Fifth International Conference on the Protection of the North Sea

Intermediate Ministerial Meeting 1997

Basis Report

on Fisheries and Fisheries related Species and Habitats Issues

Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues

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Bergen, Norway

Introduction

Over the last years there has been increasing concern about the development and status of the North Sea fish stocks as well as the impacts of fisheries upon the ecosystem. The further integration of environmental and fisheries policies was therefore an important issue at the Fourth International Conference on the Protection of the North Sea in Esbjerg in 1995.

The Ministers at Esbjerg therefore welcomed the proposal that Norway would organize an Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues in 1997 (IMM 97), in which Ministers responsible for environmental protection and Ministers responsible for fisheries would participate. The Ministers furthermore agreed to establish the Committee of North Sea Senior Officials (CONSSO), which would be responsible for the preparation of IMM 97.

CONSSO agreed at its meeting in Oslo in October 1995 to establish a progress report on fisheries and environmental issues. The Assessment Report on Fisheries and Fisheries related Species and Habitats Issues is the report from CONSSO to the Intermediate Ministerial Meeting, covering both the status of the North Sea with regard to fisheries and fisheries related species and habitats issues, as well as the progress achieved since the Fourth International Conference on the Protection of the North Sea.

In order to collect information for the Assessment Report on Fisheries and Fisheries related Species and Habitats Issues the Secretariat circulated a Reporting Format to North Sea states and observers to CONSSO early in 1996. The Basis Report on the Responses to the Reporting Format on Fisheries and Fisheries related Species and habitats Issues comprises all responses from North Sea states, the European Commission, ICES, NGOs and IGOs. It provides the main basis for the preparation of the Assessment Report on Fisheries and Fisheries Related Species and Habitats Issues.

CONSSO agreed at the meeting in Bergen 13-14 June 1996, that the Basis Report would function as a documentation of the information collected in the preparation of IMM, but not be published as a separate report. The Basis Report was finalized in January 1997.

NOTE TO THE READER

The responses in the Basis Report are structured on the basis of the questions in the Reporting Format and compiled and presented in such a form that distinguishing between the contributions should be easy.

It should be noted that additional information to some of the questions is in annexes to the Basis Report.

A map of the North Sea showing the boundaries of the North Sea Conference area and the ICES areas is enclosed in Annex I.

The species mentioned in the Basis Report are listed in Latin, English, French and German in Annex II.

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1. Indicate all major fish species in your national fishing activity and the management policies applied, including TACs as well as other regulatory management measures. The most important species in terms of total international landings in weight according to ICES are listed in Annex III. Any species not in the list which are considered to be nationally important should be added by the North Sea states.

	Management policies			
Fish species	TACs applied	Other quotas applied such as group quotas, individual quotas and vessel quotas	No quotas applied	Other regulatory management measures
FISH SPECIES				
1. Turbot			EU, N	EU*
2. Plaice	EU, N			EU* and **, N[7)]
3. Common dab			EU, N	EU*
4. Lemon sole			EU, N	EU*, N[7)]
5. Common sole	EU			EU* and **
6. Tusk			EU, N	
7. Cod	EU, N			EU* and **, N[1)]
8. Hake	EU		N	EU* and **
9. Ling			EU, N	
10. Haddock	EU, N			EU* and **, N[1)]
11. Saithe	EU, N	N		EU* and **, N[1)]
12. Pollack			EU, N	EU*
13. Norway pout	EU		N	EU**, N[2)]
14. Bib			EU	
15. Blue whiting	EU		N	EU**, N[2)]
16. Whiting	EU, N			EU* and **, N[7)]
17. Sandeels			EU, N	EU**, N[2)]
18. Anglerfish			EU, N	
19. Gurnards			EU	
20. Horse mackerel	EU		N	EU* and **
21. Herring	EU, N	N		EU* and **, N[3)]
22. Pilcard			EU	
23. Sprat	EU, N	N		EU**, N[4)]
24. Mackerel	EU, N	N		EU* and **, N[1)]
25. Dogfish			EU, N	
26. Skates and rays			EU, N	
SHELLFISH				
27. Edible crab			EU, N	N[8)]

Table continued:

	Management policies			
Fish species	TACs applied	Other quotas applied such as group quotas, individual quotas and vessel quotas	No quotas applied	Other regulatory management measures
28. Spinous spider crab			EU	EU*
29. Norway lobster	EU		N	EU* and **, N[5)]
30. Northern prawn	EU, N	N		N[6)]
31. Common shrimp			EU	EU**, NL[1)]
32. Whelk			EU	
33. Mussels	DK[1)], D[1)]	DK, D[2)], NL[2)]	EU	DK[2)], NL[3)]
34. Scallops			EU	EU*
35. Common cockle		DK, NL[2)]	EU	DK[3)], NL[4)]
36. Cuttlefish and squid			EU, N	
OTHER SPECIES to be added by the North Sea states				
Sea weed			EU	N[9)]
Lobster			EU	EU*, N[10)]
Brown shrimp		DK		DK[4)]
Eel			EU	EU**
Spisula	NL[5)]	DK, D[3)], NL[5)]	EU, NL[5)]	DK[3)], NL[5)]

DK = Denmark:
1) A TAC is applied in the Wadden Sea.
2) Licenced fishery with quotas. Limited areas. Vessel and gear specifications. Seasonal closures. Minimum size.
3) Licenced fishery with quotas. Limited areas.
4) Licenced fishery. Limited areas. Vessel specification.

D = Germany:
1) Schleswig- Holstein is preparing a TAC
2) Schleswig- Holstein has issued six licences for the fishery on blue mussels.
3) Schleswig- Holstein has issued six licences for the fishery on Spisula which are valid outside the Wadden Sea only.

NL = The Netherlands:
1) Licensed fishery, max. 226 vessels, Wadden Sea max. 93 max. beamlength 18 m. Equipped with sorting-machine
2) Annual quota, related to total stock and in relationship with the foodstock for birds
3) Licensed fishery, max. 92 vessels, Limitation in time, permanent and additional closed areas
4) Licensed (37) fishery, max. 22 vessels, limitation in time, permanent and additional closed areas
5) None
6) To avoid fishing in area's with high bird density

N = Norway:
1) Effort limitation, type of gear, minimum size, by-catch rules
2) Zone in which fishing activities are prohibited, effort limitation, type of gear, by-catch rules
3) Zone in which fishing activities are prohibited, effort limitation, type of gear, minimum size, by-catch rules
4) Effort limitation, type of gear, by-catch rules
5) Type of gear, minimum size, by-catch rules
6) Effort limitation, weekend ban, type of gear, minimum size, by-catch rules
7) Mesh size, minimum size
8) Minimum size, local gear regulations
9) Closed areas
10) Minimum size, seasonal closures

EU :
* Minimum landing size
** Mesh size
NOTE: "No quotas applied" is taken to mean: No TACs applied

The United Kingdom: The answer already covers all major fish species of interest to the UK.

The European Commission: The most important species in terms of total international landings in weight according to ICES are listed in Annex III. Any species not in the list which are considered to be nationally important should be added.

We provide a table to indicate all stocks for which EU sets TACs for stocks in the North Sea as defined for the purposes of the Conference. Of these some are joint stocks with Norway. The TACs for some of the stocks cover geographical areas which overlap with the North Sea as defined for the Conference but also extend beyond this area.

Analytical and precautionary TACs are indicated. Analytical TACs are implemented when reliable scientific predictions of short-term catch and biomass are available. Precautionary TACs are applied otherwise.

Common Wadden Sea Secretariat:

a. Medium term objective:

Fish stock or fishery	Type of objective	Status for development and acceptance	Comments
Mussel	To limit the negative ecological impact by closing considerable parts of the Wadden Sea (1991) To investigate possibilities to come to harmonised minimum marketable size and by-catch % of undersized mussels (1994)	In NL 25% of tidal area closed; In DK 45% closed; In D implementation in progress In progress	
Cockle	To be aware of and to limit the negative effects of cockle fisheries (1991)	NL: 25% of tidal flats closed. D: Whole Wadden Sea closed. DK: Only one license in one small area	
Shrimp	To investigate possibilities of a common research project on the effects of shrimp fisheries as a basis for discussion on further regulations, amongst which the closing of areas (1994)	In progress	
Other shellfish (e.g. spisula)	To investigate the impact of fisheries on shellfish stocks outside the islands as a basis for discussing regulatory measures for safe-guarding the food stocks for birds (1994)	In progress	In DK no shellfish fishery other than mussel and shrimp allowed outside the islands and up till 3 nm from the baseline

b. Long term objective:

Fish stock or fishery	Type of objective	Status for development and acceptance	Comments
All fisheries	An increased area of geomorphologically and biologically undisturbed tidal flats and subtidal areas (1994) Favourable conditions for migrating and breeding birds (in terms of food availability) (1994)	In progress	

7.a. For which fish stocks or fisheries are there established management strategies in order to reach the objectives set out in the table in Question 6.?

Norway: No particular management strategies indicating under which "target reference point" the fishery should be managed. In order to manage the fishery to achieve stocks within MBAL, means like licensing, quotas, minimum mesh size, minimum landing size and discard ban are used (ref. Question 1)

The European Commission: See reference to plaice, herring, mackerel under Question 6.

Common Wadden Sea Secretariat: Trilaterally: Under development. First proposals expected in 1997 at 8th governmental Wadden Sea Conference. In the NL a management plan for shellfish fisheries is in operation which will be evaluated in 1997. See further national report NL.

7.b. If such management strategies have not yet been established, what are the plans for their establishment?

Norway: Several working groups between the European Union and Norway have been established with the aim to develop new management strategies for mackerel, herring and demersal species in the North Sea.

The European Commission: The Commission will continue to discuss its proposals (see response to Question 6) with Council in the expectation that agreement will be reached.

2. Fishing Activities and Gears

Questions 8-9: All North Sea states and the European Commission

8.a. How is the selectivity of fishing gears improved and implemented within the different types of fisheries as regards target species?

Belgium: The main fishing methods in Belgium are beam trawling and otter board trawling. The selectivity of these gears is assured by applying the EU technical measures, of which the minimum mesh size regulation is the most important. The improvement of species selectivity in beam trawls is presently studied in the frame of EU-project "*Optimisation of species selective beam trawls*" (Contract AIR2-CT93-1015). Square mesh netting or large escape opening in the top panel are being used to reduce roundfish by-catches.

Denmark: Reference is made to the response by The European Commission.

Germany: Please add to the alternative methods to improve selectivity (2. paragraph under IMPROVEMENT):

rollers at ground rope
net design/geometry
length and circumference of codend
shortened lestridge ropes

The Netherlands: There is hardly any use of selective fishing gears in shrimpfishery. To reduce the mortality of mammals and birds the use of some types of coastal fixed nets is prohibited. Other fixed gears have to be supplied with a net with meshwidth of 14 cm as a barrier for seals and birds.

Norway: In the trawl fishery for Norway lobster encouraging results are achieved to improve size selectivity of the target species by using solid grids in front of the codend. The selectivity result obtained with such a device is superior to that of a standard diamond mesh codend. The device has not been introduced in the commercial fishery yet.

In the long line fishery reduction in bait loss and bird mortality can be obtained by adjusting the procedure when the long lines are set.

The European Commission:
Improvement
Until recently the predominant means of improving selectivity enacted by the European Union has been to increase mesh size in towed nets (trawls, demersal seines etc.) and, recently, to define minimum mesh sizes for static gears (gill nets, trammel nets and tangle nets).

In recent years, alternative methods have been developed for improving selectivity, notably separator trawls, square-mesh panels and sorting grids. It has also been suggested that regulation of the twine diameter of netting used to construct towed gears might also be considered.

At present, Community regulations regarding selectivity mainly concentrate on definition of minimum mesh sizes. However, in certain cases, reference is also made to voluntary use of square-mesh panels, to separator trawls and to some aspects of the geometry of towed fishing gears.

In UK, the use of square-mesh panels is mandatory for vessels fishing for Nephrops and for certain other towed demersal gears.

Community regulations on technical measures are currently being redrafted and a new proposal on this topic will be presented to Council before 1 June 1996.

Implementation
Community regulation 3094/86 (the technical measures regulation) specifies minimum mesh sizes to be used when fishing for defined target species. Community regulation 2847/93 (the control regulation) specifies the means by which mesh sizes and associated percentages of target and by-catch species are to be controlled.

Research
The Commission supports projects for investigation of new techniques for improvement of selectivity of fishing gears and Member States also autonomously fund research of this type. In UK, work is continuing to clarify and quantify factors which influence the escape of fish from nets.

ICES: This question is taken to refer to size selectivity.

Size selection in towed nets is improved by widening the openings through which fish can escape, usually the meshes of the codend where the catch accumulates. The traditional method is to increase the mesh size but by altering the construction of the codend, mesh opening can also be increased. This is done by increasing the codend mouth diameter, by reducing the number of meshes on the circumference and by attaching tight longitudinal (selvedge) ropes to limit stretching and closing of the meshes. By hanging the netting so that all the meshes are square a permanent zone of open meshes is created; both escape panels and complete codends of square mesh can be effective. Grids can also be used for size selection when sited in an escape route.

Size selection in dredges used for bivalves is improved by increasing the spacing of the teeth which dig into the sea bed and by increasing the diameter of the rings and/or mesh size of the netting used in the bag.

Set nets which capture fish by "gilling" are inherently very size selective, but a wider size range of fish can be retained by hanging the netting loosely to catch fish by "tangling". Reducing twine thickness increases capture efficiency but reduces netting strength. Traps for shellfish can be fitted with slots or gaps to allow smaller crabs, Nephrops and lobsters to escape.

8.b. How is the development of means by which the mortality caused by fishing gears is reduced as regards non-target organisms (including development of active and passive sonic devices and of escape routes from fishing gears)?

Belgium: It is assumed that this question refers mainly to the by-catch of marine mammals. This problem doesn't occur in Belgium where mainly low bottom-nets are used. No special measures are thus developed.

Denmark: Sorting panels in shrimp fisheries to prevent larger organisms from entering the nets. Wire crosses in fyke nets to prevent otters from entering the nets.

Germany: Shrimps: In Schleswig-Holstein, veil nets and sorter machines have been employed in order to minimise the by-catch mortality of "non-target species".

The Netherlands: For shrimpfishery several measures are established for the use of sorting machines. This sorting machines have to offer a considerable survival of discards and non-target species; only if discharged below waterline. In relation to beamtrawl fisheries, research is conducted on the development of other technical measures like sonic devices and electric fishing.

Norway: In the trawl fishery for deepwater shrimp (*Pandalus borealis*) in the Norwegian Trench and in Skagerrak the selective grid device is used voluntary by many Norwegian trawlers. The shrimp grid is often used in combination with a large mesh codend which catch larger fish escaping through a fish outlet in front of the grid.

The European Commission: In responding to this question, it is assumed that the phrase "non-target organisms" refers principally to marine birds, mammals and reptiles. Mortality rates on non-target fish species can be reduced by improvement of the selectivity of fishing gears.

The European Commission is aware that various active and passive sonic devices exist and/or are under development. The Commission has supported a number of studies in this area. However, the Commission is not aware of any such method whose effects have been sufficiently proven to justify insistence upon their application in the field. Furthermore, the Commission is unaware of any routine or episodic application of such methods by fisheries within Community waters.

In Sweden, a study has been initiated on the mortality of seals in fishing gears. The primary aim of the project is to develop or modify fishing methods, fishing gears and sonic devices which can be used to reduce or eliminate damage to the catch or gears caused by seals.

Also in Sweden, densities and distribution of harbour porpoise were studied in the Skagerrak and Kattegat in 1995 using a reporting scheme for sightings and aerial transect surveys. A similar project, supported financially by EC, will be carried out in 1996 in the Baltic. Experiments with sonic devices on fishing gears will be initiated in the context of the findings of these surveys.

The UK Ministry of Agriculture Fisheries and Food (MAFF) and the UK Department of the Environment are funding work at Loughborough University to test the use of

passive sonar devices on fishing gear to warn cetaceans of the presence of nets. In 1995 MAFF commissioned from the UK Sea Mammals Research Unit a two-year programme to collect and assess data on cetacean by-catch through a voluntary reporting scheme and formal observer schemes in the albacore tuna fishery operating to the southwest of the British Isles and the UK bottom-set gillnet fishery in the North Sea. In addition, the Sea Mammals Research Unit, together with organisations in Denmark, Ireland and Sweden, have secured EC funding for a 2-year research programme to assess the ecological significance of marine mammal by-catches. Escape doors in drift nets have been deployed on a voluntary basis by UK fishermen in the fishery for tuna in the North-east Atlantic. The fishermen claim that deployment of this method is successful but scientific verification of this claim is lacking. Otherwise, the Commission is unaware of development or deployment of escape routes from fishing gears in Community waters.

ICES: This question is taken to refer to species separation.

Separation of species of fish and crustacea has been achieved in mobile gears by the use of separator trawls with internal horizontal dividing panels; of rigid grids (or gratings) set at an angle to the water flow and by escape panels set in the top and sides of nets and codends. Separation is most readily achieved when the species to be separated differ widely in form and behaviour, e.g. separation of shrimp and roundfish by a rigid grid.

Recent research has demonstrated that providing escape routes for unwanted species is not in itself enough to ensure that they pass out of a fishing gear. It is necessary to construct the gear so as to provide a stimulus to escape. The escape route must be made to appear safer than remaining within the gear and this is achieved by the use of coloured netting and other components. It is also necessary to ensure that the net is structured such that the water flow pattern does not inhibit escape.

