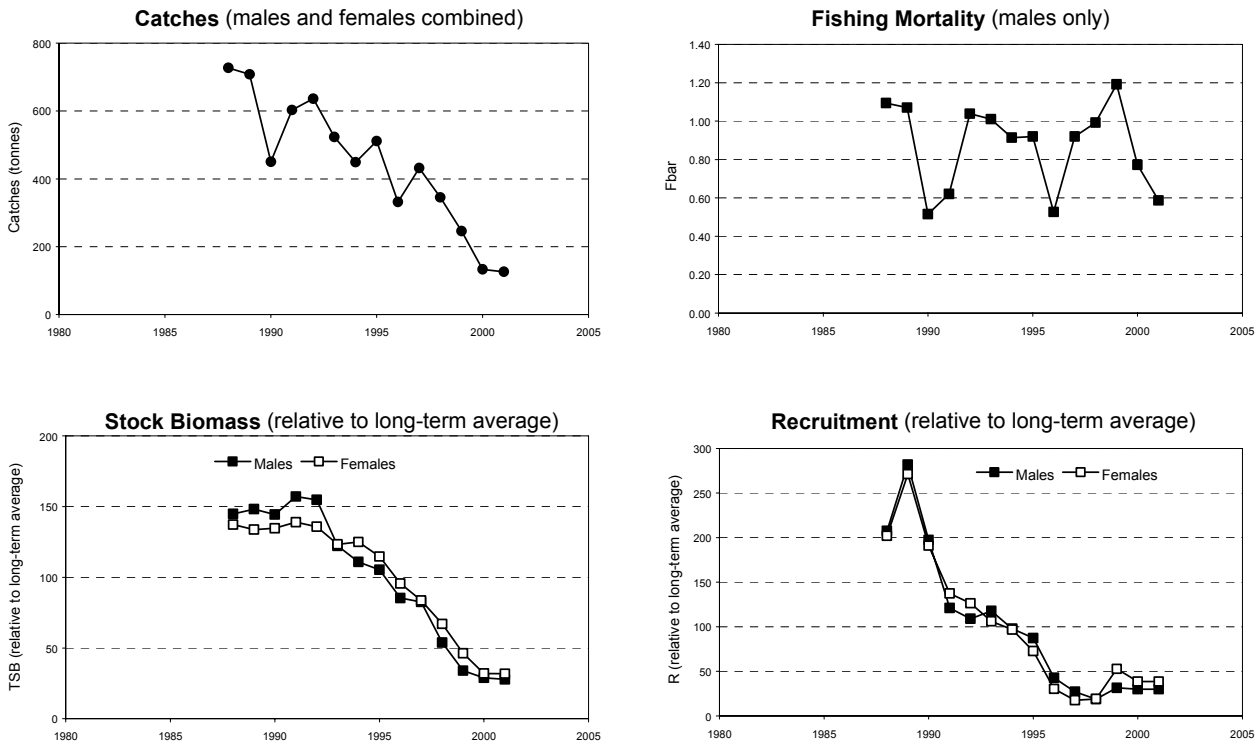


Figure 3.15.4.1 West Galicia and North Portugal (FUs 26–27): VPA output: trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment. Recruitment values for 2000 and 2001 are the GM of the VPA estimates for 1996–99. Stock biomass estimates for 2000 and 2001 are adjusted accordingly.

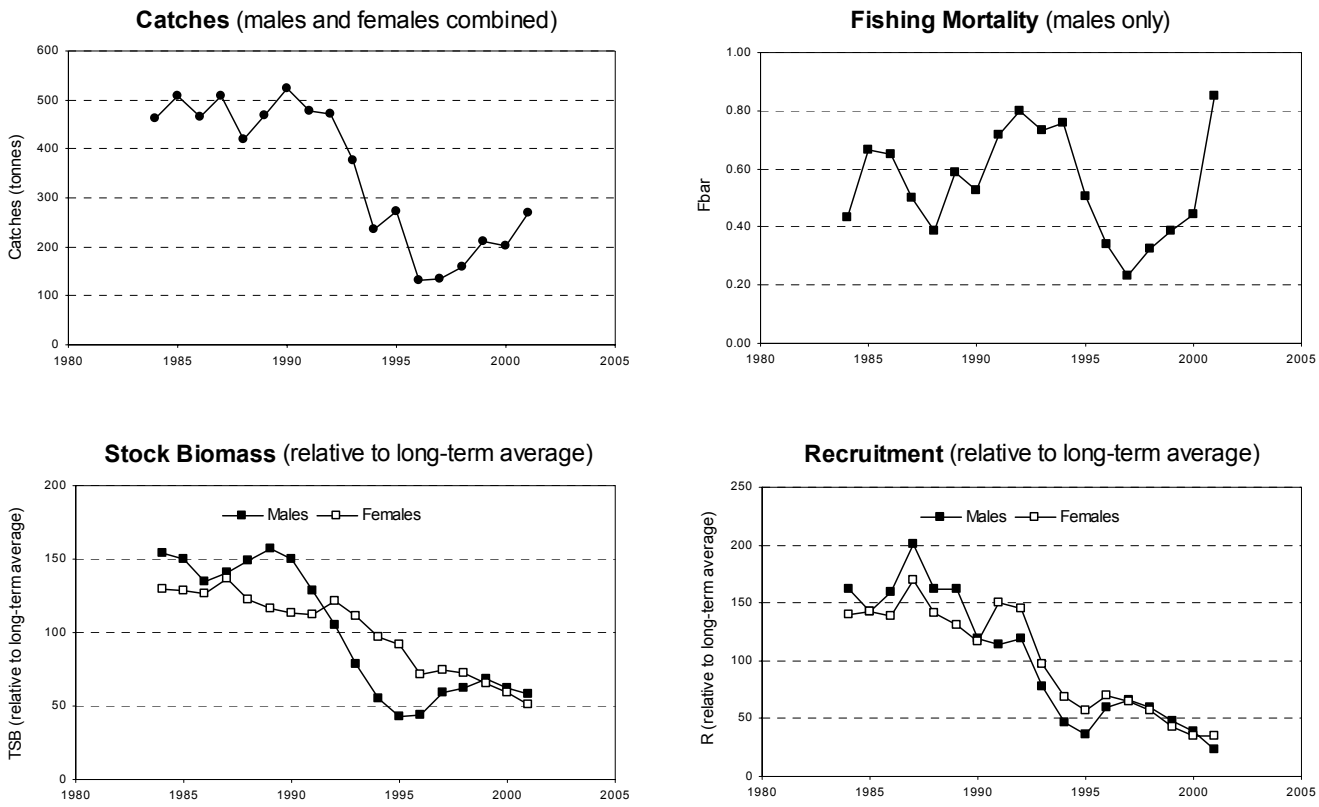


Figure 3.15.4.2 SW and S Portugal (FUs 28–29): VPA output: trends in catches, $\mathbf{F}_{bar}$, stock biomass, and recruitment.

4 ATLANTIC SALMON IN THE NORTH ATLANTIC AREA

4.1 Catches of North Atlantic Salmon

4.1.1 Nominal catches of salmon

Nominal catches of salmon reported by country in the North Atlantic for 1960–2001 are given in Table 4.1.1.1. Catch statistics in the North Atlantic also include fish farm escapees and, in some northeast Atlantic countries, ranched fish.

Reported catches (in tonnes), in four North Atlantic regions are illustrated in Figure 4.1.1.1, and those for NASCO Commission Areas, 1994–1998 are shown below.

Area	1994	1995	1996	1997	1998	1999	2000	2001
NEAC	3586	3282	2753	2075	2226	2072	2728	2887
NAC	258	261	294	231	159	154	155	147
WGC		90	92	59	17	19	29	43
Total		3628	3138	2365	2397	2245	2905	3078

The catch data for 2001 (Table 4.1.1.1) are provisional, but the total nominal catch of 3 078 t is amongst the lowest on record. However, catches in several countries were above the 5 year and 10 year averages.

The nominal catch (in tonnes) of wild fish in 2001 was partitioned according to whether the catch was taken by coastal, estuarine or riverine fisheries. These are shown below for the NEAC and NAC Commission Areas. It was not possible to split the Danish catch in 2001 and this has been excluded from the calculation. The proportions accounted for by each fishery varied considerably between countries. In total, however, coastal fisheries accounted for 54% of catches in North East Atlantic countries compared to 10% in North America, whereas in-river fisheries took 40% of catches in North East Atlantic countries compared to 76% in North America.

Area	**Coast**		**Estuary**		**River**		**Total**
	Weight	**%**	**Weight**	**%**	**Weight**	**%**	**Weight**
NEAC	1557	54	177	6	1147	40	2880
NAC	15	10	20	14	112	76	147

4.1.2 Catch and release

Catch and release data for the 1990s have been provided by 6 countries. In 2001, the proportion of the total rod catch that was released ranged from 76% in Russia to 12% in Iceland. Other catch and release rates were 55%, 43% and 39% for Canada, UK (England & Wales) and UK (Scotland), respectively. In most of these countries, rates in 2001 are among the highest in each time series and indicate an increasing trend in recent years.

4.1.3 Unreported catches of salmon

The total estimate of unreported catch within the NASCO Commission Areas in 2001 was 1 170 t (Table 4.1.1.1), or 27.5 % of the total of reported and unreported catch. There has been a decrease in the level of unreporting over the last 4 years. After 1994 there are no data available on salmon catches in international waters. Limited surveillance flights, which were the basis of past estimates of catches in international waters, have not reported any salmon fishing where these have occurred in recent years. Estimates (in tonnes) of unreported catches for the Commission Areas are given below:

Area	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
NEAC	1157	942	947	732	1108	887	1135	1079
NAC	107	98	156	90	91	133	124	81
WGC	<12	<20	<20	5	11	12	< 10	<10
Interntl. waters	25–100	n/a	n/a	n/a	n/a	n/a	n/a	n/a

The national inputs to the total North Atlantic catch range from 0% to 16%. While this broadly indicates the level of non-reporting by each country relative to the total catch in the North Atlantic, it should be noted that methods of estimation vary both within and among countries. The non-reporting rates range from 0% to 65% of the total national catch in each country.

Unreported catches are included in subsequent assessments and catch advice.

4.1.4 Production of farmed and ranched salmon

The production of farmed Atlantic salmon in the North Atlantic area was 704,177 t in 2001, an increase in production over 2000 (658,952 t). The 2001 production was 27% higher than the 1996–2000 average (554,284 t) for the area. The countries with the largest production were Norway and Scotland, accounting for 61% and 23% of the reported North Atlantic total. Reported increases compared to average production for 1996 to 2000 ranged from 77% for the Faroes to 4% for Iceland and USA.

The worldwide production of farmed Atlantic salmon in 2001 was 961,120 t, an increase compared to 891,528 t in 2000 (Figure 4.14.1). Outwith the North Atlantic area, Chile was the major producing country. The worldwide production of farmed Atlantic salmon compiled for 2001 was approximately 310 times the reported nominal catch of Atlantic salmon in the North Atlantic. As a result, aquaculture fish dominate world markets, and have probably contributed to the decline in commercial fishing effort in many countries.

Catches of ranched salmon have declined substantial from a high of 500 t in 1993 to less than 20t in 2001 (Figure 4.1.4.2) due to the closure of the Icelandic salmon ranching industry in 1999.

4.2 Review of the estimation of natural mortality (M)

4.2.1 Methods for and estimates of natural mortality (M) at sea

ICES has used an instantaneous rate of natural mortality of 0.01 per month in the NEAC and NAC models to estimate PFA of salmon. The assumed rate is from an analysis of catch-at-age and weight-at-age data from the River Bush (U.K.) and the Sandhill River (Canada) as developed by Doubleday *et al.* (1979). This rate of natural mortality has been used to calculate the number of fish immediately after the first winter, prior to the high seas fisheries, and between the high seas fisheries and returns to homewaters.

ICES reviewed theoretical and empirical methods for estimating M for Atlantic salmon. Theoretical methods are those based on life history characteristics such as lifetime fecundity, maximum age, age at maturity, and inverse-weight. Empirical methods are those based on actual measures of smolts and adult abundance at different life stages and two of these, the inverse-weight method and the maturity schedule method were applied to historical and recent data for stocks from the North Atlantic.

Inverse Weight Method

Ricker (1976) described a method for estimating the natural mortality rate based on the assumption that M decreases with increased size because marine natural mortality is assumed to be primarily the result of predation. When considered across phyla (from pelagic invertebrates to whales; McGurk 1986), there is a negative association between mortality rate and body weight (dry weight) with the exponent in the order of –0.25 (McGurk 1986).

Preliminary estimates of M for Atlantic salmon during the second year at sea were presented by Doubleday *et al*. (1979). Using three years of two smolt group releases from the River Bush, Doubleday *et al*. (1979) demonstrated that there was a significant negative association between integrated marine survival for the cohorts and initial marine mortality determined by smolt size.

Using the exponential growth model, the monthly mortality rates for River Bush fish in the second year at sea (days 516 to 834) ranged between 0.1% and 0.3% per month with survival of age-1 smolts less than that of age-2 smolts (Table 4.2.1.1). For the Sandhill River salmon, mortality rates in the second year at sea (months 14 to 24) ranged between 1.2% and 1.5% per month. Growth rates of Sandhill River fish were lower than those of River Bush and hence the mortality rates on Sandhill River fish were higher (Figure 4.2.1.1).

The exponential growth functions were considered to be less satisfactory representations of the weight at age of salmon at sea than linear growth models (Figure 4.2.1.1). For both stocks, weight at age of 1SW salmon was underestimated while that of 2SW salmon was overestimated (excessively so for River Bush). Simpler linear growth models were adjusted to the data from River Bush and North America. When these models were applied to the life stage recovery data, the mortality rate estimates in the second year at sea increased slightly to between 1.4% and 1.7% for the Sandhill River salmon. There was a greater increase for the River Bush fish, to between 0.8% and 1.8% (Table 4.2.1.1) resulting from the lower weight at age predicted for the older fish (Figure 4.2.1.1).

Including new data from the River Bush shows that weights at age have not changed from historical values and again the linear growth curve provides a more satisfactory fit to the data (Figure 4.2.1.2). Data for sixteen years from the River Trinite (Quebec) are determined from mean weight at age back to the river and the time at sea determined from the mean date of return and of the age groups and the mean smolts date of migration of the corresponding smolts age group.

Again, the linear growth curve appears to be a better fit to the data (Figure 4.2.1.3) and this was used subsequently to derive estimates of "M" in the second year at sea. The inverse-weight model described by Doubleday *et al.* (1979) provides correct estimates of M (as determined by simulation) provided the assumption of the inverse-weight association is valid. The estimates of M are sensitive to the growth model used. The exponential models produce lower mortality rate estimates than the linear growth models but the linear models have provided a better fit to the observed weight at age data.

The inverse-weight model was applied to more recent observations from the River Bush as well as to growth and abundance data of the River Trinite, LaHave River and Northwest Miramichi River (Canada). For the River Bush, the monthly mortality rates in the second year at sea of the 1999 hatchery one-year old smolts were estimated at more than three times the values in the 1970s, at 1% to 2% per month using the exponential growth model and almost 3% per month with the linear growth model (Table 4.2.1.2). For the Canadian stocks, monthly mortality rates in the second year at sea for both hatchery smolts and wild smolts from River Trinite have risen above 3% in the 1990s. The mortality rates on two wild stocks of the Maritimes in the 1990s were estimated to be between 2.4% and 3.2%, well above the 1.5% value estimated for the Sandhill River salmon between 1969 and 1971. This suggests that there may have been an increase over time in the mortality rate during the second year however long-term data for individuals stocks are scarce.

Maturity Schedule Method

Ricker (1976) summarized a number of approaches which he termed "maturity schedule methods" to derive estimates of natural mortality at sea for stocks which mature at two or more different ages. A particular approach termed "Murphy's Method" (Ricker 1975) was used to estimate the ocean mortality of Icelandic ranched Atlantic salmon during the second year at sea (Jonasson *et al*. 1994). A variation of these methods, which allows estimates of survival during the first and second years at sea and which wasdescribed by Chaput *et al.* (2002), was reviewed in ICES CM 2001/ACFM 1). Additional results are given in Table 4.2.1.2.

The model proposed by Chaput *et al*. (2002) allows for the estimation of survival rates during the first and second years at sea based on return of 1SW and 2SW salmon and sex ratios of outmigrating smolts. The model makes some general assumptions:

- survival rates at age for males and females are similar, and
- survival rates in the first year at sea of maturing and non-maturing salmon are similar.

Comparison of Maturity Schedule and Inverse-Weight Estimates

Differences in the mortality rate estimates using the inverse-weight method compared to the maturity schedule method for some stocks and time periods are apparent (Tables 4.2.1.1 and 4.2.1.2). The estimates for the River Trinite during the 1990s were similar, at about 3% per month using the two estimation methods. The estimates were very different in the 1980s when marine coastal exploitation was still occurring on this stock. It would appear that the inverse-weight method was insensitive to the marine exploitation, being driven primarily by the growth function, however violations of the assumptions of the maturity schedule method could also have produced the divergent results. The maturity schedule values for LaHave River and Miramichi River, and the Saint John River hatchery smolts are much higher than the inverse-weight estimates for corresponding years, by up to five times.

Both the inverse weight and the maturity schedule models indicate that M in the second year of sea life is greater than 1% per month. Doubleday *et al.* (1979) used the exponential growth model to estimate the coefficients of the inverse-weight model, however, in most rivers examined the exponential model does not provide a good description of the marine growth function of Atlantic salmon, especially for months 12 to 24. A simple linear function fit the data more realistically than the exponential model. Based on this linear function of growth, the inverse-weight method produced monthly mortality rate estimates during the second year at sea which varied between 1% and 3.4% (range of median values) for stocks from the North Atlantic (Table 4.2.1.2). Over the entire time and stock series analysed, the inverse-weight models indicate an M of 0.03 per month in the second year at would be more appropriate than the previously assumed value of M = 0.01.

The maturity schedule method results suggest that for some stocks, mortality in the second year at sea may also be driven by size-independent factors. In contradiction to the inverse-weight method that assumes that size determines M, mortality in the second year at sea may also be modified by factors which are non-size selective, such as parasites, disease, temperatures, or even marine mammal predators which may not be constrained in their predation rates by the size range of salmon in the second year at sea. The differences in the estimated mortality rates determined by the two methods suggest further hypotheses should be examined to test the assumptions of the inverse-weight and maturity schedule methods and factors which are modulating marine mortality of salmon at all ages.

Based on the analyses reviewed, the inverse-weight method was used as the basis of estimating M because the maturity schedule method yielded values of M that varied temporally and spatially, and it was not clear whether it was appropriate to apply values from this

method to all stocks and the entire time series. However, the most appropriate growth function for use with inverse-weight method was linear rather than the previously used exponential function. This change in growth function, plus analysis of data from additional rivers, resulted in the instantaneous monthly mortality rate previously used in the run-reconstruction model for the North American and NEAC areas to be changed from 0.01 to 0.03 for this years analyses and the provision of catch advice.

Despite the continued use of the inverse-weight method, the limitations of this method in assuming that mortality is driven entirely by size were noted, and further analyses is recommended to test assumptions of the inverse-weight and maturity schedule methods. Based on the results of these analyses, the two methods will continue to be examined for applicability in modelling.

4.2.2 Effects of higher values of M on PFA models, conservation limits and catch advice

As a result of the decision to change the value of M from 0.01 to 0.03 per month in the second year at sea, the effects of increasing M on estimates of pre-fishery abundance and conservation limits in the NASCO-NEAC area and the implications for management advice were reviewed.

The NEAC PFA and National CL models are presented in Section 5.3. Natural mortality enters into the estimation of PFA model at the stage when the numbers of salmon alive at the beginning of the second sea year are back-calculated from the estimated numbers of fish returning to homewaters. Increasing M from 0.01 to 0.015 per month increases the estimated PFA of maturing 1SW salmon by about 4% and of non-maturing salmon by 9% (Table 4.2.2.1). Increasing M to 0.05 per month will increase the estimated PFA values by 38% and 97% respectively. The substantial difference between maturing and non-maturing 1SW salmon is due to the different lengths of time between the beginning of the second sea year and the return of the fish to homewaters.

Although the PFA values are used in the estimation of the national CLs, a change in M does not affect the position of the inflection point, relative to the x-axis (lagged egg deposition) because all PFA values are increased by the same proportion (Figure 5.3.2). This would not be the case if different values of M were used for different time periods.

The potential effects of increasing M to 0.03 on catch advice is illustrated in Table 4.2.2.2 for Southern European MSW salmon stocks (at hypothetical levels). As indicated, both the PFA and the Spawner Escapement Reserve will be increased by the same percentage (40%), and as a result the estimated harvestable surplus will also be increased by this margin. If a fixed proportion of this surplus is allocated to an interception fishery, any quota will also be increased by the same percentage. However, the survivors from the fishery (assuming that the full quota is taken) will also be subject to the higher level on M and so there will be no change in the estimated numbers of fish returning to homewaters. A similar situation would occur for North American stocks but the relative changes in the SER and PFA would be different.

The consequences to the fishery of using inappropriate values of M differ from the consequences to the resource. If the assumed M is higher than the realized value, then the quota will be set too high and the stock will suffer. If M is underestimated, harvestable surplus may be foregone but the stock will receive more spawners. More importantly, if M is very much higher than currently assumed, the beneficial effects of reducing or closing distant water fisheries towards increasing spawning escapements will be overstated, which may have major implications for our understanding of the reasons for recent stock declines. Our understanding of salmon stock dynamics may be further at error if M has changed over time; this would affect both PFA and CL estimates. It is important to note that PFA is a 'latent variable' (a value which can never be measured directly) but it has value as a means to conceptualise the stock status and develop management advice. It will not be possible, in the short term, to directly validate the assumed values of M.

4.3 Recent Research Developments and Information

4.3.1 Incidence of infectious salmon anaemia virus in the USA

Information was presented to ICES about infectious salmon anaemia (ISA) in North America. Aggressive control measures taken in Canada resulted in only one site reporting the disease to date from the spring 2000 smolt class. No ISA was detected in wild and escaped-farmed fish entering the Magaguadavic River, where positive tests for both groups were obtained for the first time in 1999. Positive tests for ISA were recorded for the first time in 2000 from the Margaree River Nova Scotia, the Morell River in Prince Edward Island, and the Saint John River New Brunswick, however, the initial results are problematic because they could not be confirmed. The first confirmed case of ISA from the East Coast USA salmon farming industry was announced on 16 March 2001. The US industry is now implementing measures similar to those used in Norway, Scotland and Canada to manage the problem. Genomics research found that European ISA isolates (Scotland and Norway) were 98 – 100% similar, whereas the Canadian isolate was only about 84–88% similar to the European group. The strains may have diverged from each other about 1900, which corresponds to a period of transfers of salmonids from North America to Europe (Rainbow trout) and from Europe to North America (sea run brown trout). Both

species are asymptomatic hosts of the virus. It is not known where the virus originated. Independent testing of a widely used vaccine confirmed a significantly increased survival rate for fish that had been vaccinated.

4.3.2 Escaped farmed salmon of European ancestry in a Canadian River

In Maine, European strains of salmon were legally imported for salmon farming, although the practice has now been stopped. By contrast, the use of European strains is prohibited in Canadian East Coast salmon farming, and at present New Brunswick's Department of Fisheries and Aquaculture only issues commercial culture permits for Saint John River stock. Restrictions on the use of foreign strains of salmon in fish farming are in place due to concerns that the unintended introgression of foreign genes into indigenous salmon populations could decrease the indigenous populations' fitness.

The Magaguadavic River is located near the geographic center of the Canadian East coast Atlantic salmon farming industry, and slightly North of the majority of Maine (USA) salmon farms. Fish entering the Magaguadavic River from the sea must pass through a fish ladder, where they can be enumerated and sampled. Fish counts here have been used since 1992 as an indicator of the potential number of wild and escaped-farmed salmon entering other rivers in the region. In addition, three commercial hatcheries producing about four million smolts per year are located in the watershed. Escaped juvenile smolts from these hatcheries have been documented in the river's smolt run in each year since monitoring began in 1998.

Tissue samples were obtained from Magaguadavic River adult wild salmon, Magaguadavic adult and juvenile (smolts) escaped-farmed salmon, European-origin farmed salmon broodstock, and adult wild salmon from other Bay of Fundy and Southern Uplands (Nova Scotia, Canada) rivers. They were used in a microsatellite tetranucleotide analysis to screen for escapees of European ancestry entering this Canadian river. Results of genetic screening showed that of 88 wild Magaguadavic fish (30 smolts, 58 adults), none had the European alleles. Nor did the 1500 and 1000 wild salmon tested from inner Bay of Fundy rivers or the Southern Uplands, respectively. By contrast, of the 88 farmed-escaped salmon analyzed (35 smolts, 53 adults), three fish (two smolts and one 1 SW adult) were North American X European hybrids, and one other (a precociously maturing post-smolt) was largely if not wholly European in origin.

The adult and post-smolt farmed-salmon escapees of European ancestry might have originated from the contiguous Maine salmon farming industry. Salmon of at least partial European origin, progeny of the original legal importations, are believed to be currently under culture in Maine. However, no records exist on the companies culturing them or the degree if any to which they have been hybridized with North American strains. By contrast, the escaped smolts with a partial European ancestry must have come from one of the commercial hatcheries in the Magaguadavic watershed.

4.3.3 Changes in size selective mortality in migrating smolts

The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has been declining since the 1970s. Abnormally high marine mortality, seemingly common to all North American Atlantic salmon populations, has been observed in recent years (O'Neil *et al*. 2000). On de la Trinité river, marine survival has fluctuated from a high of 4.53% for the 1988 cohort to a low of 0.69% for those of the 1999 cohort, the last one available. Mean 1984–1999 annual smolt survival rate is 2.21%, but has recently declined. For the period 1984–1991, average marine survival of 2.96% was considered normal compared to 1.40% for the period 1992–1999, a low-survival period. One way to address the question of mortality patterns at sea is to analyse existing biological data for changes in size selective smolt mortality over time to determine if size selectivity has change in recent years. Patterns in size-selective mortality were examined for periods of normal and low marine survival, using 3-yr-old smolt from 1984 and 1985 (normal marine survival) and 1994 and 1995 (low marine survival) and the adults from these cohorts after 1 and 2 years at sea. Size at smoltification during outmigration was compared with size at smoltification back calculated from the scales of returning adults after one (1SW) and two years (2SW) at sea. In all cases, mortality selected against the smaller smolts, resulting in a higher mean size for the smolt back calculated from the adults. A second analysis was conducted to determine if these selective mortalities of smaller smolt were different between years of better (1984–1985) or poorer (1994–1995) marine survival. There was a significant increase in size selective mortality for the 1SW fish ($P<0.003$) and the 2SW fish ($P<0.001$) between periods, particularly for 2SW salmon. These preliminary results of increased mortality at sea of smaller smolt in recent years indicated that marine mortality had increased. This may be explained by an increase in predation or a change in environmental conditions such as water temperature. ICES recommends that further studies on size selective marine mortality covering additional rivers and more years be undertaken to test these hypotheses.

4.3.4 Setting biological reference points for Atlantic salmon in the NEAC area using SR data from Index rivers

It is important to know if the SR information from the index rivers can be used to set BRPs for all the NEAC salmon rivers while accounting for the major sources of variation among rivers. A meta-analysis using hierarchical modeling (Bayesian Hierarchical Analysis) provides a framework for integrating the uncertainty in transporting stock and recruitment data from well

studied rivers to rivers where this information is not available.

This hierarchical SR model is an extension of a standard single river SR model. It acknowledges that all the NEAC salmon rivers are members of a family of rivers and thus any knowledge gained on the *SR* parameters for one can provide information about the same parameters on another. Provided the data are available, new covariates can be introduced along the same line, as the link can be modeled with parameter(s) of interest. Two new covariates were considered i.e., wetted area which constrains juvenile production and secondly, latitude, as there is a latitudinal gradient in the age at which salmon smoltify in Atlantic salmon. This gradient reflects the influence of latitude on the riverine ecological processes of salmon production. Both can be measured relatively easily for any river and both have shown potential for developing conservation limits for all river within regions. Aggregating conservation limits between and among regionals will be a key element in the development of scientific advice in future.

An example was presented for the rivers in Brittany region (France). There are 29 salmon rivers in Brittany of varying size located between 48° and 48.5° north. The posterior distribution of the Brittany CL was shown to be more precise than that of its individual rivers components and illustrates the potential of the approach for a broader scale CL setting exercise over the NEAC area. The same approach could be easily extended to the NAC area. This approach also complements the type of risk analyses being developed over recent years to provide catch advice. Finally, it relates the index rivers programs with the stock management issues arising from mixed stock fisheries.

4.3.5 Salmon stocks listed as endangered

Wild Atlantic salmon of the inner Bay of Fundy (iBoF) are known to have occupied at least 32 rivers (22 rivers of SFA 22 in Nova Scotia and 10 rivers in SFA 23, New Brunswick). Additional populations were suspected to have occupied all rivers and streams where migration was not obstructed by natural barriers. Rivers in these areas have a variety of habitats and are well suited to the production of salmon. In general, habitat is impacted by forest harvesting and agriculture practices to varying degrees but because of the underlying geology, waters in rivers of the iBoF are not susceptible to acidification. Some rivers have lost their salmon production because of man-made barriers to migration, reduced fish passage and resulting loss in productive capacity. On the basis of data collected to 1999, these salmon were classified as "endangered" by the Committee On the Status of Endangered Wildlife in Canada (COSEWIC) in May, 2001. In an attempt to prevent the extirpation of inner Bay of Fundy salmon a live gene bank program was initiated in 1998. Large numbers of fish and eggs of various ages are presently held in the Biodiversity Facilities.

The only persistent wild populations of Atlantic salmon remaining in the USA are currently found in eight rivers within the Gulf of Maine. Major threats to salmon continue to be poor marine survival, water withdrawals, disease, and aquaculture impacts. While it is unlikely that any Atlantic salmon populations in the USA exist in a genetically pure native form, present populations are considered descendants of aboriginal stocks and their continued presence in indigenous habitat indicates that important heritable local adaptations still exist. This information, along with low abundances, contributed to listing the Gulf of Maine Distinct Population Segment (DPS) as a federally endangered species on December 17,2000. Eight populations are currently recognized as meeting this definition. River-specific broodfish are currently used to supplement six of the eight endangered populations. All broodfish are genetically characterized which helps managers maintain the genetic integrity of wild and captive fish, prevent irreversible losses of genetic diversity, and evaluate the stocking program. Salmon taken for from DPS rivers for hatchery broodstock purposes, and captive progeny from these salmon, are protected as endangered species.

4.3.6 Biological reference points for North Atlantic salmon

The ICES Working Group on North Atlantic salmon proposed S_{MSY} as a reference point before the concept of Limit Reference Points (LRP) was introduced. At this time it was termed the 'Spawning Target' and was used as a 'Target Reference Point'. In 1998, NASCO formally adopted the precautionary approach, and accepted S_{MSY} as the Conservation Limit (CL) for salmon stocks.

ICES considers it important to define a biological reference point for salmon that can be objectively defined for all stock-and-recruitment relationships in order to ensure a consistent approach across the large number of salmon stocks in the North Atlantic.

ICES defines a stock to be outside safe biological limits when it '*suffers increased risk of low recruitment, i.e., average recruitment will be lower than if the stock were at its full reproductive capacity*'. $\mathbf{B}_{lim}$ is defined by ICES as '*the limit spawning stock biomass below which recruitment is impaired or the dynamics of the stock are unknown*'. The current use of S_{MSY} as a limit reference point is consistent with the above definitions. However, in order to ensure consistency of advice being provided by ICES, the term S_{lim} (referenced to numbers of fish) will be used and will serve as a proxy for $\mathbf{B}_{lim}$ (referenced to the biomass).

Although ICES has continued to provide more risk averse catch options, NASCO has in the past used the 50% probability level when setting quotas. By doing so, the S_{MSY} (now S_{lim}) has been used as a 'Target Reference Point' rather than a limit reference point. The latter would require the adoption of a higher probability level.

In the provision of advice for other fisheries and stocks, ICES has introduced precautionary reference points for biomass ($\mathbf{B}_{pa}$) and fishing mortality ($\mathbf{F}_{pa}$). The equivalent terminology if applied for salmon advice would then be referred to as S_{pa}. To date no work has been carried out to develop S_{pa} for the provision of catch advice. Such a reference point should include the uncertainties in deriving S_{lim} and uncertainties in the estimate of the predicted pre-fishery abundance (PFA).

Further modelling and analyses are required to evaluate the consequences of allowing stocks to fall below S_{lim} under varying levels of probability (e.g., 50%, 75%, 90%) to improve the advice to managers. A dialogue with managers concerning their objectives will be useful input to this work.

4.3.7 Compilation of Tag Releases and Finclip Data by ICES Member Countries in 2001

Data on releases of tagged, fin-clipped, and marked salmon in 2001 were provided and are compiled as a separate report. A summary of Atlantic salmon marked in 2001 is given in Table 4.3.7.1. About 3.88 million salmon were marked in 2001, an increase from the 3.63 million fish marked in 2000. Primary marks are summarized in three classes: microtag (i.e., coded wire tag), external tag/mark, and adipose clips (without other external marks or fin clips). Secondary marks, primarily adipose clips on fish with coded wire tags, are also presented in the Annex. The adipose clip was the most used primary mark (2.97 million), with microtags (0.52 million) the next most used primary mark. Most marks were applied to hatchery-origin juveniles (3.82 million), while 39,790 wild juveniles and 19,081 adults were marked.

5 ATLANTIC SALMON IN THE NORTH-EAST ATLANTIC COMMISSION AREA

5.1 Events of the 2001 Fisheries and Status of Stocks

5.1.1 Fishing in the Faroese area 2000/2001 commercial fishery

No fishery for salmon was carried out in 2001 or, to date, in 2002. Consequently, no biological information is available from the Faroese area for this season. No buyout arrangement has been made since 1999.

5.1.2 Homewater fisheries in the NEAC area

Gear and effort: While there have been no changes in the types of commercial fishing gear used, the number of licensed gear units has, in most cases, continued to fall. Most fisheries for which data are available record a reduction of over 40% in gear units operated over the last 10 years. There are no such consistent trends for the rod fishing effort in NEAC countries over this period. Further initiatives to reduce fishing effort were introduced in several countries.

Catches: In the NEAC area there has been a general reduction in catches since the 1980s. This reflects a decline in fishing effort as a consequence of management measures and the reduced value of commercially caught salmon, as well as a reduction in the size of stocks. However, the overall nominal catch in the NEAC area in 2001 (2,887 t) was 6% higher than the catch in 2000. Compared to the 2000, catches in both southern and northern areas were higher by 4% and 8 % respectively, and higher than the five year average by 9% and 34 % respectively.

CPUE: CPUE data for various net and rod fisheries indicate a general increase in Northern Europe while patterns in Southern Europe are less consistent. The reduction in the number of fisheries operating can benefit those fisheries still in operation and that the lack of consistent trends in CPUE in Southern Europe may reflect the imprecise nature of these indices.

Composition of catches: No common trends were noted in the sea age composition of the 2001 catches in the NEAC areas and there was no clear division between countries in Northern and Southern Europe. Despite the continued high levels of production in the salmon farming industry, the incidence of farmed salmon in NEAC homewater fisheries was generally low (<2%) and similar to recent years. The exception to this is Norway, where farmed salmon continue to form a large proportion of the catch in coastal, fjord and riverine fisheries.

Origin of catch: The incidence of tagged fish taken in fisheries originating from other countries was updated for Ireland. In 2001, 189 tags were recovered from releases of smolts in UK (N. Ireland), 43 from UK(England & Wales) and 2 from Spain. These recoveries were within the range of recoveries in previous years.

An update of the adult recovery information derived from tagged smolts released in Norway was made available to ICES. Between 1996 and 2000 a total of 474,342 smolts, mainly hatchery reared, were tagged and released. A total of 4,297 adult recoveries were reported from Norway and 20 from other countries (0.5% of the total number of salmon recovered). This is consistent with previous observations that very few Norwegian salmon are intercepted in other countries.

Exploitation rates: In general, the exploitation rates on salmon stocks in the Northern NEAC area, as derived from the NEAC PFA model, have remained constant or have shown a decreasing trend. Similarly, exploitation rates for Southern NEAC area have declined considerably in most countries, particularly in the last decade.

The marine survival of wild and hatchery-reared smolts in both Northern and Southern NEAC areas has declined over the past 10–20 years. The steepest decline is seen for wild smolts in Southern NEAC area, returning as 1SW salmon. Survival of both wild and hatchery fish returning as 2SW in Northern NEAC area, however, has increased in recent years.

In general, the total returns of salmon and spawning stocks in the Northern NEAC area, as derived from the NEAC PFA model has increased in recent years. In contrast, salmon stocks in Iceland show a decline since the late 1980's, especially for MSW salmon. Salmon stocks in the Southern NEAC area show a consistent decline over the past 20–30 years. This relates especially to the MSW component of the salmon stocks.

The consistent downward trends in marine survival of smolts and the estimated returns and spawners as derived from the PFA model suggest that returns are strongly influenced by factors in the marine environment.

5.2 Evaluation of the Effects on Stocks and Homewater Fisheries of Significant Management Measures Introduced Since 1991

5.2.1 Evaluation of the effects of management measures introduced in Faroes since 1991

Between 1991 and 1998 the Faroese fishermen agreed to suspend commercial fishing for the salmon quota set by NASCO, in exchange for compensation payments. The number of fish spared as a result of this period of suspension is the catch that would have been taken if the fishery had operated, minus the catch in the research fishery which operated in most years. No buyout has been arranged since 1999. As no quota was set in 2000/2001 and there was no fishery in Faroe, the analysis which was carried out for the 2000 fishery was not repeated for 2001. Also, examination of trends in catches in NEAC countries suggests that any expected increase arising from the cessation of fishing at Faroes may be masked by other factors such as changes in marine survival and/or management measures in homewaters. For information purposes, the analysis presented in last years report is reproduced below.

Although no fishing took place in 1999, a single vessel carried out commercial fishing in 2000, catching approximately 8 t. As for last year, analysis was based on the assumption that a full quota would have been taken, had full scale commercial fishing taken place. Thus, the maximum catch that would have been taken in 1999/2000 would have been 300 t (see below). For the 1999/2000 analysis therefore the fish spared totalled 292 t (300 t-8 t).

Year	Quota (t)	Estimated increased returns to home waters in Europe			
		1SW	%	MSW	%
1992	550	2 842	0	70 809	6
1993	550	11 429	1	106 307	10
1994	550	21 078	1	134 159	11
1995	550	12 949	1	138 533	13
1996	470	10 573	1	122 196	12
1997	425	9 578	0	105 368	14
1998	380	19 699	1	103 169	13
1999	330	17 261	1	99 130	12
2000	300	15 332	1	87 726	10

The calculated additional returns represent between 6% and 14% of MSW fish and up to 1% of 1SW fish returning to homewaters between 1992 and 2000. However, about 65% of MSW salmon caught in the Faroes fishery would return to Scandinavian countries, Finland and Russia. If this were the case, they might have represented from 10% to 19% of MSW returns and up to 2% of 1SW returns to northern European homewaters in those years. If stocks and fisheries had remained stable, total catches would have been expected to increase by approximately the same proportions in respective areas.

5.2.2 Evaluation of the effects of management measures introduced in homewaters since 1991

There have been significant reductions in the number of gear units deployed in most countries in the NEAC area since 1991. Several have also introduced a number of other which include: restrictions on fishing seasons, buy-out arrangements, voluntary restrictions and increasing use of catch and release.

Both fishing effort and reported catches were believed to have increased in some NEAC net fisheries due to the anticipation of quota management systems based on historical catches or a presumption that buyouts and/or set-asides might be implemented in the future. It was not possible to quantify these increases.

The effect of specific management measures on stocks and fisheries has been evaluated in a number of NEAC countries.

NEAC northern area: The buy-out of gillnets in the Hvita river system in Iceland is estimated to have improved the rod catch in tributaries of the river by 28 to 35%. The increase in rod catches also suggested that the rod fishery may be taking 39 to 52% of the previous net catch. In Russia, commercial catches in the 1990s are estimated to be 3.5 times smaller than in the 1980s largely as a result of management changes aimed at reducing the fishing effort and a cessation of the salmon fishery on the Pechora River, in particular.

NEAC southern area: In UK (England and Wales), the North East coast fishery is the largest net fishery and has taken, on average, 68% of the national declared net catch over the period 1970–1992. A phase out of this fishery was introduced in 1993 and the number of licences issued has subsequently fallen from 142 in 1992 to 70 in 2001 (51%). The exploitation rate in 1992 was estimated to be in the region of 50%. Assuming the remaining fishermen are representative and that there have been no major changes in the fishery, the average exploitation rate (1997–2001) would have fallen to around 30% (i.e., a 40% reduction). This is greater than the reduction in the average drift net catch (1997–2001), which has fallen by 22% compared with the 5 years (1988–92) prior to the start of the phase out. A number of other smaller coastal mixed stock fisheries have also been phased out since 1991.

National measures were introduced in UK (England and Wales) in 1999 to protect spring salmon. In 2001, these are estimated to have saved around 3,100 salmon from capture by net fisheries and around 1,100 by rod fisheries before June 1. These estimates are based on the catch and the average proportion of fish taken in this period in the 5 years prior to the measures being introduced; the latter estimate has been adjusted for catch and release.

In Scotland, members of the Salmon Net Fishing Association, to which the majority of active netsmen are affiliated, continued a voluntary agreement, introduced in 2000, to delay fishing until the beginning of April in order to protect early running MSW salmon. Similar delays to the start of the season were also introduced in Sweden.

In Ireland, the introduction of measures in the commercial fishery in 1997 effectively reduced effort in the commercial fishery by about 20% (5 to 4 days per week). Further restrictions on night-time fishing further reduced the effort by up to 50% in some areas where all day fishing was previously carried out. Fishing effort on spring salmon stocks was also reduced with the later opening of the season for some gears. A more detailed appraisal of these methods on Irish monitored stocks was presented in last year's Working Group report (ICES 2001, ACFM:15) which concluded that the measures contributed to a reduction in both the overall catch and the exploitation rate on Irish stocks. Exploitation rate estimates in net fisheries for tagged wild and hatchery stocks for 2001 were below recent long-term averages; this was felt to reflect the recent management changes.

In northern France, TACs have been operated in several regions for some years. In Brittany (which provides more than 60% of the total catch) a MSW specific TAC, introduced in 2000, continued to apply and resulted in the temporary closure of some rod fisheries in 2001. One and two month delays to the start of the angling season were also introduced on three other rivers, in an effort to reduce exploitation of spring salmon. However, catch data suggest that this resulted in catches well above average when the season commenced, suggesting that the measures merely delayed exploitation. In addition, a six-week closure of the net fishery took place in the Adour estuary in June and July 2001; this is estimated to have saved around 6,500 1SW salmon.

The above estimates and the overall reduction in gear units suggest that the impact of fisheries on NEAC stocks has been significantly reduced since 1991.

5.3 Expected Abundance of Salmon in the North East Atlantic

Previous developments and improvements to the NEAC PFA Model

ICES has previously developed a model to estimate the pre-fishery abundance (PFA) of salmon from countries in the NEAC area. PFA in the NEAC area is defined as the number of 1SW recruits on January 1st in the first sea winter. The method employs a basic run-reconstruction approach similar to that described by Rago *et al.* (1993) and Potter and Dunkley (1993). The model estimates the PFA from the catch in numbers of 1SW and MSW salmon in each country. These are raised to take account of minimum and maximum estimates of non-reported catches and exploitation rates of these two sea-age groups. Finally these values are raised to take account of the natural mortality between January 1st in the first sea winter and the mid-point of the respective national fisheries. No significant changes were introduced to the model in 2002, although further improvements were made to the data inputs by some countries. In addition, as discussed in Section 4.2, a value of 'M' of approximately 0.03 per month is more appropriate than the previous value of 0.01 and a range from 0.02 to 0.04 has therefore been used in the PFA model.

Stock groupings for the NEAC PFA analysis

Each year, NASCO asks for a description of events in the salmon fisheries and the status of salmon stocks, and for management advice for the major salmon fisheries. As there are over 1,600 salmon stocks in the NEAC area, it is necessary to group stocks when providing this advice. ICES has previously provided information on the status of stocks by river or by country, and used the following groups of countries to combine the PFA estimates for managers (e.g., ICES 2001/ACFM:15):

Southern European countries:	Northern European countries:
Ireland	Finland
France	Norway
UK(England & Wales)	Russia
UK(Northern Ireland)	Sweden
UK(Scotland)	Iceland

These groupings represent a convenient geographical split delimited by the North Sea. It also roughly separates the two groups of European stocks (southern and northern) that have previously been considered to make the greatest contribution to the West Greenland and Faroes fisheries respectively.

