ICES ADVICE 2005

AVIS DU CIEM

Volumes 1- 11

Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2005

Volume 5

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2005.

Volumes 1 - 11
December 2005

Recommended format for purposes of citation:

ICES. 2005. Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2005. ICES Advice. Volumes 1 - 11. 1,418 pp.

ISBN 87-7482-042-7

VOLUME 5

Section **Page**

1 THE CELTIC SEA AND WEST OF SCOTLAND

1.1 The ecosystem

1.1.1 Ecosystem components

Bottom topography substrate and circulation

In the Celtic seas (ICES Subareas VI and VII) the continental shelf is of variable width. The Celtic Sea, south of Ireland is an extended shelf which for the most part is shallower than 100 m. It is limited to the west by the slope of the Porcupine seabight and the Goban Spur. In these areas the slope is rather gentle and sedimentary. To the west of Ireland the Porcupine Bank forms a large extension of the shelf limited to the west by the Rockall Trough. The transition between the Porcupine Bank and the trough is a steep and rocky slope along which reefs of deepwater corals occur. Further north and to the west of Scotland the slope of the Rockall Trough is closer to the coast line, particularly off NW Ireland, and at the Hebrides. West of the shelf break and the Rockall Trough is the Rockall Plateau with depths of less than 200 m. The shelf area itself contains mixed substrates, generally with soft sediments (sand and mud) in the western part and tending towards rockier, pinnacle-like areas in the eastern part. At these latitudes (55° to 58°N) the continental slope is mainly sedimentary and a trawl fishery for mid-slope fish such as roundnose grenadier, blackscabbard fish, deep sea squalids, blue ling, and orange roughy have been operating since the late 80s. The eco-region also contains several important seamounts: Anton Dohrn, the Hebrides, and Rosemary Bank, which have soft sediments on top and rocky slopes. The Irish Sea is distinct from the rest of the eco-region as a semi-enclosed sea area, with mostly soft substrates and an indigenous fish population.

The water circulation in this area is dominated by the poleward flowing slope current. This persists throughout the year north of the Porcupine Bank, and is stronger in the summer. South of the bank the current is present in the winter months, but breaks down in the summer, when the flow becomes complex. There is also a weaker current flowing north from Brittany and splitting east and west along the Irish coast (OSPAR QSR 2000). Porcupine Bank and the Rockall plateau tend to be retention zones. The Irish Sea has limited inflows from the shelf to the south and probably has an internal gyre circulation.

Summer frontal systems are formed at the Ushant Front, in the English Channel, the Celtic Sea front at the southern entrance to the Irish Sea, and the Irish shelf front west of Galway. These represent changes from stratified inshore and mixed offshore waters. The other major feature is the very high amplitude tide in the Celtic Sea area and the Bristol Channel in particular.

Physical and chemical oceanography

Temperature/salinity

The slope current introduces warm saline water from further south into the whole area. The ICES Annual Ocean Climate Status Summary (IAOCSS) does not deal with this eco-region as a whole, but data are available for the Rockall Trough area in detail. More extensive and synoptic data are undoubtedly available, but this could not be collated in the context of the WGRED meeting. The report suggests that the Rockall trough has been warming steadily over recent years and is presently at an all time high. Similar trends appear for salinity (see Figure 2.14 below).

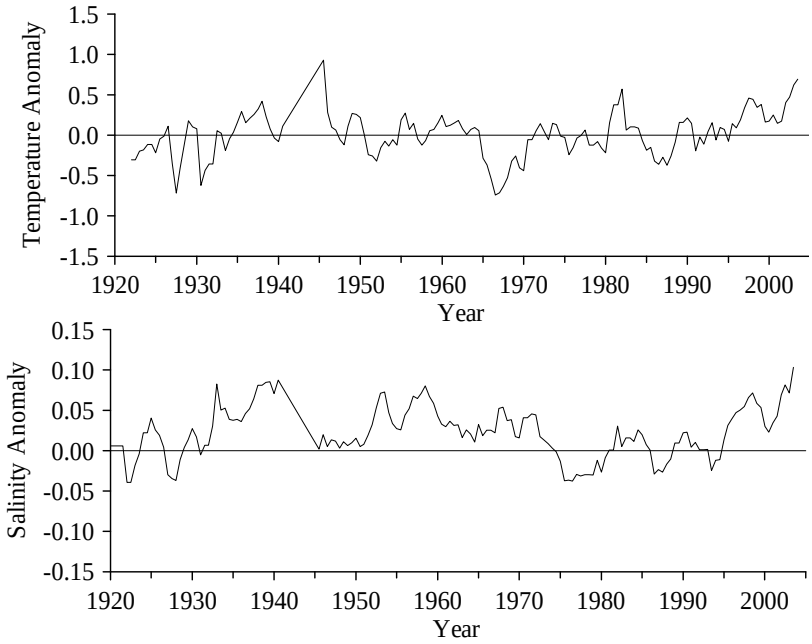


Figure 2.14. Rockall Trough temperature and salinity anomalies for the upper ocean (0–800 m) of the northern Rockall Trough. Average across section, seasonal cycle removed.

Input of freshwater

The major river inputs in the Celtic Sea area are into the Bristol Channel, the Irish Sea, and the Malin Sea north of Ireland. These inputs are important in reducing salinity locally.

Broad-scale climate and oceanographic features

See general text on this topic in the separate section on the Northeast Atlantic (Section 2.1).

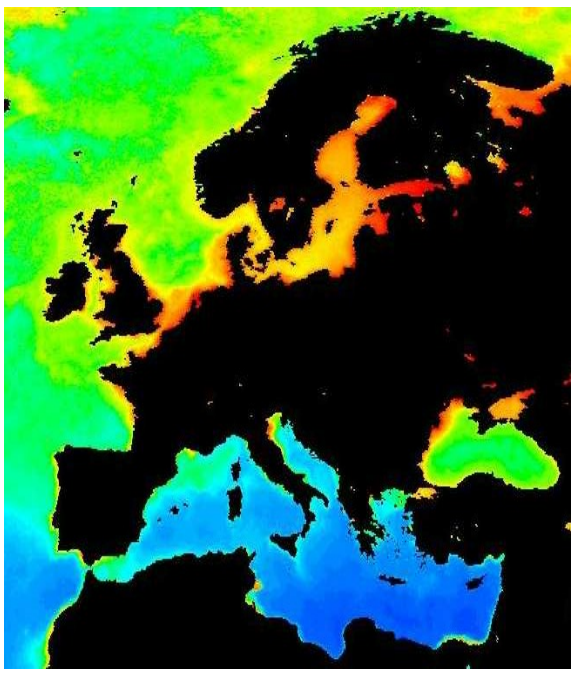


Figure 2.15. Spring chlorophyll (1998–2003).

Phytoplankton

For phytoplankton, the main feature is the strong primary productivity found along the shelf break. Figure 2.15 shows the chlorophyll concentration in various European waters. High levels of chlorophyll usually indicates a high primary

production.. This is stimulated by the warmer, nutrient rich waters found here. Productivity is reasonably strong on the shelf but drops rapidly west of the shelf break. Based on CPR greenness records for this area the spring bloom occurs around April and collapses by October, although in recent years it has continued into December. CPR data also suggests that there has been a steady increase in phytoplankton colour index across the whole area, at least over the last 20 years. Details on the taxa involved have not been located but are assumed to be dominated by diatoms (at least in the spring bloom), but will also include dinoflagellates.

Zooplankton

Like the adjacent North Sea waters, the overall zooplankton abundance in the Celtic Sea has declined in recent years. CPR areas C5, D5, and E5 all show substantial drops in Calanus abundance and are now below the long-term mean. *Calanus finmarchicus* is known to overwinter in the Faroe-Shetland channel and the abundance of this species is known to have been reduced in recent years. The distribution of Calanus in deep waters further south is unknown. More detailed information should be available from the CPR programme, but it is not available at present.

Benthos, larger invertebrates (cephalopods, crustaceans, etc.), biogenic habitat taxa

The major large invertebrate species is *Nephrops*. It is targeted by trawl fisheries on the shelf west of Scotland, the Rockall plateau, and south and west of Ireland. Cuttlefish is also exploited in the Celtic Sea, and scallops in the Irish Sea and west of Scotland.

Major fisheries dredging for scallops and some smaller bivalves exist in the western Channel, the Irish Sea, and west of Scotland. Pot fisheries exploit the lobster *Homarus gammarus* and the edible crab *Cancer pagurus* in the waters around the Channel Islands, off France (French landings about 150 t/year), and west of Scotland. Estimated landings of whelk (*Buccinum undatum*) may be as high as 20 000 t/year. Cuttlefish are also targeted by pot fishery, but trawl catches are much higher and target juveniles in coastal waters in some areas.

In addition to a major aquaculture activity for oysters and mussels, some natural beds of oysters and buried bivalves (such as cockles *Cardium edule*) are exploited by professional and recreational fisheries.

The benthos of the Celtic seas is largely influenced by shelf sea dynamic processes that generate areas with high levels of seabed stress and erosion. Coastal faunas are dominated by relatively small-sized bivalve and polychaete infauna with a highly mobile epifauna. Further offshore larger body-sized bivalves, suspension and filter-feeders dominate the assemblage. Benthic habitat diversity is high in the Celtic seas, varying from sand, through mud to bedrock in some places. Biogenic reefs of horse mussels *Modiolus modiolus*, maerl and Serpulid worms occur in specific locations (Irish Sea, west coast of Scotland). The latter can support benthos of conservation interest such as sea fans and structurally complex bryozoans. Offshore areas on the shelf slope support reefs of deep water corals such as *Lophelia pertusa*.

Fish community

This eco-region includes two distinct types of ecosystems: shelf seas and deepwater communities. There are commercial fisheries for *Nephrops*, cod, haddock, and whiting and a number of flatfish species in the northern part of the area (the Irish Sea, west of Ireland and Scotland). Hake and anglerfish are also fished across the whole area. The Rockall plateau is subject to a haddock and small-scale *Nephrops* fishery. Commercial fisheries for cod and flatfish are conducted in the Irish Sea. The whole area is also characterised as a spawning area for a number of key wide-ranging, migratory species, notably mackerel, horse mackerel, and blue whiting. These species are also commercially exploited within the area. Key pelagic species are herring, considered as consisting of a number of different stocks, as well as sardine, in the southern part of the area, and sprat, particularly in the Celtic Sea proper. The area also includes considerable stocks of argentines (two species) and large numbers of small mesopelagic myctophids along the shelf break.

The shelf slope (500–1800 m) comprises a quite different species assemblage including roundnose grenadier, black scabbard fish, blue ling, and orange roughy as well as deep-sea squalids (sharks) and macrouridae (rabbit fish, etc.). For the most part none of these species are subject to stock assessment, although some are likely to have been severely depleted by the deepwater fisheries carried out in this area. A notable example would be orange roughy, which has probably been largely fished out. All these fish are characterised as being long-lived, slow-growing, and having a low fecundity, making them very vulnerable to overfishing.

The Celtic Sea groundfish community consists of over a hundred species of which the most abundant 25 comprise 99 percent of the total estimated biomass and around 93 percent of the total estimated numbers (Trenkel and Rochet, 2003). Population and community analyses have shown that fishing has impacted a number of commercial species, primarily because individuals of too small a size have been killed in the past (Trenkel and Rochet, 2003). This can be considered as resulting partly from observed large discards (Rochet *et al.*, 2002).

Table 2.1. The indicators for the demersal fish community of the Celtic Sea (From Bertrand, 2004).

1. CATEGORY OF INDICATOR	2. INDICATOR	3. DIRECTION OF CHANGE
Population	Abundance of populations	1 in 43 decreasing, 9 in 43 increasing
	Mean size in the population	9 in 43 decreasing, 1 in 43 increasing
Community	Total abundance	Stable
	Total biomass	Stable
	Mean weight in the community	Decreasing
	Mean size in the community	Stable
	Multispecies size spectra Slope Intercept	 decreasing Stable

The elasmobranchs

The demersal elasmobranch fauna of the Celtic seas is relatively diverse. The main species caught in these areas can be divided into two groups – rays and skates, and demersal sharks.

The main skates are thornback ray *Raja clavata*, spotted ray *Raja montagui*, blonde ray *Raja brachyura*, and cuckoo ray *Leucoraja naevus*. The dominant skates in the inshore waters are *Raja clavata* and *Raja montagui*. Blonde ray is also relatively widespread in the area, though it tends to be more abundant in particular areas. Cuckoo ray is more common on the offshore fishing grounds in the Irish Sea and on the continental shelf of the Celtic Sea. Smalleyed ray *Raja microocellata* is abundant in the Bristol Channel (VIIf), with occasional individuals taken in the Celtic Sea (VIIg), southern Irish Sea (VIIa), and western English Channel (VIIe). Other rays that are less common, but are recorded in low numbers in fishing surveys include shagreen ray *Leucoraja fullonica*, sandy ray *R. circularis*, and undulate ray *Raja undulata*. *R. fullonica* and sandy ray tend to be most abundant in offshore areas, particularly the Porcupine and Rockall Banks Vib and VIIc. *R. undulata* forms small, perhaps discrete populations on the west coast of Ireland, with occasional records in the English Channel.

Common skate *Dipturus batis* is known to have declined in the Irish Sea and elsewhere and is only recorded very occasionally in the inshore waters of the area, though they are still encountered in the Celtic Sea and along the edge of the continental shelf. *Rostroraja alba* and *Dipturus oxyrynchus* became very infrequent in the 20th century, though there were known to be taken in fisheries in the 19th century. Other batoids in the area include stingray *Dasyatis pastinaca*, marbled electric ray *Torpedo marmorata*, and electric ray *T. nobiliana*, though these species may be regarded as vagrants from more southern waters, and these species are generally discarded if caught.

In this region the demersal fauna has a wide diversity of demersal sharks and rays and skates. Within the sharks are the following species: lesser spotted dogfish *Scyliorhinus canicula*, bull huss *S. stellaris*, smoothhound *Mustelus mustelus*, starry smoothhound *M. asterias*, blackmouth catshark *Galeus melastomus*, and angel shark *Squatina squatina*. *S. stallaris* and *S. squatina* are inshore species, with strong habitat preferences. *S. stellaris* is abundant on the west coast of Wales (VIIa).

Widely migratory and migratory sharks that occur in this region include: blue shark *Prionace glauca*, shortfin mako *Isurus oxyrynchus*, porbeagle *Lamna nasus*, tope *Galeorhinus galeus*, and spurdog *Squalus acanthias*. Some of these are taken in mixed demersal fisheries, others in pelagic fisheries, especially for tuna and swordfish. Blue shark and shortfin mako shark are trans-North Atlantic stocks. Spurdog, porbeagle, and tope shark are thought to comprise unitary stocks in the NE Atlantic. The deepwater slopes of the region have a large diversity of different species, and these are dealt with elsewhere.

Trophic web

The trophic relationships of four main commercial demersal predators (cod, hake, megrim, and whiting) and three forage species (blue whiting, pouts (*Trisopterus* spp.), and mackerel) were analysed by Trenkel *et al.* (in press). This study concluded that the main predator species in the Celtic Sea are generalist feeders which exhibit size-dependent, temporal and spatial prey-switching behaviour. These results from the Celtic Sea Proper (limited to the north by Ireland, and between the longitudes of 4°E and 12°W) are the same in other areas. The studied forage species are present seasonally in the Celtic Sea, resulting in prey-shifting behaviour by predators.

No major studies of forage fish have been conducted in the northern of the eco-region. Sand eel, sprat, and Norway pout are known to be present; however, their role and importance in the ecosystem is unclear. No known major industrial fisheries are currently exploiting these species.

A major component of the ecosystem is the spring migration into the area of a large abundance of migratory small pelagic fish, principally blue whiting and mackerel, but also including horse mackerel. All three species spawn and feed extensively in the area, prior to migrating north out of the eco-region in the summer.

Fish taken from the shelf edge areas of the Celtic Seas tend overall to be less planktivorous and from a higher trophic level than those in the North and Baltic Seas (c.f. Heath, 2005). For instance, the secondary production required per unit of landed fish from the southern part of the Celtic Seas is twice that for North Sea fish. In this area zooplankton production accounts for only a small fraction of the secondary production demands of the fisheries. In the Celtic Seas benthos production can be seen as a 'bottom-up' driver for fisheries production, which seems to be independent of variability in plankton production. As this situation is very different to the situation in the North Sea (see NS section), climate change and fishing pressures can be expected to influence these regional fisheries in very different ways. Overall, there appear to be strong spatial patterns in the fish food web structure and function, which should be important considerations in the establishment of regional management plans for fisheries.

Vulnerable species

While blackspot (=red) seabream (*Pagellus bogaraveo*) used to be an important target species of English fishery in the 30s (Desbrosses, 1932), catches in the Celtic seas declined well before the collapse of the fishery in region G (see this chapter for a longer account on this species). The species can now be considered as eradicated from the Celtic seas.

The red lobster (*Palinurus elephas*) was exploited by pot fisheries prior to the late 1990s, and current catches and stock of this species can be considered as residual.

Dominant species composition, size composition, biomass/abundance of species with a crucial role in the food chain, status of species which are particularly vulnerable or protected (especially if not included in the single-stock annexes)

As mentioned above, numbers of species of deepwater fish are considered as being severely depleted and meriting protection.

Birds and mammals

Dominant species composition, productivity (esp seabirds), spatial distribution (esp. mammals).

1.1.2 Fishery effects on benthos and fish communities

This eco-region is characterized by the presence of a number of important benthic features which are considered important and vulnerable to fishing activity. These include cold water corals, and particularly the Darwin mounds, other biogenic reefs, and natural reefs. Coldwater coral structures have been identified in many areas, including the Porcupine Bank, Rockall, the slope areas west of Scotland and Ireland, and on the seamounts. The Darwin mounds are found at depths of about 1000 m northwest of Cape Wrath, Scotland. These structures are all vulnerable to trawling, but particularly deepwater trawling, which uses larger and heavier gears. Most of these structures have actually been identified by fishing activity, and there is the possibility that other such structures exist in unfished areas.

The impact of fishing activities on the shelf fish communities is unclear, although there are numbers of severely depleted stocks e.g. cod, whiting and plaice and hake. It can be assumed that size spectra and community changes occurring in this area are similar to those reported for the North Sea. Trawling in the deep waters has almost certainly caused substantial changes in the community structures of the deeper waters west of the shelf break. Initial studies of catch rates from surveys west of Scotland in the 1980s compared to the last 5–10 years suggest substantial reductions in large, slow-growing species and a switch to smaller, faster-growing fish.

Based on the above, the sustainability of deep water trawling should be reconsidered given the vulnerability of both the fish communities and the benthic habitats.

Common dolphins are taken as by-catch in Celtic Sea fisheries and dead common dolphins with injuries attributable to fishing are found stranded on coasts adjacent to the Celtic Sea. ICES (2005- reference to Technical Annex accompanying ICES May 2005 advice to EC) provide a detailed review of stranding records for common dolphins on the UK, French, Irish, Spanish and Portuguese coasts. Many of these strandings were linked to damage and mortality attributable to fisheries. On the south-western UK coast, for example, entanglement in fishing gear was cited as the most common cause of death accounting for 57.9% (n = 179) of the total number of reported strandings (n = 302) on the English coastline from 1990 to 2003.

Based on available by-catch records, the two types of fishery are responsible for most common dolphin mortality are pelagic trawl and bottom-set gillnet fisheries. While by-catches have been reported in some fisheries, such as the UK

pelagic pair trawl fishery for bass in the western Channel, the Irish and English offshore hake/ pollack gillnet fishery and Irish and French pelagic pair trawl fisheries, by-catches are not being regularly and comprehensively recorded in all fisheries that may catch cetaceans (ICES, 2005).

The significance of reported rates of by-catch mortality depends on the capacity of the cetacean populations to tolerate that mortality. At present, both the abundance and population structure of most cetacean populations impacted by fisheries are poorly known and further research is essential to assess the impacts of by-catch at the population level.

Major environmental signals and implications

No obvious environmental signals were identified that should be considered in assessment or management in this area. The major trends in the ecosystem noted above are the steady warming of the area, particularly in the context of the slope current. The Rockall trough waters have been warming steadily for some years and are currently at an all time high. The general and continuing reduction of copepod abundance is also of major concern given the major role of these organisms in the food web.

Both these factors are likely to have an impact on the life histories of many species, but particularly on the migratory pelagic species; mackerel, horse mackerel, and blue whiting. Both mackerel and horse mackerel migrations are closely associated with the slope current. Mackerel migration is known to be modulated by temperature (Reid *et al.*, 2001). Continued warming of the slope current is likely to affect the timing of this migration. The timing and location of spawning by all these species is also likely to be affected this general warming. The impact on recruitment is difficult to assess, as mackerel generally recruits well, and the horse mackerel stock depends on very rare massive recruitments. No ecosystem link has been identified for either species.

1.1.3 Data gaps

In general this eco-region has attracted less attention than areas such as the North Sea. It is probably not because the data do not exist, but because they have not been correlated and integrated in the context of eco-regions. For example, the ICES Annual Ocean Climate Status Summary does not address this area as a whole. It has been recommended that ICES develops an inclusive approach to the use of eco-regions so that all output data can be matched up easily. The CPR programme samples within the area, but detailed breakdown of these data have not been carried out. As noted above, the primary, and hence presumably the secondary production changes substantially from the shelf to the shelf break and on to the open ocean. Therefore, data aggregated over all these systems is likely difficult to interpret. No single assessment working group is responsible for the fisheries in the area. These are covered by both northern and southern shelf demersal WGs, WGMHSA, HAWG, WGNEPH, WGDEEP, and even WGNPBW and WGNEW. This also makes the integration of data by eco-region more complex.

1.1.4 References

Bertrand, J. A. 2004. L'état des communautés exploitées au large des côtes de France. Application d'indicateurs à l'évaluation de l'impact de la pêche. IFREMER report, DRV/RH/RS/04-001, 170 pp.

Guéguen, J. 1969. Croissance de la dorade, *Pagellus centrodontus* Delaroche. Rev. Trav. Inst. Peches Marit., Nantes, 33, 3, 251–264.

Heath, M. R. 2005. Changes in the structure and function of the North Sea fish foodweb, 1997–2000, and the impacts of fishing and climate. *ICES Journal of Marine Science*, 62: in press

Heath, M. R. in prep. Regional variability in the trophic requirements of shelf sea fisheries in the northeast Atlantic, 1973–2000. Submitted to ICES Journal of Marine Science,

Reid, D. G., Walsh, M., and. Turrell, W. R. 2001. Hydrography and mackerel distribution on the shelf edge west of the Norwegian deeps. Fisheries Research 50: 141–150.

Rochet, M.-J., Péronnet, I., Trenkel, V. M. 2002. An analysis of discards from the French trawler fleet in the Celtic Sea. *ICES Journal of Marine Science*, 59: 538–552.

Trenkel, V. M., and Rochet, M.-J. 2003. Performance of indicators derived from abundance estimates for detecting the impact of fishing on a fish community. Canadian Journal of Fisheries and Aquatic Sciences, 60: 67–85.

1.2 The human use of the ecosystem

1.2.1 The fisheries and their impact

Most of the demersal fisheries in this area have a mixed catch. Although it is currently 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. Some fleets have also a large part of valuable non-TAC species in their catch (squids, cuttlefish, red mullet, etc.). This is particularly the case for coastal fleets.

Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. Spain took around 60% of the landings, France 30%, UK 5%, 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 (England and Wales, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, and recently also Very High Opening trawls (Spain).

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. More recently, cuttlefish have become an important component of beam trawl landings, particularly during the winter months. 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 since the 1980s.

A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea, on the shelf edge around the 200-m contour to the south and west of Ireland and Bay of Biscay in the 1970s and expanded until 1990. This fishery used single and twin rig otter trawls in medium and deep water in Divisions VIIb,c,e-k. Bycatch species include hake, megrim, and to a lesser extent *Nephrops*. Although effort in most fleets appears to have declined since the early 1990s the increasing use of twin trawls may have increased the overall efficiency. In addition, a gillnet fishery targeting anglerfish developed in the Celtic Sea on the shelf edge around the 200-m contour to the south and west of Ireland in the 1990s.

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 1986–2004.

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 bycatches of other stocks.

Demersal elasmobranchs are taken in a variety of fisheries, with bycatches being a significant portion of most demersal fisheries in the region. In inshore areas, small-scale target fisheries exist for ray, skate, and migratory sharks. These fisheries use trawl, longline, and gillnets.

Fisheries for demersal gadoids, flatfish, and *Nephrops,* using otter or beam trawls all have bycatches of rays and skates. These fisheries are carried out by UK, Ireland, France, Spain, and Belgium. In the southern Irish Sea, there is also a small target fishery for rays, by Irish otter trawls in VIIa. The main species in these fisheries are *L. naevus, R. clavata, R. montagui*, and *R. brachyura.*

More offshore fisheries for hake, anglerfish, megrims, and *Nephrops* also have a bycatch of demersal elasmobranchs. The bycatch in these fisheries is more dominated by *Leucoraja fullonica, L. circularis*, and *Dipturus* spp. that are less abundant in the shallower areas.

Large migratory sharks such as basking shark, porbeagle, and tope are caught in mixed demersal fisheries in this area, and in some cases several sharks may be taken in an individual haul. Spurdog was targeted in directed fisheries around Ireland and in the Irish Sea. Currently targeting takes place only sporadically. Vessels engaged in mixed fisheries

occasionally catch large schools of spurdogs. These catches are often the result of targeting by vessels whilst engaged in mixed fisheries for other species. Fisheries for tunas take a bycatch of pelagic sharks in this area.

There are separate pelagic trawl fisheries targeting herring in the Celtic Sea and mackerel and horse mackerel in the whole area. In the past the herring fishery in this area was principally a "roe" fishery; in recent years the number of vessels in this fishery has declined substantially, and the fishery has changed to targeting herring for human consumption. There is also a small directed fishery for sprat in the Channel.

1.3 Assessments and advice

Mixed fisheries and fisheries interactions (Celtic Sea and western Channel)

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. The stocks in poorest condition, particularly those outside precautionary limits, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Many of the fleets in the area operate on a mixture of demersal species. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. The reduction of fishing mortality (and effort) required for stocks outside safe biological limits makes it very unlikely that TACs, which would be sustainable for healthier stocks in the mixed fisheries, could be taken in this case. The needs of the stock(s) under recovery plans could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery. Formulating advice in relation to mixed fisheries is a two-step procedure. First, ICES establishes limits for the exploitation of each species on the basis of its status, consistent with the Precautionary Approach. The second step is to identify the major constraints within which mixed fisheries should operate and through this analysis identify the additional constraints that further limit the fishing possibilities.

The main interactions between the stocks in the Celtic Sea, Southwest of Ireland, Western Channel, and northern part of the Bay of Biscay are between:

- anglerfish, megrim, and hake in the otter board trawl fishery in medium to deep water;
- *Nephrops*, cod, and whiting in the *Nephrops* fishery in the Celtic Sea, and between *Nephrops* and hake in the Bay of Biscay;
- gadoids (cod, haddock, and whiting) within the trawl fishery for roundfish, mainly within Divisions VIIf,g;
- sole and plaice in the beam trawl fishery in Divisions VIIf,g and VIIe, and sole and anglerfish in VIIIa,b;
- haddock, whiting, cod, sole, plaice, hake, megrim, anglerfish, squid, elasmobranchs, and other species within the mixed demersal trawl fisheries.

The directed fisheries for hake (trawl, longlines, and gillnets) and Bay of Biscay sole (gillnets) have few interactions with other stocks:

Stock interactions

	Anglerfish IV+VI	Megrim	Cod VIa	Haddock VIa	Whiting VIa	Nephrops VIa	Saithe IV+VIa	Herring VIa	NEA Mackerel	Deepwater fish
Anglerfish IV+VI		OTB, GND	OTB	OTB	OTB	NEP OTB	OTB	PTM	PTM	OTB Deep, GND
Megrim	Strong		OTB	OTB	OTB	NEP OTB	OTB	PTM	OTB Deep	OTB Deep
Cod VIa	Weak	Weak		OTB, PT	OTB, PT	OTB, NEP OTB	OTB, OTB Deep, PT	PTM	PTM	OTB Deep
Haddock VIa	Weak	Weak	Strong		OTB, PT	NEP OTB	OTB, PT	PTM	PTM	OTB Deep
Whiting VIa	Weak	Medium	Strong	Strong		NEP OTB	OTB	PTM	PTM	OTB Deep
Nephrops VIa	Medium	Medium	Medium	Strong	Strong		OTB	PTM	PTM	OTB Deep
Saithe IIIa+IV+VIa	Weak	Weak	Medium	Medium	Weak	Weak		PTM	PTM	OTB Deep
Herring VIa	0	0	0	0	0	0	0		PTM	OTB Deep
NEA Mackerel	0	0	0	0	0	0	Weak	Medium		OTB Deep
Deepwater fish	Strong	Medium	Weak	Weak	0	Weak	Weak	0	0	

Interaction

Weak	Weak
Medium	medium
Strong	strong

OTB Deep	Otter Trawls in deepwater
OTB Nep	Otter Trawl *Nephrops* directed
GND	Gill nets demersal & deepwater

PTM	Pelagic Midwater Trawl
PT	Pair Trawl

Single-stock exploitation boundaries and critical stocks

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of stocks and single-stock exploitation boundaries are summarised in the table below:

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Anglerfish in Divisions VIIb–k and VIIIa,b *(L. piscatorius* and *L. budegassa)*	Full reproductive capacity	Increased risk (*L. piscatorius*) Harvested sustainably (*L. budegassa*)	Overexploited	-	In order to harvest the stock within precautionary limits fishing mortality should be kept below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ for both species. Fishing at $\mathbf{F}_{pa}$ for *L. piscatorius* is expected to result in landings of 25 400 t, leading to an SSB of 64 000 t in 2007. Given the link between the two species, this corresponds to a fishing mortality of 0.18 for *L. budegassa*, corresponding to landings of at most 8 500 t in 2006. The predicted SSBs are well above $\mathbf{B}_{pa}$ in all scenarios.	For *L. piscatorius* the *status quo* fishing mortality is estimated at 0.24 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.05 and $\mathbf{F}_{max}$ = 0.09). For *L. budegassa* the *status quo* fishing mortality is estimated at 0.18 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.15). This indicates that long-term yield is expected to increase at fishing mortalities below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	33 900 t for both species combined (25 400 t *L. piscatorius*, and 8 500 t *L. budegassa*)
Cod in Divisions VIIe-k	Unknown	Unknown	Unknown	-	The reduction of effort which has taken place since 1999 may not have reduced fishing mortality to sustainable levels. Reduction of effort would improve yields and reduce risks to the stock in the longer term. Therefore, in view of the uncertainty of the data and the high fishing mortality estimated for 2002 effort should be reduced to ensure a longer-term reduction in fishing mortality towards sustainable levels. Adequate monitoring including discard monitoring should be implemented	-	-

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Haddock in Divisions VIIb-k	Unknown	Unknown	Unknown	-	Because of the strong 2002 year class SSB has increased but ICES is unable to provide a reliable estimate of current stock size in relation to precautionary limits. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management.	Current fishing mortality is unknown.	-
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Increased risk	Harvested sustainable	Overexploited	Following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.	The fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$. This is equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007 with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5% and in TAC of 3%.	The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values. Fishing at such a lower mortality is expected to lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	44 000 t $F < \mathbf{F}_{pa}$
Megrim in Divisions VIIb,c,e-k and VIIIa,b,d (*L. whiffiagonis and L. boscii*)	Full reproductive capacity	Increased risk	Overexploited	-	In order to harvest the stock within precautionary limits fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above **B**pa. A recommended 23% reduction in F is needed to achieve a fishing mortality at $\mathbf{F}_{pa}$ (0.30). This corresponds to landings of less than 13 600 tonnes in 2006. The predicted SSB is well above **B**pa if F is below $\mathbf{F}_{pa}$.	The current fishing mortality ($\mathbf{F}_{sq}$) is estimated as 0.39, which is above rates that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.16). Fishing at $\mathbf{F}_{max}$ is expected to lead to high long term landings and SSB.	13 600 t. 23% reduction in F

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Nephrops in Divisions VIIb,c,j,k (Management Area L)	Unknown	Unknown	Unknown	-	There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU16-19 should not exceed 3 300 tonnes for 2006, based on the average landings of 2000–2002.	-	< 3 300 t
Nephrops in Divisions VIIf,g,h, FU20-22 (Management Area M)	Unknown	Unknown	Unknown	-	Due to uncertainty in the available data ICES is not able to reliably forecast catch. There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU20-22 should not exceed 4.6 thousand tonnes for 2006, based on the average landings of 2000–2002. The landings from all FUs in this TAC area is presented in section 1.4.36 (*Nephrops* in VIIa).	-	
Nephrops in Divisions VIIIa,b (Management Area N)	Reference points not defined	Reference points not defined	Unknown	-	The stock appears to have recovered from a low stock size based on recent landings in the order of 3 500 t. In the absence of reliable catch forecasts, ICES recommends that landings in 2006 should not exceed the recent average of 3 500 t.	-	< 3 500 t
Plaice in the Celtic Sea (Divisions VIIf and g)	Increased risk	Unknown	Overexploited	There is no management plan for this stock.	A 50% reduction in F is needed to increase SSB to around $\mathbf{B}_{pa}$ in 2007. This corresponds to landings of less than 400 tonnes in 2006. If such a large reduction in F is not achievable in the short term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality is implemented to rebuild the stock above $\mathbf{B}_{pa}$ in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.	Target reference points have not been agreed for this stock. $\mathbf{F}_{sq}$ (0.54) is above the possible target reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.	390 t F reduced by 50%
Plaice in Division VIIe (Western Channel)	Increased risk	Increased risk	Overexploited	There are no agreed management plans.	Given the low stock size, recent poor recruitment, increasing fishing mortality, the uncertainty in the assessment, and the inability to reliably forecast catch, ICES recommends a substantial reduction in catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed.	The recent fishing mortality, estimated at 0.69, is well above fishing mortalities that, given the current exploitation pattern, would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.22). This indicates that long-term	Substantial reduction in catch

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
						yield would increase substantially (around 10%) at fishing mortalities well below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	
Plaice Southwest of Ireland (Division VIIh-k)	Unknown	Unknown	Unknown	-	Catches in 2005 should be no more than the recent average (2002–2004) of around 245 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	245 t
Plaice West of Ireland (Division VIIb,c)	Unknown	Unknown	Unknown	-	Catches in 2005 should be no more than the recent average (2002–2004) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	65 t
Sole in the Celtic Sea (Divisions VIIf and g)	Full reproductive capacity	Harvested unsustainably	Overexploited	There is no management plan for this stock.	A 26% reduction in F is needed to reduce F below $\mathbf{F}_{pa}$. This corresponds to landings of less than 880 tonnes in 2006.	Target reference points have not been agreed for this stock. The present F (0.50) is well above the possible candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.	880 t 26% reduction in F
Sole in Division VIIe (Western Channel)	Increased risk	Harvested unsustainably	Overexploited	There is no agreed management plan.	ICES continues to recommend that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$. Rebuilding the stock in one year requires that fishing mortality be reduced by at least 80%. This corresponds to landings of less than 240 tonnes in 2006.	Target reference points have not been agreed for this stock, but a target reference point close to $\mathbf{F}_{0.1}$ (0.11) maximises the return from the fishery whilst being consistent with the precautionary approach. The present fishing mortality (0.45) is above the candidate reference point $\mathbf{F}_{0.1}$.	< 240 t At least 80% reduction in F

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Sole in Divisions VIIIa,b (Bay of Biscay)	Increased risk	Increased risk	Overexploited	There is no management plan for this stock.	Fishing at $\mathbf{F}_{pa}$ implies a 31% reduction in F and corresponds to landings less than 4 200 t in 2007. This will lead to a SSB in 2007 at or above **B**pa.	Target reference points have not been agreed for this stock. The present F (0.52) is well above the candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.	4 200 t F reduced by 31%
Sole Southwest of Ireland (Division VIIh-k)	Unknown	Unknown	Unknown	-	Catches in 2006 should be no more than the recent average (2002-2004) of around 380 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.	-	380 t
Sole West of Ireland (Division VIIb,c)	Unknown	Unknown	Unknown	-	Recent catches have been close to the TAC of 65 t. Catches should not be allowed to increase unless it can be shown that an expansion of the fishery is sustainable.	-	65 t
Whiting in Divisions VIIe–k	Full reproductive capacity	known	Overexploited	There is no management plan for this stock	No $\mathbf{F}_{pa}$ has been defined for this stock. As there is no long-term gain in yield and result in a reduction in spawning stock, fishing mortality should not increase, corresponding to landings of at most 10 800 t in 2006.	The current fishing mortality, estimated at 0.51, is above a fishing mortality that would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.18) ($\mathbf{F}_{max}$ is not well defined). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.	10 800 t
Celtic sea herring	Uncertain, but likely at risk of reduced reproductive capacity	Unknown	Unknown	-	The current level of SSB is uncertain, but may be below **B**pa and possibly even below $\mathbf{B}_{lim}$. Given the risk to the stock indicated by weak recent recruitment, exploitation should be significantly reduced in 2006. Supplementary measures: e.g. the re-closure of the eastern section of the Celtic Sea.	-	6 700 t Further reduction 60% of average catch 2002–2004
Herring in VIa south and VIIb,c	Unknown, but likely at risk of reduced reproductive capacity	Unknown	Unknown	-	Catches should not be allowed to increase from the recent average levels of 14 000 t, until there is clear evidence that SSB has been rebuilt to be above **B**pa.	-	14 000 t F change not known

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	In relation to precautionary limits	In relation to target reference points	
Rajidae							
Demersal sharks							

Identification of critical stocks

The table above identifies the stocks outside precautionary reference points.

Spurdog is in a critical state. Stocks for which reduction in exploitation is required are megrim in Divisions VIIbc,e-k and VIIIabd; cod in Divisions VIIe-k; sole and plaice in Divisions VIIfg; plaice and sole in Division VIIe; sole in Divisions VIIIab; and Celtic Sea herring.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- For spurdog the advice is for a zero catch;
- For sole and plaice in Division VIIe, and plaice in Division VIIf,g: either catches in 2006 as indicated in the table above, or recovery plans to define the limits within which the fisheries can take place and which ensure a large reduction in F in 2006;
- Reduction in fishing mortality has been advised for megrim in Divisions VIIbc,e-k and VIIIabd; for cod in Divisions VIIe-k; for sole and plaice in Divisions VIIfg; for plaice and sole in Division VIIe; for sole in Divisions VIIIab; and for Celtic Sea herring.

Advice on fisheries management

Fisheries in the Celtic Sea, Southwest of Ireland, Western Channel, and northern part of the Bay of Biscay should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **With no catch or discard of spurdog;**
- **without jeopardizing the recommended reduction in fishing mortality of megrim in Divisions VIIbc,e-k and VIIIabd; cod in Divisions VIIe-k; sole and plaice in Divisions VIIfg; plaice and sole in Division VIIe; sole in Divisions VIIIab; and Celtic Sea herring;**
- **concerning deepwater stocks fished in Subareas VII and VIII,;**
- **within the biological exploitation limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for all those species individually then fishing should not be permitted.

Celtic Sea and West of Scotland

Fisheries to the West of Scotland and Rockall

The main fleets operating in Division VIa include the mixed roundfish otter trawl fleet, the *Nephrops* otter trawl fleet, the otter trawl fleet targeting anglerfish, megrim, and hake, and the fleet targeting saithe and/or deep-sea species. 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 bycatches of saithe, megrim, and lemon sole.

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 targeted mainly at haddock has been declining in recent years as many of these vessels have been converted to trawlers. 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. Bycatches in this fishery include megrim, ling, and tusk.

About 200 Scottish trawlers also take part in the fisheries for *Nephrops* on inshore grounds. In recent years Irish vessels have also been targeting *Nephrops* in Division VIa, mainly on offshore grounds. These *Nephrops* vessels also land smaller quantities of haddock, cod, whiting, and small saithe, but discard large amounts of whiting and haddock.

The development of a directed fishery for anglerfish has led to considerable changes in the way the Scottish fleet operates. Part of this is a change in the distribution of fishing effort; effort in the roundfish fisheries has shifted away from the traditional inshore areas to more offshore areas and deeper waters. The expansion in area and depth-range fished has been accompanied by the development of specific trawls and vessels to exploit the stock. These vessels mainly use large twin-rig otter trawls with >100-mm mesh. A smaller Irish fleet also targets anglerfish, megrim, and hake on the Stanton bank with 90-mm to 100-mm mesh. This fleet has declined in numbers in recent years.

The fishery for anglerfish has expanded into deeper waters with an associated increase in catches. 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. A gillnet fishery has developed on the continental slopes to the West of the British Isles, North of Shetland, at Rockall and the Hatton Bank. A preliminary investigation of this fishery suggests high levels of gear loss, widespread dumping of netting, high catch & discarding levels (particularly of monkfish), and a lack of effective management. These fisheries are occurring in areas believed to have been a refuge 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.

The larger Scottish 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.

The pelagic fishery for herring is mainly operated by UK, Dutch, and German vessels in the north, and by Irish vessels 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 fthe 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. Bycatches in this fishery are very small. The Norway pout fishery is conducted mainly by Danish vessels.

Fisheries interactions to the West of Scotland and Rockall

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. Roundfish are caught in otter trawl and seine fisheries, with a 120-mm minimum mesh size that comprises mixed demersal fisheries with more specific targeting of individual species in some areas and/or seasons. Cod, haddock, and whiting form the predominant roundfish catch in the mixed fisheries, although there can be important bycatches of other species, notably saithe and anglerfish in the deeper water and of *Nephrops* on the more inshore *Nephrops* grounds. Static gear fisheries with mesh sizes generally in excess of 140 mm are also used to target cod. Saithe are mainly taken in a directed trawl fishery in deeper water along the shelf in Subarea VI. There is thought to be little bycatch of other demersal species associated with the directed fishery.

Large *Nephrops* fisheries take place in discrete areas that comprise appropriate muddy seabed sediment. Targeted *Nephrops* fisheries on these grounds are taken predominantly in trawls with mesh sizes of less than 100 mm or less (particularly in the more southerly regions) using single- or multiple-rig trawls. *Nephrops* fishing grounds are mainly inshore grounds although there are smaller offshore fisheries at Stanton Bank and west of the Hebrides. The bycatch and discarding of other demersal species in the *Nephrops* fisheries is highly variable.

There are trawl and gillnet fisheries targeting hake and anglerfish and otter trawl fisheries targeting hake, megrim, and anglerfish in Subarea VI. The catch of other demersal species associated in these fisheries is uncertain.

There is an international fishery targeting haddock, grey gurnards, and other species at Rockall using small mesh. Successful application of TACs for this stock would require that there is a simple relationship between recorded landings and effort exerted. This assumption is unlikely to be true for Rockall haddock especially when coupled with ways of evading TACs including misreporting, high-grading, and discarding. In the case of Rockall haddock these may occur to a large extent due to the remote nature of the fishery and the processing of catches at sea by some fleets. Direct effort regulation is therefore suggested as a means of controlling fishing mortality on Rockall haddock.

Fisheries in the Irish Sea

The majority of vessels in the Irish Sea target *Nephrops* with either single- or twin-rig otter trawls. These vessels use either 70-mm diamond mesh with an 80-mm square mesh panel or an 80-mm diamond mesh in their codends, and (by regulation) their landings must consist of at least 35% *Nephrops* by live weight. These vessels have bycatches of whiting (most of which are discarded) and haddock, cod, and plaice. Twin-rig otter trawl were first introduced in the early 1990s. Recent studies show that the use of twin-rigs increases the proportion of roundfish bycatch in *Nephrops* fisheries compared with single-rig otter trawls. *Nephrops* catches are highly seasonal with the highest *Nephrops* catches in the summer months. Catch rates are also dependent on tidal conditions, with higher catches during periods of weak tide.

The roundfish fisheries in the Irish Sea are conducted primarily by vessels from the UK and Ireland. A Northern Irish semi-pelagic trawling for cod and whiting developed in the early 1980s. As the availability of whiting declined this fleet switched to mainly targeting cod and haddock. Irish, Northern Irish, and English and Welsh otter trawlers target plaice, haddock, whiting, and cod, with smaller bycatches of anglerfish, hake, and sole. Some Irish vessels participate in a fishery for rays in the southern Irish Sea. 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.

Fishing effort in the semi-pelagic effort increased rapidly between the early 1980s and early 1990s before decreasing somewhat in the mid-1990s. Fishing effort in the England and Wales otter trawl vessels longer than 12m declined rapidly after 1989, and from 1999 to 2004 was less than 25% of the effort reported in the 1980s. There has been a declining trend in fishing effort for Northern Irish otter trawlers also since the early 1990s. Fishing effort for Irish otter trawlers has declined in recent years as many vessels switched from targeting roundfish to *Nephrops*.

There is also a beam trawl fishery which takes place mainly in the eastern Irish Sea with vessels from Belgium, Ireland, and the UK. This fishery mainly catches sole with important bycatches of plaice, rays, brill, turbot, anglerfish, and cod. The fishing effort of the Belgian beam-trawl fleet varies in response to the catch-rates of sole in the Irish Sea relative to catch-rates in 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.

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, and the bottom VHVO trawl targeting hake.

The main pelagic fishery in the Irish Sea is for herring. In recent years, it has been predominantly operated by one pair of trawlers from Northern Ireland. The size of this fleet has declined to a very low level in recent years.

There are also a number of inshore fisheries in the Irish Sea that target stocks not currently assessed by ICES. These include pot fisheries for crab, lobster, and whelk, hydraulic dredge fisheries for razor clams, and dredge fisheries for scallops.

Decommissioning at the end of 2003 permanently removed 19 out of 237 UK demersal vessels that operated in the Irish Sea, representing a loss of 8% of the fleet by number and 9.3% by tonnage. Of these vessels, 13 were vessels that had used demersal trawls with mesh size >=100 mm and had more than 5% cod in their reported landings. The previous round of de-commissioning in 2001 removed 29 UK(NI) *Nephrops* and whitefish vessels and 4 UK(E&W) vessels registered in Irish Sea ports at the end of 2001. Of these, 13 were vessels that used demersal trawls with mesh size >=100 mm and had more than 5% cod in their reported landings.

Fisheries interactions in the Irish Sea

Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. In these cases management advice must consider both the state of individual stocks and their simultaneous exploitation in demersal fisheries. Stocks in the poorest condition, particularly the critical stocks, necessarily become the overriding concern for the management of mixed fisheries where these stocks are exploited either as a targeted species or as a bycatch.

Four main fishery units can be described in the Irish Sea: these are *Nephrops* otter trawlers, roundfish otter trawlers, semi-pelagic trawlers, and beam trawlers. As trends in stocks of various species are generally not in synchrony, advice provided on the basis of the status of individual species may result in advised fishing mortalities for a group of co-harvested species that cannot be realized simultaneously within the context of mixed fisheries. Stocks in need of special conservation efforts, such as those affected by recovery plans, present particularly difficult challenges. For instance, the reduction of fishing mortality (and effort) required for cod makes it very unlikely that TACs, which would be sustainable for healthier stocks in the mixed fisheries could be taken. The needs of the stock(s) under recovery plans

could be met most directly by simply setting the TACs for all species in mixed fisheries to correspond to the fishing mortality intended for the species under recovery plans, which would result in large foregone yields in many healthier stocks. The foregone yield could be reduced somewhat if effort could be adjusted on a fleet-by-fleet basis to comply with the total fishing mortality in the proposed recovery plan, while allowing as much harvesting of other species as possible. However, such an approach requires reliable information on the catch-at-age for all species in all fisheries, and is still likely to leave substantial potential harvestable biomass of several species unavailable to any fishery.

Possibly the strongest mixed fishery interaction in the Irish Sea is between the *Nephrops* fishery and the whiting stock. Discard estimates for fleets targeting *Nephrops* are incomplete and considered imprecise, but demonstrate that the selectivity of *Nephrops* trawls for whiting remains relatively poor despite the obligatory use of square mesh panels for vessels targeting *Nephrops* with 70-mm cod-end mesh since 1994. ICES points out that in addition to effort restrictions, further technical measures (e.g. increased cod-end and square mesh panel mesh sizes, separator panels, and fixed grids) should be investigated and may substantially reduce by-catch and discarding of whiting in this *Nephrops* fishery.

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. Cod are also taken as a bycatch in the *Nephrops*-directed fishery Although discard estimates for cod in the Irish Sea are not available discard rates are not thought to be substantial. However, misreporting and under-reporting of cod is thought to occur in some VIIa fisheries. Estimates of mis-reporting for some nations are included in the assessment, but the scientific advice for zero catch of the cod stock requires that the practice be terminated.

The extent to which the stocks are taken in the same fisheries cannot be quantified on basis of the available data. The existing information suggests that the stocks are caught together to a high (H), medium (M), low (L) extent, or not at all (0), as indicated in the table below. The information in the table relates to catches and the linkage is thus indicated as high also in cases where the catches of most of one stock taken in a fishery with another stock is discarded.

Technical Interactions Matrix	Cod in Division VIIa	Haddock VIIa	*Nephrops* FU 15 & FU 14	Plaice VIIa	Sole VIIa	Whiting VIIa	Rays VIIa	Herring VIIaN	Scallops	Whelks	Razor Fish
Cod in Division VIIa		H	M	M	M	M	L	0	0	0	0
Haddock VIIa	White fish trawl, Semi-pelagic trawl, Seine-net		M	M	L	M	L	0	0	0	0
Nephrops FU 15 & FU 14	*Nephrops* trawl fishery	*Nephrops* trawl fishery		M	L	H	L	0	0	0	0
Plaice VIIa	Flat fish beam trawl, *Nephrops* trawl	*Nephrops* trawl	*Nephrops* trawl		H	L	M	0	0	0	0
Sole VIIa	Flat fish beam trawl, Nephrops trawl	Flat fish beam trawl	*Nephrops* trawl	Flat fish beam trawl		L	M	0	0	0	0
Whiting VIIa	Semi-pelagic trawl, *Nephrops* trawl, White fish trawl	White fish trawl, Semi-pelagic trawl, Seine-net	*Nephrops* trawl	*Nephrops* trawl	Beam trawl		L	0	0	0	0
Rays VIIa	Ray otter and beam trawl fishery	Ray otter and beam trawl fishery	*Nephrops* trawl	Beam trawl	Beam trawl	Ray otter and beam trawl fishery		0	0	0	0
Herring VIIaN	None	None	None	None	None	None	None		0	0	0
Scallops	None	None	None	None	None	None	None	None		0	0
Whelks	None	None	None	None	None	None	None	None	None		0
Razor Fish	None	None	None	None	None	None	None	None	None	None	

Single-stock exploitation boundaries and critical stocks (West of Scotland)

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of the stocks and single-stock exploitation boundaries are summarised in the table below.

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Cod West of Scotland	Reduced reproductive capacity	Unknown	Unknown	ICES is not in a position to give quantitative forecasts and can therefore not evaluate the management plan and provide upper bounds to a TAC.	Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.	There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.19).	Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	Increased risk	Harvested sustainably	Overexploited	Following the agreed recovery plan, a fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t. This implies a change in SSB of +5%.	The current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.17). This indicates that long-term yield is expected to increase at fishing mortalities well below the historic values.	The fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ equivalent to the recovery plan. A fishing mortality of F = 0.25 is expected to lead to an SSB of around 153 000 t in 2007, with estimated landings in 2006 of 44 000 t.	Landings of less than 44,000 t
Cod in Division VIb (Rockall)							No assessment.
Haddock West of Scotland	Full reproductive capacity	Harvested sustainably	Overexploited		Maintain SSB above **B**pa in 2007, requires a reduction in fishing mortality to less than 0.35.		Landings less than 8000 t.
Haddock in Division VIb (Rockall)	Unknown	Unknown	Unknown		Catches reduced to the lowest possible level.		Catches reduced to the lowest possible level.
Whiting West of Scotland	Unknown	Unknown	Unknown		Lowest possible level.		Lowest possible level.
Whiting in Division VIb (Rockall)							No assessment.
Megrim in Subarea VI (West of Scotland and Rockall)	Uncertain	Uncertain	Uncertain		Catches in 2006 should be no more than the recent (2002–2003) landings of about 2300 t. This includes landings of Division VIa and VIb and unallocated landings in Subarea IV.		2300 t

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2006
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Anglerfish in Division IIIa, Subarea IV, and Subarea VI	Unknown	Unknown	Unknown		No increase in effort.		Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Norway pout West of Scotland							No assessment
Sandeel in Division VIa							No assessment
Nephrops in Division VIa (Management Area C)		Three functional units; all three harvested at sustainable levels			No increase in effort.		Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Herring West of Scotland (Division VIa)	Full reproductive capacity	Reference points are not defined					26 400 t. The present level of fishing mortality appears to be sustainable and has lead to a rise in SSB. Fishing at $\mathbf{F}_{sq}$ is sustainable.

Identification of critical stocks

The table above identifies the stocks that are below $\mathbf{B}_{lim}$, i.e. cod in Division VIa and haddock in Division VIb. These stocks are the overriding concerns in the management advice of all demersal fisheries:

- for cod in Division VIa ICES recommends a zero catch;
- for haddock in Division VIb the catches should be reduced to the lowest possible level;
- for spurdog the catches should be zero.

Advice on fisheries management

Demersal fisheries in Subarea VI should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without catch or discards of cod in Subarea VI;**
- **without catch or discards of spurdog;**
- **no directed fishery for haddock in Division VIb;**
- **concerning deep water stocks fished in Subarea VI, Volume 10;**
- **within the biological exploitation limits for all other stocks (see table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

Single-stock exploitation boundaries (Irish Sea)

The state and the limits to exploitation of the individual stocks are presented in the stock sections. The state of stocks and single-stock exploitation boundaries are summarised in the table below.

Stock	State of the stock			ICES considerations in relation to single-stock exploitation boundaries			Upper limit corresponding to single-stock exploitation boundary for agreed management plan or in relation to precautionary limits. Tonnes or effort in 2005 and % reduction in F
	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	In relation to agreed management plan	in relation to precautionary limits	in relation to target reference points	
Cod in Division VIIa	Reduced reproductive capacity	Harvested unsustainably	Overexploited	Zero catch in 2006 provides only 50% probability of rebuilding SSB to $\mathbf{B}_{lim}$ in 2007.	Zero		Zero
Haddock VIIa	Undefined	Unknown	Unknown				Substantial reduction in effort
Nephrops FU 15 & FU 14 (Management area J)		Uknown					Effort not allowed to increase. Fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.
Whiting in Division VIIa	Unknown, low SSB	Unknown	Unknown		Lowest possible level		Lowest possible level
Plaice VIIa	Full reproductive capacity	Harvested sustainably	Harvested sustainably		5 900 t		5 900 t
Sole VIIa	Unknown	Unknown	Unknown		Recent (2002–2004) catch levels.		930 t
Herring	Uncertain	Unknown	Uncertain		Estimates of SSB and fishing mortality for recent years are uncertain and ICES cannot advise on catch levels in relation to PA limits		*Status quo* catch ~ 4 800 t.

Identification of critical stocks

The table above identifies the stocks outside precautionary reference points.

The critical stocks are cod and whiting. For these stocks the SSB is lower than $\mathbf{B}_{lim}$. Also, spurdog is assessed to be in a critical state.

These stocks are the overriding concerns in the management advice for all fisheries where the interactions between stocks taken in the same fisheries should be considered:

- for cod the advice is for zero catch;
- for spurdog the advice is for zero catch;
- for whiting the advice is to reduce catch to the lowest possible levels.
- Another stock for which reduction in exploitation is required is haddock.

Advice on fisheries management

Fisheries in the Irish Sea should in 2006 be managed according to the following rules, which should be applied simultaneously:

They should fish:

- **without bycatch or discards of cod and spurdog, and with minimal catch of whiting;**
- **without jeopardizing the recommended reduction in fishing mortality of haddock;**
- **within the biological exploitation limits for all other stocks (see text table above).**

Furthermore, unless ways can be found to harvest species caught in mixed fisheries within precautionary limits for <u>all</u> those species individually then fishing should not be permitted.

1.4 CELTIC SEA AND WEST OF SCOTLAND

1.4.1 Cod in Division VIIa (Irish Sea)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Reduced reproductive capacity	Harvested unsustainably	Overexploited	Not defined	

Based on the most recent estimates of SSB and fishing mortality, ICES classifies the stock as having reduced reproductive capacity and as being harvested unsustainably. Fishing mortality had been around $\mathbf{F}_{pa}$ until the mid-1980s. It has increased close to, or above $\mathbf{F}_{lim}$ since 1988. SSB is below $\mathbf{B}_{pa}$ and has continued below to $\mathbf{B}_{lim}$ since the mid-1990s. Recruitment has been below average for the past sixteen years and the three most recent year classes are amongst the four smallest on record. At the average rate of exploitation estimated for recent years, SSB will remain at sizes where the risk of continued poor recruitment is high.

Management objectives

The European Commission has enacted a Council Regulation ((EC) No. 423/2004) which establishes measures for the recovery of cod stocks.

For stocks above $\boldsymbol{B}_{lim}$, the harvest control rule (HCR) requires:

1. *setting a TAC that achieves a 30% increase in the SSB from one year to the next,*
2. *limiting annual changes in TAC to ± 15% (except in the first year of application), and,*
3. *a rate of fishing mortality that does not exceed $\boldsymbol{F}_{pa}$.*

For stocks below $\boldsymbol{B}_{lim}$ the Regulation specifies that:

4. *conditions 1-3 will apply when they are expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application,*
5. *a TAC will be set lower than that calculated under conditions 1-3 when the application of conditions 1-3 is not expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application.*

This plan has not yet been evaluated by ICES. However, the management plan requires annual predictions of spawning stock size, which is not available given the recent poor catch data. In that situation a management plan that does not require such a precision should be considered.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 6 000 t.	$\mathbf{B}_{pa}$ be set at 10 000 t.
	$\mathbf{F}_{lim}$ is 1.0.	$\mathbf{F}_{pa}$ be set at 0.72.
Target reference points		$\mathbf{F}_{y}$ not defined.

Yield and spawning biomass per Recruit (from 2004 Assessment)
F-reference points

	Fish Mort Ages 2-4	Yield/R	SSB/R
Average last 3 years	1.028	1.677	1.869
$\mathbf{F}_{max}$	0.310	2.153	7.999
$\mathbf{F}_{0.1}$	0.180	2.009	12.746

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$: This is the previously agreed MBAL with signs of reduced recruitment. It 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.
$\mathbf{F}_{lim}$: $\mathbf{F}_{med}$	$\mathbf{F}_{pa}$: $\mathbf{F}_{med}$***** 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 the observed stock decline.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

The most plausible forecast assumes a total removal in 2005 that is 25% greater than the agreed TAC. The forecast indicates that a zero catch in 2006 provides only 50% probability of rebuilding SSB to $\mathbf{B}_{lim}$ in 2007. The simulations indicate that a 30% increase in SSB during 2006 could be achieved with a high probability only if the fishing mortality is reduced to below 25% of the 2004 level.

Exploitation boundaries in relation to precautionary limits

Given the low stock size, recent poor recruitment, continued substantial catch well above the TAC, the uncertainty in the assessment, and the inability to reliably forecast catch, it is not possible to identify any non-zero catch which will be compatible to the precautionary approach. Rebuilding can only be achieved if fishing mortality is significantly reduced on a longer term.

Management considerations

It is an inherent problem that practices of misreporting may develop when TAC regulations are not efficiently implemented. When decisions on TACs are taken on the basis of catch forecasts it may result in a vicious circle if the forecasts are based on catch data which are lower than the real catches. If misreporting cannot be estimated accurately and included in stock assessments the result will be an increasing bias in stock assessments and forecasts, resulting in even more restrictive TACs and increasing misreporting. Over time it becomes impossible to establish the real stock situation and to advise on catches which may be taken sustainably. In this situation, a TAC regulation such as that currently implemented is therefore not adequate to regulate fishing mortality within sustainable limits and to normalise the situation. In such situations, ICES would often advise on a precautionary TAC based on recent landings. However, when the landing data are not reliable due to misreporting a relevant number for such a TAC cannot be established and a TAC regime does not regulate fishing mortality. Therefore, ICES has concluded that in such situations a possible route is to change management to focus on effort, which can be controlled through instruments like VMS, in order to reintroduce effective control of the fishery and to restore a reliable future database for advice and management decisions. It is an integral part of such a change that a detailed and stringent programme, including the mandatory reporting of both catch and effort data in logbooks should be established to collect high quality effort and landings data. When the situation is normalised and reliable data have been established the future different management schemes can then be considered.

The present stock estimates are relatively uncertain due, in part, to the lack of access to port sampling in 2003 and only limited access in 2004. Without a resumption of sampling at all major ports, there will continue to be larger uncertainties in the stock status and further deterioration in the ability to provide advice.

There are strong indications that management control is not effective in limiting the catch.

The advised measures are required if the cod stock is to reach a level where it can regain historic productivity.

As cod is taken in mixed demersal fisheries, following the advice should result in greatly reduced harvesting of other stocks, particularly haddock and *Nephrops*, unless these fisheries can demonstrate zero bycatches of cod. Management needs to take this into account.

Time and area closures have not been sufficient to lead to rebuilding of this stock. The consequence of displacing effort, caused by the closures, needs to be considered in determining the role of such measures in the recovery plan.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to restrict fishing. Unless recovery measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is managed by TACs that do not restrict landings.

Several regulations have been introduced in the Irish Sea in recent years. These regulations and their impact on the fisheries have been discussed in detail in the overview. To rebuild the SSB a closure, which was intended to maximize the reproductive output of the stock was introduced in 2000 for ten weeks from mid-February (EU Regulations 304/2000 and 2549/2000). The measures were revised in 2001, 2002, and 2003, involving a continued, but smaller spawning-ground closure, coupled with changes in net design to improve selectivity. Various derogations were introduced for gears not targeting cod.

These recovery measures have since been complemented by a system of fishing effort limitation. This is done by adjustment of the number of fishing days allowed for various vessel categories deploying gears with various mesh sizes. The introduction of effort regulation has effectively encouraged vessel operators to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes. Trends in nominal effort in this area are presented in the report of the STECF Sub-group SGRST (STECF, 2005. Evaluation of the Cod Recovery Plan) and indicate an overall decrease in effort of 19% between 2000 and 2004.

The continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of the regulations will not be possible until data of sufficient quality become available.

Scientific basis

Data and methods

The assessment model is based on a catch-at-age analysis of reported landings, calibrated with several series of survey indices. In addition, the model estimates missing removals as a bias in landings, assuming that they have the same age composition as reported landings.

The assessment is indicative of stock trends, but cannot be used as a basis for sufficiently precise forecasts.

Recent discard estimates available for some fleets indicate a variable, but very high discard rate of ages 0 and 1. These estimates are not used in the assessment due to the short time-series available.

Information from the fishing industry

The UK Fisheries Science Partnership (FSP) survey of the western Irish Sea cod spawning grounds in spring 2004 and 2005, carried out using a commercial pelagic trawler, indicated similar abundance and age structure of adult cod in both years, although catch-rates were generally poor on the spawning grounds. The equivalent FSP survey of the eastern Irish Sea in spring 2005 indicated low catch rates of 3-year-old and older cod.

Uncertainties in assessment and forecast

The present stock estimates are highly uncertain because of sampling problems, due to a lack of access to ports for sampling in some years. The need to estimate and project missing catch components introduces greater uncertainty into the assessment and forecast.

Comparison with previous assessment and advice

Traditionally, ICES has included estimates of misreported landings within the unallocated landings figures reported for this stock. These unallocated landings have represented adjustments to nominal landings figures to correct either for misreporting or for differences between official statistics and data obtained by national scientists. As the misreporting estimates are for one country only, and there is evidence that the practice is more widespread, ICES is no longer able to

provide catch estimates partially corrected for misreporting for the recent years 2003 and 2004 and hence, the change in assessment model this year.

The overall trends in biomass and recruitment appear well-estimated and the perception of the stock from this year's assessment does not differ qualitatively from that obtained last year. The basis of the advice this year is the same as last year.

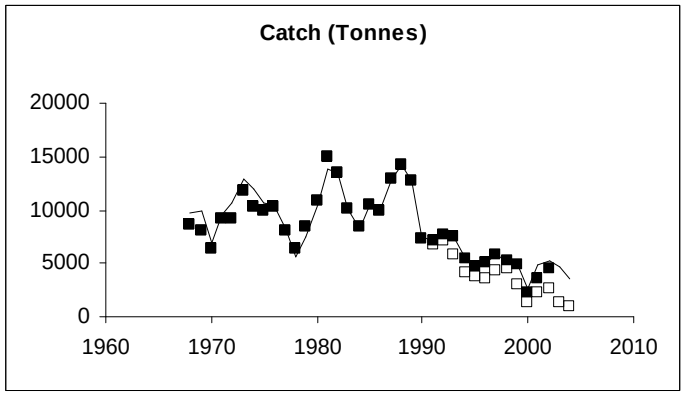
Source of information

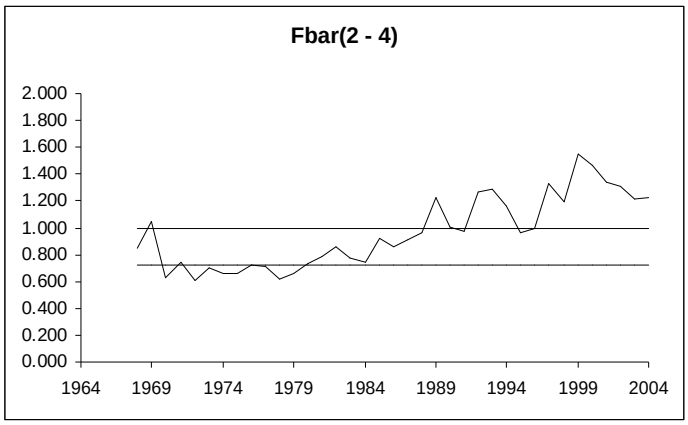
Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

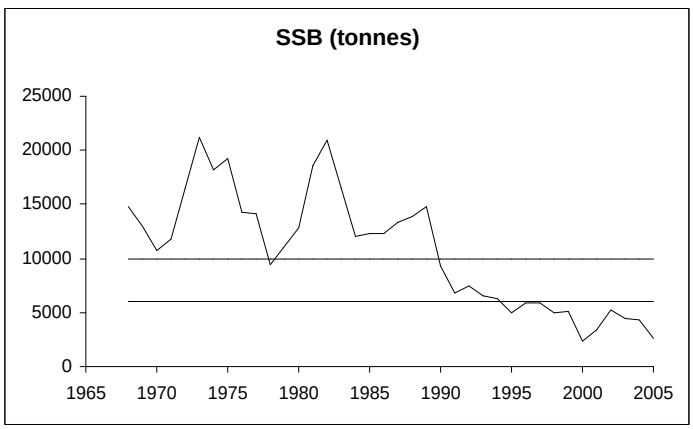
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	No increase in F; interaction with *Nephrops*		10.3		15.0	13.2	12.9
1988	No increase in F; interaction with *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	4.78[2]
2000	Lowest possible F		0		2.1	1.42	2.18[2]
2001	Lowest possible F		0		2.1	2.03	3.60[2]
2002	Establish recovery plan		-		3.2	2.7	4.42[2]
2003	Closure of all fisheries for cod		-		1.95	1.5	n/a
2004		Zero catch		0	2.15	n/a	n/a
2005		Zero catch		0	2.15		
2006		Zero catch		0			

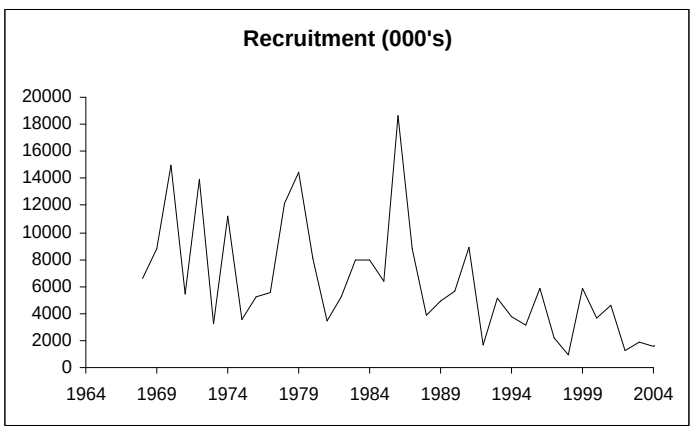
Weights in '000 t.
[1]Preliminary.
[2]Incomplete data.
n/a = not available.

Cod in Division VIIa (Irish Sea)









Catches (ACFM landings (filled squares), reported landings (open squares) and estimates from the modeled assessment (solid line)), fishing mortality, spawning stock biomass and recruitment are shown.

Table 1.4.1.1 Nominal catch (t) of COD in Division VIIa as officially reported to ICES.

Country	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[1]	2004[1]
Belgium	174	169	129	187	142	183	316	150	60	283	318	183	104
France	916	686	208	166	148	268	269[1]	85[1]	53	74	116	146[2]	n/a
Ireland	2,260	1,328	1,506	1,414	2,476	1,492	1,739	966	455	751	1,111	594	n/a
Netherlands	-	-	-	-	25	29	20	5	1	-	-	-	
UK (England & Wales)[3]	3,529	3,244	2,274	2,330	2,359	2,370	2,517	1,665	799	885	1,134	527[4]	660[4]
UK (Isle of Man)	129	57	26	22	27	19	34	9	11	1	7	7	n/a
UK (N. Ireland)	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	393	453	326	414	126	80	67	80	38	32	29	…	n/a
Total	7,401	5,937	4,469	4,533	5,303	4,441	4,962	2,960	1,417	2,026	2,708	1,457	n/a

[1]Preliminary.
[2]Revised.
[3]1989–2004 N. Ireland included with England and Wales.
[4]includes Scotland.
n/a = not available.

Table 1.4.1.2 Cod in Division VIIa (Irish Sea).

	Recruits Age 0	TOTSPBIO	Total Removals	Recorded Landings	FBAR 2- 4
1968	6570	14765	9779	8541	0.8438
1969	8771	12895	9834	7991	1.0492
1970	15024	10737	6831	6426	0.631
1971	5434	11813	9549	9246	0.7436
1972	13973	16519	10710	9234	0.6083
1973	3257	21167	12968	11819	0.7023
1974	11241	18147	11955	10251	0.6556
1975	3601	19253	10650	9863	0.6558
1976	5215	14289	10557	10247	0.7229
1977	5557	14147	8173	8054	0.7128
1978	12139	9432	5556	6271	0.6221
1979	14437	11161	7430	8371	0.6648
1980	8046	12778	10534	10776	0.7362
1981	3484	18634	13858	14907	0.7832
1982	5285	20962	13503	13381	0.8565
1983	7938	16524	10183	10015	0.7744
1984	7975	12064	8274	8383	0.7444
1985	6393	12278	10442	10483	0.9247
1986	18601	12273	9819	9852	0.8567
1987	8791	13398	12891	12894	0.9066
1988	3841	13854	14166	14168	0.9657
1989	4938	14775	12781	12751	1.2279
1990	5672	9346	7400	7379	1.0005
1991	8853	6864	7074	7095	0.9716
1992	1722	7506	7715	7735	1.2705
1993	5170	6498	7551	7555	1.2872
1994	3732	6294	5404	5402	1.1641
1995	3140	4913	4587	4587	0.9619
1996	5848	5947	4962	4964	0.9935
1997	2152	5857	5858	5859	1.3351
1998	943	4995	5309	5310	1.1971
1999	5746	5104	4785	4784	1.5645
2000	3632	2297	2594	1273	1.4408
2001	4348	3424	4873	2251	1.3493
2002	1231	5263	5391	2704	1.3684
2003	1829	4185	4273	1276	1.1311
2004	1557	4339	3616	1007	1.1952
Arith. Mean	6381	10938		7922	0.9627
Units	(Thousands)	(Tonnes)		(Tonnes)	

1.4.2 Cod in Divisions VIIe-k

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The last reliable assessment for 2002 based on landings indicated that the stock was above $\mathbf{B}_{pa}$ and was being harvested unsustainably. Effort in the main fleet targeting this stock has been declining since the late 1990s. This suggests that fishing mortality may have been reduced, but the current SSB in relation to $\mathbf{B}_{pa}$ is uncertain. Historically, recruitment is highly variable, but indications from survey data suggest that recent recruitments have been low.

Management objectives

There are no specific management objectives for this stock or a management plan.

Reference points

$\mathbf{B}_{lim}$ and $\mathbf{B}_{pa}$ were revised in 2004.

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 6 300 t, the lowest observed spawning stock biomass.	$\mathbf{B}_{pa}$ be set at 8 800 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.