The capture of cetaceans in mobile demersal gear is relatively rare since they are capable of detecting the gear visually and aurally as it approaches and can swim much faster than the normal towing speeds. The provision of escape routes for these species in the nets used in the North Sea is not perceived to be necessary.

Cetaceans are more likely to be captured in mobile pelagic gear, both pelagic trawls and purse seines, whilst preying on the target fish species, possibly because the large size of these gears makes them appear less threatening. No work has been done in the North Sea to modify these gears to reduce the by-catch.

The use of active and passive sonic devices to make surface (and bottom) set nets more readily detectable by cetaceans has been investigated. There is some evidence from American trials that this approach can reduce the cetacean by-catch but little work has been done in the North Sea. The creation of escape gaps between set nets to provide obvious bypass routes has also been investigated and found to be effective at times. [This summary of investigation of methods of reducing cetacean by-catch is probably incomplete.]

9. What is being done in order to adapt the fishing fleet capacity and fishing effort to available resources, both in respect of total capacity and capacity within the different fisheries?

Belgium: Measures were taken to adapt the fleet capacity.

Denmark: Implementation of the Multi Annual Guidance Programme for the Danish Fishing Fleet.

The existing programme 1993-1996 was adopted on December 21, 1992. According to the programme the capacity is to be reduced to 108.422 GRT and 435.738 kW at the end of 1996. The objectives take into consideration that tonnage is made up in GT and in BRT. The programme did not include vessels under 5 GRT. In 1995 a midterm adjustment was adopted, which is described in more detail below.

The development in the Danish fishing fleet's tonnage and engine power is shown in Table 1.

Table 1. MAGP-III. Development in tonnage and engine power.

	Tonnage GT/BRT		Engine power kW	
pr. 31.12.	Objective	Situation	Objective	Situation
1991	119.188	115.014	514.716	490.860
1992	116.804	107.101	504.422	453.493
1993	114.709	93.546	487.251	400.425
1994	112.613	95.168	470.080	389.086
1995	110.518		452.909	
1996	108.422		435.738	

Vessels>5BRT

The programme was divided in 4 segments. The development in each segment is shown in Table 2.

Table 2. Capacity development for the individual programme segments 1994.

	Situation 31.12.92			Situation 31.12.94		
	Number of vessels	BT/BRT	kW	Number of vessels	BT/BRT	kW
Gillnets etc.	1.202	14.533	88.665	1.124	13.698	84.903
Trawlers and Danish seine	1.357	81.384	344.093	1.111	72.098	285.141
Trawlers (Greenland)	3	4.236	4.915	3	2.011	3.221
Purse seine	11	6.949	15.821	11	7.362	15.821
Total	2.573	107.102	453.493	2.249	95.168	389.086
Vessels<5BRT[1)]	931	3.128	27.047	3.031	4.554	47.594
Total	3.504	110.230	481.228	5.280	99.722	436.680

1) The figures are tentative
By 21.12.1995

The situation compared to the objectives in the programme 31.12.1994 was as follows (See Table 3):

Table 3. Capacity development for the individual programme segments 1994.

	Situation 31.12.94			Objective 31.12.96	
	Number of vessels	BT/BRT	kW	BT/BRT	kW
Gillnets etc.	1.124	13.698	84.903	16.433	93.998
Trawlers and Danish seine	1.111	72.098	285.141	81.560	322.115
Trawlers (Greenland)	3	2.011	3.221	3.480	3.810
Purse seine	11	7.362	15.821	6.949	15.815
Total	2.249	95.168	389.086	108.422	435.738
Vessels<5BRT[1)]	3.031	4.554	47.594	-	-
Total	5.280	99.722	436.680	-	-

[1)] The figures are tentative
By 21.12.1995

By the Commission's decision of June 7, 1995 the programme was adjusted. The main objective was not changed, but 2 new segments were added. By a transfer of capacity from the trawler group a new category for pelagic fishery with trawl or seine was established. At the same time the objective for the actual category of purse seine vessels was adjusted in order to make modernisation of the vessels possible. The changes led to a new calculation of the objective without transfer from the purse seine's group to the group of trawlers.

Furthermore a new category of vessels under 5 BRT was established. The size of this group, which was to be added to the previous objective, is ultimately assessed at the end of 1995 (See Table 4):

Table 4. Programme objective and situation after the 1995 revision.

	Situation 1.12.95			Objective 31.12.96	
	Amount	BT/BRT	kW	BT/BRT	kW
Gillnets etc.	1.082	12.979	81.202	16.433	93.998
Trawlers and Danish seine	1.087	71.601	279.609	77.894	314.439
Pelagic fishery	1	155	809	2.300	5.700
Trawlers (Greenland)	1	865	1.308	3.480	3.810
Purse seine	11	7.608	15.821	7.813	17.312
Vessels<5BRT	2.989	4.491	47.125	4.641[1)]	48.705[1)]
Total	5.171	97.699	425.874	112.561	483.964

[1)] by 31.12.1994. In the programme decision the figures are 3.718 BRT/36.503kW

In connection with the 1992 programmes the EU-Commission introduced fishing effort as an element in the programmes. Denmark has due to this stated the development in fishing effort as shown in Table 5.

Table 5. Fishing effort (mill.)

	1989-91	1992	1993	1994
; days*GT/BRT	22,6	21,5	19,3	17,9
; days*kW	88,0	83,2	72,4	66,7

Note: Vessels > 5 BRT only

The programme is implemented through restrictive directives concerning the access to bring in new capacity. The directives are fundamentally unchanged in the programme period until the end of 1995.

Furthermore the adjustments has been encouraged by means of subsidies of which the substantial part has been used for the decommissioning of fishing vessels. The following amounts has been used in 1994 and 1995.

Table 6. Subsidies for Cessation purposes (mill. dkk)

	National	EU	Total
Cessation January 1994	5,998	13,995	19,992
Cessation 1994-1995	47,937	47,937	95,873
Cessation 4th quarter 1995	9,0	9,0	18,0
Total	62,935	70,932	133,865

Additional comments
In order to maintain the important fishery for mussels in the Wadden Sea and in other coastal zones in Denmark and to protect environmental interests in the same areas, it has been necessary to regulate this fishery very closely.

Accordingly the amount of mussels, which is allowed to be caught is regulated, and only a limited number of fishermen are allowed to fish mussels in certain restricted areas.

The Netherlands: For the cockle-, musselseed- and shrimpfishery as well as the fishery with fixed gears, the number of licences is limited. There is a relation between the number of licences and the available stock (shrimps) or nature-management objectives (other species). Additional measures are taken by the producer-organisations (management- and fishing programs).

Additional to the Multi-annual Orientation Program the North Sea-fleet is restricted in the amount of allowed days at sea.

Also in addition to the Multi Annual Guidance Programme fishing effort and fishing capacity are also regulated as follows: Quota-management in the Netherlands is implemented through a system of Individual Transferable Quota (ITQ) for the main species. This system is complemented by a system of Days at Sea to control input of fishing capacity. Each fishing vessel is attributed an individual number of Days at Sea in relation to the ITQ which is registered on the vessel.

The use of the Days at Sea is, as with the use of quota, monitored by the governmental inspection service and by the board of the fishing-group of which the fisherman is a

member. In this way also the capacity of the fleet is regulated. Also a balance between capacity and fishing possibilities is reached on a yearly basis.

The Dutch fishermen pool in 8 fishing groups. Yearly these fishing groups make fishing plans based on the several itq's and number of days at sea of the individual members of the groups. These fishing plans can therefore be considered as a second management tool for ensuring the balance between fishingcapacity and fishingpossibilities on a yearly basis. These fishingplans have to be approved by the Dutch authorities concerned. In this way also the capacity of the trawlerfleet is regulated.

Norway: The adaptation of the fleet capacity and fishing effort to the available resources is to a great extent accomplished by administrative measures. These measures include restrictions on number and size of vessels that may participate in the various fisheries. Furthermore there are regulations concerning the use of fishing gears, as well as licence- and quota systems.

During the last decades Norway has introduced different kinds of basic legal instruments in order to limit the fishing effort, such as;

- Act of 20 April 1951 relating to Fishing with Trawl. All fishing activity which implies the use of trawl, irrespective of the vessels size, is prohibited unless a special licence is issued by the competent authorities.

- Act of 16 June 1972 relating to the Regulation of the Participation in Fisheries. A licence issued by the fishing authorities is required in advance before purchasing a fishing vessels larger than 50 feet. Specific conditions related to the buyer of a vessel must be fulfilled and there must be an acceptable economic basis for the vessel (fishing licence, quotas etc.).

Fishing licence are issued by the Authorities upon application from the fishermen. A licence does not, however, represent a permanent privilege to participate in specific fisheries, and may as such be withdrawn. The system in force applies to vessels exceeding a certain size and participating in fisheries for specific species, fishing in specified areas, and to the use of certain fishing gears.

From 1978 several capacity reduction programmes have been introduced. 1/3 of the total amount spent on scrapping and sales programmes was granted during the period 1978 - 1983 and about 40% of the permanent capacity reduction caused by these programmes took place in that period. The total number of fishing vessels is reduced from 26 000 in 1986 to 14 500 in 1996. The reduction of tonnage from 1986 to 1994 is 50 000 gross tonnage, i.e. from 300 000 GT in 1986 to 250 000 GT in 1994.

The European Commission: Since 1983, the Commission has tried to reduce the problem of overcapacity by means of Multi-Annual Guidance Programmes (MAGP's). These programmes set targets for tonnage and power for the fleets of each Member State.

The first set of programmes appeared in 1983 and simply tried to arrest the increase in fleet capacity. The second generation of MAGP's ran from 1987 until the end of 1991, setting targets of 3% reduction in tonnage and 2% in power over the whole of the period.

The problem of overcapacity is addressed more firmly in the present generation of programmes, with reductions of 20% for roundfish trawl fisheries, 15% for flatfish and

other benthic fisheries using towed gears and a stabilisation for pelagic fisheries and fixed gears. These targets are to be achieved by the end of 1996. Sweden joined the EU in 1995 and the conditions for their targets within the MAGP were adapted accordingly. Grant aid for decommissioning is available under the regulations.

The current generation of MAGP's introduced for the first time the concept of fishing effort, where part of the target could be achieved by a reduction in activity. No Member State took advantage of this possibility. Effort by fishery is, however, controlled under the new regulations concerning access to western waters.

The Commission is now preparing the next generation of programmes, which will run from 1 January 1997 until 31 December 1999. The Commission has again convened a group of scientific experts to examine the state of stocks in relation to the fleets exploiting individual fisheries. Its report, together with a report form the administrations of each Member State and reports from a series of consultations across Europe between the industry and the Commission, will be used to formulate proposals for appropriate capacity targets to be achieved by the end of 1999.

3. Monitoring of Stocks

Questions 10-12: All North Sea states and the European Commission

10.a. For which stocks are stock assessments conducted? (The state of the stocks for which ICES carries out stock assessment is given in Annex V.)

Stocks	Commercially exploited	Not commercially exploited
Sprat in the fjords	N	
Mytilus edulis	DK	
Cerastoderma edule	DK	
Spisula solida	DK	
Macona sp.		NL
NL 1)		

DK = Denmark
N = Norway: We are assessing the stocks through ICES.
NL = The Netherlands:
NL 1): See also answer 11.a.
NOTE: For NL there is no difference in assessments and surveys.

Belgium: Belgium assesses the stocks through ICES.

France: France agrees with the European Community. We conduct national surveys of the Channel mussels, spider crabs and scallops.

Germany: There are no stock assessments in addition to the ICES stock assessments.

The United Kingdom: The UK agrees with the European Commission. We conduct a national survey of Thames estuary herring, which is mentioned in the Commission's response to Q11.a.

The European Commission: [ICES to respond]
In this context, it should be mentioned that Sweden has recently introduced an extensive sampling scheme at the fish meal plant on the Swedish west coast. The results from this scheme should greatly assist in enhancing the reliability of stock assessments of herring and sprat in the Skagerrak and Kattegat and also of the same species in the Baltic.

Denmark also carries out stock assessments on mussels (*Mytilus edulis*), cockles (*Cerastoderma edule*) and surf clam (*Spisula solida*).

Common Wadden Sea Secretariat:

Stocks	Commercially exploited	Not commercially exploited
Mussels	+	
Cockles	+	
Shrimp	+	

Additional comments
In the framework of the implementation of the Trilateral Monitoring and Assessment Program, the parameter "wild mussel beds" is proposed for regular monitoring.

10.b. For stocks where stock assessments are not conducted, indicate the reason and the estimated costs for such assessments.

Belgium: Not applicable.

Denmark: Reference is made to the response by The European Commission.

France: With regard to France, reference should be made to the response by the European Commission.

Germany: Additional stock assessments are not conducted due to lack of resources.

The Netherlands: Not applicable.

Norway: Assessments are not conducted because of lack of man power, ship time and money. Start-up investments costs at approx. 200 million NOK for all stocks and species, varying between 3-15 million NOK for each stock or species, thereafter yearly expendition at approx. 50 million.

Sweden: Stock assessments are not conducted on potential harvest species of molluscs in region IIIa: e.g. *Buccinum undatum*, *Cerastoderma edule*, *Ensis ensis* and scallop (*Pecten* sp.).

The United Kingdom: See Question 10.a.

The European Commission: The predominant reason for not conducting stock assessments is lack of money and/or lack of appropriate scientists to perform the required work. The estimated costs of assessing more stocks are difficult to evaluate unless decisions can be made on the number of stocks implied.

10.c. If stock assessments are not conducted, what action is being taken to conduct such assessments in the future?

Denmark: Reference is made to the response by The European Commission.

France: Additional stock assessments are not conducted.

Germany: Additional stock assessments are not conducted due to lack of resources.

The Netherlands: Not applicable.

Norway: The EU-project FAIR-CT95-0817 "Monitoring biodiversity in the North Sea using groundfish surveys" starting in 1996 may give some indications on the state of some of the stocks.

The United Kingdom: See Question 10.a.

The European Commission: The European Commission, in recent years, has provided financial support for the data collection activities required to support stock assessment.

However, with the exception of stocks in the Mediterranean, this support is used to maintain existing stock assessment rather than to initiate new assessments.

11.a. For which stocks and areas are national surveys conducted?

Belgium: Flatfish (mainly sole and plaice) in the North Sea, in the framework of ICES (international beamtrawl survey).

Denmark:

Stocks in which surveys are conducted	Area
Mytilus edulis	Wadden Sea, Limfjorden, IIIa
Cerastomerme edule	Wadden Sea
Spisula solida	Div. IVb
Roundfish, Flatfish	Sub-area IV and Div. IIIa
Herring, Sprat	Sub-area IV and Div. IIIa

France: Reference should be made to the response of the European Community. We conduct surveys on mussels, spider crabs and scallops.

Germany:

Stocks in which surveys are conducted	Area
Brown shrimp	Wadden Sea
Cod	German Bight
Sole	German Bight
Demersal fish assemblage monitoring	North Sea

The Netherlands:

Stocks in which surveys are conducted	Area
Mussels and musselseed	Wadden Sea, Eastern/Western Scheldt
Common cockle	Wadden Sea, Eastern/Western Scheldt, Voordelta
Spisula	Voordelta, North Sea (Wadden Isles)

Norway:

Stocks in which surveys are conducted	Area
Cod	Northern North Sea and Skagerrak
Haddock	Northern North Sea and Skagerrak
Whiting	Northern North Sea and Skagerrak
Saithe	Northern North Sea and Skagerrak
Norway pout	Northern North Sea and Skagerrak
Herring	Northern North Sea and Skagerrak
Sprat	Northern North Sea and Skagerrak
Mackerel	Northern North Sea and Skagerrak
Northern prawn	Northern North Sea and Skagerrak

The European Commission: [ICES to respond - note that many "national surveys", especially in the North Sea, are conducted in a collaborative manner and are co-ordinated under ICES. Member States should respond with respect to purely national surveys of use in stock assessment and fishery management.]

Denmark conducts national surveys on mussels (*Mytilus edulis*) in the Wadden Sea and the Limfjord, cockles (*Cerastoderma edule*) in the Wadden Sea and surf clam (*Spisula solida*) in the central North Sea (Division IVb).

UK conducts surveys on herring in the Thames estuary (Blackwater stock), on molluscan shellfish in UK coastal areas and also on the Clyde herring stock (west of Scotland).

11.b. For which stocks and areas are methods other than surveys applied for fish stock assessment.

Belgium: None

Denmark:

Stocks for which other methods are applied	Area	Method
All commercial and by-catch species	North Sea Div. IIIa	Sampling of commercial catches for stock assessment

France: The normal assessment method for the North Sea stocks is VPA. Surveys are used for estimates of scallops, mussels and spider crabs.

Germany: The normal assessment method for the North Sea stocks is the VPA. The surveys are only used for tuning the VPA and for estimates of recruiting year classes.

The Netherlands: Stocks for which other methods are applied: For coastal fisheries: none.

Norway:

Stocks for which other methods are applied	Area	Method
Cod	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Haddock	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Whiting	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Saithe	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Norway pout	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Herring	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Sprat	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Sandeel	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Mackerel	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Horsemackerel	IIIa, Iva, IVb	Fisheries statistic and biological sampling
Northern prawn	IIIa, Iva, IVb	Fisheries statistic and biological sampling

The United Kingdom: The UK agrees with the European Commission.