In order to determine the stock groups for the provision of management advice for the Faroes and West Greenland fisheries, comparable indices of exploitation were estimated for national salmon stocks. These were based upon the 10-year average of national PFA estimates and the relative contribution of national stocks to the fisheries from tag recoveries (i.e., the recovery rate per 1,000 tags released). These are shown in Figure 5.3.1 for 1SW and MSW salmon in the Faroes fishery and MSW salmon in the West Greenland fishery. There is no apparent pattern in the levels of exploitation in the Faroes fishery, for either 1SW or MSW salmon. However, there is a clear pattern for MSW salmon at West Greenland, with very low indices of exploitation for Russia, Norway, Sweden and Iceland, but increasing indices for more southerly European countries.

On this basis it was proposed that advice for the Faroes fishery (both 1SW and MSW) should be based upon all NEAC area stocks, but that advice for the West Greenland fishery should be based upon Southern European MSW salmon stocks only (comprising UK, Ireland and France).

Sensitivity analysis of the NEAC PFA model: A sensitivity analysis for the spreadsheet model, which generates pre-fishery abundance (PFA) estimates in the NEAC area was described in ICES 2001/ACFM15. The sensitivity of the overall assessment of PFA for the NEAC Area and for the Northern and Southern European stock complexes depends on the values of the various parameters provided for different countries, and these will also be weighted by the national catches. Changes to the parameter values effect the respective PFA estimates to varying degrees. The analysis also indicates that increasing 'M' from 0.03 to 0.04 per month for all the national data sets would increase the PFA estimates for maturing 1SW salmon by about 8% and for non-maturing 1SW salmon by about 19%.

At this level of disaggregation the model is fairly sensitive to some parameter values and therefore great care should be taken to ensure their accuracy:

Country (Region)	Sea-age	Parameter
Norway (mid)	1SW	non-reporting rate
Norway (North)	MSW	non-reporting rate
Ireland	1SW	non-reporting rate
Ireland	1SW	exploitation rate
Scotland (East)	1SW	exploitation rate
Scotland (East & West)	MSW	exploitation rate
Scotland (East)	MSW	non-reporting rate

Changes to the national Conservation Limits model

In 2001 a new method for setting biological reference points from "noisy" (uncertain) stock-recruitment relationships, such as provided by the national pseudo-stock-recruitment datasets (ICES CM2001/ACFM:15) was adopted. This model assumes that there is a stock level below which recruitment decreases linearly towards zero stock and recruitment, and above which recruitment is constant. Given the current knowledge, this stock level can be considered as a proxy for S_{lim} and is therefore defined as the conservation limit for salmon stocks. The model provides a more objective method for estimating these reference points than the non-parametric methods previously used.

Potter and Nicholson (2001) described a modified version of this method, which updates the method first used by ICES in 2001, by allowing uncertainty around these estimates to be described. The model also allows two probability levels to be inserted to generate upper confidence limits only (it is assumed that only more conservative CLs will be required if uncertainty is incorporated). The output from the model is shown in three embedded figures (Figure 5.3.2):

Panel 1 shows the stock-recruitment relationship with the fitted model;

Panel 2 shows the time series of stock estimates;

Panel 3 shows a plot of the residual sum of squares for values of Sc (the stock level at the inflection point).

ICES concluded this approach was more appropriate for future evaluation of the national conservation limits as it allows uncertainty around these CLs to be estimated and this information can be employed in providing precautionary management advice. Hence, this approach was applied to the 2001 national stock-recruitment relationship assessment.

Forecasting PFA for NEAC stocks: ICES considered the development of a model to forecast the pre-fishery abundance of non-maturing (potential MSW) salmon from the Southern European stock group (comprising Ireland, France and all parts of UK). Stocks in this group are the main European contributors to the West Greenland fishery. The objective was to use the model fitted to data from 1977–2000 to predict *PFA* in the subsequent years 2001–2002.

The data to be used in the model consisted of:

- *PFA*: the pre-fishery abundance of MSW salmon from Southern Europe for the period 1977–2000 was taken from the output of NEAC PFA model as reported in Section 6.3.4.
- *Stock*: the index used in the model is the 'lagged egg' numbers for the period 1977–2002 derived from the national PFA and CL analysis;

- *Habitat*: the same habitat index was used as in the North American PFA prediction model. This thermal habitat is defined as a relative index of the area suitable for salmon at sea and was derived from sea surface temperature (SST) data obtained from the National Meterological Centre of the National Ocean and Atmospheric Administration and previously published catch rates for salmon from research vessels fishing in the north-west Atlantic (as used in the current North American forecast model, Section 4).

The forecasts using this model and the probability distribution are given in Table 5.3.1. The model forecasts that, in 2002, the Southern European MSW stock will fall to around 552,000. This is about one third of the estimated PFA in the mid 1970s, and lower PFA levels have only been estimated for three years (1996 to 1998). Although the model is not strongly driven by Egg Nos, this decline is consistent with the continuing decline in estimated egg deposition.

5.4 Development of Age-Specific Conservation limits

In all, there are around 15–25 stock and recruitment datasets in the NEAC area, ranging from long time series to rivers where stock-recruitment (S/R) relationships are in the process of being (or could be) developed. These include a mixture of smaller rivers and tributaries of large river systems. Given the time and resource difficulties with collecting meaningful S/R data, it is unlikely that many further datasets will be developed in the near future. However, as these rivers are spread throughout the NEAC area and cover a wide array of river types and productivity levels, even incomplete S/R datasets may provide useful information for helping to identify BRPs for transport of conservation limits to rivers with little or no data.

These and related issues are being dealt with by the EU funded SALMODEL Concerted Action "*A co-ordinated approach towards the development of a scientific basis for management of wild Atlantic salmon in the North-East Atlantic"* (Contract No**:** QLK5-CT1999–01546; www.salmodel.net). A brief summary of the areas under consideration and where progress is being made is given below:

- Developing common methods of setting conservation limits
- Transporting SR relationships to rivers where no s/r data exist
- Non-stationarity in SR relationships
- The effect of sea trout on setting CLs
- The genetic implications of CL limits
- Risk in setting CLs
- Alternative methods for setting CLs

5.5 Catch Options or Alternative Management Advice

IES has been asked to provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits in the NEAC area. ICES reiterated its concerns about harvesting salmon in mixed stock fisheries, particularly for fisheries exploiting individual river stocks and sub-river populations that are at unsatisfactorily low levels. Annual adjustments in quotas or effort regulations based on changes in the mean status of the stocks are unlikely to provide adequate protection to the individual river stocks that are most heavily exploited by the fishery or are in the weakest condition.

ICES also emphasized that the national stock conservation limits discussed above are not appropriate for the management of homewater fisheries, particularly where these exploit separate river stocks. This is because of the relative imprecision of the national conservation limits and because they will not take account of differences in the status of different river stocks or sub-river populations. Nevertheless, ICES agreed that the combined conservation limits for the main stock groups (national stocks) exploited by the distant water fisheries could be used to provide general management advice for these fisheries.

Despite resolution of some uncertainties about the most appropriate stock groupings (section 6.3.6), because of the preliminary nature of the conservation limit estimates, ICES is unable to provide quantitative catch options for most stock complexes at this stage. In the absence of predictive estimates of PFA and more reliable estimates of conservation limits, it is unlikely that quantitative catch advice will be developed in the immediate future. An exception this year is the provision for the first time of a quantitative prediction of PFA for southern European MSW stocks (Section 6.5.2). ICES feels that the following qualitative catch advice is appropriate based upon the PFA data and estimated SERs shown in Figures 5.3.3.to 5.3.8.

- Based on recent work on resolving the most appropriate stock groupings for management advice for the distant water fisheries, ICES agreed that advice for the Faroes fishery (both 1SW and MSW) should be based upon all NEAC stocks. Advice for the West Greenland fishery should be based upon southern European MSW salmon stocks only (comprising UK, Ireland and France).

- For all fisheries, ICES considers that management of single stock fisheries should be based upon local assessments of the status of stocks. Conservation would be best achieved by fisheries in estuaries and rivers targeting stocks, which have been shown to be above biologically-based escapement requirements.

- While and estimate of unreported catches have been included in the assessment, there is a need to obtain more precise estimates or to increase the precision of reporting in future.

- It should be noted however that the inclusion of farmed fish in the Norwegian data will result in the exploitable surplus being overestimated for both maturing and non-maturing PFA estimates for the Northern European catch advice.

Northern European 1SW stocks: The PFA of 1SW salmon from the Northern European stock complex has been above the spawning escapement reserve throughout the time series (Figure 5.3.5), with some evidence of an upturn in the past few years. However, the spawning escapement was below the conservation limit until 1987 (Figure 5.3.6). This upward trend was continued with a slight reduction in 1SW spawners relative to 2000. ICES considers that overall exploitation of the stock complex at the current rate is acceptable, although this should not increase as the status of individual stocks varies considerably. Since very few of these salmon have been caught outside homewater fisheries in Europe, even when fisheries were operating in the Norwegian Sea, management of maturing 1SW salmon should be based upon local assessments of the status of river or sub-river stocks.

Northern European MSW stocks: The PFA of non-maturing 1SW salmon from Northern Europe has been declining since the mid 1980s and the exploitable surplus has fallen from around 1 million recruits in the 1970s to about half this level in recent years (Figure 5.3.5). ICES considers the Northern European MSW stock complex to be within safe biological limits, as spawners are above CL and trending in a positive direction (Figure 5.3.6), although it is recognised that the status of individual stocks will vary considerably. ICES therefore considers that caution should still be exercised in the management of these stocks particularly in mixed stock fisheries and exploitation should not be permitted to increase until a clear pattern of status above SER is established.

Southern European 1SW stocks: Recruitment of maturing 1SW salmon in the Southern European stock complex has shown a strong decreasing trend throughout most of the time series (Figure 5.3.7). Moreover the spawning escapement for the whole stock complex has fallen below the conservation limit in four of the past five years (Figure 5.3.8). Despite a small surplus above SER of around 300,000 fish during the last two years, exploitation in those years was clearly high enough to prevent conservation requirements being met. ICES therefore considers that reductions in exploitation rates are required for as many stocks as possible and that mixed stock fisheries present particular threats to conservation.

Southern European MSW stocks: The PFA of non-maturing 1SW salmon from Southern Europe has been declining steadily since the 1970s (Figure 5.3.7), and the preliminary quantitative prediction of PFA for this stock complex indicates that PFA will remain close to present low levels for each of the next two years. The spawning escapement has not been significantly above conservation limit for the last six years and there is evidence from the prediction that PFA will decrease in the near future (Figure 5.3.8). The stock group is therefore thought to remain very close to safe biological limits, and ICES therefore considers that precautionary reductions in exploitation rates are required for as many stocks as possible, in order to ensure that conservation requirements are met for each river stock with high probability. ICES also notes that mixed stock fisheries present particular threats to conservation.

5.6 Estimates of by-catch of post-smolts in pelagic fisheries in the Norwegian Sea

Atlantic salmon post-smolts have been observed to overlap in time and space with some of the mackerel fishing areas in the North East Atlantic (ICES 2000/ACFM:13), and both species seem to follow the warm and saline Atlantic current on their northward migration. The potential risk of salmon post-smolts being taken in commercial fisheries for pelagic fish has been discussed for some time, but so far little substantial data to estimate this has been available.

In June 2001 the Institute of Marine Research ran a dedicated salmon survey west of the Voering Plateau in the Norwegian Sea, at approximately the same time as the commercial mackerel fishery starts in these areas. During this survey large catches of mackerel were made and these catches contained a varying number of post-smolts. The simultaneous occurrence of salmon and post-smolts in areas where the commercial fleet is known to operate, gave for the first time the possibility to examine the magnitude of the by-catches of post-smolts of salmon in the commercial fishery.

Although the presented methods are preliminary and under development, they represent the first attempt to estimate the by-catch of salmon post-smolts in the mackerel fishery in the Norwegian Sea based on observed data.

A total of 198 post-smolts were captured simultaneously with 7,959 kg mackerel. The proportion of post-smolts per weight of the mackerel captured in the 2001 research fishery was used to scale up with the registered commercial trawl captures in the Norwegian Sea (ICES Divisions IIa and Vb) in 2nd and 3rd quarter in 2000.

Estimates of post-smolt by-catches can be obtained assuming that the catches from the research fishery are representative for the commercial fishery. Unfortunately, mackerel catch data for 2001 were not available and therefore the catch for 2000 (38,000 tons) was used in this calculation. Two estimates for scaling up the post-smolt catches applying mackerel trawl

catches in the Norwegian Sea are: (1) The total number of post-smolts per kg mackerel caught gives 950,000 post-smolts in numbers) while (2) the unweighted mean of the number of post-smolts per kg mackerel caught per individual tow suggests 608,000 post-smolts in numbers. These figures can be compared with the current total PFA estimates for the Northeast Atlantic in 2001, which was approximately 3.6 million (immature and maturing) salmon.

Only the commercial trawl catch from the above mentioned ICES Divisions have been used in the calculations because the research data are obtained by pelagic trawling and the only commercial operation that these data could possibly be representative of would be the pelagic trawl fishery.

Caution is advised when interpreting the results. It is not known how well results from commercial and scientific trawl operations compare, e.g., there are difference in trawl size and towing speed. Also, fishing areas vary from year to year due to environmental factors, stock size, and quota limitations for the participating nations. However, the distribution of commercial mackerel catches 1977 – 2000 (Figure 5.3.11) and the distribution of post-smolt captures taken in the Norwegian research surveys in 1990 – 2000 (Figure 5.3.12), overlap, giving some justification for the approach applied.

These estimates serve to illustrate that by-catch is potentially significant. However, more directed work is needed to demonstrate that the post-smolt catches are proportional to the actual landings made by the mackerel fisheries in the same area and at the same time. These first estimates could be improved by continuing to develop and expand the surveys in the actual areas and by obtaining direct by-catch estimates from the mackerel fleet. To increase the precision in the estimates, the commercial catches of mackerel in the Norwegian Sea (ICES Divisions IIa and Vb), Northern North Sea (IVa) and west of Ireland and Scotland (Divisions VIa,b; VIIb,c,j,k) should be examined by ICES Divisions and per standard week during the period May-August (week 18–33). With the captures broken down into catches per standard week by Division, the possibility of a more precise assessment of the potential by-catch of posts-smolts in these areas can be examined. Information on the proportion of the catches made by seiners and trawlers would also be important for the assessments.

5.7 Data deficiencies and research needs in the NEAC Area

1. To improve the input of environmental variables in the predictive models, research on temporal and spatial distribution on salmon post-smolts of different origin in the ocean should be continued and expanded. Two approaches are recommended: (a) a co-ordinated tagging program of salmon smolts throughout the distribution range followed by intensive sampling of returning fish in local and distant waters. (b) tagging smolts with Data Storage Tags.

2. To improve the estimates of by-catch of post-smolts in the mackerel fishery, a continuing effort to develop and expand the surveys in the actual areas is required. Furthermore, the commercial catches of mackerel in the Norwegian Sea (ICES Divisions IIa and Vb), Northern North Sea (IVa) and west of Ireland and Scotland (VIa,b; VIIb,c,j,k) should be provided by ICES Divisions and per standard week during the period May-August (week 18–33).

3. Research on post-smolts in the early marine phase should be continued and expanded. This should include studies on interactions with parasites and assessments of the impact of sea lice on post-smolts.

4. Further progress should be made in establishing PFA methodologies.

5. Further progress is needed in establishing the actual levels of unreported catch and reducing these unreported catches as much as possible.

6 ATLANTIC SALMON IN THE NORTH AMERICAN COMMISSION AREA

6.1 Events of the 2001 fisheries and status of stocks

6.1.1 Fisheries in the NAC area

Gear and effort: The 23 areas for which the Department and Fisheries and Oceans (DFO) manages the salmon fisheries are called Salmon Fishing Areas (SFAs); for Québec, the management is delegated to the Société de la Faune et des Parcs du Québec and the fishing areas are designated by Q1 through Q11 (Figure 6.1.1.1). Three user groups exploited salmon in Canada in 2001: Aboriginal peoples, residents fishing for food in Labrador and recreational fishers. Hence there were no commercial fisheries in Canada in 2001.

Aboriginal peoples' food fisheries: In Québec, Aboriginal peoples' food fisheries took place subject to agreements or through permits issued to the bands. In the Maritimes and Newfoundland (SFAs 1 to 23), food fishery harvest agreements were signed with several Aboriginal peoples groups (mostly First Nations) in 2001. The signed agreements often included allocations of small and large salmon. Under agreements reached in 2001, several Aboriginal communities in Nova Scotia were permitted to retain "adipose clipped" 1SW salmon from 5 Atlantic coast rivers using methods that permitted live release of wild fish.

Residents food fisheries in Labrador: In the Lake Melville (SFA 1) and the coastal southern Labrador (SFA 2) areas, DFO allowed a food fishery for local

residents to retain a maximum of four (4) salmon of any size while fishing for trout and charr; 4 salmon tags accompanied each license. The license restricted the fishing gear to a gillnet of 15 fathoms (27.4 m) and 3.5 in (89 mm) mesh. The seasons were June 15-July 2 and July 24-August 19 in SFA 1 and July 15-August 31 in SFA 2. All licensees were to complete logbooks.

Recreational fisheries: Recreational fisheries management in 2001 varied by area. Except in Québec and Labrador (SFA 1 and 2), only small salmon could be retained in the recreational fisheries. Other measures included seasonal and daily bag limits, hook and release fisheries and total closures.

There was no fishery for sea-run Atlantic salmon in the USA in 2001; as a result of angling closures since 1999, effort measured by license sales, was 0.

For the Saint-Pierre and Miquelon fisheries in 2001, there were 10 professional and 42 recreational gillnet licenses issued. The number of professional fishermen has increased by two licenses from 2000 and the number of recreational licenses increased by seven licenses since 2000, the maximum level encountered since 1995. No salmon fishing was allowed within 360 m of the mouths of two rivers (Belle-Riviere and Dolisie), as there are indications of salmon spawning in these rivers.

Year	Number of Professional Fishermen	Number of Recreational Licenses
1995	12	42
1996	12	42
1997	6	36
1998	9	42
1999	7	40
2000	8	35
2001	10	42

Catch: The provisional harvest of salmon in 2001 by all users was 145 t, about 5% less than the 2000 harvest of 153 t (Table 4.1.1.1). The 2001 harvest was 48,760 small salmon and 12,102 large salmon, 12% fewer small salmon and 15% more large salmon, compared to 2000. The dramatic decline in harvested tonnage since 1988 is in large part the result of the reductions in commercial fisheries effort, the closure of the insular Newfoundland commercial fishery in 1992, the closure of the Labrador commercial fishery in 1998 and the closure of the Québec commercial fishery in 2000. These reductions were introduced as a result of declining abundance of salmon.

The 2001 harvest of small and large salmon, by number, was divided among the three user groups in different proportions depending on the province and the fish-size group exploited. Newfoundland reported the largest proportion of the total harvest of small salmon and Québec reported the greatest share of the large salmon harvest. Recreational fisheries exploited the greatest number of small salmon in each province, accounting for 84% of the total small salmon harvests in eastern Canada. Unlike years previous to 1999 when commercial fisheries took the largest share of large salmon, food fisheries (including the Labrador resident food fishery) accounted for the largest share in 2001 (55% by number).

Aboriginal peoples' food fisheries. Harvests in 2001 (by weight) were up 12% from 2000 and 14% above the previous 5-year average harvest. In some cases, particularly in the Maritime provinces, Aboriginal peoples' food fisheries harvests in 2001 were less than the allocations.

Residents Fishing for Food in Labrador: The estimated catch for the entire fishery in 2001 was 5.0 t, about 2,100 fish (76% small salmon by number).

Recreational fisheries: Harvest in recreational fisheries in 2001 totalled 46,446 small and large salmon, 16% below the previous 5-year average and 8% below the 2000 harvest level (Figure 4.1.2.2). The small salmon harvest of 40,948 fish was a decrease of 16% from the previous 5-year mean. The large salmon harvest of 5,498 fish was a 10% decline from the previous five-year mean. Small and large salmon harvests were down 11% and up 19% from 2000, respectively.

Hook-and-released salmon fisheries: In 2001, about 56,600 salmon (about 25,400 large and 31,200 small) were caught and released (Table 4.1.2.2), representing about 55% of the total number caught. This was a 9% decrease from the number released in 2000. Most of the fish released were in Newfoundland (44%), followed by New Brunswick (43%), Québec (10%), Nova Scotia (3%) and Prince Edward Island (0.3%). Expressed as a proportion of the fish caught, that is, the sum of the retained and released fish, Nova Scotia released the highest percentage (90%), followed by New Brunswick (60%), Newfoundland (55%), Prince Edward Island (47%) and Québec (37%).

All fisheries (commercial and recreational) for sea-run Atlantic salmon within the USA are now closed, including rivers previously open to catch-and-release fishing. Thus, there was no harvest of sea-run Atlantic salmon in the USA in 2001. Unreported catches in the USA were estimated to be 0 t.

For Saint Pierre et Miquelon. the harvest in 2001 was reported to be 2.2 t from professional and recreational fishermen, approximately the same as 1998 through 2000. Professional and recreational fishermen caught 1 544 and 611 kg of salmon, respectively. There was no estimate available of unreported catch for 2001.

Composition and origin of catch: In the past, salmon from both Canada and the USA have been taken in the commercial fisheries of eastern Canada. These fisheries

have since been closed. The remaining Aboriginal Peoples' and resident food fisheries that exist in Labrador may intercept some salmon from other areas of North America although there are no reports of tagged fish being captured there in 2001. The fisheries of Saint-Pierre and Miquelon catch salmon of both Canadian and US origin. Little if any sampling occurs in these remaining fisheries.

The returns to the majority of the rivers in Newfoundland and to most rivers of the Gulf of St. Lawrence and Québec were comprised exclusively of wild salmon. Hatchery origin salmon made up varying proportions of the total returns and were most abundant in the rivers of the Bay of Fundy, the Atlantic coast of Nova Scotia and the USA.

Aquaculture escapees were noted in the returns to seven rivers of the Bay of Fundy and the coast of Maine (Saint John, Magaguadavic, St. Croix, Union, Dennys, Narraguagus and Penobscot). However, their numbers in the Saint John and Penobscot Rivers were low (14 and 1 respectively) and composed less than 0.01% of the returns. In the Magaguadavic River (SFA 23), which is located in close proximity to the centre of the aquaculture production area, the proportion of the adult run composed of aquaculture escapees has been high (greater than 50%) since 1994. Escaped fish were not observed between 1983 and 1988. Since 1992, escaped fish have comprised between 33% and 90% of adult salmon counts. However, while farmed fish have dominated the run in terms of percentages, in absolute terms their numbers showed a declining trend up until 2000. In 2001, this trend was reversed and four times more escapees (132) entered the river than in the previous year. An upturn compared to 2000 of escapees in the returns to the nearby St. Croix River was also noted. Farm escapees were also monitored in US rivers of Maine's with estimates of escapees ranging from 32% to 100%. These values are similar to those observed at these sites in the last few years.

Exploitation rates: In Newfoundland, exploitation rates were available for 12 rivers in 2001. For those rivers with retention of small salmon, exploitation rates ranged from 7% to 47% with a mean value of 13%. In Québec, exploitation rates were available for 35 rivers. Exploitation rates of small salmon ranged from 4% to 57% with a mean value of 33%. Retention of large salmon was permitted on 21 of those rivers; exploitation rates for large salmon ranged from 3% to 31% with a mean value of 22%. Global exploitation rates using mid-point estimates of returns and recreational landings were 17% for small salmon and 12% for large salmon. No estimates of returns to Labrador are possible for 1998 - 2001, as there was no commercial fishery and there was insufficient information collected on freshwater escapements to extrapolate to other Labrador rivers. For this reason, exploitation rates cannot be calculated for 1998 - 2001.

There was no exploitation of USA salmon in homewaters and no salmon of USA origin were reported in Canadian fisheries in 2001.

6.1.2 Status of stocks in the NAC area

Returns, recruits and spawners:

Estimated (mid-point) 1SW and 2SW returns, spawners, and spawner requirements are shown for five of six regions in North America in Figures 6.1.2.1 and 6.1.2.2. Labrador returns and thus total North American returns have been unavailable since 1998.

Trends in abundance of small salmon and large salmon within the geographic areas show a general synchronicity among the rivers. Returns of large salmon in North America were generally increased from 2000 while small salmon returns decreased. Any increases however in large salmon returns were from often record low values in 2000. For the rivers of Newfoundland, large salmon returns decreased from 2000 but remained high relative to the years before the closure of the commercial fisheries. Large salmon in Newfoundland are predominantly repeat-spawning 1SW salmon while in other areas of eastern Canada, 2SW and 3SW salmon make up varying proportions of the returns.

In most regions the returns of 2SW fish are at or near the lower end of the 31-year time series (1971–2001) except Newfoundland where they are at the sixth highest but are a minor age group component of the stocks in this area. Returns of 1SW salmon were at the lower end of the time series in Gulf, Scotia-Fundy and USA and at about at the mid-point in Québec and Newfoundland.

The rank of the estimated returns in 2001 in the 1971–2001 time series for six regions in North America is shown below. The closer the rank of returns in 2001 is to 1, the better the relative performance of the stock.

Region	Rank of 2001 returns in 1971–2001 time series (1=highest)		Mid-point estimate of 2SW spawners as proportion of conservation limit (S_{lim})
	1SW	2SW	(%)
Labrador	Unknown	Unknown	unknown
Newfoundland	16	6	193
Québec	23	28	71
Gulf	26	26	77
Scotia-Fundy	30	28	19
USA	21	29	3

In 2001, the overall conservation limit (S_{lim}) for 2SW salmon was not met in any area except Newfoundland (Figure 6.1.2.3). The overall 2SW conservation limit for Canada could have been met or exceeded in only nine (1974–78, 1980–82 and 1986) of the past 29 years (considering the mid-points of the estimates) by reduction of terminal fisheries (Figures 6.1.2.4). In the remaining years, conservation limits could not have been met even if all terminal harvests had been eliminated. It is only within the last decade that Québec and the Gulf areas have failed to achieve their overall 2SW salmon conservation limits.

Pre-fishery abundance estimates of non-maturing and maturing 1SW North American salmon

The North American run-reconstruction model has been used to estimate pre-fishery abundance and serves as the basis of abundance forecasts used in the provision of catch advice. The definitions used in the derivation of the model are provided in Table 6.1.2.1. The catch statistics used to derive returns and spawner estimates have been updated from those used in ICES 2001/ACFM:15 (Table 6.1.2.2). The North American run-reconstruction model has also been used to estimate the fishery exploitation rates for West Greenland and in homewaters.

Estimates of pre-fishery abundance suggest a continuing decline of North American adult salmon over the last 10 years. The total population of 1SW and 2SW Atlantic salmon in the northwest Atlantic has generally been declining since the 1970s, and the abundance recorded in 1993–2001 was the lowest in the time series (Figure 6.1.2.5). During 1993 to 2001, the total population of 1SW and 2SW Atlantic salmon was about 600,000 fish, about half of the average abundance during 1972 to 1990. The decline has been more severe for the 2SW salmon component than for the small salmon (maturing as 1SW salmon) age group.

Non-maturing 1SW salmon: The changes made to the calculations that determine pre-fishery abundance of non-maturing 1SW salmon for 1997 were continued for the determination of pre-fishery abundance in 2001. They included the addition of a new parameter to define the fraction of the Lake Melville catches that are immature and, in the absence of a commercial fishery in Labrador, the development of a raising factor to estimate 2SW returns to Labrador from a series of Labrador recruit estimates and pre-fishery abundance data from 1971–1996. A raising factor was also developed to include Labrador returns in the maturing component of pre-fishery abundance by dividing pre-fishery abundance without Labrador into pre-fishery abundance with Labrador based on the time series of Labrador recruit estimates and pre-fishery abundance data from 1971–1997. An assumed natural mortality rate [M] of 0.03 per month (see Section 4.3) is used to adjust the numbers between the salmon fisheries on the 1SW and 2SW salmon (10 months) and between the fishery on 2SW salmon and returns to the rivers (1 month)

As the pre-fishery abundance estimates for potential 2SW salmon requires estimates of returns to rivers, the most recent year for which an estimate is available is 2000. This is because pre-fishery abundance estimates for 2001 require 2SW returns to rivers in North America in the year 2002. The 2000 abundance estimates ranged between 81,470 and 169,954 salmon. The mid-point of this range (125,712) is 16% higher than the 1999 value (108,451) and is the 4th lowest in the 29-year time series (Figure 6.1.2.6). The most recent four years are shown with hollow symbols as no Labrador values were estimated for these years and the raising factor described previously was used. The results indicate an increase from the general decline in recent years but still much lower than the 917,300 in 1975. ICES is concerned that pre-fishery abundance for non-maturing salmon (Figure 6.1.2.6) still remains considerably lower than the Spawning Escapement Reserve of 212,189 pre-fishery abundance fish required to meet conservation limits in homewaters (see Section 4.4.2).

Maturing 1SW salmon: Estimation of an aggregate measure of abundance has utility for identifying trends, evaluating management measures, and investigating the influence of the marine environment on survival, distribution, and abundance of salmon. Maturing 1SW salmon are in some areas a major component of salmon stocks and measuring their abundance is thought to be important to provide measures of abundance of the entire cohort from a specific smolt class.

Similar to calculations to determine non-maturing 1SW salmon, a raising factor was also required to include Labrador returns in the maturing component of pre-fishery abundance necessitated by the closure of the commercial fishery in Labrador in 1998. Consequently, a raising factor was developed by dividing pre-fishery abundance without Labrador into pre-fishery abundance with Labrador based on the time series of Labrador recruit estimates and pre-fishery abundance data from 1971–1997. The mid-point of the range of pre-fishery abundance estimates for 2001 (376,132) is 15% higher than in 2000 (442,029) which had increased considerably from the low 1997 value of 331,815 which was the lowest estimated in the time series 1971–2001 (Figure 6.1.2.6). The reduced values observed in 1978 and 1983–84 and 1994 were followed by large increases in pre-fishery abundance.

Figure 6.1.2.5 shows the total 1SW recruits. While maturing 1SW salmon in 1998–2001 have increased over the lowest value achieved in 1997, the non-maturing portion of these cohorts remained unchanged since 1997. As the prefishery abundance of the non-maturing portion (potential 2SW salmon) has been consistently well below the Spawning Escapement Reserve (derived from S_{lim}) since 1993, this situation is considered to be very serious. The decline in recruits in

the time series is alarming. Although the declining trend appears common to both maturing and non-maturing portions of the cohort, non-maturing 1SW salmon have declined further.

Egg depositions: Egg depositions in 2001 exceeded or equaled the river specific conservation limits (S_{lim} for eggs) in 30 of the 85 assessed rivers (35%) and were less than 50% of conservation in 32 other rivers (38%). Large deficiencies in egg depositions were noted in the Bay of Fundy and Atlantic coast of Nova Scotia where 6 of the 7 rivers assessed had egg depositions that were less than 50% of conservation limits. Proportionally fewer rivers in Gulf (14%) and Québec (27%) had egg depositions less than 50% of conservation. Only 57% of the Gulf rivers and 43% of the Québec rivers had egg depositions that equaled or exceeded conservation. In Newfoundland, 28% of the rivers assessed met or exceeded the conservation egg limits and 39% had egg depositions that were less than 50% of limits. The deficits occurred in the east and southwest rivers of Newfoundland (SFA 13) and in Labrador. All USA rivers had egg depositions less than 5% of conservation limits.

Smolt production: The index of smolts or juveniles from geographic regions of North America was obtained by weighting the individual river indices by the egg requirement for the salmon fishing area to which they belong (SFA_{WT}). For the index of production of interest to the forecasting of 2SW salmon abundance in the Northwest Atlantic, an alternative weighting incorporated the relative contribution to the 2SW spawner requirements of the areas or zones within North America. This allows indices of smolt production from all areas of North America to be used but attributes weights to the area indices according to the expected contribution to 2SW abundance. This suggests three levels of increasing freshwater production since 1971 (Figure 6.1.2.7). Relative freshwater production which would contribute to 2SW recruitment has been fairly stable since 1992, at about twice the level observed during the late 1970s and early 1980s.

Marine Survival: Measures of marine survival rates over time indicate that survival of North America stocks to home waters has not increased as expected as a result of fisheries changes**.** There have been no significant increasing trends in survival indices of any of the stock components since commercial closures in 1992.

6.2 Effects on US and Canadian stocks and fisheries of the quota management and closure after 1991 in Canadian commercial salmon fisheries, with special emphasis on the Newfoundland stocks

ICES previously considered the impact of the closure of the Newfoundland commercial fishery in 1992 on the Newfoundland stocks (ICES 1997/Assess:10).

Dempson *et al.* (1997) developed an index of salmon returns to illustrate the impact of the commercial salmon fishery moratorium on Newfoundland stocks. It was based on the difference between the returns prior to the moratorium (1984–1991) when there was a commercial fishery to those in the years since the commercial fishery closed (1992–1997). By averaging among rivers with counting facilities this provides an estimate of commercial fishing mortality which can be used to estimate what returns would have been if the commercial fishery had not closed. The method assumes that natural mortality during the commercial fishery years remained at the same levels on average after the commercial fishery was closed. Average commercial fishing exploitation rate was 44% on small salmon and 75% on large. These exploitation rates should be regarded as a minimum values because it is evident that the natural component of marine survival has declined in recent years.

For 2SW salmon, if the commercial fishery had remained open during this period then, on average, from 1,942 to 6,821 fewer 2SW fish would have spawned. Correspondingly, for 1SW salmon, on average, from 37,672 to 96,655 fewer 1SW salmon would have spawned. For 2SW salmon, in the years since the moratorium, spawner requirements have never been achieved if one uses the minimum estimates or have always been achieved using the maximum estimate. If the commercial fishery had not closed, then 2SW spawners would never have achieved spawning requirements even at maximum estimates.

Within Newfoundland, the commercial fishery closure has resulted in increased escapements of both small and large salmon to rivers, higher catches of large salmon (which were subsequently released) in the recreational fishery, and increased spawning escapements of both size groups. These increased spawning escapements have not however always resulted in increased smolt production. Some areas of Newfoundland, particularly the south coast, did not see increases in escapement as was expected from the closure of the commercial fishery.

6.3 Age-specific stock conservation requirements

There are no changes recommended in the 2SW salmon conservation limits (S_{lim}) from those recommended previously. Conservation limits for 2SW salmon for Canada now total 123,349 and for the USA, 29,199 for a combined total of 152,548.

6.4 Sensitivity analysis of the North American PFA analysis

ICES was asked to characterize the reliability of input data used to estimate the lagged spawner variable, with special emphasis on the Labrador region, and evaluate

sensitivity of resulting pre-fishery abundance estimates (Appendix 1).

Spawner estimates are derived from a run reconstruction model described below, while the lagged spawners are calculated by applying proportions by river age to the spawner estimates and then ascribing them to the year in which their offspring will be available as 1SW non-maturing adults (pre-fishery abundance). If the run reconstruction model for Labrador is inappropriate for characterizing Labrador returns and spawners or has directional biases and/or if the river ages of Labrador salmon are biased for any reason, then lagged spawners will also be either incorrect and/or biased. In general, if the Labrador spawners are over-estimated then the forecasted pre-fishery abundance will also be over-estimated by the proportionate contribution made by the Labrador spawners to the total of Labrador, Newfoundland, Scotia-Fundy and Quebec which is then used as a variable in the forecast model (Figure 6.4.1). The contribution that Labrador spawners makes to the lagged spawner variable also increases considerably (Figure 6.4.2).

The forecast of pre-fishery abundance is highly dependent on the estimate of lagged spawners. In the present year forecast, about 12% of the forecast is determined by thermal habitat and 75% by lagged spawners. Simulations show, a varying Labrador component can in some years make a big change in pre-fishery abundance forecasts (Figure 6.4.3). Lagged spawners make an important contribution to the forecasts in 2002 and the Labrador component of lagged spawners is an important part of it. Thus, errors in the Labrador lagged spawner numbers will have a big impact on the pre-fishery abundance forecasts. As the actual number of Labrador spawners is not known, the degree of potential mis-forecasting is also unknown. This was the only technique possible for deriving lagged spawners because of a lack of an alternate data series for Labrador.

6.5 Catch options or alternative management advice with an assessment of risks

It is possible to provide catch advice for the North American Commission area for two years. The first is a revised estimate for 2001 for 2SW maturing fish based on revised estimates of the 2000 pre-fishery abundance and accounting for fish which were already removed from the cohort by fisheries in Greenland and Labrador in 2000. The second is an estimate for 2002 based on the pre-fishery abundance forecast for 2001. A consequence of these annual revisions is that the catch options for 2SW equivalents in North America may change compared to the options developed the year before.

6.5.1 Catch option for 2002 fisheries on 2SW maturing salmon

A revised forecast of the pre-fishery abundance for 2001 is provided in Table 6.5.1.1**.** This value of 332,455 is higher than the value forecast last year at this time of 295,678. A pre-fishery abundance of 332,455 in 2001 can be expressed as 2SW equivalents by considering natural mortality of 3% per month for 11 months, resulting in 239,010 2SW salmon equivalents. There have already been harvests of this cohort as 1SW non-maturing salmon in 2001 for both the Labrador (268) and Greenland (7,053) fisheries (Tables 6.5.1.2 and 6.5.1.3) for a total of 7,321 2SW salmon equivalents already harvested, when the mortality factor is considered.

6.5.2 Catch option for 2003 fisheries on 2SW maturing salmon

Most catches (91%) in North America now take place in rivers or in estuaries. The commercial fisheries are now closed and the remaining coastal food fisheries in Labrador are mainly located close to river mouths and likely harvest few salmon from other than local rivers. Fisheries are principally managed on a river-by-river basis and in areas where retention of large salmon is allowed, it is closely controlled.

Catch options which could be derived from the pre-fishery abundance forecast for 2002 (329,552 at the 50% probability level) would apply principally to North American fisheries in 2003 and hence the level of fisheries in 2002 needs to be accounted for before finalizing these catch options. Catch options were calculated by assuming probability values between 25 and 50%, accounting for mortality and the conservation limits and considering an allocation of 60% of the surplus to North America. Catches of about 6600 2SW salmon equivalents would be available at a probability value of 30%; below this probability value, there are no salmon expected to be surplus to limits. The catch at the risk neutral point (50% probability) would be about 50,600 fish. The numbers provided for catch options refer to the composite North American fisheries. As the biological objective is to have all rivers reaching their conservation requirements, river-by-river management will be necessary. On individual rivers, where spawning requirements are being achieved, there are no biological reasons to restrict the harvest.

6.5.3 Data deficiencies, monitoring needs and research requirements

Some progress was made on research needs identified last year. ICES reiterates many of last year's recommendations and suggests some further ones.

1. Estimates of total returns to Labrador no longer exist. There is a critical need to develop alternate methods to derive estimates of salmon returns and

develop habitat-based spawner requirements in Labrador.

2. There is a need to investigate changes in the biological characteristics (mean weight, sex ratio, sea-age composition) of returns to rivers, spawning stocks of Canadian and US rivers, and the harvest in food fisheries in Labrador. These data and new information on measures of habitat and stock recruitment are necessary to re-evaluate existing estimates of spawner requirements in Canada and USA and for use in the run reconstruction model.
3. Sea survival rates of wild salmon from rivers stocked with hatchery smolts should be examined to determine if hatchery return rates can be used as an index of sea survival of wild salmon elsewhere.
4. Further basic research is needed on the spatial and temporal distribution of salmon and their predators at sea to assist in explaining variability in survival rates.
5. Return estimates for the few rivers (Annapolis, Cornwallis and Gaspareau) in SFA 22 that contribute to distant fisheries should be developed and when these are available, the SFA 22 spawning requirements for these rivers (476 fish) should be included in the total.
6. A consistent approach to estimating returns is needed for instances in which offspring from broodstock are stocked back into the management area from which their parents originated.
7. Scale analysis of salmon captured at West Greenland indicated an infrequent appearance of escaped-farmed salmon. To substantiate this conclusion, farmed salmon need to be genetically characterized and included as baseline populations in continent-of-origin analysis of samples collected from West Greenland
8. The risk to stocks of being significantly above or below S_{lim} needs to be determined.

7 ATLANTIC SALMON IN THE WEST GREENLAND COMMISSION AREA

7.1 Events in the 2001 fisheries and status of stocks

7.1.1 Fishery in the WGC area

Catch, gear and effort: At its annual meeting in June 2001 NASCO introduced and agreed to a new *ad hoc* management programme for the 2001 fishery at West Greenland that incorporated the use of real-time data to allocate quota for the commercial fishery. The commercial fishery is defined as landings sold to processing plants and excludes reported private landings (not sold to plants) and unreported catch. Three harvest periods were implemented with quotas dependent on the observed average CPUE during the fishery. A total quota of 114 t was allocated for the 2001 fishery.

By regulation, all catches including landings to local markets, privately purchased salmon, and salmon caught by food fishermen, were reported on a daily basis to the Fishery Licence Office. The fishery was opened on August 13, and after closing of the agreed season of seven weeks, the reported commercial landings totalled to 34.5 t. A total of 8.0 t of private landings were reported during the 2001 season, which extended later than the closure of the commercial fishery. Compared to earlier years, a higher proportion of catch occurred in southern Greenland with 65% and 66 % taken in NAFO Division 1F in 2000 and 2001, respectively.

Licences for the salmon fishery are issued to fishermen fishing for the factories, local markets, hotels, hospitals etc., while fishing for personal use was permitted without licence for residents of Greenland. The number of active fishermen in the salmon fishery has decreased sharply since 1987, when a catch of more than 900 t was allowed and more than 500 licenses were active in the fishery. In 2001, only 76 licences were fished although this was an increase form 46 in the previous year, probably due to the expected higher quota. Of these reporting licenses, 50 licenses reported commercial landings, 23 reported private landings, and 3 licenses reported both commercial and private landings.

The average weekly CPUE varied between 90 and 161 kg per landing through the season with an overall mean of 124 kg. This was higher than any other year since 1991 apart from the record high CPUE in 2000 (343 kg).

Due to the character of this fishery, which includes provisions for personal consumption, some unreported catch likely occurs. Unreported catch is primarily associated with personal consumption or subsistence fishing, which appears to have remained relatively stable through time. There is presently no quantitative approach for estimating the magnitude of unreported catch; however, it may still be at the same level as proposed for recent years (around 10 t).

Origin of catches:

In total, 67.5% (388) of the salmon sampled from the 2001 fishery were of North American (NA) origin and 32.5% (187) fish were determined to be of European origin. Applying the results of the above analysis to the reported catch indicated that 27.2 t (9,849 salmon) of North American origin and 15.4 t (5,389 salmon) of European origin were landed in West Greenland in 2001. Quota reductions have resulted in an overall reduction in the numbers of both North American and European salmon landed at West Greenland until 1999. The number of North American salmon remained about the same in 1999 and 2000 (5,000-6,000 salmon), but doubled in 2001. The number of landed salmon of European origin increased in 2000 due to a higher proportion of European salmon in the Division 1F where a higher proportion was again observed in 2001.

Biological characteristics of the catch: The general downward trend in mean length and weight (unadjusted for sampling date) of both European and North American 1SW salmon observed from 1969 to 1995 reversed in 1996 when mean lengths and weights increased. From 1996 to 1998 the mean lengths and weights were relatively stable but increased significantly in 1999. In 2000, a decrease was observed, mainly in the North American component where the mean lengths and weights were among the lowest observed in the time series. In 2001, mean lengths and mean weights increased again to a level close to the overall average for the recent decade.

The proportion of the European origin salmon that were river age 1 fish has been quite variable through the later years with relatively high values in 1998-2000, the 2000 value being the highest on record. In 2001 this proportion was close to the overall mean value. A high proportion of this group suggests a high contribution from Southern European stocks. In 1998 and 1999 low percentages of 7.6% and 7.2%, respectively, of river age 3 were observed, the lowest on record. An increase from 1999 to 2001 (to 26.1%) was observed, higher than the overall mean of 16.8% and among the highest in the data series. The percentage of river age 2 salmon of North American origin declined somewhat from 1998, which was close to the overall mean value of 34.0%, to 22.6% in 2001.

The sea-age composition of the samples collected from the West Greenland fishery showed no significant changes in the proportions in the North American component of fish from 1998 to 2001. The proportion of 1SW salmon in the European component has been very high since 1997 (99.3 %), and was in 1999 and 2000 estimated at 100 %. A low proportion of 2SW fish and previous spawners (both components were 1.1 %) was observed in 2001.

7.1.2 Evaluation of the ad hoc management system implemented in 2001

At its 2001 meeting, NASCO implemented an ad hoc management program that provided for in-season adjustments to the allocated quota based on real time observation of catch per unit effort (CPUE) in the fishery at West Greenland (NASCO 2001). The program was based on an apparent relationship between annual catch per unit effort estimates for the West Greenland fishery and pre-fishery abundance (PFA) estimates for the North American stock complex (Figure 7.1.2.1, top panel). ICES noted that there is also an apparent relationship for the Southern European stock complex (Figure 7.1.2.1, middle panel). The management system allocated an initial quota corresponding to a 25% probability level from the quota options table (28 t) during an initial harvest period of 7 days. At the end of the first harvest period (7 days), CPUE during the harvest period was assessed to determine if the fishery would remain open and the levels of additional quota to be allocated. At the end of the 2nd harvest period, aggregate CPUE over the first two harvest periods was assessed leading to a second and final decision regarding fishery closure and quota allocation.