Due to recent changes in discarding and high grading practices the present exploitation pattern is not known and therefore yield and spawning biomass per recruit relevant for the present fishery cannot be calculated.

Technical basis

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.(B76)	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$
$\mathbf{F}_{lim}$ = based on historical response of the stock	$\mathbf{F}_{pa} = 5^{th}$ percentile of $\mathbf{F}_{loss}$

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The reduction of effort which has taken place since 1999 may not have reduced fishing mortality to sustainable levels. Reduction of effort would improve yields and reduce risks to the stock in the longer term. Therefore, in view of the uncertainty of the data and the high fishing mortality estimated for 2002, effort should be reduced to ensure a longer-term reduction in fishing mortality towards sustainable levels. Adequate monitoring, including discard monitoring should be implemented.

Management considerations

An appropriate management plan would be to maintain fishing mortality at a low precautionary target level to ensure that any recruiting year classes survive and contribute to SSB and yield. Historically, fishing mortality has always been well

above any potential targets and although effort targeting cod has reduced in recent years due to fleet changes and closed areas, further measures are required to reduce fishing mortality in the short term.

ICES has made preliminary explorations of a possible management plan option to reduce F to reach levels associated with high long-term yields. For illustrative purposes only, Figure 1.4.2.2 shows one of these preliminary explorations based on assumptions that recent fishing mortality has been maintained at a high level until 2004 and that future recruitment will be variable around the average when SSB is either above $\mathbf{B}_{lim}$ or reduced to below $\mathbf{B}_{lim}$. The absolute numerical results are very sensitive to the recruitment assumptions and these assumptions need to be fully investigated before quantitative predictions are used for management purpose. However, the general trends are informative and demonstrate that a gradual reduction of fishing mortality, if implemented efficiently may imply small immediate losses to yield, while gains in terms of both increased yield and reduced risk to SSB will materialise within a short time after implementation of such a strategy. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

Restrictive quotas have resulted in a change in discarding practices (i.e. high grading of catch such that only larger cod were reported as landed) for the main fleet exploiting this stock in 2003 and 2004. Substantial underreporting of landings is also known to occur but cannot yet be adequately quantified. Cod in this area is a fast-growing and early-maturing fish, and the future SSBs are highly dependent on the strength of incoming year classes. Indications from survey data suggest that recent recruitments have been low.

In 2005, part of the Celtic Sea was temporarily closed for trawlers. The impact of this closure on the fishing mortality cannot yet be quantified.

The assessment area covers Divisions VIIe-k and the ICES advice applies to these areas only, and this does not correspond to the TAC area. The TAC is set for Divisions VIIb-k, Subareas VIII, IX, X, and CECAF 34.1.1. Within this larger area there is no control over where the catches will be taken. Current management measures for Divisions VIIe-k include cod in Divisions VIIbc and cod in Division VIId. Cod in Division VIId is assessed together with cod in the North Sea.

Ecosystem considerations

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 and into VIIfg, where there appears to be a simple inshore-offshore migration between deepwater wrecks and reefs in the summer and inshore spawning areas in the winter. Recent tagging work in the Irish Sea suggests 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.

Cod in the Celtic Sea are at the southern limit of the range of the species in the Northeast Atlantic. The warmer waters means that growth rates in the Celtic Sea are among the fastest observed for the species. It is also known that at the southern limits of their range recruitment tends to decrease in warmer waters (above 8.5°C) and that cod are not found in waters warmer than 12°C. It is unclear to what extent the recent poor recruitments are linked to an increase in water temperature. Fishing mortality remains an important factor in fish productivity.

Factors affecting the fisheries and the stock

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, with a peak in February–March.

The effects of regulations

Technical measures applied to this stock are a minimum mesh size for beam and otter trawlers in Subarea VII and a minimum landing size (35 cm). There is a specific minimum landing size of 40 cm applied to Belgian trawlers that land in Belgium. Minimum landing sizes do not prevent cod from being caught (and thrown back dead), but might prevent targeting juvenile cod.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. Fishing effort for the French fleets operating in the 3 closed rectangles was mainly displaced to other fishing grounds outside the Celtic Sea and

to areas within the Celtic Sea with lower LPUE values for cod. Some vessels have also switched to another metier targeting anglerfish and megrim in the rest of the Celtic Sea. However, the results were too preliminary to draw any firm conclusions on the impact of this on the fishing mortality.

From the beginning of 2003, French trawlers were subject to trip landing restrictions. The restriction was suspended from May 2005 due to reduced catch rates. French vessels were also prohibited from landing the smallest size categories of cod from 2003. These two management controls were responsible for an increase in discarding due to high-grading of catches. Irish vessels are also subject to monthly quota limitations for cod.

Underreporting of landings is known to be a problem in some fleets.

Management regulations, particularly effort control regimes in other areas (Division VIIa, Subareas VI & IV), became increasingly restrictive in 2004 and 2005 and should not be allowed to result in a displacement of effort into the Celtic Sea.

Changes in fishing technology and fishing patterns

In recent years there has been a substantial behavioural change in the main fisheries with regard to discarding. Discarding (and probably underreporting) occurred in the last quarter of 2002 as the French fishery was closed when the cod quota was exhausted. In 2003 and 2004 it is thought that there was substantial high-grading of marketable cod in order to prevent a new closure of the fishery.

Analysis of French logbook data from 1999–2003 shows a large increase in the incidence of fishing operations where no cod has been landed. This is considered to be indicative of either increased discarding or avoidance of cod due to trip-by-trip limitation.

Scientific basis

Data and methods

No analytical assessment could be carried. The landings-at-age data which formerly were the basis of the assessment are thought to be biased and unreliable since 2003. This is due to the substantial changes in discarding practices described above.

Information from the fishing industry

Meetings with representatives of the fishing industry were held prior to WGSSDS 2005 in France, Ireland, and the UK.

Uncertainties in assessment and forecast

A major problem for the assessment of this stock is the lack of discard information. There is no discard information for the main French fleet in which discarding and high-grading of marketable catch is thought to be substantial in recent years. Previous Irish discard studies suggest that discarding of cod is low, while for the UK otter trawlers discarding can be as high as 64% in number. These are not accounted for in the assessment.

Underreporting and area misreporting is a problem in some fleets and may also be a major source of uncertainty in this assessment. There is not sufficient information to provide a quantitative estimate of this.

There is very little fishery-independent information for this stock. Because of the low cod abundance, the calculated abundance indices for both the UK and French surveys are based on very few cod caught. Therefore, one should be careful when drawing firm conclusions from those data. Nevertheless, both surveys give some indication of year class strength, especially when a very large year class comes through.

Comparison with previous assessment and advice

The analytical assessment was not accepted due to unreliable input data. Last year an analytical assessment could be performed, but this is now considered unreliable also.

Last year, ICES recommended a 17% reduction in F in order to bring SSB above $\mathbf{B}_{pa}$ in 2006. This year, due to the uncertainty on the current levels of F and SSB no forecast was carried out. ICES recommends that fishing effort should not be allowed to increase.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings[6]
1987	Reduce F	< 6.4[2]		10.2
1988	No increase in F; TAC	7.0[2]		17.2
1989	No increase in F; TAC	8.6[2]		19.8
1990	No increase in F; TAC	9.2[2]		12.7
1991	TAC; SSB = mean	4.5[2]		9.3
1992	Appropriate to reduce F	-		9.7
1993	20% reduction in F	6.5[2]	19.0	10.4
1994	20% reduction in F	5.6[2]	17.0	10.6
1995	20% reduction in F	4.7[3]	17.0	11.7
1996	20% reduction in F	4.7[3]	20.0	12.6
1997	20% reduction in F	7.4[4]	20.0	12.0
1998	10% reduction in F	8.8[4]	20.0	11.4
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	6.9
2001	40% reduction in F	< 4.3[5]	10.5	8.2
2002	45% reduction in F	< 5.3[5]	8.7	8.7
2003	60% reduction in F	< 3.8[5]	6.7	6.0
2004	90% reduction in F or management plan	<0.7	5.7	3.4
2005	17% reduction in F	<5.2	6.2	
2006	No increase in effort	Cannot be estimated		

Weights in '000 t.
[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 the VIIe-k stock component. [6]ACFM landings for the period 1988–2002 revised.

Table 1.4.2.1. Nominal landings of Cod in Divisions VIIe-k used by the Working Group.

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	13863	1480	1292	2	17191
1989	910	15801	1860	1223	15	19809
1990	621	9383	1241	1346	158	12749
1991	303	6260	1659	1094	20	9336
1992	195	7120	1212	1207	13	9747
1993	391	8317	766	945	6	10425
1994	398	7692	1616	906	8	10620
1995	400	8321	1946	1034	8	11709
1996	552	8981	1982	1166	0	12681
1997	694	8662	1513	1166	0	12035
1998	528	8096	1718	1089	0	11431
1999	326	6820	1883	897	0	9926
2000	208	4690	1302	744	0	6944
2001	347	5914	1091	838	0	8190
2002	555	6897	694	618	0	8764
2003	136	5018	517	346	0	6017
2004*	153	2299	647	282	0	3381

*Provisional.
Scaled landings 1971–1987 (SSDS WG 1999).

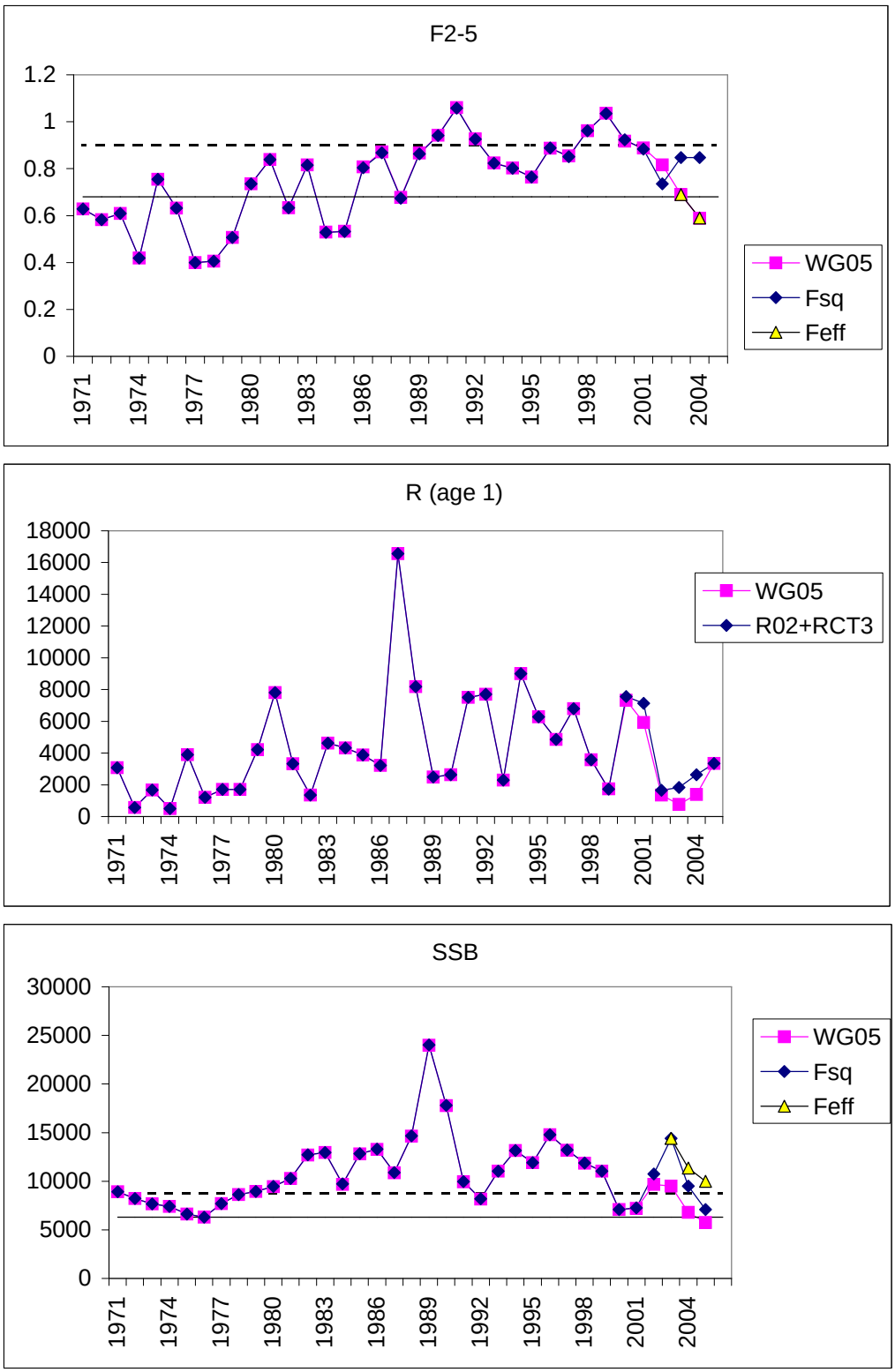


Figure 1.4.2.1 Cod in VIIe-k: Trends in fishing mortality for ages 2-5 (F2-5), recruitment and spawning stock biomass, and SSB.

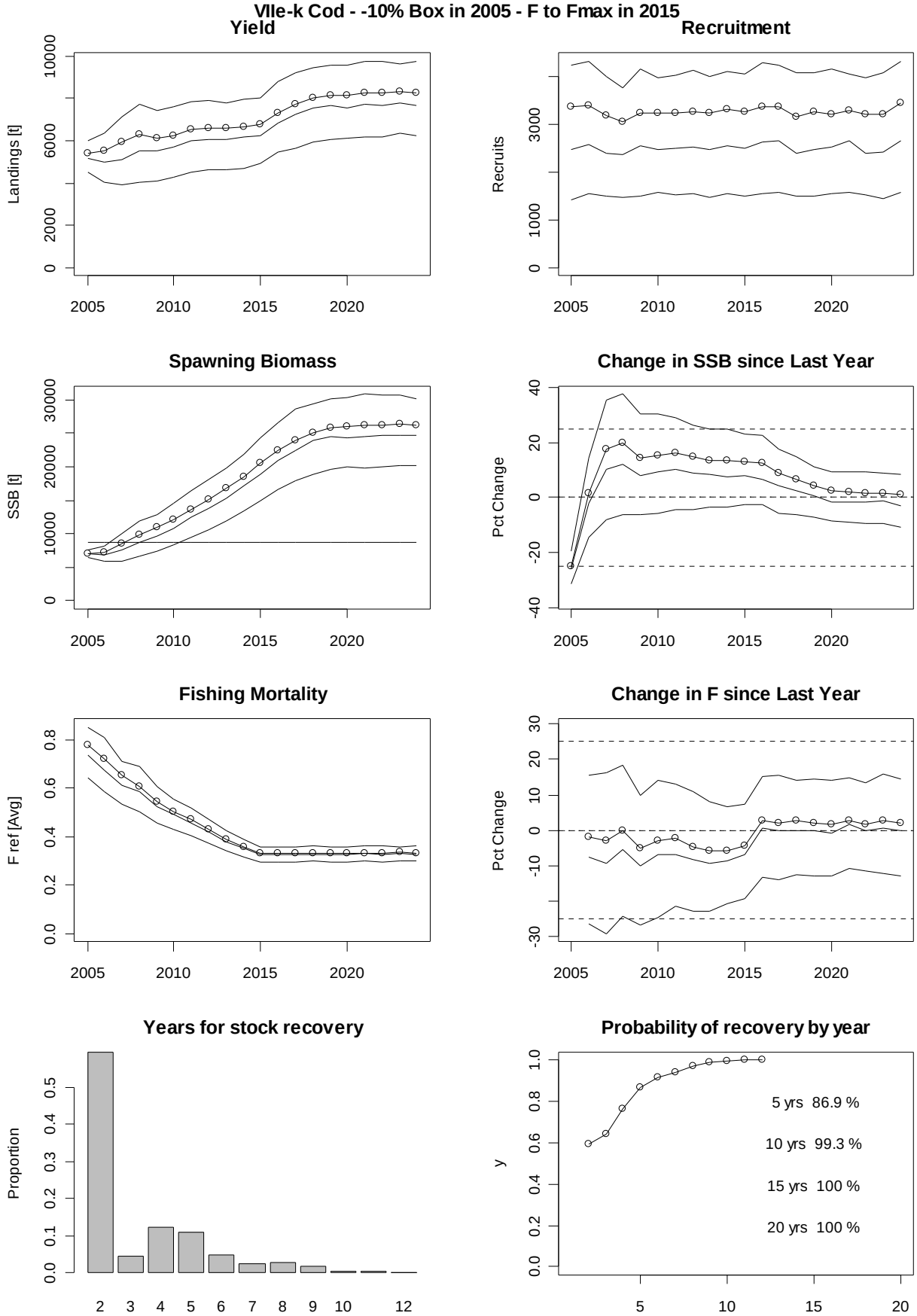


Figure 1.4.2.2 Management strategy simulation for Cod in VIIe-k: Progressive reduction in F by equal annual increments to reach $\mathbf{F}_{max}$ 0.33 in 2015. In deriving the scenario it was assumed that Fs in 2003 and 2004 were equal to the mean 2000–2002 ($\mathbf{F}_{sq}$=0.85), and that recruitment is independent of SSB (with log normal error) when SSB > $\mathbf{B}_{lim}$. This scenario also assumes that the seasonal closure implemented in 2005 has reduced F by 10%.

1.4.3 Haddock in Division VIIa (Irish Sea)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Undefined	Unknown	Unknown	Not defined	

The assessment is indicative of trends in SSB and recruitment and is based on survey results. Recent trends in fishing mortality are uncertain. Survey information indicates that fishing mortality remains at a high level relative to taking high long-term yields and that SSB has been sustained by recent high recruitment. The SSB increased since 2001 as a result of the stronger 1999 and 2001 year classes. The 2003 and 2004 year classes appear to be above average and should result in increased SSB.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ is not defined.
	$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ be set at 0.5.
Target reference points		Not defined.

Yield and spawning biomass per Recruit (from 2004 Assessment)
F-reference points

	Fish Mort Ages 2-4	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.347	0.511	1.232
$\mathbf{F}_{0.1}$	0.180	0.469	2.009

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Technical basis:

There is currently no biological basis for defining appropriate reference points, in view of the rapid expansion of the stock size over a short period (ACFM, October 2002). ACFM proposed that $\mathbf{F}_{pa}$ be set at 0.5 by association with other haddock stocks.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Recent estimates of fishing mortality have been in excess of 1.0 and there will be no gain to the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.35). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

The fishing mortality should be reduced in order to make the fishery less sensitive to variable recruitment. Recent estimates of fishing mortality have been in excess of 1.0, compared to an $\mathbf{F}_{pa}$ of 0.5. Effort and catches should be reduced considerably to approach $\mathbf{F}_{pa}$. Given the poor information on the actual catches it is not possible to quantify this reduction.

Management considerations

The EU Cod Recovery Plan regulation implemented in the Irish Sea from 2004 will impinge upon the management measures for 2006 for species caught in related fisheries, including haddock. The current directed fishery for haddock in the Irish Sea is likely to generate bycatches of cod in the same area.

Limited sampling schemes since the 1990s have shown high rates of discarding of haddock less than 3 years old, and variable discarding of 3-year-olds in fisheries using 70-80 mm mesh nets. Data for whitefish vessels since the introduction of 100+ mm mesh and other recent technical measures are too few to form a basis for evaluation. However, any measures to reduce discards will result in increased future yield.

Management plan evaluations

There are strong indications that management control is not effective in limiting the catch, and that it has resulted in very uncertain data on the quantities of fish caught by the fleet.

The extent to which F could be reduced in 2006 by management measures such as effort limitation could not be reliably evaluated by ICES.

Factors affecting the fisheries and the stock

The effects of regulations

Due to the bycatch of cod in the haddock fishery, the regulations affecting Division VIIa haddock remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the overview for the Irish Sea. The extent to which fishing mortality may have been reduced in 2005 by management measures such as effort limitation and decommissioning of vessels in 2003 could not be reliably evaluated.

Scientific basis

Data and methods

Landings data for this stock are uncertain because of species misreporting, which has been estimated from quayside observations in one country only. Restrictive quotas for some countries caused extensive misreporting during the 1990s prior to the introduction of a separate TAC allocation for the Irish Sea. Estimates of misreporting prior to 2003 have been included in the estimates of landings.

The present stock estimates are relatively uncertain due to a lack of access to port sampling in 2003 and only limited access in 2004. There will continue to be uncertainties in the estimated stock status unless full sampling is resumed at all major ports. The official landings for 2004 of 445 t may thus substantially underestimate the true removal by the fishery. The misreporting levels for haddock have been highly variable in recent years, making it impossible for ICES to provide a reasonable estimate of the 2004 landings.

Estimates of the age composition are considered adequate prior to 2003. The accuracy of the 2004 estimates remains low because of poor sampling from some major fleets. Consequently, in the absence of reliable landing data and catch-at-age data no analytical catch-based assessment could be performed.

Recent discard estimates available for some fleets indicate a variable, but very high discard rate of younger fish. These estimates are not used in the assessment due to the short time-series available.

The assessment of recent stock trends is based on survey data only using the March survey data up to 2005.

Uncertainties in assessment and forecast

Some discarding information is available, which indicates that discarding is substantial for younger age-classes. Comparisons were made of relative trends in recruitment and SSB from this year's survey-based assessment and last year's catch-based assessment. The methods indicate similar trends in SSB and recruitment estimates.

The survey-based assessment provides only relative trends in stock parameters.

Comparison with previous assessment and advice

The perception of the stock from this year's assessment does not differ qualitatively from that obtained last year, and the basis of the advice is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	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	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 req'd				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	4.139
2000	Reduce F below $\mathbf{F}_{pa}$		<2.8		3.4[2]	2.447	1.430
2001	Reduce F below $\mathbf{F}_{pa}$		<1.71		2.7[2]	2.238[3]	2.50
2002	Reduce F below $\mathbf{F}_{pa}$		<1.20		1.3[2]	1.111[3]	1.972
2003	No cod catches		-		0.6[2]	0.638	n/a
2004	[4)]	F<$\mathbf{F}_{pa}$	[4]	<1.5	1.5	0.445[3]	n/a
2005	[4)]	F<$\mathbf{F}_{pa}$	[4]	<1.37	1.5		
2006	[4)]	Substantial reduction in fishing mortality	[4]	-			

Weights in '000 t.
[1] Precautionary TAC for VII, VIII, IX, X. [2] VIIa allocation of precautionary TAC. [3] Incomplete data. [4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
n/a = not available.

Table 1.4.3.1 Nominal catch (t) of HADDOCK in Division VIIa as officially reported to ICES.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992
Belgium	3	4	5	10	12	4	4	1	8
France	38	31	39	50	47	n/a	n/a	n/a	26
Ireland	199	341	275	797	363	215	80	254	251
Netherlands	-	-	-	-	-	-	-	-	-
UK (England & Wales)[1]	29	28	22	41	74	252	177	204	244
UK (Isle of Man)	2	5	4	3	3	3	5	14	13
UK (N. Ireland)	38	215	358	230	196	…	…	…	…
UK (Scotland)	78	104	23	156	52	86	316	143	114
Total	387	728	726	1,287	747	560	582	616	656

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001
Belgium	18	22	32	34	55	104	53	22	68
France	41	22	58	105	74	86	n/a	49	183
Ireland	252	246	320	798	1,005	1,699	759	1,238	652
Netherlands	-	-	-	1	14	10	5	2	-
UK (England & Wales)[1]	260	301	294	463	717	1,023	1,479	1,061	1,238
UK (Isle of Man)	19	24	27	38	9	13	7	19	1
UK (N. Ireland)	…	…	…	…	…	…	…	…	…
UK (Scotland)	140	66	110	14	51	80	67	56	86
Total	730	681	841	1,453	1,925	3,015	2,370	2,447	2,228

Country	2002	2003	2004
Belgium	44	20	15*
France	72	111	
Ireland	401	229	
Netherlands	-	-	
UK (England & Wales)[1]		248	
UK (Isle of Man)		0	
UK (N. Ireland)	…	…	
UK (Scotland)		30	
United Kingdom	598		430*
Total	1,115	638	445*

*Preliminary.
[1]1989–2001 Northern Ireland included with England and Wales.
n/a = not available.

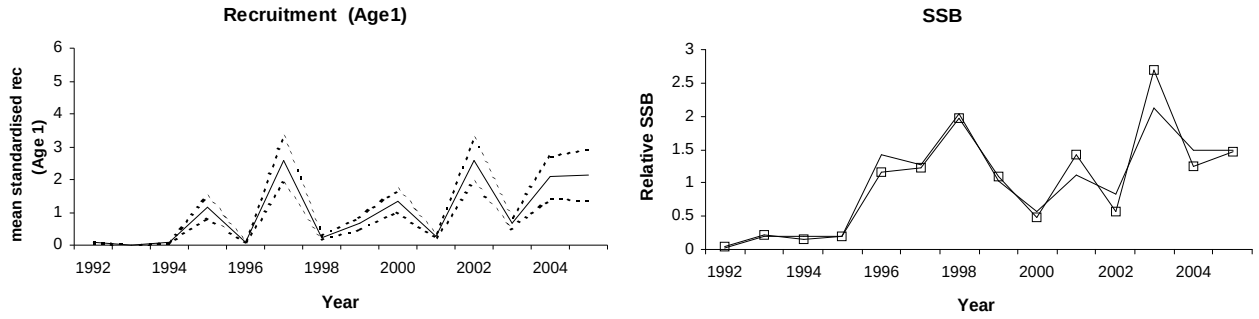


Figure 1.4.3.1 Haddock VIIa: Results of survey-based assessment. Dotted lines are +/- 1 SE in the left-hand panel. Empirical estimates of SSB from the raw survey data are shown in the right-hand panel (connected boxes).

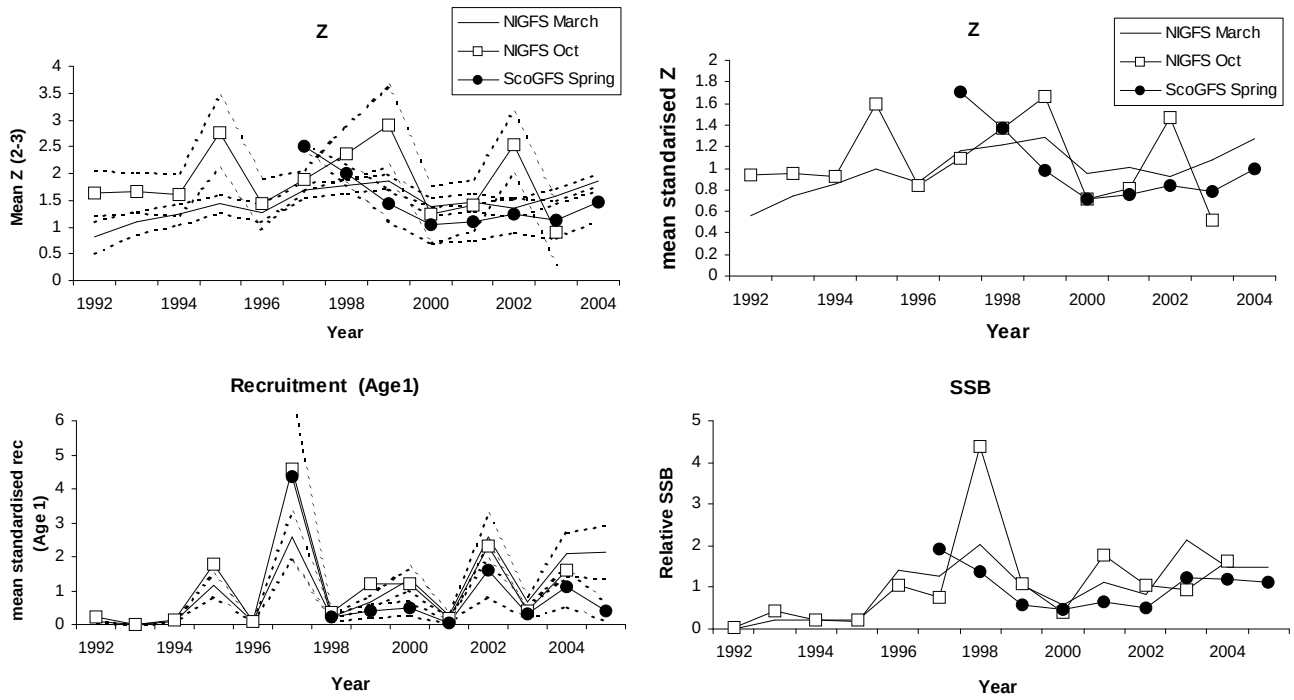


Figure 1.4.3.2 Haddock in VIIa: Comparison of SURBA 3.0 runs using NIGFS Mar, NIGFS Oct and ScoGFS Spring survey data. Dotted lines are +/- 1SE. Z estimates given as absolute and relative.

1.4.4 Haddock in Divisions VIIb-k

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The state of the stock is unknown in relation to precautionary reference points. Exploratory analysis shows no indication of a declining trend in SSB. Fishing mortality also appears to be relatively stable. Recruitment is highly variable and there were strong 1995 and 2002 year classes.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Current fishing mortality is unknown.

Exploitation boundaries in relation to precautionary considerations

Because of the strong 2002 year class SSB has increased, but ICES is unable to provide a reliable estimate of current stock size in relation to precautionary limits. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management.

Outlook for 2006

Due to large uncertainties in estimates of stock size and fishing mortality, no deterministic forecast can be presented for haddock in Divisions VIIb-k.

Management considerations

The nature of haddock as a species indicates that large pulses in recruitments are likely to occur for this stock. The survival of any big year class (e.g. 2002) is uncertain due to the expected mortality associated with discarding for these young fish. Continuing to set TACs based on average landings without regard for expected increases in SSB will increase the propensity for discarding and misreporting. Management by TAC is not effective for this stock.

An increase in mesh size or other technical measures to minimize discarding would be of huge benefit to this stock and have a substantial impact on medium-term yield. Haddock is a relatively low value species and targeting practices in the fishery are highly dependent on availability and market demand.

Factors affecting the fisheries and the stock

Haddock in Divisions VIIb-k are mainly taken in mixed trawl fisheries. These are the same fisheries fishing for cod and whiting.

The effects of regulations

The TAC for haddock is set for all of Subareas VII, VIII, IX, and X. Quotas in recent years have been based on average landings and as the strong 2002 year class recruited to the fishery underreporting, species misspecification of landings and high grading are know to have increased. Technical measures applied to this stock include a minimum landing size (≥ 30

cm) and the minimum mesh sizes applicable to the mixed demersal fisheries. Given the observed discarding rates in some towed gears there is a mismatch between minimum mesh sizes in these mixed demersal fisheries and the MLS.

Within the large management area there is no control over where the catches will be taken. Current management measures for Divisions VIIb-k include haddock in Division VIIa. Whatever management measures are implemented, they must be consistent with the assessment area.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg. and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average national annual effort (calculated over the period 1998–2002).

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. The impact of this on the haddock stock is not yet known.

Scientific basis

Data and methods

An exploratory assessment was carried out, but the available data were not considered sufficient to provide a reliable indication of stock trends. A major shortcoming is the lack of a timeseries of discard data and recent underreporting estimates. Survey information was available, but these data require closer examination before they can be used to assess the stock.

Information from the fishing industry

Meetings with representatives of the fishing industry were held prior to the assessment group ($WGSSDS_{2005}$) in Ireland and the UK. No specific concerns were raised about the state of this stock or its assessment.

Uncertainties in assessment and forecast

Only exploratory analytical assessment could be carried out for this stock.

The stock structure is uncertain. Stocks of haddock in Divisions VIa, VIIa, and VIIb-k have shown different growth rates and patterns of recruitment variation during the 1990s. This may reflect latitudinal variations in environmental conditions. Catches of haddock along the Atlantic seaboard of the British Isles are recorded more or less continuously between the west coast of Scotland and the Celtic Sea. Significant genetic differences have been found between samples collected at much smaller spatial scales than the entire west coast of the British Isles (ICES: WGNSDS 1999). The implications of this result for evaluating the present stock management units remain unclear. Further investigation is needed to better define the biological stock units.

Comparison with previous assessment and advice

Last year an analytical assessment was accepted as indicative of stock trends. However, the new information on the extent of discarding and misreporting meant that ICES no longer considers this assessment to be reliable.

The advice is consistent with last year.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

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]	5.2	5.0
2000	No expansion of catches		16.6[5]	6.7	7.6
2001	No expansion of catches		12[5]	9.7	8.7
2002	No expansion of catches	8.0	9.3[5]	7.0	6.8
2003	No expansion of catches	7.2	8.185[5]	6.9	8.4
2004	No increase in F	-	9.600[5]	0.8[4]	7.9
2005	No increase in effort	-	11.520[5]		
2006	No increase in effort	-			

Weights in '000 t.
[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.

Table 1.4.4.1 Haddock in VIIb-k (Celtic Sea and West of Ireland). Nominal landings (t) of haddock in Divisions VIIb,c,e-k as officially reported to ICES and total landings as used by the Working Group.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	-	4	6	12	64	117	22	18	21	51	123	189	133	246	142	51	90	165	132	118	135.2
France	3,328	2,438	2,279	2,380	3,275	3412	2110	1,247	1,461	1,839	2,788	2,964	4,527	6,581	3,674*	2,725	3,088	4,842	4,289	4,469	
Ireland	646	794	317	314	275	323	461	1,020	1,073	1,262	908	966	1,468	2,789	2,788	2,034	3,066	3,608	2,188	1867	
Netherlands								-	-	-	-	-	-	-	3	-	-				
Norway	17	4	86	-	-	27	31	38	26	-	17	64	38	31	49	71	13*	19	21*		
Spain	532	561	-	-	-	-	-	-	-	-	-	19	48	54	260	88	110	646	85	82	
UK (Channel Islands)	-	-	-	-	-	-	-		-	-	1	-	-	-	-	-	-				328
UK (England & Wales)	340	168	188	194	405	278	123	137	220	189	193	228	432	554	410	273	287	409	313	342	
UK (Scotland)	63	7	57	79	4	17	195	113	86	67	47	38	7	15	35	5	2	13	2	7	
United Kingdom																					312.5
Total	4926	3976	2933	2979	4023	4174	2942	2573	2887	3408	4077	4468	6653	10270	7361	5247	6656	9702	7030	6885	775.7
Unallocated										-60	54	2	103	557	307	-220	970	-956	-217	1,486	7112.3
Total as used by the Working Group										3,348	4,131	4,470	6,756	10,827	7,668	5,027	7,626	8746	6813	8371	7888

* Preliminary

1.4.5 Whiting in Division VIIa (Irish Sea)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown, low SSB	Unknown	Unknown	Unknown	

Long term information on the historical yield and catch composition all indicate that the present stock size is low. The last assessment in 2003 indicated a decrease in SSB of a factor of 10 from 1980s to the 1990s. Survey information from the 1990s indicates that the stock has remained at the low level.

Management objectives

No explicit management objectives have been set for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 5 000 t	$\mathbf{B}_{pa}$ be set at 7 000 t
	$\mathbf{F}_{lim}$ is 0.95	$\mathbf{F}_{pa}$ be set at 0.65
Target reference points		$\mathbf{F}_{y}$ not determined

Technical basis:

$\mathbf{B}_{lim}$: $\mathbf{B}_{loss}$. 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.	$\mathbf{B}_{pa}$: = $\mathbf{B}_{loss}$ * 1.4: This 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.
$\mathbf{F}_{lim}$: This is the fishing mortality estimated to lead to a potential stock collapse.	$\mathbf{F}_{pa}$: 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. It 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.

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

On the basis of the stock status, ICES advises that catches of whiting in 2006 should be the lowest possible.

Management considerations

Landings of whiting by all vessels, and discards of whiting estimated for *Nephrops* fisheries, have declined substantially since the 1990s and whiting is now a relatively minor by-catch in the demersal fisheries. Due to the small catches and low value of the catch, a high proportion of whiting are discarded. Age profiles observed on these surveys are very steep indicating either a continuing high mortality or some emigration effect. Fishing mortality cannot be managed by a TAC on whiting, and measures restricting landings alone will not be sufficient to allow recovery of the stock.

The substantial drop in landings demonstrates the need for concern for this stock, but as current catches are virtually all taken as discards in the valuable *Nephrops* fishery, measures to protect whiting would require constraints on the *Nephrops* fishery. Measures in place to protect cod will not protect whiting as there are derogations for the *Nephrops* fishery. By-catch mitigation measures (square mesh panels) are in place in the *Nephrops* fishery, but the fishery is still generating substantial discards.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to restrict fishing. Unless management measures are able to restrict the fishery within TAC limits they are not precautionary.

Factors affecting the fisheries and the stock

The Effects of Regulations

Various technical measures have been introduced in the past to mitigate by-catch of whiting in the *Nephrops* fishery, which operates on the whiting nursery grounds. It has proved difficult to evaluate the success of measures such as the mandatory use of square mesh panels in *Nephrops* trawls since 1994, as there have been very few direct observations of size and age compositions of catches prior to discarding (much of the discards data are from fisher self-sampling schemes that do not record total catch). Experimentally these measures reduce substantially whiting discarding, however, monitoring programmes are needed to evaluate if these experimental benefits have be realised in the commercial fishery

Due to the by-catch of cod in fisheries taking whiting, the regulations affecting Division VIIa whiting remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the single-species advice for cod (Section 4.6.1, *this volume*). The closure of the western Irish Sea to whitefish fishing from mid-February to the end of April, designed to protect cod, has been continued, but is unlikely to have affected whiting catches, which are mainly by-catch in the derogated *Nephrops* fishery.

Similarly the extension of days-at-sea limitations into the Irish Sea in 2005 is not expected to result in a significant reduction in fishing mortality for whiting since the *Nephrops* fleet are still permitted to fish for up to 21 days/month.

The minimum landing size (MLS) for whiting is 27 cm, however, discard data shows that individuals in excess of that size are also discarded. In addition, the discard data indicates that very large numbers of whiting below this size are caught in the *Nephrops* fishery and discarded.

Since the mid 1990's square mesh panel legislation has been mandatory for UK and Irish vessels specifically to reduce the fishing mortality on juvenile whiting in the *Nephrops* fishery. These measures have remained in place in 2004 and 2005. There are no specific recovery plans for whiting in Division VIIa, however, the technical measures for cod described in Section 1.4.1 *this volume* will also impact on vessels catching whiting.

Other factors

The stock structure of whiting in the Irish Sea is uncertain with differences in the population structure observed between the eastern and western components however whiting interchange between the western Irish Sea and other areas within the Irish Sea and this precludes treating different areas within the Irish Sea as containing functionally separate stocks.

It is not known if the severe decline 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. 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.

Scientific basis

Data and methods

Historically, the sampling of catch for length and age has been relatively poor for this stock. The unreliability of the catch numbers remained in 2004 due to a combination of low sampling levels and small landings (reported landings in 2004 only 96.3 t, down from ~11,000 t in the late 1980s). Nonetheless, issues with misreporting meant that a catch based assessment would have been unreliable.

Information from the fishing industry

Some information was available from the fishing industry. Ireland has established a trial self-sampling scheme (ECONEPH) in co-operation with the *Nephrops* fleet to augment discard sampling in the *Nephrops* fishery. The

UK(NI) industry participated in an *ad hoc* workshop on Irish Sea whiting in the spring of 2005 where their information on the fishery was used to inform on the perception of stock structure.

Uncertainties in assessment and forecast

The major deficiency is poor quality of the input data. An examination of the survey data indicates poor internal and external consistency at tracking year-classes. In addition, the most recent estimates from different surveys give conflicting signals. Discard estimation and raising procedures are problematic and discard estimates may be imprecise.

Comparison with previous assessment and advice

The last analytical assessment was undertaken in 2003 based on a catch-at-age analysis using catch estimates and the western Irish Sea survey. There was no analytical assessment carried out for this stock in 2004 and again, no analytical assessment was possible this year. The advice this year is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

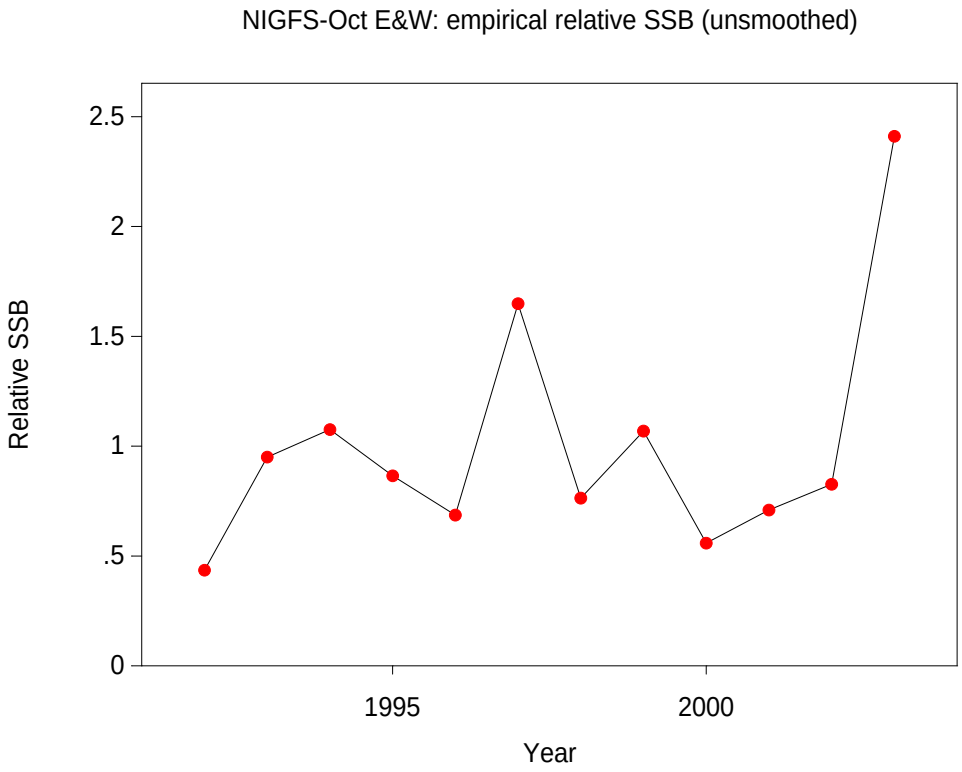
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	Disc.[2]	ACFM Catch
1987	Reduce F		16.0		18.2	11.7	3.8	14.4
1988	No increase in F; enforce mesh regulations		12.0		18.2	11.5	1.9	11.9
1989	F = $\mathbf{F}_{high}$; enforce mesh regulations		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[4]		5.0	3.4	1.3	3.5[3]
1999	Reduce F below $\mathbf{F}_{pa}$		3.5[4]		4.41	2.0	1.1	2.8[3]
2000	Reduce F below $\mathbf{F}_{pa}$		<1.6[4]		2.64	1.1	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	0.7	0.7	1.5[3]
2003	Lowest possible F		~0		0.50	0.5	n/a	n/a
2004		zero catch		0	0.514	0.1	n/a	n/a
2005		zero catch		0	0.514			
2006		lowest possible catch		-				

[1]Not including discards from the *Nephrops* fishery. [2]From *Nephrops* fishery. [3]Including estimates of misreporting.
[4]Landings only, no discards included. Weights in '000 t.

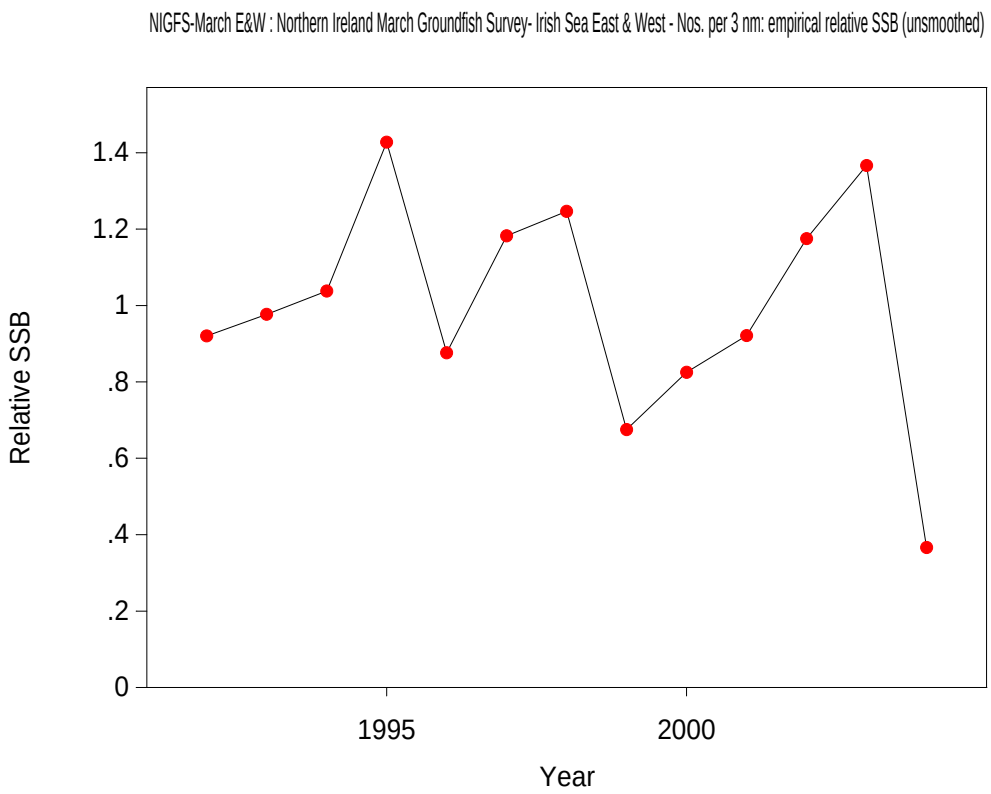
Table1.4.5.1 Nominal catch (t) of WHITING in Division VIIa, 1988-2004, as officially reported to ICES and Working Group estimates of discards.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	90	92	142	53	78	50	80	92	80	47	52	46	30	27	22	13	11
France	1,063	533	528	611	509	255	163	169	78	86	81*	150*	59	25*	33	26	n/a
Ireland	4,394	3,871	2,000	2,200	2,100	1,440	1,418	1,840	1,773	1,119	1,260	509	353	482	347	265	n/a
Netherlands									17	14	7	6	1				
UK(Engl. & Wales)[a]	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	506	284	….	85.3
Spain																85	
UK (Isle of Man)	15	26	75	74	44	55	44	41	28	24	33	5	2	1	1	1	
UK (N.Ireland)	4,621																
UK (Scotland)	107	154	236	223	274	318	208	198	48	30	22	44	15	25	27	31	
UK																130	
Total human consumption	11,492	11,328	8,183	7,411	7,094	5,977	5,637	5,465	5,581	4,472	3,355	1,989	1,130	1,066	714	551	96.3
Estimated Nephrops fishery discards used by the WG[b]	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	740	n/a	n/a

[a] 1989-2002 Northern Ireland included with England and Wales.
[b] Based on UK(N.Ireland) and Ireland data.
* Preliminary.



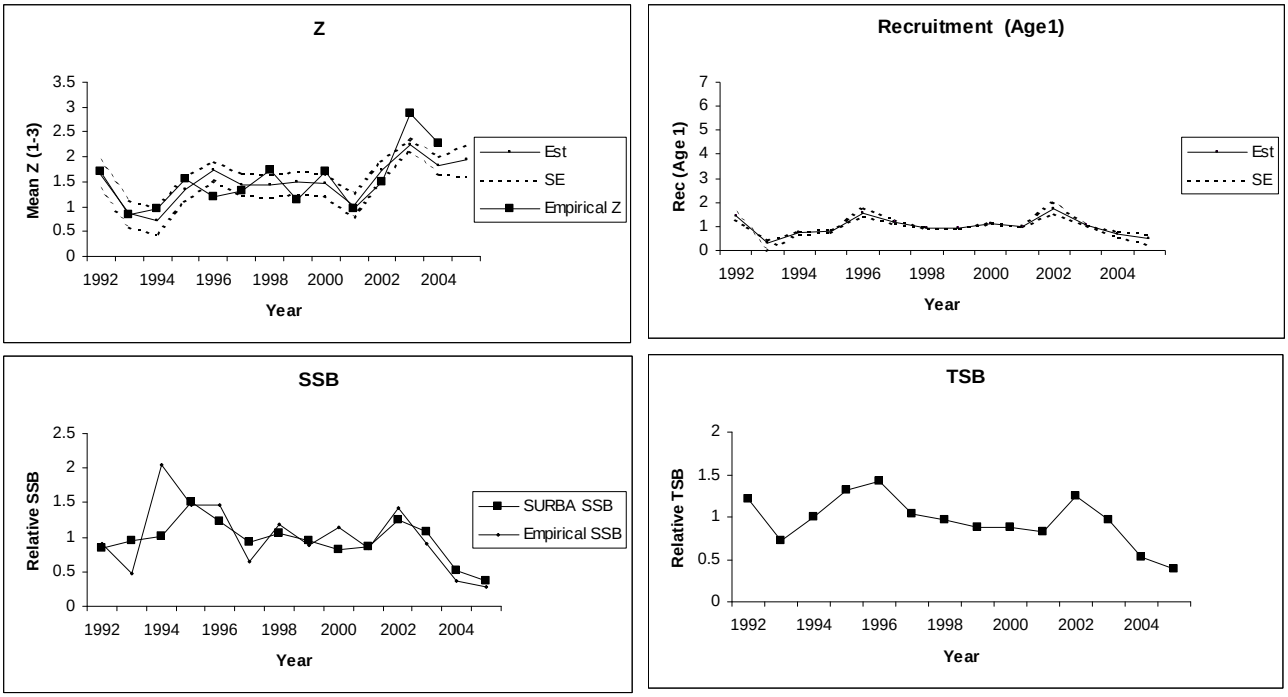
a) Northern Ireland groundfish survey October.



b) Northern Ireland groundfish survey March.

Figure 1.4.5.1 Plots of relative SSB from a survey-based analysis indicating conflicting signals in the last year of the surveys.

(a)



(b)

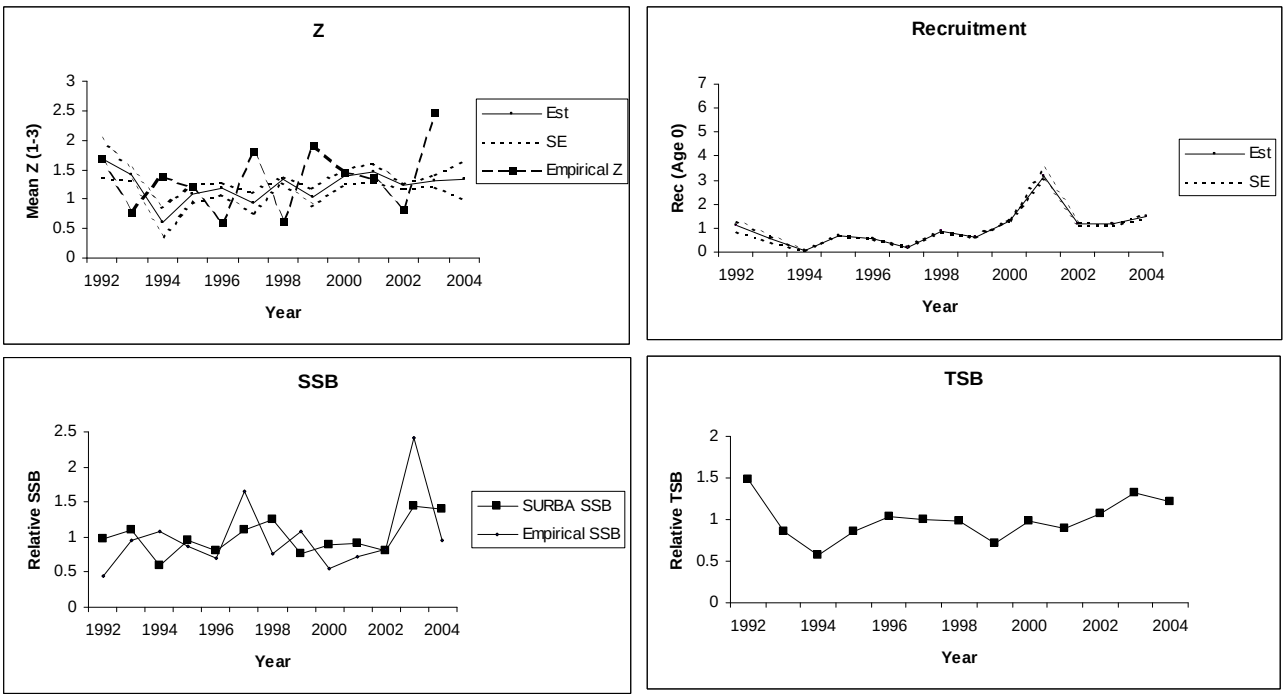


Figure 1.4.5.2 Summary plots of (a) NIGFS March and (b) NIGFS October SURBA showing mean standardized plots for Z, recruitment, SSB and TSB.

1.4.6 Whiting in Divisions VIIe–k

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Full reproductive capacity	Unknown	Overexploited	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity. SSB reached high levels in 1995 and 1996, and has decreased until 1999 though remaining well above $\mathbf{B}_{pa}$. SSB increased in 2001 as the strong 1999 year class matured. The 2000–2004 year classes are estimated to have been below average. Fishing mortality was very high during the 1980s, decreased in the early 1990s, and is currently estimated to be around 0.45.

Management objectives

There are no specific management objectives for this stock.

Reference points

	ICES considers that:	**ICES proposed that:**
Limit reference points	$\mathbf{B}_{lim}$ 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.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 2-5	Yield/R	SSB/R
Average last 3 years	0.514	0.190	0.537
$\mathbf{F}_{0.1}$	0.181	0.168	0.994
$\mathbf{F}_{med}$	0.981	0.188	0.376

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the reproductive potential of the stock may be around $\mathbf{F}_{0.1}$.

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.

Single-stock exploitation boundaries

Exploitation boundaries in relation to management plan

There is no management plan for this stock.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality, estimated at 0.51, is above a fishing mortality that would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.18) ($\mathbf{F}_{max}$ is not well defined). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

No $\mathbf{F}_{pa}$ has been defined for this stock. As there is no long-term gain in yield, which will result in a reduction in the spawning stock, fishing mortality should not increase, corresponding to landings of, at the most, 10 800 t in 2006.

Short-term implications

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.51; R_{04-05} = GM = 76.4 million; SSB(2005) = 29.26 kt; SSB(2006) = 32.41 kt; landings (2005) = 10.83 kt.					
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.51.					
The fishing mortality which is consistent with taking a high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.18.					
Rationale	**TAC(2006)**	**Basis**	**F(2006)**	**SSB(2007)**	**%SSB change**
Zero catch	0.00	F=0	0.00	46.9	45%
Status quo	10.84	$\mathbf{F}_{sq}$	0.51	35.6	10%
High long-term yield	4.42	F(long-term yield)	0.18	42.3	30%
	1.35	$\mathbf{F}_{sq}$ *0.1	0.05	45.5	40%
	3.23	$\mathbf{F}_{sq}$ *0.25	0.13	43.5	34%
	6.09	$\mathbf{F}_{sq}$ *0.5	0.26	40.5	25%
Status quo	8.60	$\mathbf{F}_{sq}$ *0.75	0.39	37.9	17%
	9.98	$\mathbf{F}_{sq}$ *0.9	0.46	36.5	13%
	10.84	$\mathbf{F}_{sq}$ *1	0.51	35.6	10%
	11.66	$\mathbf{F}_{sq}$ *1.1	0.56	34.8	7%
	12.82	$\mathbf{F}_{sq}$ *1.25	0.64	33.6	4%
Mixed Fisheries					
All weights in thousand tonnes.					

Geometric mean recruitment assumptions account for 68% of the forecast SSB (2007).

Management considerations

The assessment area covers Divisions VIIe-k and the ICES advice applies to these areas; however, this does not correspond to the TAC area. The TAC is set for Divisions VIIb-k. Within this larger area there is no control over where the catches will be taken. Current management measures for Division VIIe-k include whiting in Division VIIbc and whiting in Division VIId. Whiting in Division VIId is assessed together with whiting in the North Sea (Subarea IV).

A considerable part of the whiting catch is discarded. Any measure to reduce discarding and to improve the fishing pattern should be encouraged. Such measures might include increased cod end mesh size, square mesh panels, separator trawls, and increased top sheet mesh in towed gears.

Whiting are taken in a mixed demersal trawl fishery with cod, haddock, plaice, and *Nephrops*, and management advice needs to be considered in that context.

Whiting are a relatively low value species and targeting practices in the fishery are highly dependent on availability and market demand. In the past the TAC has been substantially higher than the realised catches and has not been restricting the fishery. There is some evidence that other species have been misreported as whiting in 2004 in some fleets.

Ecosystem considerations

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. Tagging experiments have indicated movement of whiting from the Irish Sea VIIa into the Celtic Sea.

Factors affecting the fisheries and the stock

Celtic Sea whiting are taken in mixed species (cod, whiting, hake, *Nephrops*) fisheries. French trawlers account for about 60% of the total landings, Ireland takes about 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 bycatch restrictions and market demand for larger *Nephrops*.

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) offshore in Division VIIg, targeting anglerfish and megrim with whiting as bycatch. Irish landings of whiting from Division VIIj–k are taken in both a mixed fisheries (cod/whiting/anglerfish/megrim and *Nephrop*s) and in a directed fishery in the first quarter.

The main UK fisheries in Divisions VIIe-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. 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 effects of regulations

The stock is managed by a TAC and technical measures. Technical measures applied to this stock are a minimum landing size (≥ 27 cm) and the minimum mesh sizes applicable to the mixed demersal fisheries set depending on areas. There is substantial discarding above the minimum landing size due to economic or other factors.

Management regulations, particularly effort control regimes in other areas (VIIa, VI, & IV), became increasingly restrictive in 2004 and 2005 and have resulted in a displacement of effort into the Celtic Sea.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. The effect of the closure of the three rectangles during the fist quarter of 2005 cannot yet be quantified.

Changes in fishing technology and fishing patterns

Fishing effort for the French fleets operating in the 3 closed rectangles was mainly displaced to other fishing grounds outside the Celtic Sea and to areas within the Celtic Sea. The impact on whiting has not been evaluated. Some vessels have also switched to another métier targeting anglerfish and megrim in the rest of the Celtic Sea.

Scientific basis

Data and methods

Analytical assessment based on catch-at-age (landings only) data, commercial CPUE, and survey data.

Information from the fishing industry

Meetings with representatives of the fishing industry were held in France, Ireland, and the UK prior to when the assessment was done. Their information suggests that the area closure has had a major impact on the distribution of the fishery in 2005.

Uncertainties in assessment and forecast

Although discarding is considered to be significant, the assessment does not include discard information because insufficient data are available. Not including discards biases the recruit estimates. This is apparent with the 1999 year

class which was revised by assessments in successive years. This bias and uncertainty in the assessment has contributed to overly optimistic recent forecasts. Although the current forecast remains uncertain the bias appears to have reduced as the proportion of this strong year class in landings and SSB has declined. Geometric mean recruitment assumptions account for 68% of the forecast SSB (2007).

The shape of yield-per-recruit will change significantly with the introduction of discards. Therefore, the current long-term reference points, i.e. $\mathbf{F}_{max}$ and $\mathbf{F}_{0.1}$ are rather uncertain.

Comparison with previous assessment and advice

The results of this year's and last year's assessments show remarkably consistent estimates of recent F and SSB. The perception of the state of the stock is unchanged and the advice remains the same: no increase in fishing mortality.

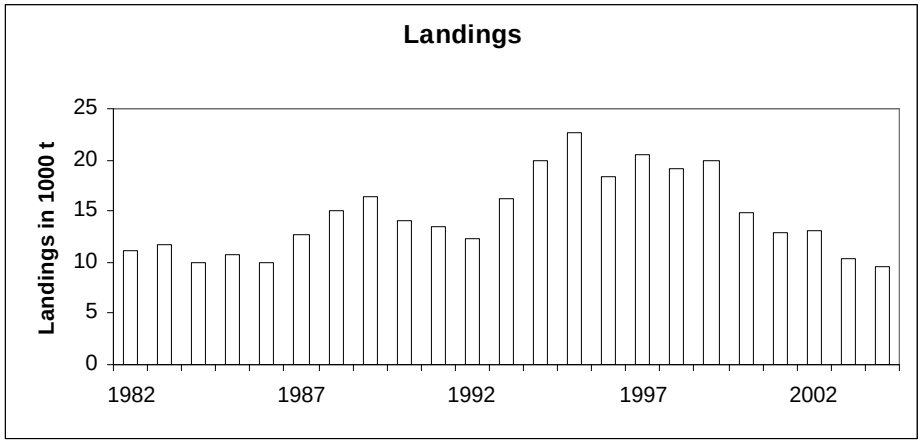
Source of information

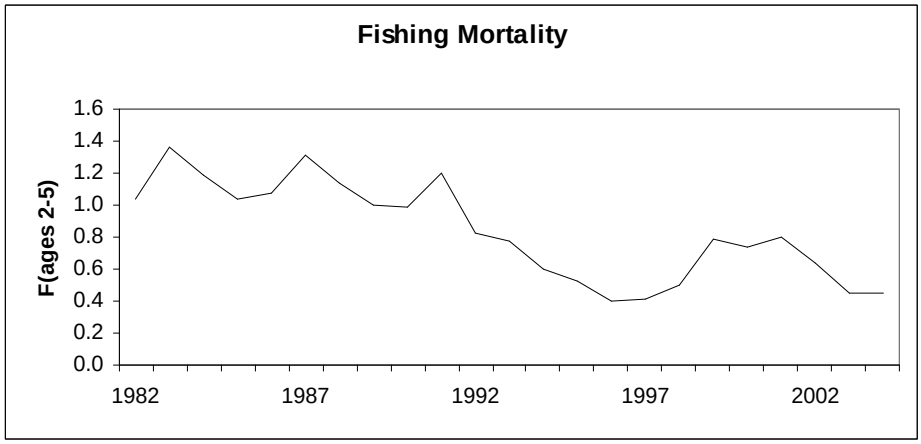
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

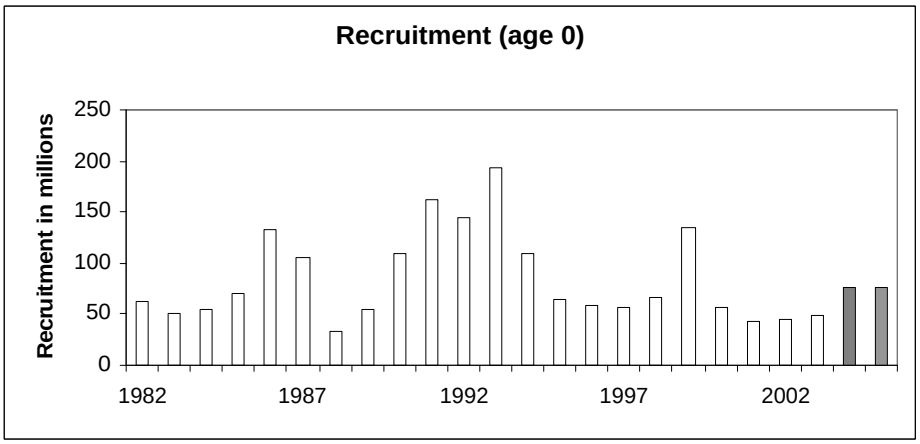
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC[1]	ACFM Landings
1987	*Status quo* F; TAC	7.1[2]		12.7
1988	Precautionary TAC	7.0[2]		13.6
1989	Precautionary TAC	7.9[2]		16.5
1990	No increase in F; TAC	8.4[2]		14.1
1991	Precautionary TAC	8.0[2]		13.5
1992	If required, precautionary TAC	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	12.9
2002	No increase in F	27.7[4]	31.7	13.1
2003	No increase in F	20.2[4]	31.7	10.4
2004	No increase in F	14.0	27.0	9.6
2005	No increase in F	10.6	21.6	
2006	No increase in F	10.8		

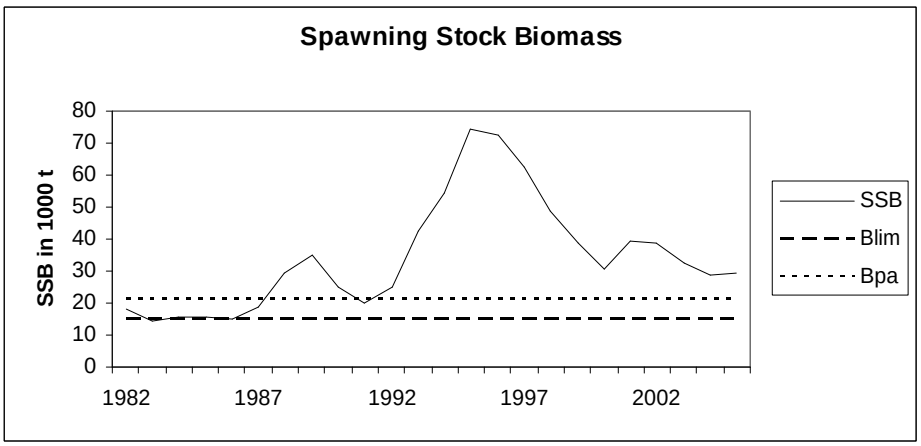
Weights in t.
[1] TAC covers Subarea VII (except Division VIIa). [2] For the VIIf+g stock component. [3] For the VIIf-h stock component. [4]For the VII e-k stock component.

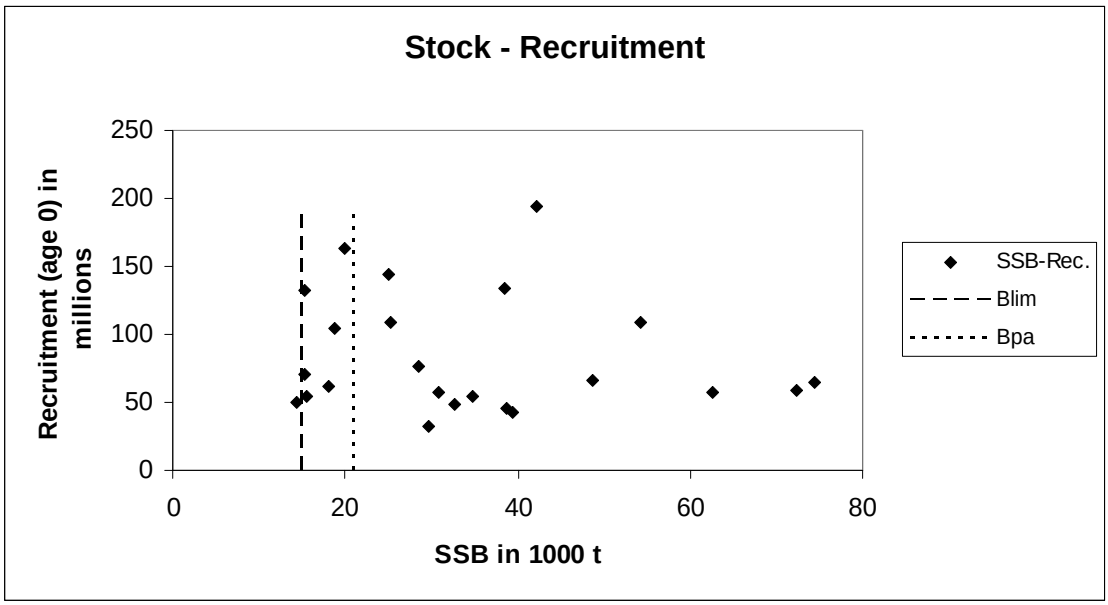
Whiting in Divisions VIIe-k.

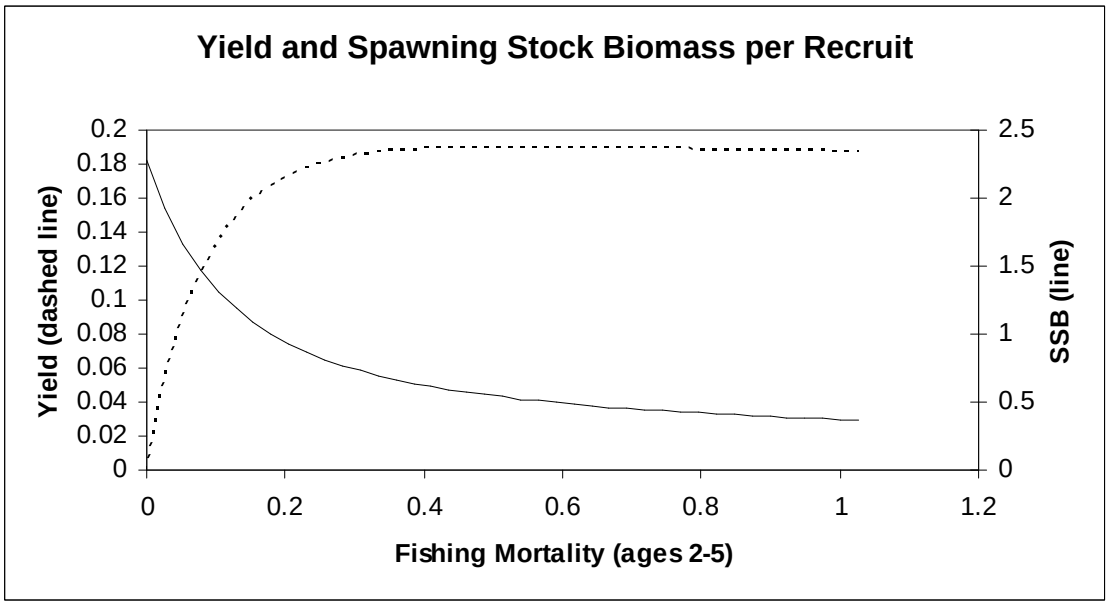









Stock - Recruitment
Recruitment (age 0) in millions
250
200
150
100
50
0
0
20
40
60
80
SSB in 1000 t
SSB-Rec.
Blim
Bpa


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)
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)

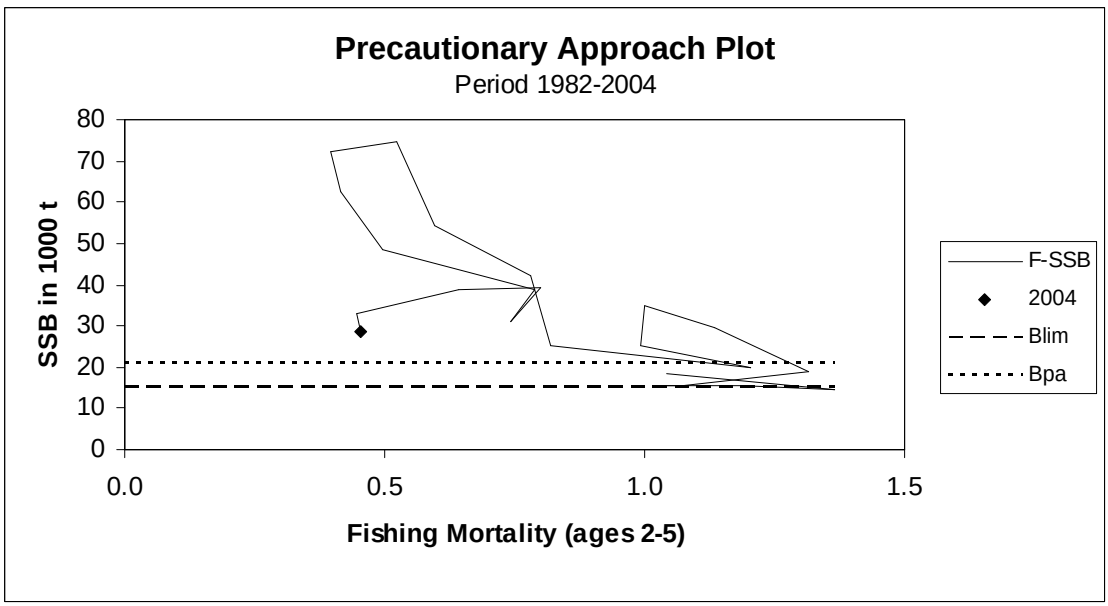

Precautionary Approach Plot
Period 1982-2004
SSB in 1000 t
80
70
60
50
40
30
20
10
0
0.0
0.5
1.0
1.5
Fishing Mortality (ages 2-5)
F-SSB
2004
Blim
Bpa

Table 1.4.6.1 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	2002	2003[c]	2004
Belgium	135	161	167	107	111	159	296	308	292	107	145	228	205	268	449	479	448	194	171	149	42	181
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[a]	16,418[b]	9,077[a]	7,203[a]	7,326[a]	4,679	N/A
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	5,008	5,332	4092	N/A
Netherlands		398		124										8		1			5	4	9	18
Spain													4	31	24	53	21	11	9	12		
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	946	844	704	715
UK(Scotland)						1	5	74	33	8	17	6	23	34	42	68	3	2	11	12		
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	24,043	15,331	13,353	13,679	9,526	913
Unallocated	0	0	0	0	0	1,562	0	0	0	0	0	0	1,165	140	12	-2	-4,126	-421	-498	-596	909	8,711
Total as used by Working Group	11,781	9,985	10,838	9,952	12,652	15,128	16,541	14,106	13,508	12,364	16,320	20,034	22,678	18,260	20,532	19,245	19,917	14,910	12,855	13,083	10,435	9,624

a: Preliminary.
b: Preliminary. Reported as VIIb-k.
c: As available from Eurostat in June 2005 (http://www.europa.eu.int/comm/eurostat).