The European Commission: In the North Sea as defined for this Conference, it is rare for stock assessments to be conducted on the basis only of survey results. Survey results are usually combined with results from market sampling as a basis for stock assessment.

In some cases, where no survey results are available, stock assessments are conducted purely on data from market sampling.

12.a. How are the results of multispecies assessments used as a part of the assessment of North Sea fish stocks? (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

The Netherlands: In coastal waters, multispecies assessment is carried out on shellfish stock in relation to fishing mortality and foodstock for birds. Fishing mortality may not jeopardise the bird-populations.

Norway: Results of multispecies assessment runs are used as natural mortalities in some of the single species assessments (see ICES).

The European Commission: [Request response from ICES - initial response given below.]

The North Sea multispecies model can be used to assess the historical state of fish stocks and to predict the possible future state of the stocks assuming some well defined scenario with respect to the fishing mortality rates exerted by various fleets.

Historical assessments
The main practical use of the historical assessments has been to redefine estimates of the natural mortality rate on juvenile fish. These estimates are incorporated into single-species predictions of the probable size of the stocks and associated fishing opportunities in the immediate future. This procedure is acceptable since single-species predictions of short-term effects are almost identical to short-term predictions obtainable by use of the full multispecies model and it is easier and quicker to run single-species predictions.

Long-term multispecies predictions
Long-term predictions produced by the multispecies model are often very different to the predictions obtained under the same assumptions from single-species predictions. The main use, therefore, of the results of multi-species predictions is to draw attention to the possibility that, taking account of the interactions between species, it may not be possible to increase biomass of certain species without adversely affecting the biomass of others.

12.b. What components of the ecosystem are included in the multispecies assessment? (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

The Netherlands: See 12.a. Main bird-populations are Eider and Oystercatcher.

Norway: (see ICES)

The European Commission: ICES should respond to this.

With respect to seabirds and marine mammals, the Commission has no up to date information at Community level.

12.c. How will multispecies assessments be conducted in the future?

Denmark: ICES to respond.

The Netherlands: Depending on the results of the evaluation-study.

Norway: Multispecies assessments will be used as soon as ICES finds the models good enough.

The European Commission: ICES should respond to this.

4. By-catches, Discards, Offal and Ecological Impact

Questions 13-15.a: All North Sea states and the European Commission

13.a. Indicate by-catches for the given fishing methods in weight, number of individuals or both. (Indicate species or groups of species if available).

Belgium: The number of marine mammals by-caught is very small, in view of the fishing methods in use and the total number of marine mammals present in Belgian waters.

The number of by-caught seabirds is probably very small, but no accurately quantified. A number of *Sula bassana*, *Podiceps cristatus*,....is caught in fixed nets used in sports fishery.

Note: The by-catch of seabirds and marine mammals is almost exclusively limited to the use of fixed (standing) nets. In Belgium there is only one professional fishing ship using these kinds of nets. With sports fishermen, this kind of fishing method is popular, though subject to a strict regulation and control.

Denmark:

Fishing methods (indicate industrial or consumption fishery)	Seabirds (number/year)	Marine mammals (number/year)	Non-target fish (tonnes/year)	Juvenile target fish (tonnes/year)	Benthic organisms[1] (tonnes/year)
1. Otter trawl (human consumption fisheries)	?	?	15000	5000	?
12. Gill nets	?	7000 ? harbour porpoises (a qualified guess)	500	600	?

France: ICES should respond to this question.

Germany: Data not yet available. Analysis of data in progress.

The Netherlands: For coastal fisheries, no recent Dutch figures available. In numbers 20. Hand-gathering (cockles), 21. suction dredging (cockles), 22. dredging mussels of the table below there is as far as known, no by-catch of any relevance.
Experimentally gathered data obtained with a sole net in the Southern North Sea showed following catch composition for beamtrawl:

in biomass:	65 % fish	35% benthos
in numbers:	35 % fish	65% benthos

In terms of weight 60-70% of the fish were undersized, in terms of numbers 85-90%.
Most of the undersized fish (90%) were dab or plaice (BEON report 13, 1991)
Data for pelagic trawls not available at this moment.

For 12 m beamtrawl each kg of marketable sole results in a catch of 8-10 kg of dead fish, of which a substantial part is landed, and 4-6 kg dead invertebrates; i.e. 270 000 tonnes of fish and 120 000 tonnes of invertebrates in the Southern North Sea (NIOZ rapport 1994 - 11: RIVO-DLO report C026/94.

Fishing methods (indicate industrial or consumption fishery)	Seabirds (number/year)	Marine mammals (number/year)	Non-target fish (tonnes/year)	Juvenile target fish (tonnes/year)	Benthic organisms[1] (tonnes/year)
3. Beam trawl			270.000 (exp.data)		120.000 (exp. data)

Norway:

Fishing methods (indicate industrial or consumption fishery)	Seabirds (number/year)	Marine mammals (number/year)	Non-target fish (tonnes/year)	Juvenile target fish (tonnes/year)	Benthic organisms[1] (tonnes/year)
Demersal active gears					
1. Otter trawl (human consumption fisheries)	0		4 000 tonnes [2]	n.a.	n.a.
2. Otter trawl (industrial fisheries)	0		15 000 tonnes [6]	n.a.	n.a.
3. Beam trawl	0				
4. Demersal pair trawl	0				
5. Twin trawl (two otter trawls with only two otterboards and a central weight)	0				
6. Seines and ring nets	0				
7. Pair seine	0				
8. Dredge	0				
Pelagic active gears					
9. Pelagic trawl (single vessel)	0				
10. Pelagic pair trawl	0				
11. Purse seine	0		1 000 tonnes [3]	n.a.	n.a.
Passive gears (nets)					
12. Gill nets	****	6%¤¤	5 000 tonnes [4]	n.a.	n.a.
13. Drift nets	*	75 harbour porpoises ¤			
14. Set nets	0				

Table continued

Fishing methods (indicate industrial or consumption fishery)	Seabirds (number/year)	Marine mammals (number/year)	Non-target fish (tonnes/year)	Juvenile target fish (tonnes/year)	Benthic organisms[1] (tonnes/year)
15. Coastal fixed nets	**				
Passive gear (traps)					
16. Creels	Creels for cod are used in some districts, and they are known to catch many Cormorants ***				
Passive gear (lines)					
17. Long-lines	Fulmar is the most numerous victim.***		1 000 tonnes [5]	n.a.	n.a.
18. Hand-lining	0		n.a.	n.a.	n.a.
19. Rod and line (sport fishing)	0		n.a.	n.a.	n.a.
Other					
20. Hand-gathering	0				

1) All benthic organisms except fish and commercially exploited species of shellfish

* When salmon driftnets where legal, these nets caught large numbers of auks. We do not know about any data on this from Norwegian North Sea waters.

** These nets are known to take a lot of breeding auks when they are set close to bird cliffs. There are no data, however from the North Sea area, but even if the numbers of killed birds are small, local populations may be effected (ref: Follestad, A. & K.-B. Strann 1991. Sjøfugl og fiskegarn. Problemets omfang og karakter i Norge. -NINA Oppdragsmelding 78:1-14)

*** Follestad, A. & O. J. Runde 1995. Sjøfugl og fiskeredskaper: gjenfunn av ringmerkede fugler. -NINA Oppdragsmelding 350:1-26

**** In Norwegian North Sea waters, gill nets cause most of the mortality of seabirds in fishing gears. There are no estimates of total numbers killed. From recoveries of ringed birds, however, cormorants (Shag, Cormorant) and auks (Guillemot, Black Guillemot) seems to be the most vulnerable species in this area. Most of these birds are killed along the west coast of Norway, where fishing gears are the reported cause of death for about 76 % of the Cormorant, 71 % of the Shag and almost all Guillemots and Black Guillemots. Large accidental catches are also reported from the Oslo-fjord, where more than 850 Guillemots were collected from local fishermen during the winter 1988/90, and further 2000 were reported from the Skagerrak area during the winter 1991/192. Most of the birds killed in this way are, however, juvenile birds, the least vulnerable part of the population with respect to consequences for future population development.

***** Anker-Nilssen T.& S.-H. Lorentsen 1995. Seabird-95
Lorentsen, S.-H. & T. Anker-Nilssen in prep

□ From salmon drift net fisheries 1988 (before the ban) (ref: Donovan, G. P. and A. Bjørge 1995. Harbour porpoises in the north Atlantic: edited extract from the report of the IWC Scientific Committee, Dublin 1995, Rep. int. Whal. Commn, Special issue 16:3-25.)

□□ About 6% of all tagged Common seals are recovered drowned in fishing gear.

(ref: Wiig, Ø and N. Øyen 1988. Recoveries of common seals *Phoca vitulina L.* tagged along the Norwegian coast. Fauna norw., ser. A 9: 51-52.)

1. All benthic organisms except fish and commercially exploited species of shellfish
2. Target species: Saithe
3. Target species: Horse, mackerel, herring, sprat, mackerel and saithe
4. Target species: Cod, saithe, haddock
5. Target species: Tusk, cod, ling, haddock and saithe
6. The figure 15.000 tonnes includes by-catch taken in pelagic trawl
   Target species: Norway Pout, blue whiting, sandeel, herring, sprat, mackerel, horse-mackerel, shrimp

(1-6: Source: Preliminary catch statistics, 1994. Quantity may vary from year to year).

Sweden:

Fishing methods (indicate industrial or consumption fishery)	Seabirds (number/year)	Marine mammals (number/year)	Non-target fish (tonnes/year)	Juvenile target fish (tonnes/year)	Benthic organisms[1] (tonnes/year)
1. Otter trawl (human consumption fisheries)				Norway lobster Area IIIa 78% by number 57% by weight are discarded (Sjöstrand 1995)	
12. Gill nets	Seabirds, mostly guillemots. 25.000 ind. during 1982-88 SE Kattegat Guillemots 10.000 ind. in area IIIa during 1982-88 (Olden *et al.* 1988)	Harbour porpoise 120-150 ind./year (mostly gillnet catches) in area IIIa (Berggren 1994)			

The United Kingdom: The United Kingdom agrees with the European Commission.

The European Commission: ICES should respond to this.

13.b. Where no data are available, is any action being taken to obtain such data?

Belgium: Efforts are presently undertaken to quantify the by-catch of marine mammals and seabirds.

Denmark: A monitoring scheme is ongoing covering all Danish fishing areas and will for 1996 produce an estimation of the total yearly discard of all species caught in the Danish fishery.

France: EU-study in order to obtain some data on by-catch in the pelagic fisheries.

Germany: EU-Study 1994-019 (1995 and 96). Age and length composition and amount of by-catches in various German fisheries in the North Atlantic.

The Netherlands: DK, D and NL are currently discussing a joint research project on shrimpfishery. A research project on dolphins is already carried out.
By-catch studies are in principle carried out on demersal fisheries. More studies are needed - both national and international - on by-catch by pelagic fisheries.

Norway: No action has been taken to obtain such data, as this has not been a necessary tool in the management of the Norwegian fisheries.

Sweden: No data available on by-catches of skates and rays, but 2 species (*Raja batis* and *R. clavata*) have more or less disappeared from area IIIa (Johnsson 1994, Swedish Fishery Board 1995).

No data available on by-catches of benthic organisms in area IIIa, but trawling for prawns is suspected to cause major damage to benthic communities in the Koster fjord (Terstad 1995).

The European Commission: The European Commission invites annually proposals for research projects related to fisheries. In recent years the Commission has increasingly invited and supported scientific work leading to the collection of data of the required type.

In UK, a monitoring scheme for discards in the Scottish demersal fisheries and covering the northern North Sea and West of Scotland has been in existence since 1973. Results from this scheme are regularly provided to ICES. Limited work is also carried out in other waters exploited by UK fisheries.

A monitoring scheme is ongoing covering all Danish fisheries and will, in 1996, produce estimates of the total annual discard of all species caught in the Danish commercial fishery.

Sweden has recently conducted investigations on the trawl fishery for pelagic species in the Baltic Sea which may be of relevance to the Skagerrak/Kattegat area.

Article 12 paragraph 4 of the Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora obliges Member States of the European Union to "establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV(a)" which includes marine species (e.g. all cetacean).

***14.a. Indicate the quantity of offal discarded at sea in tonnes per year* (ICES will provide information on this question, in addition to information from EC and North Sea states.)**

Belgium: No data available.

Denmark:

Fishery	Quantity of offal discarded at sea in tonnes per year.	Comments
1. Roundfish fisheries (trawls and seines)	7,300	1995
2. Flatfish fisheries	1,500	1995
3. Industrial fisheries (small-mesh trawl)	0	
4. Industrial fisheries (other gears)	0	
5. Pelagic fisheries (trawls)	0	
6. Pelagic fisheries (purse seines)	0	
7. Gill net and set net fisheries	3,800	1995
8. Shellfish fisheries (trawls)	400	1995
9. Shellfish fisheries (dredge)	0,5	1995
10. Shellfish fisheries (traps and creels)	NA	
11. Long-line fisheries	NA	
12. Hand-line fisheries	NA	
13. Sport fisheries (rod and line)	NA	
14. Hand-gathering	NA	

France: No French data available.

Germany:

Fishery	Quantity of offal discarded at sea in tonnes per year. *	Comments
1. Roundfish fisheries (trawls and seines)	3700 tonnes (1994)	
2. Flatfish fisheries	150 tonnes (1994)	

Comments: Average conversion factor for 1 is 25%, for 2 it is 11% of the landings.

The Netherlands: No data available (n.i.).

Norway:

Fishery	Quantity of offal discarded at sea in tonnes per year. *	Comments
1. Roundfish fisheries (trawls and seines)	13 000 tonnes	
2. Flatfish fisheries	600 tonnes	
3. Industrial fisheries (small-mesh trawl)		
4. Industrial fisheries (other gears)		
5. Pelagic fisheries (trawls)		
6. Pelagic fisheries (purse seines)		
7. Gill net and set net fisheries	4 000 tonnes	
8. Shellfish fisheries (trawls)		
9. Shellfish fisheries (dredge)		

Table continued:

Fishery	Quantity of offal discarded at sea in tonnes per year. *	Comments
10. Shellfish fisheries (traps and creels)		
11. Long-line fisheries	300 tonnes	
12. Hand-line fisheries		
13. Sport fisheries (rod and line)		
14. Hand-gathering		

Source: Preliminary catch statistics, 1994. Quantity may vary from year to year.

* Offal is calculated in the following way: Round weight less weight of product using an average conversion factor which is 1,4 for the three groups of fisheries, 1,7 and 11 in the table has been used. For the fishery labelled 2 in the table, a conversion factor of 1,2 has been used. (The offal may include some quantity landed and utilised, ref. 14.b.)

The United Kingdom: No UK data available.

The European Commission:
Denmark has provided the following data (tonnes) for 1993:
Roundfish fisheries - 3000 t, Gill net fisheries - 3000 t, Flatfish fisheries - 1100 t.

ICES:

Fishery	Quantity of offal discarded at sea (tonnes/year)	Comments
International North Sea estimate	65,000–70,000	see below

Comments

- The estimate is based on combined landings data (gutted weight) from roundfish, flatfish and shellfish (trawl) fisheries where most fish species are usually landed gutted. It did not prove possible to divide the total amount between these two categories. Most other important fisheries (pelagic and industrial) fisheries are not thought to generate significant amounts of offal because fish are landed whole.

- Estimations use species-specific conversion factors to get total from gutted weight (for details see ICES CM 1994/Assess/Env:1). The current estimate is lower than the previous estimate of 83,700 t by Furness *et al.* (1988) which was based on landings data from the early 1980s.

- Larger quantities of offal are expected in areas where large individuals of species with higher conversion factors are targeted. In that sense flatfish fisheries in ICES Division IVc (North Sea) will produce smaller quantities of offal than roundfish fisheries in offshore grounds of ICES Divisions IVa and IVb (North Sea).

- The above indirect method of estimation assumes that all landed fish are gutted and discharged at sea. The former is not always the case in the Scottish fisheries but extrapolations to other national fleets cannot be made. In Scotland, haddock and, mainly, whiting can be landed in large proportions as "rounders" (ungutted fish), especially in periods where strong year classes reach marketable size. In these cases vessels that target fish around minimum landing size (mainly inshore areas) land a good deal of the catch ungutted due to the increased labour involved with gutting.

16.b. Describe other measures applied in order to reduce discards.

Belgium: Sorting machines in the shrimp fishery.

Denmark: In most of the Danish fisheries management, accidental catches are permitted in order to prevent discards.

The Netherlands: Sorting machine in shrimp fishery.

Norway: North of N62° we have surveillance programs with temporary closure of areas where the intermixture of juvenile fish is too high. The programme, with an annual cost of 20 mill. NOK has proved to be a very successful investment contributing to a dramatic improvement in the exploitation pattern in various fisheries.

In the same area for the last few years we have had a great success with developing separation systems in different gears for sorting out juvenile fish in the catches. For a few species this work has just started in the North Sea. Due to intermixture of species and a different type of species, the work will be very difficult. There is no timetable on this work.

The European Commission: The EC believes that an important method to reduce discards is to improve the selectivity of fishing gears so that the quantities of small, juvenile fish retained by these gears is minimised. This is one of the main intentions of the technical measures regulation referred in the response to Question 8.c.

In addition, the Community regulation on technical measures defines areas and/or seasons in which the use of specified types of fishing gear is restricted or prohibited. Many of these conditions are intended to inhibit capture of juvenile fish and thereby reduce discarding.