CPUE thresholds for management decision points in the program were established based on CPUE levels associated with specific probability forecasts of 2001 PFA. There is an implicit assumption that CPUE during the harvest period considered accurately reflects the overall PFA level. The threshold level between the low and medium CPUE levels was established based on the CPUE associated with the 25% probability estimate of PFA (187,700 salmon in 2001). The CPUE level associated with this PFA forecast was estimated by regressing CPUE against PFA (1987 to 1992 and 1995 to 1999), using the resulting equation with an input of 187,700 salmon in 2001 to estimate a CPUE level of approximately 100 kg/day (Figure 7.1.2.2, top panel). The threshold level between the medium and high CPUE levels was established based on the CPUE associated with the 50% probability estimate of PFA (295,678 salmon in 2001). Similarly, the regression equation was used to estimate the CPUE associated with this PFA as approximately 135 kg/day (Figure 7.1.2.2, top panel).

The rationale associated with using the 25% and 50% PFA levels was that the fishery would be closed if CPUE data indicated that the actual PFA was below 187,700 (CPUE < 100 kg/day), and conversely, the quota associated with the 50% probability level of the PFA forecast should not be fully allocated unless CPUE provided confirmatory information that the PFA exceeded 295,678 salmon (CPUE > 135 kg/day).

During the 2001 commercial fishery, the aggregate CPUE remained at a medium level (between 100 and 135 kg/landing) at both decision points (Figure 7.1.2.3) and a total quota of 114 t (the average of the quotas indicated by the 25% and 50% risk levels) was allocated. Decisions regarding the length of harvest periods and decision points were not critical during implementation of the management system during 2001 given the NASCO established CPUE thresholds of 100 and 135 kg/landing, because CPUE levels remained intermediate to these two thresholds following the 2nd day of the season (Figure 7.1.2.3). Of the allocated quota, only 34.5 t (30.3%) was actually landed by the commercial fishery.

ICES examined the robustness of CPUE data used at decision points to make quota allocation decisions during the fishery. Although CPUE aggregated on an annual basis is available from 1987 to 1992 and 1995 to 2001, CPUE data on a daily trip basis were only available from 1997 to 2001. These data included date, port landed, NAFO Division, fisher name and/or license and landed and live weight of salmon caught. Trip information was only available for commercial trips that landed and reported salmon. Information on commercial trips that targeted, but did not land or report landing

salmon are not available. Other information that could be used to characterize fishing effort including vessel size, gear type, amount of gear deployed, soak time and other trip information are unavailable for historical data.

Examination of Spatial and Temporal Variability in Fishing Effort

The number of trips reporting commercial landings of Atlantic salmon was used to estimate commercial fishing effort. However, trips that did not land salmon could not be quantified. The number of trips reporting commercial landings of Atlantic salmon ranged from 712 trips (1997) to 58 trips in 2000 (Table 7.1.2.1). Distribution of trips across NAFO Divisions and weeks has been variable through time, and number of trips landing within given weeks is often very low, as observed during the 1998 and 1999 fisheries. The proportion of effort within Greenland was not constant among NAFO Divisions over the period 1997 to 2001 (Figure 7.1.2.4). The relative instability of fishing effort across area and time may introduce biases in CPUE estimates. In other fisheries, effort standardization procedures (e.g., General Linear Modelling approaches) have been applied to standardize effort relative to week, area, vessel size, etc., but the low number of trips within cells and lack of information about trips, vessels and gear precludes the application of many standardization approaches to existing data.

Patterns in CPUE

The CPUE data presented is slightly slightly different from data provided at the 2001 NASCO meeting, and was updated to include currently available estimates of PFA and CPUE data. Commercial CPUE over the course of the entire season seems to correspond to general trends in the North American PFA estimate for the period 1986 to 2001 (Figures 7.1.2.1 top panel and 7.1.2.5), with the exception of a large outlier in the 2000 when CPUE was much higher than the apparent prefishery abundance of the resource. In addition, there appears to be a significant relationship between annual commercial CPUE and trends in the Southern European PFA estimate for the period 1986 to 2001 (Figure 7.1.2.1 top panel), with the same outlying point in 2000. However, residual patterns for both relationships are non-random, with blocks of positive residuals preceding the 1993 and 1994 fishery buyout, and a block of negative residuals after this period. This residual pattern may indicate changes in the relative efficiency of the fishery following the buyout resulting in higher CPUE levels during the post-1994 period when overall effort levels were lower. The residual pattern is of particular concern because the apparent relationship between CPUE and PFA may not be valid, particularly for associating current and future CPUE with higher levels of abundance that were generally observed before 1993.

Catch levels in the fishery from 1997 to 2001 were skewed toward lower catches, with trips landing less than 100 kg representing 60% to 80% of all trips landed (Figure 7.1.2.6). Since fishers do not report information on trips taken, no effort data are available for trips that targeted but did not land salmon (zero catches). The absence of zero catch trips in the time series may represent a bias leading to an overestimation of actual CPUE, particularly during periods of low abundance. If the proportion of zero catch trips increased during periods of lower abundance, this would tend to change the shape of the relationship between CPUE and PFA in this region, possibly producing non-linearity. Higher proportion of trips reporting landings in excess of 100 kg in 2000 and 2001 may reflect higher levels of availability or abundance since 1999 (Figure 7.1.2.6).

The ad Hoc Management Program assumes a relationship between PFA and CPUE over a period as short as 5 to 7 days prompting a need to examine CPUE on a finer temporal scale than an annual basis. On a weekly basis, CPUE was relatively stable and at low levels in 1997 and 1998, but was more variable among weeks from 1999 and 2001 (Table 7.1.2.2). Exceptionally high CPUE levels (343 kg/landing) were observed during the first week of the 2000 fishery, more than 2.5-fold higher than levels observed during the corresponding week in 1997, 1998, 1999, and 2001. In addition, when CPUE aggregated over the harvest periods utilized, is compared to prefishery abundance estimates, there is considerably less correspondence with PFA trends observed over the past five years (Figure 7.1.2.7), although there is little contrast in the levels of both PFA and CPUE between 1997 and 1999.

Given issues of variability of effort and CPUE levels among weeks and NAFO Divisions, unstandardized catch per unit effort data should only be used with extreme caution relative to in-season quota allocation decisions. If this framework is used to manage the West Greenland fishery in the future, decision thresholds (CPUE levels delineating low, medium, and high abundance zones) and quota allocation levels will need to be updated annually to reflect changes in PFA forecasts and levels of precaution utilized to identify ranges in quota levels allocated at in-season decision points (Figure 7.1.2.2, bottom panel).

Concerns about CPUE Thresholds

The relation between CPUE and PFA (Figure 7.1.2.1) suggests that relatively small changes in CPUE levels are associated with large changes in PFA (e.g., a 50 kilo increase in CPUE relates to an increase of approximately 150,000 PFA salmon). This indicates that both the CPUE thresholds and in-season measures of CPUE must be accurately estimated to provide useful information relative to abundance. ICES notes that CPUE thresholds were established based on 25% and 50% probability levels associated with PFA forecasts, and recommends that if future adaptive management

frameworks are developed, decision thresholds should be established based on more precautionary probability levels, consistent with limit reference points (S_{lim}).

Despite concerns about the use of CPUE data as a source of confirmatory information for abundance estimates, ICES agrees with endorses the general principle of using informative in-season measures of abundance to adaptively manage fisheries. Development of more refined data characterizing fishing effort (e.g., vessel size, gear type, amount of gear deployed, soak time, documentation of zero landings trips and private sales trips) would allow for detailed analyses of CPUE data to characterize availability of Atlantic salmon in West Greenland.

7.1.3 Status of stocks in the WGC area

The salmon caught in the West Greenland fishery are mostly (>90%) non-maturing 1SW salmon, many of which would return to home waters in Europe or North America as MSW fish if they survived the fishery. While non-maturing 1SW salmon make up more than 90% of the catch there are also 2SW salmon and repeat spawners including salmon that had originally spawned for the first time after 1-sea-winter. The most abundant European stocks in West Greenland are thought to originate from the UK and Ireland although low numbers may originate from northern European rivers. Most MSW stocks with the exception of Newfoundland are thought to contribute to the fishery at West Greenland. Status of relevant stocks in the NEAC and NAC areas are summarized below.

Southern European Stocks:

The main contributor to the abundance of the European component of the West Greenland stock complex is non-maturing 1SW salmon from the southern areas of Europe. A Run-Reconstruction Model was used to update the estimates of pre-fishery abundance of non-maturing 1SW salmon. MSW salmon stocks in the Southern NEAC area show a consistent decline over the past 10–15 years, and recent spawning escapement has been below conservation limits (S_{lim}). In summary:

- the proportion of European fish in catches at West Greenland decreased steadily during the 1990s reaching levels of 10% to 15% in recent years.
- marine survivals of wild and hatchery-reared smolts in Southern NEAC area show a constant decline over the past 10-20 years.
- MSW returns and spawning stocks in the Southern NEAC area derived from the NEAC PFA model show a consistent decline over the past 20 to 30 years.
- consistent trends in marine survival of smolts and the estimated returns and spawners as derived from the PFA model suggest that returns are strongly influenced by factors in the marine environment
- overall spawning escapement has fallen below the conservation limit in four of the past five years

North American Stocks:

The North American Run-Reconstruction Model was used to update the estimates of pre-fishery abundance of non-maturing and maturing 1SW salmon from 1971-2000. The 1998 estimate of pre-fishery abundance of non-maturing 1SW salmon was the lowest on record and continued a decline that began in 1979. A slight increase is indicated for the period 1998-2000. In addition to the steady decline in total recruits (both maturing and non-maturing 1SW salmon) over the last ten years, maturing 1SW salmon (grilse) have become an increasingly large percentage of the North American stock complex. This percentage has risen from about 45 % at the beginning of the 1970s, to around 70 % in 1992–95 and almost 80 % in 1997. 2SW returns have declined from a peak of 121,000 in 1980 to 58,000 in 2001. The percentage of North American salmon in the West Greenland catch increased steadily from 50% to 60% in the early 1990s to approximately 90% by 1997 and declined to approximately 66% in 2000 and 2001.

Newfoundland:

- 2SW and MSW salmon are a relatively small component of this stock complex
- 2SW returns 6th highest in a 31 year time series
- 2SW spawners in 2001 at approximately twice 2SW stock conservation limits

Labrador:

- 2SW returns peaked in 1995, and decreased again in 1996 and 1997
- no estimate is given since 1997 from this area, there being no commercial fishery, which was the basis for the return and spawner model for Labrador

Quebec:

- 2SW salmon are an important part of this stock complex
- 2SW returns 3rd lowest in a 31 year time series
- 2SW spawners in 2001 at 71% of 2SW conservation limit ($\mathbf{S}_{lim}$)

Gulf of St. Lawrence:

- 2SW salmon are an important part of this stock complex
- 2SW returns 5th lowest in a 31 year time series
- 2SW spawners in 2001 at 77% of 2SW conservation limit ($\mathbf{S}_{lim}$)

Scotia-Fundy:

- 2SW returns 3rd lowest in a 31 year time series
- 2SW spawners in 2001 at 19% of 2SW conservation limit (S_{lim})
- inner Bay of Fundy stocks listed as Endangered, some of which may have contributed to the fishery at West Greenland

United States:

- 2SW returns 2nd lowest in a 31 year time series
- 2SW returns in 2001 at 3% of 2SW conservation limit (S_{lim})
- stocks in two of three regions extirpated, 8 remaining rivers listed as Endangered

Despite some improvements in the annual returns to some rivers, both in European and North American areas, the overall status of stocks contributing to the West Greenland fishery remains poor, and as a result, the status of stocks within the West Greenland area is thought to be low compared to historical levels.

7.1.4 Changes in the continent of origin of salmon captured at West Greenland including changes in migration patterns

There has been a considerable increase in proportion of North American origin salmon in the fishery at West Greenland in recent years. The proportion has changed dramatically over the period of observation, 1969-2001, from below 40 % to 90 %, with the highest proportion of North American salmon observed in 1999; the proportion declined in 2001. In order to more completely describe the historical and current temporal and spatial distribution of North American and European salmon at Greenland, five years (1987, 1990, 1992, 1997, and 2001) were arbitrarily chosen and the catch patterns are displayed in Figure 7.1.4.1 to show the variability in landings by week and NAFO Division. In several years, the highest landings occurred in weeks 33 to 38 and were distributed along the coast from NAFO Division 1A to 1F. However, in both 1992 and 2001 higher proportions of the overall landings occurred in NAFO Division 1F compared with all other divisions. In 1990 and 1992, higher proportions of the landings were distributed over more weeks than in the other years. Since landings varied both spatially and temporally, further analyses considered the catch to more completely describe temporal and spatial distribution of North American and European salmon. This was done through general linear models using catch to weight the results.

Application of General Linear Models to Catch Data

The biological explanation(s) for the changes in North American and European salmon will continue to elude us due to incomplete knowledge of migration of the various components contributing to the West Greenland fishery and, more importantly, the relative contributions of various stock groupings. Previous tagging studies, including tagging at West Greenland, had shown that the southern European stock group contributed more heavily to Greenland than did the northern group. Within North America, it has been shown that stocks in the Gulf of St. Lawrence contributed more heavily than others to Greenland. The DNA analysis of salmon captured at West Greenland that started in 2000 has shown that annual variations in proportional contributions do occur (ICES/ACFM15), and should lead to a greater understanding of the mixed stock fishery.

The North American proportions were analysed from 1987 to 1999. The year 2000 samples were not included because of the short time scale and geographical distribution of the catch and the results from the 2001 samples are not yet fully available.

Analysis of Variance for North American proportion at West Greenland

The North American proportion varies over year, between NAFO Divisions and there is a significant interaction effect between year and the various NAFO Divisions. The North American proportion increased from NAFO Division 1A to 1C then declined from 1D to 1E and 1F (Figure 7.1.4.2). The North American proportion has increased significantly from 1987 to 1999 (Figure 7.1.4.3). The reasons for the varying North American proportions among NAFO Divisions and years are not known. However, this possibly reflects different migration patterns and time of arrival at Greenland of the various stock components as well as a highly variable fishery.

Analysis of Microtag Recoveries

The recovery of tagged salmon within the West Greenland fishery provided an additional option for investigating fish distribution patterns. Details of all the batches of tagged fish have been collated and reported annually to ICES.

Microtags were recovered at West Greenland from 1985 to 1992. The fishery was closed in 1993 and 1994, and very few tags have been recovered since 1995. Overall, 631 microtags were recovered at West Greenland in the period 1985 to 1992 (Table 7.1.4.1). Numbers of tag recoveries are not sufficient to allow comparison of individual stocks or national stock groupings (tags from 7 countries and over 60 stocks), but do enable comparison between continent of origin (North America 407 tags and Europe 224 tags). Aggregated over all years the proportions of tags from North American countries and Europe recovered in each of the NAFO Divisions at West Greenland seem broadly similar. However, this does not account for differences in the relative size of the tagged groups at large.

Over the period, 1985 to 1991, European countries released around 4.7 million microtagged fish between 1985 and 1991, of which 4% were wild. North American countries released 4.4 million microtagged fish over the same period, with 1% wild. Although 51% of the tagged fish at large during the time period were European, only 35.5% of the recoveries were of European origin. Thus North American tagged salmon were captured in significantly higher proportion than their proportion in the tagged population at large. Recoveries were scaled by dividing counts by 100,000 tags released in the previous year. In addition, recoveries were corrected for the scanning effort using a raising factor based on the scanned proportion of the catch for each NAFO Division and sampling week. This had the effect of making tag recoveries proportional to the landings.

The analysis of the proportions of North American tagged stocks in the catch was strongly influenced by year. This was, in part at least, thought to reflect scanning programs, because scanning did not occur in all divisions (i.e., catches in 1A were not sampled at all, sampling in 1C only occurred in 1990 to 1992, and 1F was not sampled from 1989 to 1991). For the seven years and five divisions where a comparative analysis was possible, 13 combinations had no sampling (Figure 7.1.4.4). The fishery also shifted over time within seasons. By constraining the analysis to standard weeks 33 to 35, there were only six of 21 weeks without tag recoveries from 1986 to 2001. The annual variation in sampling for tags precluded modelling the data over the entire time and space array. However, to attempt to describe the distribution of fish from each of the continents (North America and Europe), the total tag returns for each were plotted over the selected NAFO Divisions and standard weeks (Figure 7.1.4.4). These plots describe the pattern in the fishery within the period, but do not highlight any major differences in distribution between the continents of origin as only relatively small differences were noted. For both groups, Division 1D appeared to be significant in terms of the probability of recapture.

The key points of the above assessments indicate that:

- The proportion of North American fish recovered at West Greenland has significantly increased from 1987 to 1999.
- North American tagged fish have been more vulnerable to capture in the fishery than European fish; based primarily on hatchery fish.
- The fact that the fishery has not been stable annually in either time (standard week) or space (NAFO Division) precludes evaluating general migratory patterns, let alone patterns for different stocks.

7.2 Effects on European and North American stocks of the West Greenland management measures since 1993

There have been the following significant changes in the management regime at West Greenland since 1993:

1) NASCO adopted a new management model (Anon., 1993) based upon ICES' assessment of the PFA of non-maturing 1SW North American salmon and the spawner escapement requirements for these stocks. This resulted in a substantial reduction in the TAC agreed to by NASCO from 840 t in 1991 to 258 t in 1992, and further reductions in subsequent years.

2) The next change in management was the suspension of fishing in 1993 and 1994 following the agreement of compensation payments by the North Atlantic Salmon Fund. Due to the closure of the fishery in the two years no sampling could be carried out in Greenland, and no biological data were collected.

3) In 1995 and 1997, established quotas were substantially lower than quotas established before 1993. In 1996, NASCO failed to reach an agreement and Greenland unilaterally established a quota of 174 t.

4) In 1998, NASCO agreed on a subsistence fishery of 20 t, which in the past has been estimated for internal consumption at Greenland. In 1999, a multi-year management plan was agreed restricting the annual catch to that amount used for internal consumption.

5) An *ad hoc* management arrangement for 2001 was agreed by NASCO, implementing an adaptive quota calculation, based upon three harvest periods. The resulting total quota for all harvest periods was 114 t.

The estimated numbers of salmon returning to home waters in the absence of a fishery, 1993–1994, or had the fishery in 1995–2001 not taken place are:

Year	Quota T	Catch t	EU Fish	NA Fish
1993	89	0	10154	12324
1994	137	0	15630	18970
1995	77	83	6926	16520
1996	174	92	5927	16589
1997	57	58	3031	12771
1998	20	11	597	2244
1999	20	19	405	4013
2000	20	21	1887	3988
2001	114	43	3492	7346

The potential catches in the years 1993 and 1994 of 89 and 137 t, respectively correspond to the TACs calculated in accordance with the quota allocation computation model that was agreed by NASCO at its annual meeting in 1993. For the successive years nominal catch figures are used. The table above shows the number of salmon returning to home waters provided there was no catch in Greenland. From 1993 to 2001, the mean number of potentially returning fish per tonne caught at Greenland is calculated as 171 and 87 salmon for North America and Europe, respectively.

From 1972 to 1992 exploitation rates in Greenland of the North American component of the salmon stock fluctuated between 10% and 45 % around an average of 34 % (Figure 7.2.1). The management measures in force since 1993 resulted in an average exploitation rate of this component of 13 %, for the period 1995 to 1997, about one third of its previous level after reopening of the fishery in 1995. After the 1998 agreement the exploitation rates decreased to about 5 %.

In the current analysis the effects of the management measures taken at West Greenland have been examined in terms of numbers of fish only. Thus it has been difficult to show direct benefits to home-water stocks from these measures.

7.3 Age-specific stock conservation limits for all stocks occurring in the WGC area

Sampling of the fishery at West Greenland since 1985 has shown that both European and North American stocks harvested are primarily (greater than 90%) 1SW non-maturing salmon that would mature as either 2 or 3 SW salmon, if surviving to spawn. Usually less than 3% of the harvest is composed of salmon that have previously spawned and a few percent are 2 SW salmon that would mature as 3SW or older salmon. For this reason, conservation limits defined previously for North American stocks have been limited to this cohort (2SW salmon on their return to homewaters) that may have been at Greenland as 1SW non-maturing fish. These numbers have been documented previously by ICES and are shown in Section 7.4.

Conservation limits for the NEAC area have been split into 1SW and MSW components on the basis of the average age composition of catches in the past ten years. The stocks have also been partitioned into northern and southern stock complexes, and tagging information and biological sampling indicates that the majority of the European salmon caught at West Greenland originate from the southern stock complex. The current conservation limit estimate for southern European MSW stocks is approximately 260,000 fish (Section 2). There is still considerable uncertainty in the conservation limits for European stocks. Outputs from the national PFA model are only designed to provide a guide to the status of stocks in the NEAC area. It has been noted that the conservation limit estimates may change from year to year as the input of new data affects the 'quasi-stock-recruitment relationship'. Previously, the conservation limits for MSW salmon in the NEAC area have not been incorporated into the modelling of catch options for West Greenland.

7.4 Catch options or alternative management advice with an assessment of risks

7.4.1 Overview of provision of catch advice

Although advances have been made in our understanding of the population dynamics of Atlantic salmon and the exploitation occurring in the fisheries, the concerns about the implications of applying TACs to mixed-stock fisheries are of concern. In principle, adjustments to catches in mixed-stock fisheries provided by means of an annually adjusted TAC would reduce mortality on the contributing populations. However, benefits losses to particular stocks would be difficult to demonstrate, in the same way that damage to individual stocks are difficult to identify.

Models based on thermal habitat in the northwest Atlantic and spawning stock indices to forecast pre-fishery abundance have been used to provide catch advice for the West Greenland fishery. While the approach has been consistent since 1993, the models themselves have varied slightly over the years. Changes have been made to these models in attempts to improve their predictive capabilities and add more biological reality. In particular, the models since 1996 have used a spawning stock surrogate variable (lagged spawners) in an attempt to describe the variations in parental stock size of the non-maturing 1SW component (PFA). The models of previous years included the following predictor variables: 1993 - thermal habitat in March; 1994 - thermal habitat in March; 1995 -thermal habitat in January, February, and March; and 1996–2001 - thermal habitat in February and lagged spawners from the Labrador, Newfoundland, Québec, and Scotia-Fundy regions of Canada. In 2000–2001, the model was based on the natural log of PFA relative to the natural log of spawners and habitat variables. In this way, the survival rate of salmon (PFA / Spawners) has a mean survival level that is modified by the habitat environmental variable.

As the method of estimating spawning escapement for Labrador was based on commercial catches and exploitation rates, which ended in 1997; lagged spawner values will have missing components in year 2003. Thus, an alternative index of salmon abundance will be required in the future. Preliminary investigations into the development of a juvenile abundance index as an alternative index of salmon abundance was continued.

North American run-reconstruction model The North American run-reconstruction model has been used to estimate pre-fishery abundance of 1SW non-maturing and maturing 2SW fish adjusted by natural mortality to the time prior to the West Greenland fishery

(See Section 3). Estimates of 2SW returns prior to 1998 in Labrador are derived from estimated 2SW catches in the fishery using a range of assumptions regarding exploitation rates and origin of the catch. With the closure of the Labrador fishery, 1998 to 2000 returns were estimated as a proportion of the total for other areas based on historical data..

Update of thermal habitat: Thermal habitat has been updated to include 2001 and January and February 2002 year data. Two periods of decline in the available habitat are identified (1980 to 1984 and 1988 to 1995) in the February index (Table 7.4.1.1 and Figure 7.4.1.1). Available habitat for February increased (10%) in 2002 from 1,685 to 1,865. The 2002 February value is more than 10% higher than the long-term mean of 1,661.

Update of lagged spawners: The lagged spawner variable used in the model is an estimate of the 2SW parental stock of the PFA. Previous analyses indicated that the sum of lagged spawner components from Labrador, Newfoundland, Québec, and Scotia-Fundy and excluding Gulf and U.S. was the strongest explanatory variable for the model. Inclusion of the Gulf spawning component reduced the explanatory power of the variable. It is recognized that there are problems inherent in this variable. The exclusion of a major component of the spawning stock contributing to the PFA was less than satisfactory. As well, spawning escapement estimates for Labrador are not available for the years 1998–2001. The previously formulated lagged spawner variable will therefore not be available beyond 2002. Alternatives to the lagged spawner variable are being explored.

Forecast model for pre-fishery abundance of North American 2SW salmon

North American Forecast Model: The 2002 forecast of pre-fishery abundance was based on a modelling approach where habitat acts on PFA through survival rather than on absolute abundance.

In the case of the PFA model, the survival rate of salmon (PFA / Spawners) has a mean survival level that is modified by the habitat variable. A linear form of the model fits the natural log of PFA relative to the natural log of spawners and habitat variables.

The basis for the model is the same two predictor variables as were used from 1999 to 2001: thermal habitat for February (term H2) and lagged spawners (sum of lagged spawners from Labrador, Newfoundland, Scotia-Fundy and Quebec, term SLNQ) (ICES 1996/Assess:11). This was justified on the basis of studies showing that salmon stocks over wide geographic areas tend to have synchronous survival rates and that the winter period may be the critical stage for post-smolt survival and maturation (Scarnecchia 1989; Reddin and Shearer 1987; Friedland *et al.* 1993; Friedland *et al.* 1998). Consequently, the model used in 2001 was updated to reflect the inclusion of the additional value and the refinement of other parameters to the time series of pre-fishery abundance estimates.

There was a significant linear relationship between estimated and predicted values of pre-fishery abundance versus February thermal habitat and lagged spawners (SLNQ) (log transformed model: $F_{2,18} = 66.41$; $r^2 = 0.87$). All model parameters were significant at less than the 5% level. Individually, the two predictor variables are also significantly related to pre-fishery abundance. Similar to last year, February habitat accounted for 12% of the total sum of squares and SLNQ spawners accounted for 75%. The jackknife and simulated predicted values for pre-fishery abundance for 1978 to 2002 are shown in Table 7.4.1.1 and Figure 7.4.1.2. The predicted values fit the observed data quite well except in the late 1980s and 90s when abundance was low and there are small positive residuals at the end of the time series (Figure 7.4.1.1). Also the residual in 2000 is one of the highest in the time series. This may indicate a developing trend to negative residuals meaning that pre-fishery abundance will be over-forecasted. The predicted pre-fishery abundance for 2002 using the February thermal habitat and lagged spawner model is about 329,600 at the 50% probability level (Table 7.4.1.1).

Predictions continue to be influenced primarily by the spawning stock variable. Thus, low levels of spawning stocks would modify the predictions of pre-fishery abundance during periods of high levels of habitat. During 1998 and 1999 thermal habitat has increased considerably, but the predicted pre-fishery abundance has remained low due to the large decline in spawners (Figure 7.4.1.1). However, the estimated 2SW spawners have improved in the year 2002, resulting in an increase of forecasted pre-fishery abundance.

Using the current model to estimate the 2001 pre-fishery abundance yields a value of 332,455. Note that the previously reported values of pre-fishery abundance were based on natural mortality rates of M=0.01 were revised to M=0.03 and thus previously reported values of pre-fishery abundance cannot be compared to those reported herein this report. The inclusion of errors in the lagged spawners has been shown to increase the median value and to widen the distribution of the forecast (ICES CM 2000/ACFM:13). Also due to the time lag between forecasted and estimated prefishery abundance there is a delay of two years before comparison of estimated and forecasted values can be made. Consequently, any developing trend in high positive or negative residuals indicating a poor fit to recent data will be hard to detect until after the fishery.

Southern European Forecast Model: The development of a preliminary model to forecast the prefishery abundance of non-maturing (potential MSW) salmon from the Southern European stock group is discussed in Section 5. Stocks in this group are the main European contributors to the West Greenland fishery.

The proposed model is similar to the North American model.

The data used in the model (Table 7.4.1.2) consisted of:

- PFA: the pre-fishery abundance of MSW salmon from Southern Europe for the period 1977 to 2000 taken from the output of NEAC PFA model as reported in Section 2;
- Stock: the index used in the model is the 'lagged egg' numbers for the period 1977–2002 derived from the national PFA and CL analysis;
- Habitat: the same habitat index was used as in the North American PFA prediction model. (Table 7.4.1.1).

The prefishery abundance forecast in 2002 for Southern European MSW stock will decline to approximately 552,000. This is about one third of the estimated PFA in the mid 1970s, and lower PFA levels have only been estimated for three other years (1996 to 1998). The probability distribution of the 2002 forecast is shown in Section 2 (Table 5.3.1). Although the model is not strongly driven by Year this decline is consistent with the continuing decline in estimated lagged egg deposition (egg numbers) in Southern European stocks.

Stochastic Analyses for North American PFA

Although the exact error bounds for the estimates of prefishery abundance (NN1(i)) are unknown, minimum and maximum values of component catch and return estimates have been estimated. Simulation methods were used to generate the probability density function of NN1(i). These estimates will be used to develop risk analysis and catch advice presented in Section 7.4.2. to 7.4.3. Managers may use this information to determine the relative risks borne by the stock (i.e., not meeting spawning limits S_{lim}) versus the fishery (e.g., reduced short-term catches).

7.4.2 Development of catch options for 2002

Catch advice for 2002: The fishery allocation for West Greenland is for fisheries on 1SW salmon in 2002, whereas the allocation for North America can be harvested in fisheries on 1SW salmon in 2002 and/or in fisheries on 2SW salmon in 2003. To achieve spawner limits, a pool of fish must be set aside prior to fishery allocation in order to meet spawner limits and allow for natural mortality in the intervening months between the fishery and return to river. In 2000, the spawner limit for North America was 152,548 2SW fish. Thus, 212,189 pre-fishery abundance fish must be reserved ($152{,}548/\exp^{(-.03*11)}$) to equate to inriver S_{lim} because of natural mortality between Greenland and Canada. The difference between the value reported in last year's report of 170,286 is entirely due to the change in a natural mortality rate of 0.03 per month from 0.01 per month previously used.

Quota computation for the 2002 fishery requires an estimate of pre-fishery abundance [NN1], stock composition by continent [PropNA], mean weights of North American and European 1SW salmon [WT1SWNA and WT1SWE, respectively], and a correction factor for the expected sea-age composition of the total landings [ACF]. Exponentially smoothed values of the biological characteristics were based on the previous years (1996–1999) and those collected during the 2001sampling programme (Table 7.4.2.1).

The quota values based on this forecast between interquartile limits of the probability density function from Table 7.4.1.3 are in Table 7.4.2.1. At the sharing fraction (Fna) of 0.4 allocation to West Greenland, quota options range from 0 to 167 t.

7.4.3 Risk assessment of catch options

The provision of catch advice in a risk framework involves incorporating the uncertainty in all the factors used to develop the catch options. The ranges in the uncertainties of all the factors will result in assessments of differing levels of precision. The analysis of risk involves four steps: 1) identifying the sources of uncertainty; 2) describing the precision or imprecision of the assessment; 3) defining a management strategy; and 4) evaluating the probability of an event (either desirable or undesirable) resulting from the fishery action. The management of Atlantic salmon in the North American and Greenland Commission areas involves managing for a fixed escapement of salmon to rivers in North America. The conservation requirements to North America are considered to be a limit reference point. The undesirable event to be assessed is that the spawning escapement after fisheries will be below the conservation limit.

The risk analysis of catch options for Atlantic salmon from North America incorporates the following input parameter uncertainties:

1. the uncertainty in the conservation requirement,

2. the uncertainty of the pre-fishery abundance forecast, and

3. the uncertainty in the biological parameters used to translate catches (weight) into numbers of North American origin salmon.

North America is divided into six stock areas that correspond to the areas used to estimate returns and spawning escapements. Under the assumption of equal production from all stock areas (i.e., recruitment in direct proportion to the spawner requirement) just over 172,000 fish should escape to North America as spawners to achieve the spawner requirement in all six stock areas at a 50% probability level. This value is higher than the point estimate for the North American stock complex (152,548 2SW salmon) because it

includes the annual variation in proportion female and the objective to have sufficient escapement in six stock areas simultaneously.

Last year, ICES expressed concerns that the spawning requirement presently used for North America is for the continent as a whole and does not reflect the expected returns to the six regions, i.e., even if 172,000 2SW salmon reach the coast of North America, there will be severe under escapement in some regions. Specifically, the 2SW returns to Labrador, Scotia-Fundy and USA have been below their corresponding conservation limits since 1985. Between 1992 and 1997, the most recent years when estimates are available for all regions of North America, Quebec and Gulf regions have accounted for a disproportionate number of salmon relative to their 2SW requirements, (Figure 7.4.3.1)

Based on past performance, there is no reason to expect the abundance of salmon in the North Atlantic to be proportional to the regional 2SW spawner requirements. Assuming that the abundance of Atlantic salmon in 2002 will be proportional to the lagged spawners that would have contributed to the prefishery abundance, we can calculate the number of salmon required to return to North America to achieve region-specific conservation requirements. To achieve the Newfoundland 2SW requirement, just over 41,000 2SW in theory would be required to return to North America. In the regions with lower stock performance, returns to North America of about 441,000 fish would be required for the Scotia-Fundy region and returns to North America of more than 1.5 million fish would be required for achieving the USA conservation requirements (Table 7.4.3.1).

There is a zero chance that the returns to USA rivers will be anywhere near 29,000 2SW salmon in 2003. There is little chance of returns in 2003 being sufficient to meet the Scotia-Fundy requirement even in the absence of high seas fisheries. The other four regions could meet conservation requirements based on the realized returns in recent years and the anticipated PFA of salmon in 2002 (Table 7.4.3.1).

To provide a better guide to managers, an alternative risk analysis is proposed. ICES recommends that fisheries managers attempt to meet the conservation limits simultaneously in the four northern regions of North America: Labrador, Newfoundland, Quebec, and Gulf. For the two southern regions, Scotia-Fundy and USA, an alternate objective to that of achieving the conservation requirement would be to rebuild the stocks, i.e., assess fisheries relative to the objective of achieving minimally a pre-agreed increase in returns relative to the realized returns of a previous time. Rates of increase could be as low as a 10% annual increase relative to the stock levels observed in the previous five years for those stocks that are approaching a stock status objective. More aggressive rebuilding rates such as 25% per year could be used for stocks that are very far from their desired state. Both levels of rebuilding are quantified in the following risk analysis.

Model fitting and the confidence intervals for the pre-fishery abundance of non-maturing North American origin salmon are described in Section 7.4. The required elements for the risk analysis are the distributions of pre-fishery abundance and their associated probabilities (Figure 7.4.3.2).

The catch options table (Table 7.4.2.3) is calculated using the probability density function of the pre-fishery abundance forecasts and point estimates for the remaining parameters including the spawner reserve for North America and biological characteristics in the fishery (proportion of the 1SW catch which would be of North American origin, weight of 1SW North American and European fish, and the age correction factor). In the risk analysis, the biological characteristics for 2002 were assumed to potentially vary between the minimum and maximum values of the previous five years fisheries, 1997 to 2002.

The final step in the risk analysis of the catch options involves combining the conservation requirement with the probability distribution of the returns to North America for different catch options. The returns to North America are partitioned into regional returns based on the proportions lagged spawners for 2002. Estimated returns to each region are compared to the conservation objectives of Labrador, Newfoundland, Quebec, and Gulf. Estimated returns for Scotia-Fundy and US are compared to the objective of achieving at least a 10% increase or a 25% increase relative to average returns of the previous five years. The input parameters for the risk analysis are in Table 7.4.3.2.

The pre-fishery abundance of salmon in 2002 is expected to be moderate relative to recent years (Figure 7.4.3.2). In the absence of any marine induced fishing mortality, there is a high probability (85% probability) that the returns of 2SW salmon to North America in 2002 will be sufficient to meet the conservation requirements of the four northern regions (Labrador, Newfoundland, Quebec, and Gulf) (Table 7.4.3.3; Figure 7.4.3.3). There is also a high probability that the returns in the southern regions (Scotia-Fundy and USA) will increase by at least 10% relative to the returns of the previous five years if the predicted PFA abundance is realized.

There are no fishery allocations that will ensure (probability of 0.99) the objective of achieving the conservation requirements for 2SW salmon in the four northern regions or an alternative objective of seeing an increased number of 2SW salmon returning to the under escaped southern regions of North America. At a quota of 70 t in West Greenland and a subsequent allocation of 81 t to North America (based on the historical sharing agreement of 40:60), there is at best a 75% chance of meeting the conservation objectives in the four northern regions.

ICES concludes that the North American stock complex of non-maturing salmon remains in tenuous condition.

Increased spawning escapements to rivers of some areas of eastern North America resulted in improved abundance at the juvenile life stages, and perhaps now at adult life stages. Despite the closure of Canadian commercial fisheries in 1992 and subsequently in Labrador in 1998 and Quebec in 1999, sea survival of adults returning to rivers has not improved and in some areas has declined further. The abundance of maturing 1SW salmon has also declined in many areas of eastern North America. Associations between 1SW returns in year i and 2SW returns in year i+1 observed in several rivers in eastern Canada suggest that abundance of 2SW salmon in 2002 in eastern Canada will be similar to or less than recent years. Smolt production in 2000 and 2001 in monitored rivers of eastern Canada were similar to or below the average of the last five years and unless sea survival improves, the abundance of non-maturing 1SW salmon in the Northwest Atlantic is not expected to improve above the levels of the last five years.

There is little information available to confirm the possibility of an improvement in prefishery abundance in 2001 and 2002 as predicted by the model. One sea winter adult returns in 2002 will provide initial indications regarding the overall abundance of adult salmon in 2003. Although the model has successfully tracked two sharp increases in prefishery abundance previously, caution is urged regarding the harvest decisions for 2002. The increasing advantage associated with each additional spawner in under-seeded river systems makes a strong case for a conservative management strategy.

ICES also noted that the PFA of non-maturing 1SW salmon from Southern Europe has been declining steadily since the 1970s, and the preliminary quantitative prediction of PFA for this stock complex indicates that PFA will remain close to present low levels for each of the next two years (575,000 and 552,000 fish). As there is evidence from the prediction that PFA will decrease in the near future and the spawning escapement has not been significantly above conservation limit for the last six years. The stock group is therefore thought to remain very close to safe biological limits, and ICES therefore considers that precautionary reductions in exploitation rates are required for as many stocks as possible, in order to ensure that conservation requirements are met for each river stock with high probability. ICES also notes that mixed stock fisheries present particular threats to conservation.

Therefore, ICES considers the stock complex at West Greenland to be outside safe biological limits and recommends that there should be no exploitation of the 2001 smolt cohort as non-maturing 1SW fish in North America or at Greenland in 2002, and also recommends that the cohort should not be exploited as mature 2SW fish in North America in 2003. Exceptions are in-river harvests from stocks which can be shown to be above biologically-based spawning escapement requirements. Further, exploitation rates on this cohort (including possible by-catch in other fisheries) should be minimised in the North American Commission and in the West Greenland Commission Areas. It should also be noted that the assessment of stocks in Southern Europe, which are also exploited at West Greenland, has shown that these stocks are at, or below, their conservation limits and this further supports the advice for no fishery at West Greenland.

There are no fishery allocations that will ensure the objective of achieving the conservation requirements for 2SW salmon in the four northern regions together with the objective of seeing an increased number of 2SW salmon returning to the under escaped southern regions of North America. If, as occurred last year, a fishery is allowed at West Greenland, management measures should be set so that the probability of attaining conservation limits in the four northern regions of North America would be at least 75%. This will also ensure that some rebuilding in the southern regions (Scotia Fundy, USA) occurs.

ICES reiterates that, in order to meet conservation limits in all areas of North America, there should be no catch at West Greenland.

7.5 Changes to the model used to provide catch advice

There were no changes to the model structure used to forecast pre-fishery abundance (PFA) of non-maturing 1SW salmon or methods used to provide catch advice for the West Greenland fishery. However, a revised estimate of natural mortality occurring at sea has been adopted. Previous to this assessment, ICES used an instantaneous rate of natural mortality of 0.01 per month in the NEAC and NAC models to estimate PFA of salmon. Based on analytical work completed and reviewed over the past two years, a revised estimate of 0.03 per month was adopted for use in estimating PFA (see Section 7.2.1).

Natural mortality enters into the PFA model used to estimate the non-maturing 1SW component at the stage when the numbers of salmon alive at the beginning of the second sea winter are back-calculated from the estimated numbers of fish returning to home waters. Increasing natural mortality from 0.01 to 0.03 per month increases both the estimated PFA and conservation limit of non-maturing salmon by approximately 20%. In addition, the harvestable surplus of salmon (if a surplus exists) will also increase by the same amount. However, salmon not taken in the fishery (assuming that the full quota is harvested) will also be subject to the higher level of natural mortality, and as a result there is no change in the estimated numbers of fish returning to homewaters. It should also be noted that for 2003, the lagged spawner variable will need to be revised to account for missing data from Labrador and this will necessarily result in a change in the current model or development of alternative models.

It is anticipated that output from the NEAC PFA forecast model will be incorporated into the catch options advice for West Greenland.

7.6 Data deficiencies, monitoring needs and research requirements in the WGC area

1) Continued efforts should be made to improve the estimates of the annual catches of salmon taken for private sales and local consumption in Greenland.

2) The mean weights, sea and freshwater ages and continent of origin are essential parameters to provide catch advice for the West Greenland fishery. ICES recommends that the sampling program be continued and closely coordinated with fishery harvest plan to be executed annually in West Greenland.

3) Scale analysis of salmon captured at West Greenland indicated an infrequent appearance of escaped-farm salmon. To investigation this observation, farmed salmon need to be genetically characterized and included as baseline populations in continent of origin analyses of samples collected at West Greenland.

4) Continue testing for ISAv and other diseases in Atlantic salmon caught in West Greenland.

5) Development of more refined data characterizing fishing effort (e.g., vessel size, gear type, amount of gear deployed, soak time) would allow for detailed analyses of CPUE data to characterize availability of Atlantic salmon in West Greenland.

6) Future analyses should focus on partitioning total mortality into fishing and natural mortality to assess changes in fishing mortality related to management. Further, efforts should focus on evaluating sensitivity to detect changes attributed specifically to management actions in homewaters.

7) Development of alternative in-season measures of abundance such as relationships between 1SW returns to rivers from the same cohort should be investigated as a future source of confirmatory information of abundance.

8) The catch options for the West Greenland fishery are based almost entirely upon data taken from North American stocks. In view of the evidence of a long-term decline in the European stock components contributing to this fishery (southern European non-maturing 1SW recruits), ICES emphasized the need for information from these stocks to be incorporated into the modelling and abundance forecasts as soon as possible.

9) Further basic research is needed on the spatial/temporal distribution and migration patterns of salmon and their predators at sea to assist in explaining variability in survival rates.

10) Other indices of change, i.e., changes in age composition, size at age and sea survival, should also be included in this evaluation.

11) An ICES Study Group is needed to allow for a focused effort to investigate alternative models and management systems for providing scientific catch advice for mixed stock and homewater fisheries.

12) Development of alternative in-season measures of abundance such as relationships between 1SW returns to rivers from the same cohort should be investigated as a future method to confirm abundance.

Table 4.1.1.1 Nominal catch of SALMON by country (in tonnes round fresh weight), 1960-2001. (2001 figures include provisional data).