Table 1.4.6.2 Whiting in Divisions VIIe-k.

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-5
1982	62000	18200	11200	1.043
1983	50000	14400	11800	1.366
1984	54000	15500	10000	1.187
1985	71000	15400	10800	1.039
1986	133000	15300	10000	1.072
1987	105000	18800	12700	1.314
1988	33000	29600	15100	1.136
1989	55000	34700	16500	1.001
1990	109000	25200	14100	0.991
1991	163000	19900	13500	1.204
1992	144000	25000	12400	0.820
1993	194000	42200	16300	0.780
1994	109000	54300	20000	0.598
1995	64000	74500	22700	0.524
1996	59000	72400	18300	0.396
1997	57000	62500	20500	0.415
1998	66000	48600	19200	0.497
1999	134000	38600	19900	0.787
2000	57000	30800	14900	0.742
2001	43000	39400	12900	0.800
2002	45000	38800	13100	0.643
2003	48000	32800	10400	0.446
2004	76000*	28600	9600	0.452
2005	76000*	29300		
Average	83625	34367	14604	0.837

*GM 82-02.

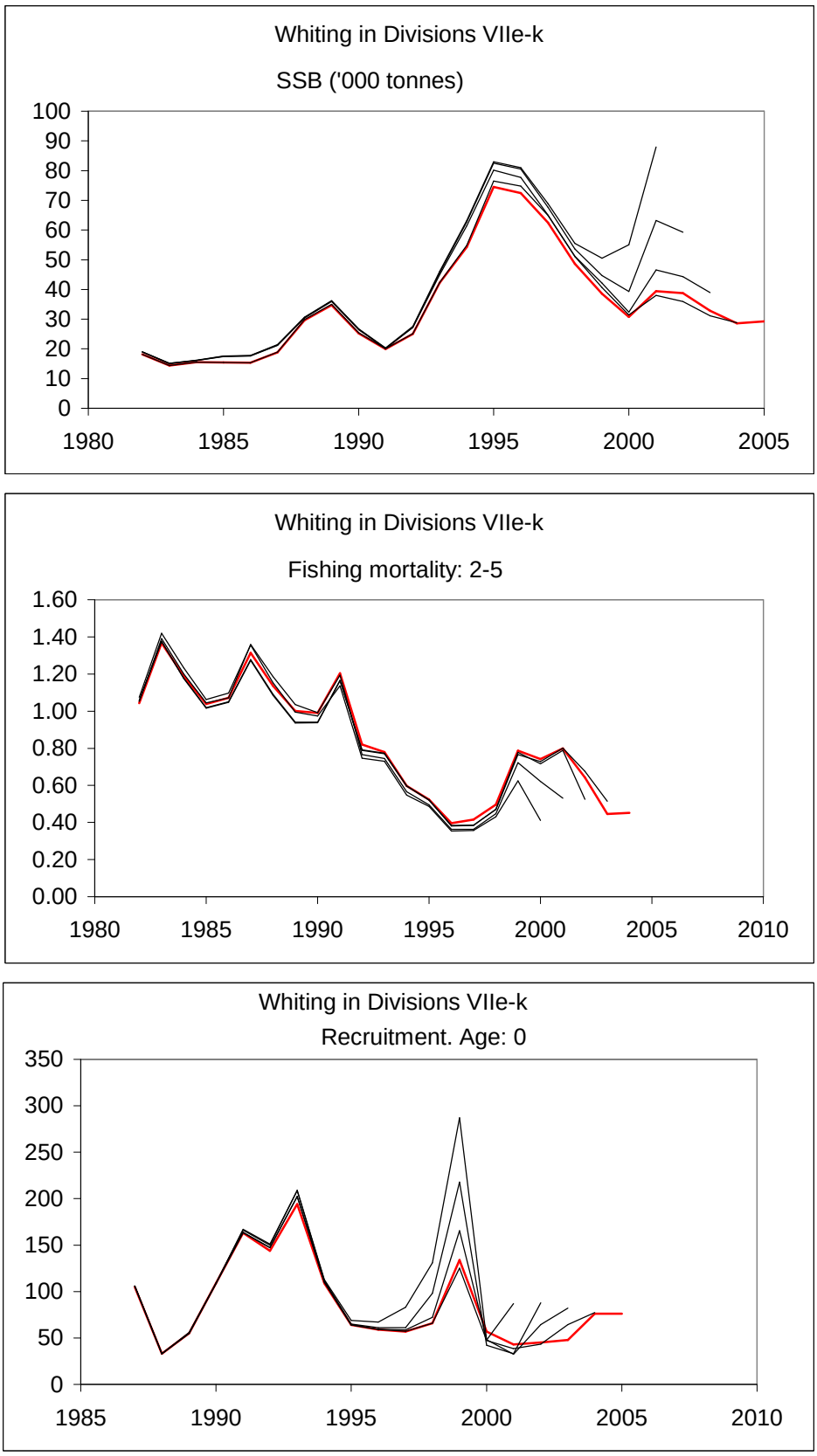


Figure 1.4.6.1 Comparison with previous assessments.

1.4.7 Plaice in Division VIIa (Irish Sea)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Harvested sustainably	Harvested sustainably	Harvested sustainably	

Based on the most recent estimate of SSB and fishing mortality, ICES classifies the stock as having full reproductive capacity and being harvested sustainably. The SSB in 2004 was above $\mathbf{B}_{pa}$ and average fishing mortality in the last three years has been below $\mathbf{F}_{pa}$. Fishing mortality on this stock has been maintained above $\mathbf{F}_{pa}$ for much of the time-series, but declined through the 1990s. SSB has been above $\mathbf{B}_{pa}$ throughout the period of assessment.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	**ICES proposed that:**
Limit reference points	$\mathbf{B}_{lim}$ is not defined	$\mathbf{B}_{pa}$ be set at 3,100t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.45
Target reference points		$\mathbf{F}_{y}$ not defined

Yield and spawning biomass per recruit
F-reference points

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.157	0.199	1.170
Fmax	0.357	0.216	0.600
F0.1	0.133	0.191	1.317
Fmed	0.564	0.213	0.407

Technical basis

$\mathbf{B}_{lim}$: There is no biological basis for defining B_{lim} as the stock-recruitment data are uninformative.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$
$\mathbf{F}_{lim}$: There is no biological basis for defining F_{lim} as F_{loss} is poorly defined.	$\mathbf{F}_{pa} = \mathbf{F}_{med}$ in a previous assessment, and in long-term considerations. This is considered to provide a high probability that SSB remains above $\mathbf{B}_{loss}$ in the long-term.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Fishing mortality is estimated to be below $\mathbf{F}_{max}$ (0.36) and close to $\mathbf{F}_{0.1}$ (0.13). There will be little gain to the long-term yield by increasing fishing mortalities above current levels. Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits, fishing mortality should be kept below $\mathbf{F}_{pa}$ (0.45). This corresponds to catches less than 5 900 t in 2006 and will lead to a reduction in SSB to 11 200 t in 2007. Average fishing

mortality in the last three years has been below $\mathbf{F}_{pa}$ and no long-term gains are obtained by increasing the current fishing mortality towards $\mathbf{F}_{pa}$.

Short-term implications

Outlook for 2006:

Basis: F(2005) = F_{sq} = mean F(02-04) = 0.16; R64-02 = GM = 14.1 million; SSB(2005) = 12.35kt; SSB(2006) = 13.61kt; landings (2005) = 2.18kt.

Rationale	TAC(2006)([1])	Basis	F(2006)	SSB(2007)
Zero catch	0	F=0	0.00	16,800
High long term yield	1983	F(long term yield)	0.13	14,900
Status quo	1000	F_{sq} *0.4	0.06	15,800
	1240	Fsq *0.5	0.08	15,600
	1477	Fsq *0.6	0.10	15,400
	1709	Fsq *0.7	0.11	15,200
	1938	Fsq *0.8	0.13	15,000
	2163	Fsq *0.9	0.14	14,700
	2384	F_{sq}	0.16	14,500
	2602	Fsq *1.1	0.18	14,300
Precautionary Limits	721	TAC(Fpa)*0.1	0.05	16,100
	1742	TAC(Fpa)*0.25	0.11	15,100
	3294	TAC(Fpa)*0.5	0.23	13,700
	4577	TAC(Fpa)*0.75	0.34	12,400
	5435	TAC(Fpa)*0.9	0.41	11,700
	5913	Fpa (~2.8*Fsq)	0.45	11,200
	6369	TAC(Fpa) *1.1	0.50	10,800
	7016	TAC (Fpa) *1.25	0.56	10,200
	8001	TAC (Fpa) *1.5	0.68	9,300
	8883	TAC (Fpa) *1.75	0.79	8,500
	9673	TAC (Fpa) *2	0.90	7,800
	10381	TAC (Fpa) *2.25	1.01	7,100

Shaded scenarios not in line with precautionary approach

[1]It is assumed that the TAC will be implemented and that the landings in 2005 therefore correspond to the TAC.

Management considerations

Plaice are taken in a mixed demersal fishery, the regulations affecting plaice in Division VIIa, and other demersal stocks, remain linked to those implemented under the Irish Sea cod recovery plan. The regulations implemented for cod are detailed in the single-species summary sheet for cod (see section 1.4.1 *this volume*).

The EU Cod Recovery Plan regulation implemented in the Irish Sea from 2004 will impinge upon the management measures for 2006 for species caught in related fisheries, particularly in relation to controlling effort.

Scientific basis

Data and methods

The assessment is based on catch-at-age analysis using landings data and data from one survey. Landings are at the lowest level in the time series but information on misreporting is not available. Discard levels are substantial in the fishery but are not currently incorporated into the assessment.

Uncertainties in assessment and forecast

There are conflicting signals in the survey and commercial tuning fleet indices. The commercial tuning fleet indices are not used in the assessment. The assessment may thus be biased, but it is not known to what extent. Surveys indicate a substantial increase in abundance of plaice in recent years that is not apparent from commercial catch data. The assessment is strongly influenced by survey trends and the resulting estimates of rapidly increasing stock biomass should be treated with some caution until the discrepancy between these two data sources can be better explained.

Discards are not currently incorporated into the assessment. The results of preliminary analyses indicate that the current perception of exploitation levels is not dramatically revised when estimates of discard levels are included. However, discard levels are substantial in this fishery and methods for estimating previous discard levels are still being investigated. Systematic collection of discard information is required for improved assessment and advice.

Comparison with previous assessment and advice

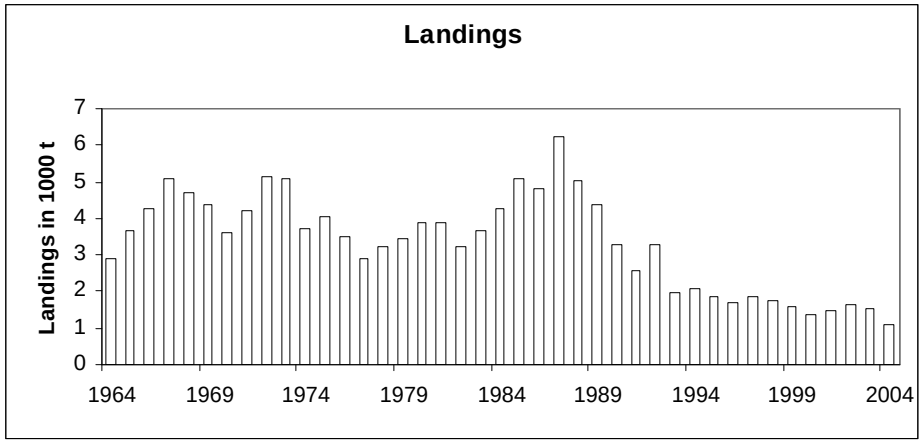
The commercial CPUE data could not be used as a reliable source of tuning information and this year's assessment is more optimistic than that of last year. The principal reason is that the commercial fleets have been removed from the tuning, resulting in a heavier weighting of the survey data in the assessment. Levels of fishing mortality have declined markedly in recent years and fishing mortality in 2004 is estimated to have declined further to a very low level. The basis of the advice is the same as last year.

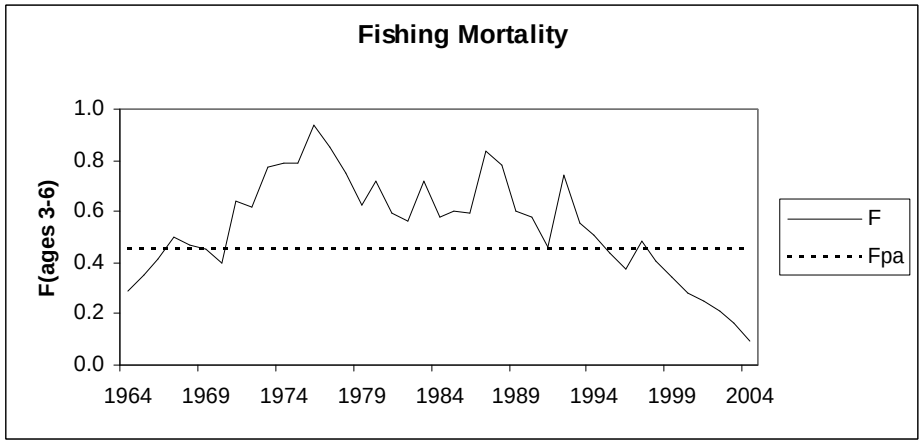
Source of information

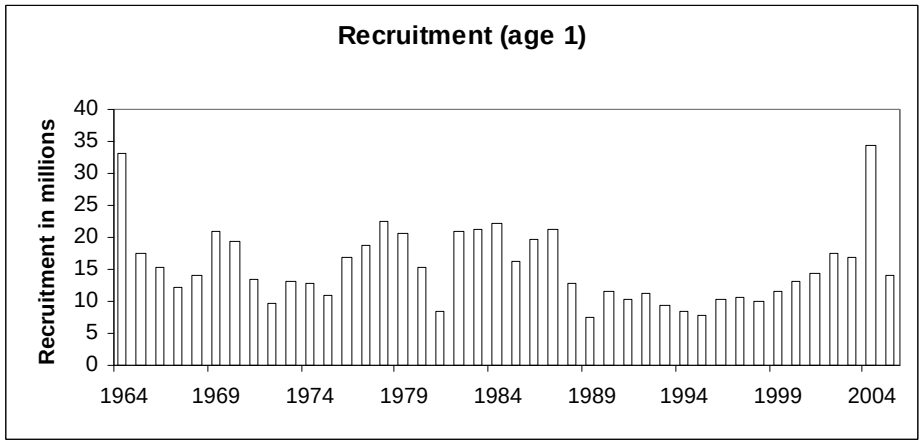
Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

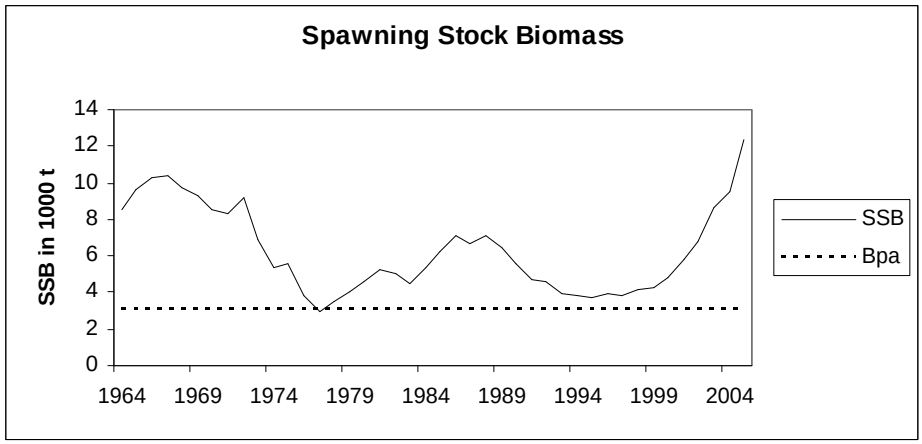
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	F high; no long-term gains in increasing F		5.0		5.0	5.6	6.2
1988	No increase in F		4.8		5.0	4.4	5.0
1989	80% 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	1.5	1.6
2003	No increase in F		1.9		1.675	1.5	1.5
2004	[3]	$F<\mathbf{F}_{pa}$		1.6	1.34	0.8[2]	1.1
2005	[3]	$F<\mathbf{F}_{pa}$		2.97	1.608		
2006	[3]	$F<\mathbf{F}_{pa}$		5.9			

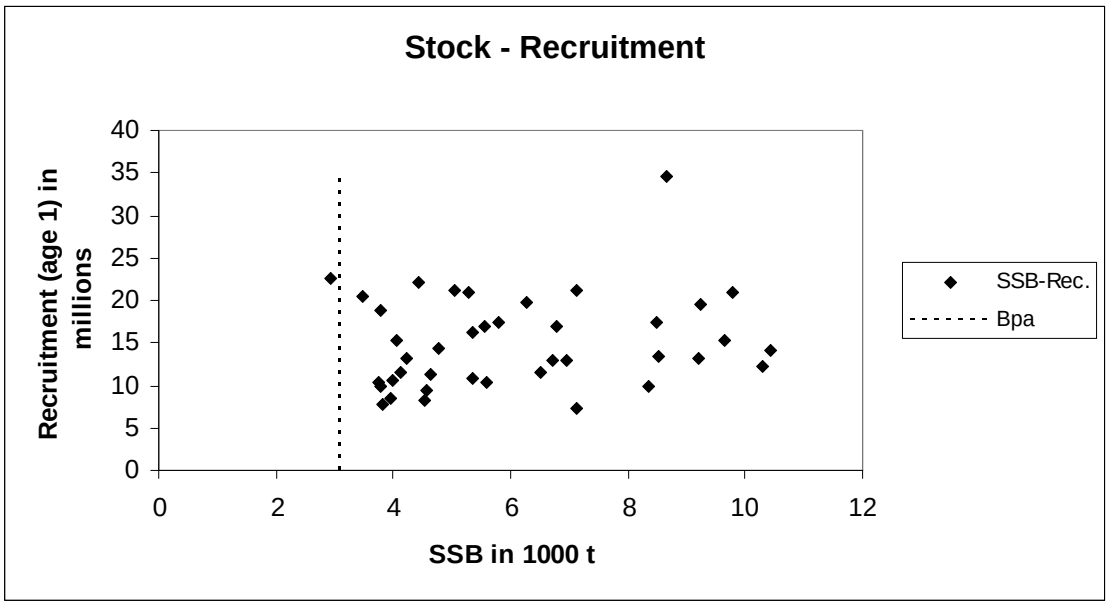
Weights in '000 t. [1]Catch at *status quo* F. [2] Incomplete statistics. [3] Single-stock boundary, the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

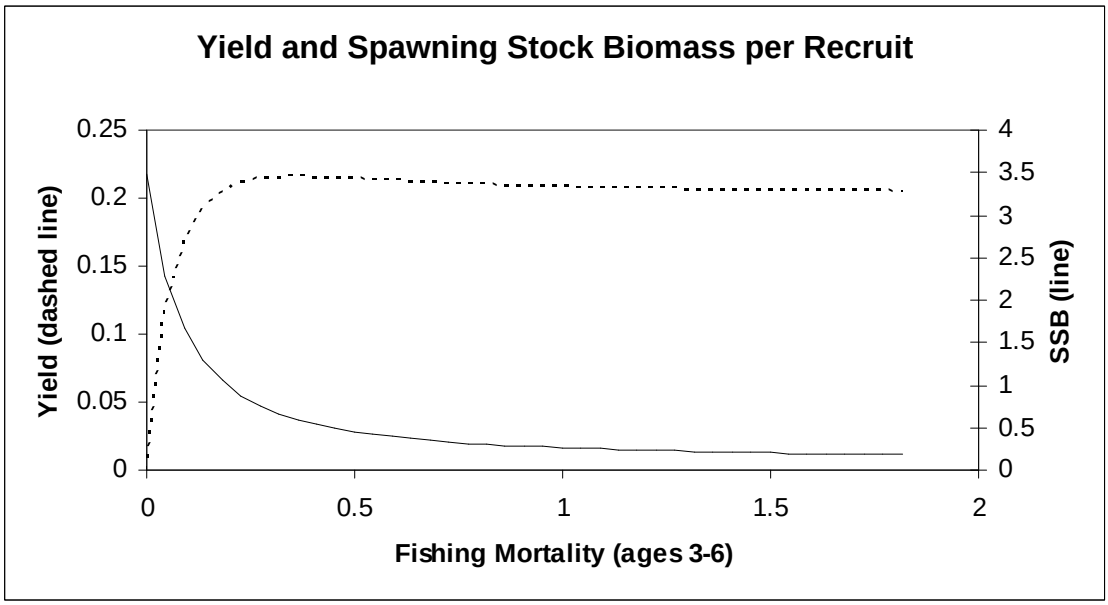

Landings
Landings in 1000 t
0
1
2
3
4
5
6
7
1964
1969
1974
1979
1984
1989
1994
1999
2004


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
2004
F
Fpa


Recruitment (age 1)
Recruitment in millions
0
5
10
15
20
25
30
35
40
1964
1969
1974
1979
1984
1989
1994
1999
2004


Spawning Stock Biomass
SSB in 1000 t
0
2
4
6
8
10
12
14
1964
1969
1974
1979
1984
1989
1994
1999
2004
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 3-6)

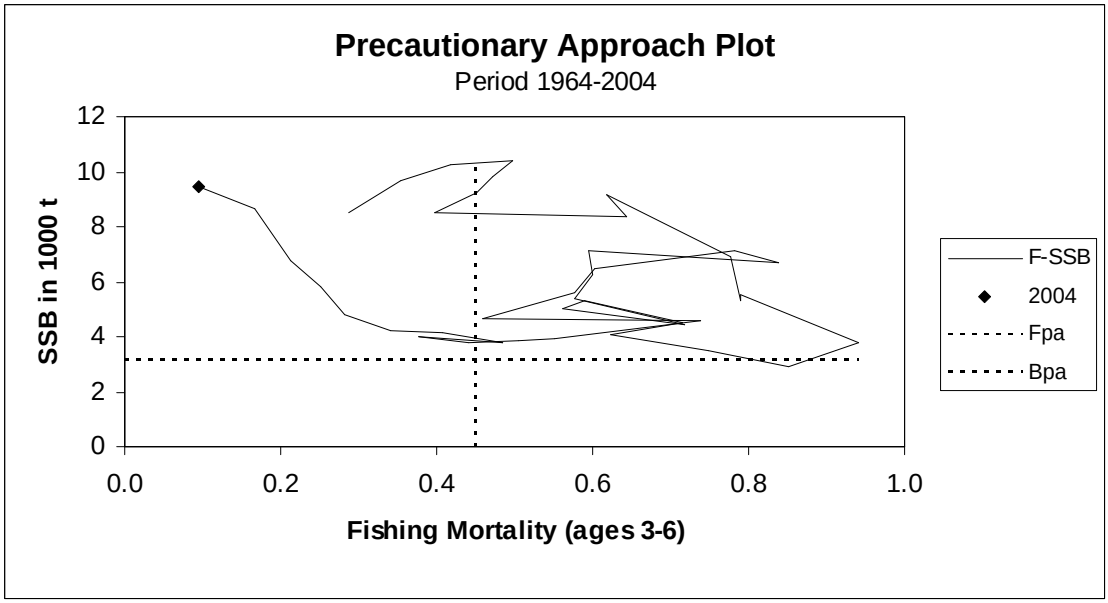

Precautionary Approach Plot
Period 1964-2004
SSB in 1000 t
Fishing Mortality (ages 3-6)
F-SSB
2004
Fpa
Bpa

Table 1.4.7.1 Nominal landings (t) of PLAICE in Division VIIa as officially reported to ICES.

Country	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	138	321	128	332	327	344[3]	459	327	275	325	482	636	628	430
France	20	42	19	13	10	11	8	8	5	14	9[1]	8	7	
Ireland	900	1,355	654	547	557	538	543	730	541	420	378	370	490	
Netherlands	-	-	-	-	-	69	110	27	30	47	-	-	-	
UK (Eng.&Wales)[2]	1,584	1,381	1,119	1,082	1,050	878	798	679	687	610	607	569	418	372
UK (Isle of Man)	51	24	13	14	20	16	11	14	5	6	1	1	1	
UK (N. Ireland)	…	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scotland)	104	70	72	63	60	18	25	18	23	21	11	7	…	
UK (Total)														
Total	2,797	3,193	2,005	2,051	2,024	1,874	1,954	1,803	1,566	1,443	1,488	1,591	1,544	802
Discards	-	-	-	-	-	-	-	-	-	-	-	-	-	
Unallocated	-243	74	-9	15	-150	-167	-83	-38	34	-72	-15	31	-24	313
Total figures used by the Working Group for stock assessment	2,554	3,267	1,996	2,066	1,874	1,707	1,871	1,765	1,600	1,371	1,473	1,622	1,520	1,115

[1]Provisional.
[2]1989–1999 Northern Ireland included with England and Wales.
[3]Final Statlant 27a data.
{UK (Total) excludes Isle of Man data}.

Table 1.4.7.2 Plaice in Division VIIa (Irish Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1964	33020	8495	2879	0.28740
1965	17400	9650	3664	0.35510
1966	15300	10290	4268	0.41740
1967	12270	10430	5059	0.49760
1968	14070	9789	4695	0.47170
1969	20870	9250	4394	0.45110
1970	19420	8508	3583	0.39700
1971	13300	8336	4232	0.64370
1972	9823	9199	5119	0.61810
1973	13180	6942	5060	0.77710
1974	12960	5344	3715	0.78970
1975	10890	5543	4063	0.78930
1976	16900	3781	3473	0.94010
1977	18730	2918	2904	0.85180
1978	22610	3461	3231	0.74820
1979	20490	4047	3428	0.62380
1980	15210	4541	3903	0.71650
1981	8315	5294	3906	0.59030
1982	21050	5053	3237	0.56210
1983	21130	4447	3639	0.71870
1984	22180	5367	4241	0.57740
1985	16140	6275	5075	0.60010
1986	19810	7109	4806	0.59380
1987	21190	6710	6220	0.83770
1988	12950	7132	5005	0.78270
1989	7410	6503	4372	0.60320
1990	11520	5579	3275	0.57630
1991	10400	4651	2554	0.45990
1992	11290	4553	3267	0.73830
1993	9516	3943	1996	0.55190
1994	8375	3832	2066	0.50580
1995	7844	3753	1874	0.44040
1996	10300	3985	1707	0.37710
1997	10610	3799	1871	0.48530
1998	9968	4127	1765	0.40660
1999	11570	4216	1600	0.34130
2000	13250	4764	1371	0.28210
2001	14410	5790	1473	0.25020
2002	17460	6777	1622	0.21210
2003	16880	8646	1554	0.16540
2004	34510	9488	1115	0.09496
2005	14080	12354		
Average	15443	6302	3348	0.53974

1.4.8 Celtic Sea plaice (Divisions VIIf and g)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Increased risk	Unknown	Overexploited	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of suffering reduced reproductive capacity. SSB peaked in 1988–1990, following a series of good year classes, then declined rapidly and has since 2000 remained close to, but above $\mathbf{B}_{lim}$. No F reference points have been defined. Fishing mortality has fluctuated around an average level (0.60) for the entire time-series. Recruitment has been below average in the most recent years.

Management objectives

There are no specific management objectives for this stock.

Reference points

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 of assessments.
$\mathbf{F}_{lim}$ not defined.	$\mathbf{F}_{pa}$ not defined.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.541	0.238	0.486
$\mathbf{F}_{max}$	0.327	0.245	0.834
$\mathbf{F}_{0.1}$	0.160	0.224	1.633
$\mathbf{F}_{med}$	0.555	0.238	0.473

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

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.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock. $\mathbf{F}_{sq}$ (0.54) is above the possible target reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary considerations

A 50% reduction in F is needed to increase SSB to around $\mathbf{B}_{pa}$ in 2007. This corresponds to landings of less than 400 tonnes in 2006.

If such a large reduction in F is not achievable in the short term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality to rebuild the stock above $\mathbf{B}_{pa}$ in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.

Short-term implications

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.54; SSB(2006) = 1.41 kt; landings (2005) = 0.66 kt. R05-06=GM89-03=3.2 million.

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	2.19	55%	-100%
Status quo	0.71	$\mathbf{F}_{sq}$	0.54	1.51	7%	49%
High long-term yield	0.47	F(long-term yield)	0.33	1.73	23%	-1%
	0.09	$\mathbf{F}_{sq}$ *0.1	0.05	2.10	49%	-82%
	0.25	$\mathbf{F}_{sq}$ *0.31	0.17	1.94	37%	-47%
	0.39	$\mathbf{F}_{sq}$ *0.5	0.27	1.81	28%	-17%
Status quo	0.56	$\mathbf{F}_{sq}$ *0.75	0.41	1.65	17%	17%
	0.65	$\mathbf{F}_{sq}$ *0.9	0.49	1.56	10%	37%
	0.71	$\mathbf{F}_{sq}$ *1	0.54	1.51	7%	49%
	0.76	$\mathbf{F}_{sq}$ *1.1	0.59	1.46	3%	60%
	0.84	$\mathbf{F}_{sq}$ *1.25	0.68	1.38	-2%	76%
Mixed Fisheries						

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.

All weights in thousand tonnes

Shaded scenarios are not considered consistent with the Precautionary Approach.

Management considerations

The TACs have been gradually reduced over the last 20 years in line with ICES advice. Nevertheless, fishing mortality has remained stable and high. This may indicate that the total removal from the stock has not been reduced despite the reductions in TACs and landings. In such cases, the estimate of the fishing mortality is likely to be realistic while the estimate of stock size might be unreliable.

ICES has explored simulations with long-term target Fs below 0.65 for this stock. These show a range of fishing mortalities from 0.25 to 0.56 which are predicted to result in the highest long-term yields (around 740 t), whilst posing little risk of being below $\mathbf{B}_{lim}$ in the long term (Figure 1.4.8.1). A Harvest Control Rule should therefore be developed to reduce F to this type of target level in the medium term whilst minimizing the risk of SSB decreasing below $\mathbf{B}_{lim}$. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

The high level of discarding indicated in this mixed fishery would suggest a mis-match between the mesh size employed and the size of the fish landed. Increases in the mesh size of the gear should result in fewer discards and, ultimately, in increased yield from the fishery. The use of larger mesh gear should be encouraged in this fishery in instances where mixed fishery issues allow for it.

Ecosystem considerations

There is some evidence from tagging that plaice from the southern and western coasts of Wales move southwards to join the adult population off the north Cornish coast during spawning.

Factors affecting the fisheries and the stock

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 targeting 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 February–March after the peak of spawning, and again in September.

Regulations and their effects

Plaice in the Bristol Channel and Celtic Sea (ICES Divisions VIIf and VIIg) are managed by TAC and technical measures. Misreporting is known to occur as quotas become more restrictive.

Technical measures in force for this stock are minimum mesh sizes, minimum landing size, and restricted areas for certain classes of vessels. Technical regulations regarding mesh sizes allowable for specific target species, and associated minimum landing sizes, came into force on 1 January 2000. The minimum landing size for plaice in Divisions VIIf&g is 27 cm.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March 2005. The effects of the area closure cannot yet be evaluated, but is the closure coincides with an area and time of high plaice abundance.

Scientific basis

Data and methods

The analytical age-based assessment (XSA) is based on landings, one survey index, and two commercial CPUE series.

Uncertainties in assessment and forecast

This assessment is conditional on the accuracy of the commercial CPUE and total catch data. Misreporting and under-reporting of landings is suspected as quotas become more restrictive. Discards are substantial. Due to the short time-series discards are not included in the assessment.

There is a strong retrospective bias of overestimation of SSB and underestimation of fishing mortality. Recent forecasts for this stock have been overly optimistic, probably due to this bias problem. The GM assumptions of average recruitment in the most recent years contribute little to forecasted landings.

The shape of the yield-per-recruit relationship will change significantly with the introduction of discards in the calculations and therefore the current long-term reference points ($\mathbf{F}_{max}$ and $\mathbf{F}_{0.1}$) are rather uncertain.

Comparison with previous assessment and advice

There has been little change in the perception of the state of the stock.

The advice for an F reduction to rebuild above $\mathbf{B}_{pa}$ or to implement a recovery/management plan is consistent with last year's advice.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

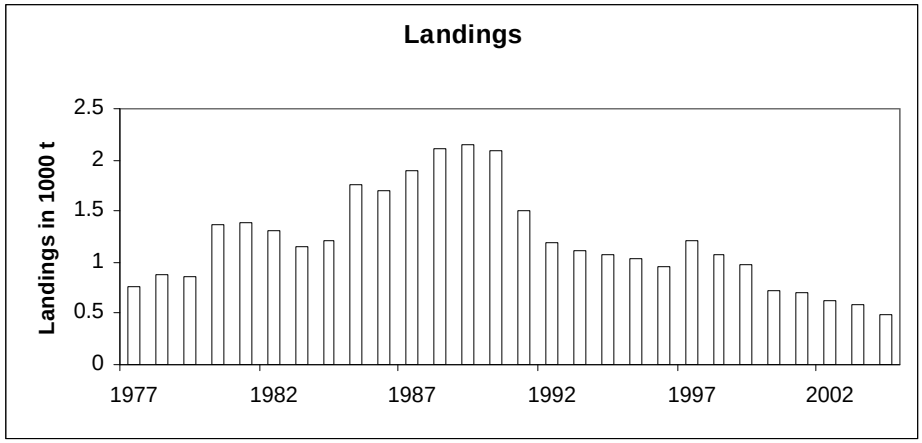
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
1987	TAC not to be restrictive on other species		-		1.8	1.91	1.90
1988	TAC not to be restrictive on other species		-		2.5	2.19	2.12
1989	TAC not to be restrictive on other species		-		2.5	2.58	2.15
1990	F likely to be F(88)		~1.9		1.9	2.22	2.08
1991	F likely to be F(89)		~1.7		1.9	1.83	1.50
1992	No long-term gains in increasing F		-		1.5	1.36	1.19
1993	No long-term gains in increasing F		-		1.4	1.30	1.11
1994	No long-term gains in increasing F		-		1.4	0.98	1.07
1995	No increase in F		1.29		1.4	0.96	1.03
1996	20% reduction in F		0.93		1.1	0.98	0.95
1997	20% reduction in F		1.10		1.1	1.26	1.22
1998	20% reduction in F		1.00		1.1	1.15	1.07
1999	35% reduction in F		0.67		0.9	0.66	0.97
2000	30% reduction in F		0.70		0.80	0.72	0.74
2001	40% reduction in F		0.60		0.76	0.68	0.72
2002	At least 35% reduction in F		0.68		0.68	0.62	0.63
2003	At least 40% reduction in F		<0.66		0.66	0.51	0.59
2004	[1]	F < 0.10 or recovery plan	[1]	<0.21	0.56	0.30	0.49
2005	[1]	70% Reduction in F or recovery plan	[1]	<0.25	0.48		
2006	[1]	50% reduction in F or Recovery plan	[1]	<0.40			

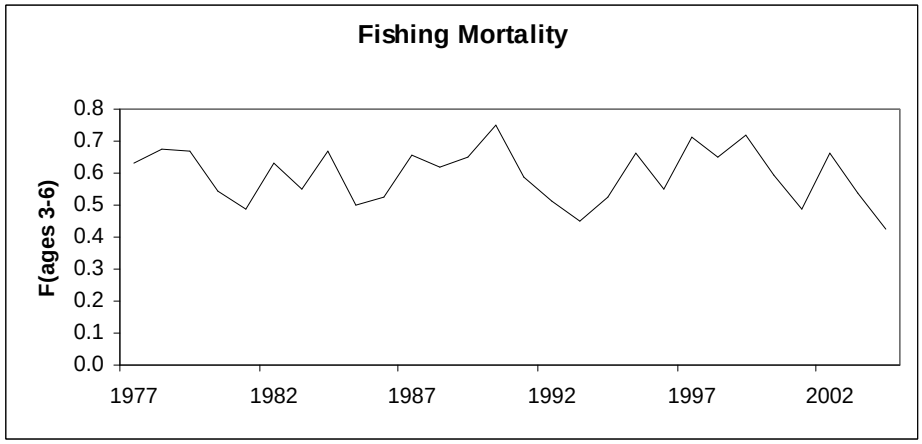
Weights in '000 t.

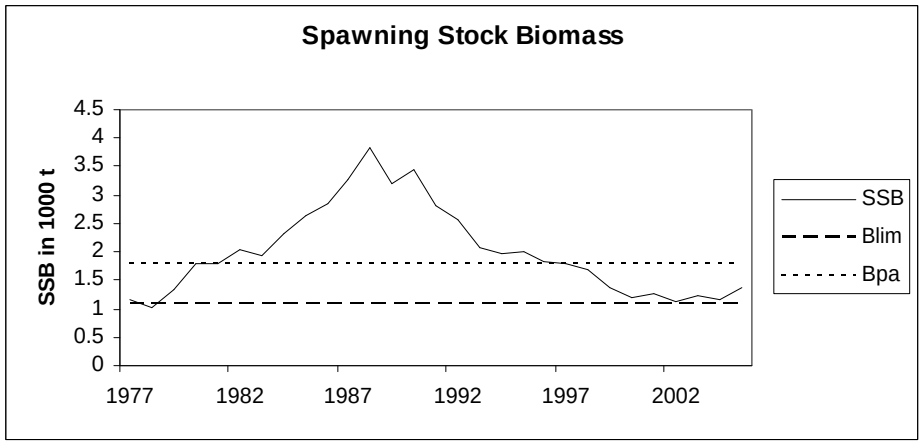
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

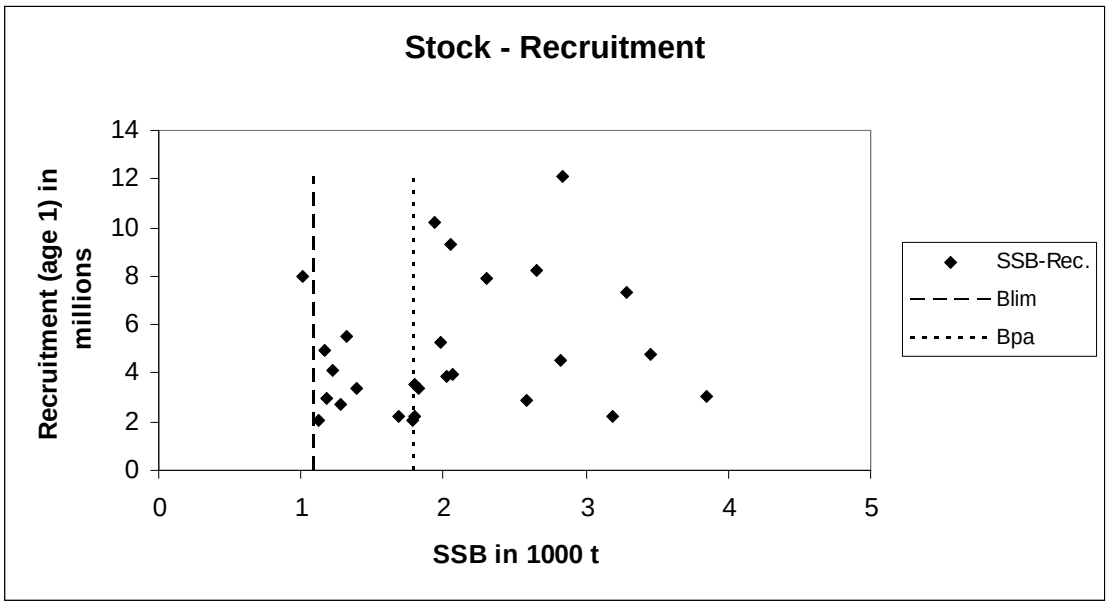
[Official landings figures have been corrected following the discovery of errors in the time-series]

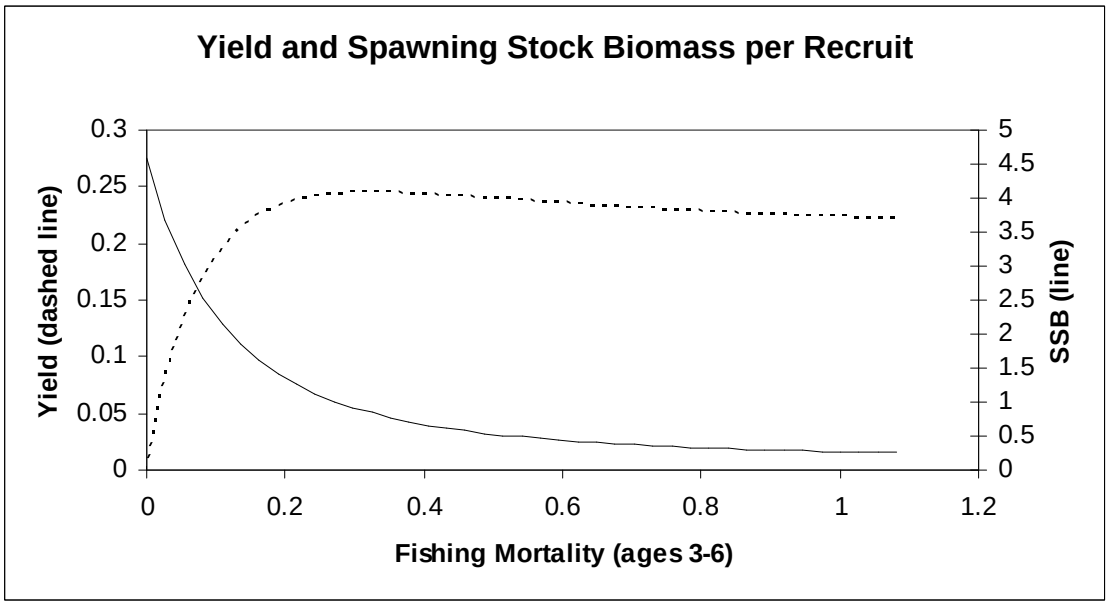
Celtic Sea plaice (Divisions VIIf and g).








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)

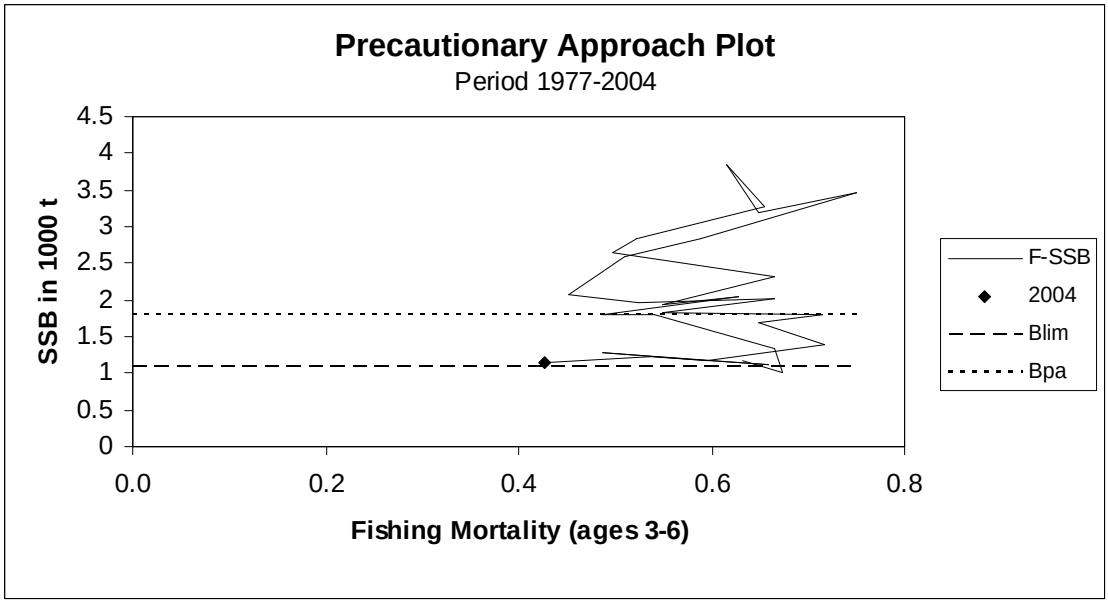

Precautionary Approach Plot
Period 1977-2004
SSB in 1000 t
Fishing Mortality (ages 3-6)
F-SSB
2004
Blim
Bpa

Table 1.4.8.1 Plaice in Divisions VIIfg. Nominal landings (t) as reported to ICES, and total landings as used by the Working Group.

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Belgium	214	196	171	372	365	341	314	283	357	665	581	617	843	794
UK (Engl. & Wales)	150	152	176	227	251	196	279	366	466	529	496	629	471	497
France	365	527	467	706	697	568	532	558	493	878	708	721	1089	767
Ireland	28	0	49	61	64	198	48	72	91	302	127	226	180	160
N. Ireland												1		
Netherlands										9				
Scotland	0	0	0	7	0	0	0	0	0	1				1
Total	757	875	863	1373	1377	1303	1173	1279	1407	2384	1912	2194	2583	2219
Unallocated	0	0	0	0	0	0	-27	-69	345	-693	-11	-78	-432	-137
Total as used by WG	757	875	863	1373	1377	1303	1146	1210	1752	1691	1901	2116	2151	2082

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	836	371	542	350	346	410	594	540	371	224	241	248	221	211
UK (Engl. & Wales)	392	302	290	251	284	239	258	176	170	134	136	105	127	87
France	444	504	373	298	254	246	329	298	NA	287	255	185	164	NA
Ireland	155	180	89	82	70	83	78	135	115	76	45	79	NA	NA
N. Ireland														
Netherlands														
Scotland		5	9	1	2									
Total reported	1827	1362	1303	982	956	978	1259	1149	656	721	677	617	512	298
Unallocated	-326	-174	-189	88	72	-26	-42	-82	312	-2	33	13	80	190
Total as used by WG	1501	1188	1114	1070	1028	952	1217	1067	968	719	710	630	592	488

Table 1.4.8.2 Celtic Sea plaice (Divisions VIIf and g).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1977	3582	1170	757	0.632
1978	4965	1010	875	0.673
1979	8006	1323	863	0.666
1980	5554	1789	1373	0.541
1981	2051	1793	1377	0.488
1982	3552	2056	1303	0.629
1983	9289	1943	1146	0.550
1984	10247	2308	1210	0.666
1985	7928	2654	1752	0.498
1986	8241	2842	1691	0.522
1987	12089	3283	1901	0.654
1988	7320	3848	2116	0.616
1989	3073	3194	2151	0.649
1990	2189	3456	2082	0.750
1991	4790	2825	1501	0.588
1992	4506	2580	1188	0.510
1993	2902	2068	1114	0.451
1994	3967	1975	1070	0.525
1995	5258	2018	1028	0.665
1996	3844	1829	952	0.550
1997	3351	1792	1217	0.714
1998	2264	1684	1067	0.648
1999	2212	1387	968	0.717
2000	3400	1186	719	0.595
2001	2970	1279	710	0.487
2002	2705	1123	630	0.660
2003	2061	1218	592	0.537
2004	4125	1149	488	0.426
2005	3164*	1369		
Average	4814	2005	1209	0.593

* GM 98-03

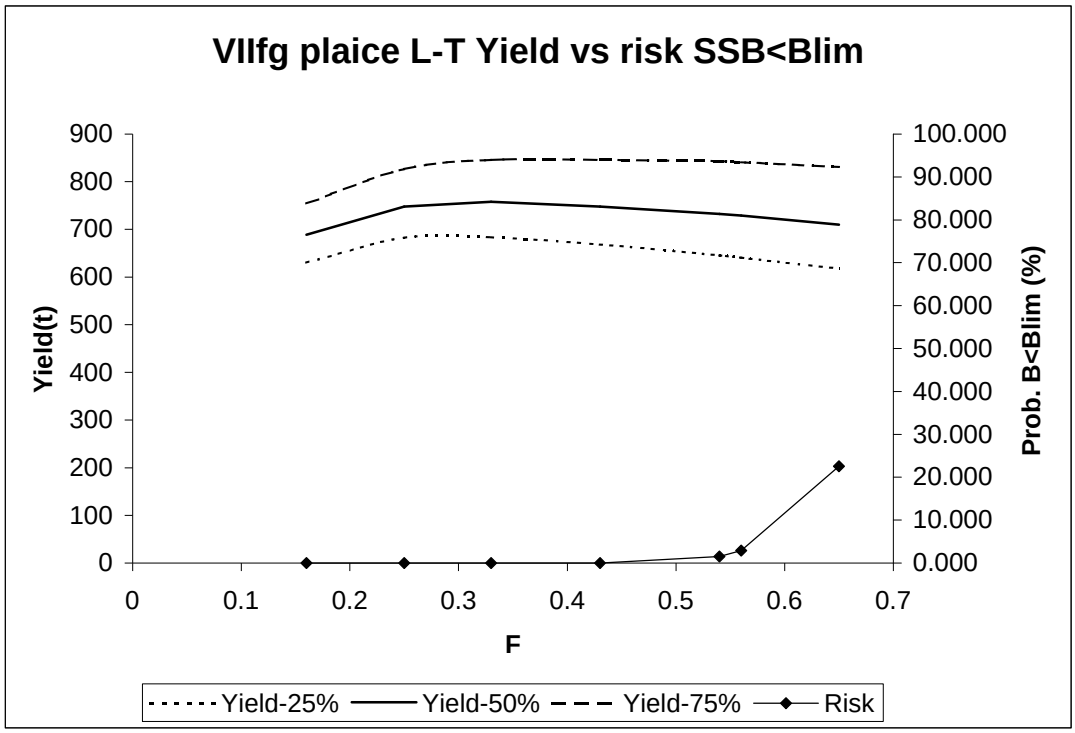


Figure 1.4.8.1 An exploration of potential long-term fishing mortality targets for plaice in Divisions VIIfg. The graphs show long-term yield and risk.

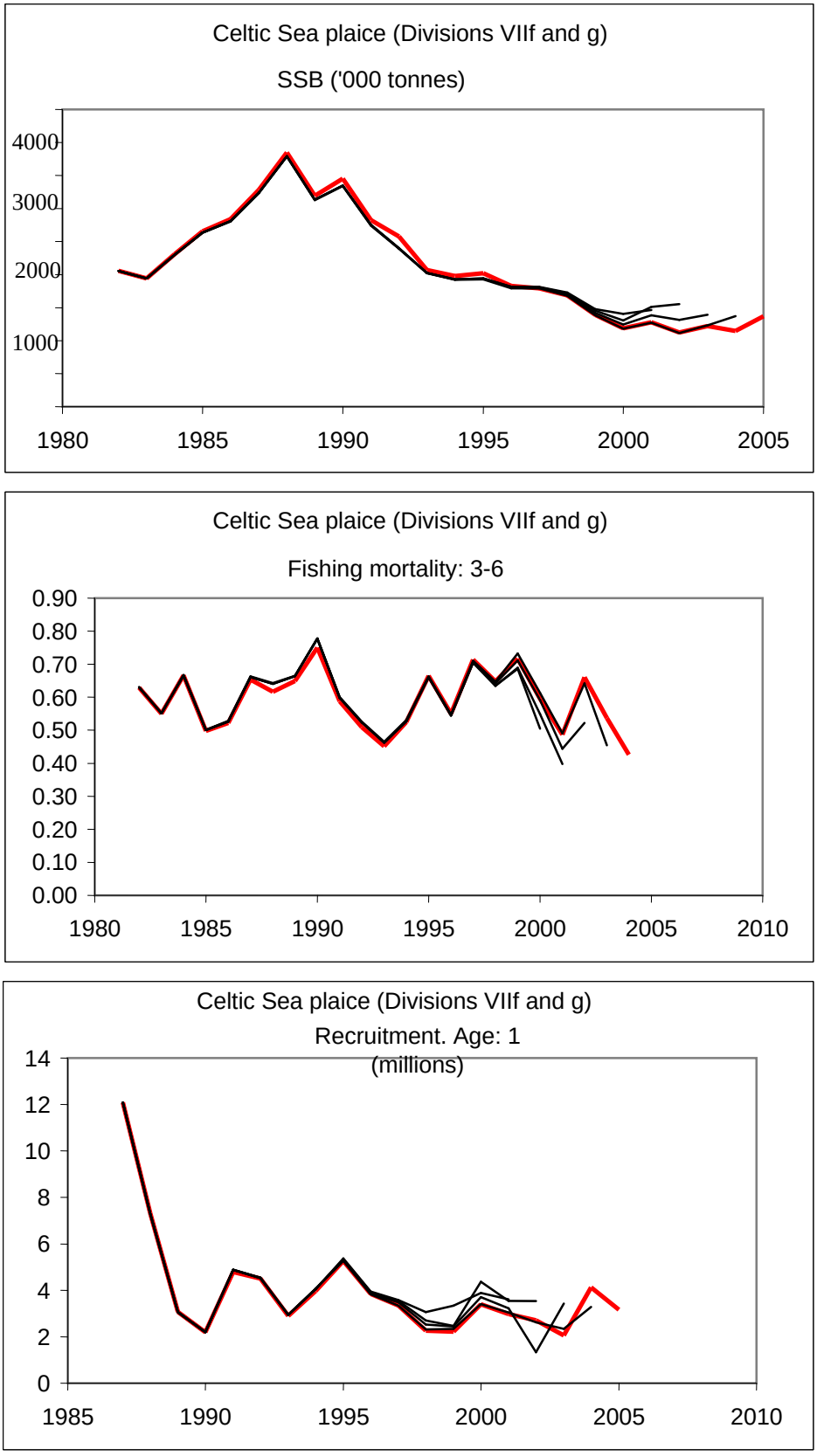


Figure 1.4.8.2 Comparison between present (thick line) and previous assessments.

1.4.9 Plaice in Division VIIe (Western Channel)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Increased risk	Increased risk	Overexploited	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of suffering reduced reproductive capacity. SSB peaked in 1988–90, following a series of good year classes, then declined rapidly and has subsequently fluctuated between 1 600 t and 2 200 t. SSB is estimated to be declining further in the most recent years. Based on the most recent estimates of fishing mortality, ICES classifies the stock as at risk of being harvested unsustainably. Fishing mortality has fluctuated above $\mathbf{F}_{pa}$ for almost the entire time-series and has been increasing since 2000. Recent recruitments have been below average.

Management objectives

There are no specific management objectives for this stock.

Reference points

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. 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.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.692	0.264	0.329
$\mathbf{F}_{max}$	0.223	0.288	1.141
$\mathbf{F}_{0.1}$	0.100	0.260	2.210
$\mathbf{F}_{med}$	0.496	0.273	0.482

In the absence of $\mathbf{F}_{msy}$ estimates $\mathbf{F}_{max}$ can be considered a suitable interim candidate reference point, consistent with taking high long-term yields and achieving a low risk of depleting the productive potential. However, as fishing mortality is reduced $\mathbf{F}_{0.1}$ may become a more appropriate proxy for $\mathbf{F}_{msy}$ in the longer term.

Technical basis

$\mathbf{B}_{lim}=\mathbf{B}_{loss}$	$\mathbf{B}_{pa}$ = MBAL
$\mathbf{F}_{lim}$=Not defined	$\mathbf{F}_{pa}$ = 0.45 low probability that ($SSB_{MT}< \mathbf{B}_{pa}$)

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

There are no agreed management plans.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The recent fishing mortality, estimated at 0.69, is well above fishing mortalities that, given the current exploitation pattern, would lead to high long-term yields ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.22). This indicates that long-term yield would increase substantially (around 10%) at fishing mortalities well below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

Given the low stock size, recent poor recruitment, increasing fishing mortality, the uncertainty in the assessment, and the inability to reliably forecast catch, ICES recommends a substantial reduction in catch until the estimate of SSB is above $\mathbf{B}_{lim}$ or other strong evidence of rebuilding is observed.

Short-term implications

Due to considerable uncertainty in recent recruitment estimates it is not possible to provide a short-term forecast for this stock.

Management considerations

As the TAC for plaice in the Channel is set for Divisions VIId,e combined, 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. Management measures should be put in place to minimize fishing mortality on the VIId stock.

Plaice are taken in a mixed demersal species otter trawl fishery, and as a bycatch in the sole beam trawl fishery. The major commercial species that interact with VIIe plaice are VIIe sole and VIIe-k cod.

Factors affecting the fisheries and the stock

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 bycatch in beam-trawling directed at sole and anglerfish. Estimated landings have been fairly stable since 1994. 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.

The effects of regulations

The catch of VIIe plaice is managed by a TAC applied to VIId (Eastern Channel) and VIIe combined. There are also technical measures including mesh size and MLS (22 cm) for this species. In addition, marketing considerations and/or by-laws tend to discourage fishers from landing plaice less than 27 cm in the UK, France, and Belgium.

Council Regulation EC No. 27/2005, Annex IVc on 'Fishing effort for vessels in the context of the recovery of Western Channel sole stocks' limits the number of days at sea to 20 per month for beam trawlers with mesh size equal to or greater than 80 mm and for static demersal nets, including gillnets, trammel nets, and tangle nets. ICES has no information as to whether this will result in an effective decrease in effort.

Scientific basis

Data and methods

The analytical age-based assessment is based on landings, one survey, and three commercial CPUE series. Discard data are becoming available and indicate that discarding is variable, but lower compared to other plaice stocks.

Information from the fishing industry

Misreporting of landings is thought to have occurred in the past, but industry comments indicate that in recent years this has not been a problem.

Fisheries science partnership surveys of the western Channel conducted cooperatively between CEFAS and the UK industry gave similar catch rates of plaice in 2003 and 2004 for all sizes of fish combined, although some small-scale spatial changes in distribution were observed.

Uncertainties in assessment and forecast

There is some uncertainty about the stock structure in VIIe plaice. Historical tagging information show that plaice may migrate from the VIIe into the VIId and the North Sea after spawning. A considerable proportion of the juvenile recruits in VIIe are thought to originate from VIId and the southern North Sea. There is also evidence of a resident stock in VIIe. Catch-at-age data have not been adjusted to take into account the impact of any migrations and it is unclear if these migrations persist.

This assessment is tuned using data from the commercial fishery as well as one survey. The accuracy of the assessment will depend on whether these commercial catch rates reflect changes in population abundance. The retrospective analysis indicates consistent downward revisions in the estimation of F in recent years. The cause of this retrospective patter is unknown, but it leads to uncertainty and potential bias in the F, rendering a deterministic short-term forecast inaccurate.

The recruit estimates in the most recent 2–3 years are very uncertain, as shown by historical and retrospective assessments. Consequently, no short-term forecast can be provided.

Comparison with previous assessment and advice

Recent recruitment estimates have been revised substantially. Results from this assessment indicate that historical SSB estimates are consistent, but the 2004 estimate of SSB has been revised downwards by 27%. Fishing mortality has also been revised downwards by the most recent assessment.

Last year ICES provided a short-term forecast for this stock. The continued uncertainty and bias in the assessment and the poor historical accuracy of the forecast has meant that this year such a forecast is no longer provided. All indications suggest that the status of the stock has continued to deteriorate; therefore, this year's advice is for continued substantial reductions in catch. Figure 1.4.9.3 shows the retrospective patterns in SSB, recruitment, and estimates of fishing mortality.

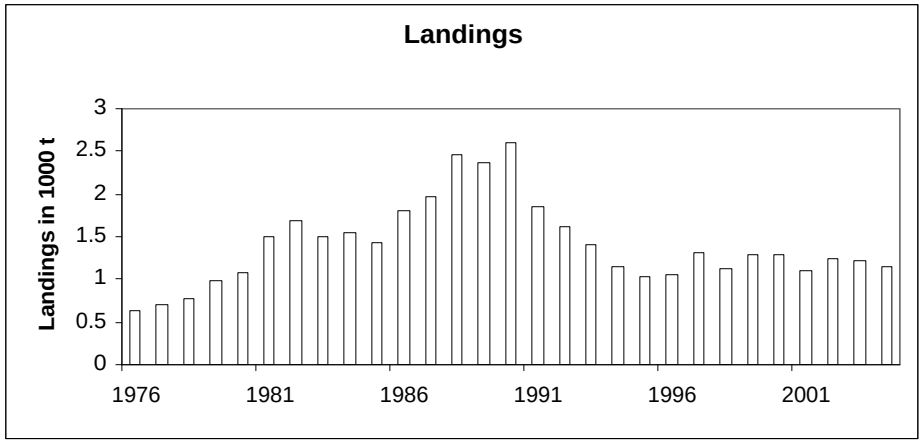
Source of information

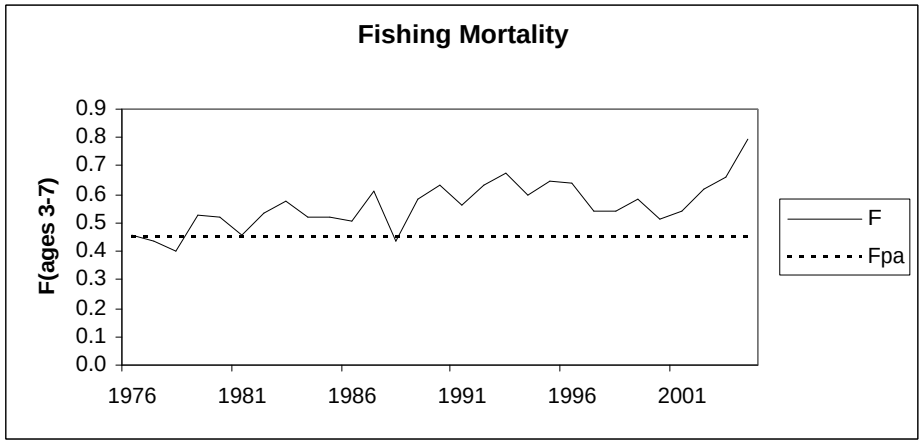
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

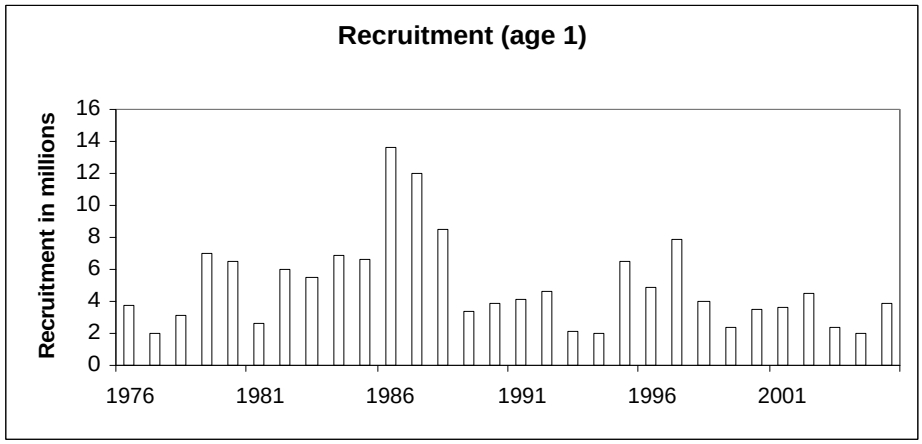
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings	ACFM Landings
1987	Precautionary TAC		6.8		8.3	1.92	1.96
1988	Precautionary TAC		6.9		9.96	2.33	2.46
1989	No increase in effort; 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[2]		6.0	0.96	0.97
2002	Reduce F below $\mathbf{F}_{pa}$		< 0.89[2]		6.7	1.25	1.26
2003	At least 50% reduction in F		< 0.53[2]		5.97	1.22	1.22
2004	[3]	A 55% reduction in F	[3]	<0.660	6.06	0.95	1.14
2005		A 64% reduction in F		<0.580			
2006		Substantial reduction in catch		-			

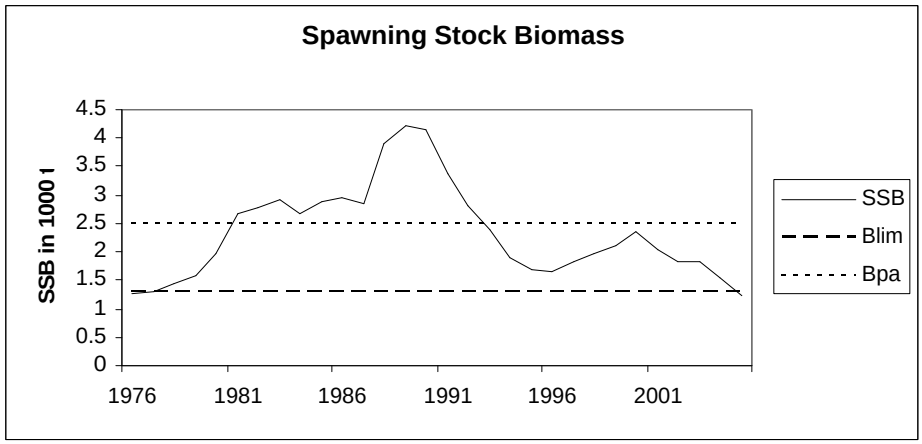
Weights in '000 t.
[1]TACs for Divisions VIId,e. [2]For Division VIIe only. [3] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

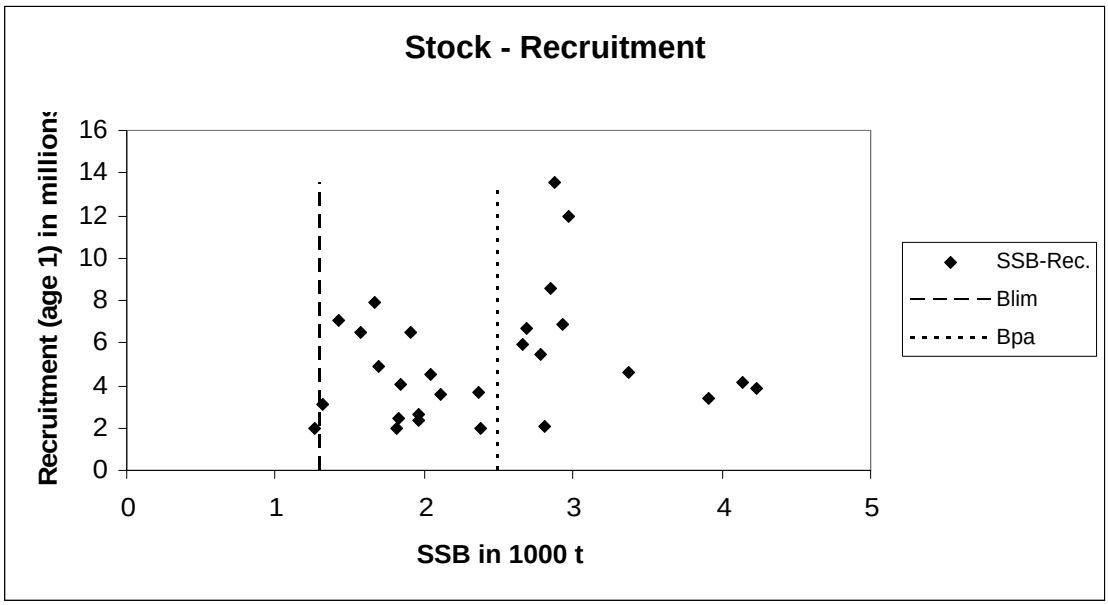
Plaice in Division VIIe (Western Channel).

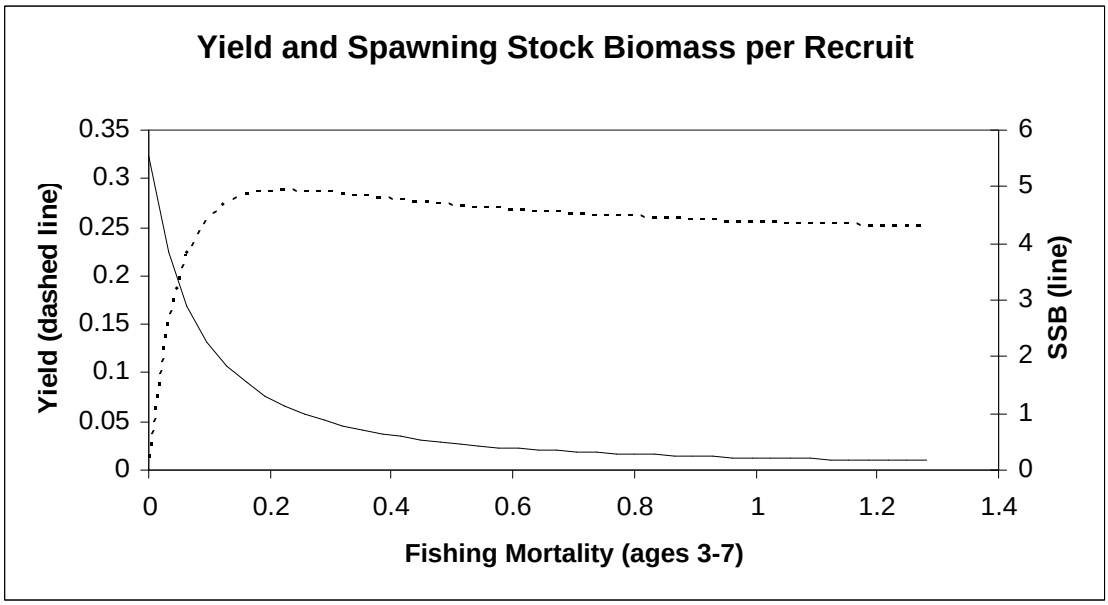









Stock - Recruitment
Recruitment (age 1) in millions
16
14
12
10
8
6
4
2
0
0
1
2
3
4
5
SSB in 1000 t
SSB-Rec.
Blim
Bpa


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)
6
5
4
3
2
1
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Fishing Mortality (ages 3-7)

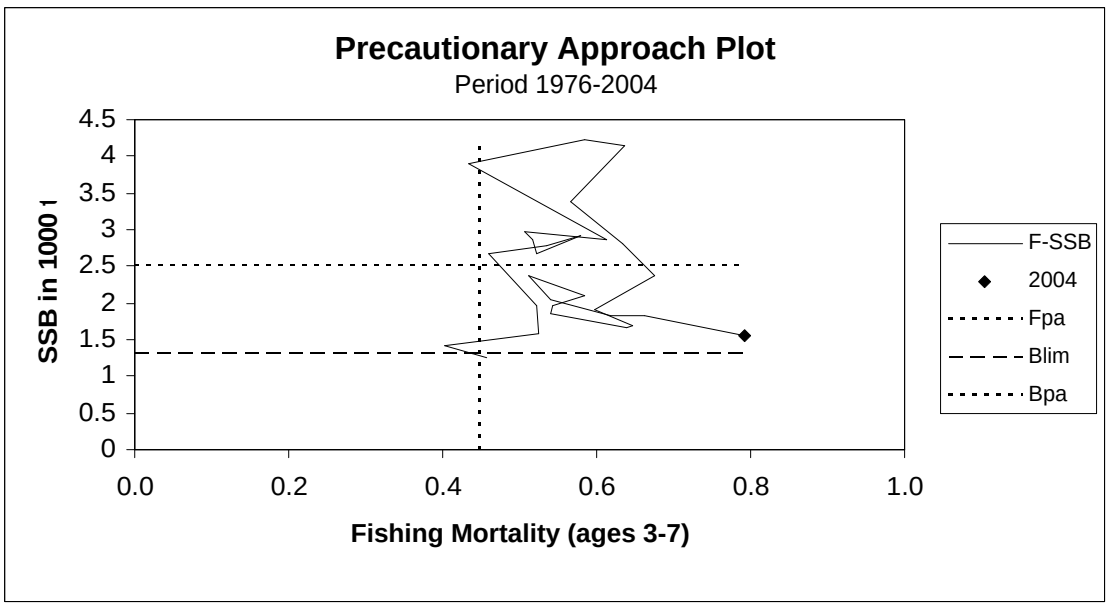

Precautionary Approach Plot
Period 1976-2004
SSB in 1000 t
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
0.2
0.4
0.6
0.8
1.0
Fishing Mortality (ages 3-7)
F-SSB
2004
Fpa
Blim
Bpa

Table 1.4.9.1 Plaice in VIIe. Nominal landings (t) in Division VIIe, as used by Working Group.