16.c. Describe possible future management measures to reduce discards and the likely timetable for implementation.

Belgium: Future EU measures.

Denmark: The system for cod in ICES 3b,c,d as described in 16.a., will possibly be implemented in ICES 4ab as well. The effort-system for sole, also described in 16.a., will in 1996 possibly be implemented for cod in the same area.

The Netherlands: Research is conducted on selective fishing gear for beamtrawl.

Norway: More effort in developing selective fishing gear.

Sweden: Introduction of traps to replace trawls in the Swedish fishery for Norway lobster in area IIIa. Introduction of exit windows on trawls.

The United Kingdom: The UK agrees with the European Commission and would only add that reducing fishing effort will contribute significantly to reducing discards.

The European Commission: The European Commission recognises that the conditions currently or previously defined within the technical measures package have not been sufficient. For this reason, the Commission is currently preparing a new proposal on technical measures to be presented to Council before 1 June 1996.

Recently, Council adopted amendments to the technical measures regulation specifying, for the first time in Community regulations, minimum mesh sizes for gill nets, trammel nets and tangle nets (will come into force December 30, 1997).

16.d. Additional comments with regard to discards.

Germany: In the German brown shrimp fishery a sieve-net is normally in use to reduce the by-catch of fish such as cod, whiting, plaice and sole and non target species. Experiments are carried out by the BFA für Fischerei to increase the selectivity of too wed gears by using sorting grids and roller ground gears (cod fishery) and to introduce high selecting gears like long-lines.

Sweden: No comprehensive data is available on discards and by-catches in the Swedish North Sea fishery.

The European Commission: Prior to 1996, Swedish fishermen were obliged to record discards in their logbooks. Following accession to EU, recording of discards in logbooks is voluntary as it is for all other Community fishermen.

17. Indicate what use is made of landed by-catches. If possible, indicate most important and less important usage.

Belgium: In consumption fisheries, landed by-catches are mainly used as food (human consumption). Approximately 700 tonnes of fish, which were used mainly as animal feed were withdrawn from the market in 1994. There are no industrial fisheries in Belgium.

Denmark:

	Used as food (human consumption)	Used as animal feed	Other uses (specify)
In consumption fisheries	xx	x	
In industrial fisheries	x	xx	

Germany: In German fisheries (only h.c.) most of the landed by-catches is used for h.c. and only small amounts as animal feed (shrimp fishery).

The Netherlands:

	Used as food (human consumption)	Used as animal feed	Other uses (specify)
In consumption fisheries		x	
In industrial fisheries			

Norway:

	Used as food (human consumption)	Used as animal feed	Other uses (specify)
In consumption fisheries	1		
In industrial fisheries	1		2 (for reduction[1)])

[1)] Through reduction, fish is processed to meal and oil. These ingredients are thereafter processed to pellets which again is given to feed salmon in the Norwegian aquaculture industry. A fraction of the meal and oil is also exported to other countries, and is used as animal feed.

The European Commission:
Finfish and shellfish
In fisheries for human consumption, all landed by-catches are offered for sale for human consumption.

In industrial fisheries, unsorted by-catches are used in the same way as the catches of the target species. However, it is permitted to sort by-catch form industrial landings and to offer them for sale for human consumption.

Under certain market conditions, fish offered for sale for human consumption are not taken up for this purpose in which case they may be used for industrial purposes.

Other organisms
Organisms other than fish and shellfish are rarely landed from North Sea fisheries. [Member States to provide relevant information.]

18.a. Which marine species including seabirds and marine mammals benefit, directly or indirectly, from fishing activities? (ICES will provide information on this question in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

Germany: 18-27: ICES should give response (WG on impact of fishing activities on NS ecosystem meeting in March 1996).

Germany: Seabirds (only those breeding in the German part of the North Sea):

Fulmar	*Fulmarus glacialis*
Gannet	*Morus bessanus*
Common Gull	*Larus canus*
Black-headed Gull	*Larus ridibundus*
Lesser Black-baked Gull	*Larus fuscus*

Herring Gull	*Larus argentatus*
Great Black-baked Gull	*Larus marinus*
Kittiwake	*Rissa tridactyla*

The Netherlands: Some seabirds scavenge on floating discards (mainly fish). Observations on the Dutch Continental Sector show that eight species utilise fishery waste on a large scale: Fulmar (*Fulmaris glacialis*), Gannet (*Sula bassana*), Great Skua (*Catharacta skua*), Common Gull (*Larus canus*), Lesser Black-backed gull (*Larus fuscus*), Herring gull (*Larus argentatus*), Great Black-backed gull (*Larus marinus*) and Kittiwake (*Rissa tridactyla*). Most likely these species benefit from discards, resulting in a population increase (C.J. Camphuysen & M.F. Leopold, 1995).

Other species which probably benefit the from fishing activities are:
- starfish (*Asterias rubens*) and crustaceans (swimming crab (*Liocarcinus holsatus*), hermit crab (*Eupagurus bernhardus*) scavenge on sunken dead/damaged/exposed benthos or fish in the trawl path dab (*Limanda limanda*), gurnards (*Trigla spp.*), whiting (*Merlangius merlangus*).

- short-living opportunistic species (e.g. worms)
- small-sized fish species, that escape relatively undamaged through the meshes of the gear (dragonet (*Callionymus lyra*), solenette (*Buglossidum luteum*)

- Resistant benthos species that escape relatively undamaged through the meshes of the gear (starfish) (BEON 1994-13).

Norway: Those species of seabirds that (are most likely to) benefit directly from North Sea fisheries, are those that utilise the discards (i.e. by-catch and offal thrown overboard) from the fishing vessels. The most numerous scavenging species at sea are fulmars and kittiwakes, but also gannets, common gull, lesser black-backed gull, herring gull, great black-backed gull and great skuas utilise discards and occur offshore in significant numbers relative to their population sizes.

Sweden: Some populations of seabirds (e.g. gulls) may benefit from feeding on discards from the Swedish fishery.

The European Commission: ICES to respond.

ICES: [Note: The term "benefit" is taken to mean an increase in population size.]

Apart from target species and seabirds there is little published information on actual trends in the abundance of marine species that may benefit from fishing activities. Furthermore, even if such trends have been established it remains uncertain whether there is a direct or indirect relationship with fisheries. Species may benefit from the discards created, but at the same time increased mortality due to fishing can counteract any profit gained. With the above caveats in mind the following list has been drawn up:

Species most likely to benefit

- Seabirds: scavengers on floating discards (mainly fish). Eight species utilise fishery waste on a large scale: fulmar (*Fulmarus glacialis*), gannet (*Morus bassana*), great skua (*Catharacta skua*), common gull (*Larus canus*), lesser black-backed gull (*Larus fuscus*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*) and kittiwake (*Rissa tridactyla*) (Camphuysen *et al.*,1995).

Species which probably benefit
- Starfish (*Asterias rubens*)

Species which possibly benefit
- Opportunistic benthic species like spionid worms.

BirdLife International:
1) *Beneficiaries of fishery waste (discards and offal)*
Key beneficiaries (dominant scavengers, regularly follow vessels) (from Camphuysen *et al.* 1995):

Fulmar *Fulmarus glacialis*
Gannet *Morus bassanus*
Great skua *Catharacta skua*
Common gull *Larus canus*
Lesser black-backed gull *L. fuscus*
Herring gull *L. argentatus*
Great black-backed gull *L. marinus*
Kittiwake *Rissa tridactyla*

There is no indication that discards form a significant proportion of the diet of seals in the North Sea (P. S. Hammond, Sea Mammal Research Unit, pers. comm.) though harbour seals are thought possibly to play an important part in the clearance of flatfish discards in the Wadden Sea (Bergahn 1990). Killer whales *Orcinus orca* are known to take discards in the north-west North Sea; white-beaked dolphins *Lagenorhynchus albirostris* and Atlantic white-sided dolphins *L. acutus* probably also make occasional use of discards (P. G. H. Evans, pers. comm.).

See also Q20, below, for more details (suggestion that the whole scavenging guild of seabirds should be the subject of detailed case review).

2) Beneficiaries of enhancement of prey stocks
Species which have increased over the last twenty years, possibly attributable - at least in part - to a fishery-induced increase in small shoaling fish (Furness 1987: see explanation in 18b, below), are:

Cormorant *Phalacrocorax carbo*
Shag *P. aristotelis*
Arctic skua *S. parasiticus*
Razorbill *Alca torda*
Guillemot *Uria aalge*
Puffin *Fratercula arctica*
Great skua *Catharacta skua*
Arctic tern *Sterna paradisaea*
Sandwich tern *S. sandvicensis*

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Camphuysen, C. J., Calvo, B., Durinck, J., Ensor, K., Follestad, A., Furness, R. W., Garthe, S., Leaper, G., Skov, H., Tasker, M. L. & Winter, C. J. N. (1995) Consumption of

discards by seabirds in the North Sea. Final Report: ERC DGXIV research contract BIOECO/93/10.

Furness, R. W. (1987) The impact of fisheries on seabird populations. Pp 179-92 in Peet, G. (ed) The status of the North Sea environment: reasons for concern. Proc. 2nd North Sea Symp. Werkgroep Nordzee. Amsterdam.

18.b. How do these species benefit from fishing activities? (ICES will provide information on this question in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

Germany: By using discard and offal as an additional food source these species benefit from fishing activities. The high number of seabirds following fishing vessels, the spatial distribution of feeding and resting seabirds comparing to fishing activities and the increasing stocks of seabirds are strong indications for the benefit these species take.

There are also indications that marine mammals use discard as food source and that some crustaceans and fish species, e.g. Gadidae, Pleuronectidae, feed on benthic invertebrates that become available due to disturbance of the seabed by e.g. beam trawl fishery. It is uncertain if this has any positive effect on the population size of these species.

The Netherlands: Species benefit from fisheries because they are scavengers on dead discards returned to the sea, or organisms dead, damaged or exposed in the trawl path. Other species may benefit from a reduced competition with, or predation of, more vulnerable species. The small sized fish, opportunistic worms and resistant invertebrates thus take over the niche of the more vulnerable species.

Norway: The seabirds can benefit directly from by-catch and offal thrown overboard, however, in an international North Sea study reported by Camphuysen *et al.* (NIOZ-rapport 1995-5), the three largest gulls were the only species of which the overall distribution was positively influenced by the presence of fishing vessels. The effects of offal from fish processing activities in harbours were not studied, but is probably an important food supply for gulls and common eiders, but not for the more pelagic species fulmar and kittiwake.

Indirect benefits are more difficult to assess. One important issue is at which level in the food chain the fisheries are directed. Fisheries based on fish that prey on small pelagic schooling fishes (gadoids, mackerel, etc.) may serve to increase the availability of prey for seabirds that depend on these important food supplies. In the North Sea, the most important fish prey for seabirds are sandeels, sprat and herring, particularly the 2-3 youngest age classes (0-2 group), but also gobies and young gadoids are important food items for some species.

In most cases the competition for the same food will have negative (or, at the best, insignificant) effects for both actors. It should, however, be mentioned that the behavioural interactions between predatory fish, fish prey and seabirds is poorly known. Thus, it is impossible to rule out that situations where a positive feedback mechanism

may be active, e.g. if a predatory fish, although competing for the same prey, induce certain anti-predator responses in the prey that would increase their availability for seabirds.

Of course, arguments as those given above implies that the structure of the North Sea seabird community to a certain extent is dependant on fisheries policy. One example is the large increase in fulmars over the past few decades, which by large is a direct result of the increased amounts of discards in these waters. If, however, more countries decide to ban the discard of by-catch and offal at sea, this could bring about major changes in the composition of e.g. seabird colonies where fulmars occupy the same breeding habitat as common guillemots. Similarly, decreased breeding success and population numbers of large gulls could, for instance, reduce gull's predation on other seabirds. Thus when some benefit, others are likely to be adversely affected, and vice versa.

The European Commission: ICES to respond.

ICES: Species benefit from fisheries because they are scavengers on dead discards returned to the sea. Other organisms scavenge on dead, damaged or exposed benthic animals in the trawl path and escape relatively undamaged through the meshes of the gear (starfish). [Note: Few seabirds are killed by fisheries in the North Sea.]

Other species may benefit from reduced competition with, or predation by, more vulnerable species, or because their scavengers are removed by fisheries. However, we are aware of no conclusive data on these possibilities.

Fulmars, Kittiwakes and to a small extent Herring Gulls and Lesser Black-backed Gulls benefit directly from the provision of fish offal from fishing vessels at sea. Gannets, Great Black-backed Gulls, Herring Gulls, Lesser Black-backed Gulls, Great Skuas and to a small extent Kittiwakes, Common Guls and Fulmars benefit directly from the provision of discards from fishing vessels, especially from whitefish fisheries and Nephrops and shrimp fisheries. The largest scavenging species gain the most discards and are best able to swallow these; smaller species obtain relatively less and may be outcompeted by the larger birds.

BirdLife International:
1) Beneficiaries of fishery waste
If we interpret "benefit" as simply meaning that the survival chances of species listed in 18a/1 are improved and that their numbers are sustained or even increased, then birds that scavenge behind fishing vessels fit in this category. It is not necessarily of "benefit", however, at the level of the ecosystem that these species have prospered in this way because they may have done so at the expense of other (less competitive species), i.e. at the community or ecosystem level this is not necessarily a desirable trend.

Increases in the provision of fishing waste is thought to have contributed to significant population increases in the following "key beneficiaries" (the most dominant competitors for waste: see above) in the northern North Sea this century, and especially since 1970 (Tasker *et al.* 1987, Furness 1992):

Fulmar *Fulmarus glacialis*
Gannet *Morus bassanus*
Great skua *Catharacta skua*
Great black-backed gull *Larus marinus*

See also Q20, below, for more details (suggestion that the whole scavenging guild of seabirds should be the subject of detailed case review).

2) Beneficiaries of enhancement of prey stocks
The seabird species listed above (18a/2) may have benefited this century from overfishing of large predatory fish, thus reducing the pressure on their prey and allowing the latter to increase (to the advantage of the seabirds that also exploit these same prey). Thus prey fish such as sandeels and sprats may well have increased in numbers as a result of the relaxation of predation by large whitefish, and by herring and mackerel (Andersen and Ursin 1978, Sherman *et al.* 1981). This process is, with hindsight, impossible to quantify and, for several seabird species, difficult to disentangle from the parallel increase in alternative food supplies (discards and offal). A further complication is the growth since the 1950s of industrial fisheries targeting these small prey fish, which could threaten to reverse the advantage to seabirds, at least where fishing effort is intense in the vicinity of breeding colonies (see answer to Question19b/4).

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Sherman, K., Jones, C., Sullivan, L., Smith, W., Berrieu, P. & Ejsymont, L. (1981) Congruent shifts in sandeel abundance in western and eastern North Atlantic ecosystems. Nature 291, 486-9.

Tasker, M. L., Webb, A., Hall, A. J., Pienkowski, M. W. & Langslow, D. R. (1987) Seabirds in the North Sea. NCC, Peterborough.

19.a. Which non-target species are negatively affected, directly or indirectly, by fishing activities? (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

Germany: The following list of species (except seabirds) is a selection out of the 1995 "German Red List of Threatened Biotopes and Species of the German Part of the Wadden Sea Area and the North Sea". All those species are listed below which are "extinct/disappeared" or "endangered" to a certain degree in this area and for which fishing activities are identified as or assumed to be a casual threat factor.

NOTE: Also listed are target species which are "endangered" or even "extinct" due to fishing activities. From the ecological point of view there is no difference between target and non-target species. Furthermore, the substantial decline in stock size of a certain species is an alarming signal concerning the ecosystem health even though the species is still within "Safe Biological Limits".

Benthic Invertebrates (mainly long-lived species):
Anthozoa:

Alcyonium digitatum
Metridium senile
Sagartiogeton undatus

Prosobranchia:

Aporrhais pespelecani

Bivalvia:

Acanthocordia echinata
Arctica islandica
Modolus modiolus
Ostrea edulis
Parvicardium ovale
Spisula elliptica
Sabellaria spuinulosa

Crustacea:

Homarus gammarus

Echinodermata:

Astropecten irregularis
Solaster papposus
Echinus esculentus
Psammechinus miliaris

Fish species:

Lampetra fluviatilis
Petromyzon marinus
Lamna nasus
Raja brachyura
Raja clavata
Raja montagui
Acipenser sturio
Coregonus lavaretus
Eutrigla gurnardus
Salmo salar
Salmo trutta trutta
Zeus faber
Gadus morhua - currently overexploited
Scomber scombrus - currently overexploited

Seabirds (breeding and/or resting/wintering in the German part of the North Sea):

Common Eider	*Somateria mollissima*
Common Scoter	*Melanitta nigra*
Oystercatcher	*Haematopus ostralegus*

Marine mammals:

Common Seal	*Phoca vitulina*
Grey Seal	*Halichoreus grypus*
Harbour Porpoise	*Phocoena phocoena*
Bottlenose Dolphin	*Tursiops truncatus*

White-beaked Dolphin	*Lagenorhynchus albirostris*
White-sided Dolphin	*Lagenorhynchus acutus*
Common Dolphin	*Delphinus delphis*

The Netherlands: Shellfish fishery: disappearance of old musselbeds, means impact on several birdspecies, especially those not eating mussels, and on species that live on/in the beds self; cockle-fishery means a decrease in food-availability for birds e.g. Eider, Oystercatcher; spisula-fishery in shallow water means a decrease in food-availability for e.g. Common Scooter.