						East	West									Sweden	UK	UK	UK			Total	Unreported catches	
	Canada	Den.	Faroes	Finland	France	Grld.	Grld.	Iceland		Ireland	Norway	Russia	Spain	St. P.		(West)	(E & W)	(N.Irl.)	(Scotl.)	USA	Other	Reported	NASCO	International
Year	(1)		(2)				(3)	Wild	Ranch	(4,5)	(6)	(7)	(8)	& M.			(12)	(5,9)			(10)	Catch	Areas	waters (11)
1960	1636	-	-	-	-	-	60	100		743	1659	1100	33	-	40	283	139	1443	1	-	7237	-	-
1961	1583	-	-	-	-	-	127	127		707	1533	790	20	-	27	232	132	1185	1	-	6464	-	-
1962	1719	-	-	-	-	-	244	125		1459	1935	710	23	-	45	318	356	1738	1	-	8673	-	-
1963	1861	-	-	-	-	-	466	145		1458	1786	480	28	-	23	325	306	1725	1	-	8604	-	-
1964	2069	-	-	-	-	-	1539	135		1617	2147	590	34	-	36	307	377	1907	1	-	10759	-	-
1965	2116	-	-	-	-	-	861	133		1457	2000	590	42	-	40	320	281	1593	1	-	9434	-	-
1966	2369	-	-	-	-	-	1370	104	2	1238	1791	570	42	-	36	387	287	1595	1	-	9792	-	-
1967	2863	-	-	-	-	-	1601	144	2	1463	1980	883	43	-	25	420	449	2117	1	-	11991	-	-
1968	2111	-	5	-	-	-	1127	161	1	1413	1514	827	38	-	20	282	312	1578	1	403	9793	-	-
1969	2202	-	7	-	-	-	2210	131	2	1730	1383	360	54	-	22	377	267	1955	1	893	11594	-	-
1970	2323	-	12	-	-	-	2146	182	13	1787	1171	448	45	-	20	527	297	1392	1	922	11286	-	-
1971	1992	-	-	-	-	-	2689	196	8	1639	1207	417	16	-	18	426	234	1421	1	471	10735	-	-
1972	1759	-	9	32	34	-	2113	245	5	1804	1578	462	40	-	18	442	210	1727	1	486	10965	-	-
1973	2434	-	28	50	12	-	2341	148	8	1930	1726	772	24	-	23	450	182	2006	2.7	533	12670	-	-
1974	2539	-	20	76	13	-	1917	215	10	2128	1633	709	16	-	32	383	184	1628	0.9	373	11877	-	-
1975	2485	-	28	76	25	-	2030	145	21	2216	1537	811	27	-	26	447	164	1621	1.7	475	12136	-	-
1976	2506	-	40	66	9	<1	1175	216	9	1561	1530	542	21	2.5	20	208	113	1019	0.8	289	9327	-	-
1977	2545	-	40	59	19	6	1420	123	7	1372	1488	497	19	-	10	345	110	1160	2.4	192	9414	-	-
1978	1545	-	37	37	20	8	984	285	6	1230	1050	476	32	-	10	349	148	1323	4.1	138	7682	-	-
1979	1287	-	119	26	10	<0,5	1395	219	6	1097	1831	455	29	-	12	261	99	1076	2.5	193	8118	-	-
1980	2680	-	536	34	30	<0,5	1194	241	8	947	1830	664	47	-	17	360	122	1134	5.5	277	10127	-	-
1981	2437	-	1025	44	20	<0,5	1264	147	16	685	1656	463	25	-	26	493	101	1233	6	313	9954	-	-
1982	1798	-	606	54	20	<0,5	1077	130	17	993	1348	364	10	-	25	286	132	1092	6.4	437	8395	-	-
1983	1424	-	678	58	16	<0,5	310	166	32	1656	1550	507	23	3	28	429	187	1221	1.3	466	8755	-	-
1984	1112	-	628	46	25	<0,5	297	139	20	829	1623	593	18	3	40	345	78	1013	2.2	101	6912	-	-
1985	1133	-	566	49	22	7	864	162	55	1595	1561	659	13	3	45	361	98	913	2.1	-	8108	-	-
1986	1559	-	530	37	28	19	960	232	59	1730	1598	608	27	2.5	54	430	109	1271	1.9	-	9255	315	-
1987	1784	-	576	49	27	<0,5	966	181	40	1239	1385	564	18	2	47	302	56	922	1.2	-	8159	2788	-
1988	1310	-	243	36	32	4	893	217	180	1874	1076	420	18	2	40	395	114	882	0.9	-	7737	3248	-
1989	1139	-	364	52	14	-	337	140	136	1079	905	364	7	2	29	296	142	895	1.7	-	5903	2277	-
1990	911	13	315	60	15	-	274	146	280	567	930	313	7	1.9	33	338	94	624	2.4	-	4924	1890	180-350

Table 4.1.1.1 (Continued)

						East	West									Sweden	UK	UK	UK			Total	Unreported catches	
	Canada	Den.	Faroes	Finland	France	Grld.	Grld.	Iceland		Ireland	Norway	Russia	Spain	St. P.	(West)	(E & W)	(N.Irl.)	(Scotl.)	USA	Other	Reported	NASCO	International
Year	(1)		(2)				(3)	Wild	Ranch	(4,5)	(6)	(7)	(8)	& M.		(12)	(5,9)			(10)	Catch	Areas	waters (11)
1991	711	3.3	95	70	13	4	472	130	345	404	876	215	11	1.2	38	200	55	462	0.8	-	4106	1682	25-100
1992	522	10	23	77	20	5	237	175	460	630	867	167	11	2.3	49	171	91	600	0.7	-	4118	1962	25-100
1993	373	9	23	70	16	-	-	160	496	541	923	139	8	2.9	56	248	83	547	0.6	-	3696	1644	25-100
1994	355	6	6	49	18	-	-	140	308	804	996	141	10	3.4	44	324	91	649	0	-	3944	1276	25-100
1995	260	3.1	5	48	9	2	83	150	298	790	839	128	9	0.8	37	295	83	588	0	-	3628	1060	-
1996	292	1.7	-	44	14	0.1	92	122	239	687	787	131	7	1.6	33	183	77	427	0	-	3138	1123	-
1997	229	1.3	-	45	8	1	58	106	50	571	630	111	3	1.5	19	142	93	296	0	-	2365	827	-
1998	157	1.3	6	48	9	0	11	130	34	624	740	131	4	2.3	15	123	78	283	0	-	2397	1210	-
1999	152	0.5	0	62	11	0.4	19	119	26	515	811	103	6	2.3	16	150	53	199	0	-	2245	1027	-
2000	153	5.2	8	95	11	0	21	82	2	621	1176	124	-	2.3	33	219	78	274	0	-	2905	1265	-
2001	145	6.4	0	125	11	0	43	87	0	769	1267	114	12	2.2	33	183	53	227	0	-	3078	1170	-
Means																							
1996-2000	197	2	5	59	11	0	40	112	70	604	829	120	5	2	23	163	76	296	0	-	2610	1090	-
1991-2000	320	4	21	61	13	2	124	131	226	619	865	139	8	2	34	206	78	433	0	-	3254	1308	-

1. Includes estimates of some local sales, and, prior to 1984, by-catch.
2. Between 1991 & 1999, there was only a research fishery at Faroes.
In 1997 & 1999 no fishery took place, the commercial fishery resumed in 2000
3. Includes catches made in the West Greenland area by Norway, Faroes, Sweden and Denmark in 1965-1975.
4. From 1994, includes increased reporting of rod catches.
5. Catch on River Foyle allocated 50% Ireland and 50% N. Ireland.
6. Before 1966, sea trout and sea charr included (5% of total).
7. Figures from 1991 to 2000 do not include catches taken in the recently developed recreational (rod) fishery.
8. Weights prior to 1990 are estimated from 1994 mean weight. Weights from 1990 to 1999 based on mean wt. from R. Asturias. Weights for 2001 based on mean wt. from french 2001 rod catches (1 SW : 2.35 kg ; 2 SW : 4.57 kg).
9. Not including angling catch (mainly 1SW).
10. Includes catches in Norwegian Sea by vessels from Denmark, Sweden, Germany, Norway and Finland.
11. Estimates refer to season ending in given year.
12. Data for 1993-98 altered from previous reports to take account of catch & release

Table 4.2.1.1 Monthly mortality rate estimates for River Bush hatchery smolts from the 1974 to 1976 releases (data from Doubleday *et al*. 1979) and for the 1999 hatchery smolts (W. Crozier, Unpubl. Data).

Stock	Growth Model	Age Group	Smolt Cohort	Lifetime Survival	Mortality - 2nd Year at Sea 314 days	Monthly
River Bush Hatchery smolts	Exponential	Age-1	All three	8.5%	3.4%	0.3%
		Age-2,2+	All three	34.3%	1.5%	0.1%
		Age-1	1974	8.4%	3.4%	0.3%
			1975	13.0%	2.8%	0.3%
			1976	8.5%	3.4%	0.3%
		Age-2,2+	1974	26.8%	1.8%	0.2%
			1975	n.e.	n.e.	n.e.
			1976	24.5%	1.9%	0.2%
	Linear	Age-1	All three	7.3%	17.0%	1.8%
		Age-2,2+	All three	31.9%	7.8%	0.8%
		Age-1	1974	6.7%	17.5%	1.8%
			1975	10.9%	14.6%	1.5%
			1976	8.4%	16.2%	1.7%
		Age-2,2+	1974	24.7%	9.5%	0.9%
			1975	n.e.	n.e.	n.e.
			1976	22.4%	10.1%	1.0%

	Growth Model	Growth Data	Smolt Cohort	Lifetime Survival	Mortality - 2nd Year at Sea 11 months	Monthly
River Bush Age-1 Hatchery	Exponential	Doubleday et al. 1979	1999	2.7%	10.5%	1.0%
		W. Crozier (Unpubl. Data)	1999	2.4%	19.2%	1.9%
	Linear	Doubleday et al. 1979	1999	2.2%	28.0%	2.9%
		W. Crozier (Unpubl. Data)	1999	2.2%	28.0%	2.9%

Table 4.2.1.2 Summary of monthly mortality rate estimates during the second year at sea for various stocks of Atlantic salmon in the North Atlantic.

Stock	Origin	Smolt cohorts			N	Method of estimation	Mortality rate (% per month) Median	Min.	Max.
North America									
LaHave River	Wild	1996	to	1999	4	Inverse-weight	2.8%	2.3%	3.3%
LaHave River	Hatchery	1972	to	1999	28	Inverse-weight	3.3%	2.3%	4.4%
Northwest Miramichi	Wild	1999	to	1999	1	Inverse-weight	2.7%	-	-
River Trinite	Wild	1984	to	1999	16	Inverse-weight	3.4%	2.9%	4.3%
Sandhill River	Wild	1969	to	1971	3	Inverse-weight	1.5%	1.4%	1.7%
Saint John River	Hatchery: age-1 smolts	1991	to	1998	7	Maturity schedule	17.6%	11.5%	20.8%
LaHave River	Wild	1996	to	1996	1	Maturity schedule	12.0%		
River Trinite	Wild	1984	to	1990	7	Maturity scehdule	12.6%	7.9%	14.7%
River Trinite	Wild	1991	to	1999	9	Maturity scehdule	5.1%	1.4%	9.1%
Miramchi River	Wild	1983	to	1997	15	Maturity schedule	12.4%	3.6%	19.2%
NEAC									
River Bush	Hatchery: age-1 smolts	1974	to	1976	3	Inverse-weight	1.7%	1.5%	1.8%
	Hatchery: age-2 smolts	1974	to	1976	3	Inverse-weight	1.0%	0.9%	1.0%
	Hatchery: age-1 smolts	1999	to	1999	1	Inverse-weight	2.9%	-	-
River Scorff	Wild	1995	to	1997	3	Maturity schedule	16.2%	15.6%	16.7%

Table 4.2.2.1 Percentage increase in estimated NEAC PFA resulting from increasing M from 0.01 to levels between 0.015 and 0.050 per month. (Return times for 1SW and MSW salmon are assumed to be 8 months and 17 months respectively)

New M	Percentage increase in estimated PFA	
	1SW	MSW
	(for 8 months)	(for 17 months)
0.015	4%	9%
0.020	8%	19%
0.025	13%	29%
0.030	17%	40%
0.035	22%	53%
0.040	27%	67%
0.045	32%	81%
0.050	38%	97%

Table 4.2.2.2 Effects on estimates of PFA, CL, SER, Harvestable surplus, etc. for Southern European MSW salmon stocks for M equal to 0.01 and 0.03 per month.

	Current M	New M	Effect of higher M
adult M	0.010	0.030	
time (months)	17.0	17.0	
Est. returns	600,000	600,000	
Est. PFA	711,183	999,175	40%
CL	501,445	501,445	0%
SER	594,365	835,052	40%
Harvestable surplus	116,818	164,123	40%
40% allocation to fishery	46,727	65,649	40%
Survivors from fishery	664,456	933,526	40%
Returns to HWs	560,578	560,578	0%

Table 4.3.7.1 Summary of Atlantic salmon tagged and marked in 2001. 'Hatchery' and 'Wild' refer to smolts or parr; 'Adult' refers to wild and hatchery fish. Data from Belgium and Spain were not available. Fish were not tagged in Finland. PIT tags were not included.

		Primary Tag or Mark			
Country	Origin	Microtag	External mark	Adipose clip	Total
Canada	Hatchery	0	44,334	1,870,421	1,914,755
	Wild	0	13,097	101	13,198
	Adult	0	6,320	0	6,320
	Total	0	63,751	1,870,522	1,934,273
Denmark	Hatchery	3	3	3	9
	Wild	3	3	3	9
	Adult	3	3	3	9
	Total	9	9	9	27
France	Hatchery	0	2,489	297,604	300,093
	Wild	0	0	0	0
	Adult	0	0	0	0
	Total	0	2,489	297,604	300,093
Iceland	Hatchery	139,041	0	0	139,041
	Wild	2,183	0	0	2,183
	Adult	0	217	0	217
	Total	141,224	217	0	141,441
Ireland	Hatchery	267,967	0	0	267,967
	Wild	3,755	0	0	3,755
	Adult	0	0	0	0
	Total	271,722	0	0	271,722
Norway	Hatchery	0	40,418	0	40,418
	Wild	0	3,893	0	3,893
	Adult	0	153	0	153
	Total	0	44,464	0	44,464
Russia	Hatchery	0	1,000	585,300	586,300
	Wild	0	94	0	94
	Adult	0	2,860	0	2,860
	Total	0	3,954	585,300	589,254
Sweden	Hatchery	0	4,920	31,285	36,205
	Wild	0	287	0	287
	Adult	0	0	0	0
	Total	0	5,207	31,285	36,492
UK (England & Wales)	Hatchery	55,445	5,136	136,231	196,812
	Wild	364	1,551	1,715	3,630
	Adult	0	1,187	0	1,187
	Total	55,809	7,874	137,946	201,629
UK (N. Ireland)	Hatchery	32,321	0	46,853	79,174
	Wild	1,350	0	0	1,350
	Adult	0	0	0	0
	Total	33,671	0	46,853	80,524
UK (Scotland)	Hatchery	6,250	0	0	6,250
	Wild	6,751	4,592	0	11,343
	Adult	500	2,434	0	2,934
	Total	13,501	7,026	0	20,527
USA	Hatchery	0	249,744	0	249,744
	Wild	0	1,578	0	1,578
	Adult	0	5,340	0	5,340
	Total	0	256,662	0	256,662
All Countries	Hatchery	501,037	348,054	2,967,707	3,816,798
	Wild	14,416	25,105	1,829	41,350
	Adult	513	18,524	13	19,050
	Total	515,966	391,683	2,969,549	3,877,198

Table 5.3.1 Bootstrapped probability distribution of forecast for 2002

Probability level	Forecast
10%	418,706
20%	463,962
30%	500,049
40%	532,903
50%	552,000
60%	603,756
70%	659,714
80%	731,029
90%	813,182

Table 6.1.2.1 Definitions of key variables used in continental run-reconstruction models for North American salmon.

i	Year of the fishery on 1SW salmon in Greenland and Canada
M	Natural mortality rate (0.03 per month)
t1	Time between the mid-point of the Canadian fishery and return to river = 1 months
S1	Survival of 1SW salmon between the homewater fishery and return to river {exp(-M t1)}
H_s(i)	Number of "Small" salmon caught in Canada in year i; fish <2.7 kg
H_l(i)	Number of "Large" salmon caught in Canada in year i; fish >=2.7 kg
AH_s	Aboriginal and resident food harvests of small salmon in northern Labrador
AH_l	Aboriginal and resident food harvest of large salmon in northern Labrador
f_imm	Fraction of 1SW salmon that are immature, i.e., non-maturing: range = 0.1 to 0.2
af_imm	Fraction of 1SW salmon that are immature in native and resident food fisheries in N Labrador
q	Fraction of 1SW salmon present in the large size market category; range = 0.1 to 0.3
MC1(i)	Harvest of maturing 1SW salmon in Newfoundland and Labrador in year i
i+1	Year of fishery on 2SW salmon in Canada
MR1(i)	Return estimates of maturing 1SW salmon in Atlantic Canada in year i
NN1(i)	Pre-fishery abundance of non-maturing 1SW + maturing 2SW salmon in year i
NR(i)	Return estimates of non-maturing + maturing 2SW salmon in year i
NR2(i+1)	Return estimates of maturing 2SW salmon in Canada
NC1(i)	Harvest of non-maturing 1SW salmon in Nfld + Labrador in year i
NC2(i+1)	Harvest of maturing 2SW salmon in Canada
NG(i)	Catch of 1SW North American origin salmon at Greenland
S2	Survival of 2SW salmon between Greenland and homewater fisheries
MN1(i)	Pre-fishery abundance of maturing 1SW salmon in year I
RFL1	Labrador raising factor for 1SW used to adjust pre-fishery abundance
RFL2	Labrador raising factor for 2SW used to adjust pre-fishery abundance

Table 3.1.2 Run reconstruction data inputs for harvests used to estimate pre-fishery abundance of maturing and non-maturing 1SW salmon of North American origin (terms defined in Table 4.2.3.2).

	{1}			{1-7, 14b}		{8-14a}		{1-7, 14b}
1SW Year (i)	AH_Small (i)	AH_Large (i+1)	AH_Large (i)	H_Small (i)	H_Large (i)	H_Small (i)	H_Large (i+1)	H_Large (i+1)
1971	0	0	0	158896	199176	70936	42861	144496
1972	0	0	0	143232	144496	111141	43627	227779
1973	0	0	0	188725	227779	176907	85714	196726
1974	0	0	0	192195	196726	153278	72814	215025
1975	0	0	0	302348	215025	91935	95714	210858
1976	0	0	0	221766	210858	118779	63449	231393
1977	0	0	0	220093	231393	57472	37653	155546
1978	0	0	0	102403	155546	38180	29122	82174
1979	0	0	0	186558	82174	62622	54307	211896
1980	0	0	0	290127	211896	94291	38663	211006
1981	0	0	0	288902	211006	60668	35055	129319
1982	0	0	0	222894	129319	77017	28215	108430
1983	0	0	0	166033	108430	55683	15135	87742
1984	0	0	0	123774	87742	52813	24383	70970
1985	0	0	0	178719	70970	79275	22036	107561
1986	0	0	0	222671	107561	91912	19241	146242
1987	0	0	0	281762	146242	82401	14763	86047
1988	0	0	0	198484	86047	74620	15577	85319
1989	0	0	0	172861	85319	60884	11639	59334
1990	0	0	0	104788	59334	46053	10259	39257
1991	0	0	0	89099	39257	42721	0	32341
1992	0	0	0	24249	32341	0	0	17096
1993	0	0	0	17074	17096	0	0	15377
1994	0	0	0	8640	15377	0	0	11176
1995	0	0	0	7980	11176	0	0	7272
1996	0	0	0	7849	7272	0	0	6943
1997	0	2269	0	9753	6943	0	0	0
1998	2988	1084	2269	0	0	0	0	0
1999	2739	1352	1084	0	0	0	0	0
2000	5323	2334	1352	0	0	0	0	0
2001	4730	0	2334	0	0	0	0	0

Table 6.5.1.1 Catch options for 2002 North American fisheries

Catch Options for 2002 North American Fisheries (Probability levels refer to probability density function estimates of pre-fishery abundance)

Probability Level	Pre-fishery Abundance Forecast	Catch Options in 2SW Salmon Equivalents (no.)
25	209,095	0
30	232,019	6,935
35	255,481	23,802
40	279,932	41,381
45	305,300	59,618
50	332,455	79,141

Table 6.5.1.2 Fishing mortalities of 2 SW salmon equivalents by North American fisheries, 1972-2002. Only mid-points of the estimated values have been used.

T

Year	CANADA										USA	Total	
	MIXED STOCK				TERMINAL FISHERIES IN YEAR i								
	NF-LAB Comm 1SW (Yr i-1) (b)	% 1SW of total 2SW equivalents	NF-LAB Comm 2SW (Yr i) (b)	NF-Lab comm total	Labrador rivers (a)	Nfld rivers (a)	Quebec Region	Gulf Region	Scotia - Fundy Region	Canadian total	Year i		Terminal Fisheries as a % of Total
1972	20,857	9	153,775	174,632	314	633	27,417	22,389	6,801	232,187	346	232,532	25
1973	17,971	6	219,175	237,146	719	895	32,751	17,915	6,680	296,107	327	296,434	20
1974	24,564	7	235,910	260,475	593	542	47,631	21,429	12,734	343,404	247	343,651	24
1975	24,181	7	237,598	261,779	241	528	41,097	15,675	12,375	331,694	389	332,084	21
1976	35,801	10	256,586	292,388	618	412	42,139	18,088	11,111	364,757	191	364,948	20
1977	27,519	8	241,217	268,736	954	946	42,301	33,433	15,562	361,931	1,355	363,287	26
1978	27,836	11	157,299	185,135	580	559	37,421	23,803	10,781	258,278	894	259,172	29
1979	14,086	10	92,058	106,144	469	144	25,234	6,299	4,506	142,796	433	143,229	26
1980	20,894	6	217,209	238,103	646	699	53,567	29,828	18,411	341,253	1,533	342,785	31
1981	34,486	11	201,336	235,822	384	485	44,375	16,326	13,988	311,381	1,267	312,648	25
1982	34,341	14	134,417	168,757	473	433	35,204	25,707	12,353	242,927	1,413	244,339	31
1983	25,701	12	111,562	137,263	313	445	34,472	27,094	13,515	213,102	386	213,488	36
1984	19,432	14	82,807	102,238	379	215	24,408	6,041	3,971	137,253	675	137,928	26
1985	14,650	11	78,760	93,410	219	15	27,483	2,745	4,930	128,802	645	129,447	28
1986	19,832	12	104,890	124,723	340	39	33,846	4,582	2,824	166,354	606	166,959	25
1987	25,163	13	132,208	157,371	457	20	33,807	3,795	1,370	196,820	300	197,120	20
1988	32,081	21	81,130	113,211	514	29	34,262	3,922	1,373	153,311	248	153,559	26
1989	22,197	16	81,355	103,551	337	9	28,901	3,513	265	136,575	397	136,972	24
1990	19,577	18	57,359	76,937	261	24	27,986	2,847	593	108,649	696	109,344	30
1991	12,048	14	40,433	52,481	66	16	29,277	1,942	1,331	85,114	231	85,344	39
1992	9,979	14	25,108	35,087	581	67	30,016	4,412	1,114	71,278	167	71,445	51
1993	3,229	7	13,273	16,502	273	63	23,153	2,977	1,110	44,078	166	44,244	63
1994	2,139	5	11,938	14,077	365	80	24,052	2,382	756	41,712	1	41,714	66
1995	1,242	3	8,677	9,918	420	92	23,331	2,025	330	36,116	0	36,116	73
1996	1,075	3	5,646	6,721	320	108	22,413	2,587	766	32,915	0	32,915	80
1997	969	3	5,390	6,360	175	136	18,574	2,085	581	27,910	0	27,910	77
1998	1,155	7	1,872	3,027	268	129	11,256	2,291	322	17,292	0	17,292	82
1999	179	1	894	1,073	268	111	9,032	1,387	450	12,320	0	12,320	91
2000	152	1	1,115	1,267	268	372	9,425	2,058	193	13,583	0	13,583	91
2001	286	2	1,925	2,212	268	264	10,104	2,055	255	15,157	0	15,157	85
2002	268	-	-	-	-	-	-	-	-	-	-	-	-

NF-Lab comm as 1SW = NC1(mid-pt) * 0.677057 (M of 0.03 per month for 13 months to July for Canadian terminal fisheries)
NF-Lab comm as 2SW = NC2 (mid-pt) * 0.970446 (M of 0.03 per month for 1 month to July of Canadian terminal
Terminal fisheries = 2SW returns (mid-pt) - 2SW spawners (mid-pt)
a - starting in 1993, includes estimated mortality of 10% on hook and released fish
b - starting in 1998, there was no commercial fishery in Labrador; numbers reflect size of aboriginal fish harvest in 1998-2001 and resident food fishery harvest in 2000-

Table 6.5.1.3 History of fishing related mortalities of North American salmon as equivalents, 1972-2002.

Year	Canadian total	USA total	North America Grand Total	% USA of Total North American	Greenland total	NW Atlantic Total	Harvest in homewaters as % of total NW Atlantic
1972	232,187	346	232,532	0.15	206,814	439,347	53
1973	296,107	327	296,434	0.11	144,348	440,782	67
1974	343,404	247	343,651	0.07	173,615	517,266	66
1975	331,694	389	332,084	0.12	158,583	490,667	68
1976	364,757	191	364,948	0.05	200,464	565,412	65
1977	361,931	1,355	363,287	0.37	112,077	475,364	76
1978	258,278	894	259,172	0.34	136,386	395,559	66
1979	142,796	433	143,229	0.30	85,446	228,676	63
1980	341,253	1,533	342,785	0.45	143,829	486,614	70
1981	311,381	1,267	312,648	0.41	135,157	447,805	70
1982	242,927	1,413	244,339	0.58	163,718	408,058	60
1983	213,102	386	213,488	0.18	139,985	353,473	60
1984	137,253	675	137,928	0.49	23,897	161,825	85
1985	128,802	645	129,447	0.50	27,978	157,425	82
1986	166,354	606	166,959	0.36	100,098	267,057	63
1987	196,820	300	197,120	0.15	123,472	320,592	61
1988	153,311	248	153,559	0.16	124,868	278,426	55
1989	136,575	397	136,972	0.29	83,947	220,919	62
1990	108,649	696	109,344	0.64	43,634	152,978	71
1991	85,114	231	85,344	0.27	52,560	137,904	62
1992	71,278	167	71,445	0.23	79,571	151,015	47
1993	44,078	166	44,244	0.38	30,091	74,335	60
1994	41,712	1	41,714	0.00	0	41,714	100
1995	36,116	0	36,116	0.00	0	36,116	100
1996	32,915	0	32,915	0.00	15,343	48,257	68
1997	27,910	0	27,910	0.00	15,776	43,686	64
1998	17,292	0	17,292	0.00	12,088	29,380	59
1999	12,320	0	12,320	0.00	2,175	14,495	85
2000	13,583	0	13,583	0.00	3,863	17,446	78
2001	15,157	0	15,157	0.00	4,005	19,162	79
2002	-	-	-	-	7,053	-	-

Greenland harvest of 2SW equivalents = NG1 * 0.718924 (M of 0.03 per month for 11 months to July of Canadian terminal fisheries)

Table 7.1.1.1 The weighted proportions and numbers of North American and European Atlantic salmon caught at West Greenland 1982-1992 and 1995-2001. Numbers are rounded to the nearest hundred fish.

	Proportion weighted by catch in number		Numbers of Salmon caught	
Year	NA	E	NA	E
1982	57	43	192200	143800
1983	40	60	39500	60500
1984	54	46	48800	41200
1985	47	53	143500	161500
1986	59	41	188300	131900
1987	59	41	171900	126400
1988	43	57	125500	168800
1989	55	45	65000	52700
1990	74	26	62400	21700
1991	63	37	111700	65400
1992	45	55	46900	38500
1993	-	-	-	-
1994	-	-	-	-
1995	67	33	21400	10700
1996	73	27	22400	9700
1997	85	15	18000	3300
1998	79	21	3100	900
1999	91	9	5700	600
2000	65	35	5100	2700
2001	67	33	9849	5389

Table 7.1.2.1. Distribution of commercial fishing effort (excluding private landings) by calendar week (Monday – Sunday beginning on the Monday nearest August 15th) and NAFO statistical area from 1987 to 2001.

Year	Week	1A	1B	1C	1D	1E	1F	XIV	Total
1997	1	0	24	78	10	68	81	0	**261**
	2	2	20	56	8	48	42	1	**177**
	3	2	5	19	0	11	17	3	**57**
	4	0	4	20	0	7	20	9	**60**
	5	1	9	50	6	10	15	15	**106**
	6	0	0	30	4	10	4	3	**51**
	Total	**5**	**62**	**253**	**28**	**153**	**179**	**31**	**712**
1998	1	6	1	3	1	0	8	0	**19**
	2	2	0	4	1	0	4	0	**11**
	3	3	0	2	0	0	3	0	**8**
	4	2	0	0	0	1	1	0	**4**
	5	1	0	2	0	0	3	0	**6**
	6	0	1	1	0	0	1	0	**3**
	7 & Later	1	2	5	2	0	5	0	**15**
	Total	**15**	**4**	**17**	**4**	**1**	**25**	**0**	**66**
1999	1	0	0	1	1	0	6	0	**8**
	2	0	1	13	5	0	0	0	**19**
	3	0	1	8	0	0	1	2	**12**
	4	0	0	9	2	1	7	0	**19**
	5	1	0	4	2	2	0	0	**9**
	6	0	0	10	2	0	1	0	**13**
	7 & Later	2	18	35	29	1	3	0	**88**
	Total	**3**	**20**	**80**	**41**	**4**	**18**	**2**	**168**
2000	**1**	**1**	**1**	**6**	**16**	**2**	**32**	**0**	**58**
2001	1	0	0	0	22	0	64	0	**86**
	2	0	0	5	14	0	37	0	**56**
	3	0	1	15	11	0	25	0	**52**
	4	0	6	7	1	0	24	0	**38**
	5	0	1	10	0	0	15	0	**26**
	6	0	0	7	0	0	5	0	**12**
	7 & Later	0	0	6	1	0	2	0	**9**
	Total	**0**	**8**	**50**	**49**	**0**	**172**	**0**	**280**

Table 7.1.2.2 Commercial (excluding private landings) catch per unit effort [live weight (kg) / landing] by calendar week (Monday – Sunday beginning on the Monday nearest August 15th) from 1997 to 2001.

Year	Week	Effort Units	CPUE (kg/landing-day) by Week	CPUE (kg/landing-day) by Harvest Period	Aggregate CPUE by Harvest Period
1997	1	**261**	89	89	89
	2	**177**	75	72	81
	3	**57**	63		
	4	**60**	59		
	5	**106**	74	68	--
	6	**51**	67		
	Total	**712**	**77**	**77**	--
1998	1	**19**	57	57	57
	2	**11**	44	46	51
	3	**8**	48		
	4	**4**	54		
	5	**6**	59	131	--
	6	**3**	87		
	7 & Later	**15**	190		
	Total	**66**	**85**	**85**	--
1999	1	**8**	82	82	82
	2	**19**	184	136	125
	3	**12**	61		
	4	**19**	171		
	5	**9**	140	83	--
	6	**13**	57		
	7 & Later	**88**	62		
	Total	**168**	**93**		--
2000	**1**	**58**	**343**	**343**	343
2001	1	**86**	115	115	115
	2	**56**	118	107	111
	3	**52**	96		
	4	**38**	161		
	5	**26**	192	153	--
	6	**12**	90		
	7 & Later	**9**	91		
	Total	**280**	**123**	**123**	--

Table. 7.1.4.1 Distribution of coded wire microtag recoveries by NAFO Division and the numbers of tagged fish released for North American and European stocks, 1985 to 1992. Numbers at large represent fish released in the previous year.

Continent	Year	Number of Recoveries by NAFO Division							Number
		1A	1B	1C	1D	1E	1F	Total	at large
N. America	1985	0	0	0	0	0	0	0	
	1986	0	10	0	11	4	1	26	178,888
	1987	0	33	0	43	11	16	103	517,435
	1988	2	25	0	40	12	2	81	702,900
	1989	0	31	0	34	7	0	72	736,722
	1990	0	0	16	29	1	0	46	720,110
	1991	0	0	14	9	5	0	28	962,019
	1992	0	0	31	0	6	14	51	602,675
	All years	2	99	61	166	46	33	407	4,420,749
	%	0.5	24.3	15.0	40.8	11.3	8.1		
Europe	1985	0	14	2	15	3	0	34	
	1986	0	15	0	20	5	4	44	381,766
	1987	0	13	0	18	7	5	43	361,340
	1988	1	10	0	11	6	1	29	490,620
	1989	0	10	0	10	7	0	27	645,742
	1990	0	0	1	3	4	0	8	851,487
	1991	0	0	4	3	2	0	9	848,675
	1992	0	0	7	0	13	10	30	1,097,663
	All years	1	62	14	80	47	20	224	4,677,293
	%	0.4	27.7	6.3	35.7	21.0	8.9		

Pre-fishery abundance estimates, thermal habitat index for February based on sea surface temperature (H2), lagged spawner index for North America excluding Gulf and US spawners (SLNQ), results of a jacknife cross-validation of the multiplicative forecast model, and simulated forecasts.

	Pre-fishery abundance			Thermal Habitat	Lagged spawners (SLNQ)			Jacknife Cross-validation	
Year	Low	High	Mid-point	February (H2)	Low	High	Mid-point	Prediction	Residuals
1971	642,329	819,161	730,745	2,011	.	.	.	.	.
1972	636,223	847,929	742,076	1,990	.	.	.	.	.
1973	767,427	1,001,959	884,693	1,708	.	.	.	.	.
1974	711,852	923,630	817,741	1,862	.	.	.	.	.
1975	801,808	1,032,778	917,293	1,827	.	.	.	.	.
1976	710,616	970,441	840,529	1,676	.	.	.	.	.
1977	574,996	766,338	670,667	1,915	.	.	.	.	.
1978	325,344	423,326	374,335	1,951	35,453	81,767	58,610	425,024	-50,688
1979	725,593	969,695	847,644	2,058	42,626	94,677	68,652	718,629	129,015
1980	626,755	845,327	736,041	1,823	43,173	97,017	70,095	663,245	72,796
1981	589,988	775,253	682,620	1,912	43,268	97,575	70,421	733,879	-51,259
1982	491,695	642,923	567,309	1,703	43,381	98,372	70,876	644,223	-76,914
1983	279,924	399,893	339,909	1,416	40,413	91,967	66,190	425,449	-85,540
1984	290,960	413,606	352,283	1,257	37,647	84,066	60,856	275,323	76,960
1985	455,731	624,417	540,074	1,410	39,344	83,435	61,389	295,522	244,551
1986	490,832	658,410	574,621	1,688	40,567	91,757	66,162	502,977	71,644
1987	444,070	596,354	520,212	1,627	36,636	88,818	62,727	404,174	116,038
1988	359,883	485,729	422,806	1,698	37,131	83,891	60,511	383,809	38,997
1989	279,510	404,579	342,045	1,642	41,955	86,459	64,207	454,430	-112,385
1990	250,138	343,986	297,062	1,503	40,948	81,667	61,307	350,810	-53,748
1991	282,412	405,168	343,790	1,357	37,582	72,966	55,274	210,786	133,004
1992	167,578	256,321	211,949	1,381	35,596	71,384	53,490	206,923	5,027
1993	118,852	224,147	171,500	1,252	38,387	79,232	58,810	277,951	-106,451
1994	137,048	270,162	203,605	1,329	38,395	75,762	57,079	249,397	-45,792
1995	144,618	247,008	195,813	1,311	36,740	69,943	53,342	195,165	648
1996	122,042	192,428	157,235	1,470	33,492	61,600	47,546	151,964	5,271
1997	80,686	146,928	113,807	1,594	29,876	55,241	42,558	118,042	-4,236
1998	68,977	146,973	107,975	1,849	25,629	50,461	38,045	95,636	12,339
1999	67,666	149,236	108,451	1,741	25,658	52,637	39,147	98,008	10,443
2000	81,470	169,954	125,712	1,634	32,960	68,185	50,572	229,349	-103,637
2001	.	.	.	1,685	37,414	81,709	59,561	*332,455* [1]	
2002	.	.	.	1,865	33,942	74,377	54,159	*329,552* [1]	

[1] Simulated forecast values.

Table 7.4.1.2 Input data for the forecast model for Southern European MSW salmon stocks. (See text for explanation of data sources.)

Year	Habitat	Lagged eggs	PFA
1977	1915	4,881,591	1,542,421
1978	1951	4,808,109	1,143,533
1979	2058	4,541,188	1,529,837
1980	1823	3,698,662	1,559,713
1981	1912	3,249,157	1,178,577
1982	1703	3,273,494	1,424,093
1983	1416	3,163,490	994,806
1984	1257	3,038,648	1,150,359
1985	1410	3,094,417	1,568,086
1986	1688	2,984,705	1,195,120
1987	1627	3,762,336	1,474,693
1988	1698	3,272,991	1,367,850
1989	1642	3,466,012	1,032,277
1990	1503	3,990,425	739,319
1991	1357	3,942,158	995,542
1992	1381	4,211,723	861,097
1993	1252	4,254,457	974,718
1994	1329	3,532,550	888,908
1995	1311	2,938,459	711,978
1996	1470	3,138,096	535,690
1997	1594	3,469,051	517,974
1998	1849	3,412,299	442,299
1999	1741	3,286,164	650,946
2000	1634	2,913,060	624,131
2001	1685	2,445,038	
2002	1865	2,360,306	

Table 7.4.1.3 Multiplicative model estimate of pre-fishery abundance for North American salmon in 2002 with probability levels between 5 and 95%.

Cumulative Density Function %	Forecast
5	101880
10	132305
15	157875
20	181472
25	204485
30	227572
35	251166
40	275683
45	301666
50	329552
55	359752
60	392915
65	430495
70	474268
75	526212
80	590251
85	674419
90	797109
95	1021989

Table 7.4.2.1 Quota options (mt) for 2001 at West Greenland based on H2-SLNQ multiplicative forecasts of fishery abundance. Proportion at West Greenland refers to the fraction of harvestable surplus allocated to the West Greenland fishery. The probability level refers to the pre-fishery abundance levels derived from the probability density function.

Prob.	Proportion at West Greenland (Fna)										
level	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
25	0	0	0	0	0	0	0	0	0	0	0
30	0	5	11	16	22	27	33	38	44	49	55
35	0	14	28	42	55	69	83	97	111	125	139
40	0	23	45	68	90	113	136	158	181	203	226
45	0	32	64	95	127	159	191	223	255	286	318
50	0	42	84	125	167	209	251	292	334	376	418

Sp. res =	212,189
Prop NA =	0.803
WT1SWNA =	2.687
WT1SWE =	2.862
ACF =	1.050

Table 7.4.3.1 Total prefishery abundance (PFA) of Atlantic salmon required to meet regional 2SW conservation limits for the six regions of North America.

	2SW Conservation Limit		Lagged spawners for 2002		PFA required to meet regional 2SW conservation limits
Region	Number of fish	Proportion of North America	Number of fish	Proportion of North America	
Labrador	34,746	0.228	22,527	0.305	158,461
Newfoundland	4,022	0.026	7,215	0.098	57,086
Quebec	29,446	0.193	20,286	0.275	148,940
Gulf	30,430	0.199	18,205	0.247	171,365
Scotia-Fundy	24,705	0.162	4,133	0.056	613,640
USA	29,199	0.191	1,400	0.019	2,137,625
Total	152,548	1.000	73,764	1.000	

Table 7.4.3.2 Input parameters for a risk analysis to achieve conservation limits (S_{lim}) for Labrador, Newfoundland, Quebec, and Gulf, while achieving at least a 10% or 25% increase in returns to Scotia-Fundy and USA.

	Management Objective			
	Achieving conservation requirement	Rebuilding of 2SW salmon abundance		Expected proportion of 2002 PFA
Region	Number of 2SW fish	at ≥ 10% increase	at ≥25% increase	
Labrador	34,746			0.305
Newfoundland	4,022			0.098
Quebec	29,446			0.275
Gulf	30,430			0.247
Scotia-Fundy		5,061	5,751	0.056
USA		1,238	1,407	0.019

Table 7.4.3.3 Probability profiles for the management objectives of achieving the 2SW conservation limits simultaneously in the four northern areas of North America (Labrador, Newfoundland, Quebec, Gulf) and achieving the stock rebuilding objectives (examples: minimally 10% or minimally 25% increase in returns of 2SW salmon in 2003) in the two southern areas (Scotia-Fundy and USA) relative to quota options for West Greenland assuming a 40:60 allocation (Fna) of the salmon from North Amrecia.

Probability of meeting management objectives			
Allocation Agreement Greenland @).4 **Tons**	Simultaneous Conservation (Lab, NF, Queb, Gulf)	Simultaneous Rebuilding (SF, USA) >=10% in 2003	>=25% IN 2003
0	0.85	0.93	0.91
5	0.85	0.93	0.90
10	0.84	0.92	0.90
15	0.83	0.92	0.89
20	0.83	0.91	0.88
25	0.82	0.91	0.88
30	0.81	0.90	0.87
35	0.80	0.90	0.87
40	0.80	0.89	0.86
45	0.79	0.88	0.85
50	0.78	0.88	0.84
55	0.77	0.87	0.84
60	0.76	0.87	0.83
65	0.76	0.86	0.82
70	**0.75**	0.85	0.82
75	0.74	0.85	0.81
80	0.73	0.84	0.80
85	0.73	0.83	0.79
90	0.72	0.82	0.78
95	0.71	0.82	0.78
100	0.70	0.81	0.77
110	0.69	0.79	**0.75**
120	0.67	0.78	0.74
130	0.66	0.76	0.72
140	0.64	**0.75**	0.71
150	0.63	0.73	0.69
160	0.61	0.72	0.68
170	0.60	0.70	0.66
180	0.58	0.69	0.65
190	0.57	0.67	0.63
200	0.56	0.66	0.62
225	0.53	0.62	0.58
250	0.49	0.58	0.55

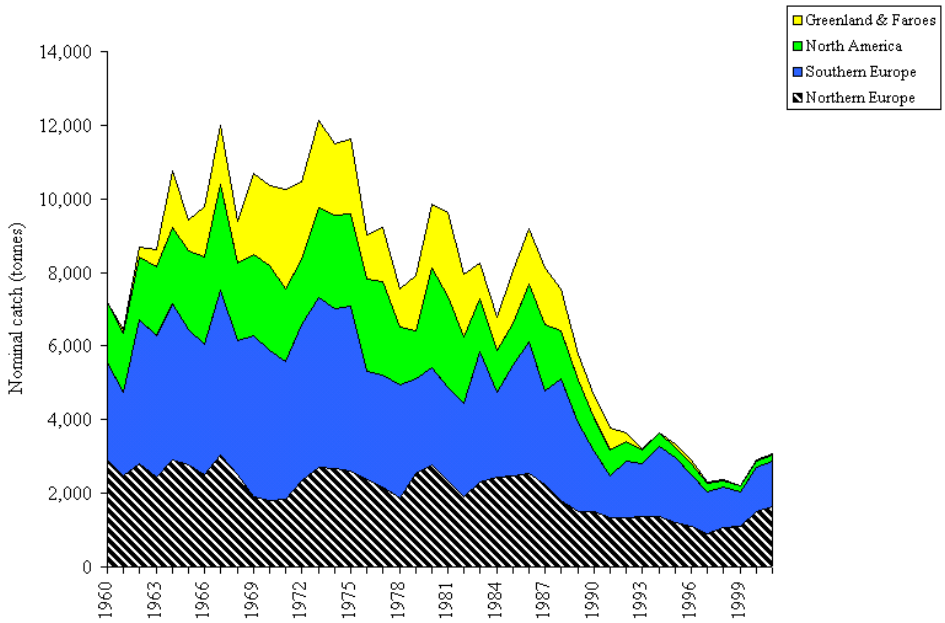


Figure 4.1.1.1 Nominal catches of salmon in four North Atlantic regions 1960–2001

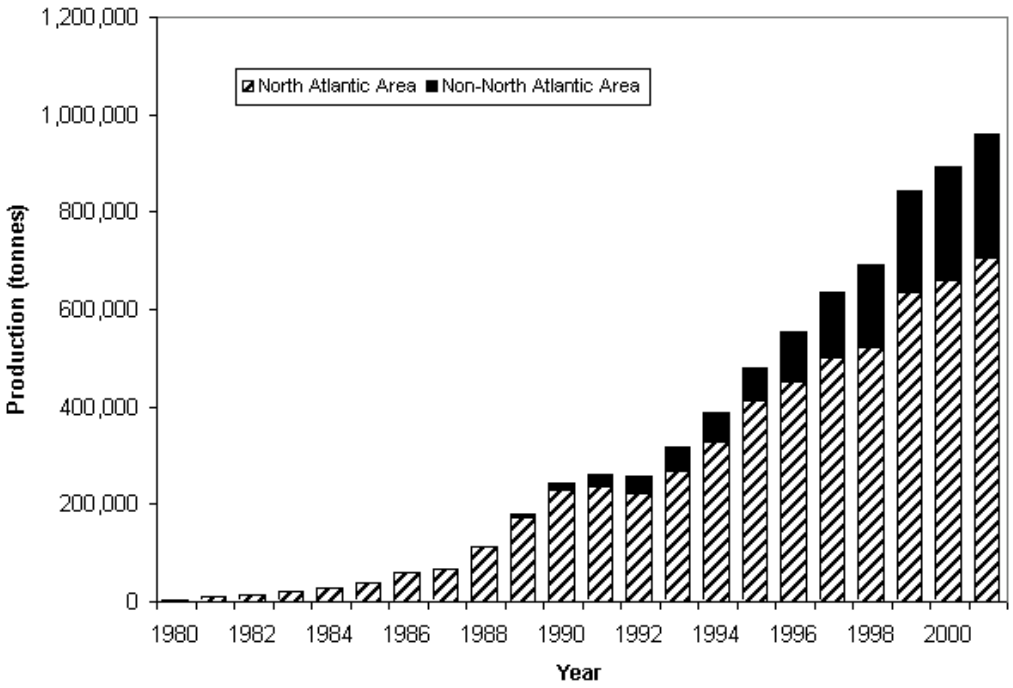


Figure 4.1.4.1 Worldwide production of farmed Atlantic salmon, 1980–2000.