Year	Belgium	Denmark	France	UK (Engl. & Wales)	Others	Total reported	Unallocated[1]	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	1079
1981	27	-	537	953	-	1517	-16	1501
1982	81	-	363	1109	-	1553	135	1688
1983	20	-	371	1195	-	1586	-91	1495
1984	24	-	278	1144	-	1446	101	1547
1985	39	-	197	1122	-	1358	83	1441
1986	26	-	276	1389	- [1]	1691	119	1810
1987	68	-	435	1419	-	1922	36	1958
1988	90	-	584	1654	-	2328	130	2458
1989	89	-	448 [1]	1708	2	2247	111	2358
1990	82	2	N/A [2]	1885	18	1987	606	2593
1991	57	-	251 [1]	1323	16	1647	201	1848
1992	25	-	419	1102	14	1560	64	1624
1993	56	-	284	1080	24	1444	-27	1417
1994	10	-	277	998	3	1288	-132	1156
1995	13	-	288	857	-	1158	-127	1031
1996	4	-	279	855	-	1138	-94	1044
1997	6	-	329	1038	1	1374	-51	1323
1998	22	-	327 [4]	892	1	1242	-111	1131
1999	12	-	194 [1]	947	-	1153	118	1271
2000	4	-	360	926	+	1290	-9	1281
2001	12	-	303	797	-	1112	-6	1106
2002	27	-	238	978	+	1253	4	1257
2003	39	-	195 [4]	983	-	1217	1	1218
2004	46	-	N/A	907	-	953	185	1138

[1]Estimated by the Working Group.

[2]Divisions VIId,e = 4,739 t.

[3]Included in Division VIId

[4]Preliminary

Table 1.4.9.2 Plaice in Division VIIe (Western Channel).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1976	3811	1265	640	0.457
1977	2009	1316	702	0.438
1978	3099	1427	784	0.403
1979	7027	1579	977	0.524
1980	6454	1966	1079	0.523
1981	2638	2664	1501	0.459
1982	5939	2778	1688	0.536
1983	5443	2928	1495	0.579
1984	6863	2685	1547	0.522
1985	6675	2875	1441	0.517
1986	13593	2965	1810	0.507
1987	11973	2854	1958	0.612
1988	8532	3912	2458	0.434
1989	3413	4229	2358	0.585
1990	3821	4139	2593	0.636
1991	4153	3370	1848	0.565
1992	4627	2814	1624	0.633
1993	2089	2376	1417	0.675
1994	2005	1915	1156	0.598
1995	6486	1689	1031	0.647
1996	4931	1665	1044	0.639
1997	7875	1842	1323	0.541
1998	4053	1960	1131	0.544
1999	2331	2111	1299	0.584
2000	3535	2361	1281	0.512
2001	3636	2048	1106	0.541
2002	4508	1825	1247	0.619
2003	2422	1819	1218	0.663
2004	2005	1553	1138	0.793
2005	3827*	1214		
Average	4992	2338	1410	0.562

* GM 89-02

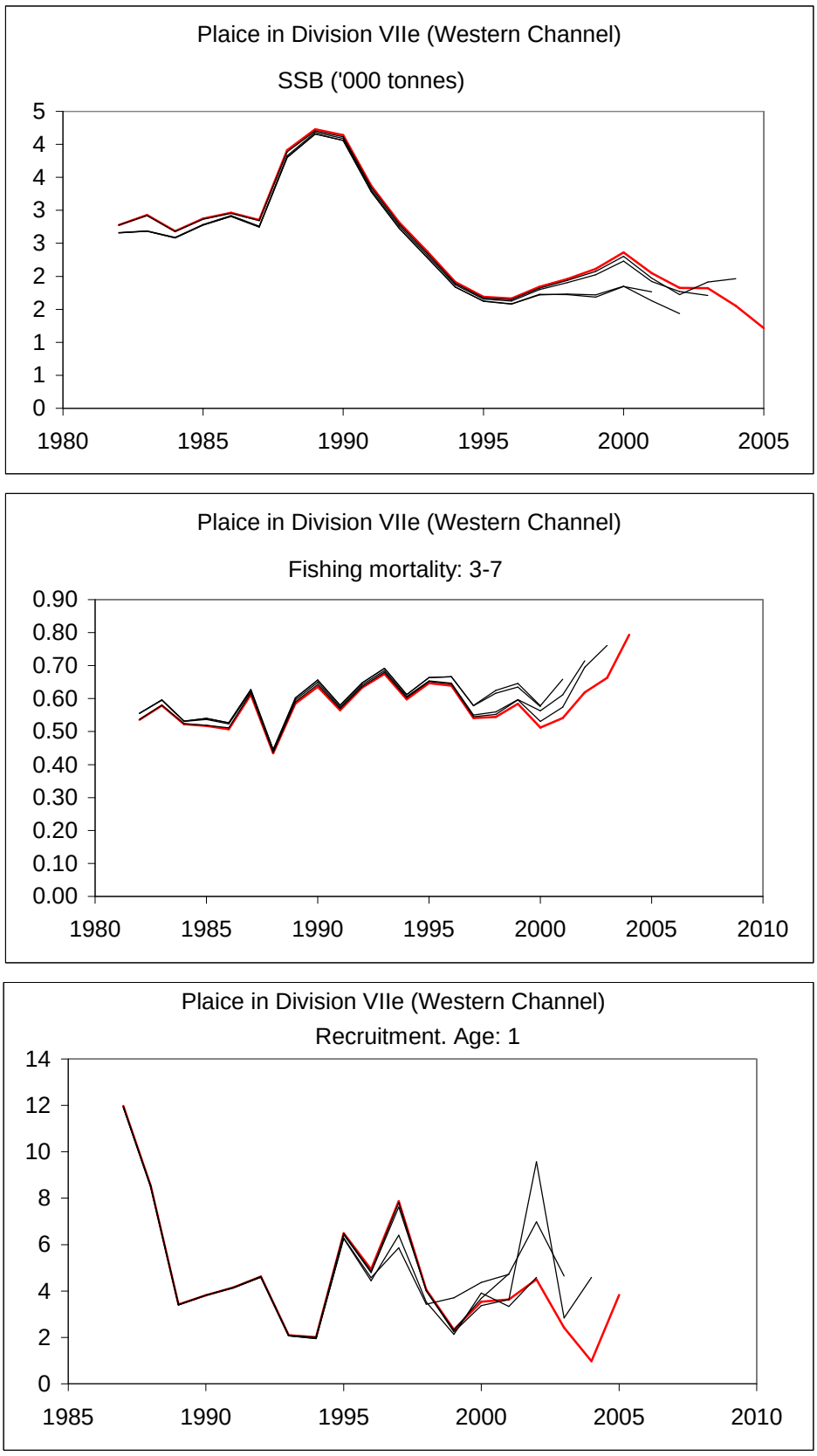


Figure 1.4.9.3 Comparison with previous assessments. The thick line is the most recent assessment.

1.4.10 Plaice Southwest of Ireland (Division VIIh-k)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2005 should be no more than the recent average (2002–2004) of around 245 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Management considerations

Landings are substantially below the TAC and have been declining. The 2004 landings are the lowest observed in the time-series. The advice based on recent average landings may not be precautionary enough if this stock is in decline. 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.

Factors affecting the fisheries and the stock

The effects of regulations

Plaice is managed through a precautionary TAC and technical conservation measures. The agreed TAC for plaice in 2004 and 2005 is 466 t, following a TAC of 582 t in 2003. Boat quota restrictions were imposed on Irish vessels for hake, cod, and anglerfish and these are likely to have impacted the plaice landings.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Ireland, UK, and France are the major participants in this fishery. Plaice are predominantly caught within mixed species otter trawl fisheries in Division VIIj. Irish vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore, and Schull. Increasingly these Irish vessels target mainly hake, anglerfish, and megrim and not the more traditional inshore species (plaice, sole, whiting, and cod). Otter trawlers accounted for the majority, with beam trawlers and seiners taking smaller catches of plaice.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	652
1994	-		-		-	578
1995	-		-		-	541
1996	-		-		-	431
1997	-		-		-	639
1998	-		-		-	439
1999	-		-		-	456
2000	-		-		-	363
2001	-		-		1215	276
2002	-		-		1080	325
2003	Reduce TAC to recent average (1998–2000)		450		582	213
2004	[1]	Reduce TAC to recent average (2000–2002)	[1]	320	466	NA
2005		Reduce TAC to recent average (2001–2003)		271	466	
2006		Reduce TAC to recent average (2002–2004)		245		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 1.4.10 Plaice in Divisions VII h-k (Southwest Ireland).

Nominal landings (t), 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	304			44.2	3.5	27.3	68.8	19	66.6
France	244	69	49		54	50	45	31	N/A
Ireland	388	344	286	299	199.5	160	155	127	N/A
Netherlands	52		12.6	1.3	2				
Spain					5	3	2	6	N/A
UK (England & Wales)	191	138	106	82	75	73.1	59.7	47	36.3
UK (Scotland)	1				1	0.1			
Portugal									8
Total	1180	551	454	427	340	314	331	230	111
Unallocated	-749	88	-15	29	23	-38	-6	26	-95
Totals used by Working Group	431	639	439	456	363	276	325	204	206

1.4.11 Plaice West of Ireland (Division VIIb,c)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The state of the stock is unknown but landings show a declining trend in recent years. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2005 should be no more than the recent average (2002–2004) of around 65 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Management considerations

Landings have been declining and 2004 landings are the lowest observed in the time-series. The advice based on recent average landings may not be precautionary enough if this stock is in decline. 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.

Factors affecting the fisheries and the stock

Ireland is the major participant in this fishery with around 90% of the international landings between 1993–2003. Plaice are normally caught in mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

The effects of regulations

Plaice is managed by a precautionary TAC and technical measures. The agreed TACs have been 160 t since 2003.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	197
1994	-		-		-	215
1995	-		-		-	315
1996	-		-		-	240
1997	-		-		-	213
1998	-		-		-	183
1999	-		-		-	172
2000	-		-		-	108
2001	-		-		240	87
2002	No advice		-		180	71
2003	Reduce TAC to recent landings		160		160	72
2004	[1]	Reduce TAC to recent av. landings (2000–2002)	[1]	90	160	N/A
2005		Reduce TAC to recent av. landings (2001–2003)		77	160	
2006		Reduce TAC to recent av. landings (2002–2004)		65		

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
Weights in t.

Table 1.4.11.1 Nominal landings (t) of plaice in Divisions VIIb,c 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001*	2002	2003	2004
France	1	3	-*	8*	31	8	17	9	N/a
Ireland	248	206	160	157	99	70	51	56	N/a
Spain	-	-	-	-	+	+	-		
UK(Eng & Wales)	2	+	1	+	+	+	2	+	
UK(Scotland)	+	+	+	2	+	-	-	+	
Total	251	209	161	159	130	78	70	65	
Unallocated	11	-4	-22	-13	22	-9	-1	7	-53
Total figures as used by the WG	240	213	183	172	108	87	71	72	53

1.4.12 Sole in Division VIIa (Irish Sea)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown		

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. Commercial CPUE indicates a stable stock situation in recent years and this is confirmed by survey information.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is 2 800 t, the lowest observed spawning stock in an earlier assessment.	$\mathbf{B}_{pa}$ 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.
	$\mathbf{F}_{lim}$ 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.	$\mathbf{F}_{pa}$ be set at 0.30. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.
Target reference points		Not defined.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 4-7	Yield/R	SSB/R
Average last 3 years	0.279	0.193	0.719
$\mathbf{F}_{max}$	0.396	0.195	0.517
$\mathbf{F}_{0.1}$	0.146	0.173	1.237
$\mathbf{F}_{med}$	0.268	0.192	0.745

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{pa}$.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss}$.	$\mathbf{B}_{pa} \sim \mathbf{B}_{lim} * 1.4$.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$ poorly defined; based on historical considerations.	$\mathbf{F}_{pa}$ = see above.

Single-stock exploitation boundaries

There are not sufficient data available to complete a quantitative catch prediction. Indications from recent CPUE and effort data are that the stock situation has been stable in recent years. As a precautionary measure a TAC based on recent catch levels is recommended (2002–2004).

Management considerations

There are indications that area misreporting of sole occurs, and there are also indications that some fleets are not limiting their uptake to their quota. Such practices have the potential of masking the true stock trends for sole. Sole is caught both in a targeted fishery and as a bycatch in the plaice fishery. Information on discards is very limited, but information from 2003 is indicative of discard ranges up to 5% in weight.

Factors affecting the fisheries and the stock

The effects of regulations

Technical measures in force are minimum mesh sizes and minimum landing size (24 cm). Limited observations indicate that the rate of discarding of sole is relatively low.

The closures of cod spawning-grounds that have been in force since 2000 are unlikely to have had a big impact on the sole fishery. In 2000 the closure covered the Western and Eastern Irish Sea. Since then, closure has been mainly in the Western part, whereas the main sole fishery has taken place in the Eastern part of the Irish Sea.

Scientific basis

Uncertainties in assessment and forecast

Low sampling levels in 2002 and 2003 for one of the major fleets did result in substantial problems with the data (anomalously low weights-at-age and exploitation pattern). In addition, the 2004 age distributions of the different countries were not in coherence and investigations revealed that the absence of older fish in some fleets gave inconsistent results. Consequently an analytical assessment was not accepted.

Comparison with previous assessment and advice

An analytical assessment was not possible this year and consequently, the basis of the advice is different from that of last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	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	1.0	1.1
2003	Keep F below $\mathbf{F}_{pa}$		<1.01		1.01	1.0	1.0
2004	[4]	Maintain SSB above $\mathbf{B}_{pa}$		<0.79	0.80	0.6	0.7
2005	[4]	F<$\mathbf{F}_{pa}$		<1.00	0.96		
2006	[4]	Recent catch levels (2002–2004)		<0.93			

Weights in '000 t.
[1]Catch at *status quo* F.
[2] Not including misreporting.
[3]Revised in 1990 to 1.5.
[4]Single-stock boundary; the exploitation of this stock should be conducted in the context of mixed fisheries.

Table 1.4.12.1 Irish Sea Sole. Nominal landings (tonnes) as officially reported by ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	930	987	915	1010	786	371	531	495	706	675	533	570	525	469	493	674	817	687	524
France	17	5	11	5	2	3	11	8	7	5	5	3	5 *	1 *	3	4	4	4	n/a
Ireland	235	312	366	155	170	198	164	98	226	176	133	130	134	120	135	135	96	103	n/a
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	4	3	3	n/a
United Kingdom																195	165	217	107
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	833	1,012	1,085	1,014	631
Unallocated	79	767	114	10	7	-11	25	52	7	-34	-21	-24	14	54	-15	41	2	1	68
Total used by Working Group in Assessment	1,995	2,808	1,999	1,833	1,583	1,212	1,259	1,023	1,374	1,266	1,002	1,003	911	863	818	1,053	1,087	1,015	699

* Preliminary

[1] 1989 onwards: N. Ireland included with England & Wales

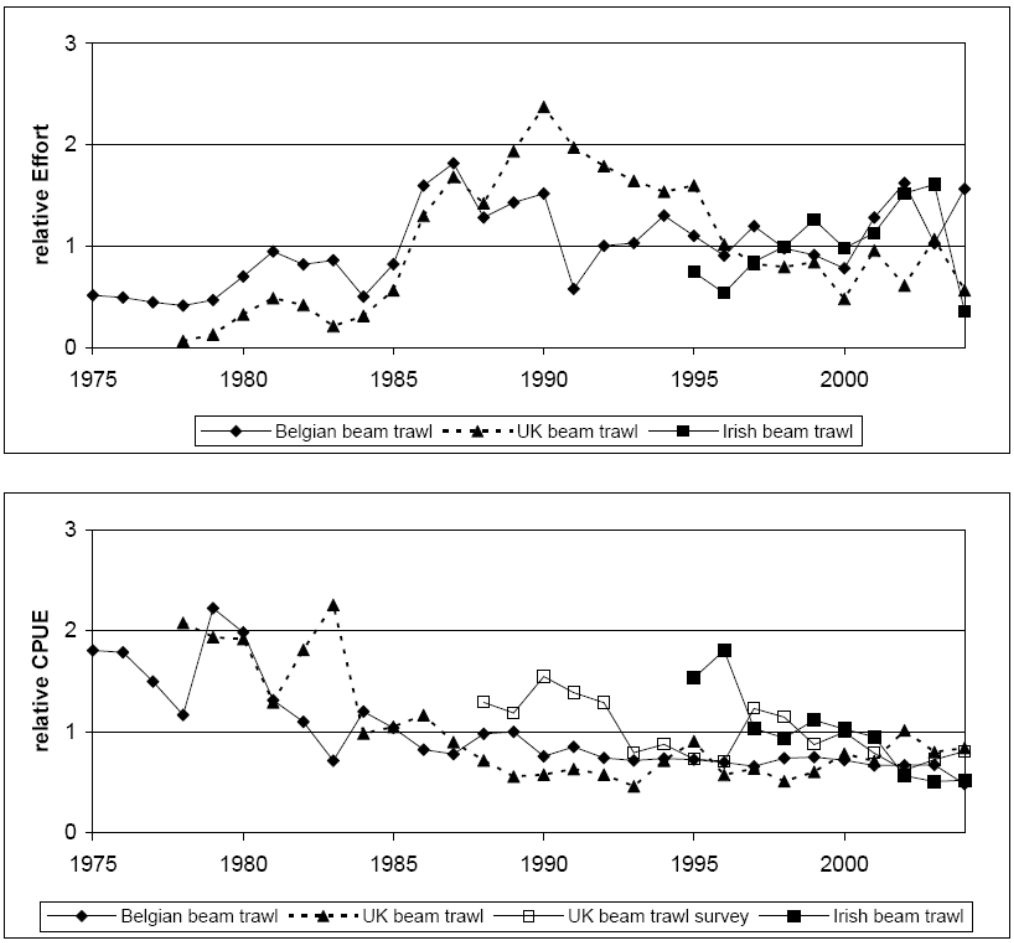


Figure 1.4.12.1 Relative effort and CPUE for some fleets.

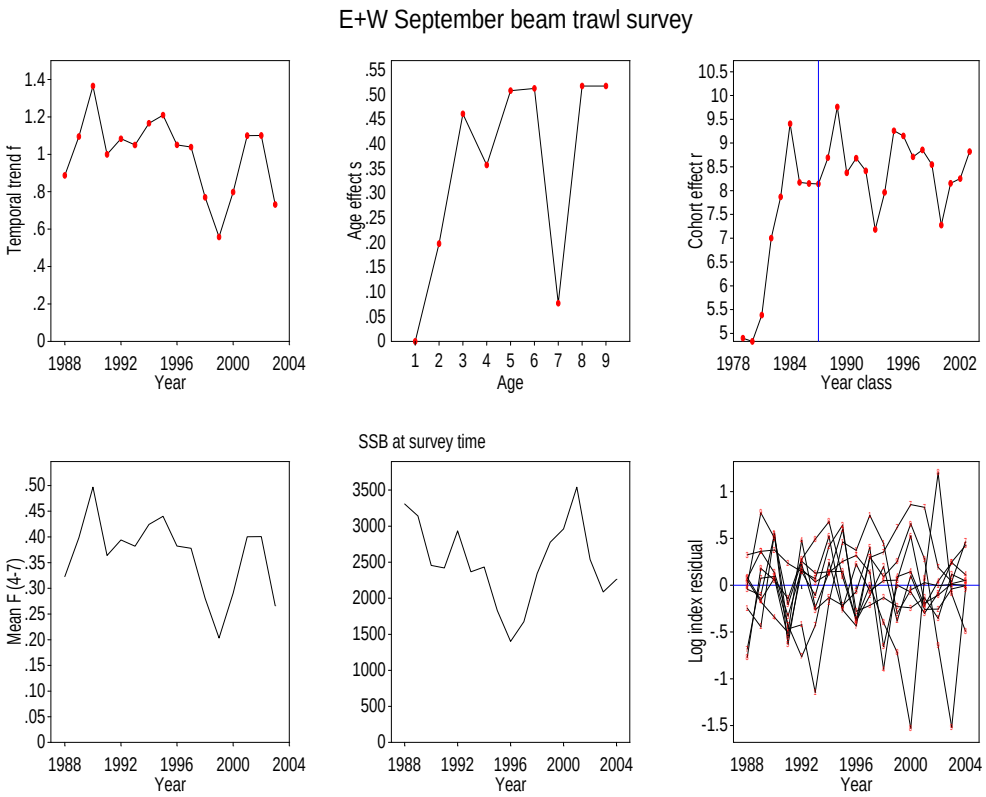


Figure 1.4.12.2 Results from Surba analysis for UK(E&W) September beam trawl survey.

1.4.13 Celtic Sea Sole (Divisions VIIf and g)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Full reproductive capacity	Increased risk	Overexploited	

Based on the most recent estimates of SSB, ICES classifies the stock as having full reproductive capacity. SSB has declined steadily since the early 1970s and reached the lowest observed value in 1998. The exceptional year class of 1998 which is the strongest in the time-series has increased SSB to above the long-term average, but as the contribution of this year class on SSB wanes, SSB declines again. Based on the most recent estimates of fishing mortality, ICES classifies the stock as being at risk of being harvested unsustainably. Fishing mortality increased in the late 1970s, exceeding $\mathbf{F}_{pa}$ in the early 1980s, and has been fluctuating around a high level since the mid-1980s. Recruitment has fluctuated with some peaks.

Management objectives

There are no specific management objectives for this stock.

Reference points

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.

Yield and spawning biomass per Recruit F-reference points:

	Fish Mort Ages 4-8	Yield/R	SSB/R
Average last 3 years	0.498	0.189	0.457
$\mathbf{F}_{max}$	0.229	0.200	1.028
$\mathbf{F}_{0.1}$	0.101	0.180	2.026
$\mathbf{F}_{med}$	0.344	0.196	0.681

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

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}< $\mathbf{B}_{pa}$)

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock. The present F (0.50) is well above the possible candidate reference points $\mathbf{F}_{0.1}$ and $\mathbf{F}_{max}$.

Exploitation boundaries in relation to precautionary limits

A 26% reduction in F is needed to reduce F below $\mathbf{F}_{pa}$. This corresponds to landings of less than 880 tonnes in 2006.

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.5; $R_{05\text{-}06}$ = GM = 4.8 million; SSB(2005) = 2.89 kt; SSB(2006) = 2.76 kt; landings (2005) = 1.12 kt.

The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.37.

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.46.

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	4.02	46%	-100%
Status quo	1.13	$\mathbf{F}_{sq}$	0.50	2.66	-4%	13%
High long-term yield	1.06	F(long-term yield)	0.46	2.74	-1%	6%
Status quo	0.14	$\mathbf{F}_{sq}$ *0.1	0.05	3.85	40%	-86%
	0.27	$\mathbf{F}_{sq}$ *0.2	0.10	3.69	34%	-73%
	0.88	$\mathbf{F}_{sq}$ *0.74	0.37	2.95	7%	-12%
	0.89	$\mathbf{F}_{sq}$ *0.75	0.38	2.93	6%	-11%
	1.04	$\mathbf{F}_{sq}$ *0.9	0.45	2.76	0%	4%
	1.13	$\mathbf{F}_{sq}$ *1	0.50	2.66	-4%	13%
	1.21	$\mathbf{F}_{sq}$ *1.1	0.55	2.55	-7%	21%
	1.34	$\mathbf{F}_{sq}$ *1.25	0.63	2.40	-13%	34%
Precautionary limits	0.10	TAC($\mathbf{F}_{pa}$) *0.1	0.04	3.89	41%	-90%
	0.25	TAC($\mathbf{F}_{pa}$) *0.25	0.09	3.71	35%	-75%
	0.48	TAC($\mathbf{F}_{pa}$) *0.5	0.19	3.43	25%	-52%
	0.69	TAC($\mathbf{F}_{pa}$) *0.75	0.28	3.18	15%	-31%
	0.81	TAC($\mathbf{F}_{pa}$) *0.9	0.33	3.04	10%	-19%
	0.88	$\mathbf{F}_{pa} = \mathbf{F}_{sq}$ *0.74	0.37	2.95	7%	-12%
	0.96	TAC($\mathbf{F}_{pa}$) *1.1	0.41	2.86	4%	-4%
	1.06	TAC($\mathbf{F}_{pa}$) *1.25	0.46	2.73	-1%	6%
	1.23	TAC($\mathbf{F}_{pa}$) *1.5	0.56	2.54	-8%	23%
	1.38	TAC($\mathbf{F}_{pa}$) *1.75	0.65	2.36	-15%	38%
	1.52	TAC($\mathbf{F}_{pa}$) *2	0.74	2.19	-20%	52%
	1.64	TAC($\mathbf{F}_{pa}$) *2.25	0.83	2.04	-26%	64%
Mixed Fisheries						

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.

All weights in thousand tonnes.

Shaded scenarios are not considered consistent with the Precautionary Approach.

Management considerations

ICES has explored simulations with long term-target Fs below 0.72 for this stock. These show a range of fishing mortalities from 0.37 to 0.22 that are predicted to result in the highest long-term yields (around 950 t), whilst posing little risk of being below $\mathbf{B}_{lim}$ in the long term (Figure 1.4.13.1). A Harvest Control Rule (HCR) should therefore be developed to reduce F to this type of target level in the medium term whilst minimizing the risk of SSB decreasing below $\mathbf{B}_{lim}$. A dialogue between managers and stakeholders will be required to define an appropriate management plan for this fishery.

In recent years, fishing mortality has been high. SSB declined until 1998; since then it has increased somewhat due to the contribution of some good year classes, particularly the 1998 year class. As the contribution of this year class wanes, SSB is predicted to decline again. At current levels of fishing mortality, there is a high probability that SSB will be below $\mathbf{B}_{pa}$ in some years. SSB levels just above $\mathbf{B}_{pa}$ are still low compared to the values observed in the past.

Effort restrictions are in place for many areas but not in the Celtic Sea, which makes the latter vulnerable to unrestricted increases in effort. This is undesirable where stocks are already overexploited. There was a substantial effort increase by the major fleet (Belgian fleet) in 2004.

Sole is mainly taken in a beam-trawl fishery as part of a mixed demersal fishery, predominantly with plaice. Fishing mortality has remained extremely high since the early 1980s.

Factors affecting the fisheries and the stock

The fisheries for sole in the Celtic Sea and Bristol Channel involve vessels from Belgium, taking two thirds, the UK one quarter, 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.

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.

The effects of regulations

Management of sole in VIIf,g is by TAC and technical measures. The agreed TACs in 2004 and 2005 are 1050 t and 1000 t, respectively. Technical measures in force for this stock are minimum mesh sizes and minimum landing size (24 cm). There are also restricted areas for certain classes of vessels.

In 2004, effort limitations (due to e.g. recovery plans for cod in the Irish Sea and the Eastern Channel) on most fishing grounds where the Belgian fleet normally operates resulted in a concentration of the Belgian effort into the Celtic Sea, where no such effort restrictions were in place.

Council Regulation (EC) No. 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4, and 32E3 during January–March 2005. This prohibition did not apply to beam trawlers during March. The effects of the area closure cannot yet be evaluated.

Changes in fishing technology and fishing patterns

No known change in fishing pattern, and no information available on technological aspects. There is evidence of a switch to targeting other species by the main beam trawl fleet in this area.

Scientific basis

Data and methods

The analytical age-based assessment is based on landings, two commercial CPUE series, and one survey index.

Information from the fishing industry

A pre-Working Group industrial briefing meeting at CEFAS (UK) was held in June 2005 together with Fisheries Science Partnership. The available information showed that catch rates were highest in the area off the coast of North Cornwall and sole up to 25 cm were discarded in relative small numbers. It was also noted that the strong 1998 year class at age 7 was still very much abundant in the fisheries.

Uncertainties in assessment and forecast

The use of commercial tuning data may result in a biased perception of stock trends and the assessment is conditional on the accuracy of this data. A comparison of a survey-tuned assessment shows higher levels of SSB and lower fishing mortalities than the current assessment.

The contribution of recruitment of the incoming year class to the short-term forecast is low, and last year's forecast was close to the realised catches.

Comparison with previous assessment and advice

Results are very close to those of the previous assessment, although the estimate of F in 2003 has been revised upwards. The perception of the stock has not changed and the basis for the advice is similar.

Source of information

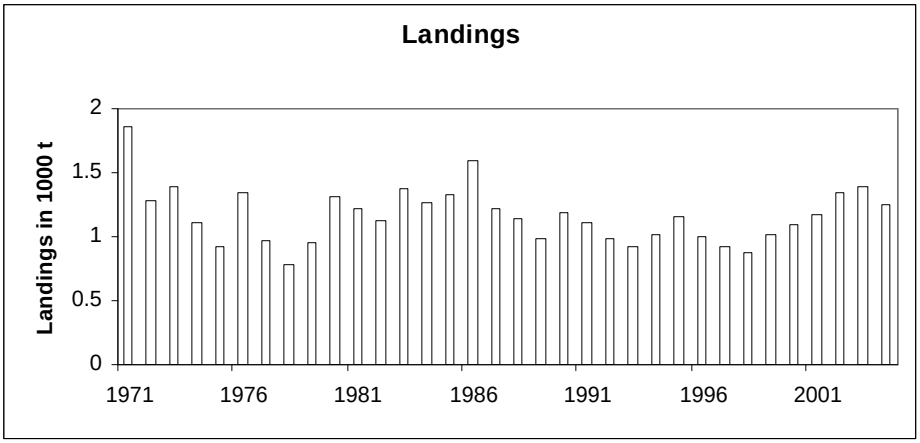
Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

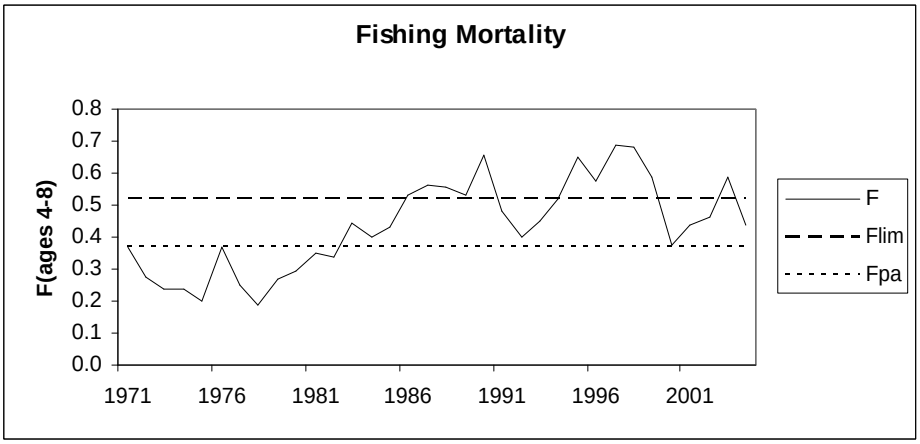
Year	ICES advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM Landings
1987	*Status quo* F; TAC		1.6		1.6	1.22
1988	F = F(pre-86); TAC		0.9		1.1	1.15
1989	F at F(81–85); TAC		1.0		1.0	0.99
1990	No increase 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	1.35
2003	Reduce F below $\mathbf{F}_{pa}$		< 1.24		1.24	1.39
2004	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 1.00	1.05	1.25
2005	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 0.84	1.00	
2006	[1]	Reduce F below $\mathbf{F}_{pa}$	[1]	< 0.88		

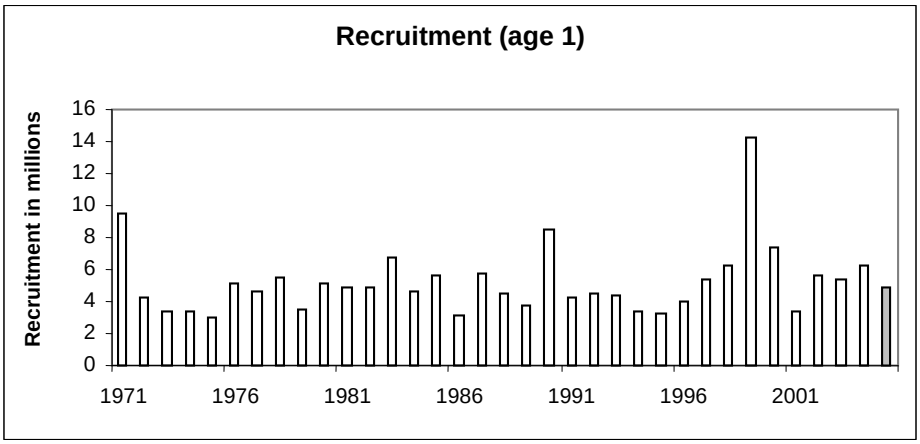
Weights in '000 t.

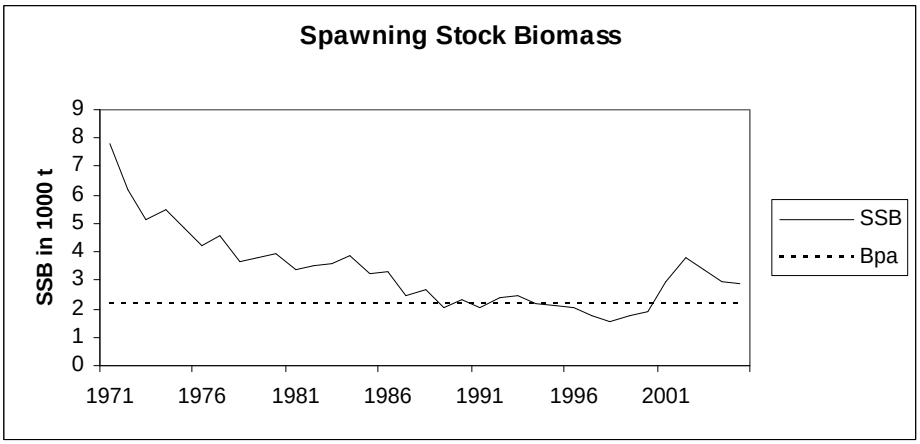
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

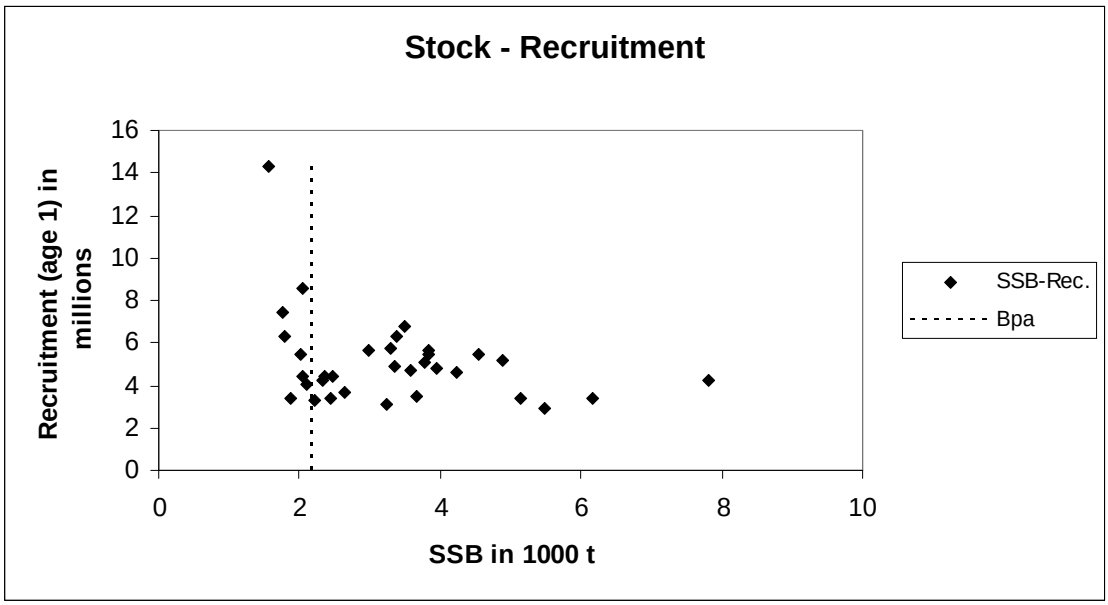
Sole in Divisions VIIf and g (Celtic Sea).

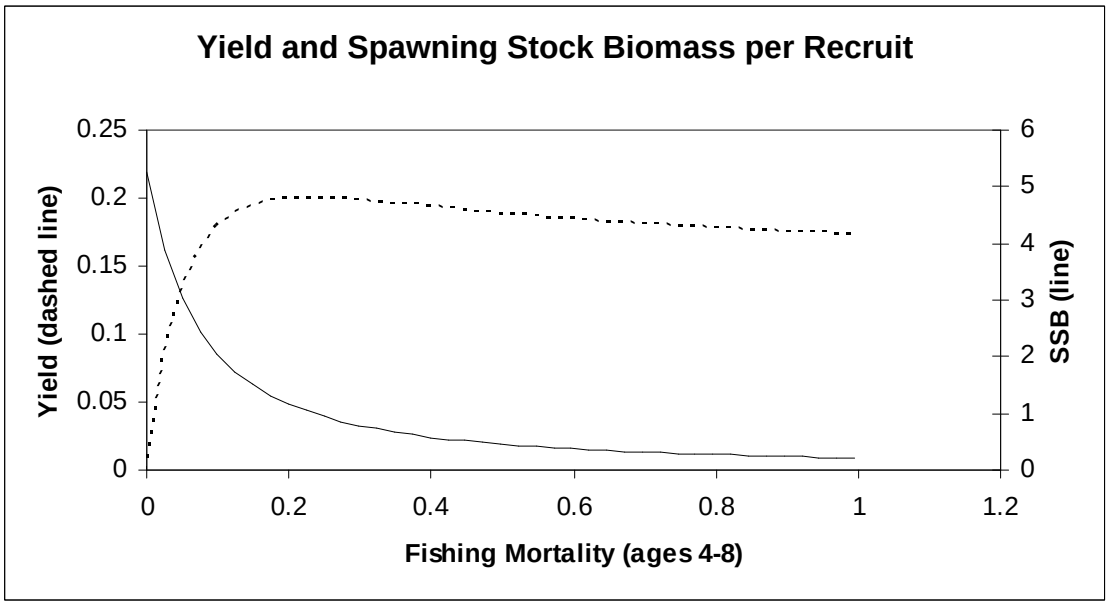









Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
SSB (line)
Fishing Mortality (ages 4-8)

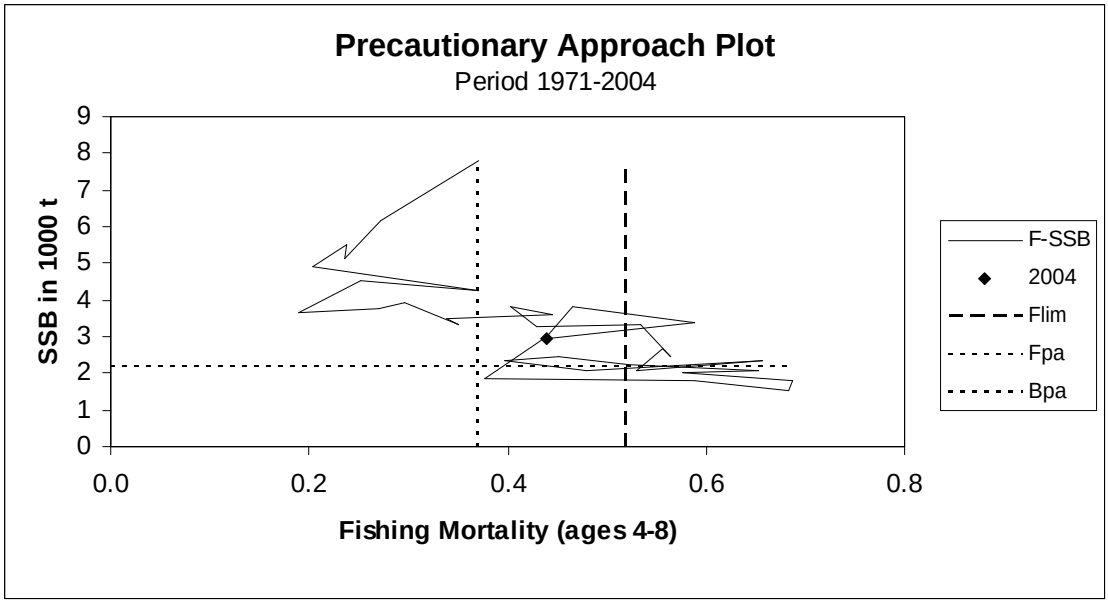

Precautionary Approach Plot
Period 1971-2004
SSB in 1000 t
Fishing Mortality (ages 4-8)
F-SSB
2004
Flim
Fpa
Bpa

Table1.4.13.1 Celtic Sea SOLE. Divisions VIIf and VIIg. Official Nominal landings (t), 1986–2004 and data used by the Working Group.

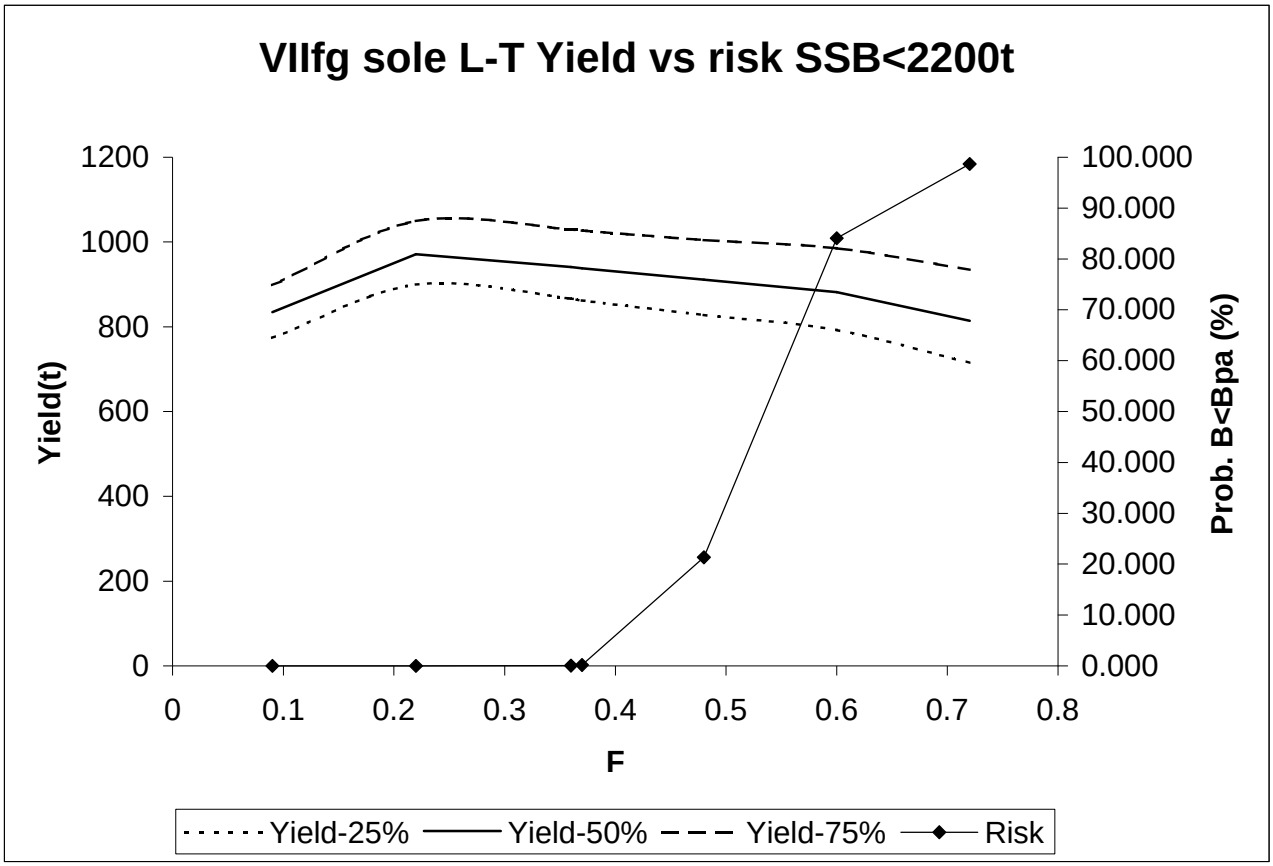
Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	1039*	701*	705*	684*	716*	982*	543*	575*	619*	763*	695*	660*	675*	604	694	720	703	715	734.6
Denmark	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	146	117	110	87	130	80	141	108	90	88	102	99	98	61	74	77	66	77	n/a
Ireland	188*	9	72	18	40	32	45	51	37	20	19	28	42	51	29	35	32	26	n/a
UK(E. & W,NI	611*	437	317	203	353	402	325	285	264	294	265	251	198	231	243	288	318	342	283.4
UK(Scotland	-	-	-	-	0	0	6	11	8	-	0	0	-	0	-	-	+	+	-
Netherlands	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,989	1,264	1,204	992	1,239	1,496	1060	1030	1,018	1,165	1081	1038	1013	886	1,040	1,120	1,119	1,133	1,018
Unallocated	-389	-42	-58	-	50	-389	-79	-102	-9	-8	-86	-111	-138	65	51	48	226	232	231
Total used 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	1,168	1,345	1,392	1,249

[1]Preliminary.
* including VIIg-k.

Table 1.4.13.2 Sole in Divisions VIIf and g (Celtic Sea).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 4-8
1971	9506	7817	1861	0.370
1972	4241	6164	1278	0.272
1973	3356	5147	1391	0.236
1974	3372	5495	1105	0.238
1975	2956	4882	919	0.203
1976	5174	4232	1350	0.371
1977	4613	4541	961	0.251
1978	5472	3656	780	0.190
1979	3521	3785	954	0.270
1980	5115	3938	1314	0.296
1981	4842	3350	1212	0.350
1982	4870	3486	1128	0.338
1983	6757	3590	1373	0.446
1984	4672	3836	1266	0.403
1985	5632	3249	1328	0.429
1986	3147	3308	1600	0.534
1987	5708	2471	1222	0.565
1988	4467	2647	1146	0.557
1989	3716	2051	992	0.530
1990	8549	2339	1189	0.657
1991	4192	2050	1107	0.480
1992	4439	2366	981	0.397
1993	4403	2432	928	0.452
1994	3393	2210	1009	0.521
1995	3301	2097	1157	0.652
1996	4014	2020	995	0.576
1997	5415	1778	927	0.688
1998	6269	1552	875	0.683
1999	14264	1775	1012	0.589
2000	7400	1872	1091	0.376
2001	3429	2973	1168	0.440
2002	5633	3828	1345	0.465
2003	5416	3376	1392	0.588
2004	6299	2959	1249	0.440
2005	4848*	2888		
Average	5211	3319	1165	0.437

* R2004 assumed to be GM71-02.



*Note these simulations have used the WG assessment as the starting point and not the final assessment. This is a slightly more pessimistic starting point to simulations.

Figure 1.4.13.1 An exploration of potential long-term Fishing Mortality targets for Sole VIIfg. Showing yield and risk in the long term (2023).

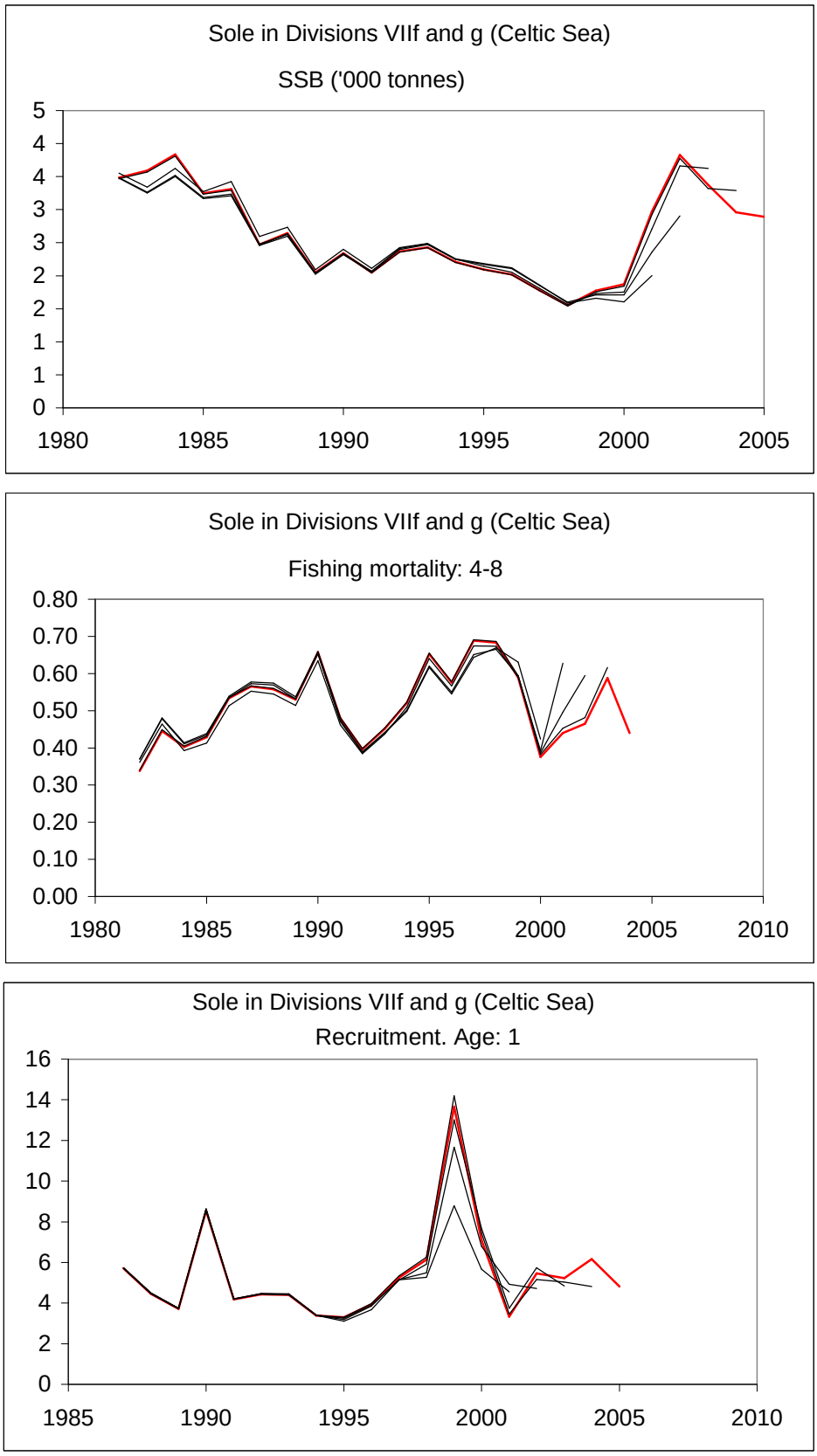


Figure 1.4.13.2 Comparison between present and previous assessments.

1.4.14 Sole in Division VIIe (Western Channel)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Increased risk	Harvested unsustainably	Overexploited	

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of reduced reproductive capacity. SSB has declined since 1980 when fishing mortality increased above 0.2 and is in 2004 estimated to be at its lowest level and close to $\mathbf{B}_{lim}$. Based on the most recent estimates of fishing mortality, ICES classifies the stock as being harvested unsustainably. Fishing mortality has been above $\mathbf{F}_{pa}$ since 1978, and mostly above $\mathbf{F}_{lim}$ since 1982.

Management objectives

There are no specific management objectives for this stock.

Reference points

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.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-7	Yield/R	SSB/R
Average last 3 years	0.449	0.202	0.411
$\mathbf{F}_{max}$	0.266	0.208	0.746
$\mathbf{F}_{0.1}$	0.113	0.187	1.628
$\mathbf{F}_{med}$	0.249	0.208	0.798

In the absence of $\mathbf{F}_{MSY}$ estimates $\mathbf{F}_{0.1}$ can be considered a suitable interim candidate reference point, which is consistent with taking high long-term yields and achieving a low risk of depleting the productive potential.

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

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

There is no agreed management plan.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

Target reference points have not been agreed for this stock but a target reference point close to $\mathbf{F}_{0.1}$ (0.11) maximises the return from the fishery whilst being consistent with the Precautionary Approach. The present fishing mortality (0.45) is above the candidate reference point $\mathbf{F}_{0.1}$.

Exploitation boundaries in relation to precautionary limits

ICES continues to recommend that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\mathbf{B}_{pa}$. Rebuilding the stock in one year requires that fishing mortality be reduced by at least 80%. This corresponds to landings of less than 240 tonnes in 2006.

Short-term implications

Outlook for 2006

Basis: F(2005) = $\mathbf{F}_{sq}$ = mean F(02-04) = 0.45; R05-06 = GM = 4.3 million; SSB(2005) = 2.12 kt; SSB(2006) = 2.15 kt; Landings (2005) = 1.1 kt.

The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.2.
The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.27.

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	3.03	41%	-100%
Status quo	1.03	$\mathbf{F}_{sq}$	0.45	2.05	-5%	19%
High long-term yield	0.88	F(long-term yield)	0.37	2.19	2%	1%
Status quo	0.12	$\mathbf{F}_{sq}$ *0.1	0.05	2.91	36%	-86%
	0.24	$\mathbf{F}_{sq}$ *0.2	0.09	2.80	30%	-72%
	0.57	$\mathbf{F}_{sq}$ *0.5	0.23	2.49	16%	-34%
	0.81	$\mathbf{F}_{sq}$ *0.75	0.34	2.25	5%	-6%
	0.94	$\mathbf{F}_{sq}$ *0.9	0.41	2.13	-1%	9%
	1.03	$\mathbf{F}_{sq}$ *1	0.45	2.05	-5%	19%
	1.11	$\mathbf{F}_{sq}$ *1.1	0.50	1.97	-8%	28%
	1.22	$\mathbf{F}_{sq}$ *1.25	0.56	1.86	-13%	42%
Precautionary limits	0.05	TAC($\mathbf{F}_{pa}$) *0.1	0.02	2.98	39%	-94%
	0.19	TAC($\mathbf{F}_{pa}$) *0.36	0.07	2.84	32%	-78%
	0.29	TAC($\mathbf{F}_{pa}$) *0.54	0.11	2.75	28%	-67%
	0.39	TAC($\mathbf{F}_{pa}$) *0.75	0.15	2.65	23%	-55%
	0.46	TAC($\mathbf{F}_{pa}$) *0.9	0.18	2.58	20%	-46%
	0.51	$\mathbf{F}_{pa}$= $\mathbf{F}_{sq}$ *0.44	0.20	2.54	18%	-41%
	0.56	TAC($\mathbf{F}_{pa}$) *1.1	0.22	2.49	16%	-36%
	0.62	TAC($\mathbf{F}_{pa}$) *1.25	0.25	2.43	13%	-28%
	0.73	TAC($\mathbf{F}_{pa}$) *1.5	0.30	2.33	8%	-15%
	0.84	TAC($\mathbf{F}_{pa}$) *1.75	0.35	2.23	4%	-3%
	0.93	TAC($\mathbf{F}_{pa}$) *2	0.40	2.14	-1%	8%
	1.03	TAC($\mathbf{F}_{pa}$) *2.25	0.45	2.05	-5%	19%
Mixed Fisheries						

Weights in '000 t.
(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.
Shaded scenarios are not considered consistent with the Precautionary Approach.

Management considerations

ICES has explored simulations with long-term target Fs below 0.6 for this stock. These show a range of fishing mortalities from 0.1 to 0.3 that are predicted to result in the highest long-term yields (around 850 t), whilst posing little risk of being below $\mathbf{B}_{lim}$ in the long term. A Harvest Control Rule (HCR) should therefore be developed to reduce F to this type of target level in the medium term whilst minimizing the risk of SSB decreasing below $\mathbf{B}_{lim}$.

For illustration, ICES examined a HCR which involves a three-staged 75% reduction where F in years 2–3 = 0.34, years 4–6 = 0.22, and from year 7 onwards F is equal to $\mathbf{F}_{0.1}$ = 0.1 (Figure 1.4.14.3). This HCR does involve a risk (<30% in the 5th year of implementation and <1% in the 10th year) of SSB decreasing below levels where the stock dynamics are unknown. A dialogue between managers and stakeholders will be required to define an appropriate management plan with acceptable risk for this fishery.

The short-term prediction based on this HCR for 2006 would be:

Rationale	Catch (2006)	Basis	F(2006)	SSB(2007)
HCR	815	Towards $\mathbf{F}_{0.1}$ (0.11)	0.34	2248

Any harvest control rule developed for sole should also take into account the plaice as these two species are strongly linked in the fishery.

The 2003 assessment and additional investigations undertaken in 2004 do not suggest that the stock is in imminent danger of collapse. This assertion is confirmed by the 2005 assessment; however, it is clear that SSB continues to decline when F > 0.2 and is currently at the lowest level observed in the time-series and that action is required urgently. The effort control regime in place in 2005 may result in greater compliance and more effective control of fishing mortality.

It is an inherent problem that practices of misreporting may develop when TAC regulations are not efficiently implemented. When decisions on TACs are taken on the basis of catch forecasts this may result in a vicious circle if the forecasts are based on catch data that are lower than the real catches. If misreporting cannot be estimated accurately and included in stock assessments the result will be an increasing bias in stock assessments and forecasts, resulting in even more restrictive TACs and increasing misreporting. Over time it becomes impossible to establish the real stock situation and to advise on catches which may be taken sustainably. In this situation, a TAC regulation such as that currently implemented is therefore not adequate to regulate fishing mortality within sustainable limits and to normalise the situation. In such situations, ICES would often advise on a precautionary TAC based on recent landings. However, when the landing data are not reliable due to misreporting a relevant number for such a TAC cannot be established and a TAC regime does not regulate fishing mortality. Therefore, ICES has concluded that in such situations a possible route is to change management to focus on effort, which can be controlled through instruments like VMS, in order to reintroduce effective control of the fishery and to restore a reliable future database for advice and management decisions. It is an integral part of such a change that a detailed and stringent programme, including the mandatory reporting of both catch and effort data in logbooks should be established to collect high quality effort and landings data. When the situation is normalised and reliable data have been established the future different management schemes can then be considered.

Although sole is the main target species in the beam trawl fishery, catches of cuttlefish, plaice, monkfish, and lemon sole are also important. Management measures applied to sole must take account of management measures applied to the other quota species, particularly VIIe plaice and to a lesser degree VIIe-k cod.

Factors affecting the fisheries and the stock

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.

The effects of regulations

Management of this stock has been by TAC, applied to sole in Division VIIe (i.e. the same as the assessment area). Industry information and commercial landings data analysis indicate that TACs have always been overshot and therefore do not provide effective control of fishing mortality. The agreed TAC in 2004 was 300 t, and landings were 1001 t. The TAC has been set to 865 t for 2005 to tackle area misreporting and underreporting problems in conjunction with an effort control regime. Beam trawlers with mesh size equal to or greater than 80 mm, which are responsible for the majority of the landings of this stock, have been restricted to 20 days at sea. The same 20 days at sea limitation has been applied to the static demersal nets, including gillnets, trammel nets, and tangle nets (Council Regulation (EC) No. 27/2005). ICES has no information as to whether this will result in an effective effort decrease.

Technical measures applied to this stock include a minimum landing size (24 cm) and minimum mesh size of 80 mm for beam trawlers. Local regulations restricting certain gear and vessel types are also in place.

Changes in fishing technology and fishing patterns

Whilst industry information indicates that fewer beam trawlers may now be active in the fishery, the overall standardised effort statistics do not show a significant reduction in effort in 2004, but effort may indeed be reduced in 2005 due to displacement and licence amalgamation. However, the boats, although fewer in number are now bigger on average than they have been in the past, so that the exact effect on fishing mortality cannot yet be estimated.

In 2005 the increased fuel prices are known to have had a negative impact on the profitability of beam trawl fleets. This might result in decreased effort and changes in fishing patterns, but no information is available yet for ICES to evaluate this.

Other factors

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 in the Western Channel are largely isolated from those found in northern Biscay, the eastern Celtic Sea, and the Eastern Channel.

Scientific basis

Data and methods

The assessment is analytical, based on landings, one survey index, and 4 commercial CPUE series (2 of which are historic).

Variations in effort and fleet catchability may occur as vessels move in and out of the fishery, depending on the prevailing catch rates of sole.

Strategic misallocation and underreporting of landings from this stock have affected the assessment in the past. In 2002, the database was revised and now includes landings misreported to two rectangles in Division VIId since 1986.

Information from the fishing industry

The industry has been cooperative in a number of scientific endeavours with regards to this stock:

1. The fisheries science partnership conducted cooperatively between CEFAS and the UK industry has provided some evidence for the wide dispersal and wide-ranging age distribution for this stock (CEFAS Fisheries Science Partnership Report (Working Document 1)). There appears to be some small-scale spatial shifts in the distribution of the highest abundance of sole from 2003–2004, but overall the catch rates for sole in Division VIIe have been very similar for both years. This work is funded until 2007.
2. The UK industry indicated a substantial decline in Division VIIe beam trawl effort in the pre-industry meeting and voiced concerns over further effort reductions, particularly those linked to effort control due to the multi-species nature of the fishery. A reduction in effort, in terms of kW days has so far been substantiated in 2005. Analysis of the available data indicates that effort has been shifted to other areas, and that the capacity of the fleet overall has been reduced due to the amalgamation of licences and a conversion of a number of boats to scalloping. There is a shift towards fewer larger boats in the fleet, but the associated reduction of fishing mortality is as yet unknown, and so could not be used by the WG in the forecast.

Uncertainties in assessment and forecast

Substantial area misreporting of catches has been evident for a number of years and the catch statistics have been partially corrected for this. The extent of underreporting is unknown and the current stock assessment and forecast will be conditional on the accuracy of the landing statistics.

This assessment is tuned using data from the commercial fishery as well as from one survey. The accuracy of the assessment and forecast will depend on whether these commercial catch rates reflect changes in population abundance.

Retrospective tendencies in F and SSB have diminished with the new assessment settings. The short-term forecast is sensitive to the assumptions about recruitment used for the 2003 year class which accounts for about 40% of the SSB in 2007.

Comparison with previous assessment and advice

The results from this assessment are largely consistent with those of last year, despite some changes to the assessment setting. Because of the uncertainty of the estimate of the incoming year-class abundance the catch projections are based on an average for the years 1969–2002, discounted for natural mortality.

The advice based on single-stock exploitation boundaries is consistent with last year. ICES continues to advise that a management plan be developed for this stock such that F can be reduced in a number of measurable steps in the medium term.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

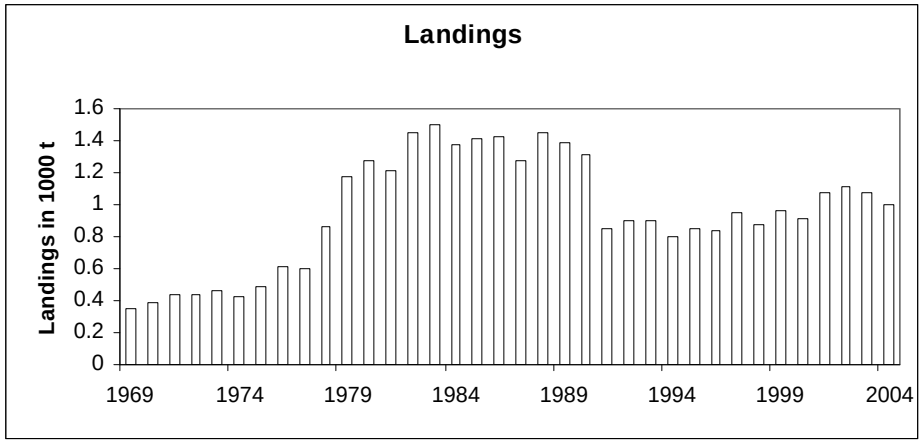
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official Landings	ACFM Landings (a)
1987	No increase in F		1.15		1.15	1.11	1.28
1988	No decrease in SSB; TAC		1.3		1.3	0.95	1.44
1989	No decrease in SSB; TAC		1.0		1.0	0.8	1.39
1990	SSB = 3000 t; TAC		0.9		0.9	0.75	1.31
1991	TAC		0.54		0.8	0.84	0.85
1992	70% of F(90)		0.77		0.8	0.77	0.89
1993	35% reduction in F		0.7		0.9	0.79	0.90
1994	No increase in F		1.0		1.0	0.84	0.80
1995	No increase in F		0.86		0.95	0.88	0.86
1996	$F_{96} < F_{94}$		0.68		0.70	0.74	0.83
1997	No increase in F		0.69		0.75	0.86	0.95
1998	No increase in F		0.67		0.67	0.77	0.88
1999	Reduce F below $\mathbf{F}_{pa}$		0.67		0.70	0.66	0.96
2000	Reduce F below $\mathbf{F}_{pa}$		< 0.64		0.64	0.65	0.91
2001	Reduce F below $\mathbf{F}_{pa}$		<0.58		0.60	0.62	1.07
2002	Reduce F below $\mathbf{F}_{pa}$		<0.45		0.53	0.54	1.11
2003	Rebuilding plan or F=0		-		0.39	0.40	1.08
2004	F=0 or recovery plan [1]		0		0.30	NA	1.00
2005	80% reduction in F or recovery plan		<0.23		0.865		
2006	80% reduction in F or recovery plan		<0.24				

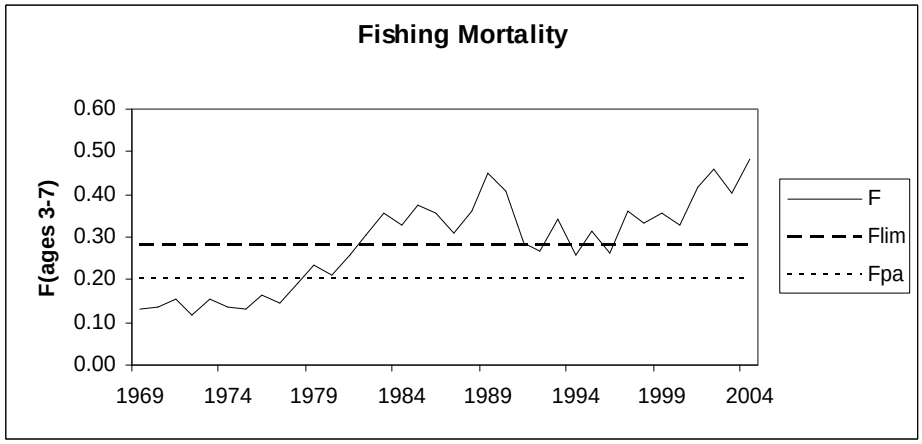
Weights in '000 t.

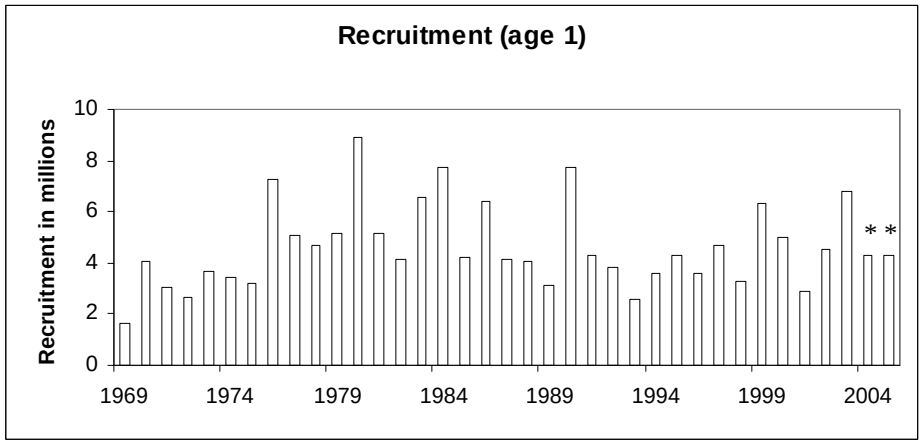
a) Includes misallocated landings, i.e. moving landings between two areas – not underreporting.

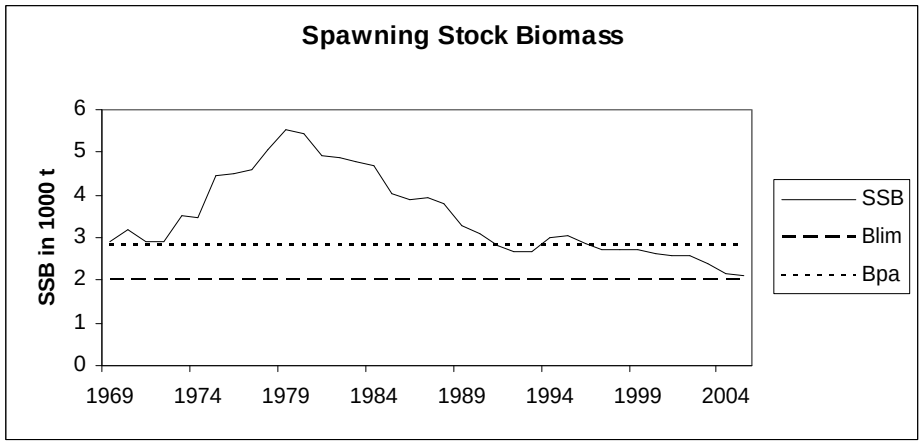
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

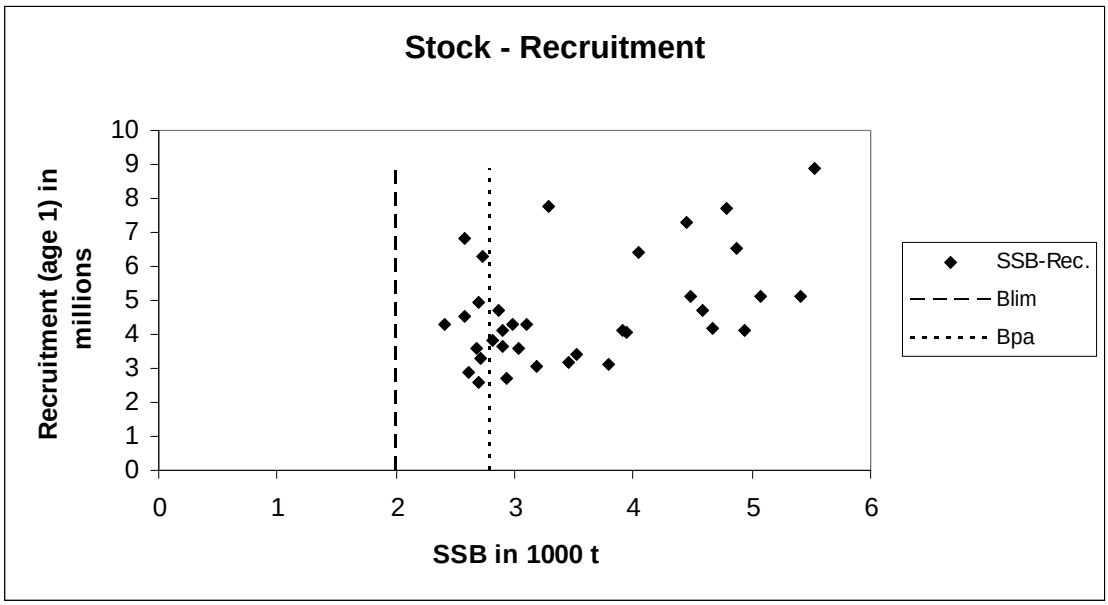
Sole in Division VIIe (Western Channel).