Bivalves living in at or in the upper 10 cm of the seabed (oyster (*Ostrea edulis*), horse mussel (*Modiolus modiolus*), *Dosinia lupidus* and *D. exoleata*, quahog (*Arctica islandica*), *Acanthocardium*, *Thracia* and gastropods (whelk *Buccinum undatum*, *Neptunea antiqua*).
- crabs, lobsters living at the seabed (edible crab *Cancer pagurus*, lobster *Homarus gammarus*) or in the upper layer of the seabed (helmet crab *Corystes cassivelaunus*)
- epifauna: sponges e.g. *Halichondria panica*, anemones e.g. *Alcyonium digitatum*, hydrozoa
- rays e.g. *Raja batis*, stingray *Dasyatis pastinaca*, roker *Raja clavata*
- sharks e.g. dogfish *Scyliothinus canicula*, smooth hound *Mustulus mustulus*
Sepia officinalis
- tube dwelling worms e.g. *Pectinaria korenii*, living at the surface of the seabed.

Norway:
- Sea birds: Many species may be negatively effected, cf 19b.
- Marine mammals: The common seal and harbour porpoise
- Benthic organisms:

[1] Anker-Nilssen T. & S.-H. Lorentsen 1995. Seabird-95; Lorentsen, S.-H. & T. Anker-Nilssen in prep
*Anker-Nilssen, T. 1992. Food supply as a determination of reproduction and population development in Norwegian Puffin (*Fratercula arctica*) Dr. scient oppgave Universitetet i Trondheim.
***Blake , B.F. 1984. Diet and fishstock availability as possible factors in the massdeath of auks in the North Sea. Journal of Experimental Marine Biology and Ecology 76:89-103.

Sweden: Marine mammals (harbour porpoise, harbour seals and grey seals) and sea birds (mainly guillemots) and skates and rays are negatively affected by fishing activities. (Berggren 1995, Olden *et al.* 1988, Johansson 1994).

The European Commission: ICES to respond.

Common Wadden Sea Secretariat: Associated benthic community of natural mussel beds and cockle beds; Zostera fields; Eiderduck, Oystercatcher.

ICES: [Note: The term "negative" is taken to mean a decrease in the size of a population.] For many non-target species there is little published information on actual trends in their abundance, although some species like oysters, lobsters, greater weever, rays, and sharks have completely disappeared from certain areas of the North Sea. However, even if decreasing trends have been established it remains uncertain whether there is a direct or indirect relationship with fisheries. Also other influences (e.g., climatic changes, pollution, eutrophication) may affect the abundance. On the other

The Netherlands:
- because they are vulnerable and easily damaged or killed in the trawl path due to contact with the tickler chains of the beamtrawl (invertebrate infauna such as quahog, *Dosinia, Thracia* and epifauna) or even due to contact with the groundrope of a ottertrawl (invertebrate infauna such as oyster, horse mussel whelk, lobster, Hydroids, anemones, sponges);

- because they are caught in the trawls and killed in the mass of the catch or during handling on board (all non-target and target fish species);

- because their eggs attached to the seabed are vulnerable for trawling (rays, sharks, Sepia, whelks);

- because reproduction cycles are too slow, both at a late stage in life cycle and with low capacity (rays, sharks) to resist adequately the pressure of fisheries. (BEON report 1994-13).

Norway:
Sea birds:
Directly :
- Mortality due to by-catches in fishing gear

Indirectly :
Reduced fish stocks may reduce breeding productivity or adult mortality
- by overexploitation of fish stocks
- by habitat changes (as by sea weed fisheries)

Changes in the structure of the North Sea bird community
- Increased predation from species which has increased in numbers due to increased food resources from discards

- Competition for nesting space

	Ful	Gan	Cor	Shag	Eid	Skua	CG	LBB	HG	GBB	Kit	Tern	Gui	Raz	Puf	BG	Oth
Discards offshore			x	x					x		x	x	x	x			
Discards on shore						x		x	x	x	x	x					
Reduced comp. for food																	
Increased mortality	x		x	x	x								x	x		x	
Reduced fish stocks			x	x									x	x	x	x	
Increased predation							x					x					
Compet. for nest space	x																

Marine mammals: Entrapped and killed in fishing gear.

Benthic organisms: Towed fishing gears such as Bottom trawls, otterboards and beam trawls may destroy some of the benthic fauna.

Sweden: Harbour porpoises - 2,9% of the population in Skagerrak was estimated to drown in benthic gillnets in the Swedish cod and pollock fishery. By-catches are also recorded in other fisheries in the area, e.g. gillnets from fishery for spiny dogfish in the Skagerrak (Berggren 1994). This is above the recommended maximum removal rate of 2% (Berggren 1995).

Guillemots - 25.000 individuals drowned in gillnets from the cod fishery in S.E. Kattegat from 1982-88. Population from Helgoland could be negatively affected. (Olden *et al.* 1988).
Rays (*Raja* spp.) are caught in by-catches from demersal trawling in Kattegat and Skagerrak and have disappeared from the area (Johansson 1994, Swedish Fishery Board 1955).

The European Commission: ICES to respond.

Common Wadden Sea Secretariat: The associated benthic community is destructed by the fishing gear; Recovery of Zostera is possibly hampered by cockle fisheries.
In years with poor stocks, the food availability of some birds species (eider, oystercatcher) is endangered.

ICES: For all species the overall basis for any negative effect is that population growth rates are insufficient to compensate for the increased mortality that fishing imposes. For some species, part of this effect is due to the destruction of suitable habitats. In addition, there may in some cases be indirect effects caused by changes in abundance and availability of food.

Species most likely to be affected

- Oyster. Oysters were common in many parts of the North Sea until about the 1870s, at which time there was an active fishery for the species. Many factors may have influenced their decline, including hydrographic changes, disease and overfishing. Given that their numbers are now so low that fishing is uneconomic, they are no longer a target species and their numbers probably remain low through the action of mobile gears. The destruction of suitable habitats through the removal or burial of stones may also play a role.

- Lobster. Incidental mortality from mobile gear and habitat destruction (burial and removal of stones).

- Sessile erect epifauna. These taxa are vulnerable and easily damaged or killed in the trawl path due to contact with the hard parts of mobile gears. Sessile species are also found on the hard substratum and the removal and burial of stones and larger shells also reduces habitat availability.

- Common skate, stingray, thornback ray, smooth hound, spurdog. These species are caught as by-catch in mobile gear and are particularly vulnerable owing to their life-history characteristics. Also, eggs are detached from the seabed and are damaged by mobile gear.

- Harbour porpoise. Drowned in bottom set fixed nets.

- Common scoter, common eider. In the southern North Sea/Wadden Sea, harvesting of shellfish (mussels, cockles and *Spisula*) may have limited the amount of food available in the past decade.

Species probably affected

- Bivalves living at or in the upper 10 cm and *Neptunia antiqua*. These taxa are vulnerable and easily damaged or killed in the trawl path due to contact with the hard parts of mobile gears.

- Edible crab. Incidental mortality from mobile gear and habitat destruction (burial and removal of stones).

Species possibly affected

- Whelk. Eggs are detached from the sea bed and adults can be damaged by contact with the hard parts of mobile gear.

- Helmet crab. Incidental mortality from mobile gear and habitat destruction (burial and removal of stones).

- Cuttlefish. Eggs are detached from the seabed and are easily damaged by mobile gear.

- Arctic tern, guillemot, kittiwake. On a local scale breeding success or winter mortality of populations may be affected by fishing for their prey species. Overall, however, populations of these species have increased during the 20th century.

BirdLife International:

1) Potential victims of reduction in fish waste

Some scavengers whose numbers increased earlier this century, presumably with the expanding provision of fishery waste (see Q18a/1, above), have recently shown signs of numbers levelling off or reversing in certain areas, suggesting deteriorating feeding conditions (perhaps associated with declining fish stocks - and thus perhaps declining discards - and increased mesh size since 1987) and heightened competition for species less able to compete for waste with the dominants. Another predicted outcome of reduction in discarding is the consequent direct predatory impact on other seabirds from discard-deprived large scavenging or predatory seabirds (Furness 1992). Notable species among those already showing signs of declines (Furness 1992) (with downturn in discard provision perhaps a contributory factor), and whose numbers are likely to show even greater reduction if discarding is significantly reduced in the future, are listed in 19a/1

See also BirdLife International's suggestion for case review, Q20/4, for further details.

2) Main victims of entanglement

In terms of overall North Sea seabird population status, this impact probably has a small effect on auks and other diving seabirds, with locally more important impacts (see BirdLife International's suggestion for case review, Q20/2, for further details). For impact on cetaceans, see case review Q20/1.

3) Main victims of long-lining.

No hard information on the scale of this impact on seabird populations in the North Sea or north-east Atlantic in general. See BirdLife International's suggestion for case review, Q20/3, for details.

4) Potential victims of excessive industrial fishing effort

Recruitment overfishing of pelagic or pseudo-pelagic (sandeel) stocks represents the greatest threat of overfishing to seabirds. Thus, industrial fishing, especially for sandeels, may compete directly with seabirds for food, especially in the breeding season when seabirds are constrained to foraging within a given radius of the colony. The seabirds most at risk are species with one or a combination of the following characteristic: specialised diets, surface-feeding habits, specialised and inflexible feeding behaviour, limited foraging ranges, limited ability to increase foraging time,

energetically expensive food-searching methods, and low tolerance of temporal fluctuations in food availability (Furness and Ainley 1984).

Industrial fishing may affect the dynamics of the entire marine ecosystem, with implications for other fish predators (seals, cetaceans) as well as seabirds. In order to evaluate this, we need to look beyond the overall statistics for the North Sea and address the potential localised impacts of industrial fishing (see BirdLife International's suggestion for a case review, Q20/5).

5) Significant victims of beam-trawling
Skates and rays represent a significant by-catch of beam-trawl fisheries for other demersal species in the North Sea. There has been concern about the status of stocks of skates and rays in the North Sea following a steady decline in landings since the 1960s. The common skate *Raja batis* is now seldom caught in the central-southern North Sea and has not been caught in Dutch coastal waters since the mid 1950s. With the exception of a few individuals, no rays (thornbacks *Raja clavata* or stingrays *Dayatis pastinaca)* have been caught in the Wadden Sea since 1966. The level of exploitation that skates and rays can withstand is unknown and is species-specific (Walker 1995).

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20. Give examples of individual species or groups of species which are positively or negatively affected by fishing activities and that could be the subject for more comprehensive case reviews. (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Germany: Long-lived benthic invertebrates (e.g. *Arctica islandica*, *Echinocardium cordatum*), benthic communities in general:
Seabirds (e.g. Fulmar, Gannet, Gulls)
Marine mammals (e.g. Harbour Porpoise)

The Netherlands: See answers previous questions and answer question 23.

Norway: From Norwegian North Sea areas (Runde included), we have monitoring data on Fulmar, Gannet, Shag, Common Gull, Lesser Black-backed gull, Kittiwake, Common tern, Arctic tern, Guillemot, Puffin.

Positively: Fulmar, Gannet, gulls
Negatively: Cormorants, auks

Sweden: Harbour porpoise, seals, seabirds, skates and rays, and benthic organisms are negatively affected by Swedish fishing activities. In general, quantitative data on by-catches are lacking. More data are also needed on survival rates of discarded fish and shellfish.

The European Commission: [ICES to respond]

ICES: [Note: This list is restricted to non-target species.]

Groups Sharks and rays, maerl, seaduck, auks, non-seabird scavengers, erect sessile biota.

Species *Arctica islandica, Phocoena phocoena, Rissa tridactyla, Sterna paradisea, Sabellaria, Modiolus, Limanda limanda*

In the case of seabirds, Great Skua (half of the entire population of this species breeds in Orkney & Shetland) feeds predominantly on discards (haddock and whiting in particular) and on sandeels when seasonally available. Without doubt Great Skua has been positively affected by recent discarding practice but has been negatively affected by recent reduced sandeel abundance at Shetland. Breeding biology and diet have been studied in detail but the extent to which breeding success and population size depend on the provision of discards is unknown. Given the importance of this seabird population in terms of % of world population in the North Sea and possible effects of changes in fishery practice on its food supply this is a prime candidate for study. Furthermore, changes in food supply for this species could lead to indirect effects on many other seabird populations since the Great Skua could switch to predatory feeding on Puffins, Kittiwakes, Eiders, storm petrels, lambs.

In the southern North Sea, the Lesser Black-backed Gull seems to be the species most likely to be affected by any major change in discarding and so would rank second after the Great Skua as a seabird species requiring evaluation of effects of changes in fisheries on its population dynamics.

BirdLife International: Possible case reviews, with some background details:
1) Entanglement of harbour porpoises (*Phocoena phocoena*) in nets
Research in a number of areas including the Celtic Shelf and the North Sea has revealed the damaging impact of bottom-set gill-nets on this species (Simmonds 1994). These findings have been endorsed by ASCOBANS, ICES, and the IWC.

Clausen and Andersen (1988) estimated that up to 3000 harbour porpoises died annually in Danish nets set in the Skagerrak and North Sea and perhaps several thousand more in other fisheries. Vinther (1994) estimated the by-catch for all Danish gill-nets set in the North Sea at 7000 harbour porpoises annually. The population in the North Sea as a whole is estimated to have fallen in recent years by 53,000-89,000 individuals (Reijnders 1992), though not all of this decline is attributed to incidental by-catch. Because of their low reproduction rate, harbour porpoises are not thought capable of withstanding sustained incidental mortality: one model suggests that a loss of even 4% per year is unsustainable (Woodley and Read 1991). Recent work by the Small Cetaceans sub-committee of the IWC also indicates that current incidental by-catch in the central North Sea and Celtic Shelf is not sustainable. In addition, population structure changes have been noted: a sample of harbour porpoises caught incidentally by fishermen in Danish waters revealed that large (and therefore probably older) animals are now rare and that

females were probably first becoming pregnant at an earlier age (Clausen and Andersen 1988).

Moreover, on the margins of the official "North Sea" area, other kinds of fisheries also impact on cetaceans. Extensive strandings of dead dolphins (mainly common dolphins *Delphinus delphis*) have occurred in recent years on the French Atlantic and Cornish coasts, showing physical evidence of by-catch mortality (Charreire 1992, Kuiken *et al.* 1994). In the 1992 Cornish incident, the investigators suggested that a trawl or purse seine fishery was probably involved and they noted the potential significance of pair-trawling where two powerful boats tow between them a large net at high speed. The Sea Mammal Research Unit (SMRU) considers this the most serious current threat to dolphins in the north-east Atlantic (P. S. Hammond, pers. comm.).

The UK, as signatory to ASCOBANS, is obliged to evaluate and reduce this by-catch in its own waters. Guidelines currently being developed strongly recommend that independent observers be used in any such assessments (Berrow *et al.* 1994, S. Northridge in press). A recent development which adds impetus to this need is the proposed lifting of the ban on the use of large mesh monofilament gillnets in Scottish waters. This development raises special concerns given the current absence of any proposed UK Special Areas of Conservation (pSACs) for the harbour porpoise under the EU Habitats Directive.

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2) Entanglement of seabirds in gill-nets

Gill-netting can take an incidental by-catch of diving seabirds when nets are set near wintering concentrations or breeding colonies. There is an extensive literature on this problem, showing localised impacts in different parts of the North Sea (for references, see Dunn 1994, ICES 1995). Gill-netting is common in certain parts of the North Sea but not in others. There is, for example, only limited gill-netting off the Netherlands, Germany, and the North Sea coast of Denmark. A heavy by-catch of guillemots *Uria aalge* (in 150-mm mesh bottom-set cod nets) in the south-east Kattegat in the 1980s (Peterz and Oldén 1987, Oldén *et al.* 1986) has receded with the disappearance of cod from the area and the comprehensive switch to herring-fishing (Paul Eric Joensson, pers. comm.).

However, there is no up-to-date assessment for apparent problem areas, such as Oslofjord (NOF) where there is reportedly a wintering by-catch of guillemots. Likewise, the by-catch on the French side of the English Channel needs assessing. Vincent (1990) estimated that several thousand wintering auks are taken annually in the Baie de Seine and along the Pays de Caux coast.

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3) Long-lining impacts on seabirds

As shelf fisheries get progressively depleted, longlining on the shelf edge is a growth sector in fisheries (Dunn 1994). By definition, therefore, this is not an important fishing technique in the North Sea but it is of relevance to the north-western edge of the North Sea region. Significantly, therefore, BirdLife International has received reports of by-catch of seabirds (gannets *Morus bassanus* and fulmars *Fulmarus glacialis*) in the longline fishery for demersal fish (such as blue ling *Molva dypterygia*) on the shelf edge west of Shetland. We have no information on the scale of the impact or its effects on seabird populations in this region, or indeed any other region in the north-east Atlantic. However, it is known that, under certain conditions in spring, seabirds take 50-70% of the bait from lines on fishing grounds deployed off Troms and Finnmark. Apart from unwanted seabird mortality, this interaction incurs losses for the fishermen, both in terms of bait loss and the knock-on effect of reduced catches (Anon 1995). Experimental research in this fishery has shown reduced bait loss and by-catch of fulmars by

accompanying the longline with a "streamer line" to which the birds show an avoidance reaction (Løkkeborg and Bjordal 1992).