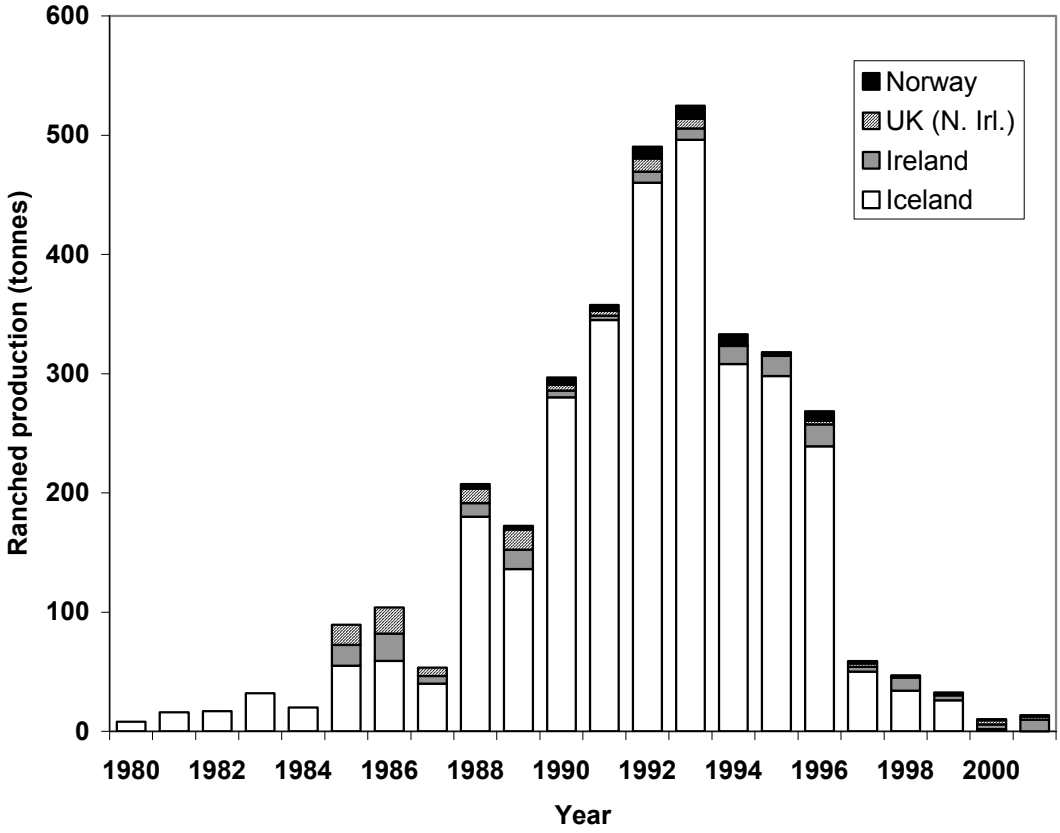


Figure 4.1.4.2 Production of ranched salmon in the North Atlantic, 1980-2001.

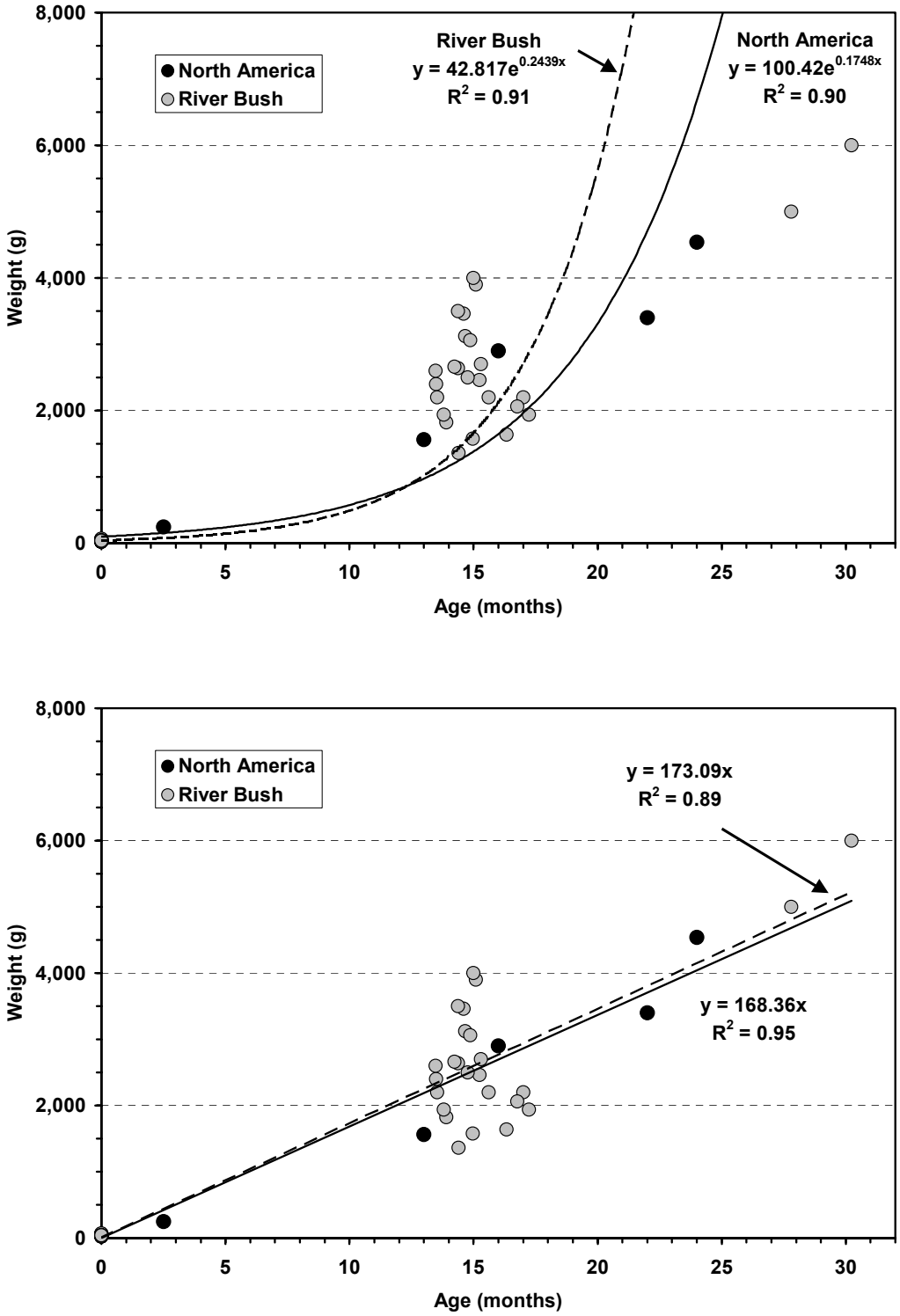


Figure 4.2.1.1 Comparison of weight at sea age (months) data used to model the growth functions of Atlantic salmon from River Bush and Sandhill River (North American stock). Exponential growth functions are in the upper panel, linear growth functions are in the lower panel. Data are from Doubleday *et al*. (1979).

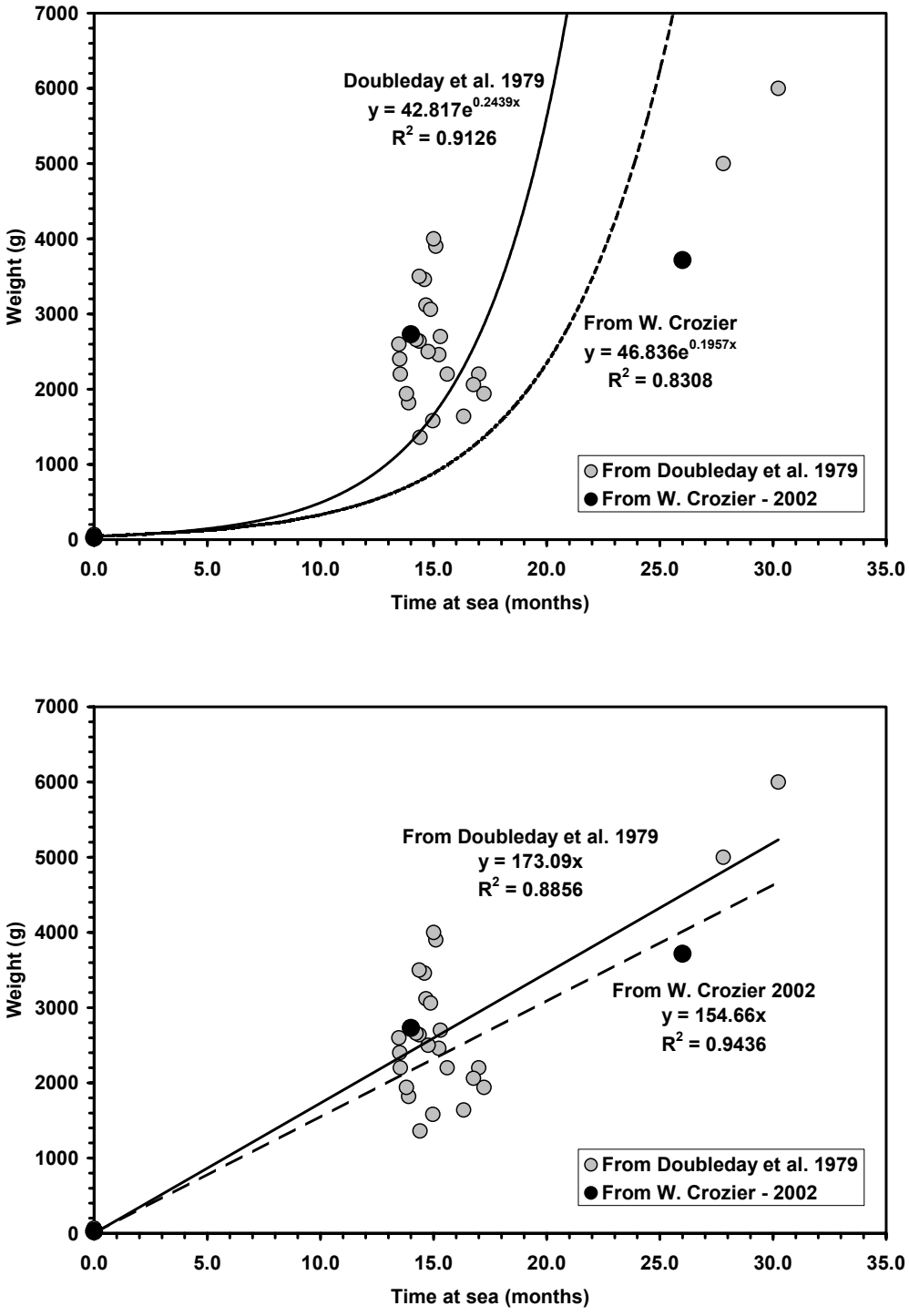


Figure 4.2.1.2 Comparison of weight at sea age (months) data used by Doubleday *et al.* (1979) and newer data provided by W. Crozier (2002) for River Bush salmon. Exponential growth functions are in the upper panel, linear growth functions are in the lower panel.

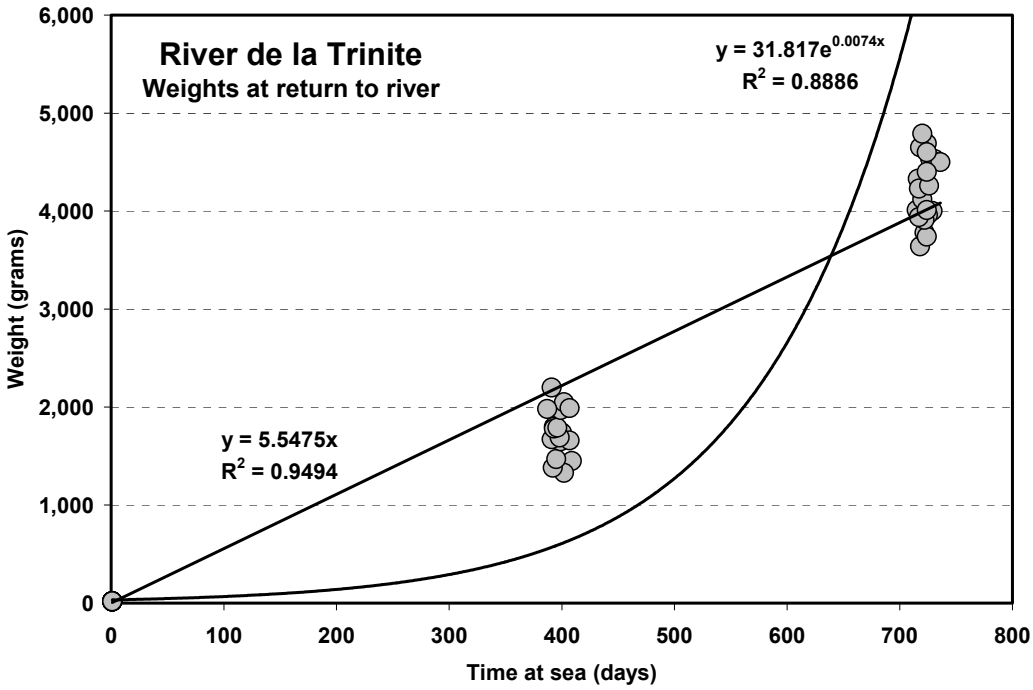
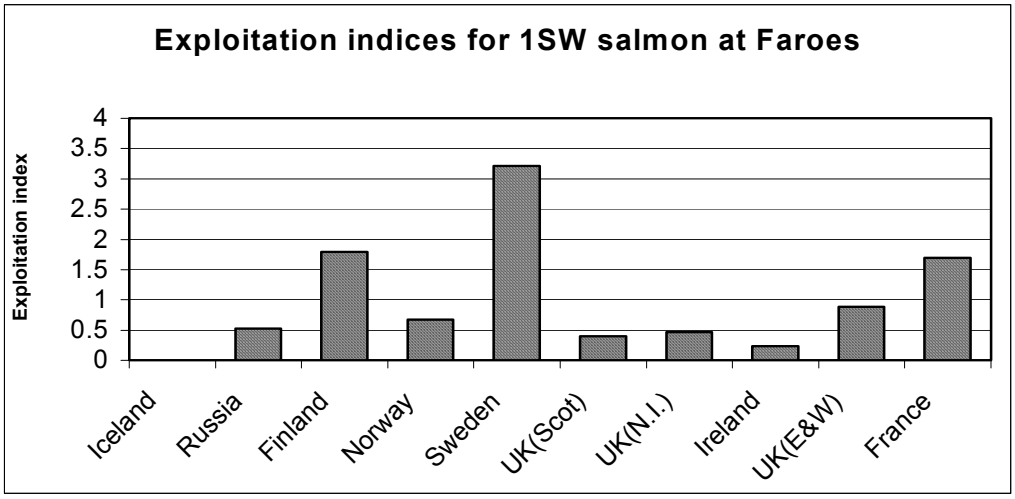
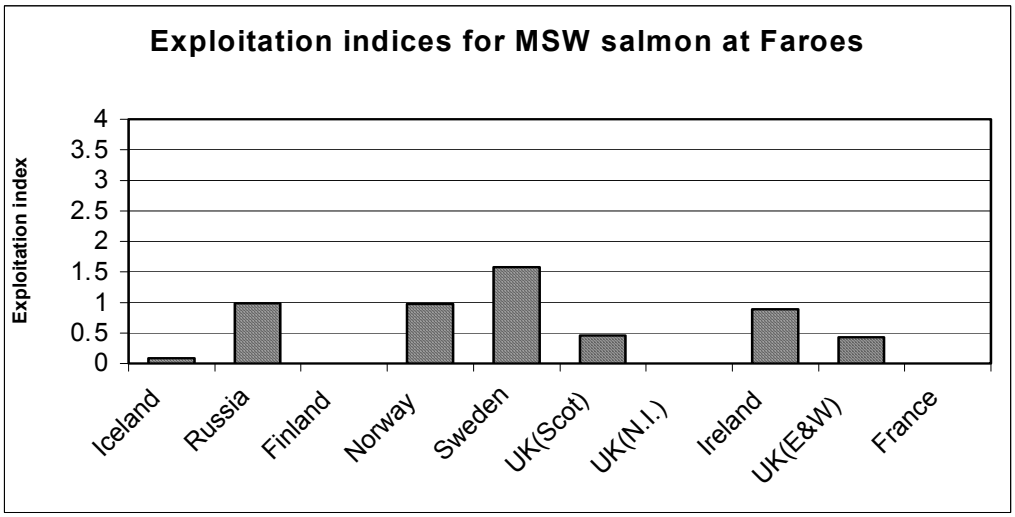


Figure 4.2.1.3 Exponential and linear growth functions applied to the weight at sea age (days) data of Atlantic salmon from the River de la Trinite (Quebec, Canada). Data are average weights of the age group relative to the days at sea since smolt migration. Days at sea are calculated as mean date of return of age group to the river from mean date of smolt migration. Data are from F. Caron (unpubl. data).





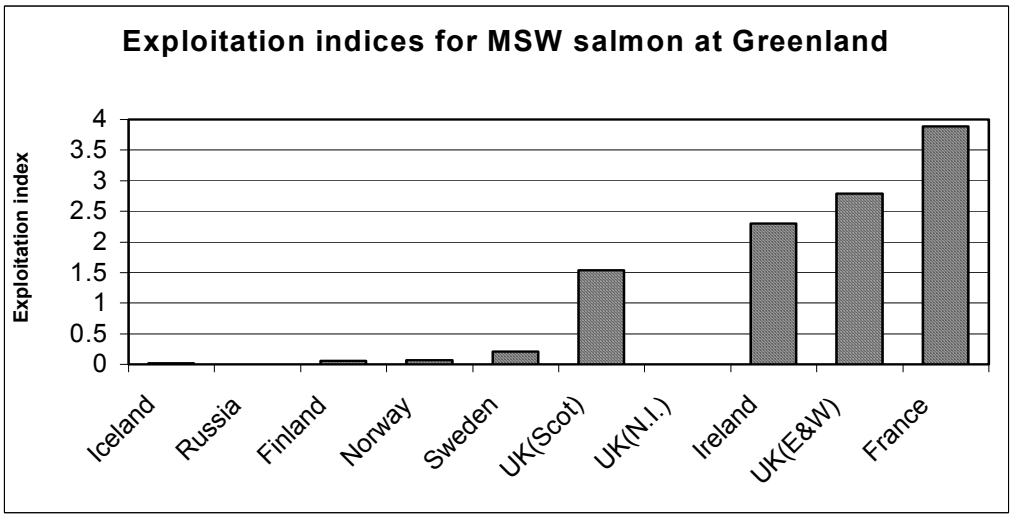
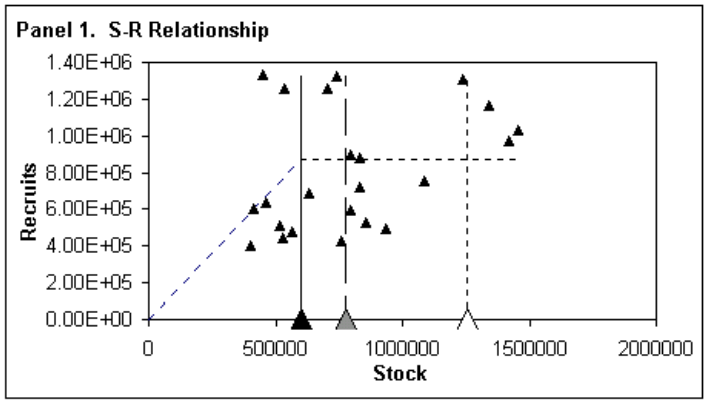
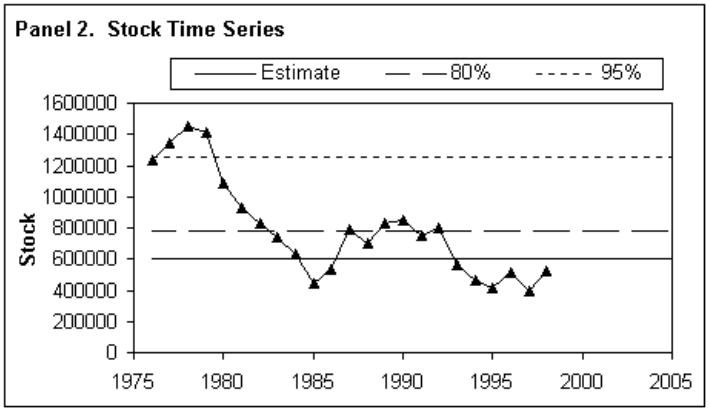


Figure 5.3.1 Exploitation indices for national salmon stocks in the Faroes and West Greenland fisheries.

Input data:		
Year	Stock	Recruits
1975		
1976	1,237,237	1,304,323
1977	1,338,879	1,163,026
1978	1,452,365	1,030,334
1979	1,415,856	972,673
1980	1,083,518	751,420
1981	932,942	495,993
1982	829,527	879,796
1983	741,970	1,326,481
1984	632,291	691,309
1985	448,307	1,329,195
1986	532,079	1,257,963
1987	793,598	894,008
1988	705,670	1,253,827
1989	831,784	725,099
1990	852,781	531,434
1991	754,693	425,903
1992	796,406	597,981
1993	566,035	476,305
1994	463,534	633,216
1995	412,901	599,599
1996	514,821	510,517
1997	398,628	403,938
1998	525,416	441,166
1999		
2000		
2001		
2002		
2003		
2004		
2005		

	Estimate	80%	95%
Conservation limit:	598,838	777,973	1,252,155





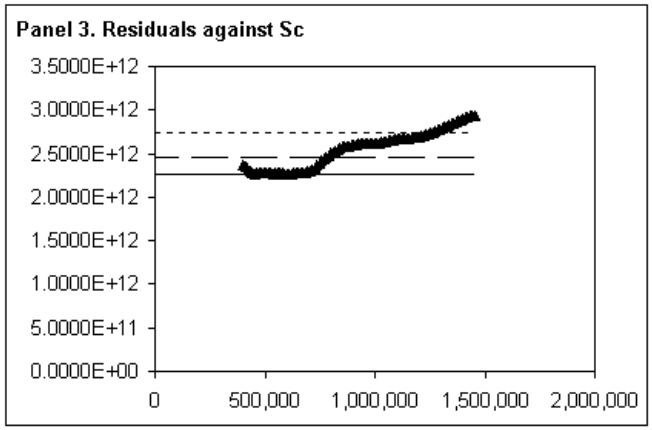


Figure 5.3.2 Estimating reference points from noisy stock-recruitment data.

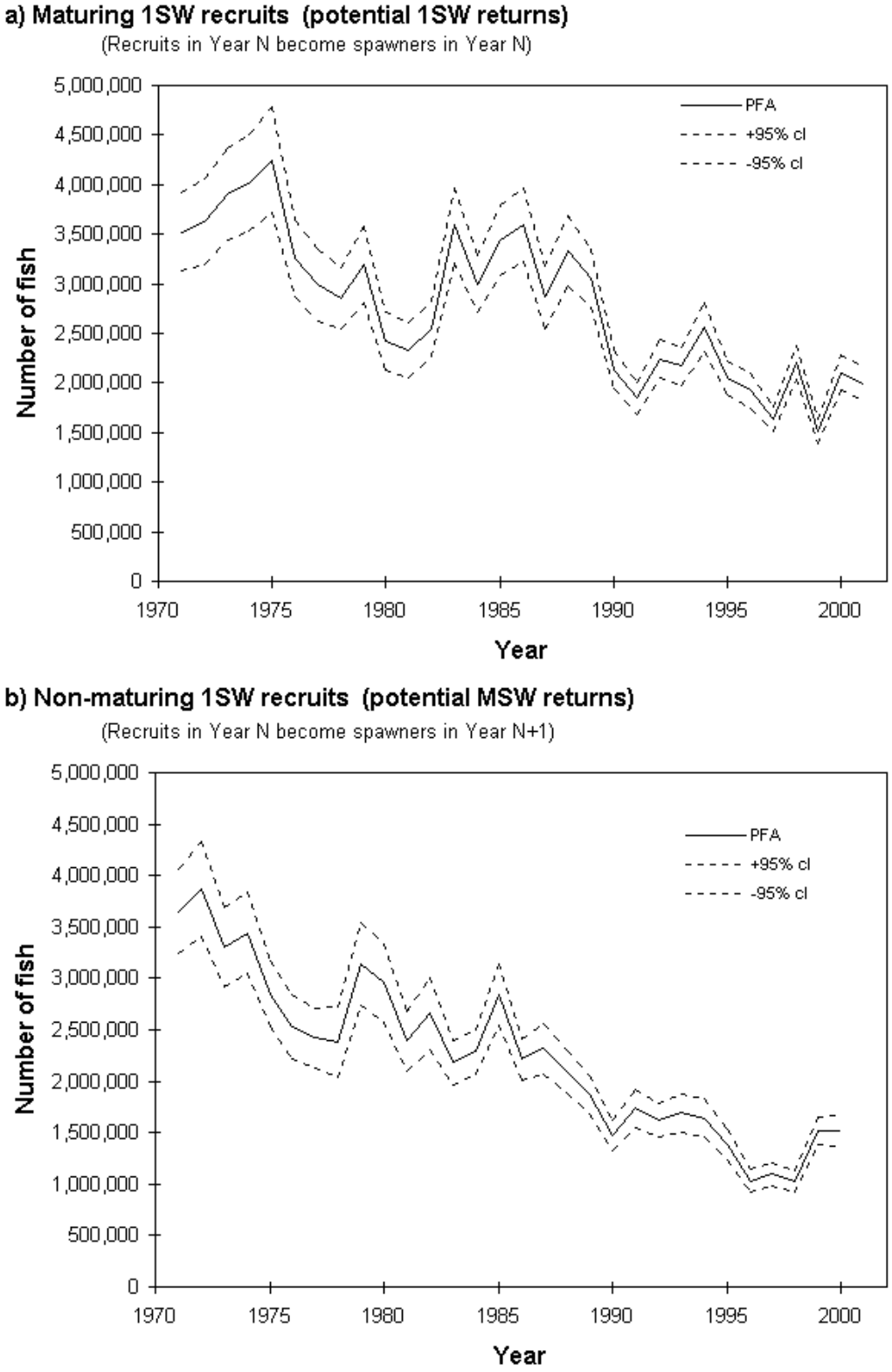
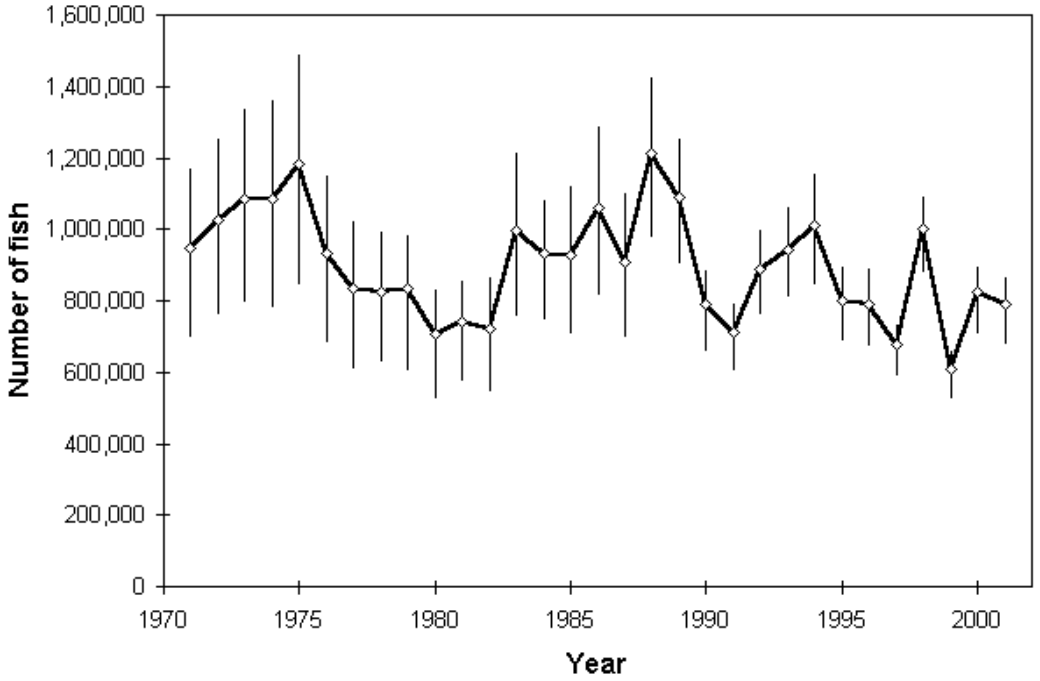


Figure 5.3.3 Estimated recruitment (PFA) in the NEAC area 1970 – 2001.



b) MSW spawners (and 95% confidence limits)

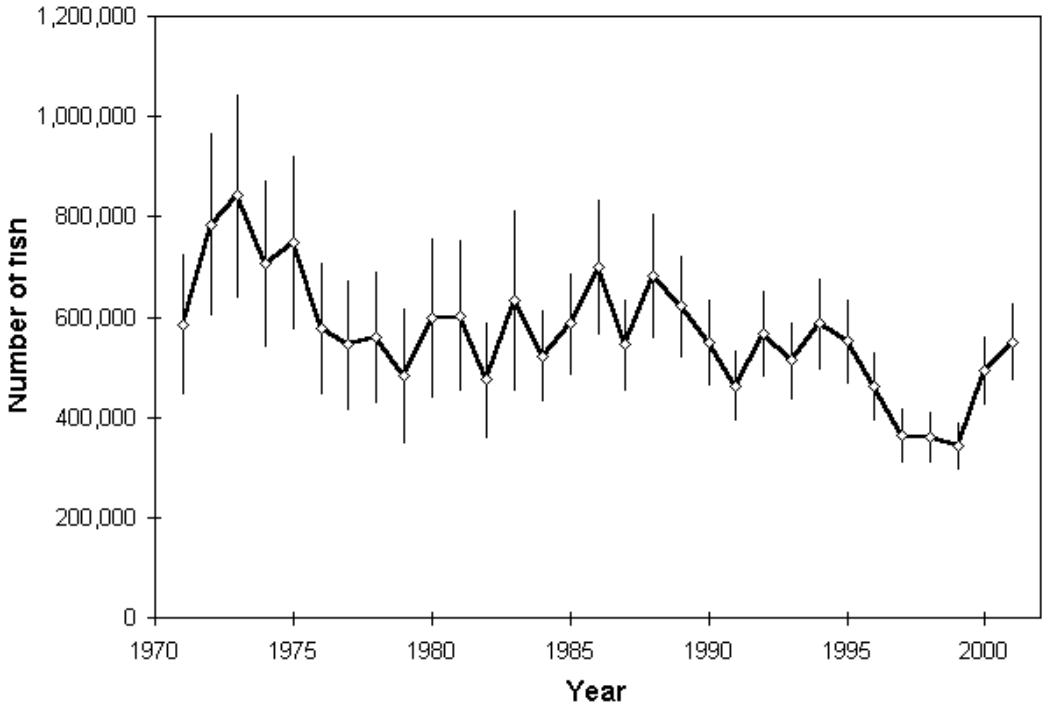


Figure 5.3.4 Estimated spawning escapement in the NEAC area 1970 – 2001.

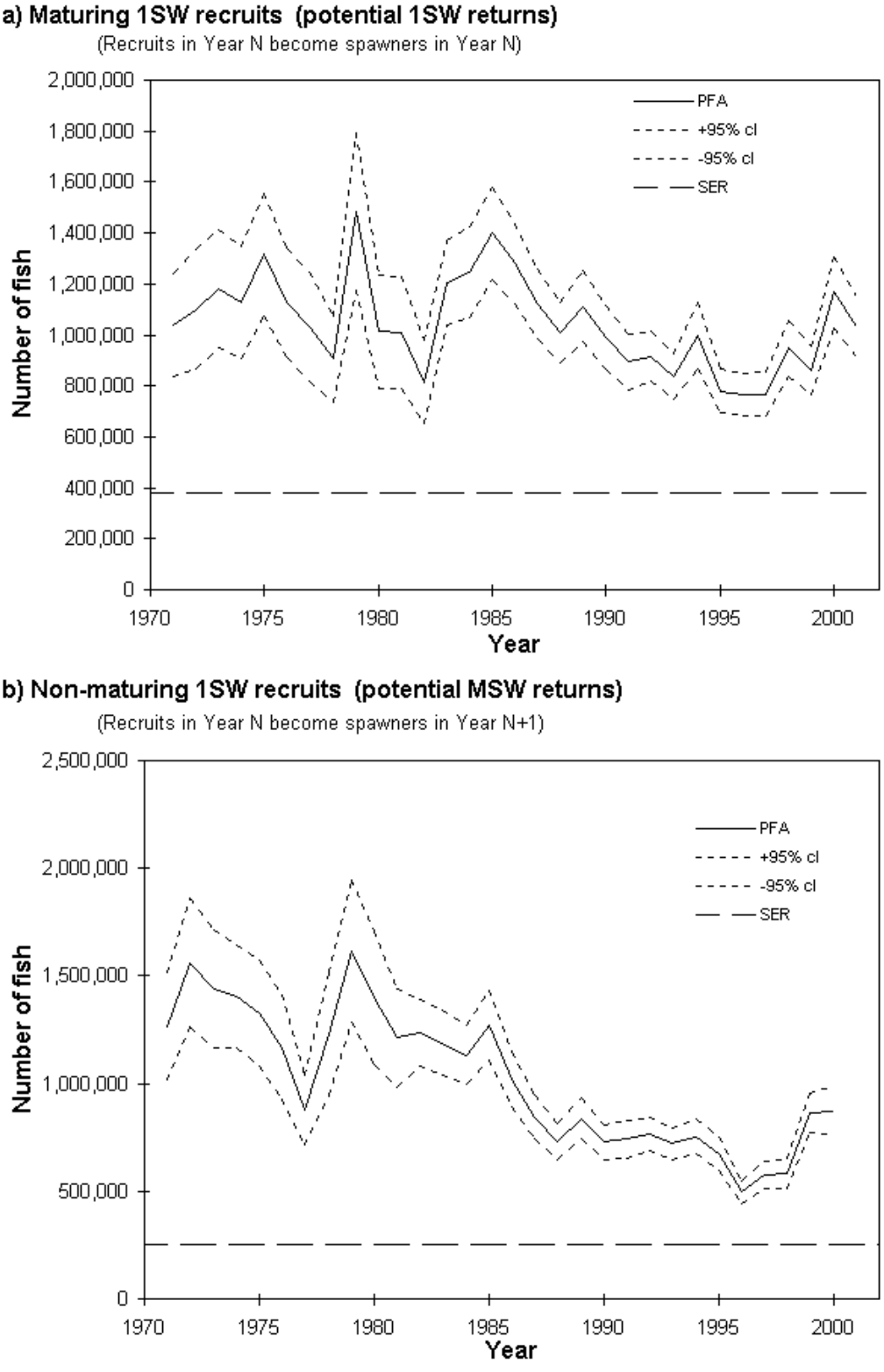


Figure 5.3.5 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and non-maturing salmon in North Europe, 1971 – 2001.

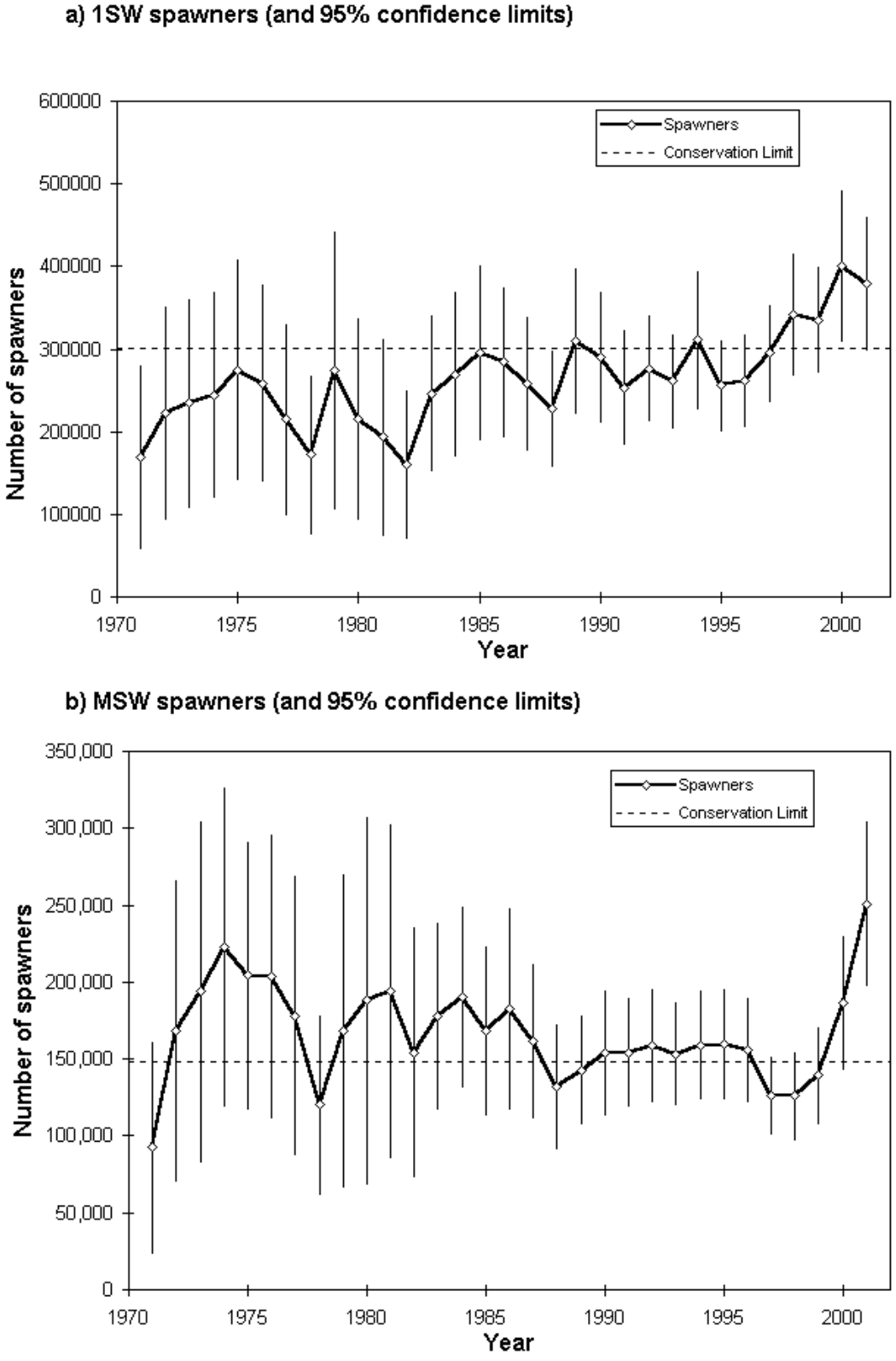


Figure 5.3.6 Estimated spawning escapement of maturing and non-maturing salmon in Northern Europe, 1971–2001.

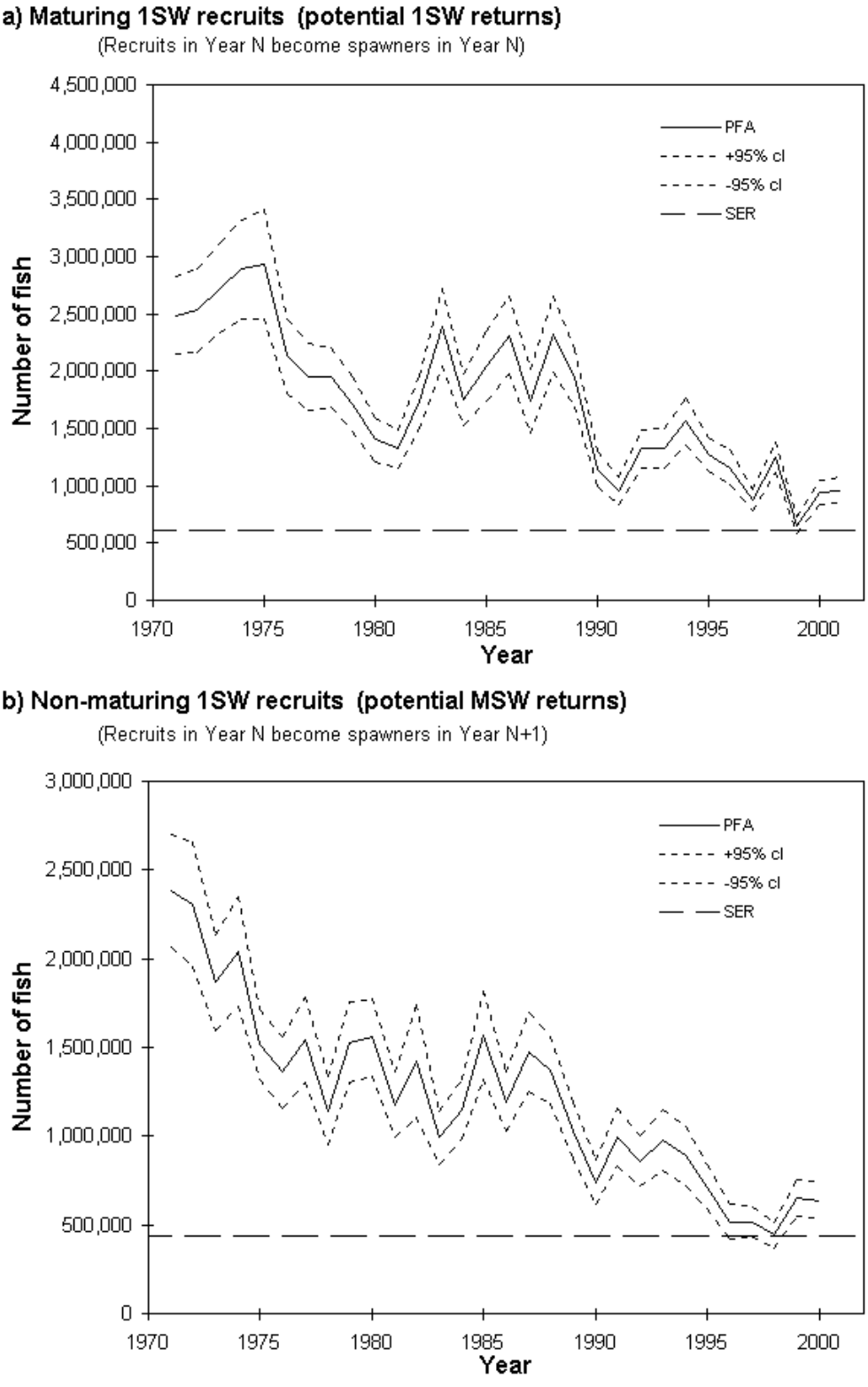


Figure 5.3.7 Estimated recruitment (PFA) and Spawning Escapement Reserve (SER) for maturing and non-maturing salmon in Southern Europe, 1971–2001.

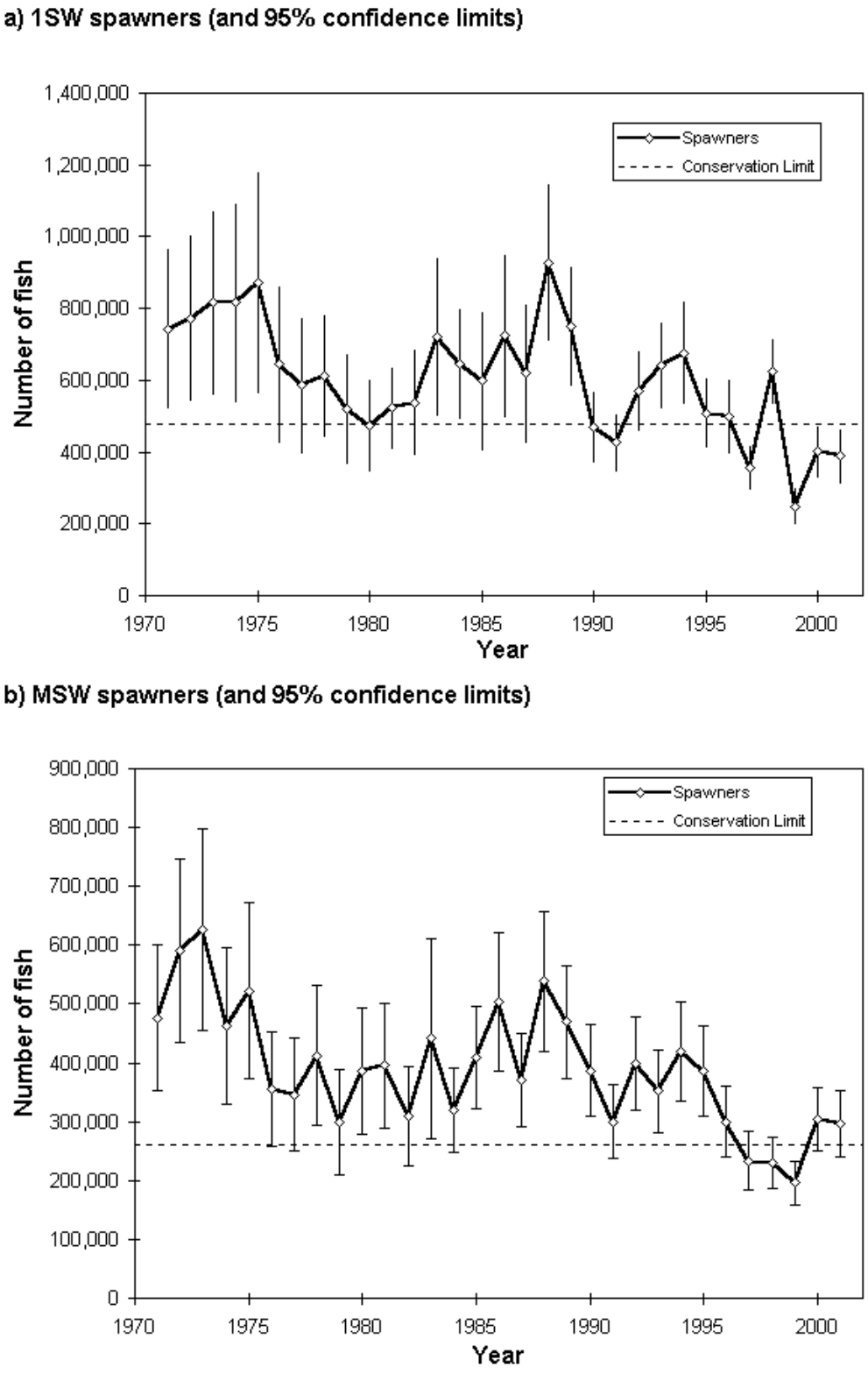


Figure 5.3.8 Estimated spawning escapement of maturing and non-maturing salmon in Southern Europe, 1971-2001.