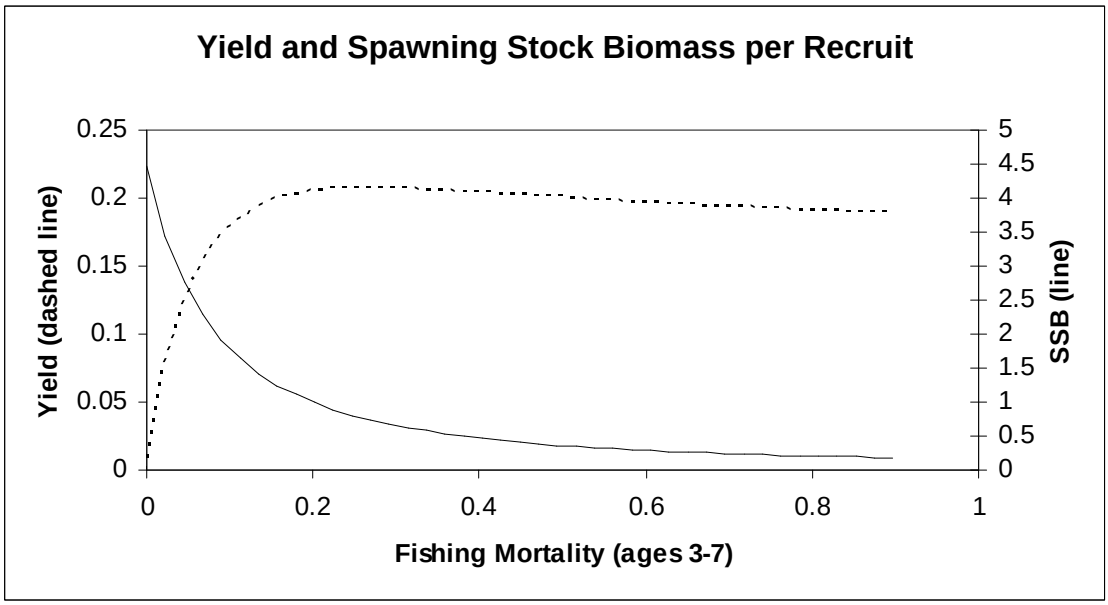









Stock - Recruitment
Recruitment (age 1) in millions
SSB in 1000 t
SSB-Rec.
Blim
Bpa


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

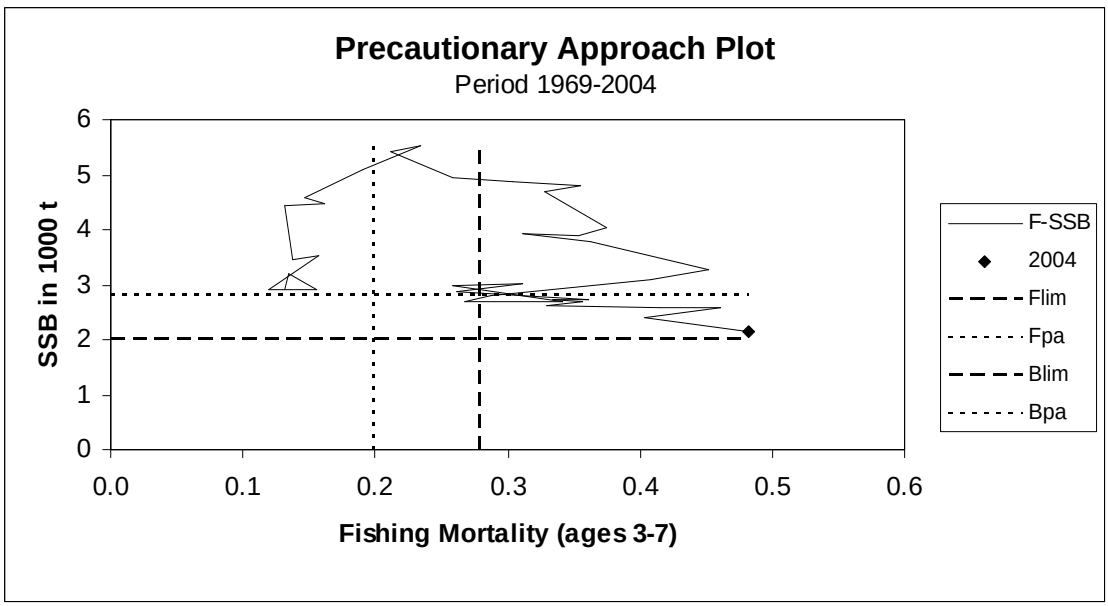

Precautionary Approach Plot
Period 1969-2004
SSB in 1000 t
Fishing Mortality (ages 3-7)
F-SSB
2004
Flim
Fpa
Blim
Bpa

Table 1.4.14.1 Division VIIe Sole. Nominal landings (t), 1972–2003 used by Working Group.

Year	Belgium	France	UK (Engl & Wales)	Other	Total Reported	Unallocated [2]	Total used by WG	
1972	6	230[3]	201	-	437	-	437	
1973	2	263[3]	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[2]	127	1,496	-77	1,419	*
1987	48	432	632[2]	-	1,112	168	1,280	*
1988	67	98	784[2]	-	949	495	1,444	*
1989	69	112[3]	610[2]	6	797	593	1,390	*
1990	41	81[3]	632[2]	-	754	561	1,315	*
1991	35	325[3]	477[2]	-	837	15	852	*
1992	41	267[3]	457[2]	9	774	121	895	*
1993	59	236[3]	480[2]	18	793	111	904	*
1994	33	257[3]	548[2]	-	838	-38	800	*
1995	21	294	565[2]	-	880	-24	856	*
1996	8	297	437[2]	-	742	91	833	*
1997	13	348	496[2]	1	858	91	949	*
1998	40	343[3]	389[2]	-	772	108	880	*
1999	13	254[3]	396[2]	-	663	294	957	*
2000	4	241	413[2]	-	658	256	914	*
2001	19	224	407[2]	-	650	419	1069	*
2002	33	198	309[2]		540	568	1108	*
2003	1	147	237[2]	1	405	673	1078	*
2004[1]	7	NA	171[2]	-	178	823	1001	*

[1]Provisional.
[2]UK total reported.
[3]Unestimated from combined 7d+7e landings.
*Totally revised to include additional unallocated landings from 1986 inclusive.

Table1.4.14.2 Sole in Division VIIe (Western Channel).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-7
1969	1651	2897	353	0.132
1970	4089	3190	391	0.134
1971	3031	2926	432	0.156
1972	2680	2901	437	0.119
1973	3637	3516	459	0.157
1974	3403	3450	427	0.138
1975	3183	4450	491	0.131
1976	7278	4488	616	0.162
1977	5110	4582	606	0.146
1978	4714	5077	861	0.190
1979	5145	5529	1181	0.234
1980	8877	5415	1269	0.211
1981	5121	4936	1215	0.258
1982	4138	4866	1446	0.304
1983	6538	4782	1498	0.355
1984	7735	4675	1370	0.328
1985	4187	4050	1409	0.375
1986	6383	3908	1419	0.354
1987	4147	3942	1280	0.311
1988	4062	3794	1444	0.363
1989	3106	3282	1390	0.452
1990	7769	3094	1315	0.408
1991	4310	2810	852	0.287
1992	3795	2694	895	0.268
1993	2561	2688	904	0.341
1994	3603	2980	800	0.258
1995	4309	3028	856	0.312
1996	3597	2866	833	0.262
1997	4718	2721	949	0.361
1998	3299	2730	880	0.334
1999	6308	2696	957	0.357
2000	4961	2619	914	0.329
2001	2876	2582	1069	0.416
2002	4547	2571	1108	0.461
2003	6802	2413	1078	0.403
2004	4282*	2134	1001	0.482
2005	4282*	2119		
Average	4601	3497	956	0.286

* GM 69-02.

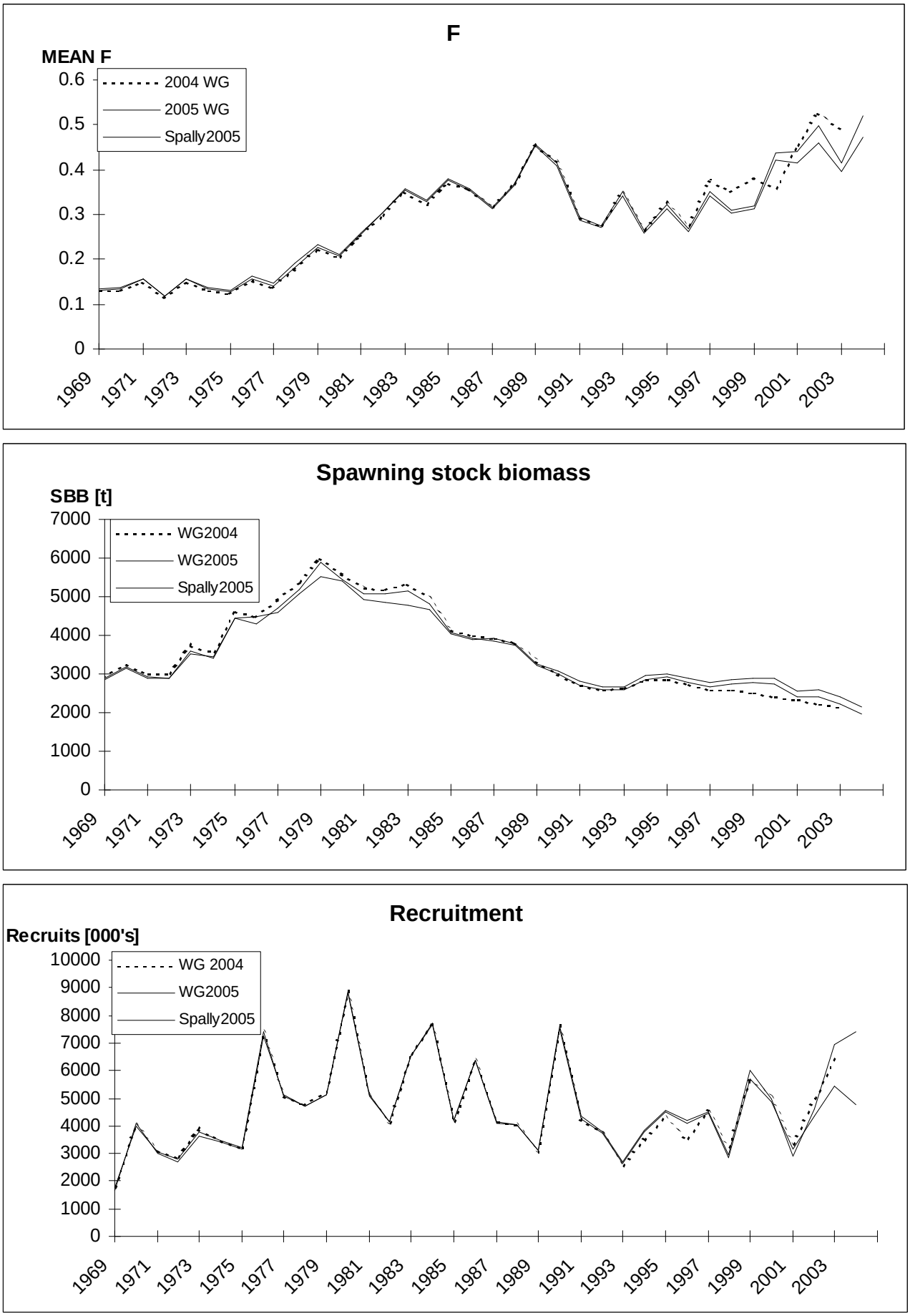


Figure 1.14.4.1 Sole in VIIe: Comparison between successive assessments.

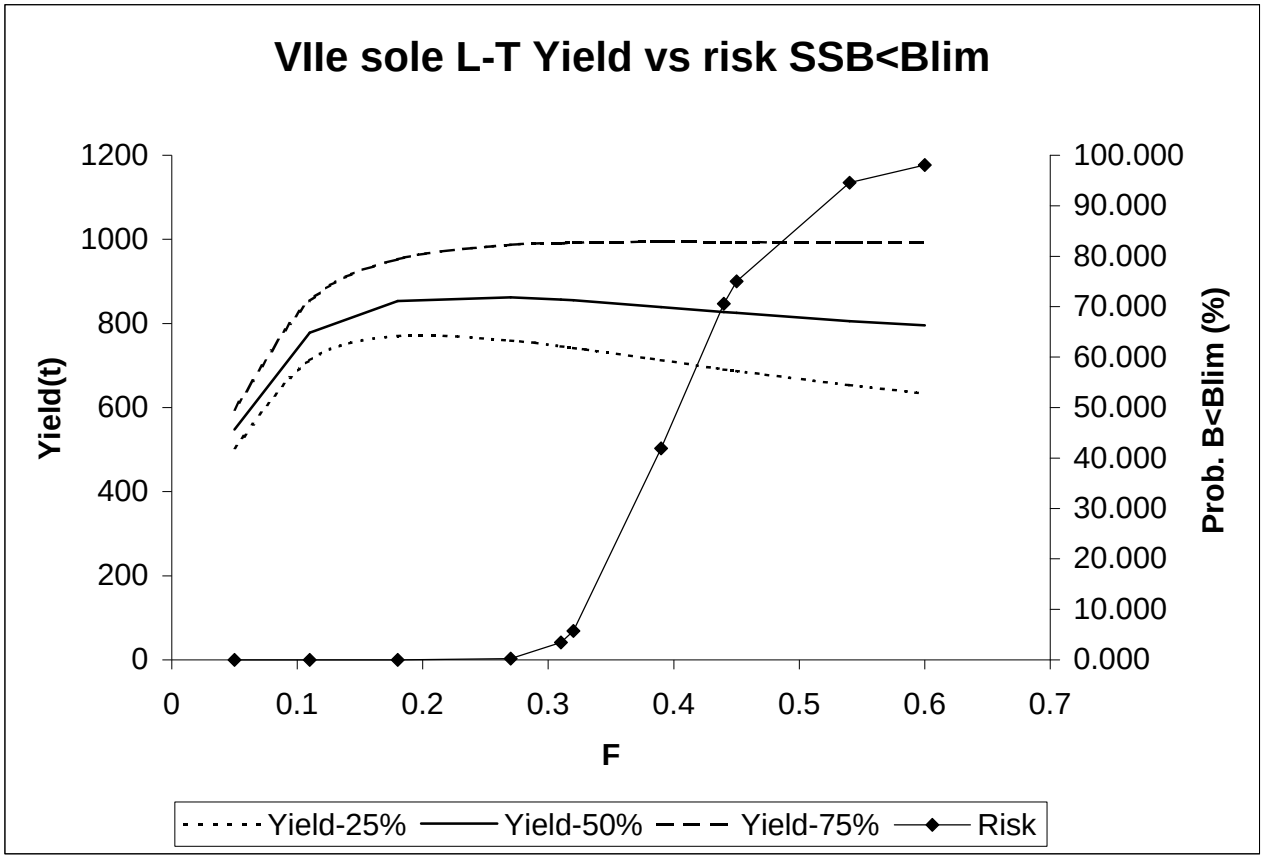


Figure 1.4.14.2 An exploration of potential long-term fishing mortality targets for Sole VIIe. Showing yield and risk in the long term (2034).

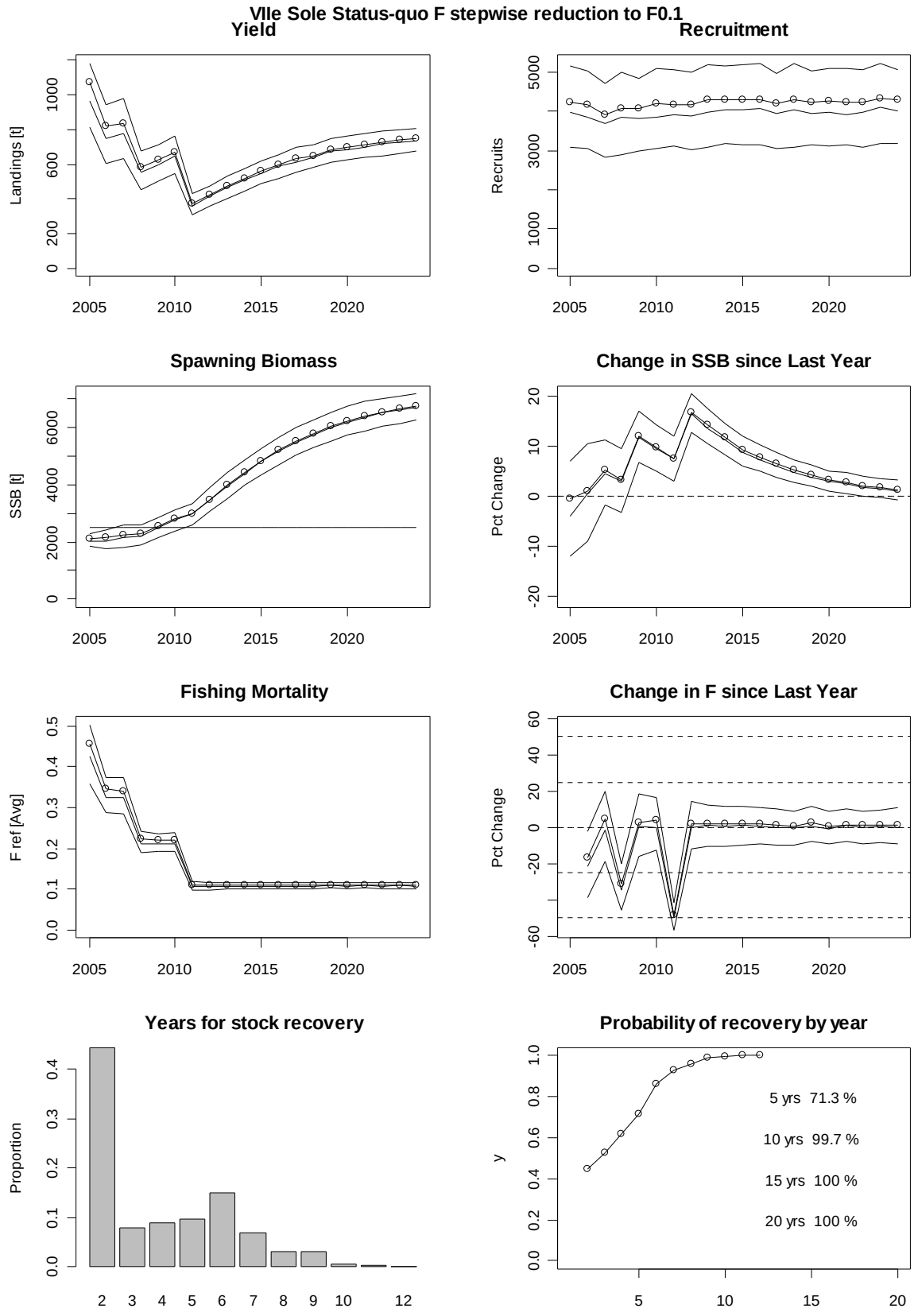


Figure 1.4.14.3 **CS5 HCR for VIIe Sole** : **stepwise reduction in F to $F_{0.1}$.**
[Year 1 = 0.45 ; Years 2–3 = 0.34; Years 4–6 = 0.22; Year 7 onwards = 0.11] ,
assuming R=GM=4282 when SSB> $\mathbf{B}_{lim}$ (2000 t).
Bottom right graph shows the probability of SSB being above $\mathbf{B}_{lim}$.

1.4.15 Irish Sea herring (Division VIIa)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Uncertain	Unknown	Uncertain		

Based on the most recent estimates of SSB and fishing mortality ICES classifies the state of the stock as uncertain. It seems likely that the stock has been relatively stable for the last 10 years, and that the fishing mortality does not appear to be increasing above the recent average. There are no recruitment indices for this stock.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is 6000 t	$\mathbf{B}_{pa}$ be set at 9 500 t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined
Target reference points	Not defined	Not defined

Yield and spawning biomass per Recruit
F-reference points

Reference point	F multiplier	Absolute F
$\overline{F}_{2-6}$		
F_{max}	undefined	
$F_{0.1}$		0.164
$F_{35\%SPR}$		0.139

Technical basis

$\mathbf{B}_{lim}$: lowest observed SSB	$\mathbf{B}_{pa}$: $\mathbf{B}_{lim}$ *1.58
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined

Single stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The TAC of 4 800 t which has been implemented in recent years is not expected to be detrimental to the stock.

Management considerations

Ecosystem considerations

Herring in this area may be an important food source for sea birds, sea mammals, and many piscivorous fish; however, that has not been investigated in this area.

Factors affecting the fisheries and the stock

Regulations and their effects

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 in the 1970s. A closed area exists to the east of the Isle of Man to protect the spawning aggregations.

Other factors

The stock identity is complex as the juveniles mix with those of the Celtic Sea and the adults migrate from the Irish Sea after spawning. The stock identity is being reviewed by an EU-funded project.

Scientific basis

Data and methods

The assessment of the stock relies on survey data. As time-series are becoming longer the assessment appears to be gaining in precision; however, the retrospective pattern is still noisy.

Separation of trawl catches of juveniles into autumn and winter spawning components, based on otolith microstructure and/or length composition, could result in acoustic and trawl survey indices of juveniles appropriate for the Irish Sea assessment.

Uncertainties in assessment and forecast

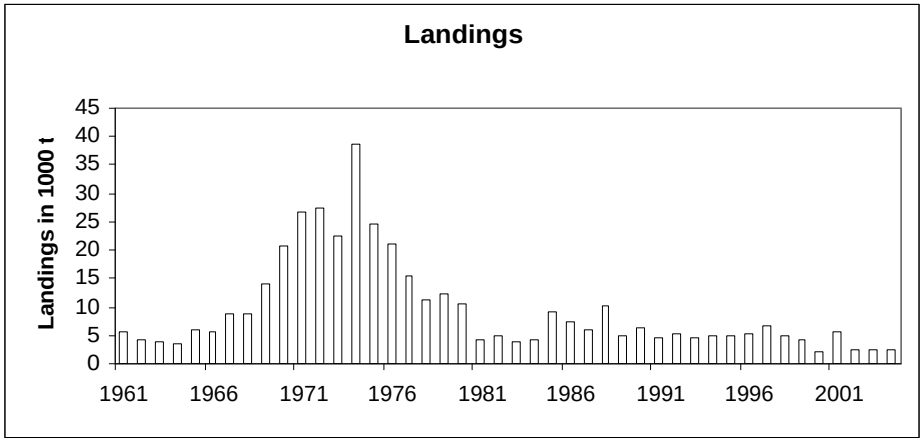
The assessment is not considered reliable with respect to recent F and SSB, but it is indicative of trends and levels in the past. Estimates of recent recruitments are based on catch and survey information. The current estimate of high 2004 recruitment is not reliable.

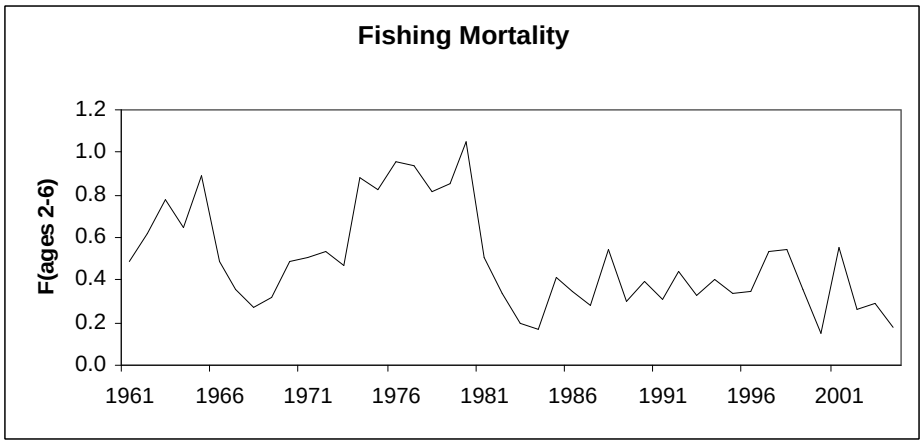
Source of information

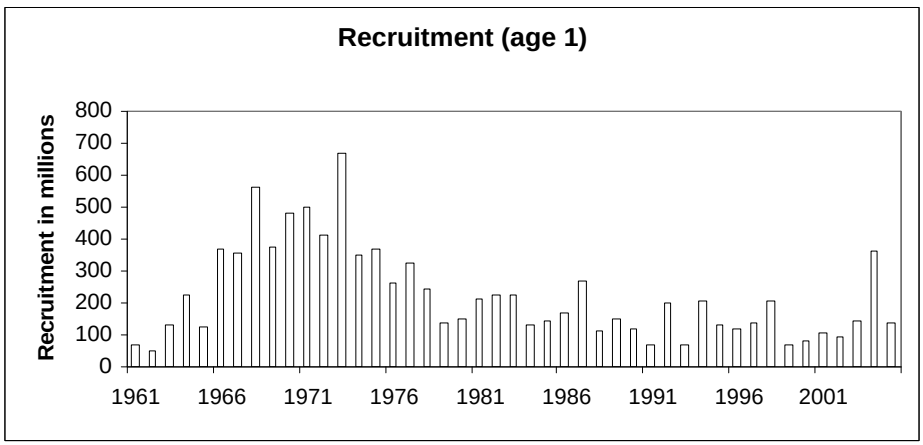
Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

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	2.0
2001	*Status quo* F= 0.26	5.1	6.9	5.5
2002	Average catch of 1996-2000	4.8	4.8	2.4
2003	2002 TAC	4.8	4.8	2.4
2004	Advice 2003 catch	4.8	4.8	2.5
2005	*Status quo* TAC	4.8	4.8	
2006	*Status quo* TAC	4.8		

Weights in ‘000 t.


Landings
Landings in 1000 t
45
40
35
30
25
20
15
10
5
0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Fishing Mortality
F(ages 2-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1961
1966
1971
1976
1981
1986
1991
1996
2001


Recruitment (age 1)
Recruitment in millions
800
700
600
500
400
300
200
100
0
1961
1966
1971
1976
1981
1986
1991
1996
2001

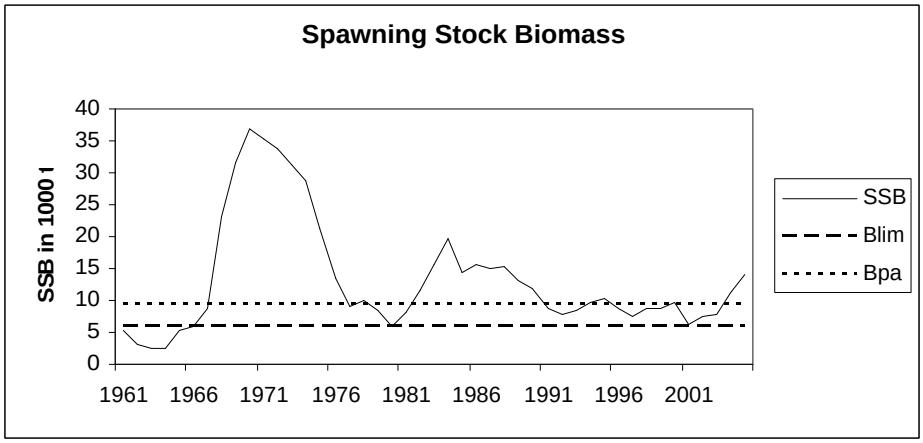

Spawning Stock Biomass
SSB in 1000 t
40
35
30
25
20
15
10
5
0
1961
1966
1971
1976
1981
1986
1991
1996
2001
SSB
Blim
Bpa

Table 1.4.15.1 Irish Sea Herring Division VIIa(N). Working group catch estimates in tonnes by country, 1987-2004. The total catch does not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995
Ireland	1,200	2,579	1,430	1,699	80	406	0	0	0
UK	3,290	7,593	3,532	4,613	4,318	4,864	4,408	4,828	5,076
Unallocated	1,333	-	-	-	-	-	-	-	-
Total	5,823	10,172	4,962	6,312	4,398	5,270	4,408	4,828	5,076

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004
Ireland	100	0	0	0	0	862	286	0	749
UK	5,180	6,651	4,905	4,127	2,002	4,599	2,107	2,399	1782
Unallocated	22	-	-	-	-	-		-	-
Total	5,302	6,651	4,905	4,127	2,002	5,461	2,393	2,399	2531

1.4.16 Celtic Sea and Division VIIj herring

State of stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Uncertain, but likely at risk of reduced reproductive capacity	unknown	unknown		

The current estimate of SSB is very uncertain but suggests that SSB may be below $\mathbf{B}_{pa}$, and may even be below $\mathbf{B}_{lim}$. Recent recruitment is weak, particularly of the 2001/2002 year class. Current fishing mortality is very uncertain and may be very high.

Management objectives

The Irish Southwest Pelagic Management Committee was established to manage the Irish fishery for this herring stock. This Committee manages the Irish quota and implements measures in addition to the EU regulations. The Committee has the following objectives:

- To build the stock to 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.
- To introduce measures to prevent landings of small and juvenile herring, including closed areas and/or appropriate time closures.
- To ensure that all landings of herring should contain at least 50% of individual fish above 23 cm.
- To maintain, and if necessary expand the spawning box closures in time and area.
- To ensure that adequate scientific resources are available to assess the state of the stock.
- To participate in the collection of data and to play an active part in the stock assessment procedure.

Reference points

	ICES considers that:	**ICES proposed that:**
Precautionary Approach reference points	$\mathbf{B}_{lim}$ 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

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The current level of SSB is uncertain, but may be below $\mathbf{B}_{pa}$ and possibly even below $\mathbf{B}_{lim}$. There is no short-term forecast on which to base catch advice for 2006. However, given the risk to the stock indicated by weak recent recruitment, exploitation should be significantly reduced in 2006. Such a reduction should include a further reduction on recent catch levels, i.e. 6 700 t corresponding to 60% of the average catch in 2002–2004. Furthermore, supplementary measures should put in place to reduce exploitation. Such measures could include the re-closure of the eastern section of the Celtic sea (i.e. East of Mine Head). ICES considers that this would be an effective measure to reduce exploitation as most of the herring catches have been taken in this area since the voluntary closure was removed in December 2003.

Management considerations

Though the state of the stock is uncertain, SSB is considered to be at a relatively low level. In addition there are indications that the most recent recruitment is weak. Given the age structure of the population and the current uncertainty, ICES considers that there is a high risk for reduced stock productivity.

Factors affecting the fisheries and the stock

Box closure

The area east of Mine Head was closed from 2001 to December 2003. This closure may have afforded protection to recruiting "first-time spawners" over this period. The strongest year class to enter the fishery in recent years was that which spawned for the first time in 2001/2002. This cohort was dominant in catches from the closed area, when this area was re-opened in 2003. It has subsequently dominated catches throughout the Celtic Sea (though not in Division VIIj).

Changes in fishing technology and fishing patterns

The number of vessels targeting this stock has been static at around 20 for the last two seasons. The Irish Southwest Pelagic Management Committee has introduced measures that have changed the pattern of the fishery. For the past two seasons an increasing proportion of the catch was taken during the summer. The summer fishery is restricted to refrigerated sea water vessels (RSW) and is conducted offshore. The remainder of the fishing is on inshore spawning grounds.

The environment

This stock is at the southern limit of species distribution. The mean sea surface temperature in the Celtic Sea has increased over the past three decades, and this may negatively affect the productivity of this stock.

Recruitment to the Celtic Sea may be affected by larvae drift into the Irish Sea.

Scientific basis

Data and methods

The current management regime has resulted in catch data which are thought reasonably reliable.

Assessment period and TAC

Celtic Sea and Division VIIj herring are assessed on a seasonal basis, the 1st April to the 31st March, while TACs are set by the calendar year.

Information from the fishing industry

The industry, through the Irish Southwest Pelagic Management Committee, has provided information and biological samples. Fishing was concentrated in Divisions VIIa south and VIIg. Landings from Division VIIj were comparatively few and the abundance of fish in this area has been lower than previously.

The industry points out that it has taken measures to avoid catches of small first-time spawning fish (<23 cm). The industry is concerned that this measure may be leading to the perception that the abundance of these fish is low. However, ICES notes that the low abundance of these fish in 2003 catches has been confirmed by relatively low abundances as age 2 in 2004.

Uncertainties in assessment and forecast

A tentative assessment and forecast was undertaken in 2005, but the results display a poor model fit. Hence, the level of SSB and F in the most recent year is therefore very uncertain. However, it is clear that there are low abundances of older fish both in the catches and the population. Also, it is clear that SSB has declined since the mid-1990s. In addition, the marked absence of 2-year-old fish is confirmed by the acoustic survey and other fishery independent data. In a fishery that is based on only a few age classes, this is a cause for concern as there may be a high risk to the reproductive capacity of the stock from such a series of events.

Comparison with previous assessment and advice

The perception of the stock status this year is influenced by the new perception of poor recruitment, and the advice for 2005 reflects this.

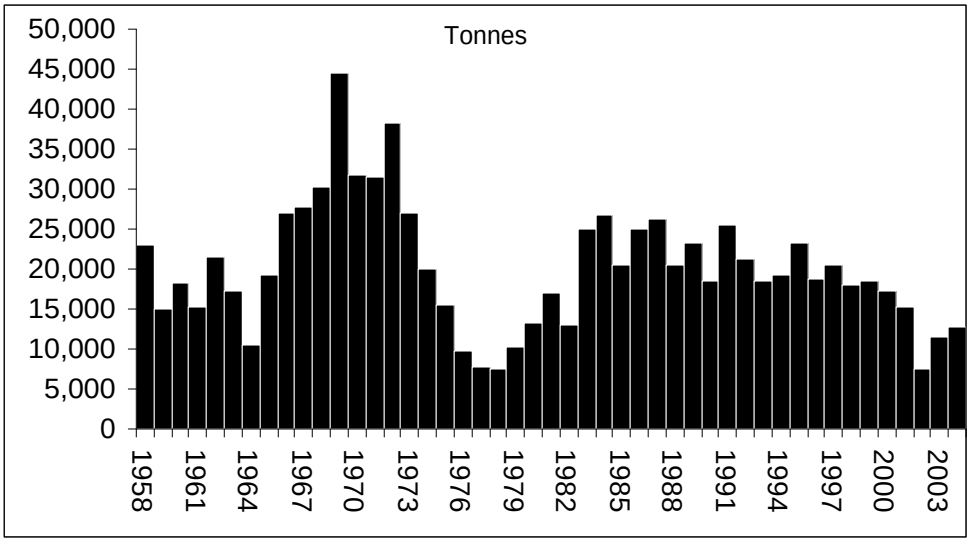
Source of information

Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

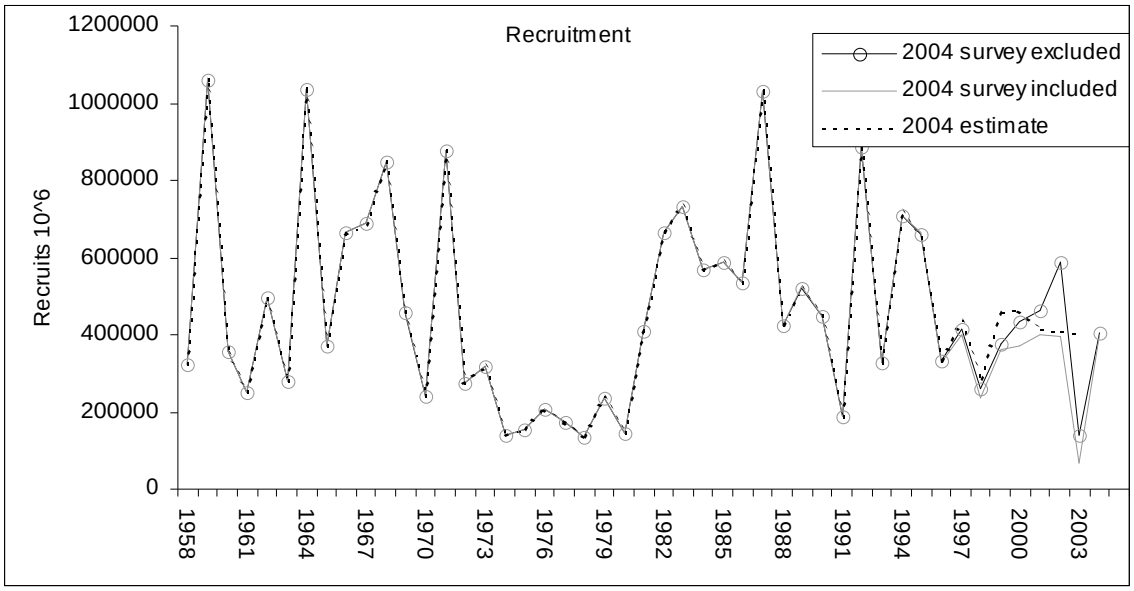
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Official Landings	Discards	ACFM Catch[1]
1987	Precautionary TAC	18	18	18	4.2	27.3
1988	TAC	13	18	17	2.4	19.2
1989	TAC	20	20	18	3.5	22.7
1990	TAC	15	17.5	17	2.5	20.2
1991	TAC (TAC excluding discards)	15 (12.5)	21	21	1.9	23.6
1992	TAC	27	21	19	2.1	23
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
1996	TAC	9.8	16.5 – 21[2]	21	3	21.8
1997	If required, precautionary TAC	< 25	22	20.7	0.7	18.8
1998	Catches below 25	< 25	22	20.5	0	20.3
1999	F = 0.4	19	21	19.4	0	18.1
2000	F < 0.3	20	21	18.8	0	18.3
2001	F < 0.34	17.9	20	17.8	0	17.7
2002	F<0.35	11	11	11.3	0	10.5
2003	Substantially less than recent catches	-	13	13	0	12
2004	60% of average catch 1997–2000	11	13	11	-	11
2005	60% of average catch 1997–2000	11	13			
2006	Further reduction 60% avg catch 2002–2004	6.7				

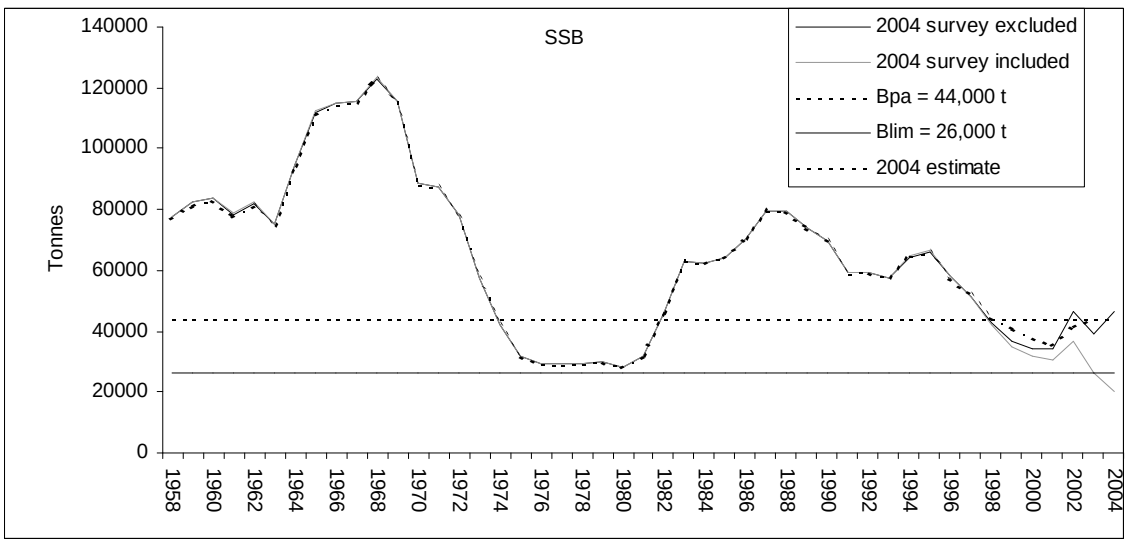
Weights in '000 t.
[1]By calendar year. [2]Revised during 1996 after ACFM May meeting.

Celtic Sea and Division VIIj Herring



ACFM estimates of landings by season.


Recruitment
2004 survey excluded
2004 survey included
2004 estimate
Recruits 10^6
1200000
1000000
800000
600000
400000
200000
0
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003


SSB
2004 survey excluded
2004 survey included
Bpa = 44,000 t
Blim = 26,000 t
2004 estimate
Tonnes
140000
120000
100000
80000
60000
40000
20000
0
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

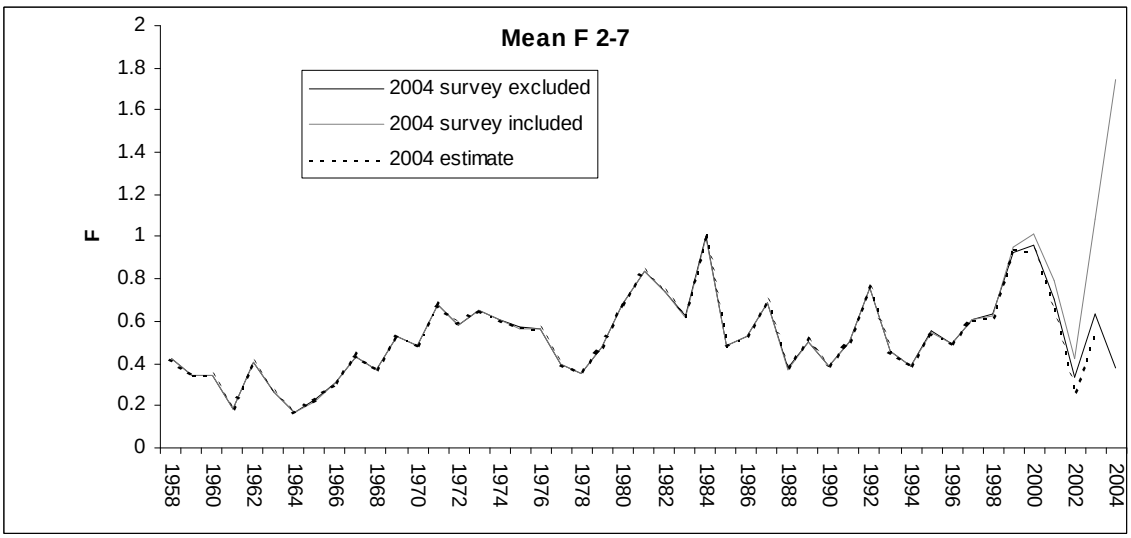

Mean F 2-7
2004 survey excluded
2004 survey included
2004 estimate
F
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

Table 1.4.16.1 Celtic Sea and Division VIIj herring landings by calendar year (t), 1988–2004 (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	-	20,300
1999		200	17,900	1300	+	-1300	-	18,100
2000	573	228	18,038	44	1	-617	-	18,267
2001	1,359	219	17,729	-	-	-1578	-	17,729
2002	734	-	10,550	257	-	-991	-	10,550
2003	800	-	10,875	692	14	-1,506	-	10,875
2004	801	41	11,024	-	-	-801	-	11,065

Table 1.4.16.2 Celtic Sea & Division VIIj herring landings (t) by season (1 April–31 March) 1988/1989-2002/2004 (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	3,60(	23,100
1990/1991	+	-	15,000	1,000	200	70(	1,700	18,600
1991/1992	500	10(	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	20(	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	-	20,500
1998/1999	+	-	17,700	1,200	-	-700	-	18,200
1999/2000		200	18,300	1300	+	-1300	-	18,500
2000/2001	573	22(	16,962	44	1	-617	-	17,191
2001/2002	-	-	15,236	-	-	-	-	15,236
2002/2003	734	-	7,465	257	-	-991	-	7,465
2003/2004	800	-	11,536	610	14	-1,424		11,536
2004/2005	801	41	12,702	-	-	-801	-	12,743

1.4.17 Herring in Divisions VIa (South) and VIIb,c

State of stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown, but likely at risk of reduced reproductive capacity	unknown	unknown		

The results of a tentative assessment suggest that the sharp decline in SSB may have stopped. The current level of SSB is uncertain, but below $\mathbf{B}_{pa}$. There is no evidence that large year classes have recruited to the stock in recent years and F appears to have been reduced due to the reduction in catch.

Management objectives

The Irish Northwest Pelagic Management Committee manages the Irish fishery for this stock. In recent years, Ireland has taken almost all the catch. The Committee has the following objectives:

- To rebuild this stock to above the $\mathbf{B}_{pa}$ level of 110 000 t.
- In the event of the stock remaining below this level, additional conservation measures will need to be implemented.
- 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.
- Implement a closed season from March to October.
- Regulate effort further through boat quotas allocated on a weekly basis in the open season.

The plan appears to be effective at constraining catches to not exceed the TAC and at providing reliable catch data, but it is uncertain if the current catch limitations are sufficient to rebuild the stock.

Reference points (changed in 1999)

	ICES considers that:	**ICES proposed that:**
Precautionary Approach reference points	$\mathbf{B}_{lim}$ 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)

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Catches should not be allowed to increase from the recent average levels of 14 000 t, until there is clear evidence that SSB has been rebuilt to be above $\mathbf{B}_{pa}$.

Management considerations

The management of the Irish fishery (which takes most of the catch) has improved in recent years and catches have been considerably reduced since 1999. The reduced catches over this period have resulted in a reduction in fishing mortality, although it is not possible to be precise about the current levels.
The sharp decline in SSB may have stopped. Though the peak in SSB in the 1980s may have been an isolated event, ICES suggests that this stock should be exploited with caution, particularly as the current state of the stock is uncertain. F appears to have been substantially reduced since 1998, but may still be high. Though little information on recruitment is available, it is unlikely that it is above average. Certainly, every effort should be made to maintain catches at or below the current level. In particular ICES recognized that strict enforcement of catch quotas is necessary.

Factors affecting the fisheries and the stock:

Regulations and their effects

Changes in the management of this stock have changed how the fishery is prosecuted in space and time.

Changes in fishing technology and fishing patterns

The pattern of this fishery has changed over time. In the early part of the 20th century the main fisheries were in winter on spawning grounds in VIa south (off Co. Donegal). In the 1970s and 1980s the main fishery was earlier (in autumn) and further south in VIIb (along west Connacht, and in Counties Galway and Mayo). More recently the distribution of catches has shifted northwards again and the grounds in VIa south have become more important. Remaining fishing grounds in Division VIIb are concentrated near the boundary to Division VIa south (between Clew Bay and Killala).

Other factors

The fishery exploits a mixture of autumn- and winter/spring-spawning fish. The winter/spring-spawning component is distributed in the northern part of the area. The main decline in the stock appears to have taken place on the autumn-spawning component.

Scientific basis

There are essentially two fleets exploiting this stock, the smaller dry-hold vessels tend to target the stock more than the larger boats. Although ICES notes that increased accuracy in the catch data over the past 3 years gives a greater confidence in the perception of stock development, it will be necessary to collect biological data from each fleet, in order to refine the information from catch-at-age data. In order to obtain a proper assessment of this stock for the most recent years, reliable survey data are required.

Data and methods

Recent changes to the management of the fisheries on this stock are likely to have 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, in addition to consistent data a tuning index is needed before it will be possible to produce reliable estimates of final year SSB and review the appropriateness of the reference points.

Information from the fishing industry

Information from the dedicated component of the fleet indicates that in 2004 herring fishing in this area was the best in many years in terms of the availability of the fish aggregations. Catches have been good and fish were easily located. Fishing on the traditional inshore spawning grounds around Mayo and Donegal performed very well. The autumn roe fishery in particular was reported to be very strong in 2004 with large marks of fish encountered in traditional grounds

off Mayo. There were also strong aggregations of fish along and north of the line dividing this area from Division VIaN.

Uncertainties in assessment and forecast

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, but general trends in stock development are similar over a range of F values, using the same choice of terminal F. Tuning indices are necessary to gain precision in estimates.

Environment conditions

Herring catch data were analysed in relation to oceanographic variation. Long-term trends in herring catches showed herring abundance decreasing with a warming of the sea surface temperature in the 1930s–1940s. Short-term fluctuations of catches are believed to reflect real fluctuations in herring abundance on a cycle of about 10 years and were correlated with (ICES CM 2005/G:06):

- Salinity in western approaches, especially in the two winter quarters with a lag period of 3 years;
- Sea surface temperature on the shelf and west of the shelf, especially in November, December, and January with a lag period of 3–4 years. Although herring correlated negatively to temperature in the long term, short-term variations were positively correlated.

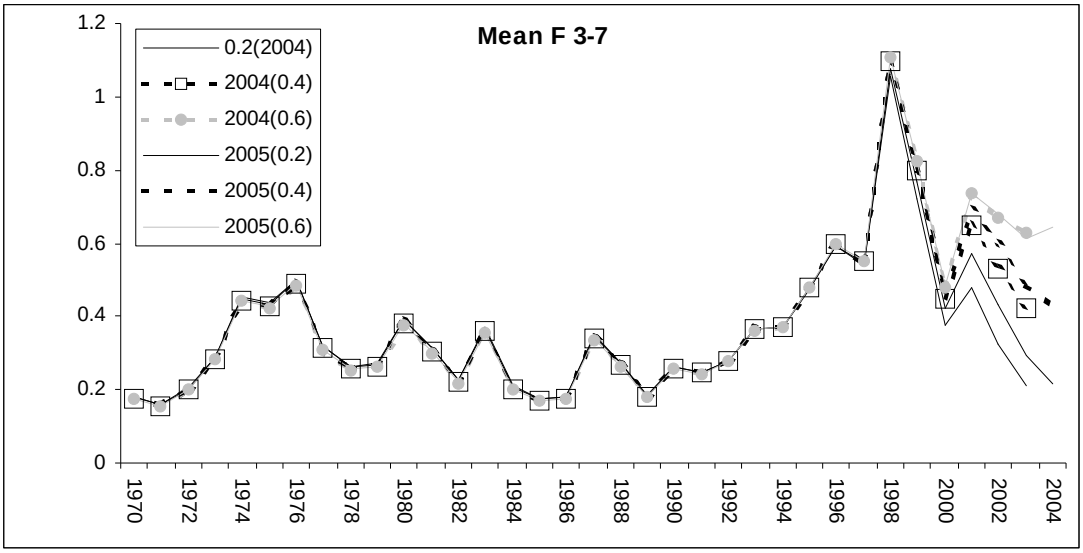
Comparison with previous assessment and advice

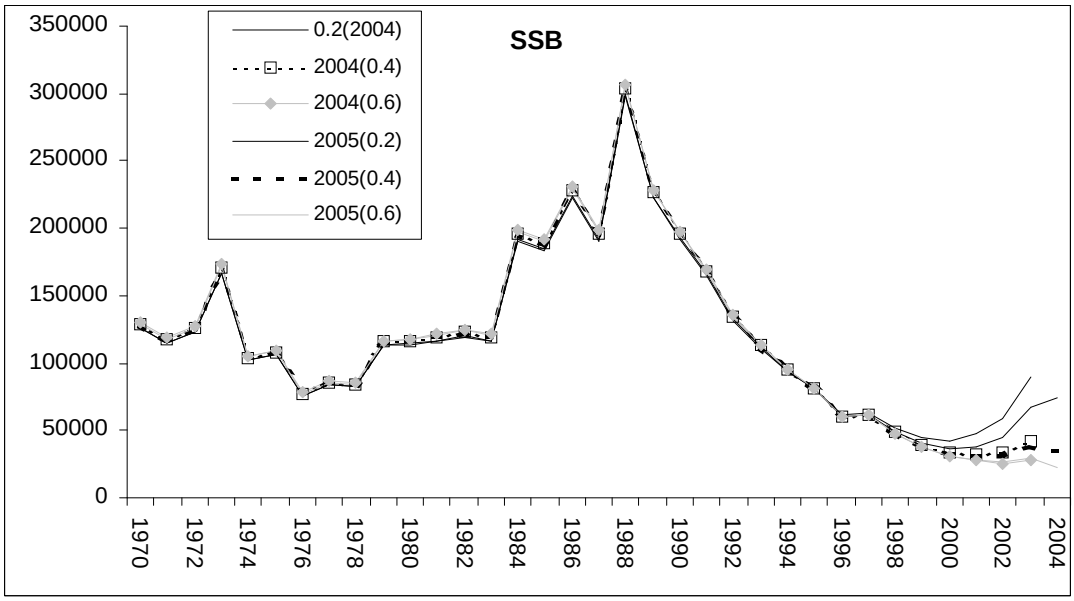
The assessment reviewed in 2004 was considered to be illustrative of trends only. It does not give a substantial change in perception compared to last year, with F and SSB in the same range.

Source of information

Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

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	14	-	13.6
2003	No increase in catches	14	14	14	-	14
2004	No increase in catches	14	14	11	-	12
2005	No increase in catches	14	14			
2006	No increase in catches	14				


Mean F 3-7
0.2(2004)
2004(0.4)
2004(0.6)
2005(0.2)
2005(0.4)
2005(0.6)
1.2
1
0.8
0.6
0.4
0.2
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004


SSB
0.2(2004)
2004(0.4)
2004(0.6)
2005(0.2)
2005(0.4)
2005(0.6)
350000
300000
250000
200000
150000
100000
50000
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

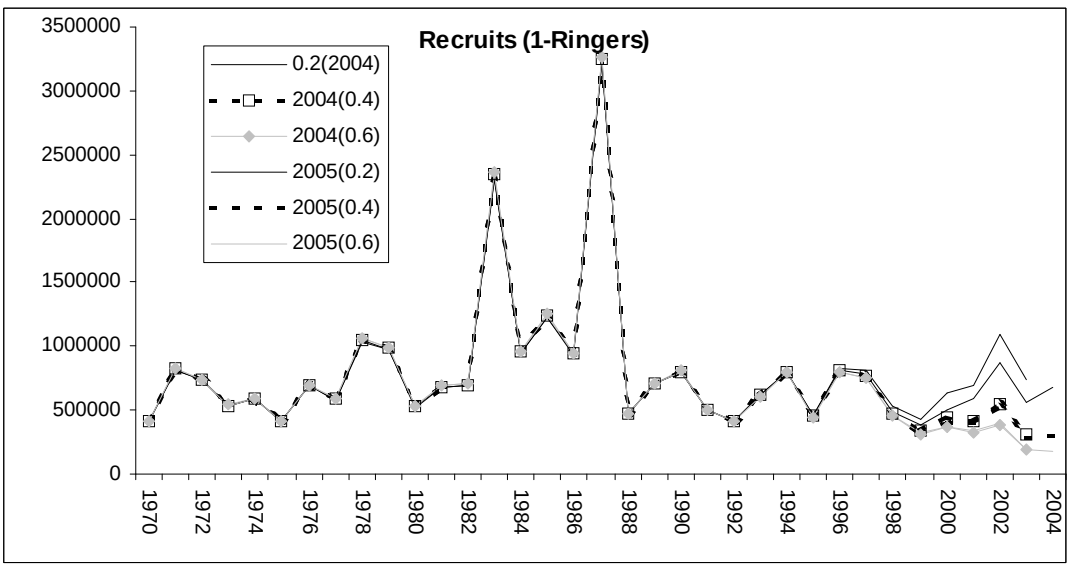

Recruits (1-Ringers)
0.2(2004)
2004(0.4)
2004(0.6)
2005(0.2)
2005(0.4)
2005(0.6)
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004

Table 1.4.17.1 Herring in Divisions VIa(S) & VIIb,c. Estimated Herring catches in tonnes, 1988–2004. 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	2002	2003	2004
France	-	-	+	-	-	-	-	-	-	-	-	-	-	-	515	-	-
Germany, Fed.Rep.	-	-	-	-	250	-	-	11	-	-	-	-	-	-	-	-	-
Ireland	15,000	18,200	25,000	22,500	26,000	27,600	24,400	25,450	23,800	24,400	25,200	16,325	10,164	11,278	13,072	12,921	10,950
Netherlands	300	2,900	2,533	600	900	2,500	2,500	1,207	1,800	3,400	2,500	1,868	1,234	2,088	366	-	64
UK (N.Ireland)	-	-	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UK (England + Wales)	-	-	-	-	-	-	50	24	-	-	-	-	-	-	-	-	-
UK Scotland	-	+	-	+	-	200	-	-	-	-	-	-	-	-	-	-	-
Unallocated	13,800	7,100	13,826	11,200	4,600	6,250	6,250	1,100	6,900	-700	11,200	7,916	3,607	695	366	-	1,375
Total landings	29,100	28,200	41,439	34,300	31,750	36,550	33,200	27,792	32,500	27,100	38,900	26,109	15,005	14,060	13,587	12,921	12,289
Discards	-	1,000	2,530	3,400	100	250	700	-	-	50	-	-	-	-	-	-	-
Total catch	29,100	29,200	43,969	37,700	31,850	36,800	33,900	27,792	32,500	27,150	38,900	26,109	15,005	14,060	13,587	12,921	12,289

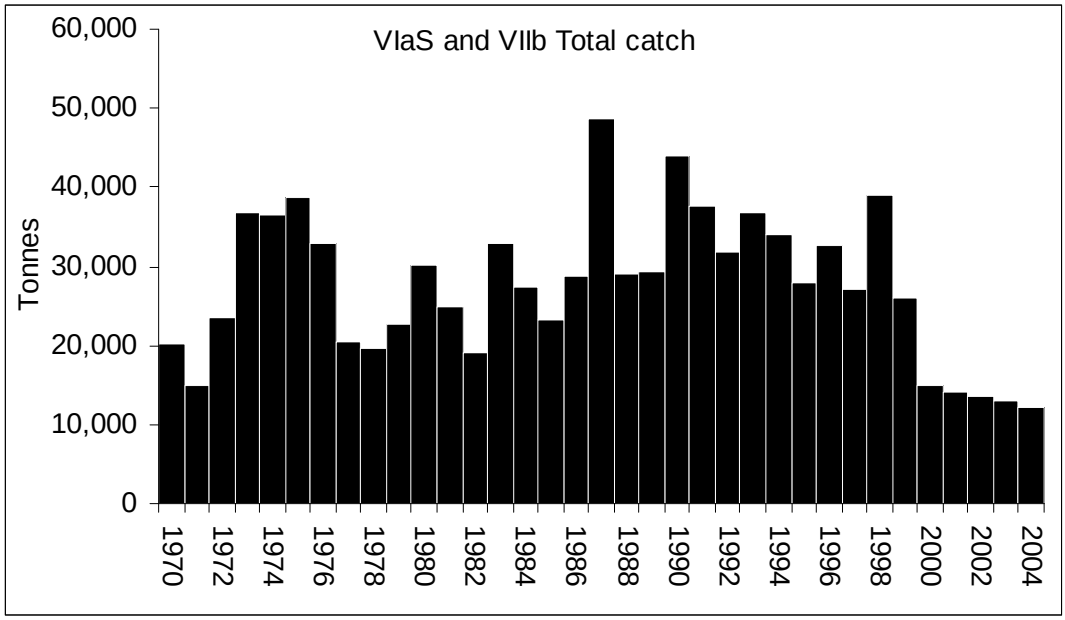


Figure 1.4.17.1 Herring in Divisions VIa (South) and VIIb,c. Landings in tonnes.

1.4.18 Sprat in Divisions VIId,e

State of the stock

The state of the stock is not known as available data are insufficient to carry out an assessment.

Management objectives

There are no explicit management objectives for this stock.

Reference points

Reference points for this stock have not been defined.

Management considerations

Sprat catches are very low and are mainly taken in the second half of the year by the Lyme Bay sprat fishery. The catch has decreased and was 836 t in 2004, being the lowest of the whole time-series.

Ecosystem considerations

There are indications that there may be interactions between herring and sprat biomass. The current situation is unclear and is further complicated by the increasing presence of sardine and anchovy in the area.

Scientific basis

Data and methods

Available data are insufficient to carry out an assessment.

Source of information:

Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

	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	1.2
2003	No advice	-	9.6	1.4
2004	No advice	-	9.6	0.8
2005	No advice	-	7.7	
2006	No advice	-		

Weights in ‘000 tonnes.

Table 1.4.18.1 Sprat in Division VIId,e.

Year	Landings
	tonnes
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
2002	1196
2003	1377
2004	836
Average	2252

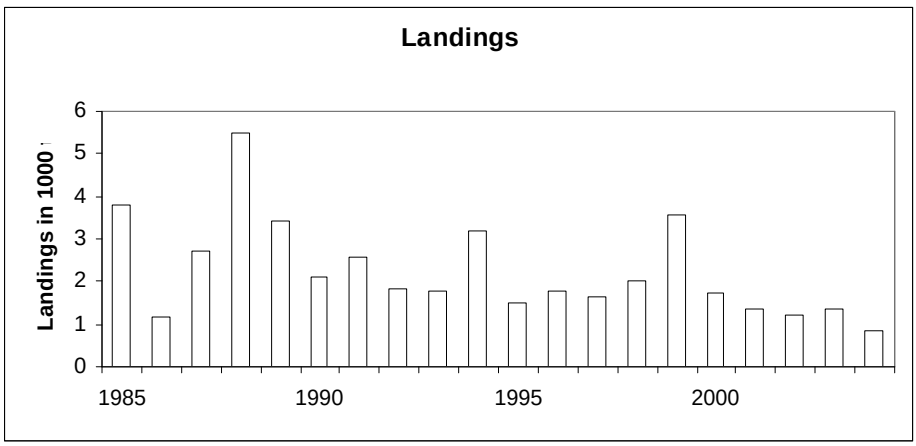


Figure 1.4.18.1 Sprat landings (‘000 t) from Divisions VIId and VIIe,f in the period from 1985 to 2004.

1.4.19 Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIc-k and VIIIa,b,d

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Increased risk	Overexploited	Unknown	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and at risk of being harvested unsustainably.

SSB has been above $\mathbf{B}_{pa}$ since 1994. The fishing mortality has been around $\mathbf{F}_{pa}$ in the 1990s, and appears to have increased since. The 2001 year class is estimated to be strong.

Management objectives

There are no specific management objectives for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ be set at 55 000 t.
	$\mathbf{F}_{lim}$ is 0.44.	$\mathbf{F}_{pa}$ be set at 0.30.
Target reference points		$\mathbf{F}_{y}$ is not defined.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-6	Yield/R	SSB/R
Average last 3 years	0.399	0.061	0.193
$\mathbf{F}_{max}$	0.229	0.064	0.334
$\mathbf{F}_{0.1}$	0.139	0.061	0.515
$\mathbf{F}_{med}$	0.311	0.063	0.247

Technical basis:

Blim = Not defined	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$. 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
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$	$\mathbf{F}_{pa} = \mathbf{F}_{med}$; this implies a less than 45% probability that ($SSB_{MT} < \mathbf{B}_{pa}$)

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality ($\mathbf{F}_{sq}$) is estimated as 0.39, which is above rates that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.16). Fishing at $\mathbf{F}_{max}$ is expected to lead to high long-term landings and SSB.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits fishing mortality should be below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$. A recommended 23% reduction in F is needed to achieve a fishing mortality at $\mathbf{F}_{pa}$ (0.30). This corresponds to landings of less than 13 600 tonnes in 2006. The predicted SSB is well above $\mathbf{B}_{pa}$ if F is below $\mathbf{F}_{pa}$.

Short-term implications

Outlook for 2006

Basis: $\mathbf{F}_{sq}$ =mean F(02-04)=0.4; R04-05 = GM 1987-2002=262 millions; landings (2005) = 17.8; SSB(2006) = 58.8.
The fishing mortality applied according to the agreed management plan (F(management plan)) is not defined.
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.3.

Rationale	Landings (2006)	Basis	F total (2006)	F HCons (2006)	F disc (2006)	Disc (2006)	Catch (2006)	SSB (2007)	%SSB change 1)	%TAC change 2)
Zero catch	0.0	F=0	0.00	0.00	0.00	0.0	0.0	79.9	36%	-100%
High long-term yield	8.1	F(long-term yield)	0.17	0.13	0.04	1.1	9.1	68.8	17%	-62%
Status quo	2.1	$\mathbf{F}_{sq}$ *0.1	0.04	0.03	0.01	0.3	2.4	77.0	31%	-90%
	4.1	$\mathbf{F}_{sq}$ *0.2	0.08	0.06	0.02	0.5	4.6	74.3	26%	-81%
	9.6	$\mathbf{F}_{sq}$ *0.5	0.20	0.15	0.05	1.3	10.8	66.8	14%	-55%
	13.6	$\mathbf{F}_{sq}$ *0.75	0.30	0.23	0.07	1.8	15.4	61.3	4%	-37%
	15.8	$\mathbf{F}_{sq}$ *0.9	0.36	0.27	0.09	2.2	18.0	58.3	-1%	-26%
	17.2	$\mathbf{F}_{sq}$ *1	0.40	0.30	0.10	2.4	19.6	56.4	-4%	-20%
	18.5	$\mathbf{F}_{sq}$ *1.1	0.44	0.33	0.10	2.6	21.1	54.6	-7%	-14%
	20.4	$\mathbf{F}_{sq}$ *1.25	0.50	0.38	0.12	2.8	23.3	52.1	-11%	-5%
Precautionary limits	1.6	F(prec limits) *0.1	0.03	0.02	0.01	0.2	1.8	77.7	32%	-93%
	3.9	F(prec limits) *0.25	0.08	0.06	0.02	0.5	4.4	74.6	27%	-82%
	7.4	F(prec limits) *0.5	0.15	0.11	0.04	1.0	8.4	69.8	19%	-66%
	10.6	F(prec limits) *0.75	0.23	0.17	0.05	1.4	12.1	65.3	11%	-51%
	12.5	F(prec limits) *0.9	0.27	0.21	0.06	1.7	14.1	62.8	7%	-42%
	13.6	$\mathbf{F}_{pa}$ = $\mathbf{F}_{sq}$ *0.75	0.30	0.23	0.07	1.8	15.5	61.3	4%	-37%
	14.8	F(prec limits) *1.1	0.33	0.25	0.08	2.0	16.8	59.7	2%	-31%
	16.4	F(prec limits) *1.25	0.38	0.29	0.09	2.2	18.6	57.5	-2%	-24%
	18.9	F(prec limits) *1.5	0.45	0.34	0.11	2.6	21.5	54.1	-8%	-12%
	21.2	F(prec limits) *1.75	0.53	0.40	0.13	3.0	24.2	51.0	-13%	-1%
	23.4	F(prec limits) *2	0.60	0.46	0.14	3.3	26.7	48.1	-18%	9%
	25.4	F(prec limits) *2.25	0.68	0.51	0.16	3.6	29.0	45.4	-23%	18%

All weights in '000 tonnes.
The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long-term yield)) is 0.165.
Shaded scenarios are not considered consistent with the Precautionary Approach.
1) SSB 2007 relative to SSB 2006.
2) Predicted landings 2006 relative to TAC 2005 (21 500 t).

Management considerations

Megrim is caught in a mixed demersal fishery, both as a targeted fishery and as a valuable bycatch.

Technical measures applied to other species will affect the management of megrim. Management measures directed at the reduction of discards of megrim will have an effect on other target species (e.g. hake).

Factors affecting the fisheries and the stock

The effects of regulations

The 2005 TAC was set at 21 500 t, including a 5% contribution of *L. boscii* in the landings for which stock there is no assessment.

The minimum landing size of megrim was reduced from 25 to 20-cm length in 2000, partially explaining the observed decrease in discards in 2000–2002. Since then high-grading appears to have lead to an increase in discarding again.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Subareas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002). These measures appear not to have resulted in a decrease in fishing effort for fleets fishing for megrim.

Changes in fishing technology and fishing patterns

No significant changes in recent years.

Other factors

French trawlers operating in the Celtic Sea and targeting demersal species catch megrim as a bycatch. Spanish fleets have a targeted fishery for megrim and also catch megrim in mixed fisheries for hake, anglerfish, *Nephrops*, and other species. Otter trawlers account for the majority of the Spanish landings from Subarea VII. Most UK landings of megrim are made by beam trawlers fishing in ICES Divisions VIIe,f,g,h. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids, plaice, sole, and anglerfish.

Scientific basis

Data and methods

An age-based assessment (XSA) using landings and discards data, calibrated by three commercial CPUE series and two surveys was carried out. Incomplete discard estimates were used.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time-series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

Uncertainties in assessment and forecast

- Limited discards data are available in the time-series and filling in of the missing years is problematic because both discarding practices in the fisheries are variable over time.
- France has not provided the required catch-at-length, catch-at-age, and survey data for 2003 and 2004. This degraded the quality of the input data.
- The commercial CPUE data used to calibrate the assessment give conflicting signals.

Comparison with previous assessment and advice

In this year's assessment, there is a substantial upward revision of F and a downwards revision of SSB. This could be due to the conflicting signals in the CPUE series.

The advice this year, although consistent in principle with last year's advice, results in a substantial reduction in the advised catch. This is due to the more pessimistic view of the stock in the current assessment.

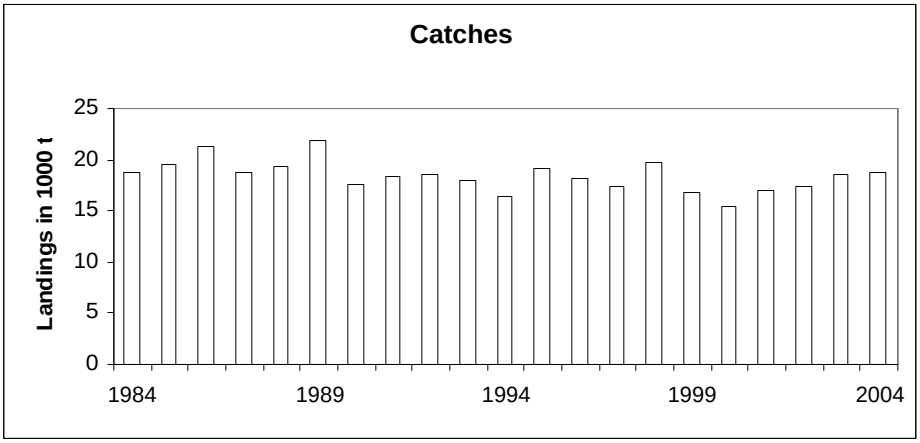
Source of information

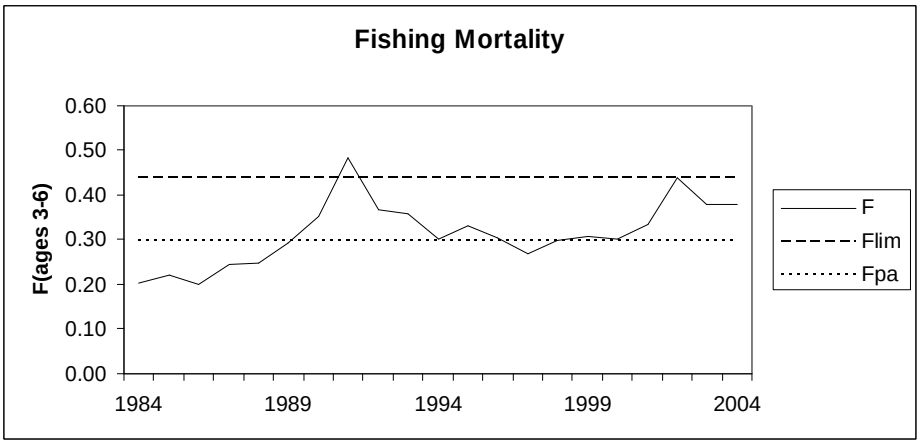
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ACFM:01).