There is an extensive body of literature on the efficacy of this and other mitigating measures (both technical and in terms of fishing practice, e.g. time of day when longline is shot, timing of discarding in relation to deploying and hauling line) in longline fisheries elsewhere in the world (Dunn 1995). Beyond this suite of measures, the Norwegian manufacturer "Solstrand" has developed a new device - a tube that shoots the line from underwater - that could, if universally adopted, potentially eliminate bait-snatching and thus safeguard seabirds completely from this impact (Anon 1995).

Research needs:
- assessment of impact of longline fisheries in the north-west North Sea;
- assessment of various mitigating measures (technical and other practices accompanying deployment of longline).

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4) <u>Seabirds dependent on discards</u>

The discharge of fishery waste in the North Sea is estimated to support between 2.5 and 3.5 million seabirds (Camphuysen *et al.* 1995). Waste consumption rates are especially high in winter, and in the northern and western sectors of the North Sea. Discards and offal are therefore most valuable to seabirds when they are generally harder-pressed to find natural food, e.g. in areas with particularly high bird densities or in adverse weather. Waste fish could become less available through one or a combination of the following: reduced fishing effort, more selective gear, retention of waste on board. Any such downturn would heighten competition, to the disadvantage of the smaller species, especially in winter. The community may thus change to one dominated by the most successful scavengers (fulmar, gannet, great black-backed gull *Larus marinus*), with the most significant victim likely to be great skua *Catharacta skua* (Furness 1992, Camphuysen *et al.* 1995). This species occurs in internationally important numbers in northern Scotland (60% of world population) and probably requires discards for successful breeding (R. W. Furness, pers. comm.).

The likely outcome of reducing fishing effort and increasing mesh size have been modelled for the northern North Sea (Furness 1992) but this cannot be extrapolated to the North Sea as a whole because conditions in the northern and southern North Sea are so different (Kees Camphuysen, pers. comm., on which the following information is based). In the southern North Sea there are many more discards than birds can use,

community in the southern North Sea (e.g. BEON 1992, de Groot and Lindeboom 1994). In addition, benthic animals damaged, displaced or discarded by beam trawls contributes significantly to the diet of scavenging seabirds (see Q20/4, above). In areas which have been continually trawled for decades, some of the rarer and long-lived benthic species may have already have disappeared at the expense of relatively resistant species becoming community dominants. The direct effects, however, are still inconclusive and a better assessment can only be achieved by studying relatively large areas closed to fishing for several years. The requirement for closed areas arises because of the failure to detect any untrawled areas which could serve as potential control reference areas.

The general recommendations of the Dutch-led study are:

- create areas closed to fishing as soon as possible. Until such time, continue study in quasi-closed areas, e.g. around wrecks;
- compare, between closed area and an actively fished area, the development of the benthic system (sediment characteristics, meiofauna, macrofauna and fish) for at least 10-20 years;
- compare long-term trends in contrasting areas in the North and Irish Seas to distinguish between natural and anthropogenic changes in the marine ecosystem;
- initiate research to reduce the unnecessary destruction of potentially valuable undersized fish;
- study the impact of heavy discard mortality on the populations of discarded species and on dependent predators, and the likely impact of any reduction in discarding (see Q19b/1, above);
- study the survival of organisms that pass through the meshes of commercial beam-trawl nets.

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21.a. List those species for which the target fish species constitute a major food source. (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Denmark: Bivalves (mussels, cockles and species of *Spisula* and *Venus* and others) constitute major food sources for most diving ducks and some gulls and large waders. Grebes, mergansers, auks, skuas and terns prey entirely on smaller fish such as herring, sprat and sandeels and juveniles of larger fish species such as Gadoids, mackerel and others and on pelagic crustaceans. Cormorants and gannets also prey entirely on fish, of which they can take somewhat larger ones. Seals and toothed whales prey almost entirely on fish, including larger ones, but also to some extent on pelagic crustaceans and squids, whereas baleen whales prey on pelagic crustaceans and smaller fish such as herring, sprat and sandeels.

Germany: Seabirds (breeding or resting/wintering in the German part of the North Sea):

Common Eider	*Somateria mollissima*
Common Scoter	*Melanitta nigra*
Oystercatcher	*Haematopus ostralegus*
Razorbill	*Alca torda*
Guillemot	*Uria aalge*

Marine mammals:
All seals and all small cetaceans.

The Netherlands: As far as we know, all cetaceans and seabirds, including oystercatcher, Common Scooter, eider, starfish, knot (*Caladris canatus*).

Norway:
- Sea birds: Puffin, Common guillemot (and other auks), Cormorants
- Marine mammals: Killer whales: herring is the major food source
Common seals: herring is the major food source
Harbour porpoise: herring is a major food source

	Ful	Gan	Cor	Shag	Eid	Skua	CG	LBB	HG	GBB	Kit	Tern	Gui	Raz	Puf	BG	Oth
Herring, sprat, sandeel		x						x	x	x	x	x	x	x	x		
Gadoids, flatfish			x	x													

Sweden: Herring, whiting and flatfishes are a major food source for cod in area IIIa. Herring, sprat and sandeel are major prey species for mackerel and salmon. Herring and sprat are staple food for harbour porpoises (Börjesson & Berggren 1995, Berggren 1995).

The European Commission: [ICES to respond]

Common Wadden Sea Secretariat: Eider duck; Oystercatcher.

ICES: The response to this question (21) refers only to topics related to seabirds. Further information may be provided later.

Sandeels are a major food for most seabirds in the North Sea during the breeding season, especially Common Guillemot, Red throated Diver, Shag, Kittiwake, Arctic Tern, Arctic Skua, Razorbill, Puffin, Great Skua.

Discards are a major food for Great Skua, Great Black-backed Gull, Lesser Black-backed Gull, Gannets at certain seasons, and Herring Gulls in certain areas.

Offal is a major food for Fulmars and Kittiwakes (in winter).

BirdLife International: The following listing applies to capture of live commercially important fish and does not take account of the variety of fish taken as discards or offal. Thus Herring Gull *Larus argentatus* and Great black-backed gull *L. marinus* eat significant amounts of fish, but only as discards/offal, so are not included here. Moreover, seabirds are opportunists and any one species may consume a great variety of fish species, as available; only the most important dietary interactions in the North Sea are therefore listed.

For threat from shellfish fisheries to seaduck in the south-eastern North Sea, see ICES (1994a, b).

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21.c. What are your priorities for actions and studies with regard to the issue outlined in question 21.a. and 21.b.?

Belgium: ICES to respond

Denmark: Surveys of bivalve populations are being carried out on a yearly basis to ensure sustainability for fishermen as well as for birds.

France: Improve the selectivity of fishing gear in order to reduce by-catch and discards.

Germany:

- monitoring and assessment of by-catch of small cetaceans, seabirds and non-target fish species;
- development of measures to reduce by-catch and discard;
- monitoring and assessment of the effects of demersal fisheries on benthic communities;
- establishment of marine protected areas, e.g. with the purpose to protect harbour porpoise or to conserve benthic communities of ecological importance and/or rareness;
- elaboration of multispecies assessments that also include non-target species and other environmental aspects like the protection of habitats.

The Netherlands: To evaluate the effectiveness of the management measures taken in coastal fisheries, e.g. effects on benthos and seabeds, and effects on foodavailability for birds in coastal areas.

Norway: Ecosystem models are important tools to help reduce the impacts on marine mammals and sea birds, development of such models have some priority. To develop ecosystem models it is an assumption that consideration for seabirds and marine mammals is implemented in international fishery, the following subjects are important:

Sea birds:
- Establish network of key areas for monitoring of prime population parameters as breeding numbers, adult survival, reproduction and food supply of seabirds breeding in the Norwegian North Sea area, and studies on their relationship to pray stocks.

- Actions to reduce deaths of seabirds in fishing equipment:
    -avoid gill nets in areas where (or periods when) conflicts are unavoidable
    -avoid equipment that is known to catch birds in high risk areas

(Follestad & Strann 1991, see also Dunn, E. 1994. Interactions between fisheries and marine birds: Research Recommendations RSPB 31/307/94 44 for detailed recommendations for studies and action)

Marine mammals:
- Monitoring trend in population size of the Common seal. Monitoring trends in the population size and the distribution of the killer whale.

Sweden: Sweden needs to undertake studies of the diet of marine mammals, seabirds and fish species in the Kattegat and Skagerrak.

The United Kingdom: These priorities have already been identified in the Commission Working Paper "Report on the Meeting on the Data Base for Evaluation of Biological Impact of Fisheries" SEC(94) 1453.

The European Commission: [ICES and Member States to respond]

The European Commission has recently made the following request to ICES: to constitute a group of scientists of appropriate background to define the program of work and associated budget required to evaluate the biological impact of fisheries within Community waters and, where required, adjacent waters, on all relevant animal biota and to prioritise the various elements of this program from the scientific viewpoint.

In the Swedish Action Plan on the Environmental Problems of the Fishery Sector, there are a number of measures intended to reduce negative ecological impacts of different types of fishing including development of more selective fishing gears and means to reduce by-catches of fish and other biota.

Common Wadden Sea Secretariat: None

ICES: a) Study of Great Skua population dependence on discards to assess impacts of changes in discarding practice on seabird communities where great skuas are potential top predators.

b) Study of local utilisation of inshore sandeel grounds by seabirds to determine whether establishment of closed areas to industrial fishing could prevent fishery-seabird conservation conflicts.

BirdLife International: For BirdLife International's suggested priorities for sandeel-seabird interactions, see response (Case Review No. 5) to Q20.

BirdLife International endorses the view (ICES 1994b) that a lack of dedicated studies on the interaction between seabirds, sprats and the sprat fishery makes it difficult to consider more fully the question of whether the sprat fishery could have indirectly affected seabird survival in the 1980s.

For seaduck-shellfish interactions see ICES (1994a, b).

22. What is being done to elucidate the interactions between seabirds or other species and individual fisheries and what evidence for interaction exist? (ICES will provide information on this question in addition to information from EC and North Sea states.)

Denmark: Areas in the North Sea where seabirds and fishery are likely to compete for the same fish resource has been mapped (Final report to EC DG.XIV PEC 92/35301). A EC case study starting in 1997, will investigate interactions between seabirds, marine mammals and fishery in the Firth of Forth area.

The Netherlands: Research on seagrass, musselbeds, foodreservation by fishery for birds etc.

Norway:
- Seabirds feed on discarded fish and offal (see 18b).

- Two reports from NINA (Follestad, A & K.-B. Strann 1991 & Follestad, A. & O.J. Runde 1995) discuss the problem on a national level, primarily based on reports on cases of mass deaths of seabirds in passive gears (nets, traps and lines). They prove that interactions exists between seabirds and fishing gears, but no information on the effects on the population level of seabirds in the North Sea area exists.

- A long-term study on the breeding success of Puffin at Røst (in the Lofoten archipelago) shows how they depend on 0-group Herring of the Norwegian spring-spawning stock.

- Information was collected on by-catch levels of harbour porpoise in coastal fisheries (in 1988-1990).

Sweden: Little research is being carried out in Sweden. Stockholm University is conducting research on by-catches of harbour porpoise in gillnets from the cod fishery (Per Berggren, Dept. of Zoology). Previous research on by-catches of seabirds (Olden *et al.* 1998) needs to be updated and extended to other areas.

The European Commission: [ICES also to respond - particularly about evidence for interaction]

The European Commission [Jan 1996] has requested ICES to constitute a group of scientists to provide a programme of work required to evaluate the biological impact of fisheries in all Community waters and, where required adjacent waters and also to provide an associated budget. (See response to Question 22.c.)

In addition, the European Commission has, in recent years, supported a number of scientific projects relating to biological impact of fisheries.

Areas in the North Sea where seabirds and fisheries are likely to compete for the same fish resource(s) have been mapped (Final report to EC DGXIV PEM92/3501). An EC case study starting in 1997 will investigate interactions between seabirds, marine mammals and fisheries in the vicinity of the Firth of Forth.

ICES: A detailed EU-funded study of the consumption of discards by scavenging seabirds in the North Sea in each season has been completed (Camphuysen *et al.* 1995 NIOZ Rapport; Garthe *et al.* 1996 Mar. Ecol. Prog. Ser.). Most discarded roundfish and most offal was found to be consumed by seabirds and numbers obtaining their energy needs in this way are in the 100,000s. An evaluation of the evidence for competition between seabirds and the industrial fishery for sandeels and estimated sandeel consumption by seabirds for input into MSVPA has been carried out. The evidence suggests the possibility for local negative effects of the sandeel fishery on seabirds but a general pattern for the two to be spatially separated so not interacting extensively at present. Correlation's between sandeel harvests from inshore banks off the Firth of Forth and local winter mortalities of Common Guillemots and Shags suggest an interaction that requires further investigation. The extent to which scavenging seabirds now depend on discards is uncertain and requires investigation.

BirdLife International: Evidence for interaction is given in answers to Q 20, 21. BirdLife International defers to ICES for a comprehensive review of work currently under way.

One of the essential tasks for the IMM will be to make progress on the ministerial commitment at Esbjerg on the designated research needs to establish the sustainability of industrial fisheries and their dependent predators. The proposed ELIFONS ("Effects of Large scale Industrial Fisheries on Non-target Species") project planned for the Firth of Forth sandeel fishery will help but the project is not developing with the urgency required by the Esbjerg Declaration, and does not address the sustainability of the fishery itself.

It is important that the necessary research is done on a sufficient scale (of resources) to yield answers, the more so because, the climate for designated long-term research is deteriorating, at least in the UK.

23. Indicate the different types of fishing methods used within the different fishing activities and their possible impact on species and habitats. (ICES will provide information on this question, in addition to information from EC and North Sea states.)

Belgium:	Beam trawl	no data available
	Otter trawl	no data available
	Shrimp fishery (Beam trawl)	no data available

5. Control and Enforcement

Questions 28-29: All North Sea states and the European Commission

28.a. Describe how fishing activity is being controlled with regard to monitoring and recording of quantities of fish landed.

Belgium: As the European Commission describes, the basis for the monitoring of landed fish are the logbooks and landing declarations. In Belgium an additional control exist in a cross check of the data obtained from the auctions (sales notes).

Denmark: Recording of catches and landings are done using two independent sources of information. Masters of fishing vessels are obliged to keep a logbook, in which catches must be recorded. In principle, there are no exceptions to this rule, however, for vessels below 10 m length over all, that are not used in a licensed fishery, the master can complete a declaration of catch water, stating this water is the only one he is fishing in.

The second source of information concerns a separate landing declaration, that must be completed at the landing, stating the exact quantities landed of each species. Foreign fishermen are also obliged to complete a landing declaration at landings in Danish ports. When landing in a Danish port, the master can replace the quantities in the landing declaration by information on the receiver or buyer of the landing. Receivers or buyers of fish are obliged to transmit information on the quantities of fish received or bought, specified by species, presentation and quality to the responsible authorities (The Directorate for Fisheries). Buyers must also give information on prices. This information must be given regardless of the nationality of the vessel landing in a Danish port.

The above information is verified in three steps. The first step is inspections at sea where physical checks are made by inspectors boarding fishing vessels assuring at the same time that the logbook reflects the results of these checks. This is followed by random checks at the landings by inspection teams operating in the ports, where physical checks are carried out as well.

The second step is cross-checks of the databases of logbooks and sales notes etc. landing by landing. This is done in the Directorate for Fisheries in a semicomputerized way.

The third and final step is the verification of quantities of landed fish. This is done by random checks of companies, where input and output are compared with what has been reported to the Directorate for Fisheries for selected periods. In this analysis, the accounts of companies are examined as well.

The Directorate for Fisheries operates 5 inspection vessels manned with 102 persons. The three largest vessels are operated by three crews each, meaning that they are on 24 hour service. In 1994, the inspection vessels sailed 94.000 nautic miles for inspection purposes. 625 vessels were boarded. From 6 local inspectorates 62 persons were engaged in the inspections of landings in the ports, 3700 landings were inspected.

In Denmark, non compliance with management measures will result in a fine of 1/3 of the value of the illegal fish landed, if the master owns the vessel. If this is not the case,

the fine will be 1/4 of the value of the illegal fish. The value of the illegal fish landed will be seized. If fish is misreported without otherwise being illegal a fine of 1/10 of the value of the misreported fish is applied. Receivers or buyers which are misreporting will be punished with a fine also 1/10 of the value of the fish misreported, if it is not illegally caught. If this is the case, the fine will be calculated as 1/2 of the value of the illegal fish, furthermore 1/10 of the value of the illegal fish will be seized.

France: The basis for the monitoring of landed fish are the logbooks and landing declarations (See the EU answer).

Germany: With regard to Germany, reference should be made to the response by the European Commission.

The Netherlands:

Purpose of the control and type of fisheries	Frequency of the control 1) 2)	Is the control conducted at sea or on shore	Measures, if existing rules are not complied with
Stock-management (mussels, cockles)	High	Both	Black boxes, quota's, limited time, closed areas
Survival by-catch , (shrimp)	High	Both	Type of sorting machine, mesh-width, limited power, max. beamlength

1) Fill in zero if no control is conducted.
2) Indicate by number of cruises, inspectors, inspections, black boxes, inspections at landings or at sea etc.

The Dutch implementation of the EU and national enforcement regulations is controlled by the General Inspection Service of the ministry of Agriculture, Nature Management and Fisheries. The controls of the service cover the full range of activities: from the fishing at sea until the selling of the fish and the distribution channels.