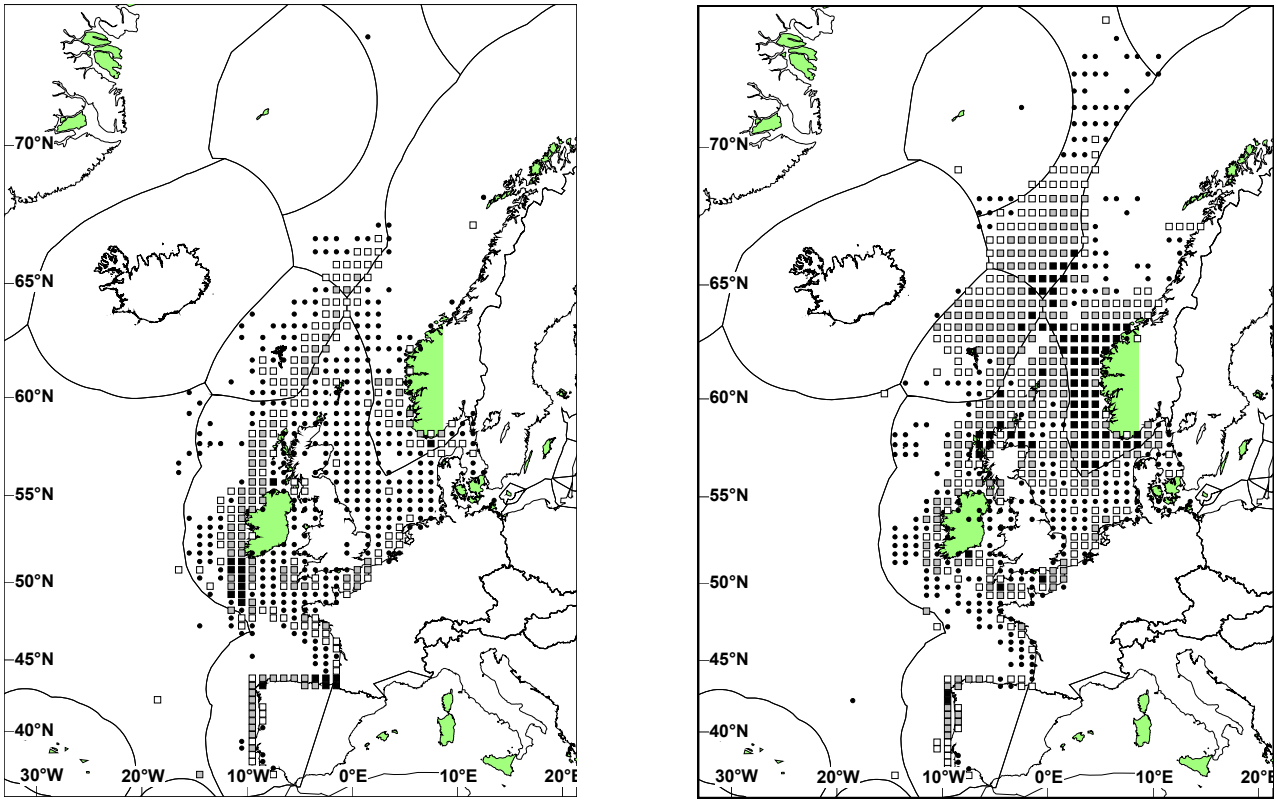


Figure 5.3.11 Distribution of the total mackerel catches 1977–2000 by statistical rectangle in 2nd (left) and 3rd (right) quarter (from ICES 2002/G:03).

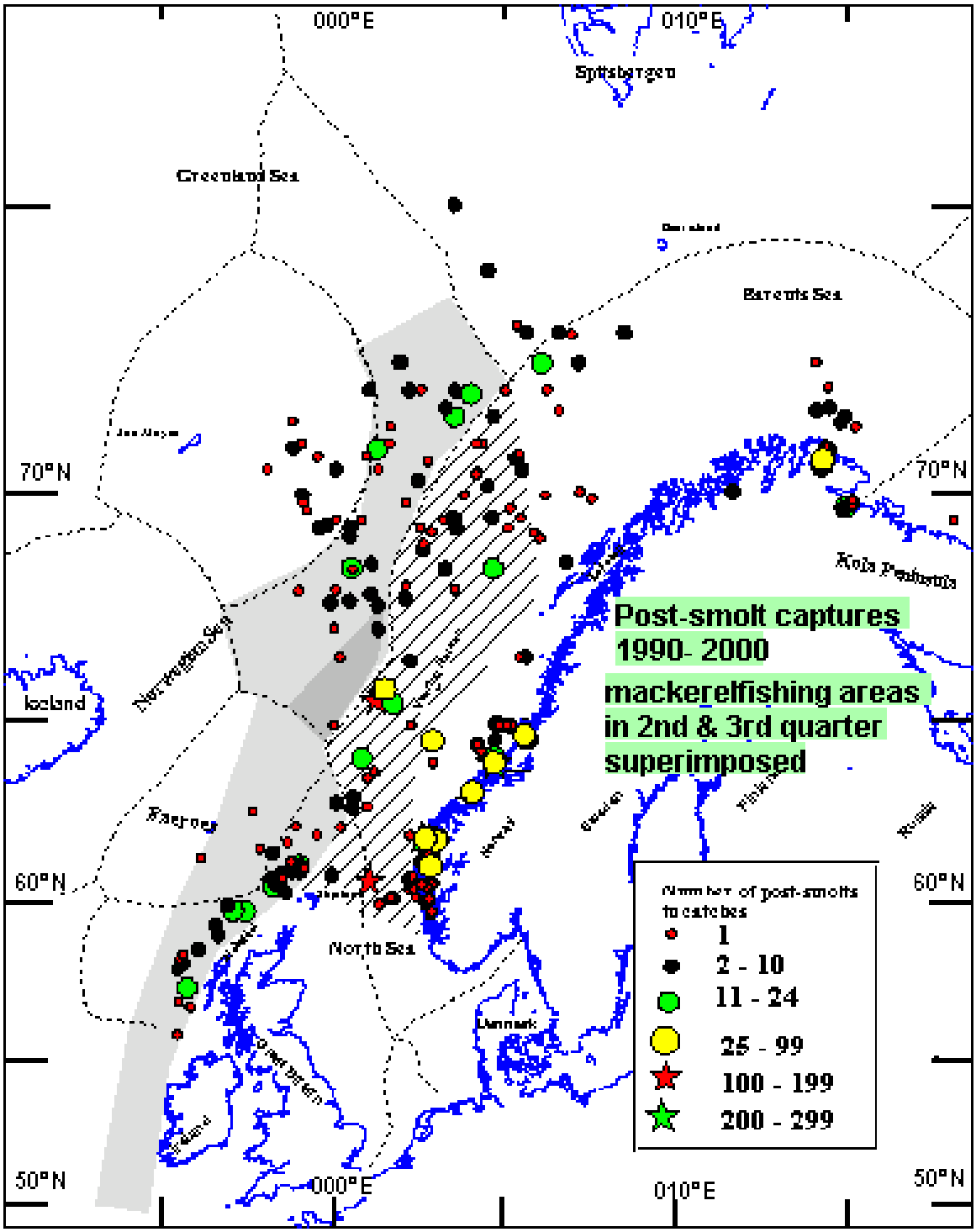


Figure 5.3.12. Post-smolt captures in pelagic surveys 1990–2000. Post-smolt legends in figure. Mackerel fishing areas 1977–2000 are superimposed as a shaded area. The highest trawl captures occurred in international areas close to the Norwegian EEZ. Norwegian purse seine capture areas are hatched.

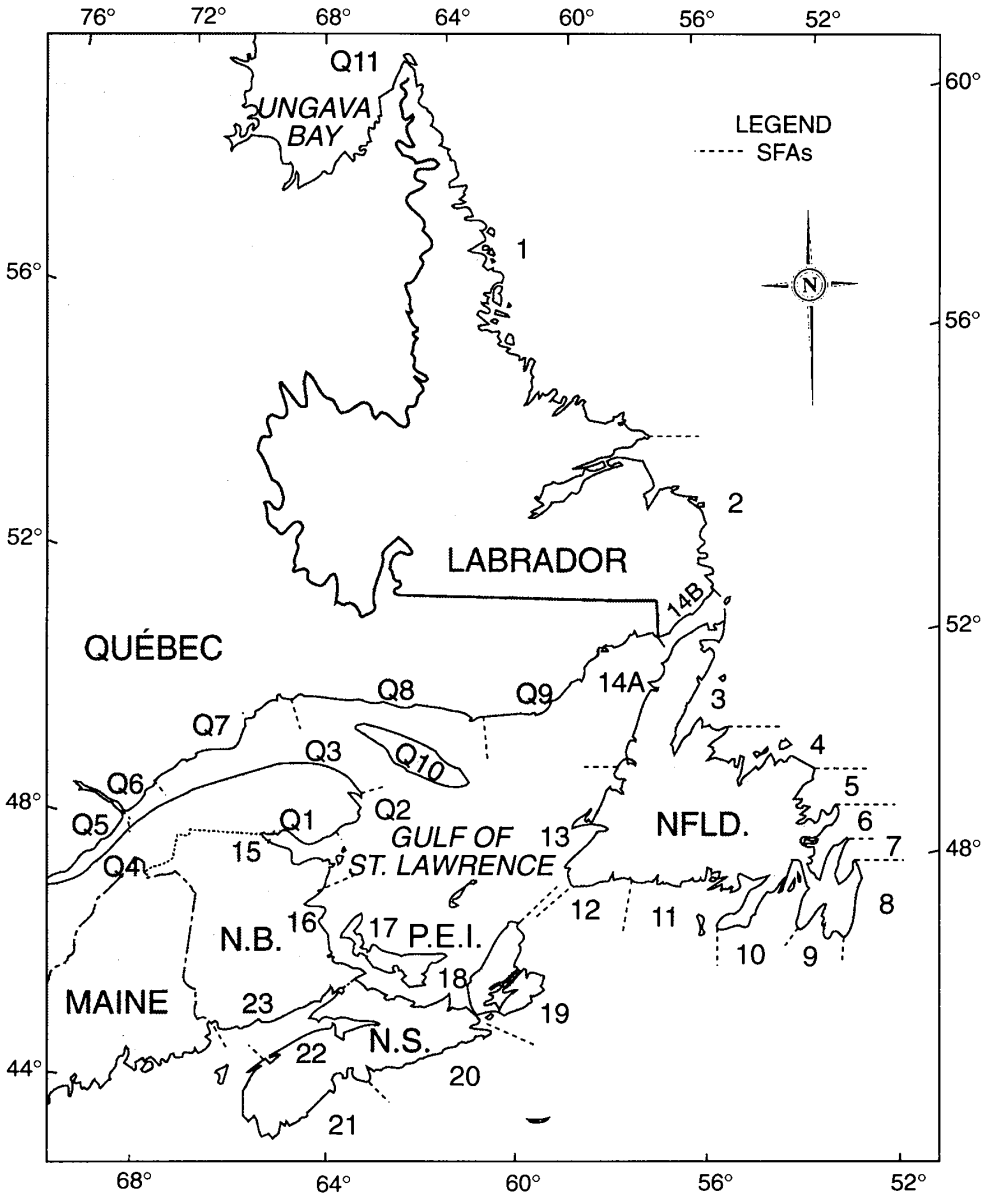


Figure 6.1.1.1 Map of Salmon Fishing Areas (SFAs) and Quebec Management Zones (Qs) in Canada.

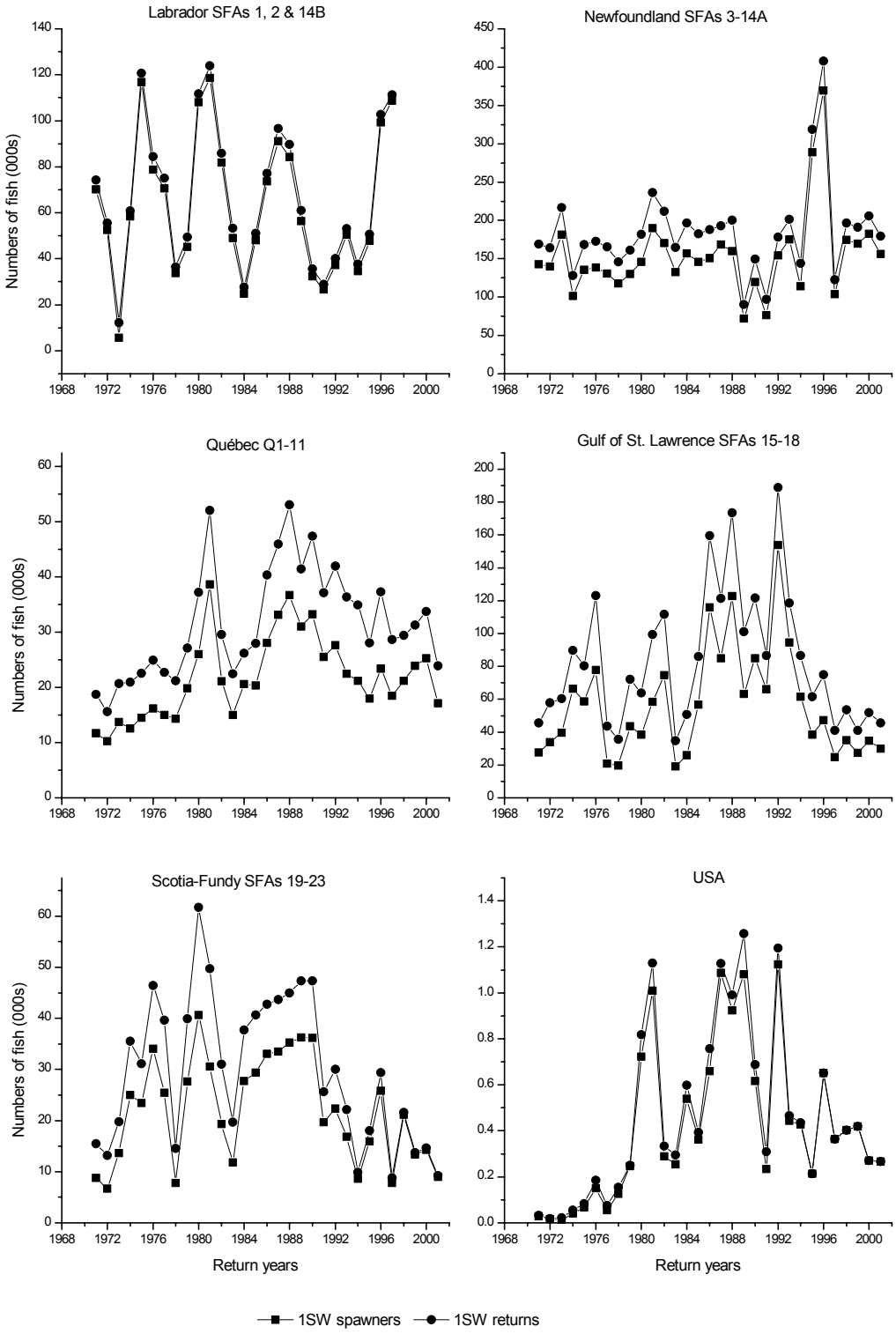
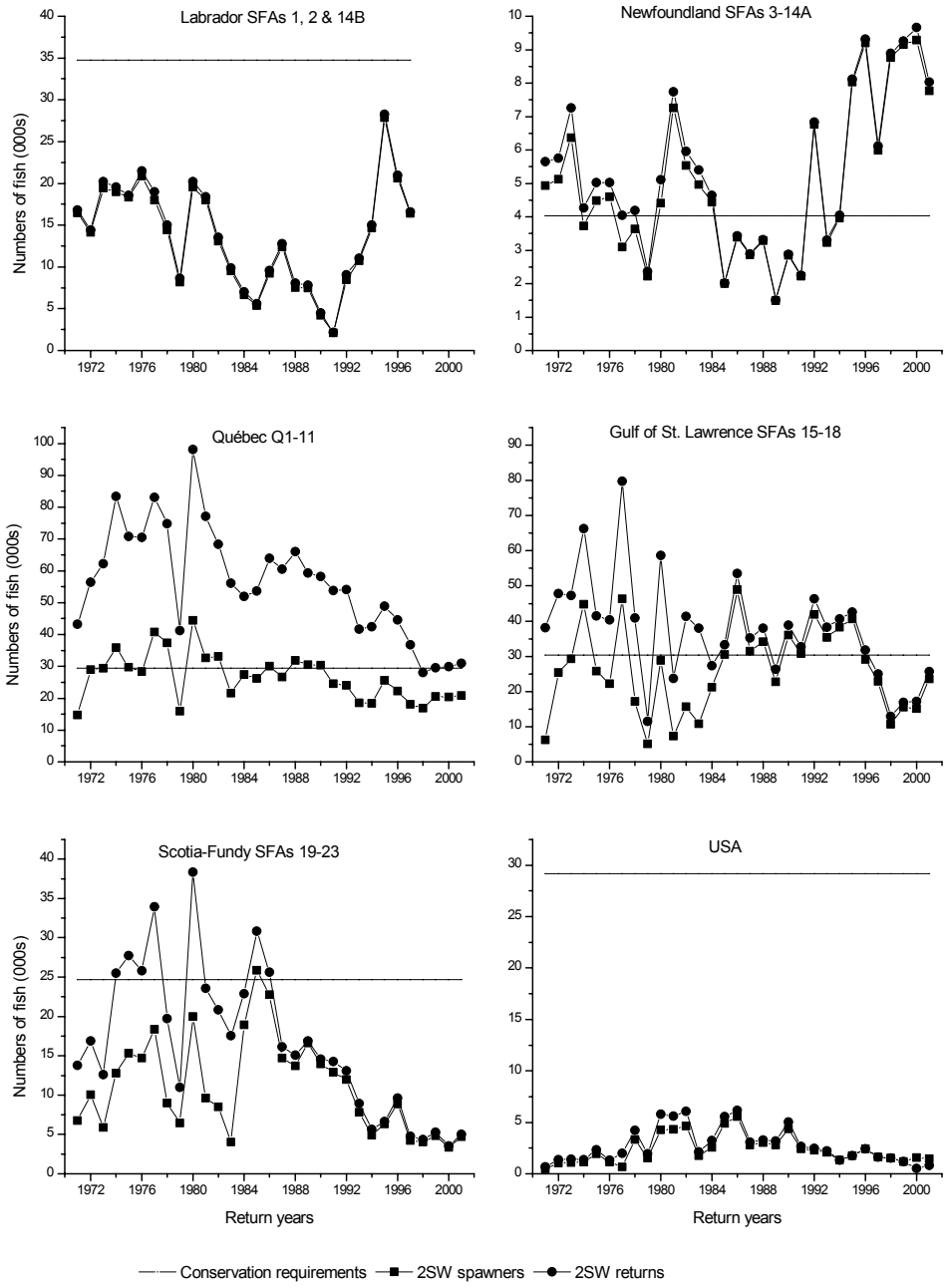


Figure 6.1.2.1 Comparison of estimated mid-points of 1SW returns to and 1SW spawners in rivers of six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and a portion of SFA 23.


Labrador SFAs 1, 2 & 14B
Newfoundland SFAs 3-14A
Québec Q1-11
Gulf of St. Lawrence SFAs 15-18
Scotia-Fundy SFAs 19-23
USA
Numbers of fish (000s)
Return years
Conservation requirements
2SW spawners
2SW returns

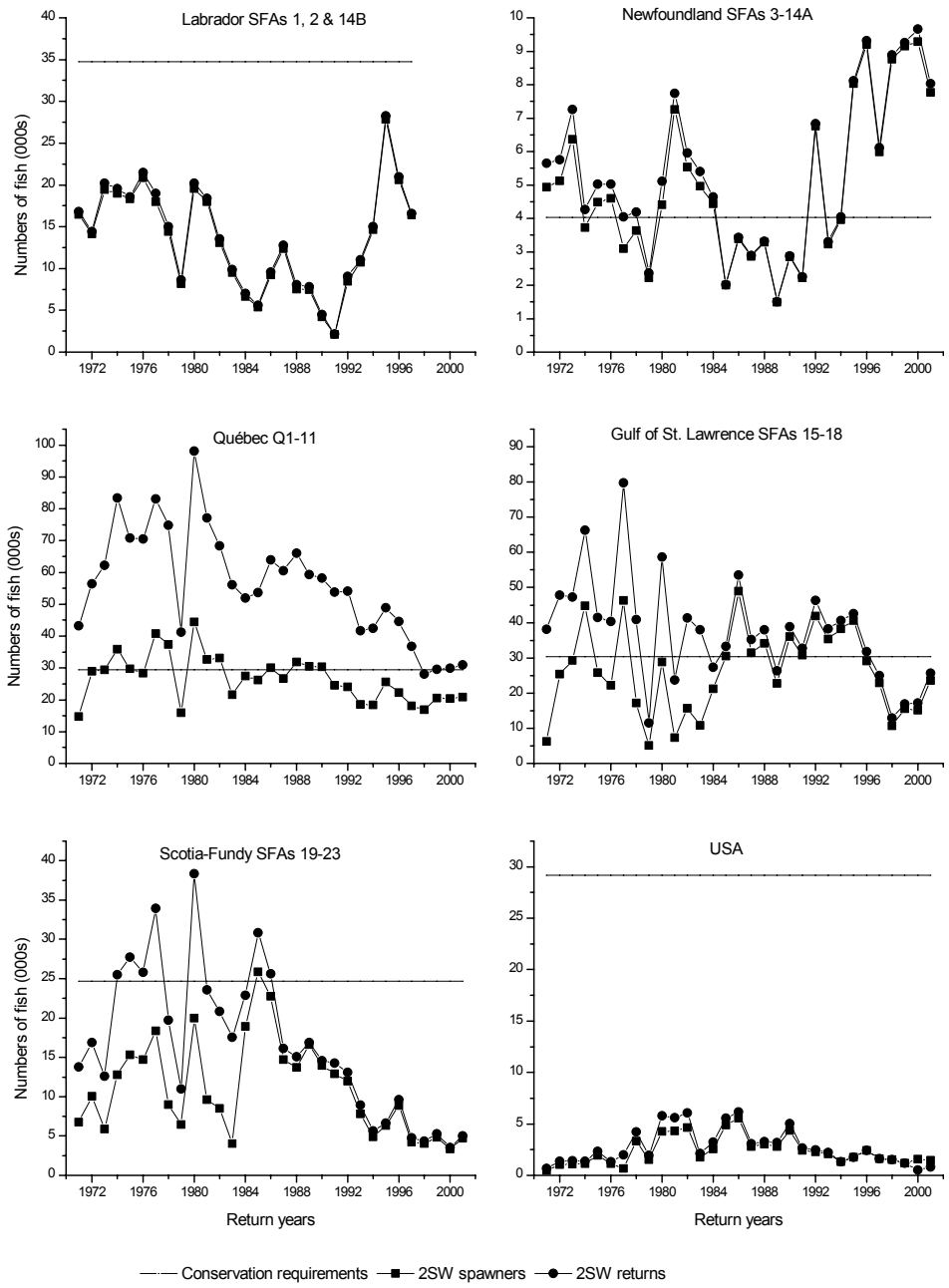


Figure 6.1.2.2 Comparison of estimated mid-points of 2SW returns, 2SW spawners, and 2SW conservation limits for six geographic areas in North America. Returns and spawners for Scotia-Fundy do not include those from SFA 22 and portion of SFA 23.

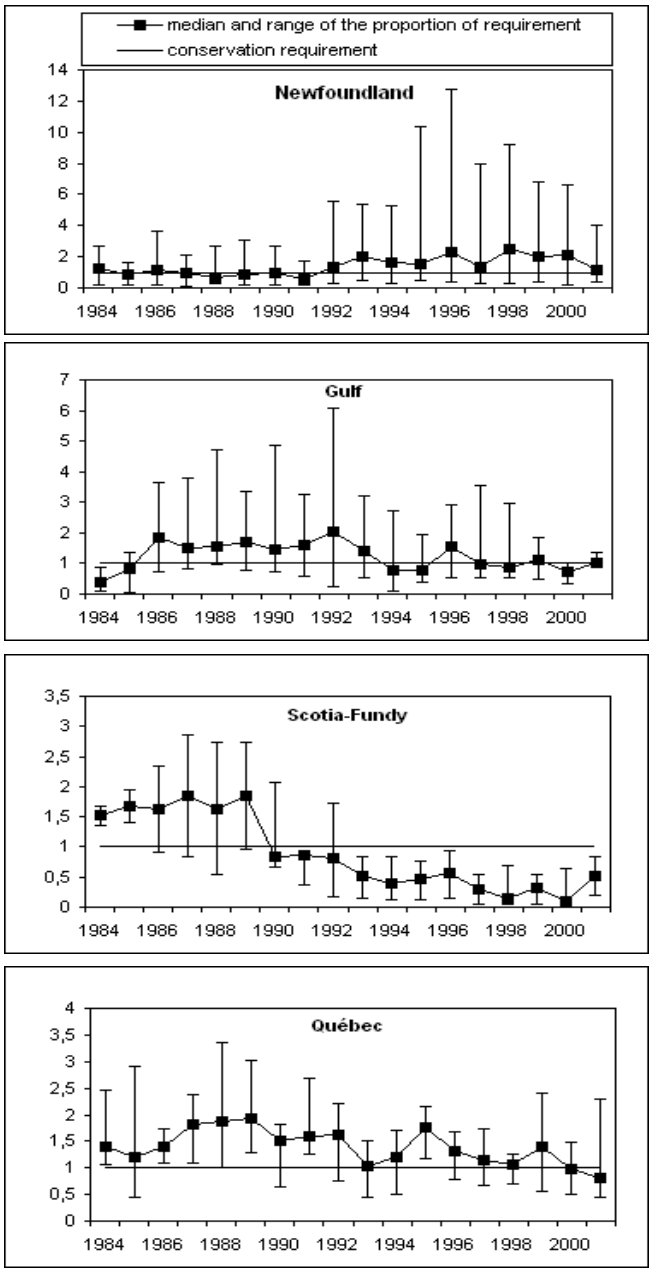


Figure 6.1.2.3 Proportion of the conservation limits met in monitored rivers in four geographic areas of eastern Canada, 1984 to 2001. The vertical line represents the minimum and maximum proportion achieved in individual rivers, the black square is the median proportion. The range of the number of rivers included in the annual summary was 7–8 for Newfoundland, 3–8 for the Gulf, 2–3 for Scotia-Fundy and 9 for Québec.

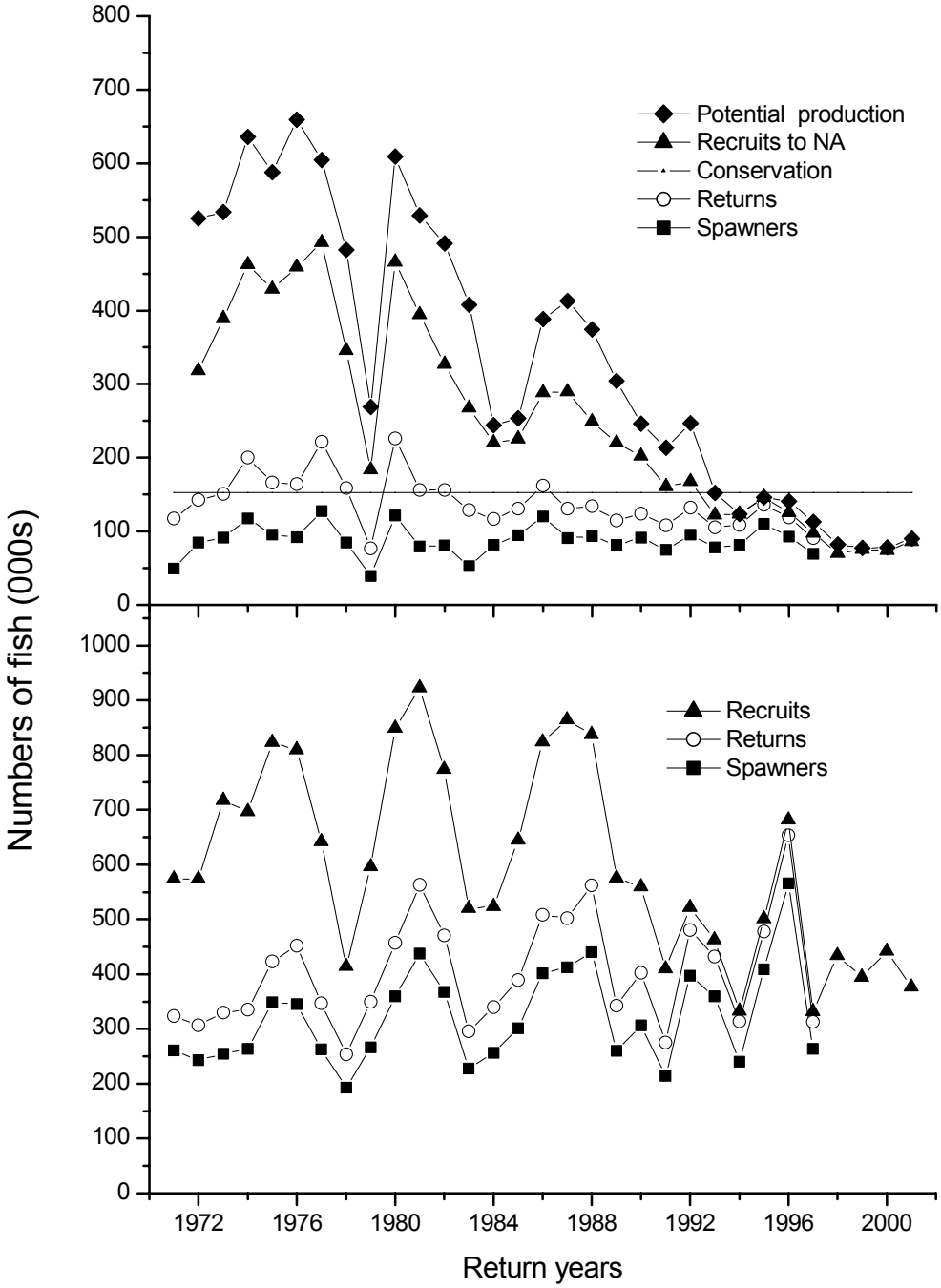


Figure 6.1.2.4 Top panel: comparison of estimated potential 2SW production prior to all fisheries, 2SW recruits available to North America, 1971–2001 and 2SW returns and spawners for 1971–1997, as 1998–2001 data for Labrador are unavailable. The horizontal line indicates the 2SW conservation limits. Bottom panel: comparison of potential maturing 1SW recruits, 1971–2001 and returns and 1SW spawners for 1971–1997 return years as Labrador data for 1998–2001 are unavailable.

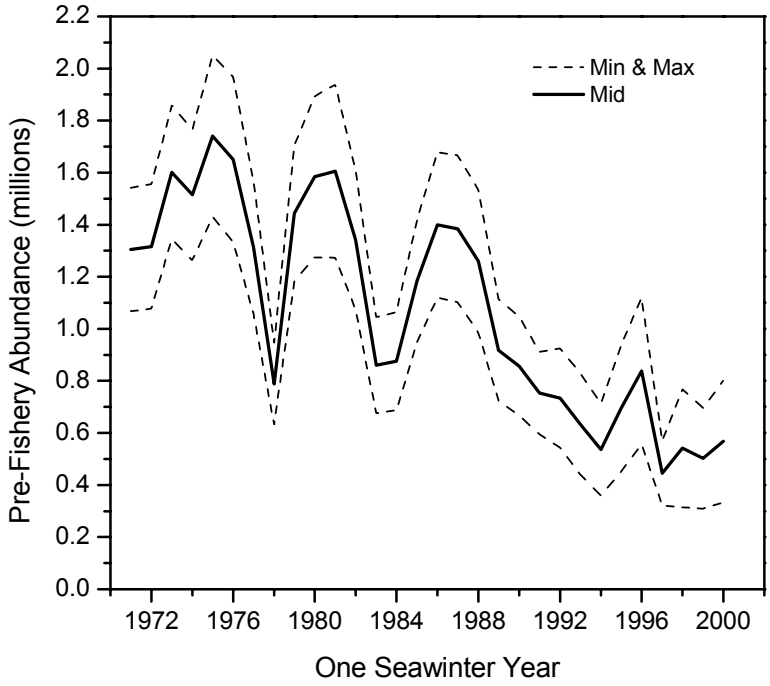


Figure. 6.1.2.5 Total 1SW recruits (non-maturing and maturing) originating in North America.

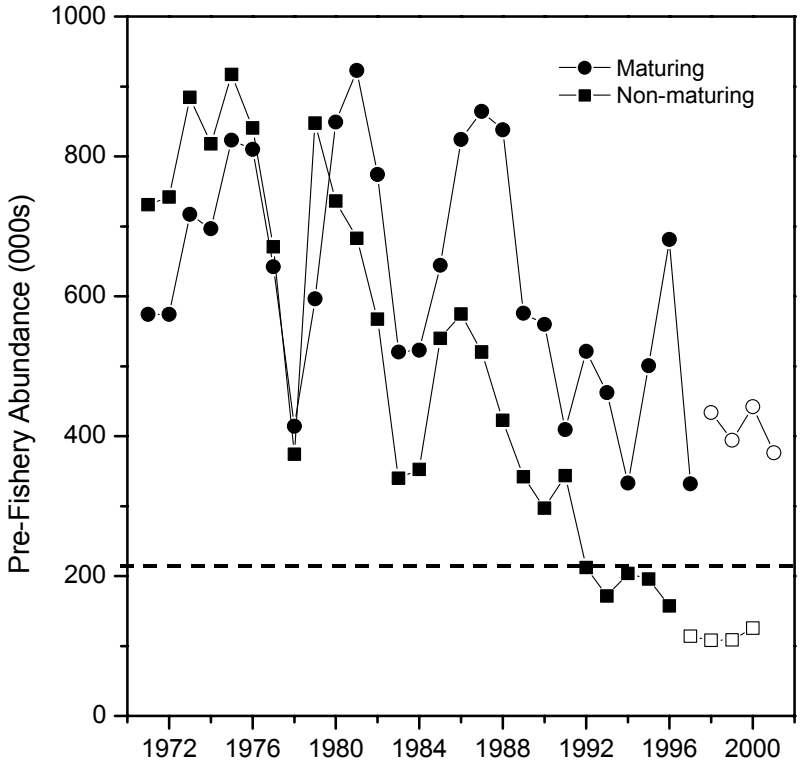


Figure 6.1.2.6 Prefishery abundance estimate of maturing and non-maturing salmon in North America. Open circles are for the years that returns to Labrador were assumed as a proportion of returns to other areas in North America. The dashed line represents the spawning escapement reserve of 212, 189 non-maturing pre-fishery abundance fish salmon.

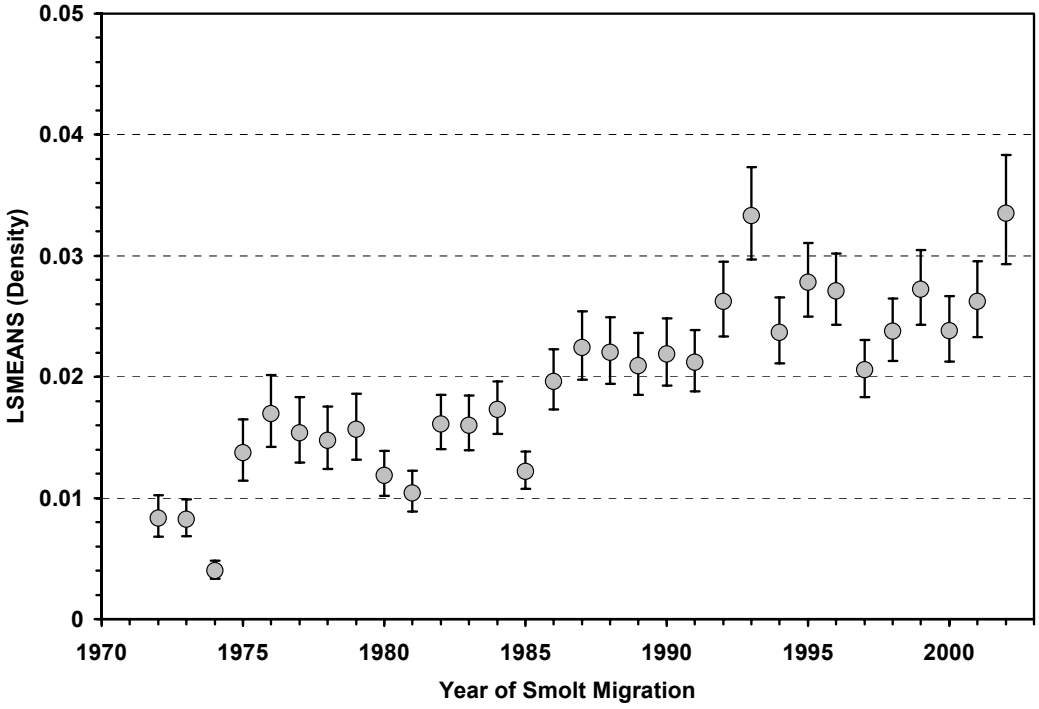


Figure 6.1.2.7 Relative index of smolt production in eastern North America. The index was derived from juvenile and smolt surveys in rivers of eastern Canada. The circle is the model adjusted mean (salmon fishing area factor) and the t-bars show one standard deviation range. Juvenile and smolt data were natural ln transformed before analysis. The individual river indices were weighted by the 2SW spawner requirement for their respective salmon fishing areas.

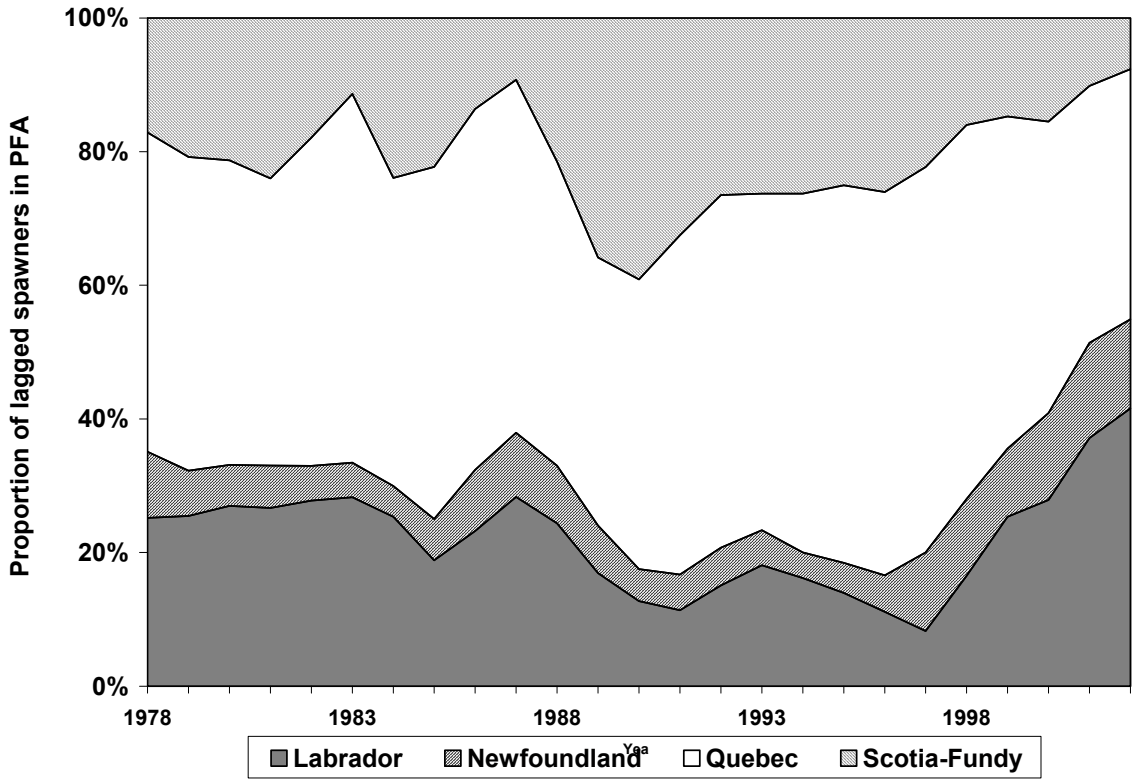


Figure 6.4.1 Proportional contribution of four salmon production regions to the lagged numbers of spawning salmon contributing to the estimate of the pre-fishery abundance of maturing two-sea-winter Atlantic salmon in the North Atlantic 1978 to 2002.

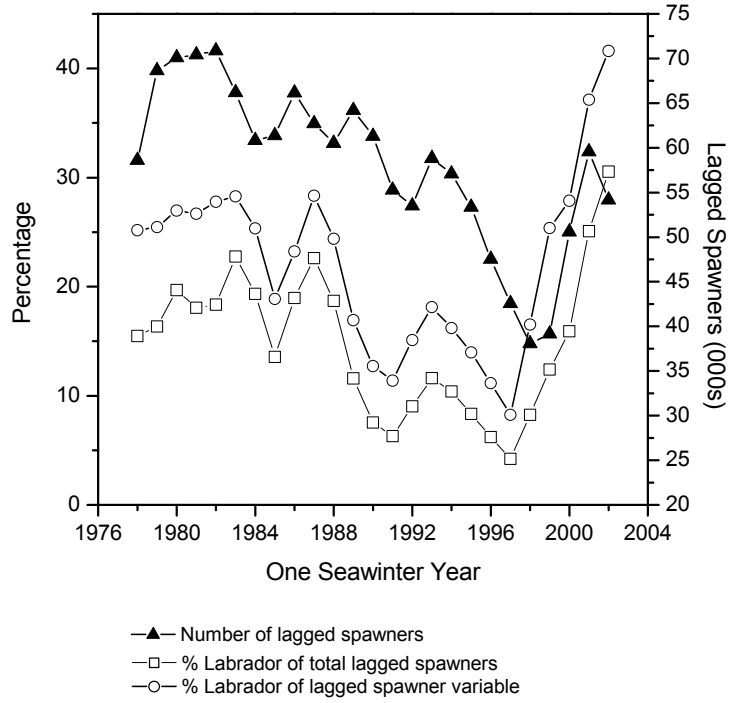


Figure 6.4.2 The lagged spawner variable used to forecast pre-fishery abundance and its relationship to the total number of lagged spawners in North America and and the Labrador component.