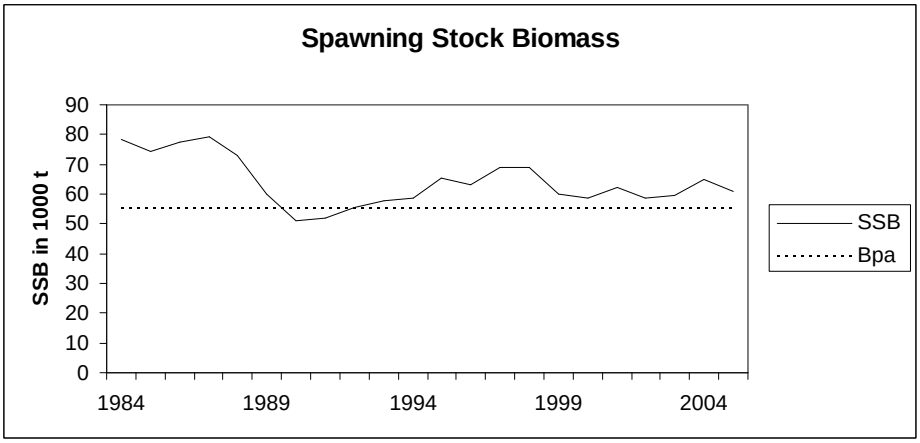
Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	ACFM Landings	Disc. slip.	ACFM Catch
1987	Not assessed		-		16.46	17.1	1.7	18.8
1988	Not assessed		-		18.1	17.6	1.7	19.3
1989	Not assessed		-		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		21.20	15.1	3.0	18.1
1997	No advice		14.3		25.0	14.3	3.1	17.3
1998	No increase in F		15.2		25.0	14.3	5.4	19.7
1999	Reduce F below $\mathbf{F}_{pa}$		14.6[1]		25.0	13.7	3.1	16.9
2000	Reduce F below $\mathbf{F}_{pa}$		<14.2[1]		20.0	15.0	2.3	17.3
2001	Reduce F below $\mathbf{F}_{pa}$		< 14.1[1]		16.8	15.8	1.3	17.1
2002	Reduce F below $\mathbf{F}_{pa}$		< 13.0[1]		14.9	15.9	1.5	17.4
2003	Reduce F below $\mathbf{F}_{pa}$		< 16.1[1]		16.0	15.6	3.1	18.8
2004	Reduce F below $\mathbf{F}_{pa}$		< 20.2[1]		20.2	14.3	4.5	18.8
2005	Reduce F below $\mathbf{F}_{pa}$		< 22.6[1]		21.5			
2006	Reduce F below $\mathbf{F}_{pa}$		<13.6					

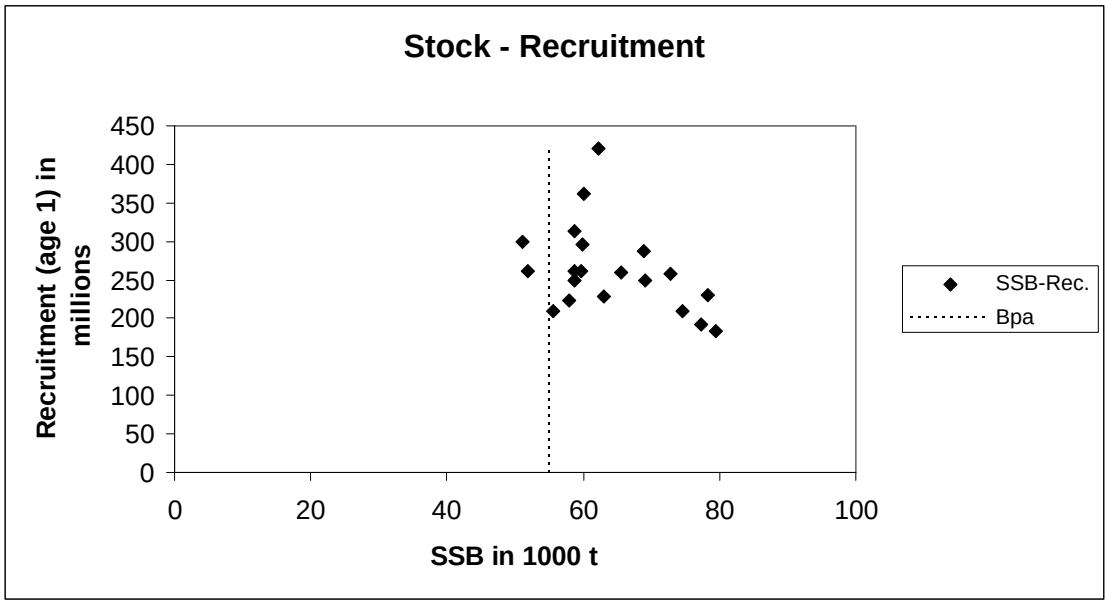
Weights in '000 t.
[1]Includes *L. boscii.*

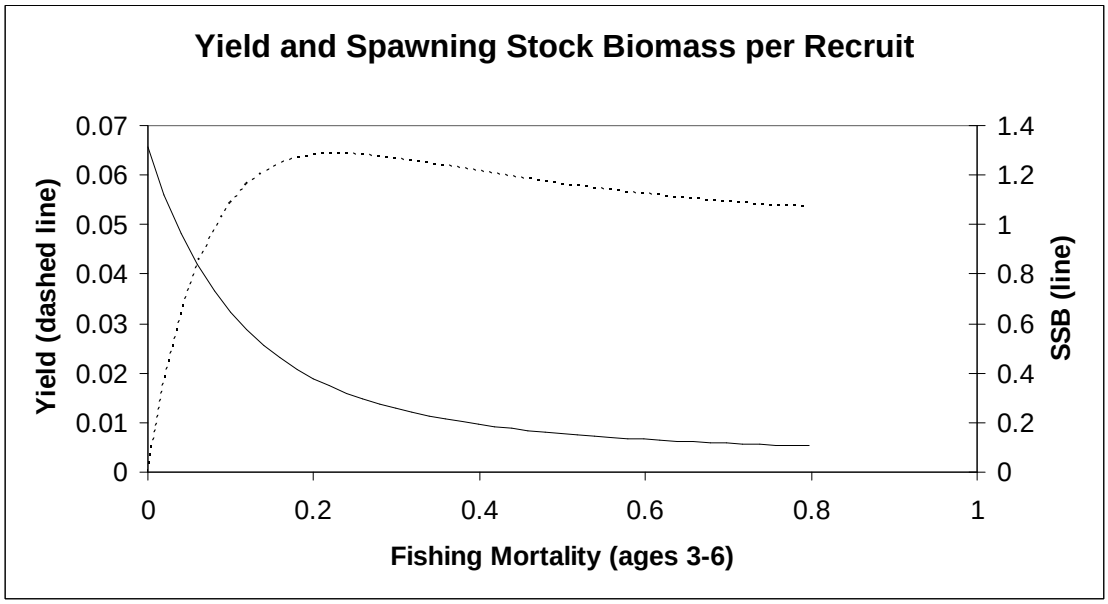
Megrim (*Whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d,e








Stock - Recruitment
Recruitment (age 1) in millions
450
400
350
300
250
200
150
100
50
0
0
20
40
60
80
100
SSB in 1000 t
SSB-Rec.
Bpa


Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
0.07
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
0.2
0.4
0.6
0.8
1
Fishing Mortality (ages 3-6)

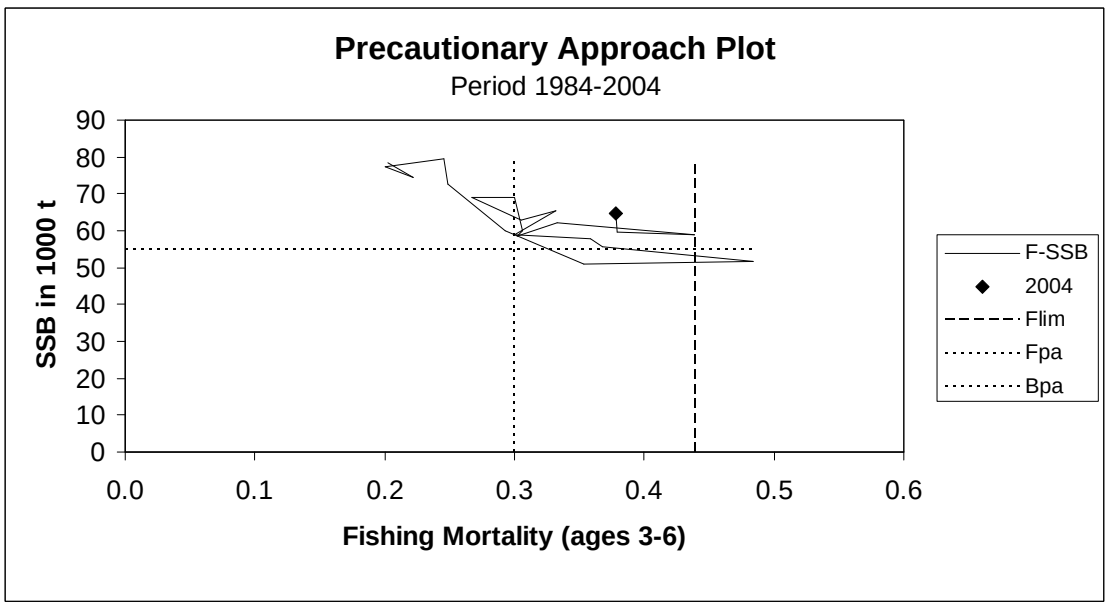

Precautionary Approach Plot
Period 1984-2004
SSB in 1000 t
90
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 3-6)
F-SSB
2004
Flim
Fpa
Bpa

Table 1.4.19.1 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total landings	18927	17114	17577	19233	14371	15094	15600	14929	13685	15862
Total discards	2321	1705	1725	2582	3284	3282	2988	3108	2700	3206
Total catches	21248	18819	19302	21815	17655	18376	18588	18037	16385	19068
Agreed TAC [1]		16460	18100	18100	18100	18100	18100	21460	20330	22590

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total landings	15109	14230	14345	13715	14485	15806	15988	15414	14300	
Total discards	3026	3066	5371	3135	1033	1275	1466	3147	4511	
Total catches	18135	17296	19716	16850	15517	17081	17454	18561	18811	
Agreed TAC [1]	21200	25000	25000	25000	20000	16800	14900	16000	20200	21500

[1] For both Megrim species and with catches from Division VIIa included.

Table 1.4.19.2 Megrim (*Whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d,e.

Year	Recruitment Age 1 thousands	SSB tonnes	Catches tonnes	Mean F Ages 3-6
1984	233931	78336	18828	0.2020
1985	229827	74488	19597	0.2219
1986	209480	77246	21248	0.2008
1987	192002	79363	18819	0.2460
1988	184033	72814	19302	0.2491
1989	257421	59964	21815	0.2923
1990	295330	51079	17655	0.3533
1991	299758	51846	18376	0.4843
1992	261476	55567	18588	0.3682
1993	209564	57915	18037	0.3586
1994	224132	58751	16385	0.3002
1995	249527	65577	19068	0.3317
1996	258823	62969	18135	0.3047
1997	228353	68934	17296	0.2674
1998	287011	69124	19716	0.2999
1999	249886	60070	16850	0.3064
2000	361635	58650	15517	0.3019
2001	313018	62150	17081	0.3333
2002	420561	58770	17454	0.4385
2003	262166*	59633	18561	0.3794
2004	262166*	64712	18811	0.3784
2005	262166*	61023		
Average	261467	64045	18435	0.3152

*GM 1992–2003.

1.4.20 Anglerfish in Divisions VIIb–k and VIIIa,b (*Lophius piscatorius and Lophius budegassa*)

State of the stock

L. piscatorius

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Increased risk	Overexploited	Unknown	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and being at risk of being harvested unsustainably.

L. budegassa

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	harvested sustainbly	Overexploited	Unknown	

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and being harvested sustainably.

SSB of both stocks decreased from 1986 until 1993, then increased up to 1995-1996 and at present are stable above $\mathbf{B}_{pa}$. For both stocks, fishing mortality in most years has been above $\mathbf{F}_{pa}$. In 2004 fishing mortality is estimated to be around $\mathbf{F}_{pa}$ for *L. budegassa* and *L. piscatorius*. Recent recruitments (1997-2002 year classes) for both species are above average.

Management objectives

There are no explicit management objectives for this stock.

Reference points

***L. piscatorius*:**

	ICES considers that:	ICES proposed that:
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is undefined	$\mathbf{B}_{pa}$ = 31 000 t.
	$\mathbf{F}_{lim}$ is 0.33	$\mathbf{F}_{pa}$ = 0.24
Target reference points		$\mathbf{F_y}$**:** not defined

Candidates for target reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F_{0.1}}$-$\mathbf{F_{max}}$.

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 3-8	Yield/R	SSB/R
Average last 3 years	0.243	0.853	2.042
Fmax	0.088	1.084	6.910
F0.1	0.054	1.019	10.303
Fmed	0.241	0.856	2.070

Technical basis:

$\mathbf{B}_{lim}$: Not defined.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed. $\mathbf{B}_{pa}$ is equal to the lowest observed SSB in 1993 as estimated in 2000.
$\mathbf{F}_{lim}$: $\mathbf{F}_{loss}$, the fishing mortality estimated to lead to potential stock collapse.	$\mathbf{F}_{pa}$: $\mathbf{F}_{lim}$ x 0.72. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$, taking into account the uncertainty in the assessment.

***L. budegassa*:**

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is undefined	$\mathbf{B}_{pa}$ = 22 000 t.
	$\mathbf{F}_{lim}$ is undefined	$\mathbf{F}_{pa}$ = 0.23
Target reference points		$\mathbf{F_y}$**:** Not defined

Yield and spawning biomass per Recruit
F-reference points:

	Fish Mort Ages 6-10	Yield/R	SSB/R
Average last 3 years	0.225	0.490	1.882
Fmax	0.151	0.512	3.059
F0.1	0.097	0.484	4.691
Fmed	0.255	0.475	1.575

Candidates for target reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F_{0.1}}$-$\mathbf{F_{max}}$.

Technical basis:

$\mathbf{B}_{lim}$= Not defined.	$\mathbf{B}_{pa}$= $\mathbf{B}_{loss.}$ There is no evidence of reduced recruitment at the lowest biomass observed (SSB for 1993 as estimated in 2002).
$\mathbf{F}_{lim}$= Not defined.	$\mathbf{F}_{pa}$ =$\mathbf{F}_{med}$ as estimated in 2000. This F is consistent with the proposed $\mathbf{B}_{pa}$.

Single stock exploitation boundaries

Exploitation boundaries in relation to high long term yield, low risk of depletion of production potential and considering ecosystem effects

For *L. piscatorius* the *status quo* fishing mortality is estimated at 0.24 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.05 and $\mathbf{F}_{max}$ = 0.09). For *L. budegassa* the *status quo* fishing mortality is estimated at 0.18 which is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion ($\mathbf{F}_{0.1}$ = 0.10 and $\mathbf{F}_{max}$ = 0.15). This indicates that long-term yield is expected to increase at fishing mortalities below the historic values. Fishing at such a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to harvest the stock within precautionary limits fishing mortality should be kept below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ for both species. Fishing at $\mathbf{F}_{pa}$ for *L. piscatorius* is expected to result in landings of 25 400 t, leading to an SSB of 64 400 t in 2007. Given the link between the two species, this corresponds to a fishing mortality of 0.22 for *L. budegassa* (fishing at $\mathbf{F}_{sq}$), corresponding to landings of at most 8 300 t in 2006. The predicted SSBs are well above $\mathbf{B}_{pa}$ in all scenarios.

Short term implications

Outlook for 2006:
L. Piscatorius: Basis: Fsq =mean F(02-04)=0.24; R04-05 = GM 1987-2002=21 millions; landings (2005) = 25.5; SSB(2006) = 66.4
L. budegassa: Basis: Fsq =mean F(02-04)=0.22; R04-05 = GM 1987-2001=16 millions; landings (2005) = 8.1; SSB(2006) = 30.8
The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.24 (*L. Piscatorius*), and 0.23 (*L. budegassa*)

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is 0.09 (*L. Piscatorius*), and 0.16 (*L. budegassa*)

					L. piscatorius			***L. budegassa***			
Rationale	**Landings *L. Pisc.* (2006)**	**Landings *L. Bud.* (2006)**	**Combined landings (2006)**	**Basis**	**F (2006)**	**SSB (2007)**	**%SSB change [1)]**	**F (2006)**	**SSB (2007)**	**%SSB change [1)]**	**%TAC change [2)]**
Zero catch	0.0	0.0	0.0	F=0	0.00	91.8	38%	0.00	39.7	29%	-100%
High long-term yield	10.6	5.8	16.3	F(long-term yield)	0.09	80.3	21%	0.15	34.2	11%	-48%
Status quo	3.0	0.9	3.9	$\mathbf{F}_{sq}$ *0.1	0.02	88.5	33%	0.02	38.8	26%	-87%
	5.9	1.8	7.7	$\mathbf{F}_{sq}$ *0.2	0.05	85.4	29%	0.04	38.0	23%	-75%
	14.0	4.4	18.4	$\mathbf{F}_{sq}$ *0.5	0.12	76.6	15%	0.11	35.5	15%	-41%
	20.1	6.4	26.5	$\mathbf{F}_{sq}$ *0.75	0.18	70.1	6%	0.17	33.6	9%	-15%
	23.5	7.6	31.1	$\mathbf{F}_{sq}$ *0.9	0.22	66.4	0%	0.20	32.5	6%	0%
	25.7	8.3	34.0	$\mathbf{F}_{sq}$ *1	0.24	64.1	-3%	0.22	31.8	3%	9%
	27.8	9.1	36.8	$\mathbf{F}_{sq}$*1.1	0.27	61.8	-7%	0.25	31.1	1%	18%
	30.8	10.1	40.9	$\mathbf{F}_{sq}$ *1.25	0.30	58.7	-12%	0.28	30.1	-2%	31%
Precautionary Limits	25.4	-	-	**Fpa**	0.24	64.4	-3%	-	-	-	-

All weights in '000 tonnes
Shaded scenarios are not considered consistent with the precautionary approach
1) SSB 2007 relative to SSB 2006
2) Landings 2006 relative to TAC 2005 = 31.202
Note: Fmultipliers on F precautionary limits are not consistent between the two species.

Management considerations

L. piscatorius and *L. budegassa* are both caught on the same grounds and by the same fleets, and are usually not separated by species in landings and the fishing mortalities are linked. Both species show similar trends in stock trajectories (figure 1.4.20.1). So far the stocks have developed synchronously but this may not be so in the future in which case they should be managed separately.

Management measures for both species must be considered together and in conjunction with other species caught in these fisheries (sole, cod, rays, megrim, *Nephrops*, and hake).

There are two separate TACs for these stocks: in Subarea VII and in Divisions VIIIa,b,d,e. The assessment is carried out on a smaller area (Divisions VIIb-k and VIIIa,b) than the management area and will thus be a underestimate of the overall stock size. However, the assessment cover the majority of the area as recent landings in Division VIIa have been relatively small compared to the total TAC.

The majority of the anglerfish catch consists of young fish. An improvement of the selection pattern is expected to give a higher long term yield.

Factors affecting the fisheries and the stock

The effects of regulations

There is no minimal landing size for anglerfish but a Council Regulation (2406/96) laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. When the minimum landing size does not fit with the selective properties of the gears, this is expected to lead to discarding of undersized fish.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a biologically sensitive area in Subareas VIIb, VIIj, VIIg, and VIIh. Effort exerted within the biologically sensitive area by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002). These measures have not resulted in a decrease in fishing effort for fleets fishing for anglerfish.

Changes in fishing technology and fishing patterns

No significant changes in recent years.

The environment

The spawning of the *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m. This particular spawning pattern results in a highly clumped distribution of eggs and newly emerged larvae. Although this could result in recruitment being sensitive to environmental variations, this has not been observed.

Other factors

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. Landings decreased between 1981 and 1993 and since 2000, landings have shown an increasing trend. France and Spain together still report 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 the total international landings of *L. budegassa* are taken by otter trawlers. There has been an expansion of the French gillnet fishery in the last decade in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels landing 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.

Scientific basis

Data and methods

Age-based (XSA) assessments for each species separately are based on landings, one survey, and four (*piscatorius*) or five (*budegassa*) commercial CPUE series.

Information from the fishing industry

The fishing industry and scientists have met at the national level to discuss information that can be used in the assessments. Some CPUE time series have been provided by the fishing industry. Qualitative information has also been provided and has contributed to the assessment process.

The UK Fisheries Science Partnership report on the anglerfish was made available to the WG as a Working Document.

Uncertainties in assessment and forecast

Retrospective patterns exist in the absolute estimations of SSB, Recruitment, and F. For *L. piscatorius* there is a strong underestimation of SSB and overestimation of fishing mortality in recent years. For *L. budegassa*, the historical pattern is uncertain in the overall level of stock size. The recruitment estimates of the most recent years appear to be very uncertain.

The main factors contributing to the uncertainties for this stock are:

- Stock definition is problematic.
- Discards are not included in the assessment and discards are known to be partly dependent on market conditions and TAC restrictions.
- There are conflicting signals in the commercial CPUE series which could be caused by different targeting behaviour (changes in spatial and temporal fishing patterns).
- Fishery-independent data is insufficient to assess the state of the stock because the only survey does not cover the whole stock distribution (in depth).

Comparison with previous assessment and advice:

For *L. piscatorius* fishing mortality and recent recruitments are revised downward and SSB upward, and for *L. budegassa* recent recruitments and SSB are revised downward and fishing mortality upward.

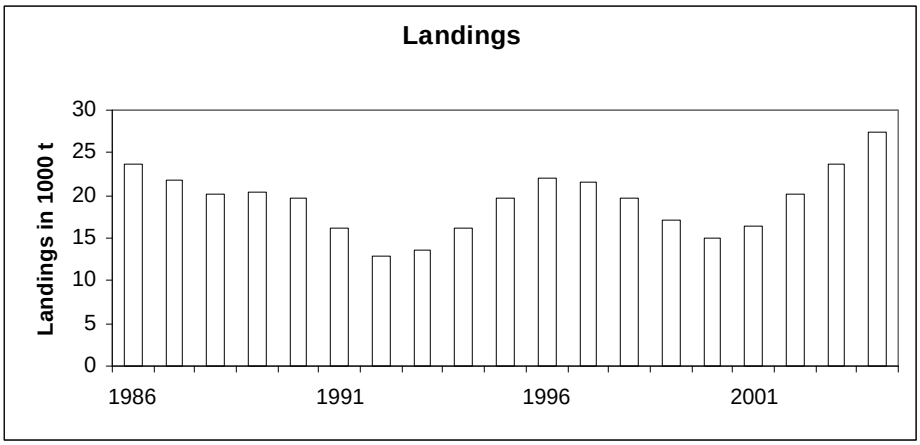
Source of information:

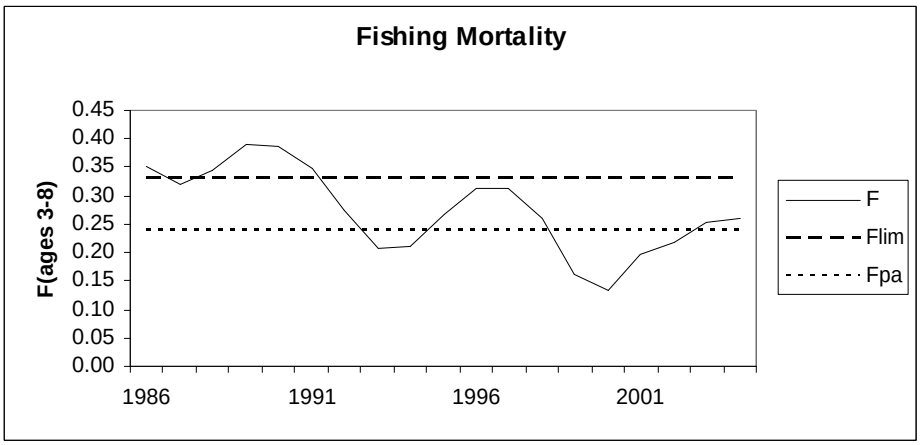
Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to Single-Stock Exploitation Boundaries	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		-		25.1	20.1	13.5	6.7
1994	SSB decreasing, still inside safe		-		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	17.2	7.3
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[3]	16.5[3]	5.7[3]
2002	Reduce F below $\mathbf{F}_{pa}$		< 19.9		23.7	26.7[3]	20.1[3]	6.5[3]
2003	At least 30% decrease in F		< 16.4		21.0[4]	31.7	23.6	8.1
2004	At least 10% decrease in F		< 26.7		26.7	34.9	27.3	7.6
2005	Maintain F below Fpa		< 37.8		31.2			
2006	Maintain F below Fpa		<33.9					

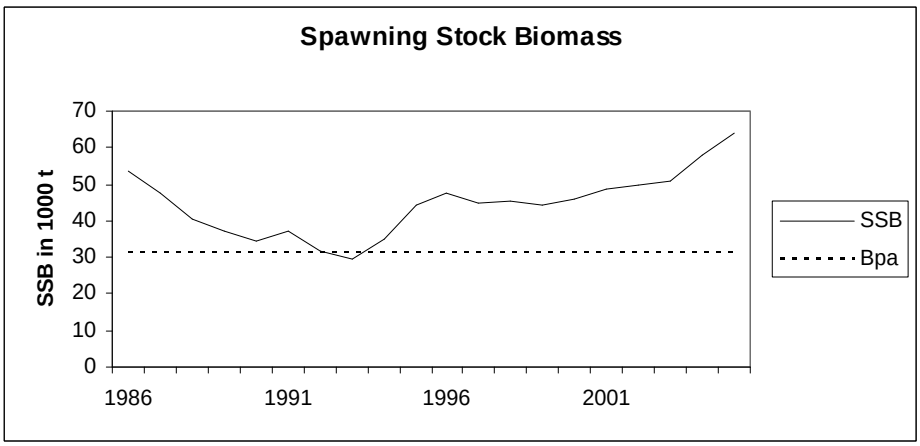
[1] Includes Division VIIa and Divisions VIIId,e; [2] applies to both species. [3]Revised. [4]TAC was changed during 2003 from 19 400t. to 21 000t. following fast-track advice from ICES.
[*)] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Weights in '000 t.

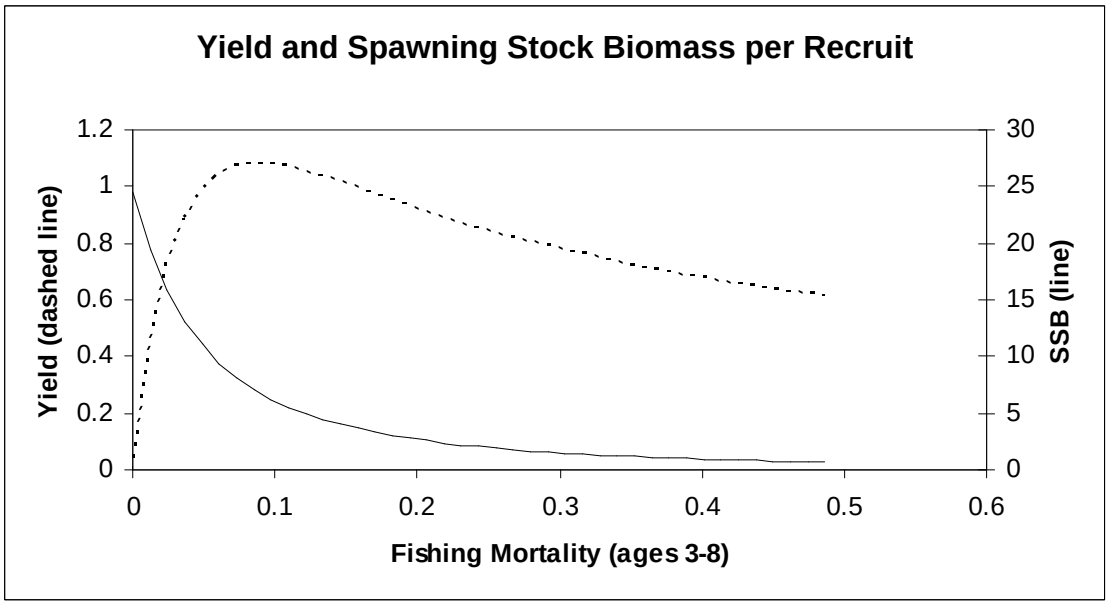

Landings
Landings in 1000 t
30
25
20
15
10
5
0
1986
1991
1996
2001

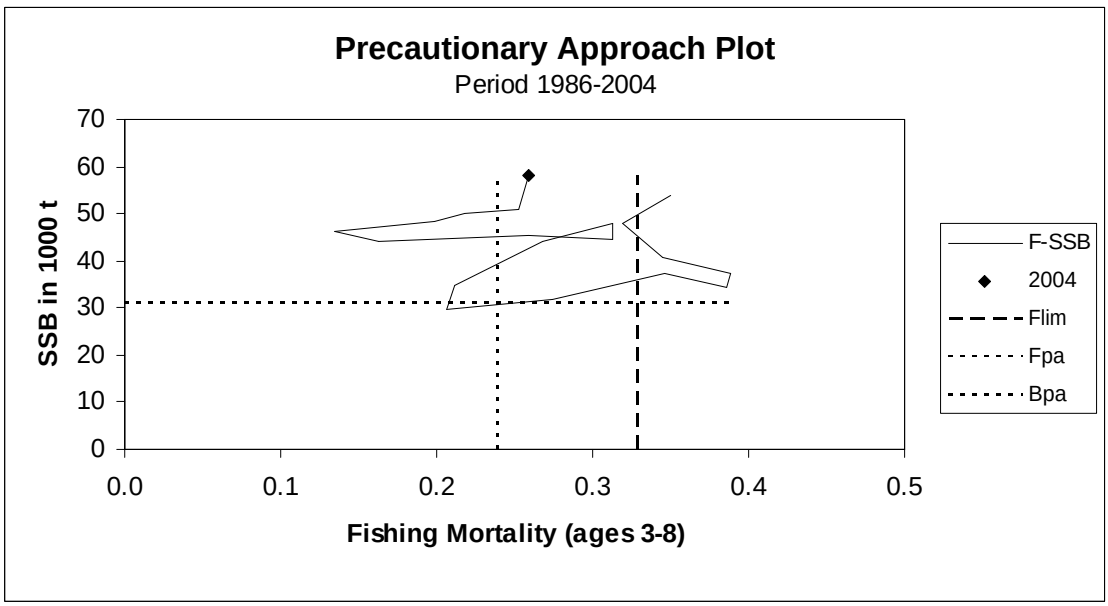

Fishing Mortality
F(ages 3-8)
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1986
1991
1996
2001
F
Flim
Fpa

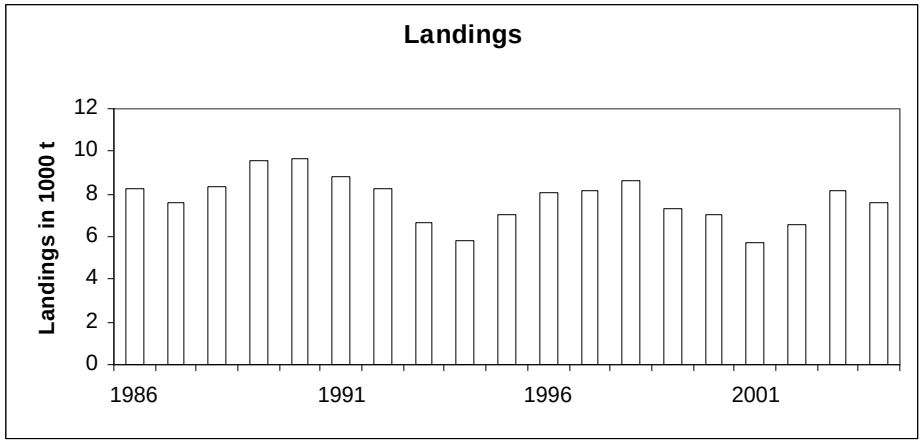

Recruitment (age 1)
Recruitment in millions
45
40
35
30
25
20
15
10
5
0
1986
1991
1996
2001

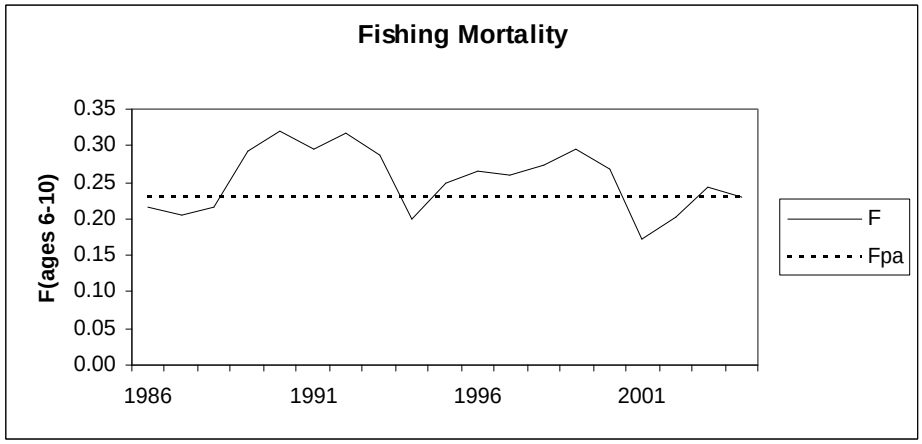

Spawning Stock Biomass
SSB in 1000 t
70
60
50
40
30
20
10
0
1986
1991
1996
2001
SSB
Bpa


Stock - Recruitment
Recruitment (age 1) in millions
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
SSB in 1000 t
SSB-Rec.
Bpa

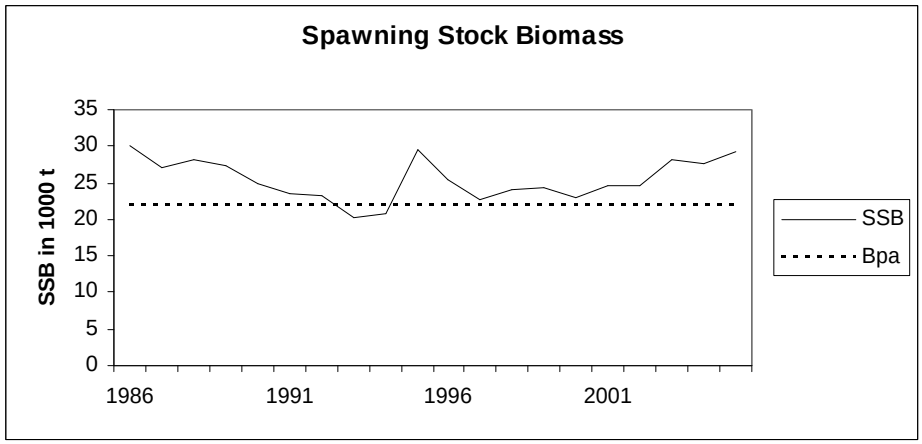

Yield and Spawning Stock Biomass per Recruit
Yield (dashed line)
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
Fishing Mortality (ages 3-8)
SSB (line)
30
25
20
15
10
5
0

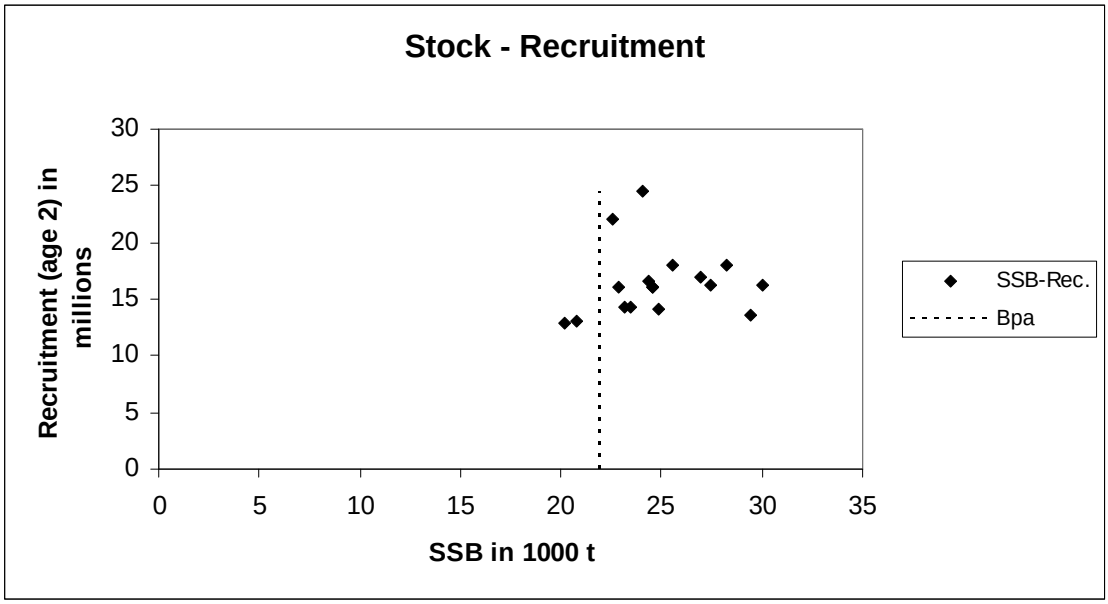

Precautionary Approach Plot
Period 1986-2004
SSB in 1000 t
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4
0.5
Fishing Mortality (ages 3-8)
F-SSB
2004
Flim
Fpa
Bpa

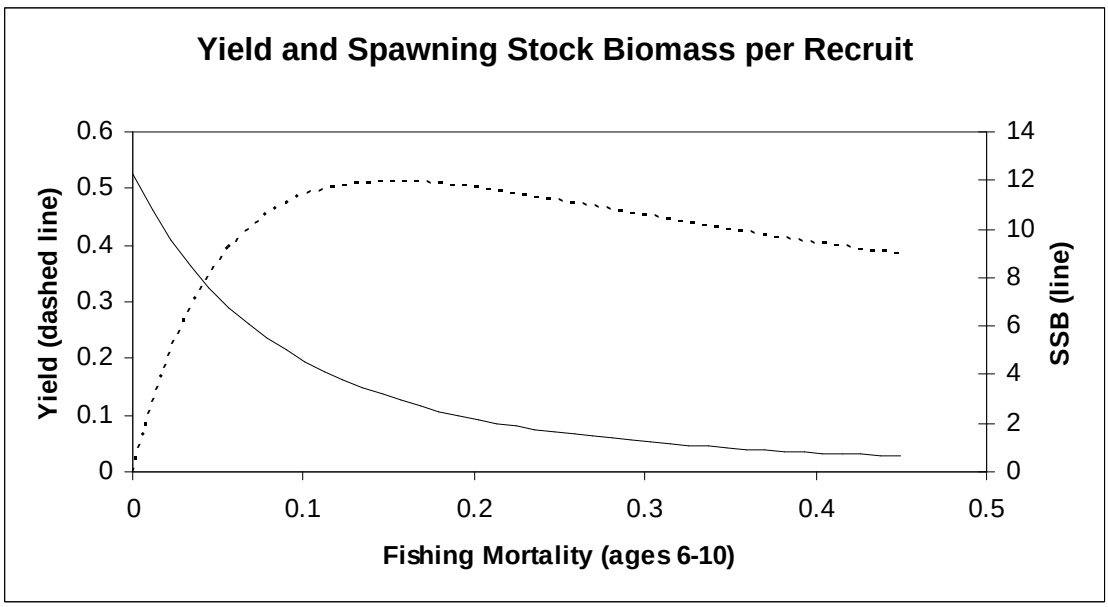

Landings
Landings in 1000 t
0
2
4
6
8
10
12
1986
1991
1996
2001


Fishing Mortality
F(ages 6-10)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
1986
1991
1996
2001
F
Fpa


Recruitment (age 2)
Recruitment in millions
0
5
10
15
20
25
30
1986
1991
1996
2001


Spawning Stock Biomass
SSB in 1000 t
0
5
10
15
20
25
30
35
1986
1991
1996
2001
SSB
Bpa


Stock - Recruitment
Recruitment (age 2) in millions
SSB in 1000 t
SSB-Rec.
Bpa
0
5
10
15
20
25
30
35


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

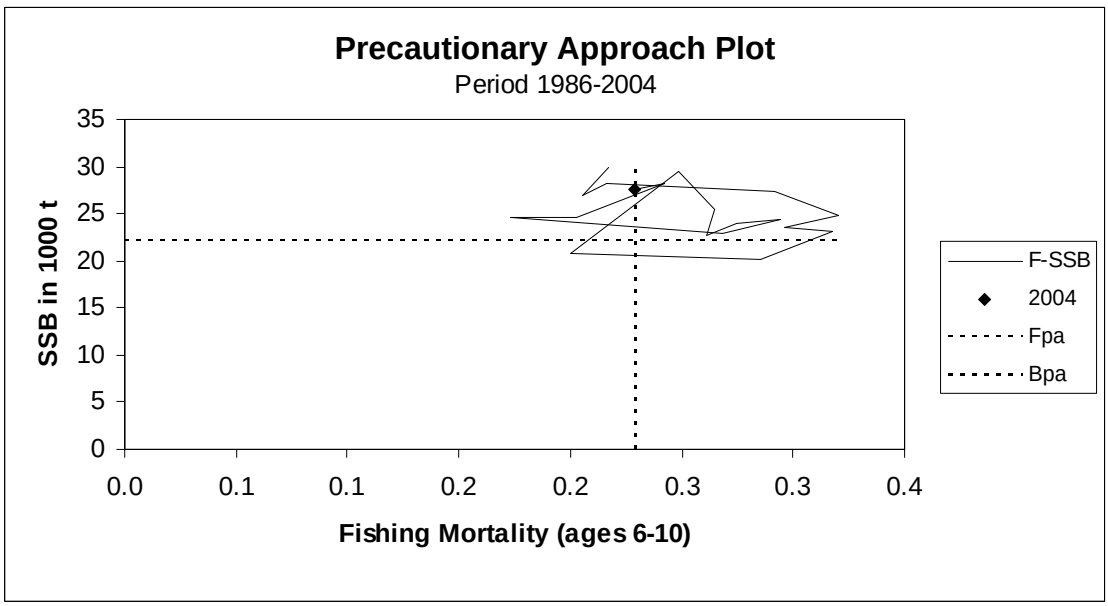

Precautionary Approach Plot
Period 1986-2004
SSB in 1000 t
Fishing Mortality (ages 6-10)
F-SSB
2004
Fpa
Bpa
0
5
10
15
20
25
30
35
0.0
0.1
0.2
0.3
0.4

Table 1.4.20.1 Landings (tonnes) of both species of anglerfish in Divisions VIIb-k and VIIIa,b,d

Working group estimates

Year	VIIb-k	VIIIa,b,d	Total
1977			19895
1978			23445
1979			29738
1980			38880
1981			39450
1982			35285
1983			38280
1984	28847	7909	36756
1985	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	21288	3224	24512
2000	19250	2711	21962
2001	19357	2838	22195
2002	22990	3674	26664
2003*	27408	4317	31725
2004**	28983	5920	34903

* revised

** preliminary

Table 1.4.20.2. **Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.**
Landings in tonnes by Fishery Unit

	VIIb,c,e-k						VIIIa,b,d				
Year	Gill-Net (Unit 3)	Medium/ Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/ medium Neph.Trawl (Unit 8)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/ Deep Trawl (Unit 14)	Unallocated	**TOTAL** VII +VIII
1986	429	13781	2877	1437	1021		746	720	2657		23666
1987	560	11414	2900	1520	787		1035	542	3152		21909
1988	643	9812	3105	1814	774		927	534	2487		20095
1989	781	8448	5259	2342	754		673	444	1772		20474
1990	1021	8787	3950	1736	880		410	391	2578		19753
1991	1752	7565	2806	1196	752		284	218	1657		16229
1992	1773	6254	1489	1052	887		254	166	942		12818
1993	1742	5776	2125	1281	969		360	278	950		13481
1994	1377	7344	2595	1523	1236		261	198	1586		16120
1995	1915	8461	3195	1805	1242		501	429	1954		19502
1996	2244	9796	2637	2189	1149		441	379	2229	938	22003
1997	2538	9225	2945	2031	964	39	429	376	2045	1068	21660
1998	3398	8714	2138	1722	812	3	397	149	1699	542	19572
1999	2912	8343	2257	1407	743	19	97	117	1292	0	17186
2000	2299	7340	1853	1457	838	5	100	84	949	0	14925
2001	1806	7978	2243	1982	866	17	136	75	1405	0	16508
2002	2731	9679	2644	1836	922	5	223	88	2002	0	20130
2003*	3087	11957	2622	1978	925	81	377	124	2440	0	23591
2004**	3982	12773	3055	2454	869	14	461	180	3523	0	27313

* revised

** preliminary

Table 1.4.20.3 ***Lophius budegassa*** **in Divisions VIIb-k and VIIIa,b,d**
Landings in tonnes by Fishery Unit

	VIIb,c,e-k						VIIIa,b,d				TOTAL
Year	Gill-Net (Unit 3)	Medium/ Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/ medium Neph.Trawl (Unit 8)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/ Deep Trawl (Unit 14)	Unallocated	VII +VIII
1986	23	5126	348	540	406	0	443	150	1181	0	8217
1987	30	3493	696	462	434	0	483	116	1904	0	7619
1988	34	4072	1095	751	394	0	435	102	1498	0	8382
1989	40	4398	976	1217	515	0	446	112	1829	0	9533
1990	53	4818	631	905	653	0	550	156	1865	0	9632
1991	88	4414	921	384	507	0	475	117	1933	0	8840
1992	90	4808	301	305	594	0	459	191	1518	0	8266
1993	93	3415	429	405	399	0	433	101	1385	0	6659
1994	70	2935	265	209	540	0	232	49	1515	0	5814
1995	110	3963	455	159	617	0	312	62	1286	90	7053
1996	118	4587	477	245	524	28	374	109	1239	392	8092
1997	134	4836	602	132	474	9	313	17	1128	471	8114
1998	179	5565	246	230	288	1	258	72	1454	305	8599
1999	16	4872	115	285	319	0	146	76	1496	0	7325
2000	68	4675	187	261	267	0	136	36	1407	0	7037
2001	36	3761	107	260	301	0	114	28	1080	0	5688
2002	31	4354	151	251	386	0	102	12	1247	0	6534
2003*	79	5647	320	346	362	5	155	32	1189	0	8134
2004**	107	4720	265	349	394	0	259	8	1489	0	7590

* revised
** preliminary

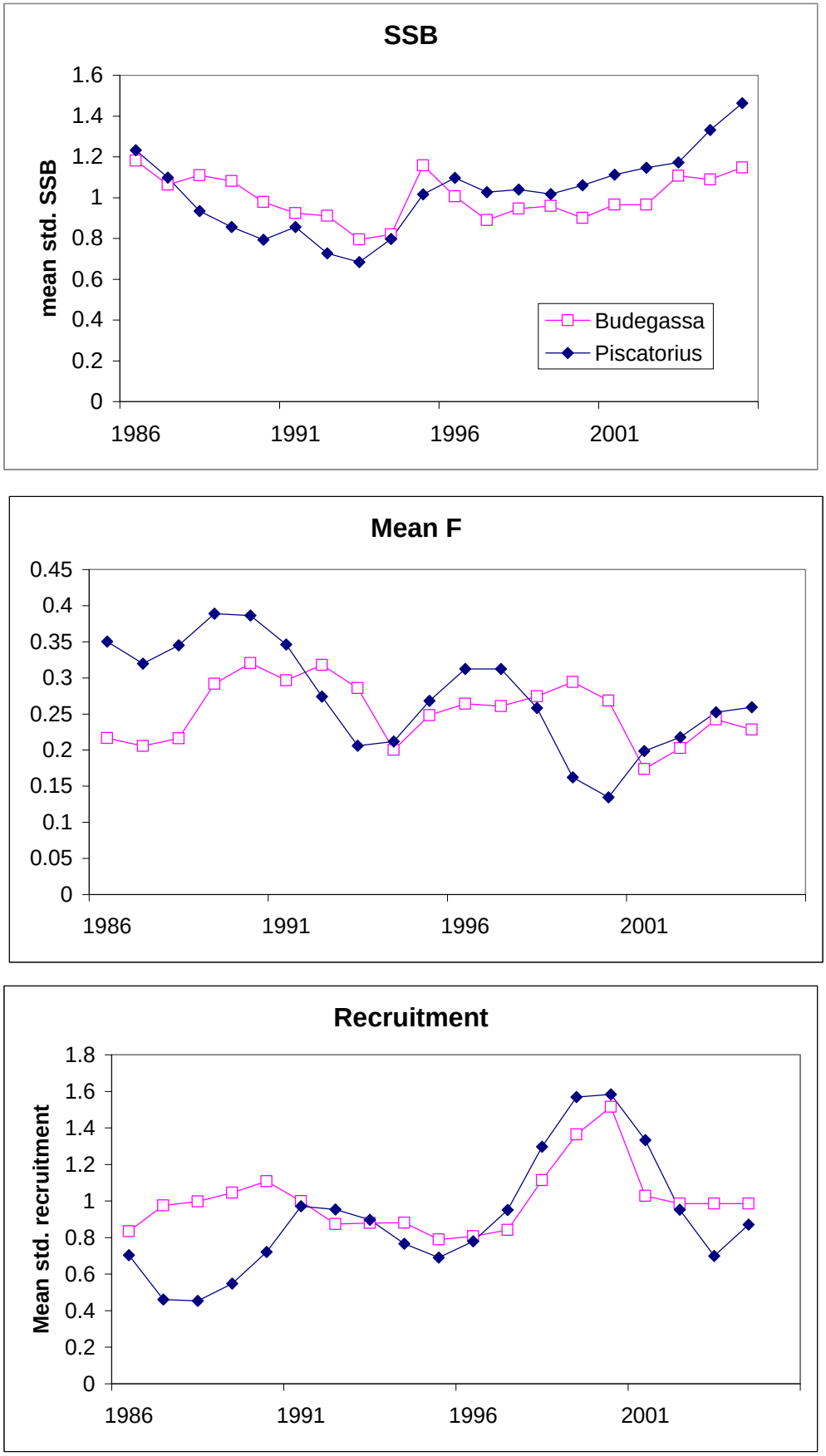


Figure 1.4.20.1 Anglerfish (*Budegassa* and *piscatorius*) in Divisions VIIb-k and VIIIa,b,d,e. Trends in fishing mortality (ages 6-10 *budegassa*, ages 3-8 *piscatorius*) and mean standardized SSB and recruitment (age 2 *budegassa*, age 1 *piscatorius*).

1.4.21 Cod in Division VIa (West of Scotland)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Reduced reproductive capacity	Unknown	Unknown	Not defined	The state of the stock is uncertain, but all indicators point towards the stock being at an historical low.

The spawning stock biomass is at an all time low but the rate of exploitation is uncertain. The survey SSB estimates indicate that the stock has been declining and is presently at an historical low. Recruitment estimates indicate a decline in recruitment in the last decade, correlated with a decline in the spawning stock to the lowest levels observed. Recruitment since 2002 has been the weakest in the survey time series.

Management objectives

The European Commission has enacted a Council Regulation ((EC) No 423/2004) which establishes measures for the recovery of cod stocks:

For stocks above $\boldsymbol{B}_{lim}$, the harvest control rule (HCR) requires:

1. *setting a TAC that achieves a 30% increase in the SSB from one year to the next,*
2. *limiting annual changes in TAC to ± 15% (except in the first year of application), and,*
3. *a rate of fishing mortality that does not exceed $\boldsymbol{F}_{pa}$.*

For stocks below $\boldsymbol{B}_{lim}$ the Regulation specifies that:

4. *conditions 1-3 will apply when they are expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application,*
5. *a TAC will be set lower than that calculated under conditions 1-3 when the application of conditions 1-3 is not expected to result in an increase in SSB above $\boldsymbol{B}_{lim}$ in the year of application.*

This plan has not yet been evaluated by ICES. However, the management plan requires annual predictions of spawning stock size, which is not available given the recent poor catch data. In that situation a management plan that does not require such a precision should be considered.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 14 000 t	$\mathbf{B}_{pa}$ be set at 22 000 t
	$\mathbf{F}_{lim}$ is 0.8	$\mathbf{F}_{pa}$ be set at 0.6
Target reference points		$\mathbf{F}_{y}$ not determined

Yield and spawning biomass per Recruit (from 2004 Assessment, assuming the selection pattern at that time)
F-reference points:

	Fish Mort Ages 2-5	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.191	1.138	8.637
$\mathbf{F}_{0.1}$	0.132	1.088	11.440

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$, the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ **:** 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.
$\mathbf{F}_{lim}$: Fishing mortalities above this have historically led to stock decline.	$\mathbf{F}_{pa}$: This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

The advice is based on information from abundance surveys. Reference points have not been estimated from the surveys. However, recovery of the stock will require substantial and persistent increase of both SSB and recruitment. The recent survey SSB estimates are below any likely candidates for a survey-based SSB limit point.

Single-stock exploitation boundaries

Exploitation boundaries in relation to existing management plans

ICES is not in a position to give quantitative forecasts and can therefore not evaluate the management plan and provide upper bounds to a TAC.

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.19). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

Since no recovery has been observed in this stock, ICES advises zero catch of cod in 2006.

Management considerations

Management of cod fisheries must deal with the combined effects of assessment bias (of which unreliable catch data are a major contributing factor) and the inability of management to control catch. As long as these two interrelated conditions persist and substantial effort is permitted for fisheries which catch cod, rebuilding cannot be achieved. Survey information shows that the total removal of cod in Division VIa may have been underestimated in the past decade relative to earlier periods. The effect of the fishery on the stock has therefore been evaluated in relative terms and advice on absolute levels of future catches is not possible.

The advised measures are required if the cod stock is to reach a level where it can regain historic productivity.

As cod is taken in mixed demersal fisheries, following the advice will likely result in greatly reduced harvesting of other stocks, particularly haddock, whiting and *Nephrops*. Management needs to take this into account.

Time and area closures for particular fisheries may be a tool for rebuilding this stock. The consequence of displacing effort, caused by the closures, needs to be considered in determining the role of such measures in the recovery plan.

Management plan evaluations

There are reports of significant non-reported landings and therefore the current implementation of the TAC system is not able to regulate fishing mortality. Unless recovery measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is managed by a TAC that does not, however, seem to be restricting catches.

Several regulations have been introduced for West of Scotland in recent years. These regulations and their impact on the fisheries have been discussed in detail in the overview. Emergency EU measures were established in the first half of 2001 and led to short-term area closures in the north of the Division and, on a smaller scale, in the Clyde Sea area.

These closures were intended to allow as many cod as possible to spawn. The Clyde closure continued in 2002 and 2003 under national UK legislation. Various derogations were introduced for gears not targeting cod. A new closed area was implemented west of Scotland in 2004 (EC Reg. 2287/2003).

The proportion of discarded fish has been high. In 2002 and 2003 regulations to improve the exploitation pattern of cod were implemented. It is not clear if it is possible to evaluate potential impacts of these measures to the stock and fishery.

Increases in cod-end mesh sizes have been introduced into the fishery to improve selectivity. The increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mixed fishery trawls due to the loss of valuable *Nephrops* catch. Catch composition regulations for this mesh size may have resulted in increased discarding and high grading.

The regulation is complemented by a system of fishing effort limitation. This is done by adjustment to the number of fishing days for various vessel categories deploying gears with various mesh sizes. The introduction of effort regulation, has effectively further encouraged vessel operators to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited cod without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

However, the continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of such regulations is not possible until data of sufficient quality become available.

Changes in fishing technology and fishing patterns

From mid September 2003 to mid July 2004 the Irish trawl fishery off Greencastle, Co. Donegal that traditionally targets juvenile cod was closed. The closure was instigated by the local fishing industry to allow an assessment of seasonal closure as a potential management measure. The fishing industry again called for and received a statutory instrument closing the fishery from November 2004 until mid-February 2005. Most of the cod catch is normally taken in the fourth quarter. During 2000-2002 50% of the Irish catch weight of cod in VIa (61% by number) was taken in the fourth quarter. The closure is expected to have reduced the Irish fishing mortality on cod that would otherwise have occurred in 2003 and 2004.

Scientific basis

Data and methods

A survey based assessment was used to evaluate trends in spawning stock biomass and recruitment.

Uncertainties in assessment and forecast

Some changes have been made to the survey design in the past, but surveys are considered to provide an indicator of long-term stock trends.

Comparison with previous assessment and advice

The last analytical assessment was undertaken in 2003 based on a catch-at-age model using estimates of landings-at-age, discards-at-age, and survey CPUE data. There was no analytical assessment carried out for this stock in 2004 and again, no analytical assessment was possible this year. This year's assessment is based on survey information alone but the perception of the state of the stock remains unchanged. The advice this year is the same as last year.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings
1987	Reduce F towards $\mathbf{F}_{max}$		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	9.7[3]
1993	70% of effort (89)		-		14.0	10.5	11.8[3]
1994	30% reduction in effort		-		13.0	9.1	10.8[3]
1995	Significant reduction in effort		-		13.0	9.7	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 $\mathbf{F}_{pa}$		<9.7[5]		11.8	4.3	4.2
2000	Recovery plan, 60% reduction in F		<4.2		7.48	2.8[4]	3.0
2001	Lowest possible F, recovery plan		-		3.7	2.5	2.3
2002	Recovery plan or lowest possible F		-		4.6	2.0	2.1
2003	Closure		-		1.81	1.3	n/a
2004		Zero catch	[6]	0	0.85	0.5	n/a
2005		Zero catch	[6]		0.72		
2006		Zero catch	[6]				

[1]TAC is for the whole of Subareas Vb1, VI, XII and XIV. [2]Not including misreporting. [3]Including ACFM estimates of misreporting. [4]Incomplete data. [5]For VIa only. [6] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

Table 1.4.21.1 Cod in Division VIa. Official catch statistics in 1985–2004, as reported to ICES.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003*	2004*
Belgium	48	88	33	44	28	-	6	-	22	1	2	+	11	1	+	+	2	+		
Denmark	-	-	4	1	3	2	2	3	2	+	4	2	-	-	+	-	-	-		
Faroe Islands	-	-	-	11	26	-	-	-	-	-	-	-	-	-	-	-	-	-		
France	7,411	5,096	5,044	7,669	3,640	2,220	2,503	1,957	3,047	2,488	2,533	2,253	956	714*	842*[2]	236	391	208	172	
Germany	66	53	12	25	281	586	60	5	94	100	18	63	5	6	8	6	4	+	+	
Ireland	2,564	1,704	2,442	2,551	1,642	1,200	761	761	645	825	1,054	1,286	708	478	223	357	319	210	120	
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-	-	-	
Norway	204	174	77	186	207	150	40	171	72	51	61	137	36	36	79	114*	40*	88	46	10
Spain	28	-	-	-	85	-	-	-	-	-	16	+	6	42	45	14	3	11	3	
UK (E., W., N.I.)	260	160	444	230	278	230	511	577	524	419	450	457	779	474	381	280	138	195	79	
UK (Scotland)	8,032	4,251	11,143	8,465	9,236	7,389	6,751	5,543	6,069	5,247	5,522	5,382	4,489	3,919	2,711	2,057	1,544	1,519	879	
UK																				458
Total landings	18,613	11,526	19,199	19,182	15,426	11,777	10,634	9,017	10,475	9,131	9,660	9,580	6,992	5,671	4,289	2,767	2,439	2,231	1,299	468

* Preliminary.

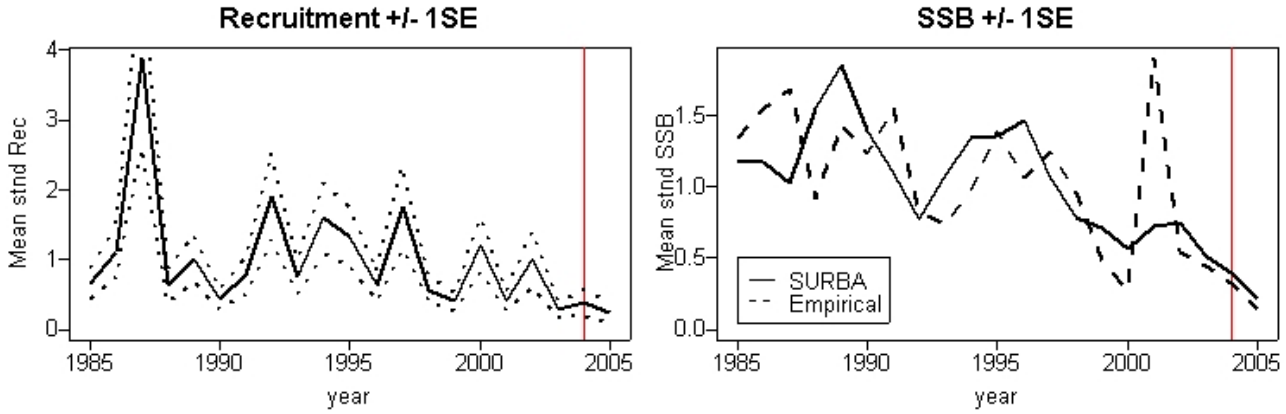


Figure 1.4.21.1 Cod in Division VIa. Survey-based estimates of recruitment and SSB (both mean-standardised). Empirical estimates of SSB from the raw survey data are shown as dashed lines in the right-hand panel.

1.4.22 Cod in Division VIb (Rockall)

State of the stock

There is no information on the status of cod in Division VIb. Official catch data are incomplete.

Management considerations

Due to the rapid decline in cod catches in Division VIa the official landings reported from this area have in some of the most recent years accounted 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, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Table 1.4.22.1 Cod in Division VIb (Rockall). Official catch statistics.

Country	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Faroe Islands	18	-	1	-	31	5	-	-	-	1	-
France	9	17	5	7	2	-	-	-	-	-	-
Germany	-	3	-	-	3	-	-	126	2	-	-
Ireland	-	-	-	-	-	-	400	236	235	472	280
Norway	373	202	95	130	195	148	119	312	199	199	120
Portugal	-	-	-	-	-	-	-	-	-	-	-
Russia	-	-	-	-	-	-	-	-	-	-	-
Spain	241	1200	1219	808	1345	-	64	70	-	-	-
UK (E. & W. & N.I.)	161	114	93	69	56	131	8	23	26	103	25
UK (Scotland)	221	437	187	284	254	265	758	829	714	322	236
Total	1,023	1,973	1,600	1,298	1,886	549	1,349	1,596	1,176	1,097	661

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Faroe Islands	-	-	-	-	-	n/a	n/a	n/a		
France	-	-	-	-	-	+	+*	1		
Germany	-	10	22	3	11	1	-	-		
Ireland	477	436	153	227	148	119	40	18	11	
Norway	92	91	55*	51*	85*	152*	89	28	25	23
Portugal	-	-	5	-	-	-	-	-		
Russia	-	-	-	-	-	7	26	-		
Spain	2	5	1	6	4	3	1		6	
UK (E. & W. & N.I.)	90	23	20	32	22	4	2	2	3	
UK (Scotland)	370	210	706	341	389	286	176	67	57	
UK										45
Total	1,031	775	962	660	659	572	334	115	102	68

* Preliminary.
n/a = not available.

1.4.23 Haddock in Division VIa (West of Scotland)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Harvested sustainably	Overexploited	Not defined	

Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity and harvested sustainably. Fishing mortality has been above $\mathbf{F}_{pa}$ in every year since 1987, except in the most recent years. Fishing mortality has fallen steadily from a peak in 1999. SSB varied around $\mathbf{B}_{pa}$ during the 1990s. The very strong 1999 year class has caused SSB to increase from a level near the historic low in 2000 to above $\mathbf{B}_{pa}$ since 2001. More recent year classes are close to average except the 2003 and 2004 year classes, which are estimated to be low. The SSB is thus expected to decrease in the short-term.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 22 000 t	$\mathbf{B}_{pa}$ be set at 30 000 t
	$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ be set at 0.5
Target reference points		$\mathbf{F}_{y}$ not determined

Yield and spawning biomass per Recruit from 2004 assessment
F-reference points:

	Fish Mort Ages 2-6	Yield/R	SSB/R
Average last 3 years	0.493	0.083	0.361
Fmax	0.184	0.118	0.935
F0.1	0.123	0.112	1.232
Fmed	0.555	0.076	0.316

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$-$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss,}$ the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{lim}$ * 1.4. 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 not defined.	$\mathbf{F}_{pa}$: The F below which there is a high probability of avoiding SSB<$\mathbf{B}_{pa}$ in the long term.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current estimated fishing mortality is 0.49. There will be no gain to the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.21). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

In order to maintain SSB above $\mathbf{B}_{pa}$ in 2007, ICES recommends a reduction in fishing mortality to less than 0.35. This corresponds to landings less than 8 000 t in 2006. Due to recent poor recruitments and in order to maintain SSB above $\mathbf{B}_{pa}$ also after 2007, a TAC for 2006 well below 8 000 t should be considered.

Short-term implications

Outlook for 2006:

Basis: F(2005) = Fsq = mean F(02-04) = 0.49; R82-02 = GM = 15.6 million; SSB(2005) = 49kt; SSB(2006) = 36.4kt; landings (2005) = 12.8kt

The maximum fishing mortality which would be in accordance with precautionary limits (F (precautionary limits)) is 0.5

The fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock (F(long term yield)) is not defined

Rationale	TAC(2006) (1)	Basis	F(2006)	SSB(2007)	%SSB change	%TAC change
Zero catch	0.00	F=0	0.00	42.60	17%	-100%
Status quo	10.50	Fsq	0.49	26.10	-28%	38%
High long term yield	5.01	F(long term yield)	0.21	34.67	-5%	-34%
Status quo	4.80	Fsq *0.4	0.20	35.00	-4%	-37%
	5.75	Fsq *0.5	0.25	33.52	-8%	-24%
	6.90	Fsq *0.6	0.29	31.70	-13%	-9%
	7.81	Fsq *0.7	0.34	30.31	-17%	3%
	8.80	Fsq *0.8	0.39	28.80	-21%	16%
	9.67	Fsq *0.9	0.44	27.42	-25%	27%
	10.50	Fsq *1	0.49	26.10	-28%	38%
	11.24	Fsq *1.1	0.54	24.92	-32%	48%
Precautionary limits	1.25	TAC(Fpa) *0.1	0.05	40.60	12%	-84%
	3.08	TAC(Fpa) *0.25	0.13	37.70	4%	-60%
	5.85	TAC(Fpa) *0.5	0.25	33.35	-8%	-23%
	8.48	TAC(Fpa) *0.75	0.38	29.28	-20%	12%
	9.82	TAC(Fpa) *0.9	0.45	27.18	-25%	29%
	10.65	Fpa = Fsq *1.02	0.50	25.86	-29%	40%
	11.40	TAC(Fpa) *1.1	0.55	24.66	-32%	50%
	12.71	TAC(Fpa) *1.25	0.63	22.58	-38%	67%
	15.25	TAC(Fpa) *1.5	0.75	18.57	-49%	101%
	17.80	TAC(Fpa) *1.75	0.88	14.57	-60%	134%
	20.34	TAC(Fpa) *2	1.00	10.57	-71%	168%
	22.88	TAC(Fpa) *2.25	1.13	6.56	-82%	201%

(1) It is assumed that the TAC will be implemented and that the landings in 2006 therefore correspond to the TAC.

All weights in thousand tonnes

Shaded scenarios are not considered consistent with the precautionary approach.

[1)] SSB 2007 relative to SSB 2006.

[2)] TAC 2006 relative to TAC 2005.

Management considerations

Measures to reduce discards and 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 as well as the requirement to fit square mesh panels to certain towed gears since late 2000, may have improved the selection pattern for haddock.

The likelihood that mortality will stay at the reduced levels observed over the last 4 years is increased by recent substantial reductions in Scottish fleet size (~30% reduction from 2001-2004) due to decommissioning. Further reductions in F may be expected through the effort regulations controlling days at sea. They are likely to lead to additional reductions in mortality on haddock if properly implemented and enforced.

Special attention needs to be given to considering the sporadic nature of haddock recruitment and how to manage periods of low recruitment interspersed with large, occasional pulses. In recent years over 50% of the total catch in weight is discarded, so restricting landings alone may not achieve the necessary increase in SSB. Recent recruitment has been poor.

There are reports of significant non-reported landings and therefore a TAC system may not be able to restrict fishing. The conflicting signals in the survey and the catch-at-age information indicate that there is unaccounted removal from the system. The problem does not appear to be as severe as for whiting and cod, but this has not been fully evaluated.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is regulated by a TAC that does not, however, seem to be restricting catches.

The increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mixed fishery trawls due to the loss of valuable *Nephrops* catch. Poorer selectivity at this mesh size may have resulted in increased discarding and high grading.

With the introduction of effort regulation, vessel operators have effectively been further encouraged to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited haddock without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

Changes in fishing technology and fishing patterns

Haddock in Division VIa are caught mainly by Scottish trawlers. Since 1976, Scottish heavy trawl and seine effort has declined, whilst that of light trawlers (shorter than 90 feet) has generally increased.

Other factors

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.

Scientific basis

Data and methods

The analytical age-based assessment is based on landings-at-age data, discard-at-age data, and indices from research vessel surveys.

Uncertainties in assessment and forecast

Survey information indicates an increase in unaccounted removal from this stock. Absolute biomass estimation may thus be biased, but it is not known to what extent. The relatively high SSB in recent years implies that the unaccounted catches have not caused harm to the stock in recent years.

Since effort data are unreliable (due to effort reporting not being mandatory in logbooks) commercial CPUE data are not used as tuning inputs.

Weights-at-age have shown a declining trend in this stock. Continuation of such trends would render forecast too optimistic. Forecasts are highly dependent on assumed average recruitment.

Comparison with previous assessment and advice

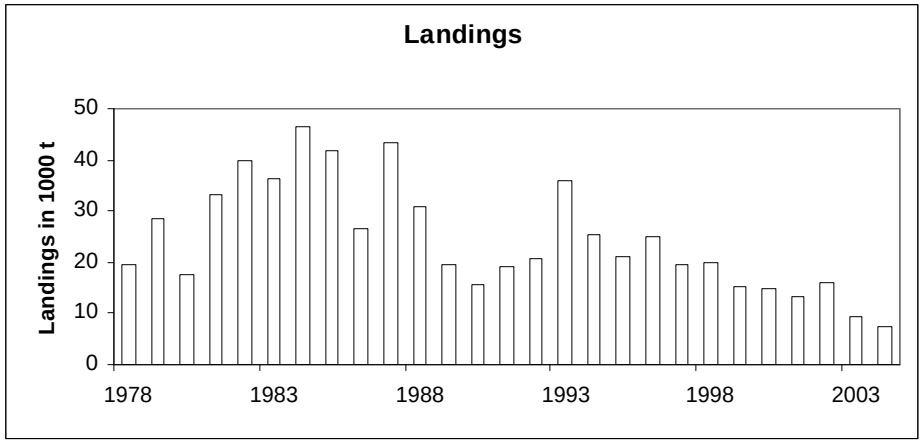
The perception of the state of the stock from this year's assessment does not differ from that obtained last year and the basis for the single-stock fishery advice is the same as last year.

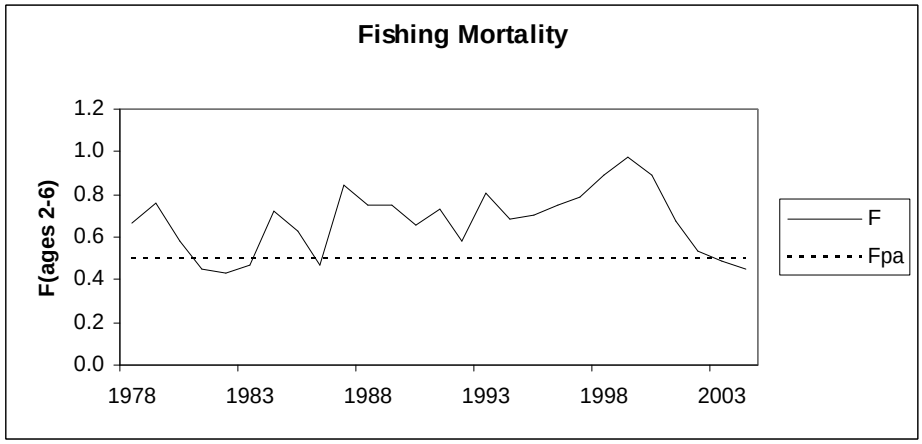
Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10-19 May 2005 (ICES CM 2006/ACFM:13).

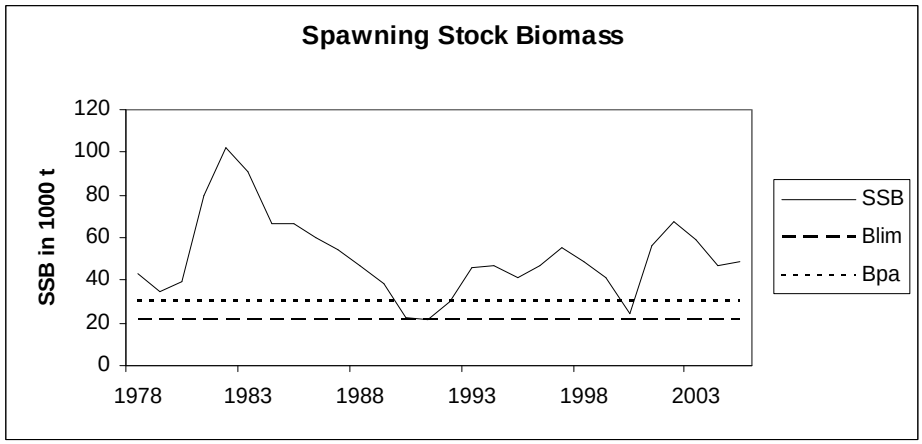
Year	ICES Advice	Single-Stock Exploitation Boundaries	Predicted catch corresp. to advice	Predicted catch corresp. to Single-Stock Exploitation Boundaries	Agreed TAC[1]	Official Landings	ACFM Landings	Discard Slip.	ACFM Catch
1987	Reduce F towards $\mathbf{F}_{max}$		20.0		32.0	27	27.0	16.2	43.2
1988	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	7.2	14.0
2002	Reduce F below $\mathbf{F}_{pa}$		<14.1[3]		14.1	7	6.7	8.6	15.2
2003	No cod catches		-		8.7	4.9	5.3	4.2	9.6
2004	[4]	$\mathbf{F}_{pa}$		12.2	6.5	3.0	n/a	n/a	n/a
2005	[4]	¾*Fpa		7.6	7.6				
2006	[4]	0.7*Fpa		8.0					

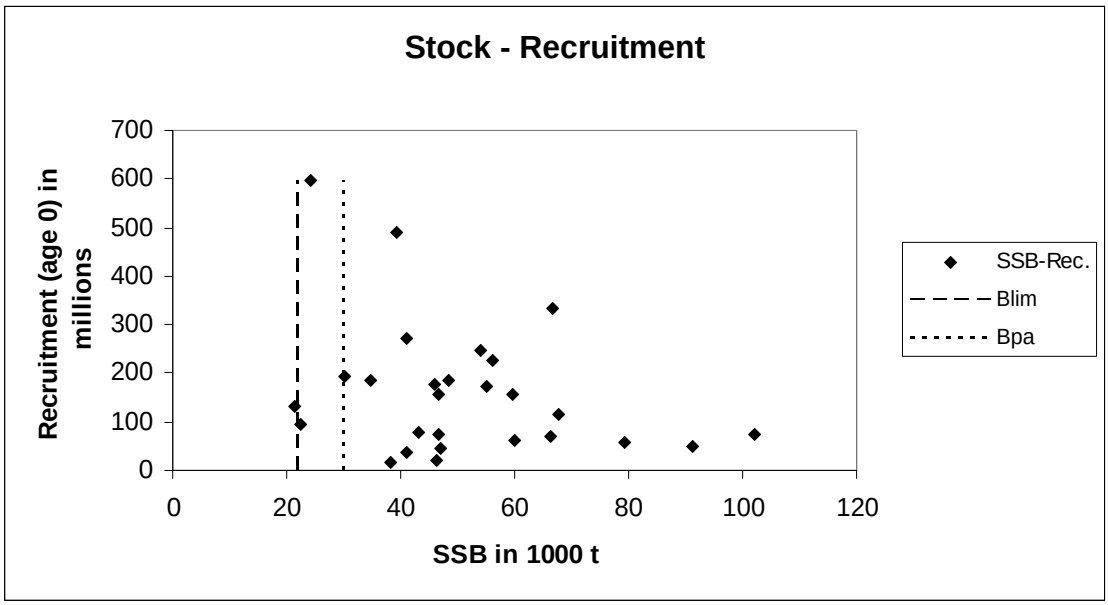
[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV), combined with restrictions on the quantity that can be taken in VIa from 1990. [2]Adjusted for misreporting. [3] For VIa only. [4] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits. Weights in '000 t.