The inspection verifies the logbooks of the fishermen. The data on the logbook are registered in a database of the ministry in which the licenses and fishing rights are registered. This information also shows the amount and the origin of the catches. It is the basis of the monitoring of the national quota.

About 63 persons are employed in the enforcement of fishery-regulations. Five are full time employed for data entry activities. Some surveying activities are executed by private companies under responsibility of the governmental inspection service. The average number of controls at sea is aimed at 1.8 per vessel per year. Needless to say that average means a higher percentage of controls for vessels which are regarded as potential risk groups. Every vessel is obliged to ask for permission of the inspection service before landing the fish. Per Year about 28.000 landings take place. In average some 14% of these landings are subject to physical control. Other controls are carried out in transport and administration on the quantities of fish.

About 96% of the Dutch fishermen are member of a fishing group in which the ITQ's are pooled for group management. The members of these groups voluntarily agreed to a set management rules to obtain two objectives: a better compliance with fishing regulations and a more flexible and economic optimal use of the ITQ's. Auction duty for group members is one of these management rules. The governmental inspection service assists the boards of the groups in the control of this private agreement that is supplementary to the EU and National regulations.

Denmark: The measures above secure an overall satisfactory knowledge of the activities in the fishing sector.

France: Yes

Germany: The control activities mentioned under 28.a are deemed sufficient.

The Netherlands: Yes

Norway: *Reasonable good, but room for improvements.*

The European Commission: The reports of ICES Working Groups concerning various stocks show important discrepancies between official catch/landing figures and the estimates of the scientists. For the North Sea, the ICES documents indicate serious underreporting for some species. It therefore appears that the control of landings is not as effective as might be wished.

Overall, however, Member States appear to be reasonably satisfied with the effectiveness of their control activities.

28.c. What improvements do you suggest?

Belgium: A better exchange of data of landings, sales notes etc. would lead to improved landing statistics.

Denmark: Improvements can be obtained by an enhanced co-operation between third countries and EU member states, facilitating exchange of data on fisheries and landings in the respective states.

The Netherlands: Better compliance with regulations aiming at conservation of the stocks cannot only be reached by enforcement but should be enhanced by policies that give more responsibility to the fishermen in the way they want to use the quota. Policies should have elements of a carrot and a stick.

Norway: Further co-operation between control authorities in the North Sea states like exchange of information on inspections, exchange of information on landings, exchange of statistics, common standards on reporting etc.

Better national co-ordination of control conducted at sea and on shore.

In Norway, the use (and exhaustion) of quotas are registered when the fishermen sell their catch. Increased control by the processors to which fishermen sell their catch may reduce not-registered landings.

Sweden: Establishment of a system of independent observers on fishery vessels in order to quantify landings, discards and by-catches.

The European Commission: It has been suggested that fishermen themselves may be given greater responsibility in the manner in which they wish to use their quotas. In

addition, closer liaison between the EU and third countries to facilitate exchange of data on fisheries and landings should lead to improvement.

Pilot projects concerning satellite monitoring of fishing vessels have been initiated in accordance with Council Regulation (EEC) No 2847/93.

29.a. Describe the measures and monitoring mechanisms adopted in order to reduce by-catches.

Denmark: Reference is made to the response by The European Commission.

The Netherlands: See earlier answers on this issue.

Norway: (By-catch = catch of non-target species, both fish and non-fish species.)

By-catch of fish:

Instruments / measures used	Has the particular instrument been implemented				National importance			
	fully	partly	not at all	comment number	very important	important	not important	comment number
Monitoring procedures at sea	N				N			
Monitoring procedures on shore	N					N		
Economic instruments (fees, taxation)	N					N		
Information to fishermen		N				N		
Legislation	N				N			
Selective fishing gear			N			N		

N = Norway

By-catch of other species:

For sea mammals, seabirds and benthic organisms: no measures or monitoring mechanisms are adopted in order to reduce by-catches.

The European Commission:
Fish / shellfish by-catches
Community regulations for demersal trawls and seines and similar towed gears specify for each of a number of geographical areas a reference minimum mesh size. Currently, the reference mesh size for the North Sea is 100 mm while that for the Skagerrak and Kattegat is 90 mm. Any individual of any species (except salmon and sea trout) caught when fishing with nets of these mesh sizes or greater, may be retained if such individuals are greater than the defined minimum landing size.

Community regulations also recognise the fact that, to effectively exploit some species, mesh sizes less than the reference mesh size must be deployed. For catch retained on board taken with each of these mesh sizes, a minimum percentage of the target species and a maximum percentage of by-catch species is defined. Monitoring is conducted by the fisheries inspection services of Member States to ensure compliance with these conditions.

Non-fish / shellfish by-catches
The European Union does not monitor or record such quantities. Information on this topic comes entirely from scientific investigations many of which have been or are supported by the European Commission.

However, Article 12 paragraph 4 of Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora requires Member States to "establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV(a)" which includes marine species (e.g. all cetacean) - See response to Question 13.b. Moreover "in the light of the information gathered, Member States shall take further research on conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned".

29.b. Describe the measures and monitoring mechanisms adopted in order to reduce discarding.

Instruments / measures used	Has the particular instrument been implemented				National importance			
	fully	partly	not at all	comment number	very important	important	not important	comment number
Monitoring procedures at sea	N, UK				N, UK			
Monitoring procedures on shore		N				N		
Economic instruments (fees, taxation)		N				N		
Information to fishermen		N, UK			UK	N		
Legislation (e.g. discard ban)	N, UK				N, UK			
Selective fishing gear	UK		N		UK	N		
Other: (specify)	NL				NL			

Denmark: Reference is made to the response by The European Commission. No additional information.

NL = The Netherlands: Other instruments / measures used: Sorting-machines
N = Norway:
UK = The United Kingdom: UK fleet required to use square mesh panels in nephrops nets. EC technical conservation measures applied.

France: To discuss regulation with regard to technical measures in order to eliminate or reduce to a minimum the catch of juveniles which is the main reason for discards. Being discussed in Brussels within the framework of the community policy (Secretariats translation).

The European Commission: The European Union does not monitor or record quantities of fish discarded. Information on quantities discarded comes entirely from scientific investigations many of which have been or are part-funded by the European Commission.

Question 30: Norway

30. Indicate how fishing activity is being controlled with regard to monitoring of the discard ban.

Norway: In monitoring of the discardban control at sea is very important. The Coastguard is normally present on the most important fishing grounds and will carry out inspections to get a picture of the catch composition. If the amount of undersized fish is too high a vessel is requested to change fishing ground. The Coastguard may also on a voluntary and temporary basis establish limited areas where vessels on account of high amount of undersized fish in the catches are requested not to go.

6. Impact on Fisheries from other Activities

Questions 31-32: All North Sea states and the European Commission

31. Indicate the activities involving hazardous substances that have been negatively affecting the mortality rate, the production of juveniles and the growth rate of marine species. (ICES will provide information on this question in addition to information from EC and North Sea states.)

Denmark: ICES to respond.

Germany: In the "German Red List of Threatened Biotopes and Species of the German Part of the Wadden Sea Area and the North Sea" for 21 marine species that are "extinct/disappeared" or "endangered" in this region hazardous substances are identified or assumed as threat factors (comparing to 33 marine species for which fishery activities are threat factors, see 19.a). Note that a certain species may be negatively affected by both hazardous substances and fishery activities as well as by only one of them.
Only in few cases it is possible to show the interrelation between a specific activity or substance and observed negative biological effects in the field as, e.g. the imposex in Common Whelk (*Buccinum undatum*) due to TBT-based anti-fouling paints.

Activity/hazardous substances	Fish species, other marine biota and areas affected	Description of effects
Tributyltin and other organotins	Marine gastropods in coastal areas	Imposex and intersex

Additional comments
The biological effects of tributyltin (TBT) on gastropods are only an (well documented) example for the impact of hazardous substances on marine organisms. It has to be emphasised that all toxic anthropogenic substances released into the marine environment via various pathways may have an impact on mortality rate, the production of juveniles and the growth rate of exposed marine organisms, either by specific toxic action or by causing unspecific physiological stress, as soon as critical concentrations of these substances are exceeded. However, clear cause/effect-relationships between exposure to contaminants and the above effects are only hard to establish due to the complex multifactorial environmental interactions affecting the health status of marine organisms.

The Netherlands: The present levels of PCB's and PAH's and trends in their concentrations are possibly adversely affecting the early reproduction phase of fish (larvae and eggs). Dutch policy on the reduction of inputs of contaminants into the marine environment is conform the precautionary principle and the North Sea Ministerial Declarations.

Information also to be taken into account:
- QSR 93: chapter 5, man's impact on ecosystems
- additional information on this issue provided by ICES

Norway: (See ICES)

Sweden:

Activity / hazardous substances	Fish species, other marine biota and areas affected	Description of effects
Input of nutrients, esp. nitrogen	Flatfishes, shellfish, perennial seaweed	Eutrophication of coastal areas (Rosenberg *et al.* 1990). Overgrowth of annual, filamentous algae in shallow waters has displaced perennial seaweed and seagrasses and thus reduced recruitment of fish and shellfish in these nursery areas (Isaksson & Phil 1992).
Oxygen depletion	Norway lobster Fish Shellfish	Result of eutrophication. Cause extensive anoxia on shallow and deep bottoms, which has lead to mass mortality of fish and shellfish, including collapse of Norway lobster stocks in Kattegat (Phil-Baden *et al.* 1990).
Chrysochromulina bloom 1998	Benthic and pelagic organisms incl. fish and shellfish	Caused extensive mortality of benthic and pelagic organisms. 100 tonnes of fish in aquaculture facilities died or had to be killed (Lindahl & Rosenberg 1989).

The European Commission: The UK monitors fish, water and sediments in UK coastal waters for the presence of a range of known contaminants. Results are published annually.

The UK also monitors fish stocks to determine levels of parasitised, diseased and deformed fish. Samples of such fish are examined to determine whether exposure to contaminants has adversely affected the fish either by direct influence or by changing susceptibility to infectious disease. These studies are complemented by other safeguards such as the control on hazardous substances under the Food and Environment Protection Act 1985.

ICES: Seismic surveys are used continuously to prospect for oil bearing strata under the North Sea. Survey vessels follow planned tracks over zones of interest, continuously emitting high intensity acoustic pulses from electric or pneumatic equipment, and detecting the echoes on long towed arrays of hydrophones. Fishermen have expressed concern for some time about the effects of these surveys on sea life and claimed that fish are driven from the grounds. The Norwegians conducted a study in the Barents Sea in 1992 in water depths of 250-280 m which lent support to these claims. Fish densities in the survey area were reduced and species composition was altered.

In tabular form:

Seismic surveying for gadoids	Departure from fishing grounds;
Oil bearing strata	Disturbance of normal activity

32.a. Which natural or genetically modified organisms have deliberately or accidentally been introduced to the marine ecosystem within your maritime areas (e.g. from mariculture)? (ICES will provide information on this question in addition to information from EC and North Sea states.)

Belgium: Natural organisms: *Ensis directus* (Mollusca, Bivalvia) is recently became very common along the entire Belgian coast. It could be presumably due to accidental introduction through ballast water.

Denmark: No genetically modified organisms. Of natural organisms, the rainbow trout has deliberately been introduced. Several species of animals and plants are reported to have been accidentally introduced with mariculture organisms or due to shipping. It is anticipated that ICES will cover the subject sufficiently.

France:
-Accidental introduction: *Crepidula fornicata* (crèpidule), *Sargassum muticum* (Sargasse)
-Deliberate introduction: *Ruditapes phillippinorum* (palourde japonaise), *Crassostrea gigas* (huître japonaise)

Germany:

	Accidental introduction	Deliberate introduction
Natural organism	- *Marenzellaria viridis* - *Anguillicola crassus* - *Eriocheir sinensis* - *Oncorhynchus mykiss* -organisms introduced via: *discharges ships' ballast water; or *transportation on ships' hulls	- *Crassostrea gigas* - *Salmo trutta* - *Salmo salar*
Genetically modified organism	None	None

These are only examples for well documented cases. It is likely that much more organisms which now are assumed to belong to the natural fauna have been introduced a considerable time ago.

The Netherlands:

	Accidental introduction	Deliberate introduction
Natural organism		Mussels, oysters
Genetically modified organism		

Norway:

	Accidental introduction	Deliberate introduction
Natural organism	*Odontalla sinesis* (and other algea) *Goninemus fornicata* (hydromedusa) *Crepidulata fornicata* (slipper limpet) *Paludestrina jenkinsi* (snail) *Eriocheir sinesis* (Chinees crab) *Ensis americanus* (clam) *Teredo navalis* (molusc) *Balanus improvisus* (barnacle) *Sargassum muticum* (jap. weed) *Mustella vison* (mink) *Salmo salar* (Atlantic salmon)	*Ruditapes philippinorum* (Manilla clam) *Salmo gairdneri* (rainbow trout)

Additional comments
The salmon used in aquaculture is genetically different from the wild salmon because of breeding. Escaped farmed salmon are capable of spawning in the wild and of having offspring, it therefore represents a threat to the local genetic adaptation of the wild salmon.

Sweden:

	Accidental introduction	Deliberate introduction
Natural organism	Phytoplankton: 5 species Macroalgae: 7 species including *Sargassum muticum* ("Jap. weed") Invertebrates: 9 species (Jansson 1994)	
Genetically modified organism		

The European Commission:
Non-indigenous Species
A number of species has been introduced for aquaculture purposes throughout Europe in historical or more recent times. These include *Crassostrea gigas* (Pacific oyster), *Ruditapes phillipinarum* (Manila clam).

In addition *Oncorhyncus kisutch* (Coho salmon) were introduced into ? Siberian rivers by former USSR? and some individuals were caught in the North Sea in ? the late 1960's/early 1970's. Similarly, the steelhead strain of the rainbow trout (*Oncorhyncus mykiss*) may escape from farms and enter the sea. It is believed that neither of these species reproduce in the North Sea.

UK indicates that *Mercenaria mercenaria* (hard-shell clam), *Urosalpinx cineria* (American tingle) and *Crepidula fornicata* (slipper limpet) have been accidentally introduced.

Non-indigenous strains
Considerable transfer of Atlantic salmon (*Salmo salar*) strains takes place between producer countries. The Commission is aware of transfers between Sweden and Norway, from Norway to Scotland and Ireland, from Sweden, Norway, Scotland and Ireland to Spain and France.

Movements of shellfish occur mostly between North Sea countries (e.g. mussels (*Mytilus edulis*)) from Denmark and German to Netherlands, Oysters (?which species?) from/to France to/from United Kingdom. These transfers are legal according to EC legislation, the only existing limitations concern veterinary issues referred to in Directive 91/67.

Very little "leakage" of hatchery-reared or wild salmon occurs from the Baltic.

Genetically modified organisms
No genetically modified organism (individuals whose karyotype contains parts of the genome of another species) is currently cultivated in the European Union.

The case is different for selected genomes. The release of individuals resulting from "natural" selection, such as individuals naturally resistant to some disease(s), falls into the category indicated above as "non-indigenous strains". Most of the currently-used

aquaculture stock is selected for some characteristic(s). Triploids are a particular case: they are not "naturally selected strains" nor are they "genetically modified organisms" according to the definition provided above. Triploids exist for oysters, rainbow trout and salmon. They are widely used and they are all sterile so that, even if escapes occur, there is no chance of long term competition with wild stocks. Additionally, at least with regard to the triploid fish, they appear to be poor competitors in the wild.

In this context it should be noted that a recent report (Jansson, K. (1994) "Alien species in the marine environment. Introductions to the Baltic Sea and the Swedish west coast" - publication of the Swedish Environmental Protection Agency) indicates that some 50 non-indigenous species, both plants and animals, have become established in the Baltic Sea and the Swedish west coast. Along the coasts of the Skagerrak and Kattegat, some 20 species of non-native phytoplankton, macroalgae and invertebrates have become established. The most important vectors are shipping (ballast water and fouling) and aquaculture. Secondary dispersal from introductions in other parts of Europe also play an important part on the Swedish west coast. Since marine introductions are international in character, co-operation at international level is highly required for prevention to be effective.

32.b. What kind of problems or threats to the marine environment do these introductions represent? (ICES will provide information on this question in addition to information from EC and North Sea states.)

Belgium: This kind of problems have not been experienced but the matter is under investigation.

Denmark: Reference is made to the contribution by The European Commission.

Germany: At present, introductions via ships' ballast water are considered the greatest threat, since a large variety of exotic marine organisms belonging to many taxonomic orders enters the maritime waters of many countries via this pathway. If these organisms find suitable environmental conditions they may reproduce and spread and may replace natural flora and fauna (for example the exotic polychaet *Marengellaria viridis* replacing the indigenous polychaet *Nereis diversicolor* in some areas of the Baltic Sea). This may cause severe ecosystem effects affecting exploited fish stocks and populations of other marine organisms utilised for human consumption, for example by changing the structure of the natural food web. The Chinese crab *E. sinensis* is an example for an exotic species which had already been introduced via ballast water to German ports along the North Sea coast at the turn of the century and is now extremely abundant in estuarine regions due to favourable conditions and directly affects fisheries since it partly feeds on fish which it removes from standing gears.

Other introductions may occur when exotic species are cultured and released accidentally (for example rainbow trout, *O. mykiss*) or when epiflora or -fauna living on imported organisms are released (for example organisms living on shells of *C. gigas*).