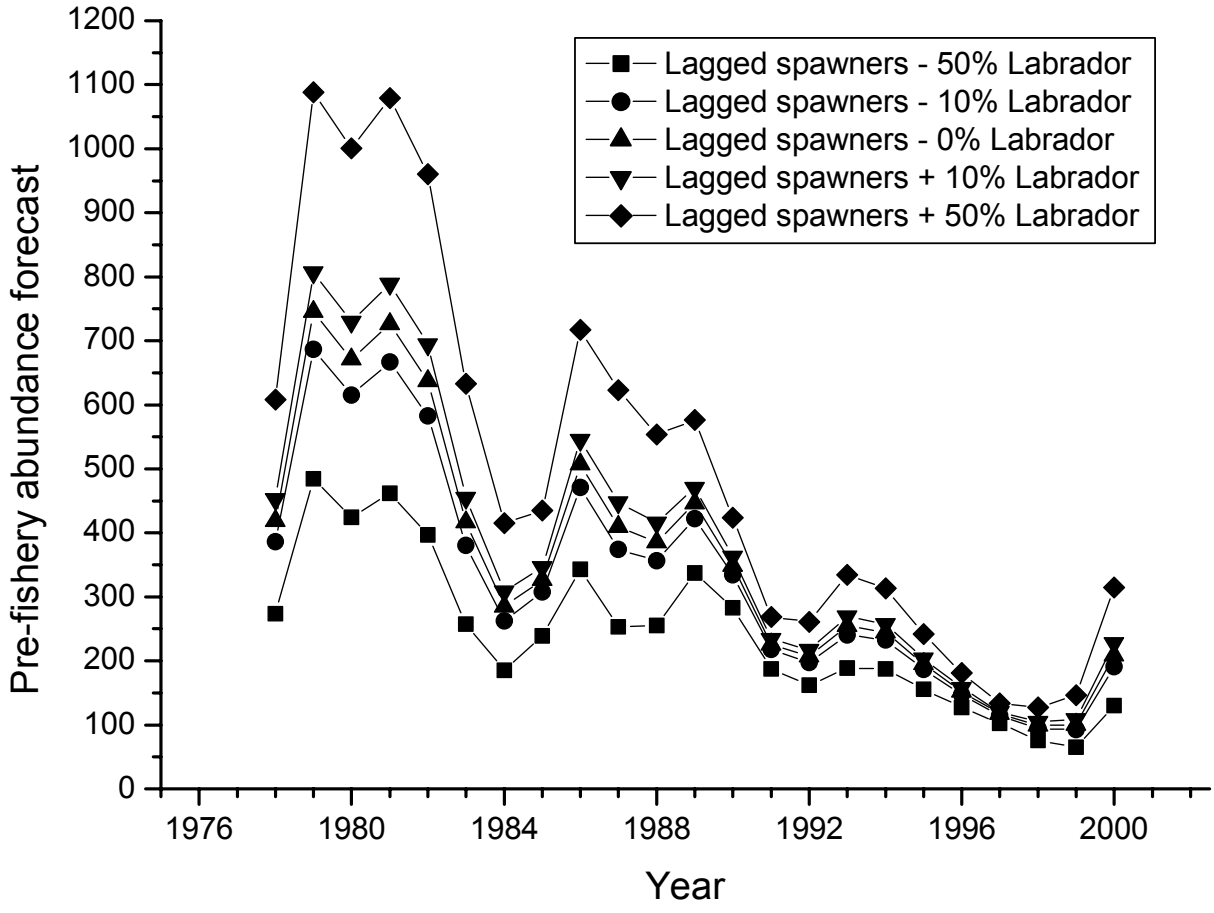


Figure 6.4.3 An examination of the sensitivity of the lagged spawner variable to changes in its Labrador component evaluated at variations of 0%, ±10% and ±50%.

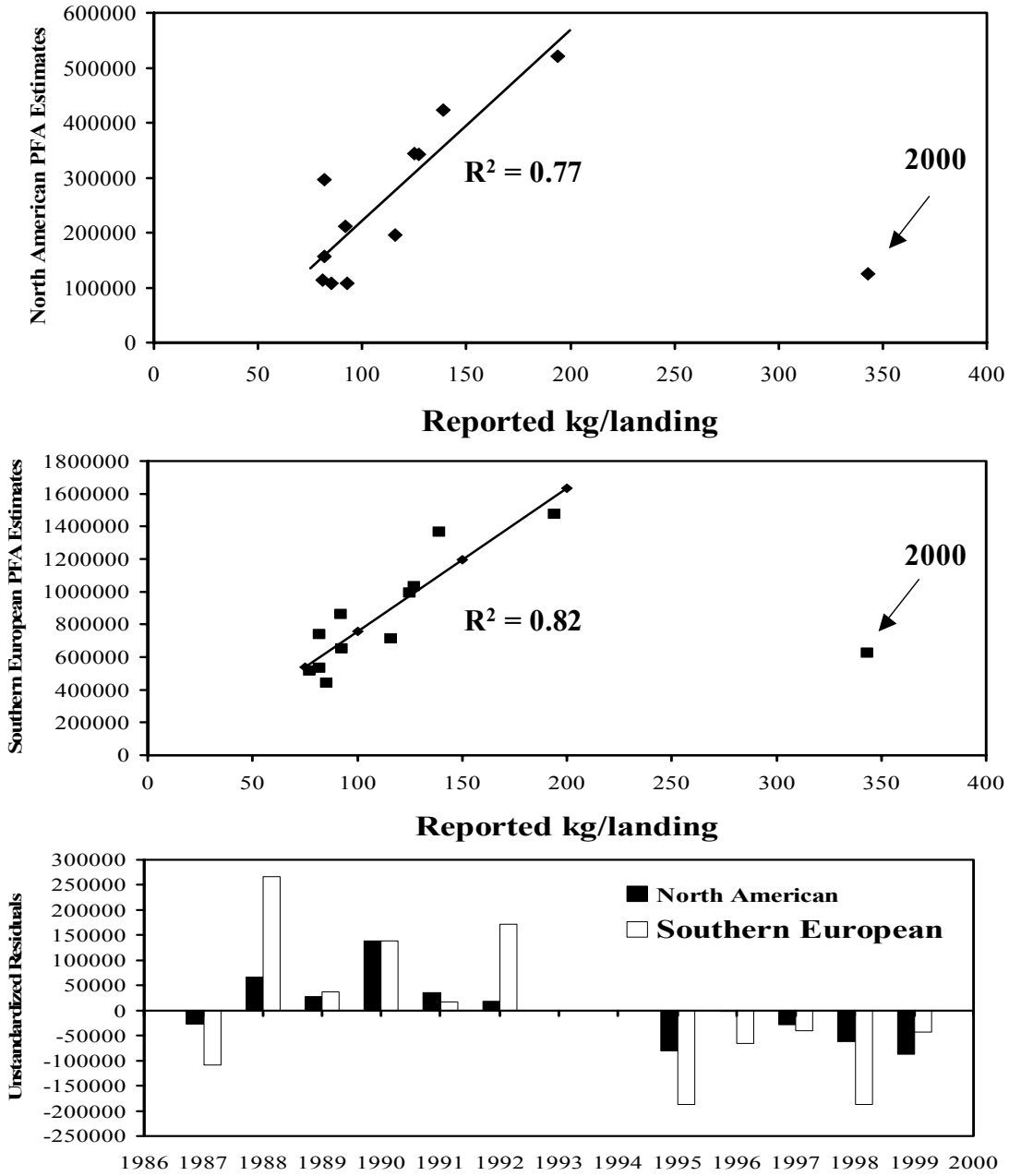


Figure 7.1.2.1 Relationship of CPUE and prefishery abundance estimates for the non-maturing 1SW component of the North American (top panel) and Southern European stock complex (middle panel). Input data have been updated with revised PFA values and CPUE data are slightly different than those available at the 2002 NASCO meeting. Regression relationships exclude the outlying point for 2000, and residuals from both regressions are shown in the bottom panel.

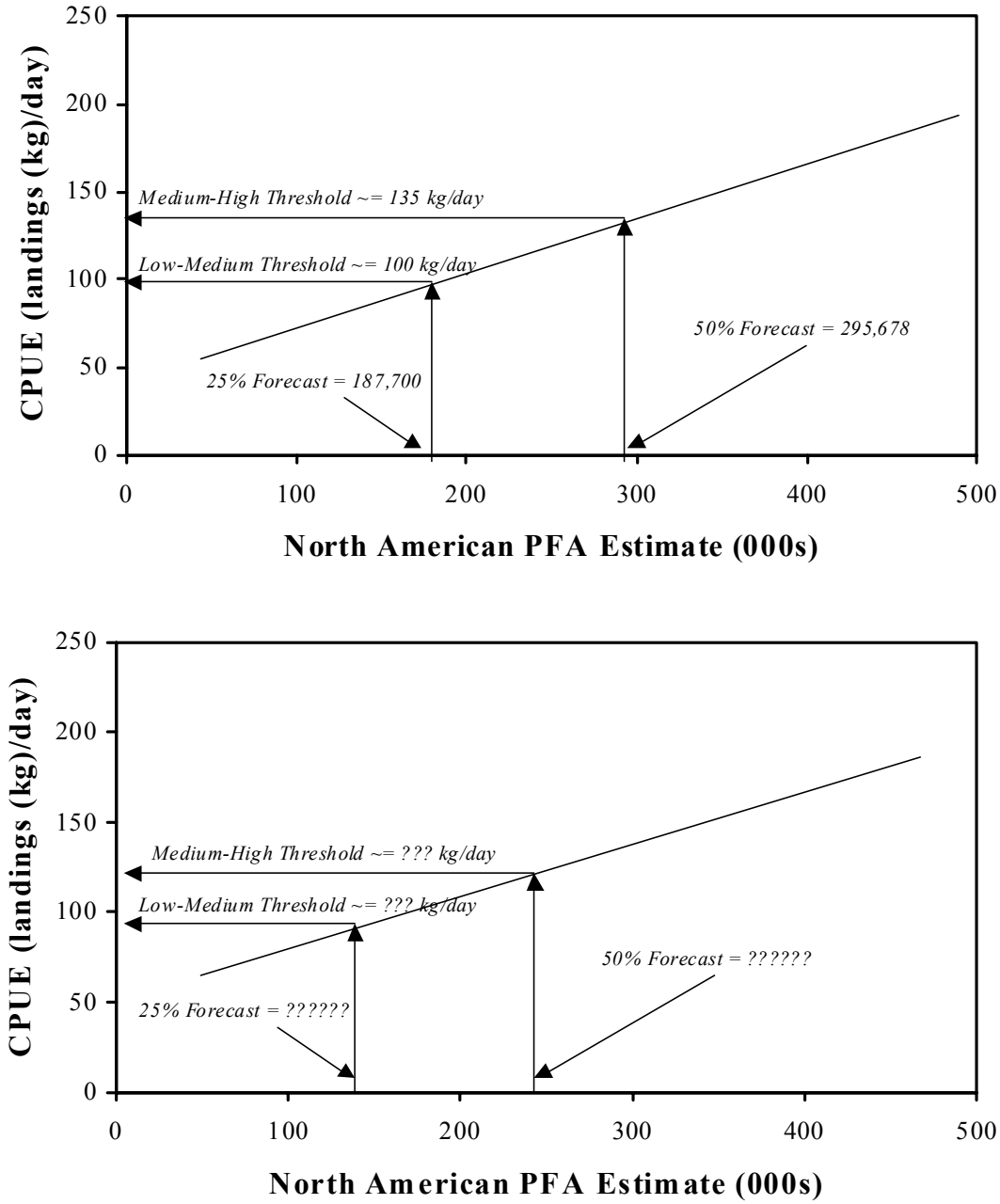


Figure 7.1.2.2. Illustration of method used to establish CPUE thresholds for the 2001 ad hoc management system, which included 1) regressing CPUE against the PFA estimates, 2) using the resulting relationship to estimate the CPUE associated with the 25% and 50% probability levels of the PFA forecasts to use as thresholds between the low, medium and high CPUE zones. Bottom panel provides an example of how threshold levels could change as a result of revised PFA estimates, and a different probability distribution of PFA estimates.

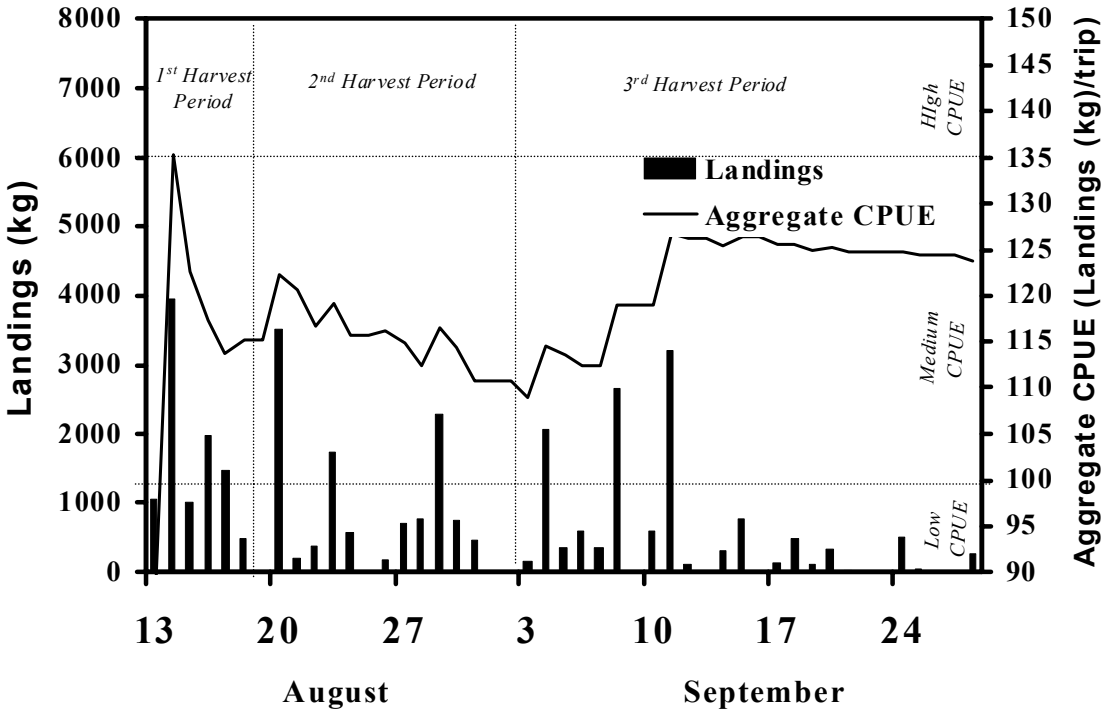


Figure 7.1.2.3 Daily landings and aggregated catch per unit effort (kg/landing) during the 2001 fishery relative to harvest periods and CPUE thresholds established for quota allocation decisions.

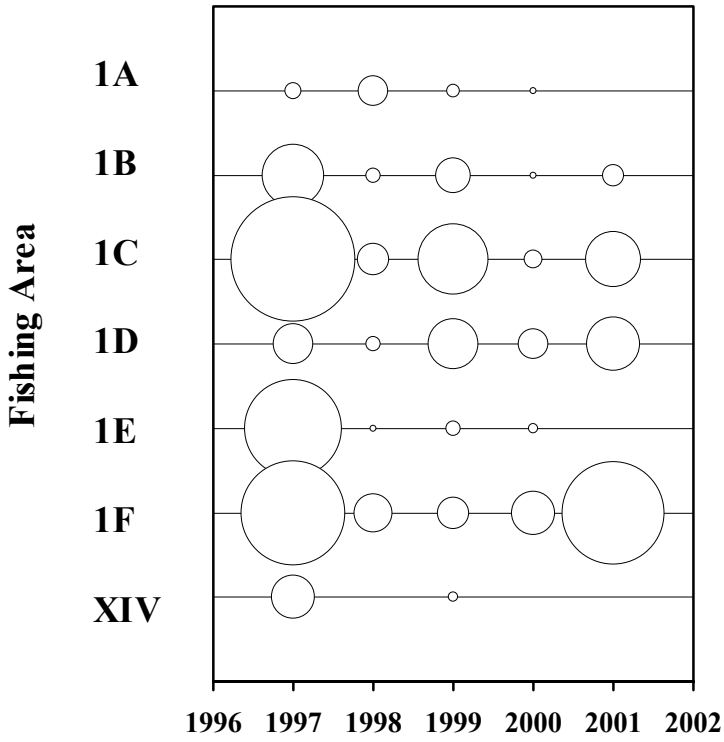


Figure 7.1.2.4. Distribution of commercial effort (number of trips reporting salmon landings) by NAFO area in the fisheries at West (regions 1A to 1F) and East Greenland fisheries from 1997 to 2001. The size of circles indicates the number of commercial trips reported in each year and area.

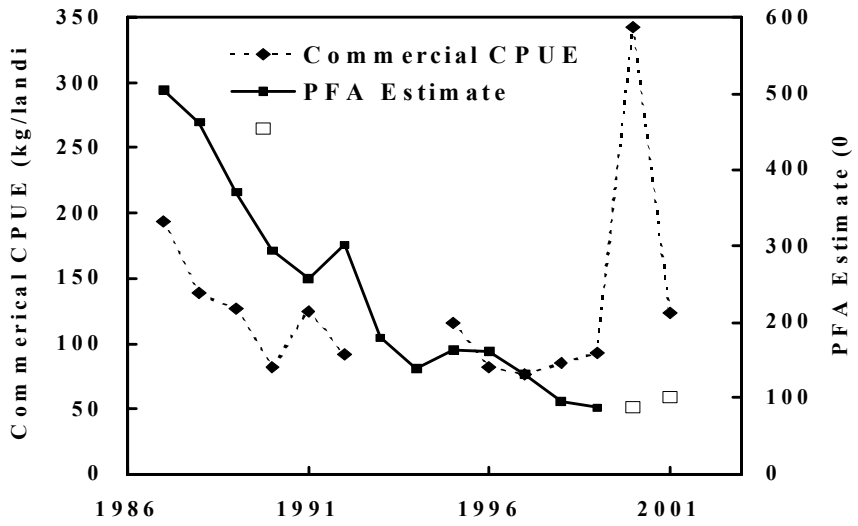


Figure 7.1.2.5. Relationship of CPUE and prefishery abundance estimates and forecasts for the non-maturing 1SW component of the North American Atlantic Salmon stock complex using PFA estimates updated in 2002.

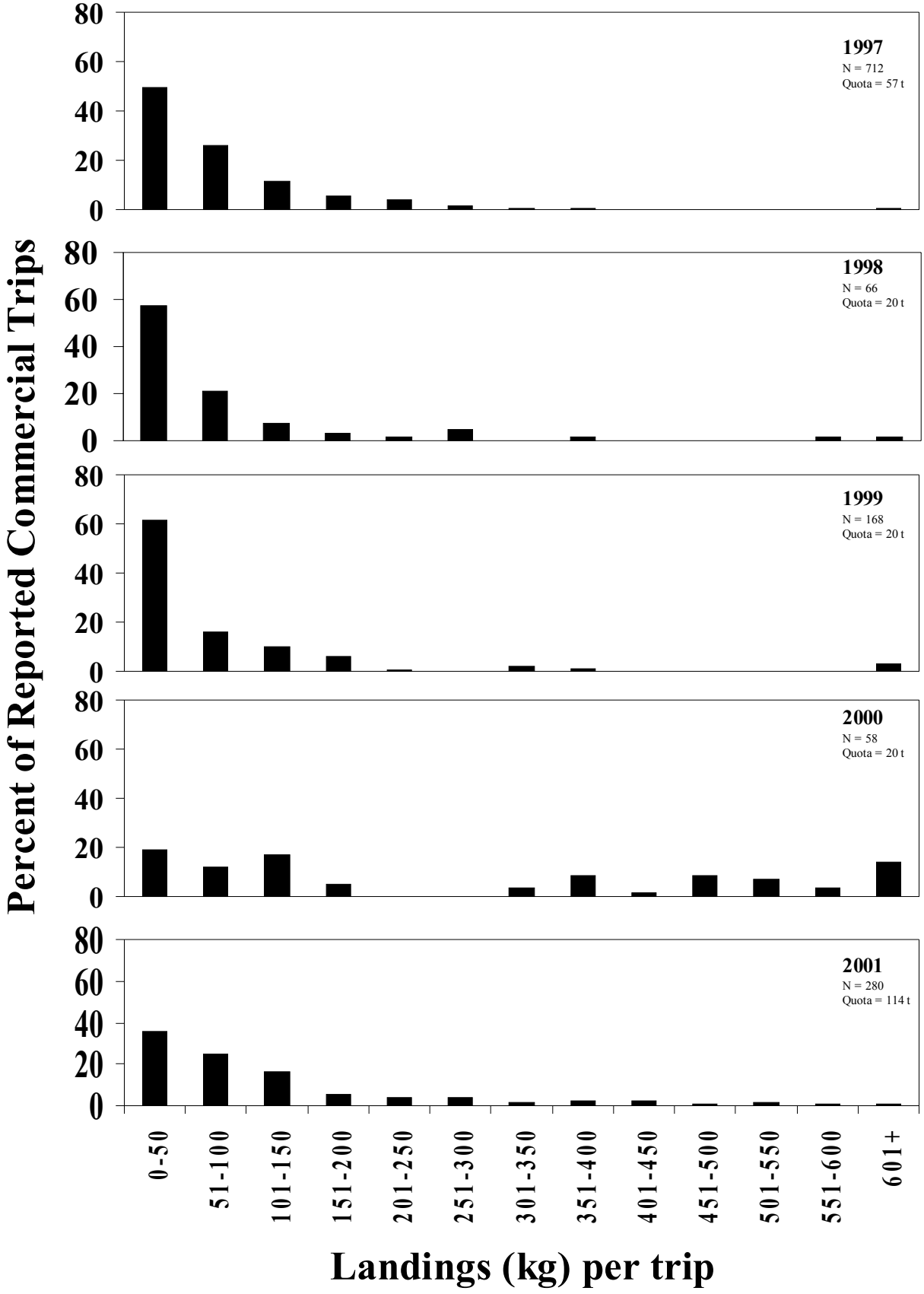


Figure 7.1.2.6. Distribution of landings (kg) of Atlantic salmon from individual commercial trips in the West Greenland fishery from 1997 to 2001.

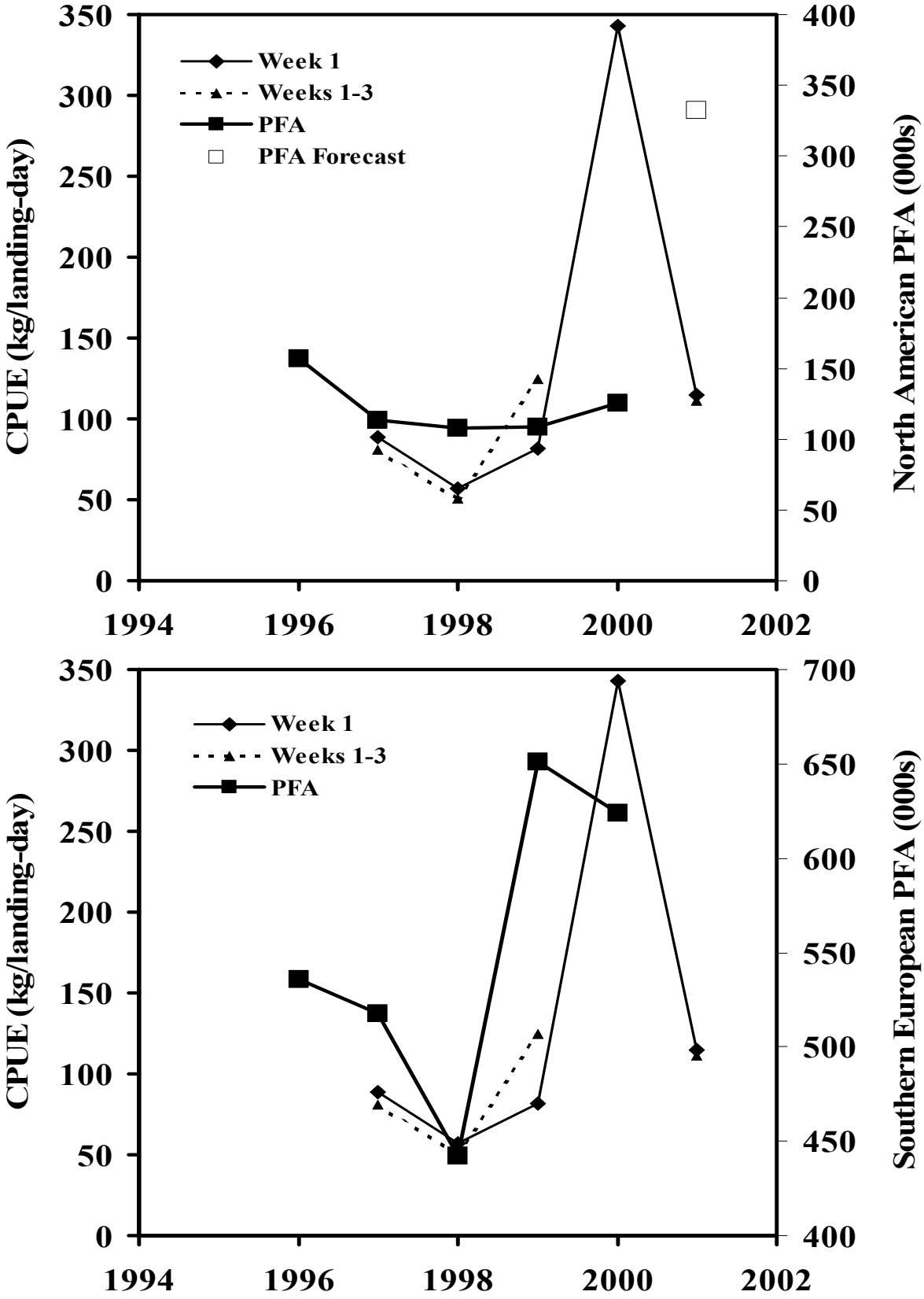


Figure 7.1.2.7 Relationship of CPUE indices used in decision points in the 2001 ad hoc management system and prefishery abundance estimates for the non-maturing 1SW component of the North American (top panel) and Southern European (bottom panel) salmon stock complexes.

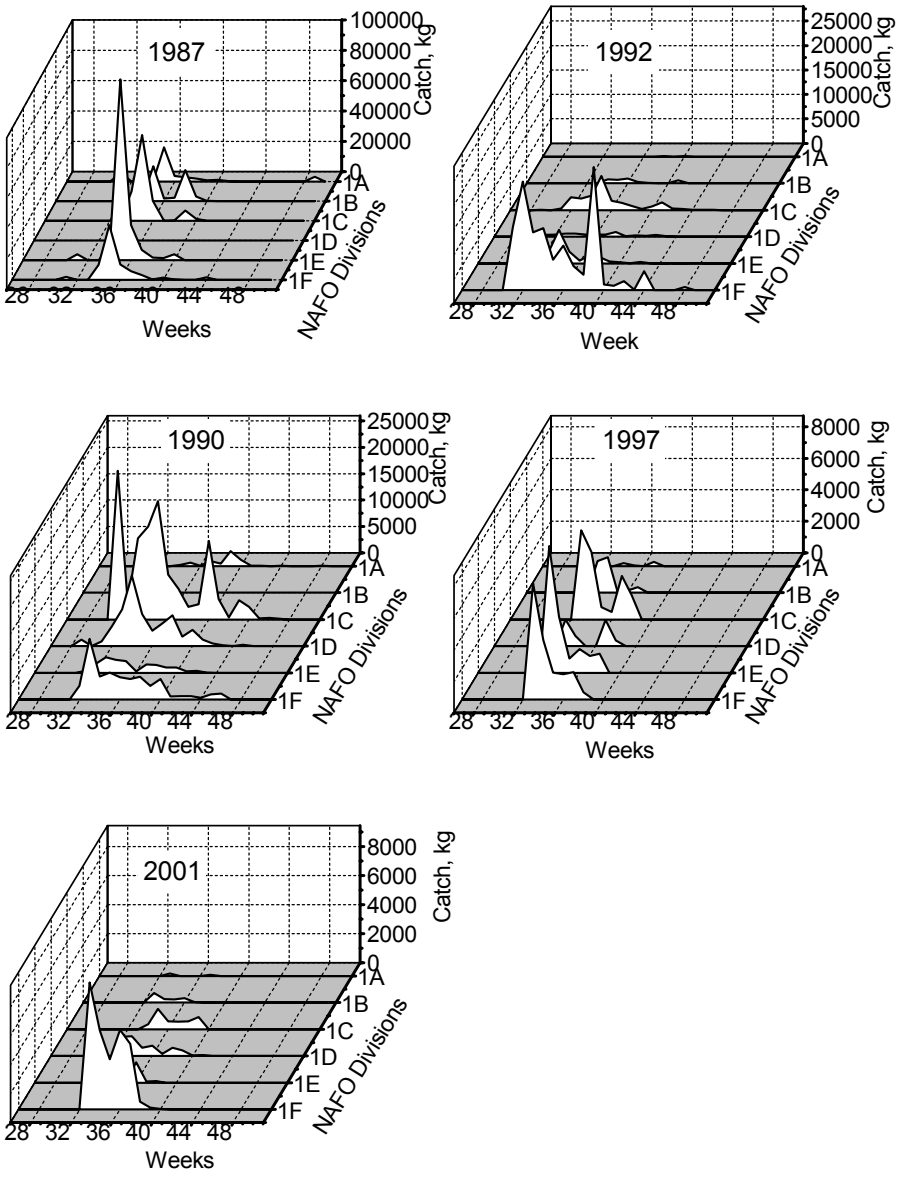


Figure 7.1.4.1 The distribution of landings at Greenland for NAFO Divisions, weeks for the years 1987, 1990, 1992, 1997, and 2001.

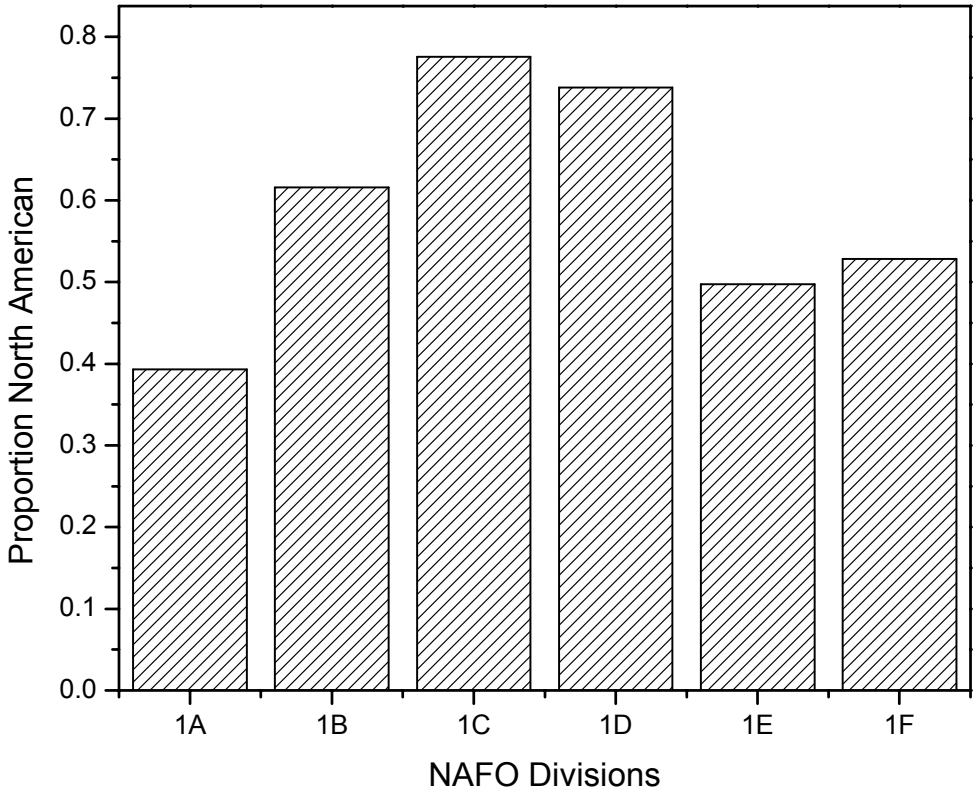


Figure 7.1.4.2 The proportion of North American salmon for NAFO Divisions.

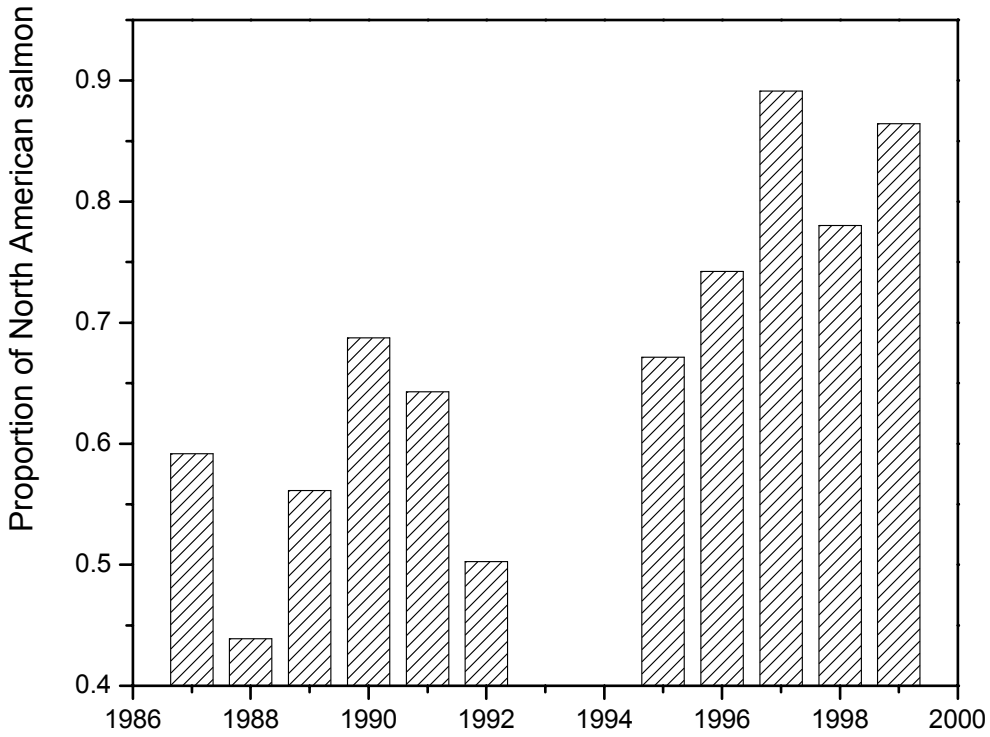


Figure 7.1.4.3 The proportion of North American salmon for years, 1987–1999.

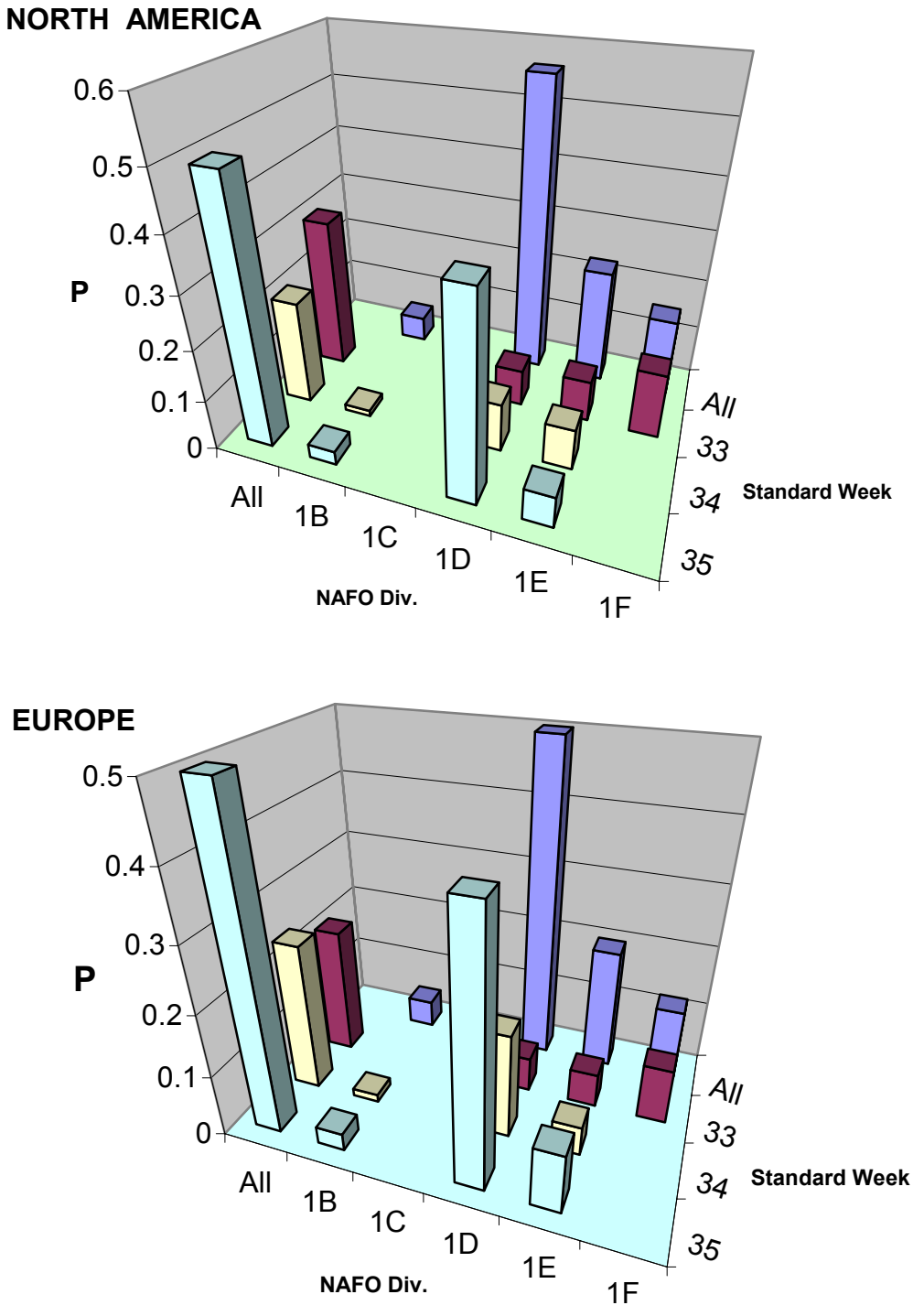


Figure 7.1.4.4 Probability of capture among standard weeks 33 through 35 and NAFO divisions 1B, 1C, 1D, 1E, 1F for fish originating from Europe and North America. Within each graph, the probabilities for rows closest to the walls (All) and within the 3 (week) x 5 (division) space each equal 1. No proportions are presented for under sampled cells. The two ALL rows collapse probabilities over standard week and NAFO division.

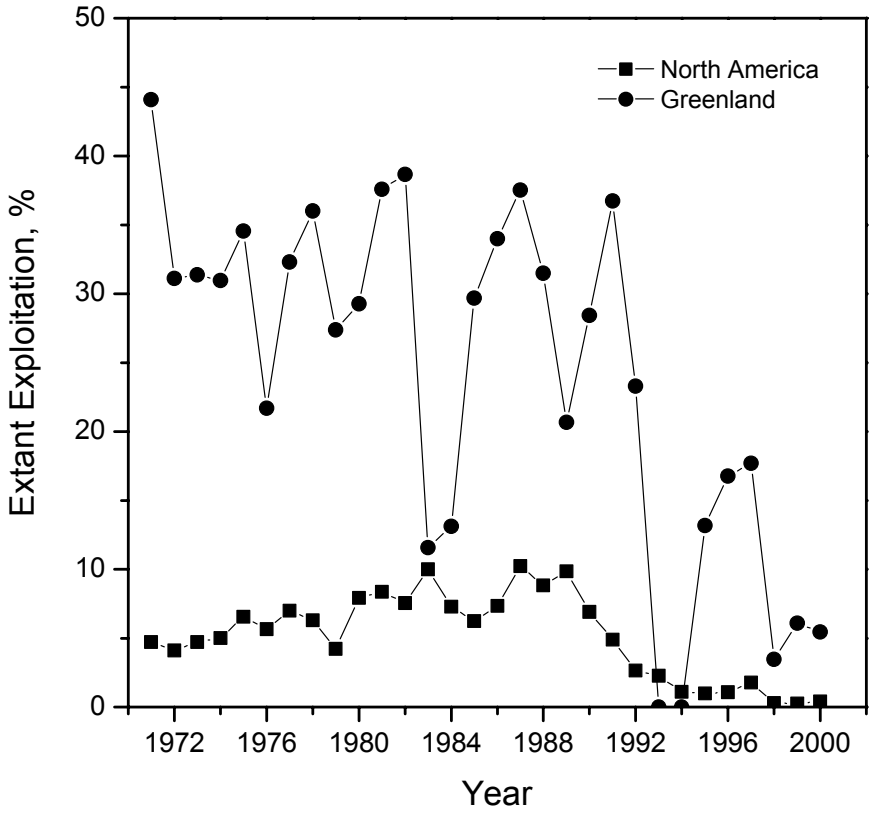


Figure 7.2.1 Extant exploitation of the non-maturing component of North American salmon as 1SW salmon in North America and Greenland from the run-reconstruction statistics.

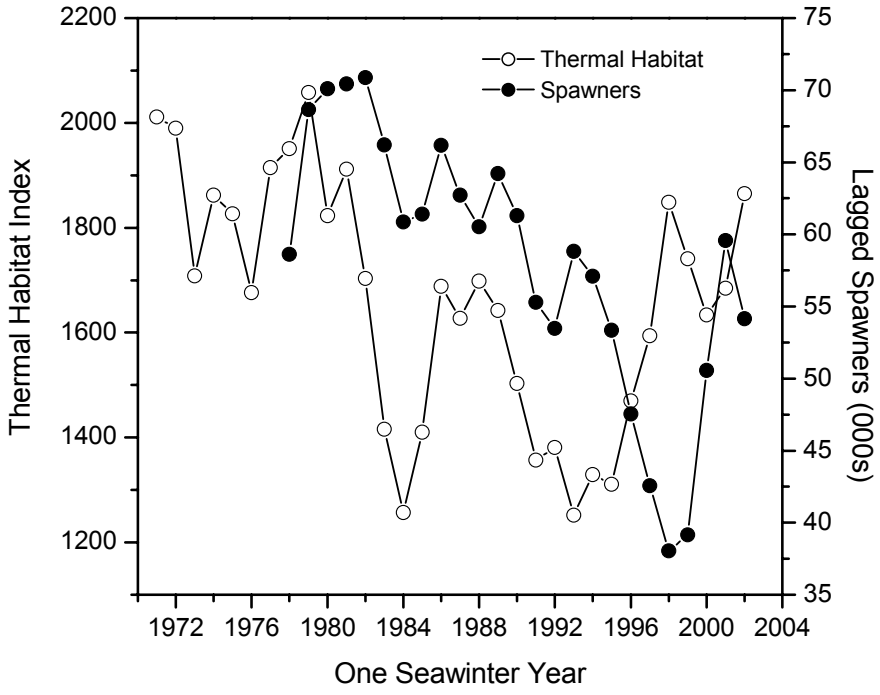


Figure 7.4.1.1 Thermal habitat index for February (H2) and lagged spawners (SLNQ).

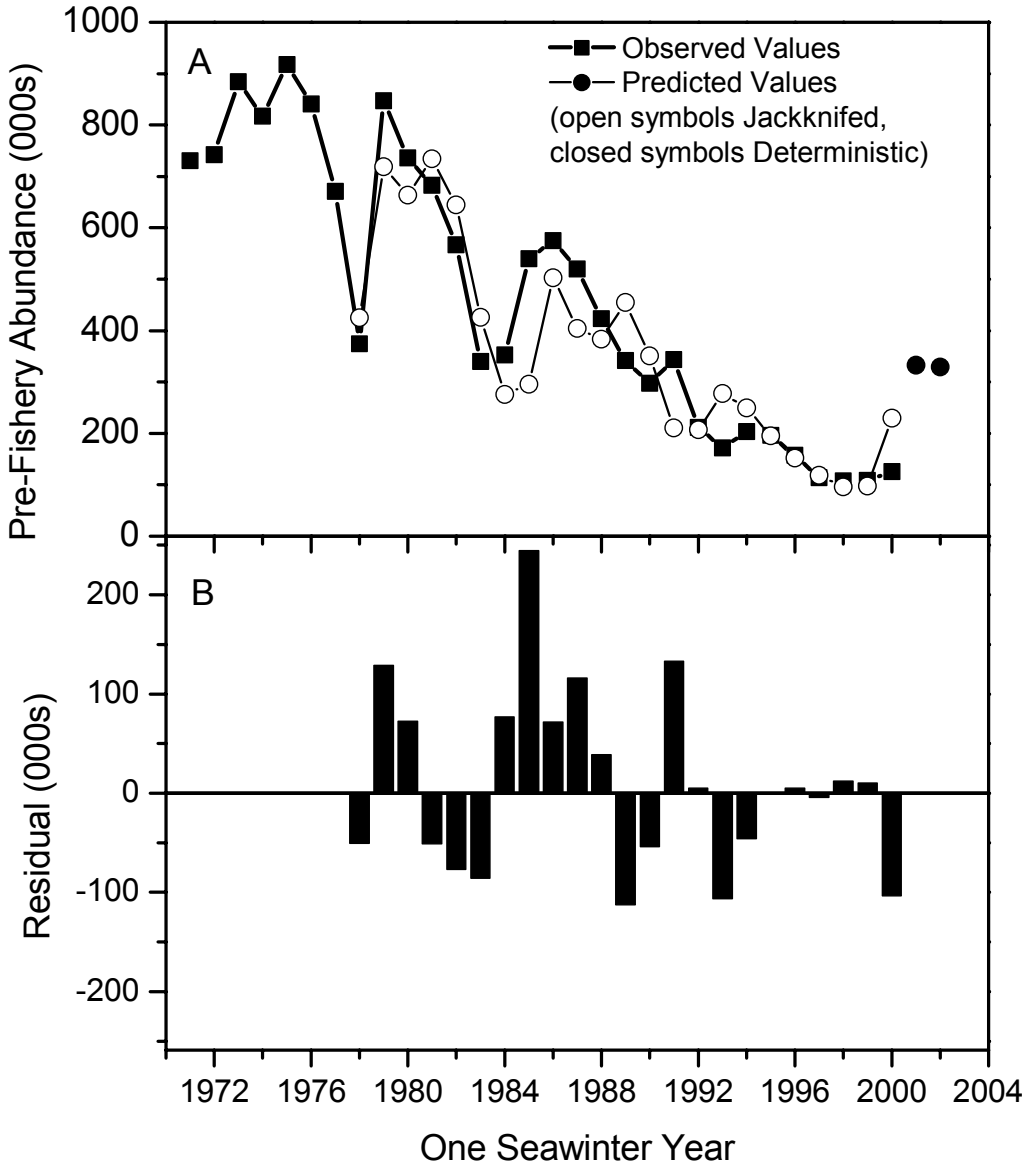


Figure 7.4.1.2 Observed estimates, jackknifed historical predictions, and deterministic forecasts (upper Panel A) of prefishery abundance from the multiplicative model. The residual pattern from the jackknifed predictions is shown in the lower panel (Panel B).