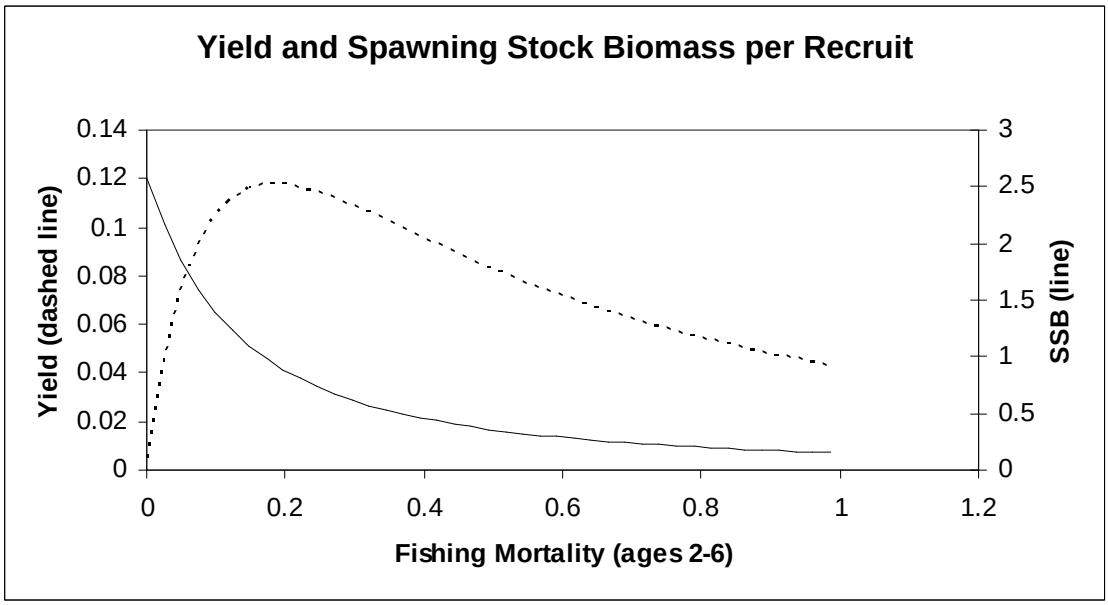

Landings
Landings in 1000 t
0
10
20
30
40
50
1978
1983
1988
1993
1998
2003


Fishing Mortality
F(ages 2-6)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1978
1983
1988
1993
1998
2003
F
Fpa


Recruitment (age 0)
Recruitment in millions
0
100
200
300
400
500
600
700
1978
1983
1988
1993
1998
2003


Spawning Stock Biomass
SSB in 1000 t
0
20
40
60
80
100
120
1978
1983
1988
1993
1998
2003
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 0) in millions
700
600
500
400
300
200
100
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)
0.14
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
Fishing Mortality (ages 2-6)

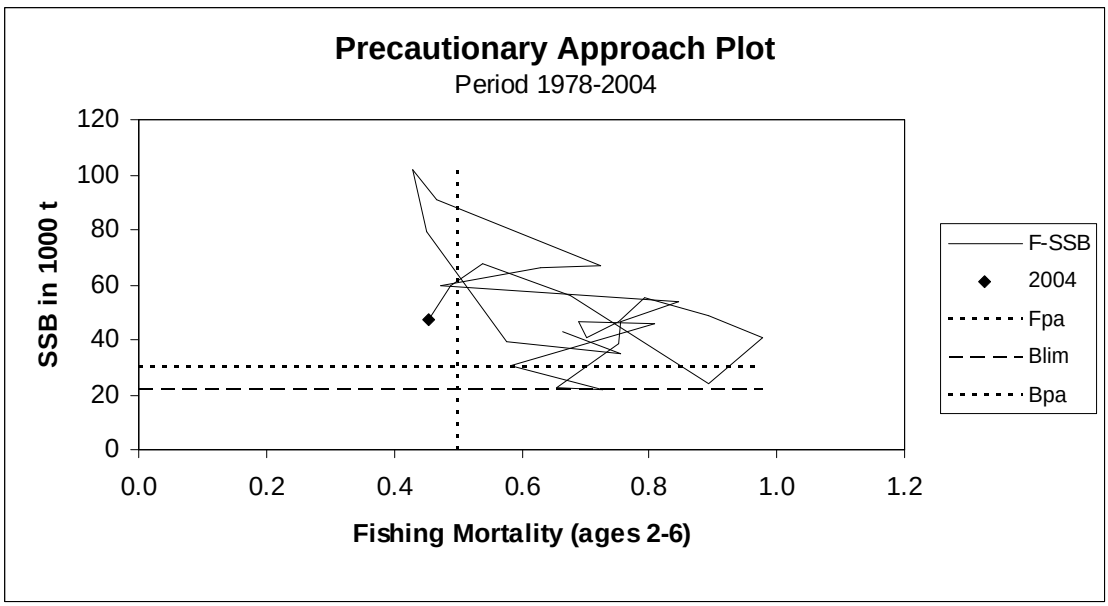

Precautionary Approach Plot
Period 1978-2004
SSB in 1000 t
120
100
80
60
40
20
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 2-6)
F-SSB
2004
Fpa
Blim
Bpa

Table 1.4.23.1 Haddock, Division Via. Nominal catch (ones) of haddock, 1986–2004, as officially reported to ICES.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
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	4956	5,456	3,001	1,335[1,2]	863[1,2]	761[1,2]	761	1,132	753	671	445	270	394[1]	788	282	159[1]	151	180	
Germany, Fed.Rep.	25	21	4	4	15	1	2	9	19	14	2	1	1	2	1	1	+	-	
Ireland	2026	2,628	2,731	2,171	773	710	700	911	746	1,406	1,399	1447	1,352	1054	677	744	672	497	
Norway	45	13	54	74	46	12	72	40	7	13	16[1]	21[1]	28	18	70[1]	33[1]	30	23	4
Spain	-	-	-	-	-	-	-	-	-	-	-	-	2	4	9	4	4	5	
UK (E & W)[3]	222	425	114	235	164	137	132	155	254	322	448	493	458	315	199	201	237		
UK (N. Ireland)	1	1	35								...	...	…	...	…	…	…		
UK (Scotland)	12955	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	5,886			
UK (total)																	6225	4,688	3002
Netherlands																			1
Total	20,385[1]	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	7,163	7,030	7,113	4,884	3007

[1]Preliminary. [2]Includes Divisions Vb(EC) and VIb. [3]1989–2002 N. Ireland included with England and Wales. n/a = not available.

Table1.4.23.2 Haddock in Division VIa (West of Scotland).

Year	Recruitment Age 0 thousands	SSB tonnes	Landings tonnes	Mean F Ages 2-6
1978	76612	42996	19505	0.664
1979	184464	34613	28678	0.755
1980	489559	39170	17474	0.578
1981	58611	79250	33281	0.450
1982	74028	102049	39698	0.428
1983	49936	91263	36192	0.466
1984	333420	66838	46355	0.724
1985	71622	66373	41837	0.630
1986	61037	59931	26714	0.472
1987	247894	53991	43205	0.847
1988	21367	46438	30672	0.754
1989	16278	38331	19669	0.751
1990	93692	22553	15522	0.656
1991	132547	21464	19248	0.727
1992	194137	30334	20513	0.582
1993	175992	45878	35871	0.808
1994	73589	46680	25342	0.689
1995	272516	40955	20920	0.701
1996	158324	46594	24817	0.752
1997	174447	55063	19344	0.792
1998	185725	48412	19936	0.894
1999	37720	40965	15321	0.976
2000	599068	24212	14851	0.894
2001	225177	56018	13389	0.677
2002	115176	67554	15977	0.539
2003	155004	59488	9438	0.488
2004	45850	47059	7579	0.453
2005	35873	48977		
Average	155702	50837	24494	0.672

1.4.24 Haddock in Division VIb (Rockall)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown	Not defined	

The state of the stock is uncertain. Historical perspectives of fishing mortality indicate that they have been high, but the current exploitation rate is unknown. Survey-based indices of SSB show a decline since 1995 and indicate that the stock was at an historical low in 2002, but may have increased in subsequent years. Recruitment indicates a relatively strong 2001 year class.

Management objectives

In consultation with the Russian Federation, a recovery plan has been proposed by the EC, but has not yet been implemented. The recovery plan is designed to be facilitated by quota and technical regulations.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 6 000 t.	$\mathbf{B}_{pa}$ be set at 9 000 t.
	$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ be set at 0.4.
Target reference points		$\mathbf{F}_{y}$ not determined.

Technical basis:

$\mathbf{B}_{lim} = \mathbf{B}_{loss,}$ the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa} = \mathbf{B}_{lim} * 1.4$. 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 not defined due to uninformative stock recruitment data.	$\mathbf{F}_{pa}$: This F is adopted by analogy with other haddock stocks as the F that provides a small probability that SSB will fall below $\mathbf{B}_{pa}$ in the long term.

Single-stock exploitation boundaries

Catches in 2006 should be reduced to the lowest possible level.

Management considerations

Previous to 2004, the EU TAC was set as a total for Division VI, with a limit on how much of the catch could be taken in Division VIa. The 2004 and 2005 (EU) TACs set a specific limit for the EU fleets operating in Division VIb. In addition, part of Division VIb falls (since 1999) within international waters where non-EU vessels are not subject to TAC. This allows for an unregulated fishery in the Rockall area. An international TAC applicable only to Division VIb, including international waters, would improve prospects for sustainability in the fishery in Division VIb.

However, the application of TACs implies that there is a simple relationship between recorded landings and effort exerted, and TACs are therefore likely to be effective only if the fishery strictly adheres to them. Such assumptions are unlikely to be true for Rockall haddock, especially when coupled with ways of evading TACs including misreporting, high grading, and discarding. In the case of Rockall haddock these may occur to a large extent due to the remote nature of the fishery and the processing of catches at sea by some fleets. Therefore, effort regulation should be considered as a means of controlling fishing mortality on Rockall haddock.

There is a need for an internationally agreed management plan. Such a plan should involve extensive collaboration between stakeholders, scientists, and management authorities in both the design and the monitoring of conservation

measures. ICES notes that this is a mixed fishery that currently includes substantial catches of blue whiting and non-assessed species such as grey gurnard.

Factors affecting the fisheries and the stock

The effects of regulations

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 that this closure has had on the haddock stock for several reasons: An analytical assessment was not possible this year. It is necessary to know that there is effective compliance with the closed area regulations, and that the closed area continues to encompass a sufficient proportion of the population of young fish. It is also necessary to establish that the selection pattern of the fishery has improved, or the overall effort has been reduced, and that improved survival of young fish has occurred as a result.

Scientific basis

Data and methods

Information about age composition in the landings is incomplete. The total catch composition has been estimated, but it is not possible to validate these estimates. Survey estimates are available from 1988–2003. In 2004–2005 new data on biology and distribution were obtained, a trawl acoustic survey was carried out, and the biomass of haddock from the Rockall Bank was estimated (Oganin *et al*., 2005).

Uncertainties in assessment and forecast

The survey covers only part of the currently known distributional area of haddock. The survey index may thus in part reflect changes in the distributional pattern, and not only in stock dynamics. An annual survey covering the whole of the distributional area may improve assessment of the stock status if managed under a TAC regime.

There is an urgent requirement for well-designed scientific monitoring programmes capable of delivering accurate data on trends in abundance and composition of the fish fauna throughout the area, in a form that can support the development and implementation of a management plan for Rockall Bank.

Comparison with previous assessment and advice

The assessment and the advice are the same as last year. The 2005 assessment attempted to take into account some previously unavailable data regarding discards, incomplete catch-at-age data, and discontinuous survey data.

Sources of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Oganin, I. A., Ratushny, S. V., Astakhov, A. Yu., Khlivnoy, V. N., and Vinnichenko, V. I. 2005. Preliminary results from the Trawl-Acoustic survey for haddock (*Melanogrammus aeglefinus*) stock on the Rockall Bank in 2005. Working Document to the Working Group on the Assessment of Northern Shelf Demersal Stocks, 2005.

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	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	4.5
1999	Reduce F below $\mathbf{F}_{pa}$		3.8			6.0	5.1
2000	Reduce F below $\mathbf{F}_{pa}$		< 3.5			5.7[4]	5.3[5]
2001	Reduce F below $\mathbf{F}_{pa}$		< 2.7			2.3[4]	2.0[5]
2002	Reduce F below 0.2		<1.3			3.0	3.3
2003	Lowest possible F		-			6.1	6.2
2004	[6]	Lowest possible catch		-	0.702*	6.3	6.4
2005	[6]	Lowest possible catch			0.702*		
2006	[6]	Lowest possible catch					

Weights in '000 t.
[1]TAC is set for Divisions VIa and VIb (plus Vb1, XII & XIV), combined with restrictions on the quantity that can be taken in VIa from 1990.
[2]Including misreporting.
[3]Landings at *status quo* F.
[4]Incomplete data.
[5]Russian data adjusted to exclude fish below MLS of 30 cm.
[6]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
* Agreed EU TAC for VIb, XII, and XIV.

Table 1.4.24.1 Nominal catch (tonnes) of HADDOCK in Division VIb, 1986–2004, as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[1]	2004[1]
Faroe Islands	-	-	-	-	-	-	-	-	-	-	-	n/a	n/a			
France	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	…[2]	-	-	-*		5	2*	+	1	
Germany, Fed. Rep.	1	-	-	-	-	-	-	-	-	-	-	-	-			
Iceland	-	-	-	-	-	-	-	-	+	-	167	-	-	-		
Ireland	-	620	640	571	692	956	677	747	895	704	1,021	824	357	206	169	19[5]
Norway	47	38	69	47	68	75	29	24	24	40	61	152*	70*	49	60	32
Portugal	-	-	-	-	-	-	-	-	-	4	-	-	-			
Russian Federation	-	-	-	-	-	-	-	-	-	-	458	2,154	630	1,630	4,237	5,844
Spain	337	178	187	51	-	-	28	1	22	21	25	47	51	7	19	
UK (E, W & NI)	272	238	165	74	308	169	318	293	165	561	288	36	-	-	56	
UK (Scotland)	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	1,145[3]	1,606	411[3]
United Kingdom															1,662	
Total	6,643	8,213	5,853	4,520	4,113	3,735	5,491	6,818	5,220	5,098	5,990	5,688	2,315	3,037	6,148	6,306
Unallocated catch	85	-4,329	-198	800	671	1,998	-379	-543	-591	-599	-851	-357	-279	299	94	139
WG estimate	6,728	3,884	5,655	5,320	4,784	5,733	5,112	6,275	4,629	4,499	5,139	5,331[4]	2,036[4]	3,336[4]	6,242[4]	6,445

[1]Preliminary.
[2]Included in Division VIa.
[3]Includes UK England, Wales, and NI landings.
[4]includes the total Russian catch.
[5] non-official.
n/a = not available.

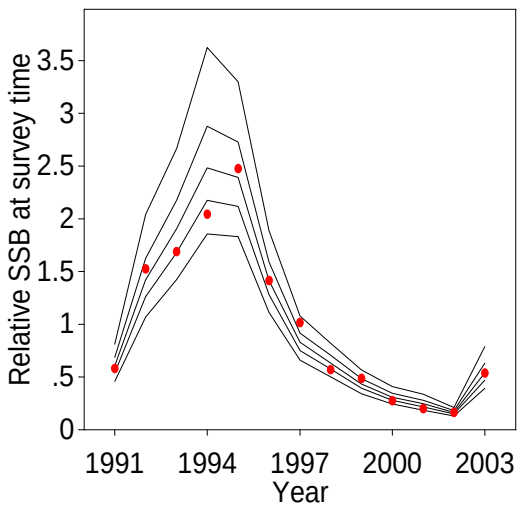


Figure 1.4.24.1 Relative trends in SSB based on the Scottish Groundfish Survey. The lines represent SSB indices of individual age groups.

1.4.25 Whiting in Division VIa (West of Scotland)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown	Not defined	The state of the stock is unknown, but all indicators point towards the stock being at an historical low.

Long-term information on the historical yield and catch composition all indicate that the present stock size is low. The last assessment in 2003 indicated a decrease in SSB by a factor 5 from the 1980s to the 1990s. Survey information from the 1990s indicates that the stock has remained at this low level.

Management objectives

There are no explicit management objectives for this stock.

Reference points

	ICES considers that:	ICES proposes that:
Limit reference points	$\mathbf{B}_{lim}$ is 16 000 t.	$\mathbf{B}_{pa}$ be set at 22 000 t.
	$\mathbf{F}_{lim}$ is 1.0.	$\mathbf{F}_{pa}$ be set at 0.6.
Target reference points		$\mathbf{F}_{y}$ not defined.

Yield and spawning biomass per Recruit (from 2004 assessment)
F-reference points:

	Fish Mort Ages 2-4	Yield/R	SSB/R
$\mathbf{F}_{max}$	0.229	0.104	0.624
$\mathbf{F}_{0.1}$	0.138	0.097	0.870
$\mathbf{F}_{med}$	0.680	0.076	0.240

Candidates for reference points which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential of the stock may be identified in the range of $\mathbf{F}_{0.1}$–$\mathbf{F}_{max}$.

Technical basis:

$\mathbf{B}_{lim}$ = $\mathbf{B}_{loss}$(1998), the lowest observed spawning stock estimated in previous assessments.	$\mathbf{B}_{pa}$ = $\mathbf{B}_{lim}$ * 1.4. 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 the fishing mortality above which stock decline has been observed.	$\mathbf{F}_{pa}$ = 0.6 * $\mathbf{F}_{lim}$. This F is considered to have a high probability of avoiding $\mathbf{F}_{lim}$.

The advice is based on information from abundance surveys. Reference points have not been estimated from the surveys. However, recovery of the stock will require substantial and persistent increase of both SSB and recruitment. The recent survey SSB estimates are below any likely candidates for a survey-based SSB limit point.

Single-stock exploitation boundaries

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

There will be no gain in the long-term yield by having fishing mortalities above $\mathbf{F}_{max}$ (0.23). Fishing at such lower mortalities would lead to higher SSB and, therefore, lower risks of fishing outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

Catches in 2006 should be reduced to the lowest possible level. Survey and catch-at-age data are inconsistent, indicating substantial unaccounted removals. Based on the survey data the stock is at a low level similar to the one in the early 1990s, but official catches are now much lower than during this period; however, the exact catch level is not known.

Management considerations

There are strong indications that management control is not effective in limiting the catch. Survey information shows that the total removal of whiting in Division VIa may be underestimated in the past decade relative to earlier periods. The effect of the fishery on the stock has therefore been evaluated in relative terms and advice on absolute levels of future catches is not possible.

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 reduce discards and to improve the exploitation pattern would be beneficial to the stock and to the fishery.

Management plan evaluations

There are reports of significant non-reported landings and the current implementation of the TAC system is therefore not able to regulate fishing mortality. Unless management measures are able to restrict the fishery they are not precautionary.

Factors affecting the fisheries and the stock

The effects of regulations

The fishery is regulated by a TAC that does not, however, seem to restrict catches.

The more widespread use of 110-mm mesh nets in 2002 as well as the requirement to fit square mesh panels to certain towed gears since late 2000, may have temporarily improved the selection pattern for whiting. However, the increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80-mm mesh sizes in the mixed fishery trawls, due to the loss of valuable *Nephrops* catches. Poorer selectivity at this mesh size may have resulted in increased discarding and high grading.

With the introduction of effort regulation, vessel operators have effectively been further encouraged to reduce mesh size and shift to other fisheries, particularly *Nephrops* trawling, in order to gain more days at sea. It is not possible to evaluate whether the mesh size changes and effort limitations may have benefited whiting without information on the level of adherence to catch composition regulations required when using smaller mesh sizes.

The continued decline in the stock indicates that these measures alone have not proven sufficient to rebuild the stock to precautionary levels. Detailed analysis of the impact of the regulations will not be possible until data of sufficient quality become available.

Changes in fishing technology and fishing patterns

Whiting in Division VIa are caught mainly by Scottish trawlers. There has been a reduction in trawl and seine effort, but with a more moderate reduction by *Nephrops* trawlers. At present a higher proportion of the overall effort is by relatively small-meshed trawls. There has been a tendency to shift from the use of heavy groundgear (like rockhopper) to lighter groundgear.

Scientific basis

Data and methods

A survey-based assessment was used to evaluate trends in SSB and recruitment.

Uncertainties in assessment and forecast

Some changes have been made to the survey design in the past, but surveys are considered to be a reasonable indicator of long-term stock trend. Jumps in survey indices are observed in occasional years. Survey information indicates an increase in unaccounted removal from this stock. Absolute biomass estimation may thus be biased, but it is not known to what extent. Thus, an analytical catch-at-age assessment is not acceptable as a basis for management advice. Advice has therefore been conditioned to the survey-based assessment patterns. The decrease in survey biomass in recent years implies that the unaccounted catch is causing harm to the stock.

Comparison with previous assessment and advice

This year's assessment is based on survey information alone. Fishing mortality is not well estimated by the survey-based assessment and has therefore not been used as a basis for advice.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Catch corresponding to single-stock boundaries	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	11.8	23.1
1989	No increase in F; TAC		13.0		16.4	7.7	7.5	4.1	11.6
1990	No increase in F; TAC		11.0		11.0	6.0	5.6	4.4	10.0
1991	70% of effort (89)		-		9.0	6.9	6.7	5.3	12.0
1992	70% of effort (89)		-		7.5	6.0	6.0	9.4	15.4
1993	70% of effort (89)		-		8.7	6.8	6.9	8.5	15.4
1994	30% reduction in effort		-		6.8	5.8	5.9	8.9	14.8
1995	Significant reduction in effort		-		6.8	6.3	6.1	7.6	13.7
1996	Significant reduction in effort		-		10.0	6.6	7.2	6.9	14.1
1997	Significant reduction in effort		-		13.0	6.2	6.3	4.9	11.2
1998	No increase in F		6.5		9.0	4.7	4.6	5.8	10.5
1999	Reduce F below $\mathbf{F}_{pa}$		4.3		6.3	4.7	4.6	3.1	7.7
2000	Reduce F below $\mathbf{F}_{pa}$		<4.3		4.3	3.2	3.0	6.7	9.7
2001	Reduce F below $\mathbf{F}_{pa}$		<4.2		4.0	2.5	2.4	2.4	4.9
2002	SSB>$\mathbf{B}_{pa}$ in short term		<2.0		3.5	1.7	n/a	n/a	n/a
2003	No cod catches		-		2.0	1.3	n/a	n/a	n/a
2004	[2]	SSB>$\mathbf{B}_{pa}$ in the short term	[2]	<2.1	1.6	0.8	n/a	n/a	n/a
2005	Exploitation not allowed to increase			<1.6	1.6				
2006	Lowest possible level			-					

Weights in '000 t.
[1]TAC is set for Divisions VIa and VIb combined.
[2]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
n/a = not available.

Table 1.4.25.1 Nominal catch (t) of WHITING in Division VIa, 1989–2004, as officially reported to ICES.

Country	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
Belgium	1	-	+	-	+	+	+	-	1	1	+	+	-		-	
Denmark	1	+	3	1	1	+	+	+	+	-	-	-	-		0	0
France	199[1,2]	180	352[1,2]	105	149	191	362	202	108	82[1]	300[1]	48	54[1]	21	[11]	[11]
Germany	+	+	+	1	1	+	-	+	-	-	+	-	-	+	+	
Ireland	1,315	977	1,200	1,377	1,192	1,213	1,448	1,182	977	952	1,121	793	764	577	568	354
Netherlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Spain	-	-	-	-	-	-	1	-	1	2	+	-	2	n/a	n/a	
UK (E&W)[3]	44	50	218	196	184	233	204	237	453	251	210	104	71	…	…	
UK (N.I.)	…	…	…	…	…	…	…	…	…	…	…	…	…	…	…	
UK (Scot.)	6,109	4,819	5,135	4,330	5,224	4,149	4,263	5,021	4,638	3,369	3,046	2,258	1,654	…	…	
UK (total)														1,137	786	457
Total landings	7,669	6,026	6,908	6,010	6,751	5,786	6,278	6,642	6,178	4,657	4,677	3,203	2,545	1,735	1365	822

[1]Preliminary.
[2]Includes Divisions Vb (EC) and VIb.
[3]1989–2002 N. Ireland included with England and Wales.
n/a = Not available.

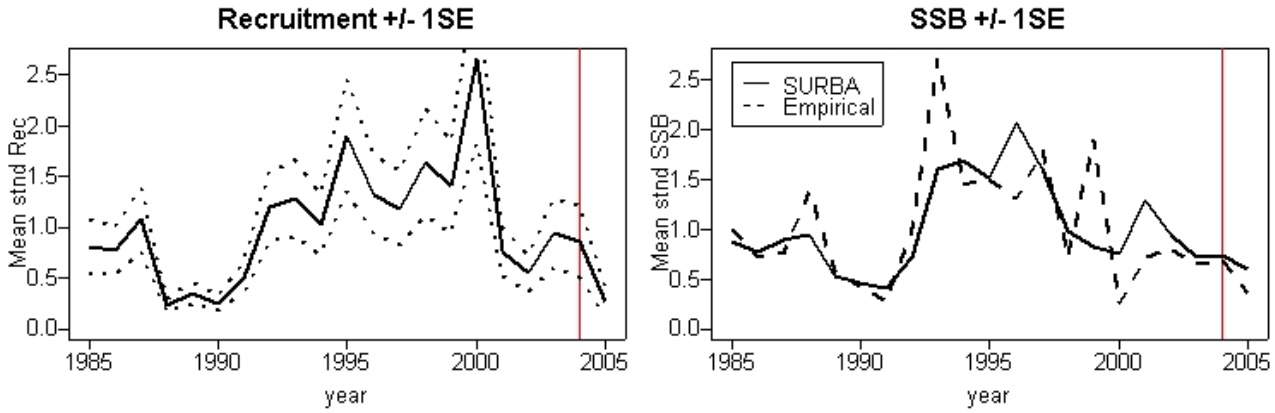


Figure 1.4.25.1 Whiting in VIa. Survey-based estimates of recruitment and SSB (both mean-standardised). Empirical estimates of SSB from the raw survey data are shown as dashed lines in the right-hand panel.

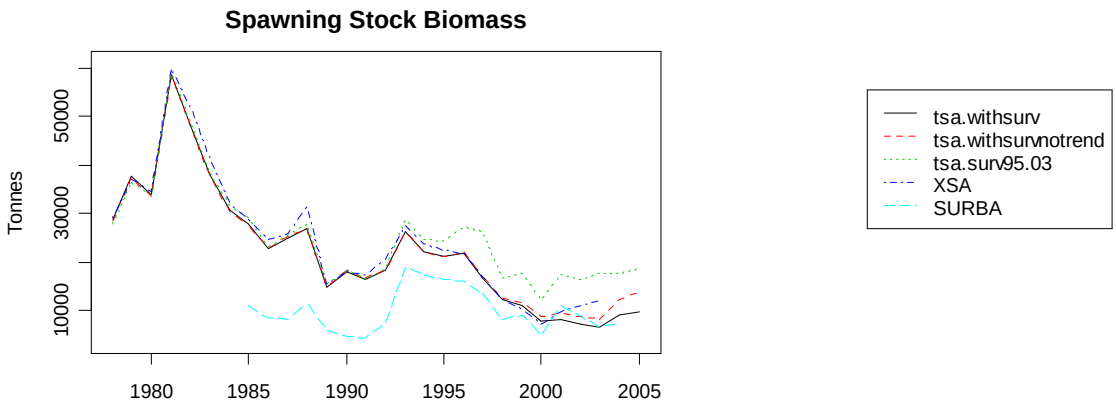


Figure 1.4.25.2 Spawning stock biomass calculated based on different databases and model assumptions (see legend).

1.4.26 Whiting in Division VIb (Rockall)

State of the stock

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, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Table 1.4.26.1 Nominal catch (t) of WHITING in Division VIb (Rockall), 1988–2004, as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004[1]
France	-																
Ireland	-	-	-	-	-	32	10	4	23	3	1	-	-	10		2	
Spain	-	-	-	-	-	-	-	-	-	-	-	+	-	-			
UK (E.& W)	-	16	6	1	5	10	2	5	26	49	20	+	+	-			
UK (N.Ireland)	-	…	…	…	…	…	…	…	…	…	…	…	…		…		
UK (Scotland)	23	18	482	459	283	86	68	53	36	65	23	44	58	4	…		
UK (all)															7	11	1
Total	23	34	488	460	288	128	80	62	85	117	44	44	58	14	7	13	

[1] Preliminary.

1.4.27 Saithe in Subarea VI (West of Scotland and Rockall)

This stock had now been combined with Saithe in Subarea IV (North Sea), Division IIIa (Skagerrak), and Subarea VI (West of Scotland and Rockall) and can be found in Volume 6 – 1.4.12.

1.4.28 Megrim in Subarea VI (West of Scotland and Rockall)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Uncertain	Uncertain	Uncertain	Uncertain	

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown.

Management objectives

No explicit management objectives have been set for this stock.

Reference points

	ICES considers that:	ICES proposed that:
Limit reference points	$\mathbf{B}_{lim}$ is not defined.	$\mathbf{B}_{pa}$ is not defined.
	$\mathbf{F}_{lim}$ is not defined.	$\mathbf{F}_{pa}$ is not defined.
Target reference points		$\mathbf{F}_{y}$ is not defined.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Catches in 2006 should be no more than the recent (2002–2003) landings of about 2300 t. This includes landings in Division VIa and VIb and unallocated landings in Subarea IV.

Management considerations

Although the international megrim landings in recent years have been below the precautionary TAC, some national quotas are restrictive and this may have led to under-reporting of catches.

Area misreporting has been prevalent as megrim catches were misreported from Subarea VI into Subarea IV, due to restrictive quotas for anglerfish (i.e. vessels targeting anglerfish misreported all landings including megrim from Subarea VI into Subarea IV). In order to avoid misreporting by area the TAC should include Subarea IV.

In the past, management of the megrim stock has been linked to that for anglerfish on the assumption that landings were correlated in the fishery. It was assumed that the anglerfish management would also constrain fishing mortality on megrim. This may no longer be true due to recent changes in the fishing pattern of certain fleets, and the dynamics of the species are probably not linked.

The minimum landing size (MLS) of megrim was reduced in January 2000 to 20 cm (EC Regulation No. 850/98). Despite this extremely small size the catch is routinely high graded and large numbers of fish continue to be discarded above this MLS.

Factors affecting the fisheries and the stock

The effects of regulations

New effort regulations provided an incentive for some vessels previously using >100-mm mesh in otter trawls to switch to smaller mesh gears to obtain the right to more days-at-sea. This would also require these vessels to be targeting either *Nephrops* or anglerfish, megrim, and whiting with various catch and bycatch composition limits after EC Regulation No. 850/98. No detailed information was available to quantify how many vessels have switched to using smaller meshes as a result of effort regulation as this information is not reliably recorded in logbook information for some countries.

Changes in fishing technology and fishing patterns

There have been recent changes to the UK Scottish fleets with decommissioning schemes removing 96 of the 298 demersal trawlers (mesh sizes >= 100 mm) between 2001 and 2004. This will have affected the effort, but due to uncertainty in the effort statistics it is not know to what extent effort has been reduced. The Irish fleet has also reduced substantially in recent years and now the majority of the reported landings are made by only 12 vessels. In the case of the Irish fleet a large number of older vessels have been replaced by fewer modern whitefish vessels as part of a national whitefish renewal scheme. A further Irish decommissioning scheme is planned for 2005 and 2006.

No information is available on changes in the French and Spanish fleets operating in this area.

Scientific basis

Data and methods

The stock was evaluated using information on landing compositions provided by Scotland and catch compositions provided by Ireland.

The quality of the available landings data, specifically the area misreporting and lack of effort and CPUE data for the main fleet in the fishery, severely hampers the ability of ICES to carry out an assessment for this stock. For stocks like megrim and anglerfish on the northern shelf, there is a general need for improved spatio-temporal resolution of commercial catch and effort data.

At the moment no survey series adequately covers this stock. Scottish and Irish ground fish surveys catch low numbers of megrim due to unsuitable gear and survey design. In addition, the Irish GFS survey series consists of only two years.

Uncertainties in assessment and forecast

The quality of the landing statistics is unknown, and discard information and CPUEs from the main fleet are lacking. The surveys only cover a limited range of the known distribution of the stock and are not suitable for a survey-based assessment/forecast approach.

Comparison with previous assessment and advice:

Last year there was no analytical assessment for this stock and the management advice was based on average landings. ICES has serious concerns about the accuracy of the landings data which are area misreported and underreported for this stock. This year the advice is based on effort rather than on landings.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official Landings[2]	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	3.7
1991	No advice		-		4.84	3.2	3.7
1992	No advice		-		4.84	3.2	4.8
1993	No long-term gain in increased F		-		4.84	3.0	4.3
1994	No long-term gain in increased F		-		4.84	3.0	4.3
1995	No advice		-		4.84	3.3	4.6
1996	No advice		-		4.84	2.9	5.3
1997	No advice		-		4.84	2.8	4.6
1998	Adequate catch controls		-		4.84	2.7	4.2
1999	Maintain current TAC		4.84		4.84	2.5	3.8
2000	Maintain current TAC		4.84		4.84	2.4	3.6
2001	Maintain current TAC		4.84		4.36	2.4	3.3
2002	Maintain current TAC		4.36		4.36	1.6	2.3
2003	Maintain current TAC		4.36		4.36	1.7	2.3
2004	[4]	Reduce TAC to recent landings		3.60	3.60	n/a	n/a
2005	[4]	Reduce TAC to recent landings		2.3	2.88		
2006	[4]	Reduce TAC to recent landings		2.3			

Weights in '000 t.
[1]Vb(EC), VI, XII and XIV.
[2] VIa and VIb.
[3] Landings in VIa and VIb and unallocated landings from IV. Landings in Vb (EC), XII, and XIV are negligible.
[4] Single-stock boundaries and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
n/a = not available.

Table 1.4.28.1 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)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Belgium	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	398	455	504	517	408	618	462	192	172	0	135	252	79	92	n/a
Ireland	317	260	317	329	304	535	460	438	433	438	417	509	280	344	n/a
Netherlands	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Spain	91	48	25	7	1	24	22	87	111	83	98	92	89	98	n/a
UK - Eng+Wales+N.Irl.	25	167	392	298	327	322	156	123	65	42	20	7	14	13	-
UK – Scotland	1093	1223	887	896	866	952	944	954	841	831	754	770	643	558	-
UK															484
Offical Total	1924	2154	2125	2047	1907	2451	2044	1795	1622	1394	1424	1630	1105	1105	n/a
Unallocated	286	278	424	674	786	1047	2010	1477	1083	1254	823	843	723	537	n/a
As used by WG	2210	2432	2549	2721	2693	3498	4054	3272	2705	2648	2247	2473	1828	1642	1328
Area Mispreported landings	339	338	466	735	871	1126	2062	1556	1156	1066	868	829	731	544	421

Megrim in Division VIb (Rockall)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
France	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
Ireland	196	240	139	128	176	117	124	141	218	127	167	176	87	83	n/a
Spain	363	587	683	594	574	520	515	628	549	404	427	370	120	93	n/a
UK - Eng+Wales+N.Irl.	19	14	53	56	38	27	92	76	116	57	57	42	41	74	0
UK - England & Wales	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UK – Scotland	226	204	198	147	258	152	112	164	208	278	309	236	207	382	0
UK															414
Offical Total	804	1045	1073	925	1046	816	843	1009	1091	866	964	824	455	632	n/a
As used by WG	804	1045	1073	925	1046	816	843	1009	1091	866	964	825	456	632	n/a

Total Megrim in Sub-area VI (West of Scotland and Rockall)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Offical Total	2728	3199	3198	2972	2953	3267	2887	2804	2713	2260	2388	2454	1560	1737	n/a
As used by WG	3014	3477	3622	3646	3739	4314	4897	4281	3796	3514	3211	3298	2284	2274	n/a

n/a = not available.

1.4.29 Anglerfish in Division IIa (Norwegian Sea), 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 in these areas, *Lophius piscatorius* and *L. budegassa*, although catches are almost exclusively of the former.

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

There are major uncertainties about catch and effort data for anglerfish, as well as limited knowledge about population dynamics and distribution. The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk. The development of commercial CPUE from a logbook study indicates that the stock is not in decline.

Management objectives

There are no explicit management objectives for this stock; the European Community and Norway are in discussions regarding the joint management of this shared stock.

Reference points

ICES considers that:	ICES proposes that:
There is currently no biological basis for defining $\mathbf{B}_{lim}$ or $\mathbf{F}_{lim}$.	$\mathbf{F}_{35\%SPR}$= 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 $\mathbf{F}_{MSY}$.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch fish.

Management considerations

For a number of years, anglerfish in Subareas VI, XII, XIV and Division Vb (EU zone) were subjected to a precautionary TAC (8600 t) based on average landings in earlier years. In 2002 the TAC was set at 4770 t and was further reduced to 3180 t in 2003 and 2004. The TAC for 2005 has been increased to 4686 t. Within ICES it was highlighted that the reduction of the TAC in 2003 to just two-thirds of that in 2002 would likely imply an increased incentive to misreport landings and increase discarding unless fishing effort was reduced accordingly (Section 6.4.6, ICES WGNSDS 2003/CM 2004/ACFM:01). Anecdotal information from the fishery in 2003 and 2004 appears to suggest that the TAC did not restrict the catches in these years. The official statistics for 2003 and 2004 are therefore likely to be particularly unrepresentative of actual landings.

The absence of a TAC prior to 1998 for the adjacent Subarea IV means that prior to 1998, landings in excess of the TAC in other areas were likely to be misreported into the North Sea. In 1999, a precautionary TAC was introduced for North Sea anglerfish, but unfortunately for current and future reporting purposes, the TAC was set in accord with recent catch levels from the North Sea which included a substantial amount misreported from Subarea VI. The area misreporting practices have thus become institutionalised. Estimates which account for this area misreporting indicate that the percentage of the catch taken in Division IIIa and Subarea IV, and in Divisions VIa & VIb in the years 1993–2002 average 60% and 40%, respectively. In previous years, these proportions have been used to allocate TAC between these areas. However, given the concerns about the veracity of the recent reported landings data, such proportionate splitting may no longer be appropriate.

A TAC regulation such as that currently implemented is therefore not adequate to regulate fishing mortality within sustainable limits. However, it is implicit in the inadequate landings and effort data that a reliable estimation of $\mathbf{F}_{sq}$ would also be impossible, as such a TAC would continue to result in misreporting.

In this situation the most productive way forward would be a two-stage approach. The first stage would be to substantially improve the quality and quantity of data collected on the fishery while maintaining exploitation at its current level. This was the basis of ICES' recommendation (ACFM 2004) to allow the fishery to continue with the current effort (inasmuch as this can be determined). This was to be accompanied by a detailed and stringent monitoring programme, including the mandatory reporting of both catch and effort data in logbooks, as well as use of VMS data. The programme would also include the development of a targeted, industry collaboration trawl survey to start in 2005.

A key point in this recommendation was that the restrictive TAC in 2004 and previous years had led to extensive mis-reporting. Management aimed at maintaining effort at or below that of 2004, but without a specific TAC, would have allowed the accurate reporting of catch and effort. In the event, a TAC-based regime was retained, although at an increased level. To date it is not clear if this has improved the quality of the landings data; however, the TAC is still perceived as restrictive by the industry. The existing tally book scheme is to be continued and extended, and observers will be placed on as many vessels as is feasible. The targeted survey is planned to go ahead in the autumn of 2005 and analysis of VMS data at approximately the same time. More robust management measures to control the targeted fishery have been proposed in the UK.

This first stage of data collection would be expected to take at least five years to establish useable time-series of fisheries-dependent and -independent data. The second stage could then be launched to use these data to examine alternative management approaches and harvest control rules appropriate to this fishery in a similar fashion to that used elsewhere within this response; e.g. North Sea cod and plaice. Should evidence appear of a decline in the state of the stock during this period of data collection, the management of this stock should be revisited and appropriate management measures initiated.

The following should be considered:

- A detailed and stringent programme, including the mandatory reporting of both catch and effort data in logbooks should be established in all countries fishing for anglerfish to ensure high quality effort and landings data.
- Small-sized anglerfish are known to be discarded. Routine sampling schemes should be implemented in order to estimate levels of discarding.
- Female anglerfish reach 50% maturity at a length of about 90 cm. A high proportion of anglerfish catches consist of small anglerfish. Technical measures improving the selectivity of gears used in these fisheries should be implemented.

Ecosystem considerations

Ghost fishing and discarding of fish not suitable for consumption due to long soaking times are known to be problems within some offshore gillnetting carried out by "flag-vessels" targeting anglerfish in Subareas VI and VII.

Factors affecting the fisheries and the stock

Until the mid-1980s, anglerfish was taken mainly as a bycatch in bottom trawl groundfish fisheries. Restrictive TACs for other species in Division VIa led to increased fishing pressure on anglerfish in that area, where they are now caught in a targeted anglerfish fishery and as a bycatch in other demersal fisheries, including roundfish fisheries in Division VIa, the haddock fishery on Rockall Bank, *Nephrops* fisheries, and fisheries in deeper waters. In the North Sea, anglerfish are caught as a bycatch in demersal fisheries, *Nephrops* and *Pandalus* fisheries in the northern and eastern parts of the North Sea, the Fladen Ground, and the Norwegian Deeps. In the Norwegian Deeps anglerfish has also been targeted by some demersal trawlers. A Norwegian large-mesh gillnet fishery targeting fish above 60–65 cm has been developed along the Norwegian coast since the early 1990s.The distribution of anglerfish in the North Sea, Kattegat, and Skagerrak is associated with the distribution to the West of Scotland (Division VIa & VIb). It is likely that catches from these areas come from the same biological stock. Genetic studies have found no evidence of separate stocks and particle-tracking studies have indicated interchange of larvae between areas.

The fishery has expanded into deeper waters, areas believed to have been a refuge for adult anglerfish, and this new fishery therefore increases the vulnerability of the stock to overexploitation. Immature fish are subjected to exploitation for a number of years prior to first maturity.

Other factors

The key features of the species' life history in relation to its exploitation are the location of the main spawning areas in relation to the exploited areas, and whether or not there is any systematic migration of younger fish back into the deeper waters to spawn. At present, despite the large increase in catches, there is no apparent contraction in distribution; fish are still recruiting to relatively inshore areas such as the Moray Firth and along the Norwegian coast in the northern North Sea. The fact that spawning appears to occur largely in deep water off the edge of the continental shelf may offer the stock some degree of refuge. It is therefore likely that the current expansion of the fisheries into deeper water will have a negative effect on the stock.

Scientific basis

Data and methods

Information on catch-at-length distribution is available from Scottish market sampling covering Divisions VIa, VIb, and IVa. Irish length-frequency data are also available for the West of Scotland (Division VIa). Danish length samples of landings covering mainly Division IVa are available from 2002. The Norwegian sampling-at-sea by the coast guard began in 2003 and covers also the eastern part of Division IVa. Catch and corresponding effort data based on official Danish logbook records covering the fisheries where anglerfish are caught were presented to ICES in 2005. It is hoped that together with UK data they could provide useful information on stock development. Logbook information from the Norwegian fisheries is not yet available.

Information from the fishing industry

Personal logbook information from Scottish vessels has recently been made available to scientists but could not be incorporated in the assessment because data mostly covered only a short time period. These logbooks also showed contradictions in the trends, particularly in recent years. As these data become available over a longer time span, methods should be developed to use them in an assessment on the status of the stock. There was no evidence of a decline in LPUE in any of the areas considered, and in some areas there was strong indication of an increasing LPUE.

Uncertainties in assessments and forecasts

Although historical catches for the combined area are believed to have been adequately estimated there is uncertainty in the recent level of landings due to misreporting; these data can therefore not be used as the basis for stock assessment. There are inconsistencies in the survey data and traditional groundfish surveys do not appear to be useful indicators of anglerfish stock abundance. The weakness in the recruitment index and the problems in landings data would suggest that previous assessments may also be unreliable.

A targeted survey has been initiated this year (2005). It normally takes at least 5 years before the time-series is sufficiently long to allow quantitative use of such data.

Comparison with previous assessment and advice

Analytical assessments have not been made since 2003. The assessment model used was a modified catch-at-length analysis, which requires reliable landings-at-size data and access to effort data, as well as a survey index. However, problems have been identified in the data sources:

- Anecdotal evidence from the fishery suggests that there has been substantial misallocation and discarding, making the overall level of landings and the length structure unreliable. Hence the landings data may not be reliable.
- In 2003 ACFM identified a conflict between model and survey indices of recruitment. Further analyses indicated that this conflict was severe and included other surveys considered.
- No new effort data have been available for the Scottish fishery for 5 years, requiring assumptions to be made about recent changes in effort. Recent decommissioning schemes mean that assumptions of constant effort over recent years are no longer valid, but it is not possible to quantify any reduction in effort.
- Lack of information on stock structure and basic biology.

The advice in previous years was based on a reference value for F established from the analytical assessment. Due to the lack of assessments since 2004, only general advice based on the precautionary principle has been possible.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Subarea IV – North Sea

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	Official landings	ACFM Landings
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	14.7	Na
2002	2/3 of the catches in 1973–1990	-	5.7	-	10.50	12.3	Na
2003	Reduce F below $\mathbf{F}_{pa}$	-	<6.7[2]	-	7.0	9.3	Na
2004	[1]	Reduce F below $\mathbf{F}_{pa}$		<8.8	7.0	9.7	Na
2005	[1]	No effort increase		-	10.31		
2006	[1]	No effort increase		-			

Weights in '000 t.

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

[2] Advice for Division IIIa, Subarea IV, and Subarea VIa combined.

Subarea VI – West of Scotland and Rockall

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	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	4.4	7.5
2001	2/3 of the catches in 1973-1990		4.3		6.4	4.0	Na
2002	2/3 of the catches in 1973-1990		4.3		4.8	3.0	Na
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7[3]		3.18	3.0	Na
2004	[4]	Reduce F below $\mathbf{F}_{pa}$		[4]	3.18	1.2	Na
2005		No effort increase		-	4.69		
2006		No effort increase		-			

Weights in '000 t.
[1]Vb(EC), VI, XII, and XIV.
[2]Division VIa only.
[3]Advice for Division IIIa, Subarea IV, and Subarea VIa combined.
[4]Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Division IIIa, Subarea IV, and Subarea VI combined

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. To advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC[1]	Official landings	ACFM landings[2]
2003	Reduce F below $\mathbf{F}_{pa}$		<6.7		10.2	12.3	n/a
2004	[2]	Reduce F below $\mathbf{F}_{pa}$	[2]	<8.8	10.2	10.9	n/a
2005		No effort increase	[2]	-	15.0		
2006		No effort increase	[2]	-			

Weights in '000 t.
[1]Vb(EC), VI, XII, and XIV.
[2] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.
n/a = not available.

Table 1.4.29.1 Nominal catch (t) of Anglerfish in Division IIIa, 1990–2004, as officially reported to ICES.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	15	48	34	21	35	-	-	-	-	-	-	-	-	
Denmark	493	658	565	459	312	367	550	415	362	377	375	371	217	311
Germany	-	-	1	-	-	1	1	1	2	1	+	+	+	
Netherlands														4
Norway	64	170	154	263	440	309	186	177	260	197	200	241	187*	130
Sweden	23	62	89	68	36	25	39	33	36	27	46	55	71	55
Total	595	938	843	811	823	702	776	626	660	602	621	667	475	500

*Preliminary.

Table 1.4.29.2 Nominal catch (t) of ANGLERFISH in the North Sea, 1989–2004, as officially reported to ICES.

Northern North Sea (IVa)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	2	9	3	3	2	8	4	1	5	12	-	8	1	
Denmark	1,245	1265	946	1,157	732	1,239	1,155	1,024	1,128	1,087	1,289	1,308	1,517	1,538
Faroes	1	-	10	18	20	-	15	10	6	n/a	2		2	
France	124	151	69	28	18	7	7	3*	18[1*]	8	9	7	6	
Germany	71	68	100	84	613	292	601	873	454	182	95	95	65	
Netherlands	23	44	78	38	13	25	12	-	15	12	3	8	9	38
Norway	587	635	1,224	1,318	657	821	672	954	1,219	1,182	1,212	928	771*	999
Sweden	14	7	7	7	2	1	2	8	8	78	44	56	8	5
UK(E, W&NI)	129	143	160	169	176	439	2,174	668	781	218	183	98	104	…
UK (Scotland)	7,039	7,887	9,712	11,683	15,658	22,344	18,783	13,319	9,710	9,559	10,024	8,539	6,033	…
UK (total)														6,357
Total	9,235	10,209	12,309	14,505	17,891	25,176	23,425	16,860	13,344	12,338	12,861	11,047	8,516	8,937

* Preliminary. [1]Includes IVb,c.

Central North Sea (IVb)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	357	538	558	713	579	287	336	371	270	449	579	435	178	258
Denmark	345	421	347	352[1]	295	225	334	432	368	260	251	255	190	271
Faroes	-	-	2	-	-	-	-	-	-	n/a		9		
France	-	1	-	2	-	-	-	-*	…[2*]	-	-	-	-	
Germany	4	2	13	15	10	9	18	19	9	14	9	17	11	
Ireland													1	
Netherlands	285	356	467	510	335	159	237	223	141	141	123	62	42	25
Norway	17	4	3	11	15	29	6	13	17	9	15	10	13*	22
Sweden	-	-	-	3	2	1	3	3	4	3	2	9	2	1
UK(E, W&NI)	669	998	1,285	1,277	919	662	664	603	364	423	475	236	167	…
UK (Scotland)	845	733	469	564	472	475	574	424	344	318	378	210	241	…
UK (total)														258
Total	2,522	3,053	3,144	3,447	2,627	1,847	2,172	2,088	1,517	1,617	1,832	1,243	845	835

* Preliminary. [1]Includes 2 tonnes reported as Sub-area IV. [2]Included in IVa.

Southern North Sea (IVc)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	13	12	34	37	26	28	17	17	11	15	15	16	9	5
Denmark	2	-	-	-	-	-	-	+	+	+	+	+	+	+
France	-	-	-	-	-	-	-	10	…[1*]	+	-	+	-	
Germany	-	-	-	-	-	-	-	-	-	+	-	+	+	
Netherlands	5	10	14	20	15	17	11	15	10	15	6	5	1	
Norway	-	-	-	-	+	-	-	-	+	-	+	-	-*	-
UK(E&W&NI)	6	17	18	136	361	256	131	36	3	1	+	+	10	…
UK (Scotland)	-	-	-	17	-	3	1	+	+	+	+	+	-	…
UK (total)														10
Total	26	39	66	210	402	304	160	78	24	31	21	21	20	15

* Preliminary. [1]Included in IVa.

Total North Sea

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Total	11,783	13,301	15,519	18,162	20,920	27,327	25,757	19,026	14,885	13,986	14,714	12,311	9,381	9,787
WG estimate	10,566	11,728	13,078	15,432	15,794	16,240	18,217	14,027	11,719	11,564	12,677	10,334	8,273	9,027
Unallocated	-1,217	-1,573	-2,441	-2,730	-5,126	-11,087	-7,540	-4,999	-3,166	-2,422	-2037	-1,977	-1,108	-760

* Preliminary.

Table 1.4.29.3 Anglerfish in Subarea VI. Nominal landings (t) as officially reported to ICES.

Anglerfish in Division VIa (West of Scotland)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Belgium	3	2	9	6	5	+	5	2	+	+	+	+	+	
Denmark	1	3	4	5	10	4	1	2	1	+	+	-	+	
France	1,910	2,308	2,467	2,382	2,648	2,899	2,058	1,634	1,814[1]	1,132	943	732	1,166	
Germany	1	2	60	67	77	35	72	137	50	39	11	3	27	
Ireland	250	403	428	303	720	717	625	749	617	515	475	304	322	
Netherlands	-	-	-	-	-	-	27	1	-	-	-	-	-	
Norway	6	14	8	6	4	4	1	3	1	3	2	1	+*	+
Spain	7	11	8	1	37	33	63	86	53	82	70	101	196	
UK(E&W&NI)	270	351	223	370	320	201	156	119	60	44	40	32	30	
UK(Scotland)	2,613	2,385	2,346	2,133	2533	2,515	2,322	1,773	1,688	1,496	1,119	1,100	705	
UK (total)														885
Total	5,061	5,479	5,553	5,273	6,354	6,408	5,330	4,506	4,284	3,311	2,660	2,273	2,446	885
Unallocated	296	2,638	3,816	2,766	5,112	11,148	7,506	5,234	3,799	3,114	2,068	1,882	985	1,938
As used by WG	5,357	8,117	9,369	8,039	11,466	17,556	12,836	9,740	8,083	6,425	4,728	4,155	3,431	2,823

*Preliminary. [1]Includes VIb.

Anglerfish in Division VIb (Rockall)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Estonia														+
Faroe Islands	-	2	-	-	-	15	4	2	2		1			
France	-	-	29	-	-	-	1	1	…[1]	48	192	42	99	
Germany	-	-	103	73	83	78	177	132	144	119	67	35	63	
Ireland	272	417	96	135	133	90	139	130	75	81	134	51	26	
Norway	18	10	17	24	14	11	4	6	5	11	5	3	6*	5
Portugal	-	-	-	-	-	-	-	+	429	20	18	8	4	
Russia	-	-	-	-	-	-	-	-	-	-	1	-	-	
Spain	333	263	178	214	296	196	171	252	291	149	327	128	59	
UK(E&W&NI)	99	173	76	50	105	144	247	188	111	272	197	133	133	
UK(Scotland)	201	224	182	281	199	68	156	189	344	374	367	317	160	
UK (total)														347
Total	923	1,089	681	777	830	602	899	900	1401	1074	1309	717	550	352
Unallocated									-9	17	-162	-40	145	121
As used by WG	923	1,089	681	777	830	602	899	900	1392	1091	1147	677	695	473

*Preliminary. [1]Included in VIa.

Total Anglerfish in Subarea VI (West of Scotland and Rockall)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004*
Total official	5,984	6,568	6,234	6,050	7,184	7,010	6,229	5,406	5,685	4,385	3,969	2,990	2,996	1237
Total ICES	6,280	9,206	10,050	8,816	12,296	18,158	13,735	10,640	9,475	7,516	5,875	4,832	4,126	3,296

*Preliminary.

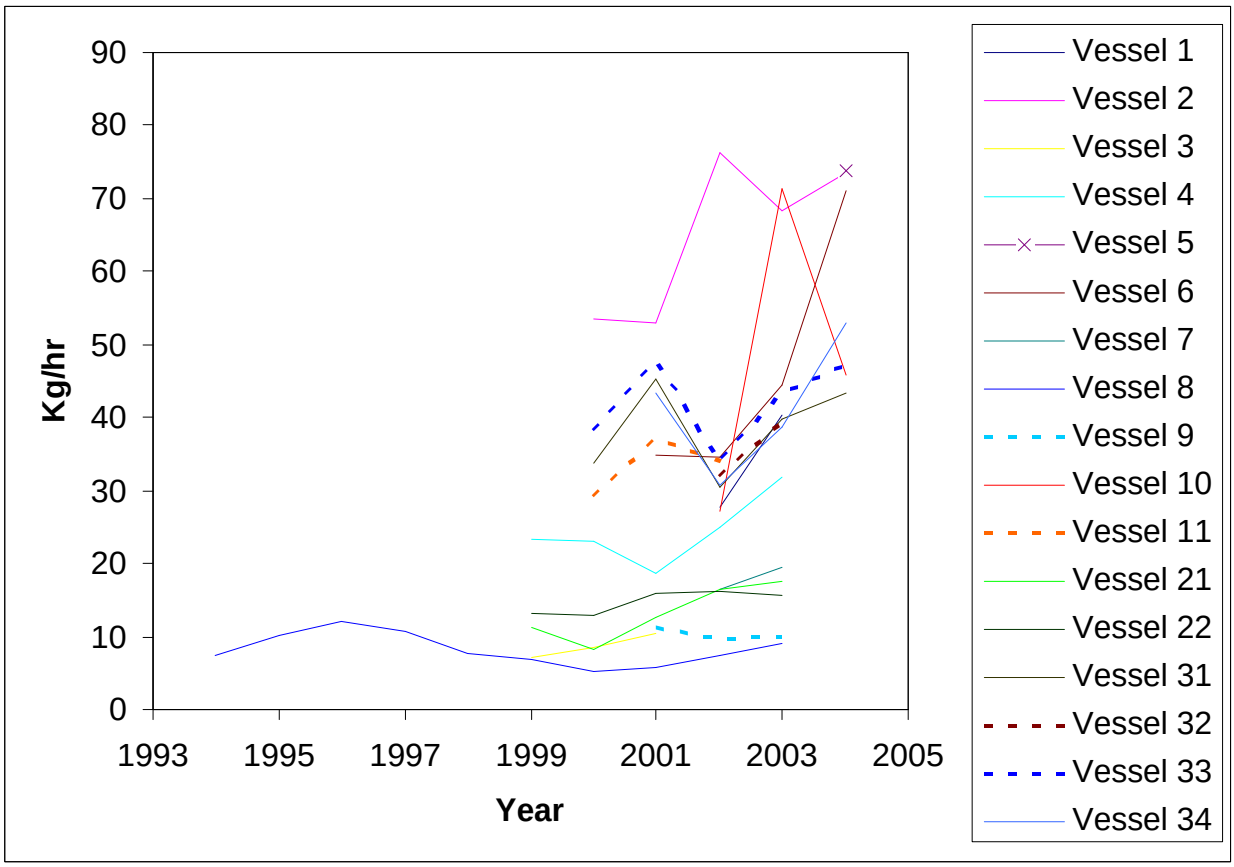


Figure 1.4.29.1 Anglerfish in Subarea VI. Annual catch rates (Kg/hr) from Scottish vessels supplying diary information.

1.4.30 Herring in Division VIa (North)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Full reproductive capacity	Reference points are not defined	-	-	

Based on the most recent estimates of SSB, ICES classifies the stock as having full reproductive capacity. The assessment shows a relatively stable SSB with a small decline due to reduced recruitment this year, though the stock is still substantially higher than the previous ten years. Fishing mortality has stabilised at a low level. Current fishing mortality is at a level where the stock remains within PA bounds. The 2001 year class is small.

Management objectives

There are no explicit management objectives for this stock.

Reference points –defined in 2004

	ICES considers that:	**ICES proposed that:**
Precautionary Approach reference points	$\mathbf{B}_{lim}$ is at 50 000 t	$\mathbf{B}_{pa}$ is at 75 000 t
	$\mathbf{F}_{lim}$ not defined	$\mathbf{F}_{pa}$ not defined

Yield and spawning biomass per Recruit
F-reference points

Reference point	**F multiplier**	**Absolute F**
$\overline{F}_{(3–6)(2002–2004)}$	1.00	0.19
$\mathbf{F}_{0.1}$	0.85	0.16
$\mathbf{F}_{35\%SPR}$	0.90	0.17
$\mathbf{F}_{low}$	0.33	0.06
$\mathbf{F}_{med}$	1.48	0.27

In absence of defined PA reference points for fishing mortality, candidates for target reference points are between $\mathbf{F}_{0.1}$ and $\mathbf{F}_{med}$. The Yield-per-Recruit curve rises slowly above $\mathbf{F}_{0.1}$ and there is a 12% gain in long-term yield by fishing at the higher fishing mortality of $\mathbf{F}_{med}$.

Technical basis

$\mathbf{B}_{lim}$: lowest reliable estimate of SSB	$\mathbf{B}_{pa}$: Approximately 1.5 $\mathbf{B}_{lim}$
$\mathbf{F}_{lim}$ is not defined	$\mathbf{F}_{pa}$ is not defined

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The present level of fishing mortality ($\mathbf{F}_{sq}$) appears to be sustainable and has led to a rise in SSB. The candidate HCR presented below also seems to maintain the stock inside precautionary limits.

Short-term implications

Outlook for 2006

Basis: F(2005) = *Status quo* = 0.19; SSB(2005) = 136 672; catch (2005) = 25 057 t.

Rationale	Catches (2006)	Basis	F(2006)	SSB(2006)	SSB(2007)
Zero catch	0	F=0	0	160	191
proportional	16.4	0.6 *$\mathbf{F}_{sq}$	0.11	149	164
proportional	21.5	0.8* $\mathbf{F}_{sq}$	0.15	146	156
$\mathbf{F}_{sq}$	26.4	$\mathbf{F}_{sq}$	0.19	142	148
Proportional	33.5	1.3* $\mathbf{F}_{sq}$	0.24	137	138
Proportional	40.2	1.6* $\mathbf{F}_{sq}$	0.30	133	128
Proportional	46.6	1.9* $\mathbf{F}_{sq}$	0.35	128	119
$\mathbf{F}_{0.1}$	21.5	$\mathbf{F}_{0.1}$	0.17	144	152

Weights in '000 t.

Management considerations

Exploration of options for management plans

ICES has explored HCR candidates and offers the following reflections:

Herring in Division VIa(N) has experienced higher productivity in the period 1957-1974 than in the subsequent period. It is unclear why this is the case. One possible reason is that the SSB has not been allowed to rise high enough to reach this potential. ICES has explored HCRs with a range of Fs from 0.2 to 0.4 for this stock. The results show that if the stock is required to be managed to allow for expansion then F must be kept well below F=0.35. However, as transition to this more productive state cannot be guaranteed, all predictions presented here follow stock recruit relationships that infer only the current level of productivity.

An HCR with the following rule is shown to be sustainable and delivering a reasonably high yield:

F=0.25	if SSB > 75 000 t	Optional year-on-year TAC constraint.
F=0.2	if SSB < 75 000 t	No constraint on TAC.

The rule should be supplemented with a requirement for F = 0 if SSB falls below $\mathbf{B}_{lim}$. The short-term prediction based on this HCR for 2006 would be:

Rationale	Catches (2006)	Basis	F(2006)	SSB(2007)
HCR	34 000 (only valid within an agreed HCR)	F(long-term yield) HCR F=0.25	0.25	136 000

These simulations provide a good basis for selecting the main components of a HCR. The HCR above might be adopted subject to an evaluation of a year-on-year TAC constraint, if required.

Ecosystem considerations

Herring in this area is an important food source for sea birds, sea mammals, and many piscivorous fish.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

Historically, catches have been taken from this area by three fisheries:

i) A Scottish domestic pair trawl fleet and the Northern Irish fleet operating in shallower, coastal areas, principally fishing in the Minches and around the Island of Barra in the south; younger herring are found in these areas. This fleet has reduced in recent years.

ii) The Scottish single-boat trawl and purse seine fleets, with refrigerated seawater tanks, targeting herring mostly in the northern North Sea, but also operating in the northern part of Division VIa (N). This fleet now operates mostly with trawls, but many vessels can deploy either gear.

iii) An international freezer-trawler fishery has historically operated in deeper water near the shelf edge where older fish are distributed. These vessels are mostly registered in the Netherlands, Germany, France, and England, but most are Dutch owned.

In recent years the composition of the catch of these last two fleets has become more similar and has been dominated by younger adults resulting from increased recruitment into the stock.

In 2004, the Scottish trawl fleet fished both in areas similar to the freezer trawler fishery, and in the coastal areas in the southern part of Division VIa (N), unlike the previous year where the Scottish fleet tended to omit the coastal areas.

As a result of perceived problems of area misreporting of catch from Division IVa into Division VIa (N), Scotland introduced a fishery regulation in 1997 with the aim to improve reporting accuracy. Under this regulation, Scottish vessels fishing for herring were required to hold a license either to fish in the North Sea or in the west of Scotland area (Division VIa (N)). However, in 2004 the requirement to carry only a single license was rescinded. Area misreporting of catch taken in Division IVa into Division VIa (N) seems to have increased. Reinstating this single-area license requirement should be considered as it appears to be helpful to management for this area.

Other factors

The stock identity is uncertain and is being reviewed by an ongoing EU-funded project.

Scientific basis

Uncertainties in assessment and forecast

Catch estimates from observer programs indicate that misreporting of the catches has decreased until 2003 and risen again in 2004. The figure for misreporting used for 2004 is 6 000 tonnes. Better information on the catches has been obtained and biological sampling of catches has improved over the last 4–5 years, but it declined in 2004. Satellite surveillance data has improved knowledge of vessel behaviour.

Comparison with previous assessment and advice

The perception of the state of the stock is largely consistent with last year's assessment, but there is a small downward revision in SSB over the last 3 years and a corresponding upwards revision of F.

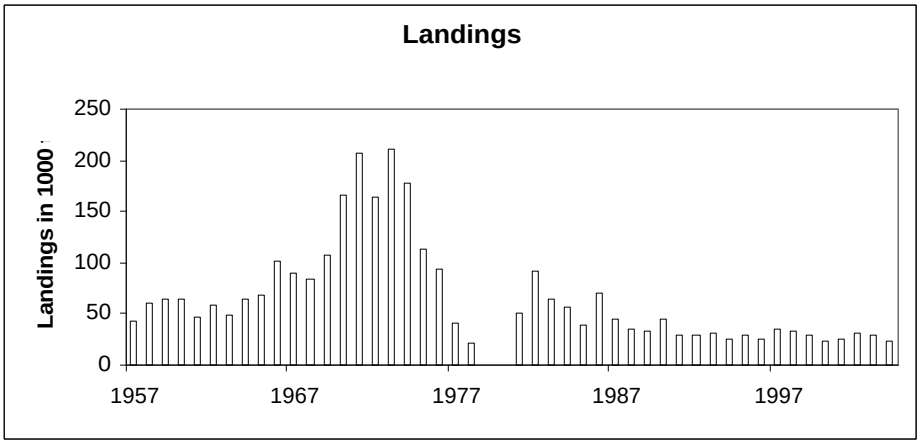
The assessment in 2005, like the assessment in 2004, is less uncertain than in previous years, reflecting the stability of the input data over the last three to four years. Estimates of fishing mortality are reasonably reliable.

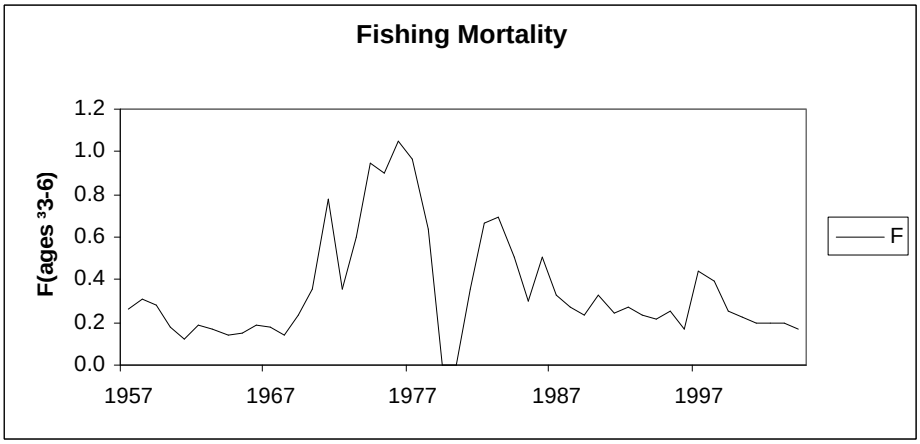
Source of information

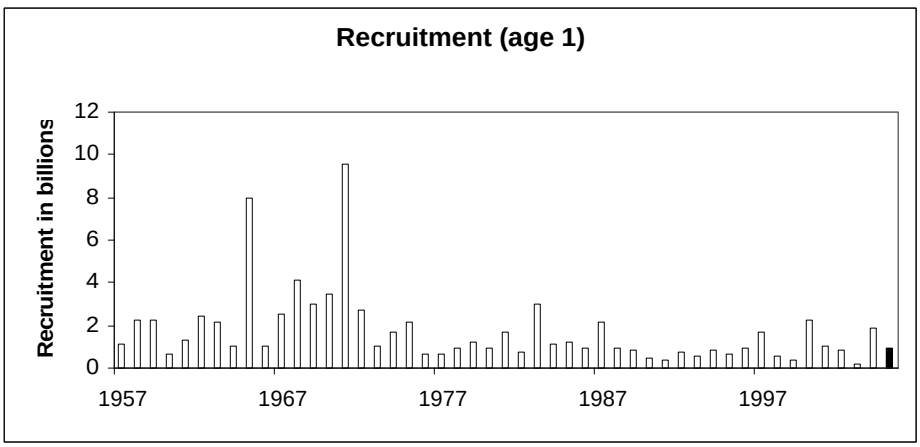
Report of the Herring Assessment Working Group for the Area South of 62°N, 8–17 March 2005 (ICES CM 2005/ACFM:16).

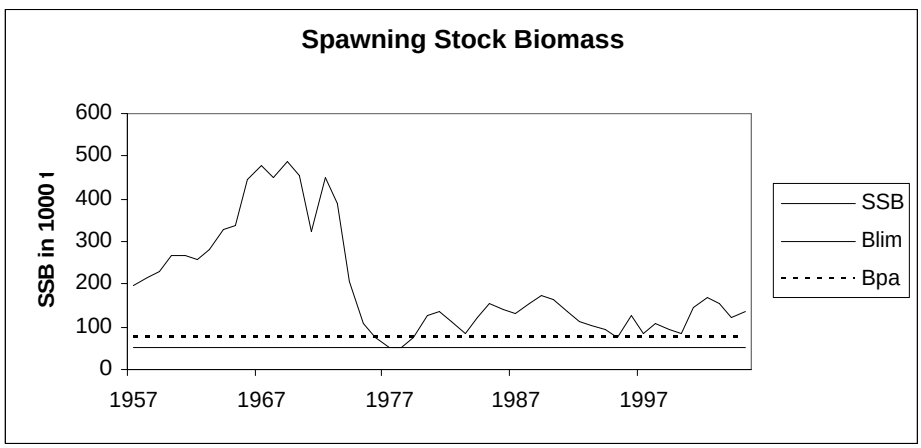
Year	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch[1]
1987	Reduce F to $\mathbf{F}_{0.1}$/*status quo* F	38-55	49.7		44
1988	TAC	46	49.8		36
1989	TAC	58	58	1.6	34
1990	TAC	61	75	1.3	45
1991	TAC	57	62	1.2	29
1992	TAC	62	62	0.2	29
1993	Catch at *status quo* F	54-58	62	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	36.36		32
2003	Catch at *status quo* F	30	30		29
2004	F=0.30	41	30	0.1	23
2005	Catch at *status quo* F	30	30.1		
2006	Catch at *status quo* F	26.4			

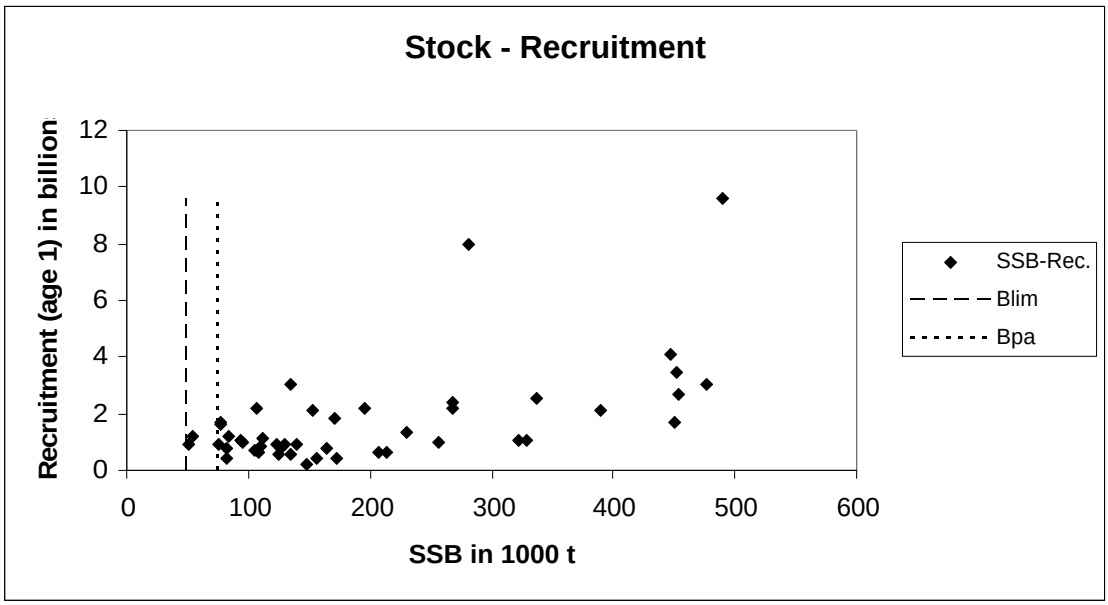
Weights in '000 t.
[1]Adjusted for misreporting. [2]Catch at *status quo* F. [3]Revised down from 60 in 1999.

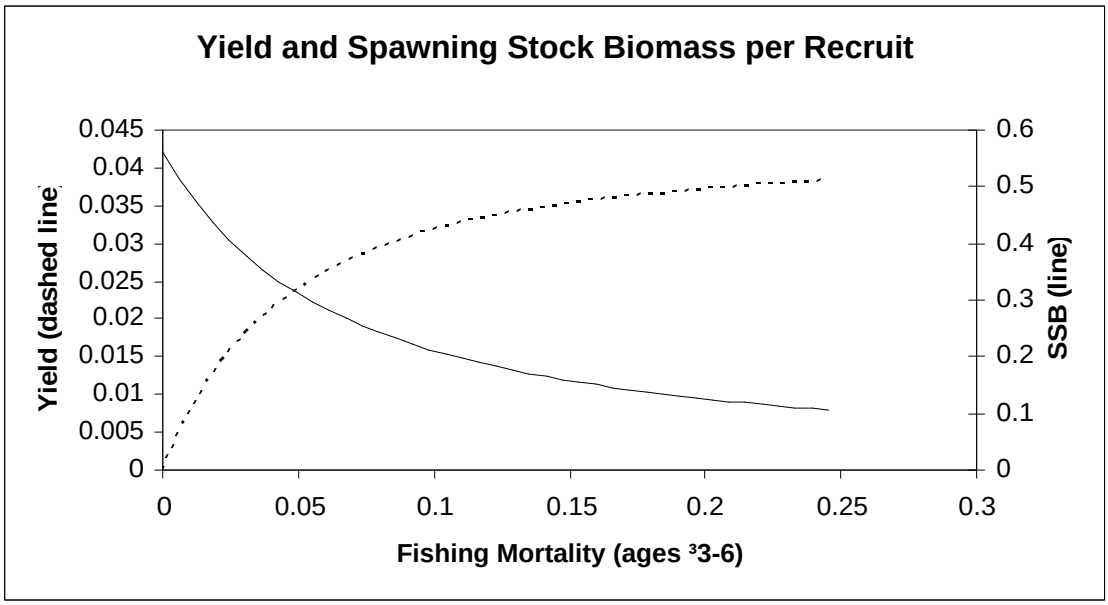

Landings
Landings in 1000 t
250
200
150
100
50
0
1957
1967
1977
1987
1997


Fishing Mortality
F(ages 3-6)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1957
1967
1977
1987
1997
F


Recruitment (age 1)
Recruitment in billions
12
10
8
6
4
2
0
1957
1967
1977
1987
1997


Spawning Stock Biomass
SSB in 1000 t
600
500
400
300
200
100
0
1957
1967
1977
1987
1997
SSB
Blim
Bpa


Stock - Recruitment
Recruitment (age 1) in billion
12
10
8
6
4
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)
0.045
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
0.05
0.1
0.15
0.2
0.25
0.3
Fishing Mortality (ages 3-6)

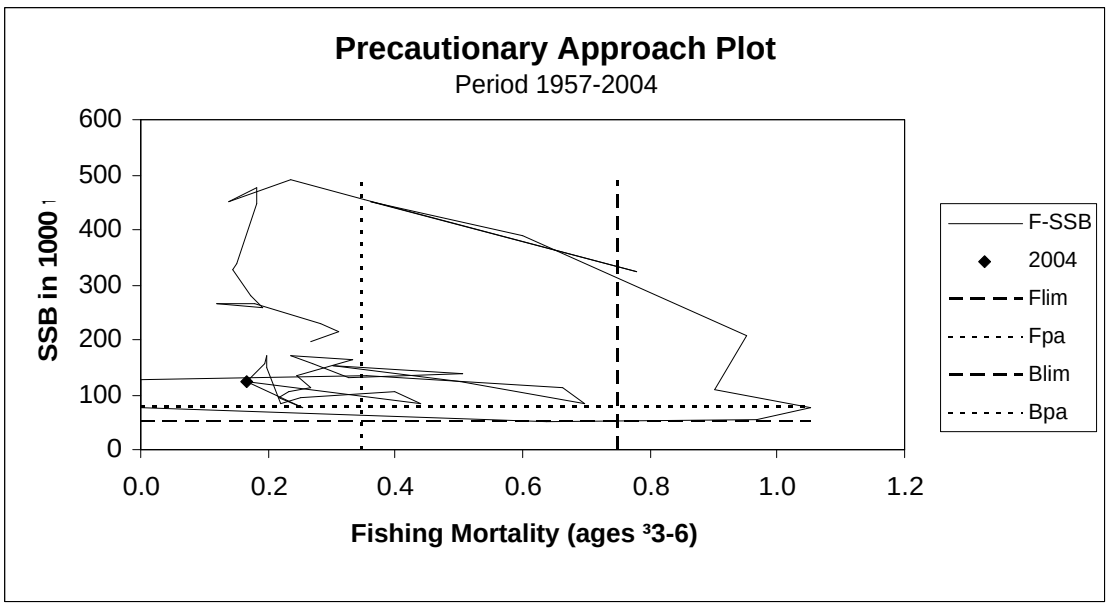

Precautionary Approach Plot
Period 1957-2004
SSB in 1000 t
600
500
400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Fishing Mortality (ages 3-6)
F-SSB
2004
Flim
Fpa
Blim
Bpa

Table 1.4.30.1. Herring in VIa(N). Catch in tonnes by country, 1982-2004. These figures do not in all cases correspond to the official statistics and cannot be used for management purposes.

Country	1982	1983	1984	1985	1986	1987	1988	1989
Denmark			96					
Faroes	74	834	954	104	400			
France	2069	1313		20	18	136	44	1342
Germany	8453	6283	5564	5937	2188	1711	1860	4290
Ireland					6000	6800	6740	8000
Netherlands	11317	20200	7729	5500	5160	5212	6131	5860
Norway	13018	7336	6669	4690	4799	4300	456	
UK	38471	31616	37554	28065	25294	26810	26894	29874
Unallocated	18958	-4059	16588	-502	37840	18038	5229	2123
Discards								1550
Total	92360	63523	75154	43814	81699	63007	47354	53039
Area-Misreported			-19142	-4672	-10935	-18647	-11763	-19013
WG Estimate	**92360**	**63523**	**56012**	**39142**	**70764**	**44360**	**35591**	**34026**
Source (WG)	1984	1985	1986	1987	1988	1989	1990	1991

Country	1990	1991	1992	1993	1994	1995	1996	1997
Denmark								
Faroes	326	482						
France	1287	1168	119	818	274	3672	2297	3093
Germany	7096	6450	5640	4693	5087	3733	7836	8873
Ireland	10000	8000	7985	8236	7938	3548	9721	1875
Netherlands	7693	7979	8000	6132	6093	7808	9396	9873
Norway	1607	3318	2389	7447	8183	4840	6223	4962
UK	38253	32628	32730	32602	30676	42661	46639	44273
Unallocated	2397	-10597	-5485	-3753	-4287	-4541	-17753	-8015
Discards	1300	1180	200		700			62
Total	69959	50608	51578	56175	54664	61271	64359	64995
Area-Misreported	-25266	-22079	-22593	-24397	-30234	-32146	-38254	-29766
WG Estimate	**44693**	**28529**	**28985**	**31778**	**24430**	**29575**	**26105**	**35233***
Source (WG)	1992	1993	1994	1995	1996	1997	1997	1998

Country	1998	1999	2000	2001	2002	2003	2004
Denmark							
Faroes					800	400	228
France	1903	463	870	760	1340	1370	625
Germany	8253	6752	4615	3944	3810	2935	1046
Ireland	11199	7915	4841	4311	4239	3581	1894
Netherlands	8483	7244	4647	4534	4612	3609	8232
Norway	5317	2695					
UK	42302	36446	22816	21862	20604	16947	17706
Unallocated	-11748	-8155			878	-7	
Discards	90						123
Total	65799	61514	37789	35411	36283	28835	29854
Area-Misreported	-32446	-23623	-14626	-10437	-4496		-6762
WG Estimate	**33353**	**29736**	**23163**	**24974**	**31787**	**28835**	**23092**
Source (WG)	1999	2000	2001	2002	2003	2004	2005

*WG estimate for 1997 has been revised according to the Bayesian assessment (see text section 5.1.3 in WG Report).

Table 1.4.30.2 Herring in Division VIa (North).

Year	Recruitment Age 1 thousands	SSB tonnes	Landings tonnes	Mean F Ages 3-6
1957	1142600	195006	43438	0.2668
1958	2233280	214239	59669	0.3102
1959	2210650	230608	65221	0.2826
1960	650960	267233	63759	0.1800
1961	1316730	267140	46353	0.1205
1962	2397760	256605	58195	0.1915
1963	2168180	281103	49030	0.1721
1964	990370	329003	64234	0.1443
1965	7944920	336409	68669	0.1504
1966	1072530	447179	100619	0.1837
1967	2514340	476691	90400	0.1828
1968	4109110	451299	84614	0.1397
1969	3001080	489299	107170	0.2367
1970	3442590	452907	165930	0.3528
1971	9583050	322748	207167	0.7792
1972	2677210	450283	164756	0.3609
1973	1075830	388841	210270	0.6015
1974	1674820	206519	178160	0.9510
1975	2116220	108846	114001	0.9016
1976	617140	75124	93642	1.0531
1977	628720	53731	41341	0.9664
1978	920880	50606	22156	0.6385
1979	1219120	76967	60	0.0007
1980	894760	126894	306	0.0004
1981	1667470	134101	51420	0.3565
1982	775930	112097	92360	0.6640
1983	3044640	83577	63523	0.6977
1984	1162470	123779	56012	0.5038
1985	1215220	153372	39142	0.3031
1986	903510	139572	70764	0.5059
1987	2136720	130666	44360	0.3271
1988	922040	155513	35591	0.2706
1989	887290	172677	34026	0.2364
1990	451370	164571	44693	0.3328
1991	391520	134519	28529	0.2456
1992	789720	110920	28985	0.2684
1993	591700	104992	31778	0.2319
1994	866950	95777	24430	0.2182
1995	673990	76860	29575	0.2559
1996	976180	125104	26105	0.1675
1997	1654100	82719	35233	0.4386
1998	553870	106749	33353	0.3980
1999	395980	93223	29736	0.2526
2000	2204430	82857	23163	0.2210
2001	1045060	147507	24974	0.1970
2002	810990	170175	31787	0.1966
2003	187860	155027	28835	0.1938
2004	1863770	124145	23092	0.1662
2005	925834*	136672		
Average	1708193	197397	63138	0.3503

* geometric mean

1.4.31 Clyde herring (Division VIa)

State of the stock

The available information is inadequate to evaluate stock trends, and the state of the stock is unknown.

Management objectives

There are no explicit management objectives for this stock.

Reference points

There are no reference points for this stock.

Short-term implications

Until new evidence is obtained on the state of the stock, existing time and area restrictions on the fishery should be continued in 2006.

Management considerations

In the absence of surveys and catches, nothing is currently known about the state of the spring-spawning stock. All the management measures, currently in force, need to remain. TACs should remain at the current low level until more is known about the dynamics of this stock.

Other factors

The stock identity is uncertain and is being reviewed by an ongoing EU-funded project.

Source of information

Report of the Herring Assessment Working Group for the Area South of 62°N, 8 – 17 March 2005 (ICES CM 2005/ACFM:16).

	ICES Advice	Predicted catch corresp. to advice	Agreed TAC	Disc. slip.	ACFM Catch
1987	Fishing at $\mathbf{F}_{0.1}$	3.5	3.5	0.4	3.6
1988	TAC	3.2	3.2	0.2	1.9
1989	Stabilise catch at recent levels	2.9–3.4	3.2		2.3
1990	TAC	2.6	2.6		2.3
1991	TAC	2.9	2.9		0.7
1992	TAC	1.6	2.3		0.9
1993	Lowest possible level	-	1.0		0.9
1994	Lowest possible level	-	1.0		0.6
1995	Lowest possible level	-	1.0		0.4
1996	Lowest possible level	-	1.0		0.9
1997	Lowest possible level	-	1.0		0.5
1998	Continue existing restrictions	-	1.0		1.0
1999	Continue existing restrictions	-	1.0		0.3
2000	Continue existing restrictions	-	1.0		0.0
2001	Continue existing restrictions	-	1.0		0.5
2002	Continue existing restrictions	-	1.0		0.4
2003	Continue existing restrictions	-	1.0		0.3
2004	Continue existing restrictions	-	1.0		0.0
2005	Continue existing restrictions	-	1.0		
2006	Continue existing restrictions	-			

Weights in ‘000 t.

Clyde herring (Division VIa)

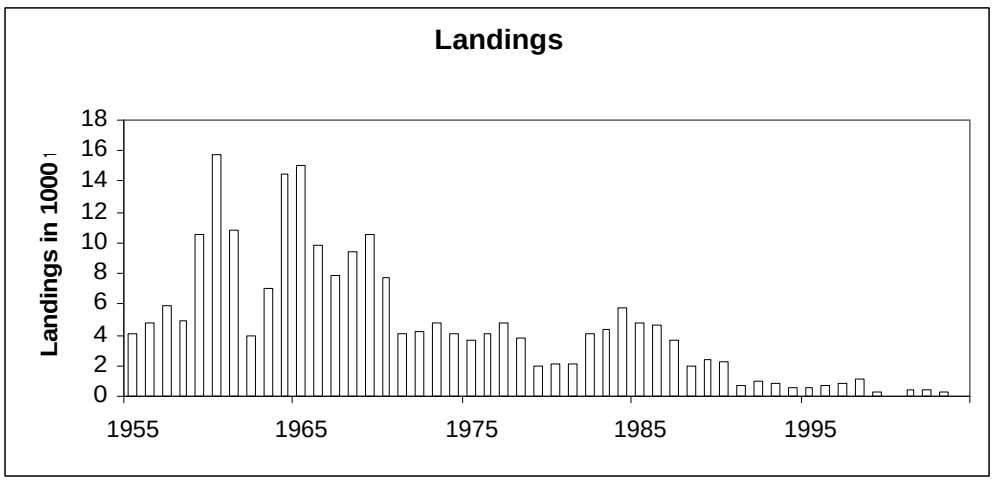


Table 1.4.31.1 HERRING from the Firth of Clyde. Catch in tonnes by country, 1955–2004. Spring and autumn spawners combined.

Year	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
All Catches																	
Total	4,050	4,848	5,915	4,926	10,530	15,680	10,848	3,989	7,073	14,509	15,096	9,807	7,929	9,433	10,594	7,763	4,088

Year	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
All Catches										
Total	4,226	4,715	4,061	3,664	4,139	4,847	3,862	1,951	2,081	2,135

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Scotland	2,506	2,530	2,991	3,001	3,395	2,895	1,568	2,135	2,184	713	929	852
Other UK	-	273	247	22	-	-	-	-	-	-	-	1
Unallocated[1]	262	293	224	433	576	278	110	208	75	18	-	-
Discards	1,253	1,265	23,083	13,443	6793	4394	2454	-2	-2	-2	-2	-2
Agreed TAC			3,000	3,000	3,100	3,500	3,200	3,200	2,600	2,900	2,300	1,000
Total	4,021	4,361	5,770	4,800	4,650	3,612	1,923	2,343	2,259	731	929	853

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Scotland	608	392	598	371	779	16	1	78	46	88	-
Other UK	-	194	127	475	310	240	0	392	335	240	-
Unallocated[1]	-	-	-	-	-	-	-	-	-		-
Discards	-2	-2	-	-	-	-	-	-	-		-
Agreed TAC	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	-
Total	608	586	725	846	1089	256	1	480	381	328	0

[1]Calculated from estimates of weight per box and in some years estimated bycatch in the sprat fishery.

[2]Reported to be at a low level, assumed to be zero, for 1898–1995.

[3]Based on sampling.

[4]Estimated assuming the same discarding rate as in 1986.

Table 1.4.31.2 Clyde herring Division VIa.

Year	Landings
	tonnes
1955	4050
1956	4848
1957	5915
1958	4926
1959	10530
1960	15680
1961	10848
1962	3989
1963	7073
1964	14509
1965	15096
1966	9807
1967	7929
1968	9433
1969	10594
1970	7763
1971	4088
1972	4226
1973	4715
1974	4061
1975	3664
1976	4139
1977	4847
1978	3862
1979	1951
1980	2081
1981	2135
1982	4021
1983	4361
1984	5770
1985	4800
1986	4650
1987	3612
1988	1923
1989	2343
1990	2259
1991	731
1992	929
1993	853
1994	608
1995	586
1996	725
1997	846
1998	1089
1999	256
2000	1
2001	480
2002	381
2003	328
2004	0
Average	4486

1.4.32 Norway pout in Division VIa (West of Scotland)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. The size of the stock is unknown.

Management considerations

The fishery is a small-mesh trawl fishery operated by Danish vessels.

Scientific basis

Uncertainties in assessment and forecast

Catches are highly variable. The only data available are official landings statistics. There is no information available on which to base scientific advice.

Ecosystem considerations

Bycatches 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, 6–15 September 2005 (ICES CM 2006/ACFM:09).

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	4.8
2003	No advice	6.4
2004	No advice	2.3
2005	No advice	
2006	No advice	

Weights in '000 t.

Table 1.4.32.1 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	2002	2003	2004
Denmark	7186	4624	2005	3214	4815	6395	2281
Faroes	-	-	-	-	4	2	-
Germany	-	-	-	-	-	-	-
Netherlands	-	1	-	-	-	-	-
Norway	-	-	-	-	-	-	-
Poland	-	-	-	-	-	-	-
UK (E+W)	-	-	-	-	-	-	-
UK (Scotland)	-	-	-	-	-	-	4
Total	7186	4625	2005	3214	4819	6397	2285

1.4.33 Sandeel in Division VIa (West of Scotland)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The available information is inadequate to evaluate spawning stock or fishing mortality relative to risk, so the state of the stock is unknown. There is no current information on which to evaluate the state of the stock.

Management objectives

There are no explicit management objectives for this stock.

Single-stock exploitation boundaries

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.

Reference points

No reference points have been defined for this stock.

Management considerations

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 for another three years.

Ecosystem considerations

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.

Source of information

Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 6–15 September 2005 (ICES CM 2006/ACFM:09).

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	0.7	0.7
2003	No advice	-	NO AVAILABLE DATA	NO AVAILABLE DATA
2004	No advice	-	0.6	0.6
2005	No advice	-		
2006	No advice	-		

Weights in '000 t.

Table 3.7.10.1 Sandeel, Division VIa
Landings (tonnes), 1981–2004, 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
Total effort	-	-	447	446	475	530	290	455	315	281

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
Total effort	116	83	134	162	131	203	203	60	17	-

Country	2001	2002	2003	2004
Denmark				
UK, Scotland				
United Kingdom	295	706	-	566
Total	295	706	-	566
Total effort	-	-	-	-

Preliminary data for 2001.

1.4.34 Sole Southwest of Ireland (Division VIIh-k)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Catches in 2006 should be no more than the recent average (2002–2004) of around 380 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

Short-term implications

No forecast.

Management considerations

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.

Area misreporting from VIIf,g into VIIhjk is known to be a problem in some fleets, but landings data have not been corrected for this. The extent of other misreporting is not known.

Factors affecting the fisheries and the stock

Sole are predominantly caught in mixed species otter trawl fisheries in Division VIIj. These vessels target mainly hake, anglerfish, and megrim. Sole are also caught in flatfish-directed beam trawler fisheries. Seiners generally take a lesser catch of sole. Ireland and Belgium are the major participants in this fishery.

The effects of regulations

Sole is managed through TAC and technical conservation measures. Boat quota restrictions were imposed on Irish vessels for hake, cod, and anglerfish, and these are likely to have impacted the sole landings.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Ireland, UK, and France are the major participants in this fishery. Sole were predominantly caught by Irish otter trawl vessels in Division VIIj, within a mixed species fishery. Irish otter trawl vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore, and Schull. Increasingly these Irish vessels target mainly hake, anglerfish, and megrim and not the more traditional inshore species (plaice, sole, whiting, and cod). The Irish beam trawlers and seiners generally take a lesser catch of sole. Other international fleets operating in this area are the UK, French otter trawl, and Belgian beam trawl fleets.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	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		-		-	381
2000	No advice		-		-	329
2001	No advice		-		650	325
2002	No advice		-		650	430
2003	Reduce TAC to recent landings		330		390	374
2004	[1]	Reduce TAC to recent average (2000–2002)	[1]	360	390	354
2005		Reduce TAC to recent average (2001–2003)		335	650	
2006		Reduce TAC to recent average (2002–2004)		380		

Weights in t.

[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Table 1.4.34.1 Sole in Divisions VII h-k (Southwest Ireland).

Nominal landings (t), 1996–2004, as officially reported to ICES.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004 [3]
Belgium		368	346	101	8	13	154	170	157
France		58	74*	77[1]*	78	99	108	64	N/a
Ireland		203	221	207	111	125	130	105	N/a
Spain							1 [2]		
Netherlands			7	1	10	-	-		
UK (England & Wales)		113	11	97	95	111	124	78	79
Portugal									1
Total	0	742	585	406	302	348	516	417	238
Unallocated	443	-178	-162	-25	27	-23	-86	43	117
Total figures used by Working Group	443	564	423	381	329	325	430	374	354

*To be updated.[1] Reported as. [2] *Solea* spp.[3] Preliminary figures.

1.4.35 Sole West of Ireland (Division VIIb,c)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The state of the stock is unknown. No assessment was performed, due to the short series of data and lack of reliable tuning indices.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No precautionary reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Recent catches have been close to the TAC of 65 t. Catches should not be allowed to increase unless it can be shown that an expansion of the fishery is sustainable.

Short-term implications

No forecast.

Management considerations

The recent average catches (2002–2004) were 64 t. 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.

Factors affecting the fisheries and the stock

Ireland is the major participant in this fishery with around 75% of the international landings in recent years. Sole are normally caught in a mixed species otter trawl fisheries in Division VIIb. These vessels mainly target other demersal fish species and *Nephrops*.

The effects of regulations

Sole is managed by a precautionary TAC and technical measures. The agreed TAC for 2004 and 2005 was 65 t, which is a decrease from the previous TAC of 80 t for 2001–2003.

Council Regulation (EC) No. 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in Divisions VIIb, VIIj, VIIg, and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998–2002).

Changes in fishing technology and fishing patterns

Sole are opportunistically exploited in otter trawl fisheries in this area and there is no known change in fishing technology and fishing patterns in this area.

Scientific basis

Data and methods

Data update and screening methods only. No analytical assessment was performed.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

Year	ICES Advice	Single-stock exploitation boundaries	Predicted catch corresp. to advice	Predicted catch corresponding to single-stock boundaries	Agreed TAC	ACFM landings
1993	-		-		-	60
1994	-		-		-	70
1995	-		-		-	59
1996	-		-		-	57
1997	-		-		-	55
1998	-		-		-	66
1999	-		-		-	72
2000	-		-		-	57
2001	-		-		80	60
2002	No advice		-		80	61
2003	Reduce TAC to recent landings		65		80	64
2004	[1]	Reduce TAC to recent landings (1998–2002)	[1]	65	65	N/A
2005		Reduce TAC to recent landings (1999–2003)		62	65	
2006		No increase in catches		64		

Weights in t.
[1] Single-stock boundary and the exploitation of this stock should be conducted in the context of mixed fisheries protecting stocks outside safe biological limits.

Table 1.4.35.1 Nominal landings (t) of sole in Divisions VIIb,c 1993–2004, as officially reported to ICES.

Country	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
France	1	1	2	2	3	_*	2*	12	7	14	19	N/A
Ireland	59	60	59	52	51	49	68	65	53	50	50	N/A
UK(E/W/NI)	+	+	+	+	1	+	-	+	-	+	+	+
Total	60	61	61	54	55	49	70	77	60	64	86	N/A
Unallocated	0	-9	2	-3	0	-17	-2	20	0	3	22	-66
Total figures used by the working group	60	70	59	57	55	66	72	57	60	61	64	66

* Preliminary.

1.4.36 *Nephrops* in Division VIa (Management Area C)

There are three Functional Units in this Management Area: a) North Minch (FU 11), b) South Minch (FU 12), and c) Clyde (FU 13).

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Comment
Unknown	Unknown	Unknown	

The available fishery information is inadequate to use analytical methods to evaluate spawning stock or fishing mortality relative to risk. Results from TV surveys, however, suggest that the stock in this Management Area appear to be exploited at a sustainable level.

a. North Minch: The TV survey estimate of abundance for *Nephrops* in the North Minch suggests that the population remained relatively stable between 1994 and 2001, but has increased sharply between 2001 and 2003. The higher level of abundance observed in 2003 has been maintained in 2004. The increase in abundance observed between 2001 and 2003 coincides with the increases in CPUE observed in the catch data, particularly for the smaller size category, interpreted as increase in recruitment.

b. South Minch: The TV survey estimate of abundance for *Nephrops* in the South Minch suggests that the population fluctuated without trend between 1995 and 2000, but appears to have remained more stable and at a slightly higher level from 2001 to 2003. The survey suggests a further increase in abundance in 2004. The increase to the more stable level of abundance observed after 2001 coincides with the increase in CPUE and reduction in mean size observed in the catch data, particularly for the smaller size category, interpreted as increase in recruitment.

c. Clyde: Two TV surveys are conducted in the area. The TV survey estimate of abundance for *Nephrops* in the Firth of Clyde suggests that the population has increased steadily since 1999. Reductions in the mean size in catches coincide with increases in CPUE. The increase to the more stable level of abundance observed after 2001 likewise coincides with the increase in CPUE, suggesting strong recruitments in 1995, 1998, and 2003. A series of good recruitments would be consistent with the increase in abundance observed from the TV surveys. The higher levels of discarding observed in recent years are associated with the increase in CPUE of smaller individuals. The TV survey estimate of abundance for *Nephrops* in the Sound of Jura suggest that the population increased between the mid-1990s and 2002 (although there is a gap in the survey time-series and no survey was available in 2004), but appears to have declined from the high 2002 figure in 2003.

d. *Nephrops* are also caught outside these areas. TV surveys in deep water suggest widespread distribution at low density, and surveys in sea lochs, where an important creel fishery occurs, suggest widespread distribution there also.

Management objectives

There are no management objectives set for this fishery.

Reference points

No reference points have been determined for *Nephrops*.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

Information on these stocks is considered inadequate to provide advice based on precautionary limits. The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch species.

Short-term implications

Outlook for 2006

The harvest ratio is a proxy for relative effort. Historically the harvest ratio has been around 15% for this stock. As an indication of the relationship between landings (tonnes) and effort the table below shows calculated landings for the three functional units for a range of harvest ratios applied to TV survey biomass results.

Harvest ratio %	North Minch	South Minch	Clyde	Total
15	3150	7037	3068	13255
20	4201	9383	4091	17675
25	5251	11729	5113	22093

Shaded options are not in accordance with the advice as this implies increased effort.

Management considerations

The *Nephrops* trawl fisheries take considerable bycatches of other species. The management of these fisheries should be seen in the context of mixed fisheries (see Volume 5 Section 1.1.2).

Factors affecting the fisheries and the stock

The effects of regulations

The minimum landing size for *Nephrops* is 20 mm carapace length (CL), and less than 0.5% of the animals are landed under size. Discarding takes place at sea. The main bycatch species is haddock, although whiting, Norway pout, and flatfish also feature significantly in discards.

Scientific basis

Data and methods

There is considerable uncertainty about landings, discard, and effort data for these stocks. The 2003 and 2004 underwater TV surveys indicate higher stock abundance than in recent years.

Comparison with previous assessment and advice

Previously advice has been based largely on historical landings, but there are now concerns over the accuracy of official landings and effort statistics. There is considerable doubt about the quality of fisheries data and assessments cannot be based on these data, i.e. catch and LPUE. The advice is therefore for no increase in effort as it is not possible to provide a catch prediction based on fisheries data. As reliable fisheries data are not available the TV underwater survey biomass estimates are used to indicate landings associated with various effort levels.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Recommended TAC	Agreed TAC	Official landings	ACFM catch
1989				11.0	n/a
1990				10.0	n/a
1991				10.5	n/a
1992	maintain current effort	~11.4	12.0	10.8	n/a
1993	maintain current effort	~11.3	12.0	11.3	n/a
1994	maintain current effort	11.3	12.6	11.1	n/a
1995	maintain current effort	11.3	12.6	12.8	n/a
1996	maintain current effort	11.3	12.6	11.2	n/a
1997	as for 1996	11.3	12.6	11.2	n/a
1998	maintain current effort	11.3	12.6	11.2	n/a
1999	as for 1998	11.3	12.6	11.5	n/a
2000	maintain current effort	11.3	12.6	11.0	n/a
2001	as for 2000	11.3	11.34	10.9	n/a
2002	maintain current effort	11.3	11.34	10.5	n/a
2003	as for 2002	11.3	11.34	10.7	n/a
2004	maintain current effort	11.3	11.3	10.3	n/a
2005	as for 2004	11.3	12.7		
2006	No increase in effort	-			

Weights in '000 t.
n/a = not available.

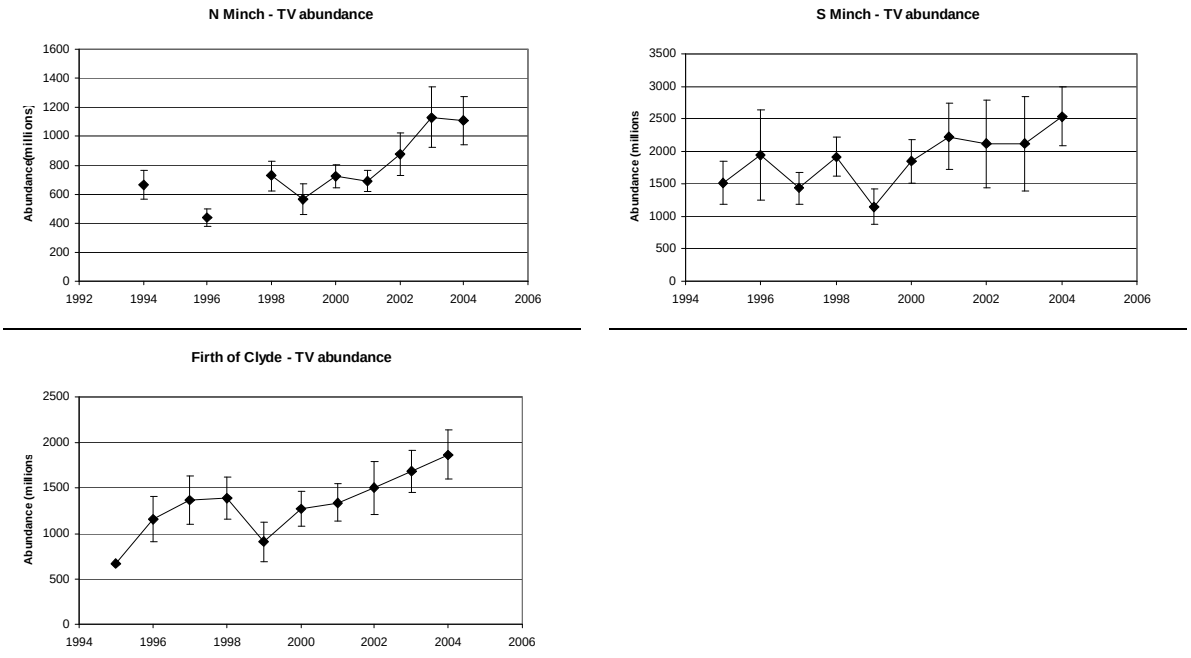


Figure 1.4.36.1 ***Nephrops*** **abundance estimates from TV surveys.**

1.4.37 *Nephrops* in Division VIIa, North of 53°N (Management Area J)

There are two Functional Units in this Management Area: a) Irish Sea East (FU 14) and b) Irish Sea West (FU 15).

State of the stock/exploitation

The status of the stocks in this Management Area is unknown.

a) Irish Sea East: Annual LPUEs have been fluctuating, but were generally lower in the 1990s and 2000s than in the late 1970s and early 1980s. Landings have been fairly stable since the mid-1980s.
b) Irish Sea West: CPUEs and LPUEs for the Northern Ireland fleet have remained relatively constant since 1995, with a slight drop in 2000 and 2001 being recovered in 2002. Republic of Ireland CPUE data available from 1995 showed a steady increase, followed by a slight drop since 1999.

Management objectives

This is managed as a total TAC for Division VII. There are no management objectives set for this fishery.

Reference points

No reference points have been determined for *Nephrops*.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary limits

The effort in this fishery should not be allowed to increase and the fishery must be accompanied by mandatory programmes to collect catch and effort data on both target and bycatch species.

Management considerations

The *Nephrops* trawl fisheries take considerable bycatches of other species. The management of these fisheries should be seen in the context of mixed fisheries (see Section 1.1.2, *this volume*).

Evidence of under-reporting of landings creates problems with using commercial data for analytical assessments and in TAC recommendations. Despite evidence of underreporting, the *Nephrops* fisheries in Division VIIa have been sustained for over 20 years with similar high levels of fishing effort.

The landings from all FUs in this TAC Area VII are presented in Table 1.4.37.1. Because of some uncertainty regarding the accuracy of recent landings the advice for these FUs (14 & 15) is based on effort, whereas the advice for other *Nephrops* stocks (see Sections 1.4.40 and 1.4.41) within the TAC area is based on recent average landings (2000–2002). There is no information on the accuracy of landings for these other *Nephrops* stocks.

Factors affecting the fisheries and the stock

The effects of regulations

The minimum landing size for *Nephrops* is 20 mm carapace length (CL), which is appropriate for the gears used in this area. Almost all of the discarded catch are above the minimum landing size and discard sampling indicates that *Nephrops* over 25 mm CL are mainly retained.

Separator trawls were introduced in the Irish fishery in 2000 in an attempt to reduce cod bycatches. The uptake of separator trawls has increased in recent years (to around 80% of vessels in 2002).

Scientific basis

Data and methods

The underwater TV surveys performed in 2003, 2004, and 2005 provide additional information, but the surveys are still in the development phase. These surveys demonstrate promise to contribute to assessments of these stocks in the future when more information is available and the method has been consolidated.

Comparison with previous assessment and advice

Previously advice has been based largely on historical landings, but there are now concerns over the accuracy of official landings and effort statistics. Evidence of underreporting of landings creates problems with using commercial data for analytical assessments and in quota advice.

Source of information

Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks, 10–19 May 2005 (ICES CM 2006/ACFM:13).

Year	ICES advice	Recommended TAC	Agreed TAC [1]	Official landings
1987				10.3
1988				9.3
1989				12.4
1990				12.0
1991				13.1
1992		8.9	20.0	8.0
1993		9.4	20.0	8.6
1994		9.4	20.0	8.7
1995		9.4	20.0	9.3
1996		9.4	23.0	8.3
1997		9.4	23.0	10.9
1998		9.4	23.0	9.1
1999		9.4	23.0	11.3
2000		9.4	21.0	8.9
2001		9.4	18.9	8.1
2002	Set TAC in line with 1995–99 landings	9.55	17.79	7.3
2003	Set TAC in line with 1995–99 landings	9.55	17.79	7.5
2004	Set TAC in line with 1995–99 landings	9.55	17.45	4.9
2005	Set TAC in line with 1995–99 landings	9.55	19.544	
2006	No increase in effort	9.55		

Weights in '000 t.
[1)] Subarea VII.

Table 1.4.37.1 ICES best estimates of *Nephrops* landings from ICES Subarea VII by Functional Unit.

Year	FU 14 - Irish Sea East	FU 15 - Irish Sea West	FU 16 - Porcupine	FU 17 - Aran Grounds	FU 18 - Ireland North West coast	FU 19 - Ireland South West and South East coast	FUs 20+21+22 - All Celtic Sea FUs combined	Other statistical rectangles - Outside FUs	Total Landings ICES Sub-area VII
1978	1039	4867	1744	272	0	0	4056	249	12226
1979	1010	5944	2269	481	0	0	4542	237	14484
1980	799	3022	2925	452	0	0	3535	205	10938
1981	873	4301	3381	442	0	0	3680	382	13060
1982	897	5004	4289	414	1	2	3316	238	14161
1983	765	5152	3426	210	0	0	3732	182	13467
1984	619	4500	3686	131	0	2	3691	190	12819
1985	520	4522	3967	324	0	1	3602	194	13129
1986	693	5393	2591	208	0	0	2638	117	11640
1987	475	5169	2499	147	0	2	2842	348	11483
1988	497	5447	2375	62	1	2	2769	299	11451
1989	438	8147	2115	831	17	899	3801	356	16604
1990	644	8308	1895	344	7	754	4050	360	16361
1991	859	9568	1640	519	0	1077	3132	350	17145
1992	495	7548	2015	412	2	888	4018	645	16023
1993	582	8112	1857	372	10	905	4374	735	16948
1994	513	7618	2512	729	126	390	4869	859	17614
1995	637	7799	2936	866	26	695	5223	727	18909
1996	511	7257	2230	525	46	888	4611	881	16949
1997	597	9979	2409	841	15	756	4027	637	19260
1998	389	9145	2155	1410	78	827	3835	663	18501
1999	625	10786	2132	1140	16	572	3532	471	19273
2000	567	8370	872	880	9	686	4579	299	16263
2001	532	7378	1163	913	2	809	4644	409	15850
2002	577	6914	1282	1154	14	1288	4603	389	16223
2003*	376	6921	831	933	16	1230	4929	n/a	15237
2004[1]*	472	7209	1365	525	25	1065	4146	n/a	14808
Average	**630**	**6829**	**2317**	**575**	**15**	**509**	**3955**		**15216**

[1]Preliminary.
*Incomplete data.
n/a = not available.

1.4.38 *Nephrops* in Divisions VIIb,c,k,j (Management Area L)

There are 4 Functional Units in this Management Area: a) Porcupine Bank (FU 16), b) Aran Grounds (FU 17), c) Ireland SW and SE Coast (FU 19) and d) Ireland NW Coast (FU 18).

The TAC area applies to the whole of area VII, including VIIa (section 1.4.37)

State of the stock

No quantitative assessment of this stock is available.

For FU 16 (Porcupine bank) landings have been variable over time. Maximum landings of more than 4000 t. were observed in early 1980s and the lowest observed landing was 872 t (in 2000). Recent landings have fluctuated around 1000 t. For most fleets, landings and effort are at low levels in recent years. LPUEs for all fleets in this fishery reached a minimum in 2000, and there are conflicting signals since then.

For FU 17 (Aran Grounds) maximum landings of 1 400 t have been recorded. Landings fluctuated around 1 000 t in recent years but in 2004 landings dropped to 525 t. The LPUEs have been relatively stable but show a substantial decrease in 2004.

The Irish Aran Grounds UWTV survey was initiated in 2002. In 2004 this survey showed an increase in burrow densities on the main Aran grounds and a substantial increase in the biomass estimate over the three years which contradicts the signal from the LPUE series.

For FU 19 (Ireland SW and SE coast) landings have been variable throughout the time series but show an increasing trend since 2000 which could be attributed to an increasing numbers of vessels targeting this fishery. Effort increased substantially after 2000. In 2004 the LPUE decreased to 17kg/hr which is close to the series minimum.

For FU 18 (Ireland NW coast) landings have shown a decrease in the time series: maximum landings of 126 t were taken in 1994 and minimum landings of 25 t in 2004. No effort data is available for this fishery.

Management objectives

There are no management objectives set for this fishery

Reference points

There are no reference points for this fishery. There is no yield per recruit table for this fishery.

Single stock exploitation boundaries

There are no exploitation boundaries for this stock. In view of the relative stability of landings, landings from FU16-19 should not exceed 3.3 thousand tonnes for 2006, based on the average landings of 2000-2002. The landings from all FUs in this TAC area is presented in section 1.4.38 (*Nephrops* in VIIa).

Management considerations

Management area L is part of the larger Subarea VII TAC area. Landings in management area L have recently been in the order of 3000 tonnes. The VII TAC for 2005 was 19.5 thousand tonnes. Therefore there is a risk that inappropriate levels of effort may occur for stocks in Management Area L due to effort shifts from other areas.

Fishing effort directed at *Nephrops* will have implications for the hake stock in the mixed fisheries unless species and size selectivity of gears can be improved.

Factors affecting the fisheries and the stock

Changes in fishing technology and fishing patterns

In FU 16 (Porcupine bank) landings from Spanish and French vessels have declined. Spain still has the largest contribution of the international landings, but Irish landings now form the second contribution to the international landings.

In FU 17 (Aran Grounds) the typical vessel length is 13-38m compared to 15-25m in 2003, engine power ranges from 120-870kW compared to 150-550 kW in 2003. The most recent change in the fishery is the proportion of twin-rig vessels, which has increased to over 90 % of the fleet in the past eight years. This implies that nominal fishing effort is not an appropriate indicator of effective fishing effort.

In FU 19 (Ireland SW and SE coast) there has been a shift of effort to *Nephrops* by Irish vessels due to a combination of factors. With increasing enforcement of the anglerfish quota, resulting in the detention of a number of Irish vessels, several vessels in the 20-24m category based in the southwest of Ireland have converted to *Nephrops*. Due to the low price of whitefish species during 2004 and in early 2005 a number of Irish seine net vessels have also switched to *Nephrops*. The number of vessels reporting landings in this area has increased from 34 in 2000 to 71 in 2003

No information is available on FU 18 (Ireland NW coast).

Scientific basis

Data and methods

There are some length structured data available but growth rates cannot be well determined. Analytical assessments are not feasible at present.

For FU 16 (Porcupine bank) annual landings length compositions for males and females are available from Spain (1986-2004), France (1995-2004) and Ireland (1995-2004). LPUE and effort data are available for the Spanish (SP-CORUTR7), French (FR-PORCUPINE) and Irish fleets (Figure 1.4.38.1). No analytical assessment of this stock was carried out.

For FU 17 (Aran Grounds) landings length compositions by sex are available for 1995-2000. Since 2001 a catch and discard sampling programme has been in place which shows the discarding of smaller individuals. An effort and LPUE data set for Irish trawlers from 1995-2004 is available (figure 1.4.40.2). Results of the TV survey for this stock are shown in Table 1.4.38.1. No analytical assessment of this stock was carried out.

For FU 19 (Ireland SW and SE coast) length frequency data of the landings were collected on an irregular basis in the years 1996-1997, 1999, 2002 and 2004. Spatial and temporal coverage is problematic because landings from FU 19 originate from several discrete grounds. In 2004 length frequency data were only available for quarters 1 and 2. Since 2001 a catch and discard sampling programme has been in place which shows the discarding of smaller individuals. Effort and LPUE data are available for the Irish *Nephrops* fleet in FU 19 from 1995-2004 (Figure 1.4.38.3). No analytical assessment of this stock was carried out.

FU 18 (Ireland NW coast) only landing data are available. No analytical assessment of this stock was carried out.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim, May 2005 (ICES CM 2006/ACFM:01).

Year	ICES advice	Recommended TAC	Agreed TAC [1]	ACFM landings [2]
1987				4.5
1988				3.9
1989				4.0
1990				3.1
1991				3.4
1992		3.8	20.0	3.7
1993		~4.0	20.0	3.6
1994		~4.0	20.0	4.3
1995		~4.0	20.0	4.9
1996		4.0	23.0	4.3
1997		4.0	23.0	4.4
1998		4.0	23.0	5.0
1999		4.0	23.0	4.2
2000		4.0	21.0	2.7
2001		4.0	18.9	3.3
2002		4.44	17.79	4.0
2003		4.44	17.79	2.9
2004	Restrict landings to 2000-2002 levels	3.3	17.45	2.9
2005	Restrict landings to 2000-2002 levels	3.3	19.5	
2006	Restrict landings to 2000-2002 levels	3.3		

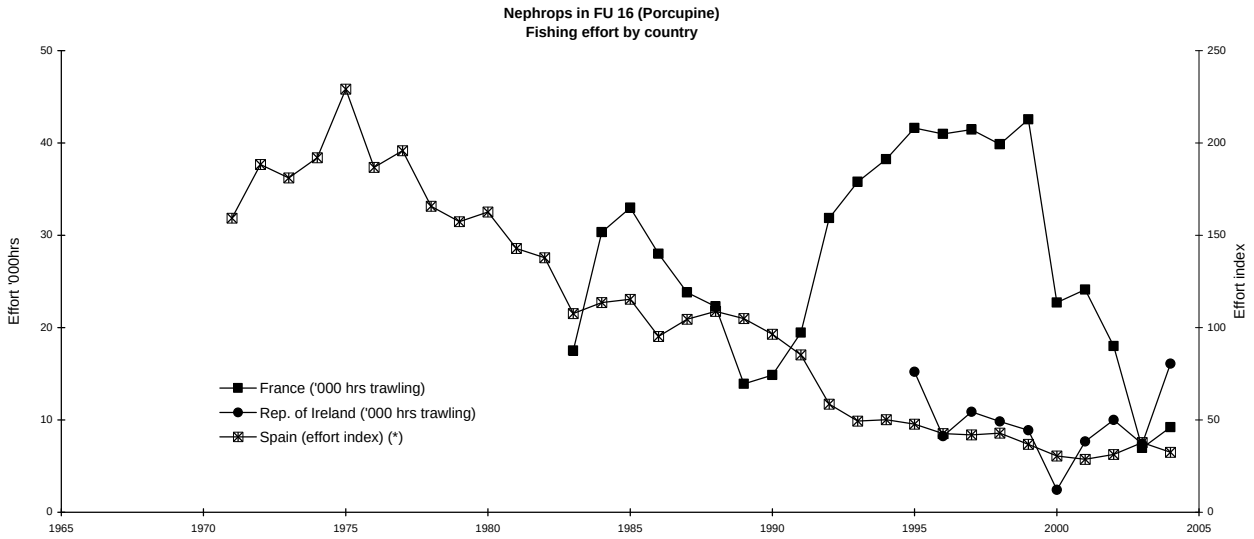
Table 1.4.38.1 UWTV survey of Nephrops in FU17 (Aran grounds)

GROUND	YEAR	NUMBER OF STATIONS	RAISED ABUNDANCE ESTIMATE (MILLION BURROWS)	TOTAL BIOMASS ESTIMATE (TONNES)
Aran Grounds	2002	49	787	14,667
	2003	42	997	17,687
	2004	64	1,406	21,787

Table 1.4.38.2 Total Nephrops landings (in tonnes) in MA L

Year	FU 16	FU 17	FU 18	FU 19*	TOTAL MA L
1965	514				514
1966	0				0
1967	441				441
1968	441				441
1969	609				609
1970	256				256
1971	1944				1944
1972	1738				1738
1973	2946				2946
1974	2794	477			3271
1975	2150	822			2972
1976	1327	131			1458
1977	1545	272			1817
1978	1744	481			2225
1979	2269	452			2721
1980	2925	442			3367
1981	3381	414			3795
1982	4289	210			4499
1983	3426	131			3557
1984	3571	324			3895
1985	3919	207			4126
1986	2591	147			2738
1987	2499	62			2561
1988	2375	828			3203
1989	2115	344			2459
1990	1895	519			2414
1991	1640	410			2050
1992	2015	372			2387
1993	1857	372	10	905	3144
1994	2512	729	126	390	3757
1995	2936	866	26	695	4523
1996	2230	525	46	888	3689
1997	2409	841	15	756	4021
1998	2155	1410	78	827	4470
1999	2132	1140	16	572	3859
2000	872	880	9	686	2448
2001	1163	913	2	809	2888
2002	1282	1154	14	1288	3739
2003	831	933	16	1079	2859
2004	1365	525	25	997	2913

* Irish data for 1993-95 exclusive of landings from rectangles that were previously in FUs 20-22, and that are now in FU 19



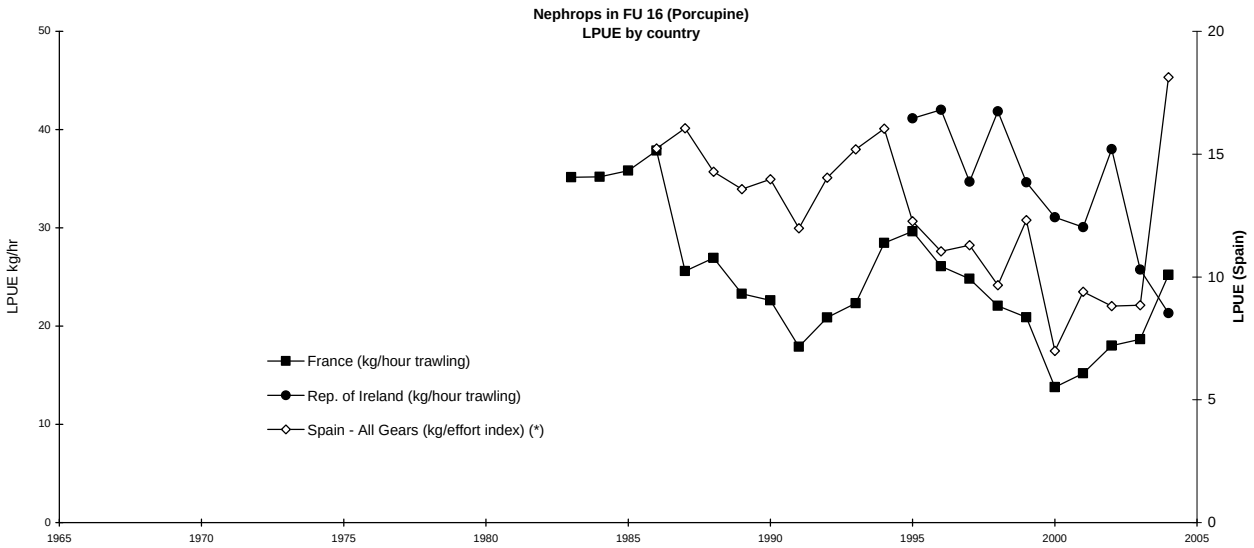
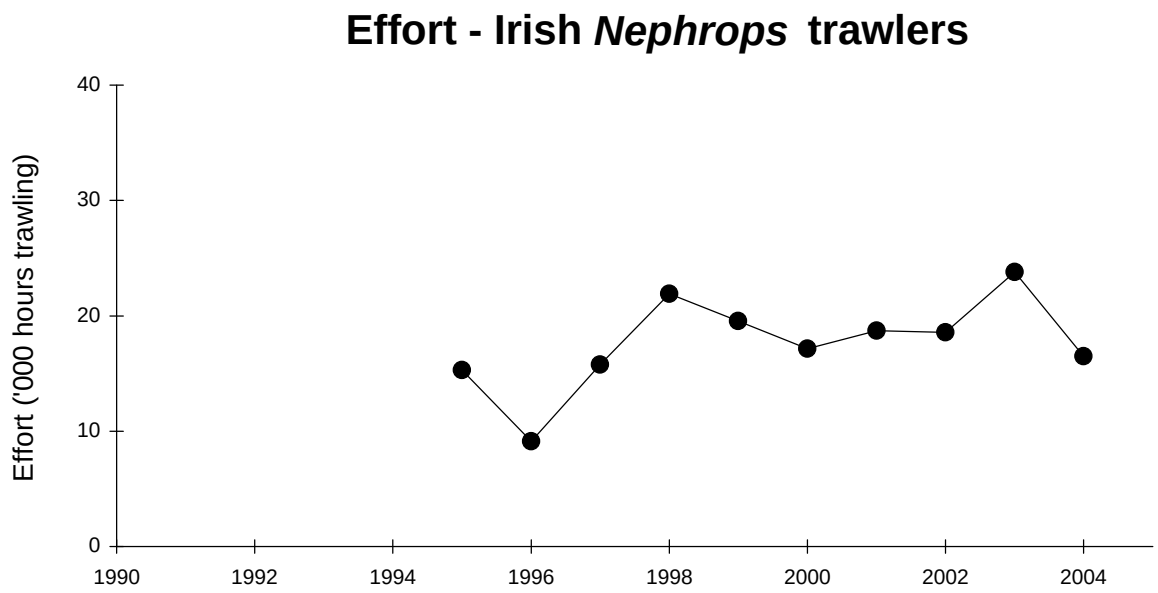


Figure 1.4.38.1 Effort and LPUE of *Nephrops* in FU16 (Porcupine)



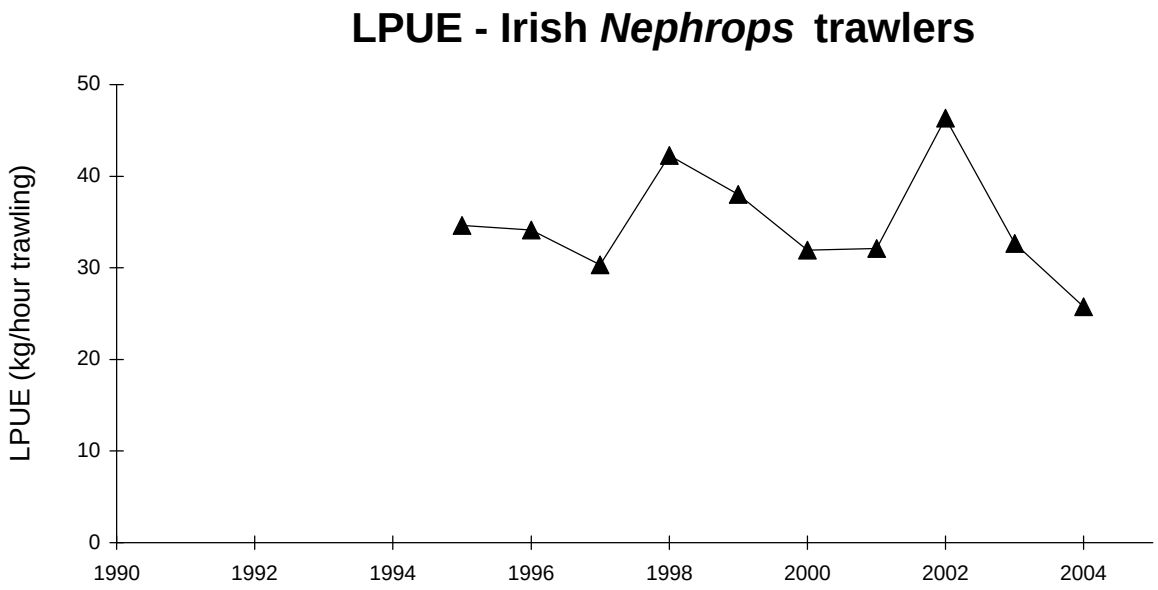
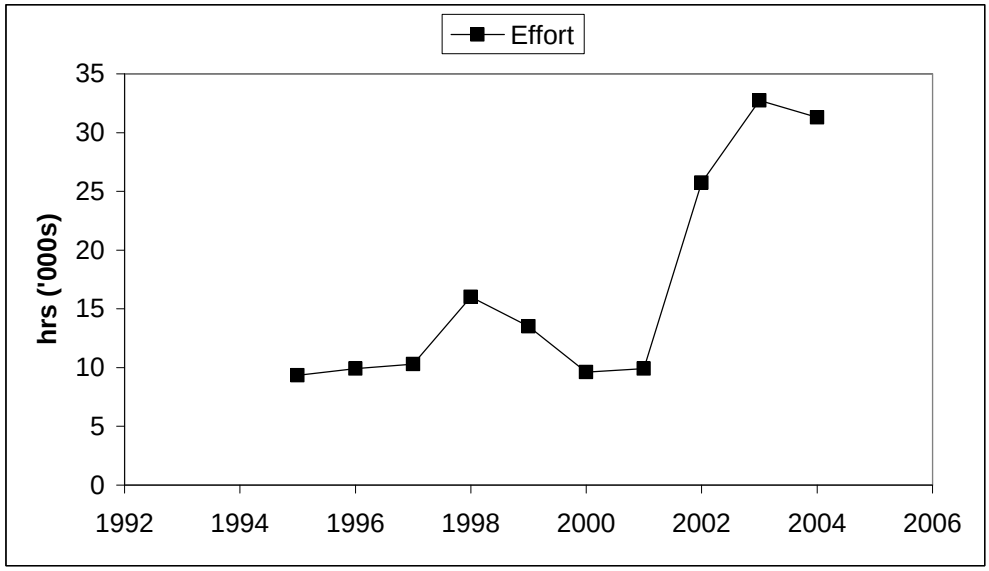


Figure 1.4.38.2 Effort and LPUE on *Nephrops* in FU17 (Aran grounds)



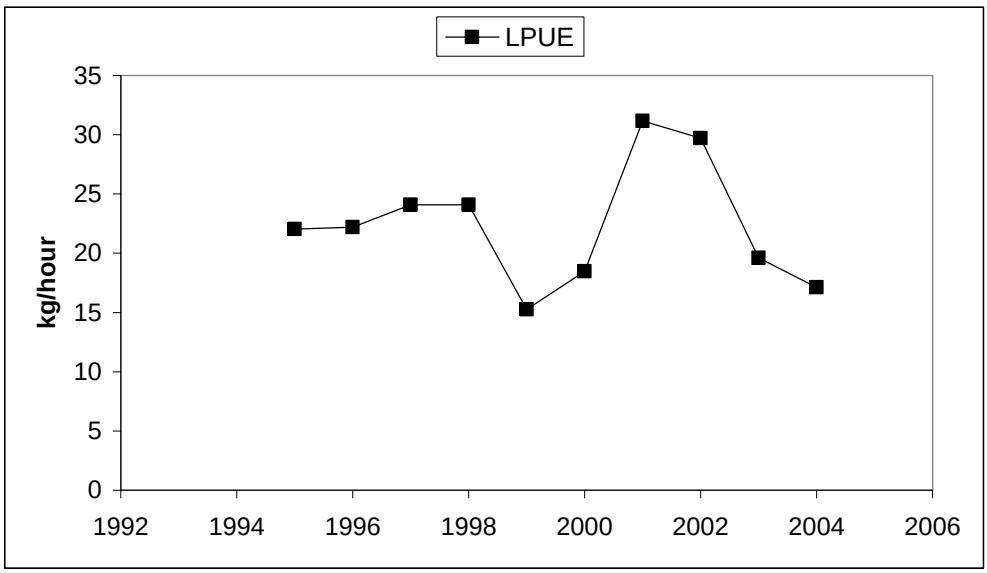


Figure 1.4.38.3. Effort and LPUE on *Nephrops* in FU19 (SE and SW Ireland)

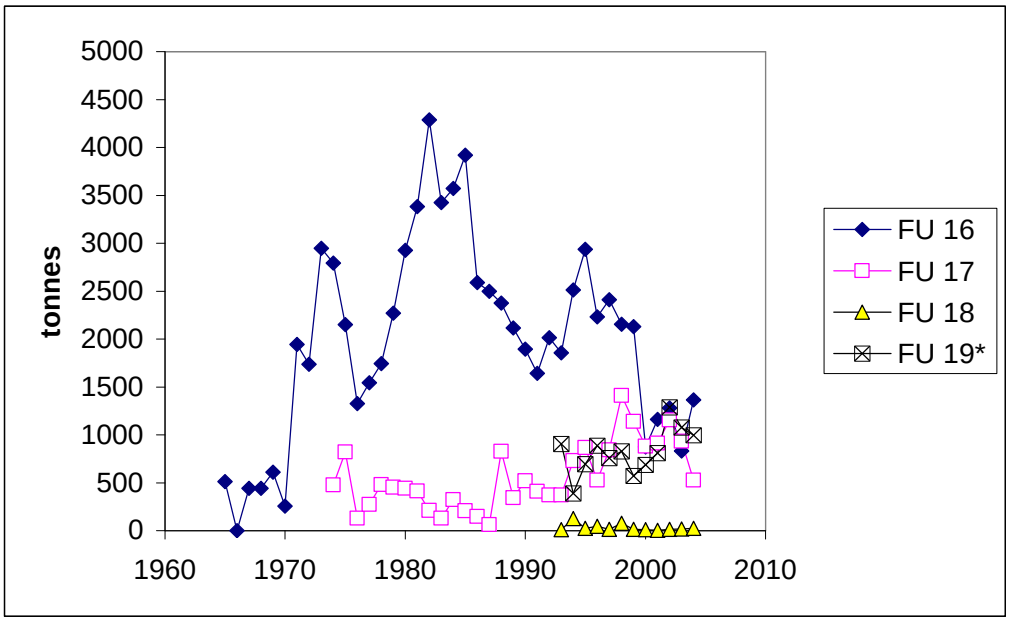


Figure 1.4.38.4 Landings of *Nephrops* in Management Area L by functional unit.

1.4.39 *Nephrops* in Divisions VIIf,g,h, excluding Rectangles 31 E1, 32 E1-E2 + VIIa, South of 53ºN (Management Unit M)

State of the stock

Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to highest yield	Fishing mortality in relation to agreed target	Comment
Unknown	Unknown	Unknown		

In the absence of defined reference points, the state of the stock cannot be evaluated in this regard. Landings show an increasing trend up to 1995; since then landings have fluctuated between 3500 t and 5000 t (mostly around 4000 t). The landings per unit effort (LPUE) series for the French *Nephrops* trawlers indicate an increase from a low in 1999 to the highest in the series in 2002.

Management objectives

There are no explicit management objectives for this stock.

Reference points

No reference points have been established.

Single-stock exploitation boundaries

Exploitation boundaries in relation to precautionary considerations

Due to uncertainty in the available data ICES is not able to reliably forecast catch. In view of the relative stability of landings, landings from FU 20–22 should not exceed 4.6 thousand tonnes for 2006, based on the average landings of 2000–2002. The landings from all FUs in this TAC area is presented in Section 1.4.36 (*Nephrops* in Division VIIa).

Management considerations

Management for *Nephrops* stocks should be conducted on an appropriate geographic scale (e.g. Functional Unit). Currently the TAC is set for Subarea VII and this may allow unrestricted catches for stocks where catches should be limited.

Nephrops in these functional units are known to occur in several areas of muddy sediment and the stock structure is uncertain. The *Nephrops* fisheries target different areas and have very different size structures in *Nephrops* catches and landings. These fisheries also have differences in non-*Nephrops* bycatch composition.

Discarding of *Nephrops* is substantial. This shows that trawls currently used to target *Nephrops* are not technically adapted to select marketable *Nephrops.* Discarding of other fish species is a problem in *Nephrops* fishery. Technical measures such as separator trawls can substantially reduce discarding and should be encouraged. Currently there are no pot fisheries for *Nephrops* in this area. Pot fisheries can be very selective in reducing discards and have less impact on the broader ecosystem. However, in other areas pots are known to have higher catches of female *Nephrops* than trawls and pots may therefore have a greater impact on SSB per tonnes landed.

Ecosystem considerations

Nephrops occur in discrete patches where the sediment is suitable for them to construct their burrows. There is a larval phase where there may be some mixing with *Nephrops* from other areas depending on the oceanographic conditions, but the mechanisms for this in the Celtic Sea are not currently known.

Cod has been identified as a predator of *Nephrops* in some areas, and the generally low level of the cod stock is likely to have resulted in reduced predation on *Nephrops*.

Factors affecting the fisheries and the stock

Landings from this stock are reported by France, the Republic of Ireland, and the UK. Up to 1993, the French landings represented at least 80% of the international *Nephrops* landings from the Celtic Sea but this proportion has declined somewhat since then. There has been a considerable increase in Irish landings, from around 700 t in the early 1990s to around 1 500 t from the mid-1990s until the present. There has also been increasing effort by Irish vessels targeting *Nephrops* in the Celtic Sea in recent years.

The effects of regulations

Although the minimum landing size for *Nephrops* in this area is 25 mm CL there is substantial discarding above this size by the French fleet due to market conditions.

Changes in fishing technology and fishing patterns

There has been increasing diversification into different *Nephrops* fisheries within this area by the Irish fleet.

Other factors

Although *Nephrops* is the main target species for two specialized fleets, cod, whiting, and to a lesser extent haddock are the main bycatches.

Scientific basis

Data and methods

The basic source of information on the structure and dynamics of *Nephrops* stocks is the length composition of catches, landings, and discards. Interpretation of these data is complicated by uncertainties in stock structure and the lack of geo-referenced sampling data. Age and growth for *Nephrops* stocks in this area is unknown.

There is limited fishery independent survey data for this stock and no survey specifically targeted at *Nephrops.*

French discard data are available for some years only (1985, 1991, and 1997). It is expected that the new Irish catch sampling programme implemented in 2002 will improve the quality of the series for future assessment. More frequent discard samplings of the French fleet would greatly improve the quality of the length-frequency data, the more so since (a) the minimum landing sizes applied by the two fleets are different (25 mm CL in Ireland vs. 35 mm CL in France), and (b) discarding by the French fleet is substantial (owing to the large commercial minimum landing size).

Information from the fishing industry

Prior to the assessment (WGSSDS 2005) a meeting was held with the Irish and French industry. No specific concerns were raised about this stock.

Comparison with previous assessment and advice:

Previously this stock has been assessed every two years and the advice based on various stock indicators (size, LPUE trends, XSA assessment). This year no assessment could be carried out due to limited and uncertain input data.

As in previous years the advice is based on recent average landings.

Source of information

Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks, June 2005 (ICES CM 2006/ACFM:01).

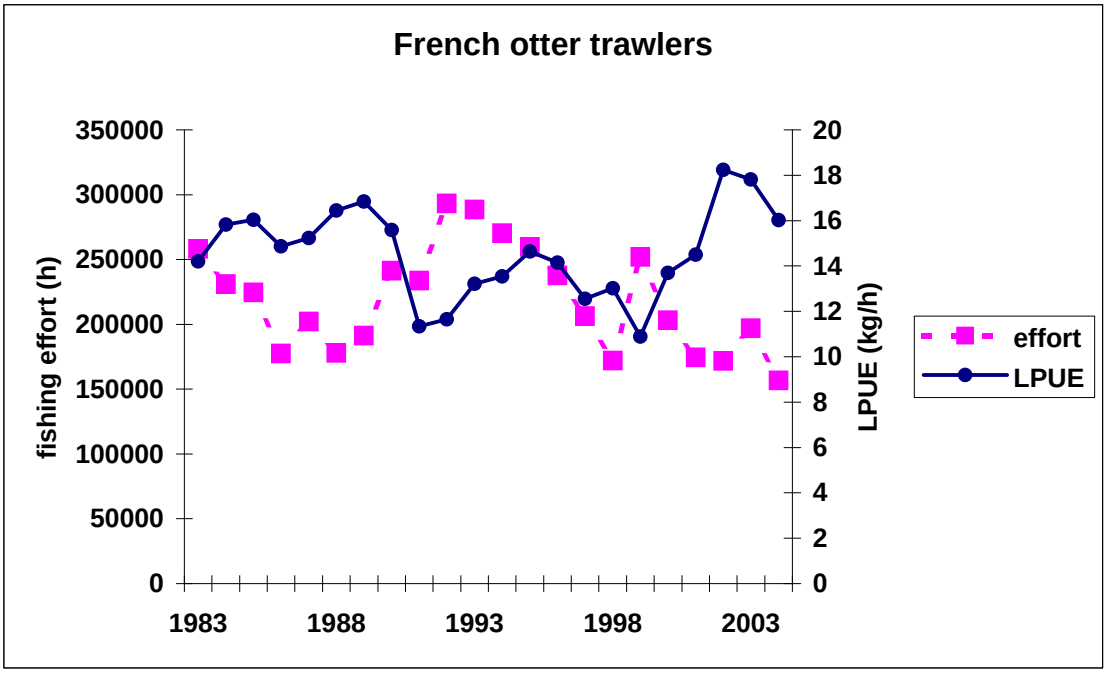
Year	ICES advice	Recommended TAC	Agreed TAC[1]	ACFM landings[2]
1987				3.1
1988				2.9
1989				4
1990				4.3
1991				3.3
1992		~3.8	20	4.3
1993		3.8	20	4.374
1994		3.8	20	4.869
1995		3.8	20	5.223
1996		3.8	23	4.611
1997		3.8	23	4.027
1998		3.8	23	3.835
1999		3.8	23	3.532
2000		3.8	21	4.579
2001		3.8	18.9	4.644
2002		3.8	17.79	4.603
2003		3.8	17.79	4.92
2004	Adjust TAC in line with landings of most recent 10 years	4.6	17.45	4.146
2005	Adjust TAC in line with landings of most recent 10 years	4.6	19.544	
2006	Recent average landings 2000–2002	4.6		

Weights in '000 t.
[1)] Subarea VII.
[2)] Does not include discards.

Table 1.4.39.1 *Nephrops* in VIIg,h. Nominal landings (t) in Division VIIgh as used by Working Group.

Year	France	Rep. of Ireland	UK	Other Countries[1]	Total reported	Unallocated	Total
1983	3667						
1984	3653						
1985	3599						
1986	2638						
1987	3080	329					
1988	2926	239					
1989	3221	784					
1990	3762	528					
1991	2651	644					
1992	3415	750					
1993	3815	770	63	0	4648	-274	4374
1994	3658	1415	68	2	5143	-274	4869
1995	3803	1575	125	2	5505	-282	5223
1996	3363	1377	86	2	4828	-217	4611
1997	2589	1552	95	4	4240	-213	4027
1998	2241	1619	64	1	3925	-90	3835
1999	2745	824	41	0	3610	-78	3532
2000	2782	1793	47	1	4623	-44	4579
2001	2532	2123	21	1	4677	-33	4644
2002	3134	1496	15	8	4653	-50	4603
2003	3511	1390	19	N/A	4901	0	4920
2004	2511	1599	36	N/A	4110	0	4146

[1]Other countries includes Belgium.



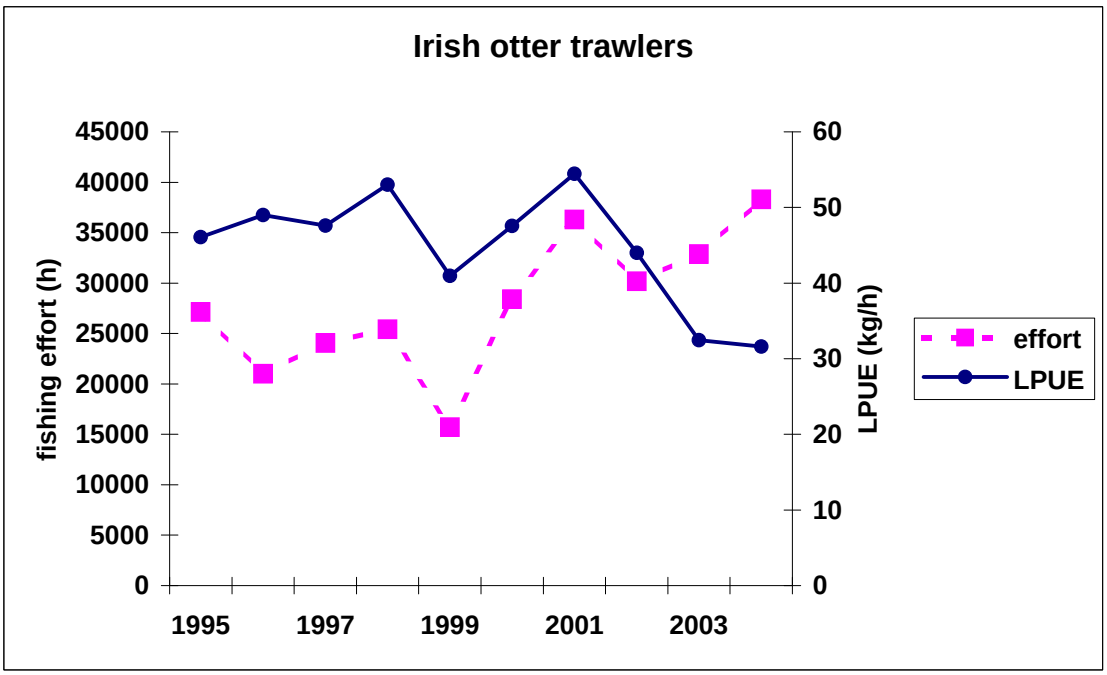


Figure 1.4.39.1 Fishing effort and landings per effort unit (LPUE) in *Nephrops* fisheries.