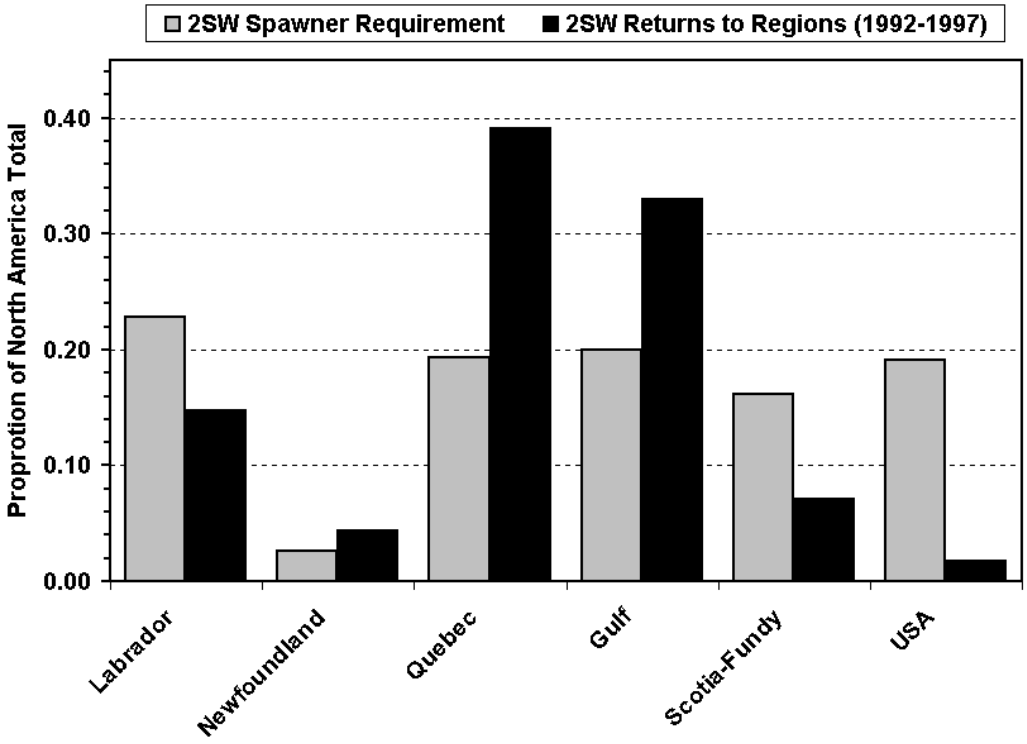


Figure 7.4.3.1 Average returns of 2SW salmon to six regions of North America, expressed as the proportion of total returns to North America, during 1992 to 1997 compared to the 2SW requirements of each region as a proportion of the conservation requirement for North America.

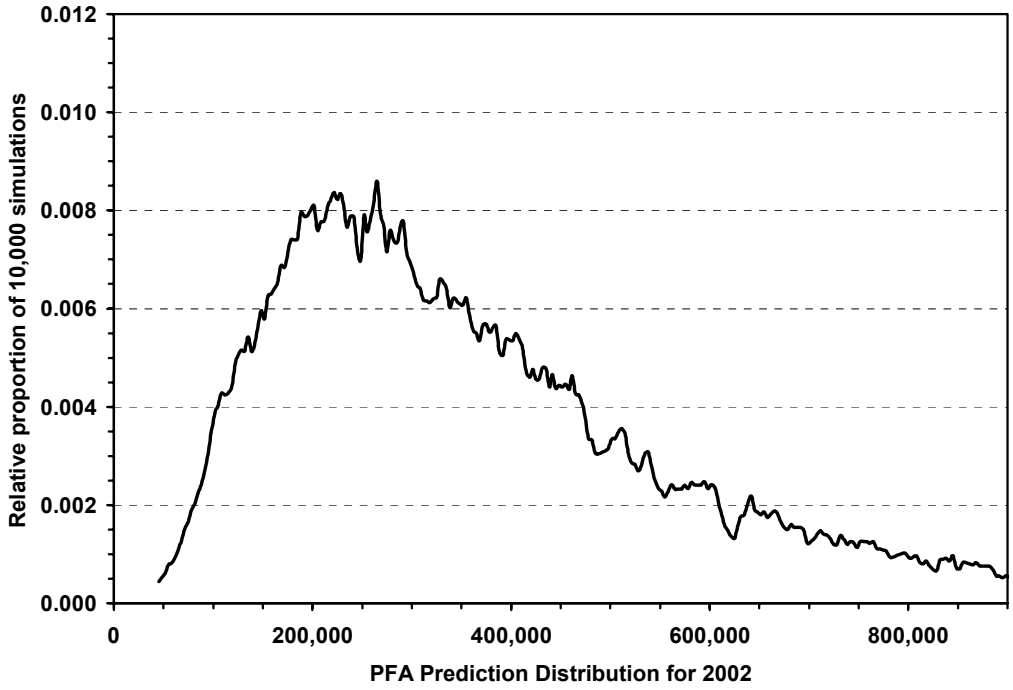


Figure 7.4.3.2 Exact posterior predicted probability distributions of the PFA in year 2002 based on the multiplicative model with errors in the PFA and SNLQ variables. The distributions were generated from 10,000 Monte Carlo simulations.

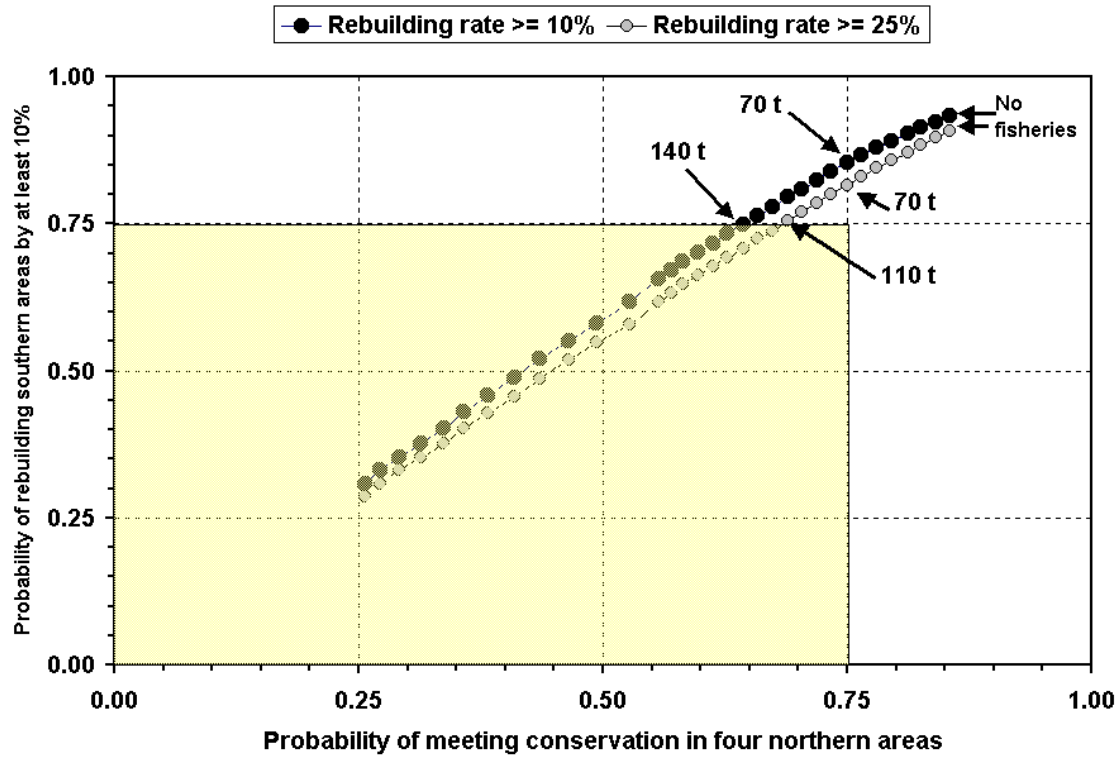


Figure 7.4.3.3 Probability profiles for the management objectives of achieving the 2SW conservation limits simultaneously in the four northern areas of North America (Labrador, Newfoundland, Quebec, Gulf – horizontal axis) and achieving the stock rebuilding objectives for the southern regions of Scotia-Fundy and USA (vertical axis) relative to quota options for West Greenland assuming a 40:60 allocation of the harvest. The symbols represent individual quota (t) options for the West Greenland fishery.

APPENDIX 1

CNL(01)66
REQUEST FOR SCIENTIFIC ADVICE FROM NASCO TO ICES (JULY 2001)

1 with respect to Atlantic salmon in the North Atlantic area:

1.1 provide an overview of salmon catches and landings, including unreported catches by country and catch and release, and worldwide production of farmed and ranched salmon in 2001,
1.2 report on significant developments which might assist NASCO with the management of salmon stocks,
1.3 provide a compilation of tag releases by country in 2001

2 with respect to Atlantic salmon in the North-East Atlantic Commission area:

2.1 describe the key events of the 2001 fisheries and the status of the stocks,
2.2 update the evaluation of the effects on stocks and fisheries of significant management measures introduced since 1991,
2.2 further develop the age-specific stock conservation limits where possible based upon individual river stocks,
2.3 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits,
2.4 Provide an estimate of by-catch of salmon post-smolts in pelagic fisheries based on the scientific information currently available.
2.5 identify relevant data deficiencies, monitoring needs and research requirements;

3 with respect to Atlantic salmon in the North American Commission area

3.1 describe the key events of the 2001 fisheries and the status of the stocks,
3.2 update the evaluation of the effects on US and Canadian stocks and fisheries of management measures implemented after 1991 in the Canadian commercial salmon fisheries
3.3 update age-specific stock conservation limits based on new information as available,
3.4 characterise the reliability of input data used to estimate the lagged spawner variable, with special emphasis on the Labrador region, and evaluate sensitivity of resulting pre-fishery abundance estimates.
3.5 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits,
3.5 identify relevant data deficiencies, monitoring needs and research requirements;

4 with respect to Atlantic salmon in the West Greenland Commission area:

4.1 describe the events of the 2001 fisheries and the status of the stocks,
4.2 update the evaluation of the effects on European and North American stocks of the Greenlandic quota management measures and compensation arrangements since 1993,
4.3 characterise the historical and current temporal and spatial distribution and relative abundance of North American and European Atlantic salmon and, where possible, smaller stock groups, in fisheries at West Greenland.
4.4 provide catch options or alternative management advice with an assessment of risks relative to the objective of exceeding stock conservation limits,
4.5 provide a detailed explanation and critical examination of any changes to the model used to provide catch advice and of the impacts of any changes to the model on the calculated quota
4.6 evaluate the ad hoc management programme and advise on an appropriate management system for the fishery in future years, taking account of the stocks of both North American and European origin
4.7 identify relevant data deficiencies, monitoring needs and research requirements.

NOTES:

1 In response to questions 2.1, 3.1 and 4.1 ICES is asked to provide details of catch, gear, effort, composition and origin of the catch and rates of exploitation. For homewater fisheries the information provided should indicate the location of the catch in the following categories: in-river, estuarine and coastal. Any new information on non-catch fishing mortality of the salmon gear used and on by-catch of other species in salmon gear and of salmon in any new fisheries for other species is also requested.

2 *In response to question 2.4 advise on the potential biases in the catch advice resulting from the inclusion of farm fish escapes in the assessment models.*

3 *In response to question 4.1, ICES is requested to provide a brief summary of the status of the North American and North-East Atlantic salmon stocks. The detailed information on the status of these stocks should be provided in response to questions 2.1 and 3.1.*

4 *With regard to question 4.3 "change to the model " would include the development of any new model.*

APPENDIX 2

Computation of Catch Advice for West Greenland

The North American Spawning Reserve (SpT) for 2SW salmon of 152 548 fish remains the same as in 2000.

This number must be divided by the survival rate for the fish from the time of the West Greenland fishery to their return of the fish to home waters (11 months) to give the Spawning Target Reserve (SpR). Thus:

Eq. 1. SpR = SpT * (exp(11*M) (where M = 0.03)

The Maximum Allowable Harvest (MAH) may be defined as the number of non-maturing 1SW fish that are available for harvest. This number is calculated by subtracting the Spawning Target Reserve from the pre-fishery abundance (PFA).

Eq. 2. MAH = PFA - SpR

To provide catch advice for West Greenland it is then necessary to decide on the proportion of the MAH to be allocated to Greenland (f_{NA}). The allowable harvest of North American non-maturing 1SW salmon at West Greenland NA1SW) may then be defined as

Eq. 3. $NA1SW = f_{NA} * MAH$

The estimated number of European salmon that will be caught at West Greenland (E1SW) will depend upon the harvest of North American fish and the proportion of the fish in the West Greenland fishery that originate from North America [PropNA] [1]. Thus:

Eq. 4. E1SW = (NA1SW / PropNA) - NA1SW

To convert the numbers of North American and European 1SW salmon into total catch at West Greenland in metric t, it is necessary to incorporate the mean weights (kg) of salmon for North America [WT1SWNA][1] and Europe [WT1SWE][1] and age correction factor for multi-sea winter salmon at Greenland based on the total weight of salmon caught divided by the weight of 1SW salmon [ACF][1]. The quota (in t) at Greenland is then estimated as

Eq. 5. Quota = (NA1SW * WT1SWNA + E1SW * WT1SWE) * ACF/1000

1 Sampling data from the 1995–1999 fishery at West Greenland were used to update the forecast values by exponential smoothing of the proportion of North American salmon in the catch (PropNA), weights by continent [WT1SWNA, WT1SWE] and the age correction factor [ACF].

APPENDIX 3

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Rago, P.J., D.J. Meerburg, D.G. Reddin, G. J. Chaput, T.L. Marshall, B. Dempson, F. Caron, T.R. Porter, K.D. Friedland, and E.T. Baum. **1993b**. Estimation and analysis of pre-fishery abundance of the two-sea-winter population of North American Atlantic salmon (*Salmo salar*), 1974–1991. ICES CM 1993/M:24.

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8 European eel

ICES (1998, 1999, 2001) has provided advice that the eel stock is outside safe biological limits and current fisheries not sustainable. It is recommended to develop an international recovery plan for the whole stock, and to reduce exploitation to the lowest possible level until such a plan is agreed upon and implemented. ICES also proposed several management measures that could contribute to the recovery plan and reductions in exploitation.

State of the stock and exploitation: The eel stock is outside safe biological limits and the current fishery is not sustainable. Recruitment has been in decline since 1980, which is more than a generation time ago and reached a historical minimum in 2001. The most recent information indicates no improvement in 2002. Eels are exploited in all life stages present in continental waters. Fishing mortality is high both on juvenile (glass eel) and older eel (yellow and silver eel) in many water systems. Total yield has declined to about half that of the mid-1960s. Other anthropogenic factors (habitat loss, contamination, and transfer of diseases) have had negative effects on the stock, possibly of a magnitude comparable to exploitation. All information indicates that the stock is at a historical minimum and continues to decline.

Management objective: There is no stock-wide objective stated for this stock. Some countries are formulating national policies that include both biological and economic considerations, but in most countries no management objective has been set. Management objectives need to be internationally co-ordinated, targeting the whole continental distribution area.

Advice on management: **Actions that would lead to a recovery of the stock are urgently required. Management of eel fisheries requires coordinated action at the scale of catchment areas and higher, commonly spanning multiple jurisdictions. Uncoordinated management actions in isolated areas are not likely to lead to a recovery of the stock. Because of the length of the life cycle, it will take 5–20 years before positive effects can be expected.**

ICES recommends that an international recovery plan be developed for the whole stock on an urgent basis and that exploitation and other anthropogenic mortalities be reduced to as close to zero as possible, until such a plan is agreed upon and implemented.

A range of management measures is documented by ICES in its advice from 2001 and in the report of the ICES/EIFAC Working Group on Eel.

Relevant factors to be considered in management: A recovery plan should include measures to reduce exploitation of all life stages and restore habitats. A long-term rebuilding goal could be to achieve recruitment levels similar to those of the 1980s. Short-term goals on catchment area level could be based on indicators of escapement of glass eel in areas with a glass eel fishery, density and size structure in a yellow eel population, and escapement of silver eels.

Elaboration and special comments: The ecology of eels makes it difficult to demonstrate a stock-recruitment relationship, however, the precautionary approach requires that such a relationship should be assumed to exist for the eel until demonstrated otherwise.

Current scientific knowledge is inadequate to provide management reference points for eel. Considering the many uncertainties in eel management and biology and the uniqueness of the eel stock (one single stock, spawning only once in their lifetime), a precautionary reference point for eel must be stricter than universal provisional reference targets. Exploitation, which provides 30% of the virgin (F=0) spawning stock biomass is generally considered to be such a reasonable provisional reference target. However, for eel a preliminary value could be 50%.

Current monitoring is based on national programmes only. Several of the long-lasting time-series have come under pressure, because of the decreased turnover of the local eel fisheries and the impossibility of addressing the stock decline at the local level. However, in light of the poor state of the stock and the high anthropogenic impacts, it is of utmost importance that existing time-series of monitoring recruitment, effort, and yield should be continued and preferably be supplemented.

Source of information: Report of the ICES/EIFAC Working Group on Eels, 2–6 September 2002 (ICES CM 2003/ACFM:06).

Table 8.1 Recruitment data series. In this table, recruitment data series are listed, in the units in which they were reported. Part 1: Scandinavia and British Isles.

	N	S	S	S	S	DK	D	N.Irl.	Irl	Irl	UK
	Imsa	Göta Älv	Viskan	Motala	Dalälven	Vidaa	Ems	Bann	Erne	Shannon	Severn
1950		2947		305			875				
1951		1744		2713	210		719				
1952		3662		1544	324		1516				
1953		5071		2698	242		3275				
1954		1031		1030	509		5369				
1955		2732		1871	550		4795		167.00		
1956		1622		429	215		4194				
1957		1915		826	162		1829				
1958		1675		172	337		2263				
1959		1745		1837	613		4654		244.00		
1960		1605		799	289		6215	7409	1229		
1961		269		706	303		2995	4939	625		
1962		873		870	289		4430	6740	2469		
1963		1469		581	445		5746	9077	426		
1964		622		181.6	158		5054	3137	208		
1965		746		500	276		1363	3801	932		
1966		1232		1423	158		1840	6183	1394		
1967		493		283	332		1071	1899	345		
1968		849		184	266		2760	2525	1512		
1969		1595		135	34		1687	422	600		
1970		1046		2	150		683	3992	60		
1971		842	12	1	242	787	1684	4157	540		
1972		810	88	51	88	780	3894	2905			
1973		1179	177	46	160	641	289	2524			
1974		631	13	58.5	50	464	4129	5859	794		
1975	42945	1230	99	224	149	888	1031	4637	392		
1976	48615	798	500	24	44	828	4205	2920	394		
1977	28518	256	850	353	176	91	2172	6443	131	1.02	
1978	12181	873	533	266	34	335	2024	5034	320	1.37	
1979	2457	190	505	112	34	220	2774	2089	488	6.69	40.1
1980	34776	906	72	7	71	220	3195	2486	1352	4.50	32.8
1981	15477	40	513	31	7	226	962	3023	2346	2.15	32.0
1982	45750	882	380	22	1	490	674	3854	4385	3.16	30.4
1983	14500	113	308	12	56	662	92	242	728	0.60	6.2
1984	6640	325	21	48	34	123	352	1534	1121	0.50	29.0
1985	3412	77	200	15.2	70	13	260	557	394	1.09	18.6
1986	5145	143	151	26	28	123	89	1848	684	0.95	15.5
1987	3434	168	146	201	74	341	8	1683	2322	1.61	17.7
1988	17500	475	92	170	69	141	67	2647	3033	0.15	23.1
1989	10000	598	32	35.2		9	13	1568	1718	0.03	13.5
1990	32500	149	42	21		5	99	2293	2152	0.47	16.0
1991	6250	264	1	2			52	677	482	0.09	7.8
1992	4450	404	70	108	10		6	978	1371	0.03	17.7
1993	8625	64	43	89	7		20	1525	1785	0.02	20.9
1994	525	377	76	650	72		52	1249	4400	0.29	22.3
1995	1950		6	32	8		40	1403	2400	0.40	36.0
1996	1000	277	1	14	18		20	2667	1000	0.33	25.7
1997	5500	180	8	8	8		5	2533	1038	2.12	16.9
1998	1750		5	6	15		4	1283	782	0.28	20.0
1999	3750		2	85	16		3	1345	1100	0.02	18.0
2000	1625		14	270	12		4	563	900	0.04	7.6
2001	1875		2	178	8		1	250	699	0.003	5.4
2002		685	13					1000	112	0.16	

Table 8.2 Recruitment data series; continued. Part 2: Mainland Europe.

	NL	B	F	F	F	F	F	E	P/E	It
Year	DenOever	Ijzer	Vilaine	Loire	Gironde (CPUE)	Gironde (Yield)	Adour	Nalon	Minho	Tiber
1950	6.56			86						
1951	12.94			166						
1952	83.88			121				14529		
1953	12.22			91				8318		
1954	18.32			86				13576		
1955	25.15			181				16649		
1956	6.68			187				14351		
1957	14.98			168				12911		
1958	47.75			230				13071		
1959	26.73			174				17975		
1960	20.67			411				13060		
1961	35.7			334				17177		
1962	80.48			185				11507		
1963	115.38			116				16139		
1964	36.42	3.7		142				20364		
1965	75.26	115.0	5.0	134				11974		
1966	17.9	385.0	4.0	253				12977		
1967	28	575.0	9.0	258				20556		
1968	19.06	553.5	12.0	712				15628		
1969	16.16	445.0	10.0	225				18753		
1970	36.49	795.0	8.0	453				17032		
1971	16.52	399.0	44.0	330				11219		
1972	28.99	556.5	38.0	311				11056		
1973	22.26	356.0	78.0	292				24481		
1974	24.53	946.0	107.0	557				32611	1.642	
1975	32.14	264.0	44.0	497				55514	10.578	11.00
1976	25.51	618.0	106.0	770				37661	20.048	6.70
1977	56.8	450.0	52.0	677				59918	36.637	5.90
1978	37.47	388.0	106.0	526				37468	24.334	3.60
1979	50.32	675.0	209.0	642	19.7	286.2		42110	28.435	8.40
1980	25.79	358.0	95.0	525.5	25.9	404.8		34645	21.32	8.20
1981	21.59	74.0	57.0	302.7	20.0	332.2		26295	54.208	4.00
1982	13.71	138.0	98.0	274	15.0	123.3		21837	16.437	4.00
1983	8.98	10.0	69.0	259.5	13.6	80.3		22541	30.447	4.00
1984	12.3	6.0	36.0	182.5	19.2	82.0		12839	31.387	1.80
1985	13.79	13.0	41.0	154	9.6	64.5		13544	20.746	2.50
1986	14.42	26.0	52.6	123.4	10.6	45.2	8	23536	12.553	0.20
1987	5.71	33.0	41.2	145	14.0	82.4	9.5	15211	8.219	7.40
1988	3.88	48.0	46.6	176.6	10.9	33.0	12	13574	8.001	10.50
1989	2.71	30.0	36.7	87.1	7.2	80.0	9	9216	9.000	5.50
1990	3.29	218.2	35.9	96	5.6	48.1	3.2	7117	6.000	4.40
1991	0.99	13.0	15.4	35.7	7.7	64.0	1.5	10259	9.000	0.80
1992	2.6	18.9	29.6	39.3	3.7	41.7	8	9673	10.000	0.60
1993	2.61	11.8	31.0	90.5	8.2	69.4	5.5	9898	7.600	0.50
1994	4.48	17.5	24.0	94.6	8.7	45.8	3	12602	4.700	0.50
1995	6.52	1.5	29.7	132.5	8.2	73.2	7.5	5992	15.200	0.30
1996	7.38	4.5	22.4	80.8	4.8	30.7	4.1	3655	8.700	0.10
1997	11.9	9.8	22.6	70.8	6.5	50.5	4.6	3275	7.400	0.10
1998	2.12	2.3	17.5	60.7	4.3	25.0	1.5	3814	7.400	0.13
1999	3.27		15.3	86.9	7.5	44.1	4.3	1331		0.06
2000	1.62	17.9	14.2	79.9			10	1289		0.07
2001	0.53	1.0	8.1							0.04
2002	1.09	1.4	16.0							0.02

Table 8.3 Statistics of eel landings, reported in the FAO database of fishing yields. These data include landings of 'river eels' in Atlantic waters, the Mediterranean, and Inland waters. Data for Denmark, Netherlands, and Italy have been corrected for incorrectly included aquaculture yield.

Country year	Norway	Sweden	Denmark	Germany	Ireland	UK	Netherlands	France	Spain	Portugal	Italy	Remaining Europe	Northern Africa
1950	300	2188	4500	400			4200	500	100		1000		
1951	300	1929	4400	400			3700	500	100		1000		
1952	200	1598	3900	400			4000	700	100		1000		
1953	400	2378	4300	500		400	3100	600	100		1000	900	
1954	300	2106	3800	300		500	2100	500	900		1000	800	
1955	500	2651	4800	500		700	1700	500	600		1000	1000	
1956	300	1533	3700	400		600	1800	500	800		2000	900	
1957	400	2225	3600	400		600	2500	500	500		2000	800	
1958	400	1751	3300	400	100	600	2700	500	500		2100	1200	
1959	400	2789	4000	500	100	500	3400	900	500		3000	700	
1960	400	1646	4723	400	0	800	3000	1300	500		2700	1000	
1961	500	2066	3875	500	100	800	2660	1300	400		2600	900	300
1962	400	1908	3907	400	100	700	1543	1300	800		3100	1000	300
1963	500	2071	3928	2100	100	700	1818	1400	1100		3500	1000	300
1964	400	2288	3282	1900	100	600	2368	1400	1700		3500	1100	400
1965	500	1802	3197	1500	200	800	2509	1700	1300		3200	900	500
1966	500	1969	3690	1700	100	1000	2739	1300	1300		3100	1000	400
1967	500	1617	3436	1900	100	600	2884	2000	1400		3100	1100	400
1968	600	1808	4218	1800	100	600	2622	2700	1300		3200	1100	400
1969	500	1675	3624	1600	100	600	2741	1900	1400		3400	1100	400
1970	400	1309	3309	1600	200	800	1512	4200	1100		3300	1400	100
1971	400	1391	3195	1300	100	800	1153	4900	1100		3400	1500	100
1972	400	1204	3229	1300	100	700	1057	2600	1000		2900	1138	100
1973	400	1212	3455	1300	100	800	1023	3900	700		2900	1150	800
1974	383	1034	2814	1285	67	817	994	2493	1300	42	2697	1528	352
1975	411	1399	3225	1398	79	833	1173	1590	570	44	2973	1400	85
1976	386	935	2876	1322	150	694	1306	2959	675	38	2677	1254	47
1977	352	989	2323	1317	108	742	929	1538	666	52	2462	1384	159
1978	347	1076	2335	1162	76	877	862	2455	655	44	2237	1357	112
1979	374	956	1826	1164	110	879	687	3144	394	25	2422	1518	134
1980	387	1112	2141	1051	75	1053	828	4503	300	32	2264	1242	448
1981	369	887	2087	1033	94	858	876	1425	250	33	2340	1192	497
1982	385	1161	2378	1027	144	1032	1097	1469	200	14	2087	1419	455
1983	324	1173	2003	1029	117	1113	1230	1856	150	11	2076	1782	575
1984	309	1073	1745	911	88	957	681	2336	150	80	2361	2445	477
1985	352	1140	1519	866	87	781	666	2288	200	76	1907	2123	258
1986	271	943	1552	887	87	997	729	2924	200	633	1928	1867	356
1987	282	897	1189	731	221	939	512	2378	259	566	2076	2479	306
1988	513	1162	1759	746	215	715	590	2879	205	501	2165	2790	256
1989	312	952	1582	678	400	1075	645	2482	83	6	1301	2365	368
1990	336	942	1568	976	256	1039	657	2484	75	295	1199	2209	560
1991	323	1084	1366	1010	245	822	707	2260	65	314	1106	2337	358
1992	373	1180	1342	1026	234	782	621	1964	60	674	1662	2749	358
1993	340	1210	1023	1027	260	752	320	1674	55	505	1307	2509	613
1994	472	1553	1140	585	300	873	369	1417	50	979	986	2797	732
1995	454	1205	840	585	400	808	279	500	106	10	886	2572	1176
1996	352	1134	717.5	696	550	895	336	563	97	21	883	2676	984
1997	497	1382	757.6	746	550	807	315	1942	113	16	1010	2034	1327
1998	353	645	557	717	670	741	346	491	160	13	682	2159	1069
1999	475	734	686	747	675	697	372	189	166	3		1532	1257
2000	281	561	620	686	250	796	368	247	48	29		604	30
2001		429			110	795	351						

Table 8.4 Re-stocking of glass eel and yellow eel smaller than minimum legal size (bootlace eel). Numbers of eels (in millions) re-stocked in (eastern) Germany (D east), the Netherlands (NL), Sweden (S), Poland (PO), and Northern Ireland (N.Irl.).

	D east	NL	S	PO	N.Irl.	Flanders
1945					17.0	
1946		7.3			21.0	
1947		7.6				
1948		1.9				
1949		10.5				
1950	0.0	5.1				
1951	0.0	10.2	0.0			
1952	0.0	16.9	0.1	17.6		
1953	2.2	21.9	0.0	25.5		
1954	0.0	10.5		26.6		
1955	10.2	16.5		30.8	0.5	
1956	4.8	23.1		21.0		
1957	1.1	19.0		24.7		
1958	5.7	16.9		35.0		
1959	10.7	20.1		52.5	0.7	
1960	13.7	21.1		64.4	25.9	
1961	7.6	21.0		65.1	16.7	
1962	14.1	19.8		61.6	27.6	
1963	20.4	23.2		41.7	28.5	
1964	11.7	20.0	0.0	39.2	10.0	
1965	27.8	22.5		39.8	14.2	
1966	21.9	8.9		69.0	22.7	
1967	22.8	6.9		74.2	6.7	
1968	25.2	17.0			12.1	
1969	19.2	2.7			3.1	
1970	27.5	19.0			12.2	
1971	24.3	17.0			14.1	
1972	31.5	16.1			8.7	
1973	19.1	13.6			7.6	
1974	23.7	24.4			20.0	
1975	18.6	14.4			15.1	
1976	31.5	18			9.9	
1977	38.4	25.8			19.7	
1978	39.0	27.7			16.1	
1979	39.0	30.6	0.1		7.7	
1980	39.7	24.8	0.1		11.5	
1981	26.1	22.3			16.1	
1982	30.6	17.2			24.7	
1983	25.2	14.1			2.9	
1984	31.5	16.6			12.0	
1985	6.0	11.8	0.8		13.8	
1986	23.8	10.5	0.1		25.4	
1987	26.3	7.9	0.0		25.8	
1988	26.6	8.4	0.2		23.4	
1989	14.3	6.8	0.0		9.9	
1990	10.65	6.1	0.7		13.3	
1991	2.01	1.9	0.3		3.5	
1992	6.36	3.5	0.3		9.4	
1993	7.62	3.8	0.6		9.9	0.8
1994	7.6	6.2	1.7		16.4	0.5
1995	0.99	4.8	1.5		13.5	0.5
1996	0.05	1.8	2.3		11.1	0.5
1997	0.38	2.3	2.4		10.9	0.4
1998	0.3	2.5	2.1		6.2	0.0
1999	0.0	2.9	2.2		12.0	0.8
2000	0.0	2.8	1.2		5.4	0.0
2001		0.9	0.7		2.8	0.2
2002		1.6				

Table 8.4 Cont. Re-stocking of glass eel and yellow eel smaller than minimum legal size (bootlace eel). Numbers of eels (in millions) re-stocked in (eastern) Germany (D east), the Netherlands (NL), Sweden (S), Poland (PO), and Northern Ireland (N.Irl.).

	D east	NL	S	DK	Flanders
1945					
1946					
1947		1.6			
1948		2.0			
1949		1.4	0.0		
1950	0.9	1.6	0.0		
1951	0.9	1.3	0.0		
1952	0.6	1.2	0.0		
1953	1.5	0.8	0.0		
1954	1.1	0.7	0.0		
1955	1.2	0.9	0.0		
1956	1.3	0.7	0.0		
1957	1.3	0.8	0.0		
1958	1.9	0.8	0.0		
1959	1.9	0.7	0.0		
1960	0.8	0.4	0.0		
1961	1.8	0.6	0.0		
1962	0.8	0.4	0.0		
1963	0.7	0.1	0.0		
1964	0.8	0.3	0.1		
1965	1.0	0.5	0.1		
1966	1.3	1.1	0.1		
1967	0.9	1.2	0.1		
1968	1.4	1.0	0.1		
1969	1.4	0.0	0.0		
1970	0.7	0.2	0.0		
1971	0.6	0.3	0.0		
1972	1.9	0.4	0.1		
1973	2.7	0.5	0.1		
1974	2.4	0.5	0.1		
1975	2.9	0.5	0.1		
1976	2.4	0.5	0.1		
1977	2.7	0.6	0.0		
1978	3.3	0.8	0.1		
1979	1.5	0.8	0.1		
1980	1.0	1.0	0.1		
1981	2.7	0.7	0.1		
1982	2.3	0.7	0.4		
1983	2.3	0.7	1.0		
1984	1.7	0.7	0.8		
1985	1.1	0.8	0.9		
1986	0.0	0.7	0.5		
1987	0.0	0.4	1.0	1.6	
1988	0.0	0.3	1.3	0.8	
1989	0.0	0.1	1.0	0.4	
1990	0.1	0.0	1.6	3.5	
1991	0.1	0.0	1.8	3.1	
1992	0.1	0.0	2.2	3.9	
1993	0.2	0.2	2.0	4.0	0.2
1994	0.2	0.0	2.0	7.4	0.1
1995	0.7	0.0	1.8	8.4	0.1
1996	0.9	0.2	2.5	4.6	0.1
1997	1.5	0.4	2.5	2.5	0.1
1998	1.2	0.6	2.4	3.0	0.1
1999	1.1	1.2	2.4	4.1	0.1
2000	1.0	1.0	1.5	3.8	0.0
2001			0.4	1.7	0.0
2002	0.4				

Table 8.5 Production of European eel in aquaculture in Europe and Asia. Compilation of production estimates (tonnes) derived from reports of previous meetings, FAO, FEAP, and others.

	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**
Norway									
Sweden	15	47	59	193	233	190	160	195	192
Denmark	18	40	200	240	195	430	586	866	748
Germany									
Ireland									
UK				20	30	0	0		
Netherlands		20	100	200	200	350	550	520	1250
Belgium/Lux.					30	30	125	125	125
Spain	15	20	25	37	32	57	98	105	175
Portugal	60	60	590	566	501	6	270	622	505
Marocco							35	41	68
Algeria					72	53	22	1	0
Tunisia							150	151	250
Italy	2600	2800	4200	4600	4250	4500	3700	4185	3265
Greece			6	4	10	54	94	132	337
Turkey									
Macedonia									1
Yugoslavia	44	52	48	49	19	10	5	1	8
Croatia								7	5
Hungary					90	39	73	33	
Czech.rep.									2
Sum EU	1950	2229	3448	4729	5517	5159	6667	6098	6818
Japan		3000							

	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Norway	120	200	200	200	200				
Sweden	182	158	184	215	250	250	250	260	253
Denmark	782	1034	1324	1568	1913	2483	2718	2674	2040
Germany	100	100	100	150	150	150	150	300	160
Ireland								100	
UK		25		25					
Netherlands	1487	1535	2800	2443	3250	3800	4000	3800	3228
Belgium/Lux.	125	150	140	150	150	40	20	50	55
Spain	134	214	249	266	270	300	425	200	
Portugal	979	200	110	200	200	200	200		
Marocco	85	55	55	56					
Algeria	22	20	17	17					
Tunisia	260	108	158	147	108				
Italy	3000	2800	3000	3000	3100	3100	3100	2750	2500
Greece	341	659	550	312	500	500	300	600	
Turkey									
Macedonia	0	70	83	60					
Yugoslavia	2	9	5	5					
Croatia	5	7	6	7					
Hungary	50		50			19	19		
Czech.rep.	4	4	3	3					
Sum EU	7721	7689	8935	9031	10646	11059	10839	10510	8435
Japan								10000	

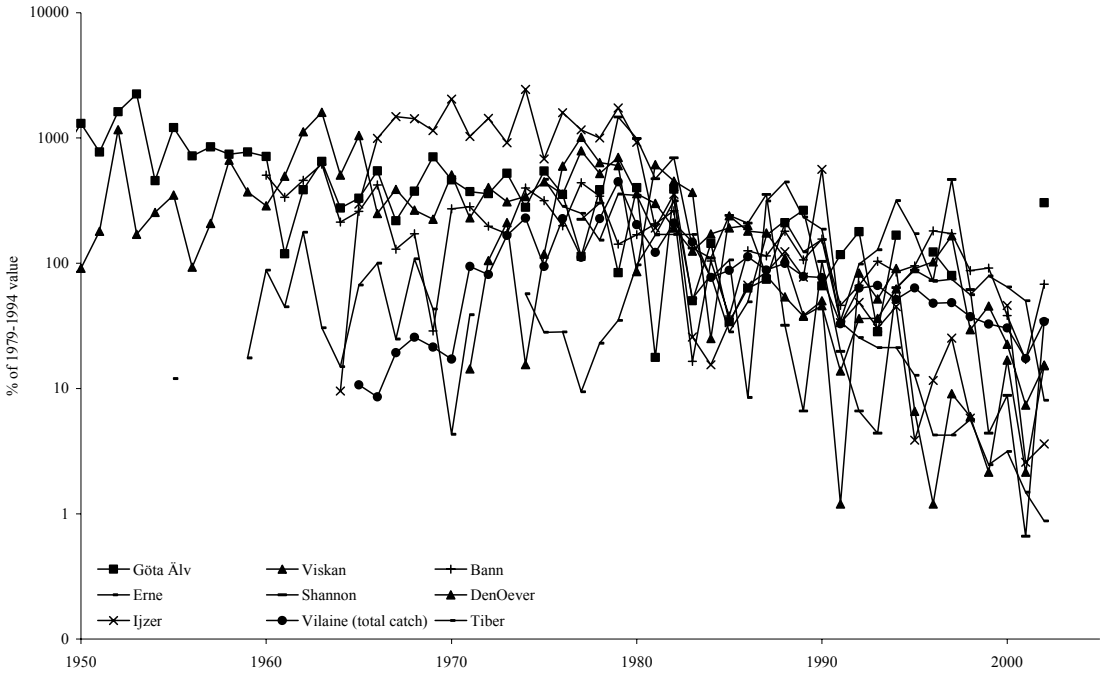

Figure 8.1 Time-series of glass eel monitoring in Europe. Each series has been scaled to the 1979–1994 average. The heavy line indicates the geometric mean of the series from Loire (F), Ems (D), Gota Alv (S), and DenOever (NL), which are the longest and most consistent time-series.

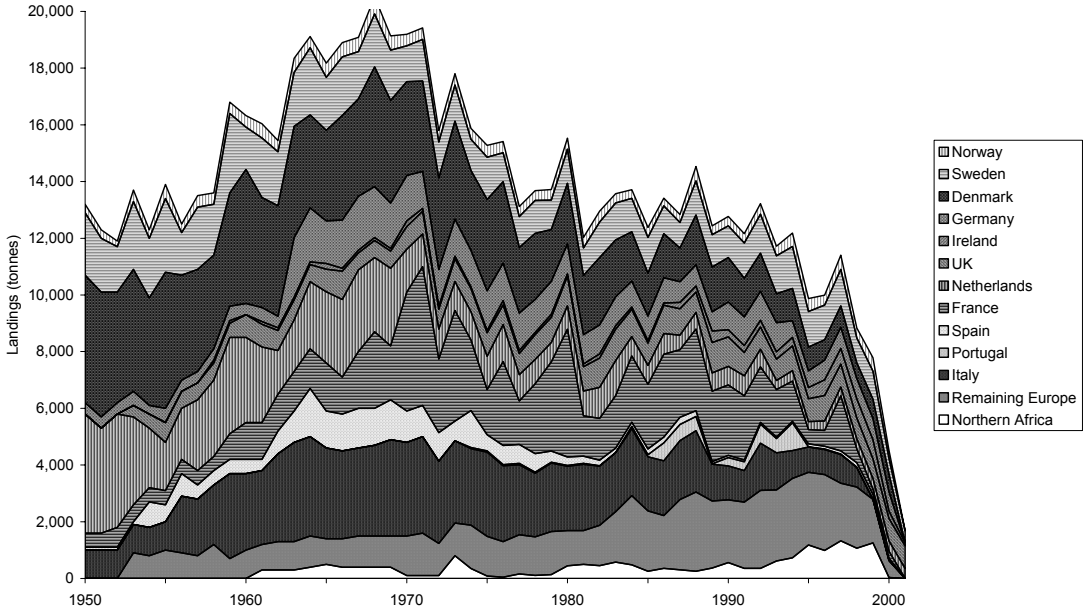

Figure 8.2 Landing statistics of the eel in the past 50 years, as reported by FAO database, with minor corrections.

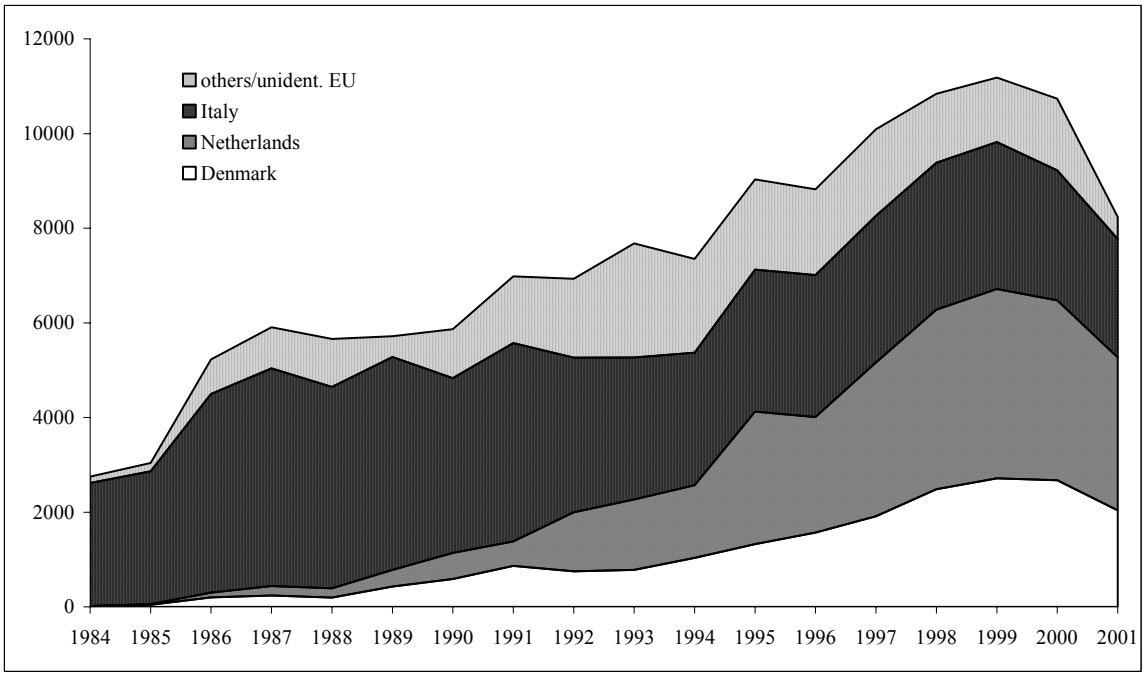

Figure 8.3 Trends in aquaculture production of the European eel.