If pathogenic organisms (virus, bacteria other parasites) are introduced they may directly affect growth, reproduction and survival of populations of marine organisms. An example is the swimmbladder parasite *Anguillicola crassus* (Nematoda) which has been introduced to European waters by eels imported from Asia. Heavy infestation with this

parasite (juvenile and adult stages) causes pathological changes in the swimmbladder tissue which may lead to functional disorders in the gas exchange necessary for vertical orientation during swimming. This may have an adverse impact on the migration of the European eel to its natural spawning grounds in the Sargasso Sea and may, therefore, contribute to the decline of the European eel stock.

The introduction of organisms for restocking purposes (e.g. *S. salar*, *S. trutta*) may lead to genetical changes of the natural populations if these organisms stem from regions other than those where they are released. Moreover, genetical differences may lead to a replacement of natural populations of the same species if the newly introduced specimens are more opportunistic and successful competitors for food and other resources.

The Netherlands: Introduction of unknown organisms, possibly dangerous for the nature-environment and fish and shellfish-stocks. See also ICES info.

Norway: *Sargassum muticum*: The algae can cover small bays and harbours. It is possible that it locally can outgrow original species (Rueness, J. & H. Steen. Undersøkelser i forbindelse med spredning av den japanske tangarten *Sargassum muticum* i Norge. Avd for botanikk UiO 1991).

Mink, *Mustela vison,* eat eggs from seabirds and can be a serious threat to seabird species in some areas.

(Salmon: see 32.a.)

Sweden: Overgrowth by Japweed, *Sargassum muticum*, results in oxygen deficiency on sediment bottoms and shifts in species composition in benthic ecosystems.
Risk of algae blooms due to organisms introduced in ballast water.

The European Commission: On a purely theoretical basis, it cannot be precluded that in the foreseeable future the release or use of genetically modified organisms could arise. However, at present, problems can actually only arise from the introduction of non-indigenous species or strains.

Released or escaped exotics rarely flourish in their new environment; but it has happened and it may happen again. The effects of any introduction of non-indigenous species are unpredictable. However, for aquaculture, it should not be overlooked that many of the cultivated species, which produce valuable food and generate income and employment, often in deprived areas, were originally exotic species. This is the case in the European Community with four of the most important cultured species: rainbow trout, carp, Pacific oyster and Manila clam. Current concern with the possible impact of aquaculture is related more to the fact that the resources of the aquatic environment have been relatively untapped rather than to the extent of the changes which are occurring.

The consequences of transfers and introductions in the aquatic environment have been the subject of many studies and reviews: most of the transfers are not connected with aquaculture and, of those which are, few have been disastrous. Some well recorded events have had serious consequences usually because of the inadvertent introduction of parasites or diseases. Ecologically important cases in Europe include:

- catastrophic mortalities of native crayfish in England and Spain following spread of crayfish plague from the American signal species *Paciastacus leniusculus*,

- the transfer of the parasite *Bonamia ostreae* from oyster spat imported from USA to European flat oyster resulting in losses of up to 80% in some areas,

- high mortalities in salmonid species caused by spread of furunculosis introduced on live fish imports, originally into the UK and later to Scandinavia.

Deliberate transfers may also be accompanied by other organisms, frequently seaweed and invertebrates, which are included accidentally and may become established in the new environment. The seaweed *Sargasm muticum* is believed to have been introduced into European waters on imported Japanese shellfish and is now replacing native algae in some locations.

UK considers that nether Pacific oyster or Manila clam represent a demonstrable threat to the inter-todal ecosystem. The main problem with the hard-shell clam is the effect of the dredges used to harvest it from the soft sediments which it inhabits. The American tingle was a significant oyster pest in the Thames estuary until it suffered imposex as a result of Tri-Butyl Tin (TBT) pollution. It is still too early to say if it was eradicated before TBT was banned. The slipper limpet is a filter feeding gastropod which was once believed to be a serious competitor for the food ?of oysters? This is no longer a concern but its presence in high concentrations can make it a pest on some oyster grounds.

32.c. What measures have been taken to reduce possible negative impacts?

Belgium: See 32.b.

Denmark: None.

Germany: Application of the EU-regulations for the control of the spread of diseases of farmed freshwater and marine fish species and other organisms.

The Netherlands: Licensing import and introduction of live shellfish.

Norway: Introduction of alien or genetically modified species:

- Introductions of genetically modified species shall be approved (*genteknologiloven* - The Act relating to production and use of genetically modified organisms (Genetechnology Act)).

- It is not legal to introduce alien seabirds (*viltloven* - The wildlife Act).

- It is not legal to introduce alien species in protected areas (*naturvernloven* - The nature conservation Act).

- It is not legal to introduce marine fish or shellfish (*saltvannsfiskeloven* - "The Act for seawater fisheries" (June 17 1955)).

- According to the convention on biodiversity, the contracting parts shall avoid introduction of, control or exterminate alien species that can be a threat to biodiversity.

During 1992 and 1993, the Directorate of Fisheries (or the authorities) have checked the technical standard of every aquaculture location in the nation. The number of salmons escaping from the aquaculture has been reduced considerably.

Sweden: No practical measures have been undertaken.

The European Commission: Transfers and introductions of aquatic non-indigenous species and genetically altered stocks are the subject of a code of practice jointly issued by ICES to cover marine organisms and EIFAC for freshwater. This code has recently been revised. FAO, in collaboration with ICLARM are currently revising the ICES/EIFAC code for global application. Although the codes have no legislative force, countries which are members of ICES and EIFAC have agreed to abide by their conditions and some now have, or are introducing, appropriate national legislation. Even countries which are outside ICES and EIFAC areas are adopting at least part of the codes into local laws.

UK has operated strict import and quarantine measures since 1960.

To control the risk of introduction of exotic diseases and parasites, the codes require the imported organisms to be pathogen-free if possible and then to be reared to maturity in quarantine facilities where all effluents are sterilised. Regular pathogen screening of the broodsock and the progeny ensures that first generation offspring are only transplanted into the open environment if they are entirely free of diseases and parasites. The organisms originally imported are never removed alive from quarantine. Provided that these conditions are closely followed the risk of pathogen introduction is minimal.

Furthermore, the risk of pathogen introduction due to transfers for aquaculture purposes is minimal compared to the continuous release of ballast water from ships where considerable numbers of exotic species can and are released daily into coastal waters.

Sweden (National Board of Fisheries) has issued a regulation on the use and deliberate release of genetically modified aquatic organisms.

32.d. What measures are being planned in order to reduce accidental introductions in the future?

Belgium: See 32.b.

Denmark: None.

Germany: In 1991, the Marine Environment Protection Committee (MEPC) of the International Maritime Organisation (IMO) adopted the Guidelines for Preventing the Introduction of Unwanted Aquatic Organisms and Pathogens from Ships' Ballast Water and Sediment Discharge. These guidelines give advice to IMO Member Countries on a voluntary basis on how they might introduce relatively simple ballast water management controls. Due to resolutions of the IMO Assembly in 1993, a Ballast Water

Working Group was established by the MEPC which, since 1994, has been considering form and contents of possible binding regulations for the Control and Management of Ships' Ballast Water to Minimise the Transfer of Harmful Aquatic Organisms and Pathogens which will contain both legally binding provisions and guidelines on their implementation on the basis of recommendations to IMO Member Countries.

Application of the ICES Code of Practise on the Introductions and Transfers of Marine Organisms 1994 which provides recommendations related to the following aspects:

- the steps to take prior to introducing a new species
- the steps to take after deciding to proceed with an introduction
- the prevention of unauthorised introductions by ICES Member Countries
- policies for ongoing introductions or transfers which have been an established part of commercial practise
- the steps to take prior to releasing genetically modified organisms.

The Netherlands: Stricter regulation of the introduction of live shellfish in coastal waters.

Norway: International Maritime Organisation (IMO) Ballast Water Guidelines can be followed in Norway (voluntary rules).

"ICES Code of Practice to reduce the risks of Adverse Effects Arising from Introductions and Transfers of Marine Species" is introduced in Norway.

Sweden: Swedish initiatives to develop international agreements to prevent undesirable introductions of non-native organisms (Terstad 1995).

Development of technical and/or operational methods to control unintentional introductions of non-native organisms resulting from shipping e.g. in ballast water (Terstad 1995).

The European Commission: Aquaculture is unavoidably accompanied by the escape of individuals by accident or intent. If this happens on a substantial scale, either because of mass releases of because of continuous low-level losses from widely cultured species, there can be significant consequences if the escapees are able to survive and thrive in the wild in competition with native, local species. Problems arise mainly from ecological competition and genetic change. However, research evidence exists indicating that, very often, cultured animals are not sufficiently well adapted to the wild to compete effectively with native stocks, so they are more likely to constitute a food source than a threat.

Genetic change results from escaped fish interbreeding with native populations introducing long term damage by the loss of genetic diversity and reduction of fitness. It is surmised that populations are uniquely adapted to local conditions and that any genetic introgression will produce individuals which are less able to survive. However, the fears for genetic change are not founded so far on sound scientific evidence. Example of deleterious changes are lacking, even for the Atlantic Salmon, where escapees form a substantial proportion of the species free in the wild and are able to interbreed with the local fish. Threats to the survival of wild fish stocks are probably more likely to derive from the degradation of habitat resulting from human activities than from any induced genetic change.

Nevertheless, fish farmers should and do make considerable efforts to prevent escape of their valuable stocks and current research on the commercially viable production of sterile animals could limit the impact of escapees. Improved security and husbandry in culture facilities, appropriate site location and the use of sterile or locally-derived populations will reduce the potential for ecological and genetic damage to native stocks. Cost-effectiveness, insurance requirements and legislation will all contribute to ensure that the number of organisms escaping and their potential for influencing local populations will be rapidly and radically reduced.

Activities of restocking and ranching require deliberate release into the natural environment. These practices have been followed with variable success for hundreds of years and there is currently a revival of interest in them, especially in the use of enhancement to counter the depletion of wild stocks of fish and crustaceans.

Even if practical evidence is lacking, all the theoretical environmental risks associated with normal aquaculture are present and exacerbated because the organisms are deliberately released, usually repeatedly and in very substantial numbers. The release of large numbers of hatchery reared fish for ranching or enhancement has the potential to modify ecosystems both by altering the ecological equilibrium and by changing the genetic constitution of wild animals belonging to the same species, with a consequential diminution of their adaptation to the environment which they occupy. So, in addition to the safety measures already mentioned, it is recommended that the released organisms are as similar as is possible in their genetic constitution to those in the environment which they will occupy.

However, when re-stocking is contemplated because wild stocks have been severely depleted (which is the most common case) by overfishing or environmental degradation, the introduction aims to return the ecosystem to the balance that once existed. Also in these circumstances, potential genetic change can be avoided or reduced by introducing juveniles originating from local broodstock, although this may not be the most effective course of action for ensuring the survival of the enhanced species.

At the 1995 meeting of the Working Group on Impacts on the Marine Environment (IMPACT of OSPARCOM) it was agreed that Sweden, as Lead Country, should distribute a questionnaire to Contracting Parties "requesting relevant national information on alien species, including *inter alia*, information on relevant research activities, strategies for the development of monitoring programmes and sampling/measurement techniques" (IMPACT 95/14/1). A questionnaire has been submitted and replies are to be given no later than 1 April 1996.

Table continued:

Type of protection	Location	Period	Purpose	Legal status
Closed areas (temporarily) 3)			Game reserves with seasonal restrictions on access and fishery restriction zones with seasonal restrictions on fishery	By executive order
Undisturbed areas 4)			Conservation measures	Law
Ban on trawl	Within 3 nautic miles from the coastal line	All year	Exclusion mussel fishery	Law (by executive order)
Ban on bottom set gillnet	Within 100meters from the coastal line	All year	Conservation measure	Law

1) Areas assigned to protect certain species or habitats such as nature reserves
2) Areas closed to certain activities
3) Areas closed seasonally or temporarily to certain activities. In fisheries management, flexible closed areas are used to protect juvenile fish
4) Areas established, on experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem

Additional comments
In all of the protected areas, certain activities are restricted, either permanently or in certain parts of the year, but generally not commercial fisheries.

In the SPAs and SACs extraction of stones is prohibited and the extraction of sand and gravel as well as the dumping of dredged materials is being brought to a stop, with the exception of uncontaminated materials from smaller harbours.

France: Reference to be made to the EU response.

Germany:
Protected areas
At the German mainland coast of the North Sea there are three areas established as protected areas. These are the Wadden Sea national parts of Niedersachsen (year of establishment: 1985), Hamburg (1990) and Schleswig-Holstein (1985). The purpose of the national parks is the protection of the specific characteristic, beauty and originality of these areas. In particular the species rich flora and fauna should be conserved and it should be safeguarded that natural processes may act undisturbed as far as possible.

About 35 sm northwest of Cuxhaven a marine area of five ha with rocky bottoms was established as nature reserve in 1981. The nature reserve includes both tidal and subtidal rocky areas surrounding the Isle of Helgoland. The purpose of the nature reserve is to protect the unique geological characteristic of the "Helgoländer Falssockel" with its habitats of plants and animals.

Certain fishing methods (e.g. creels) are still allowed to fishermen from the Isle of Helgoland. There are no indications of recovering of the former overexploited stocks of Lobster (*Homarus gammarus*).

Type of protection	Location	Period	Purpose	Legal status
Partly Protected areas Plaice Box	 German Bight	 All year	 Protect. juv. plaice	-
National Parks	Wadden Sea	All year	Protect. biotop	-
NSG Helgol. Felssockel	Helgoland	All year	Protect. biotop	-

The Netherlands:

Type of protection	Location	Period	Purpose	Legal status
Protected areas **A.1 The Dollard**	North Sea, Wadden Sea; 53°18'N, 07°08'E	Permanently	Natureconservation	Protected Nature Monument, State Nature Monument (Internal Waters)
A.2 Oosterschelde Buitendijks	North Sea, 51°44'N, 03°59'E	Permanently	Natureconservation	Protected Nature Monument, State Nature Monument (Internal Waters), International: Ramsar wetland
A.3 Waddenzee I and II	53°15'N, 05°15'E	Permanently	Natureconservation	State Nature Monument (Internal Waters), International: Ramsar wetland, Unesco Biosphere Reserve, Biogenetic Reserve, EC Birds Directive site.
Closed areas (permanently) 2) **B.1 Closed areas (26%) to shellfishfisheries Waddenzee**	53°15'N, 05°15'E	At least till 1998	Natureconservation	Government's policy decision with regard to the Wadden Sea laid down in the Key Planning Decision Wadden Sea and the Struktuurnota Zee- en kustvisserij.
B.2 Closed areas to shellfishfisheries Voordelta		At least till 1998	Natureconservation	Governments policy decision with regard to the Voordelta laid down in policy document "Integraal Beleidsplan Voordelta".
B.3 Closed areas to shellfishfisheries Oosterschelde	North Sea 51°44'N, 03°59'E	At least till 1998	Natureconservation	Governments policy decision with regard to the Oosterschelde laid down in policy document "Struktuurnota Zee- en kustvisserij".
Closed areas (temporarily) 3)	None			
Undisturbed areas 4)	None			

1) Areas assigned to protect certain species or habitats such as nature reserves
2) Areas closed to certain activities
3) Areas closed seasonally or temporarily to certain activities. In fisheries management, flexible closed areas are used to protect juvenile fish
4) Areas established, on experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem

Norway:

Type of protection	Location	Period	Purpose	Legal status
Protected areas 1)				
Closed areas (permanently) 2)	Within 4 n.m. off the coast		Prohibiting trawl (except trawling for shrimps and Norway lobster)	National fleet Unilateral regulation
Closed areas (temporarily) 3)	Between 62°N and 58° 12' N within 40 n.m.	1/1 - 30/4 for herring	Protection of spawning grounds for Norwegian spring spawning herring	National and foreign fleet Unilateral regulation
Undisturbed areas 4)				

1) Areas assigned to protect certain species or habitats such as nature reserves
2) Areas closed to certain activities
3) Areas closed seasonally or temporarily to certain activities. In fisheries management, flexible closed areas are used to protect juvenile fish
4) Areas established, on experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem

Sweden:

Type of protection	Location	Period	Purpose	Legal status
Protected areas 1)	Gullmars fjorden, Skagerrak	1983 onwards	Protection of Sweden's only true fjord (high diversity on flora and fauna)	Marine reserve (Andersen *et al.* 1995)
Closed areas (permanently) 2)				
Closed areas (temporarily) 3)	70 locations outside rivers and streams in area IIIa	15 Sep.-28(29) Feb.	Protect salmon and trout	Fisheries Ordinance (FIFS) for Swedish west coast
Undisturbed areas 4)				

1) Areas assigned to protect certain species or habitats such as nature reserves
2) Areas closed to certain activities
3) Areas closed seasonally or temporarily to certain activities. In fisheries management, flexible closed areas are used to protect juvenile fish
4) Areas established, on experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem

The European Commission:

Protected areas

[Member States to respond]

With regard to European Community nature conservation legislation, there are two relevant protection categories, both of which contribute to the construction of the "Natura 2000" ecological network in the European Union.

1) Under Directive 79/409/EEC on the conservation of wild birds, Member States classify Special Protection Areas (SPA's) for the protection of habitats of endangered and migratory bird species. Each of the EU North Sea countries has coastal/marine SPA's within their territories (e.g. large section of the Wadden Sea have been thus classified). However, further classification is required.

2) Under Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora, Member States were required to propose, by June 1995, a national list of sites for the protection of listed species (other than birds) and habitats of EC interest. However, to date and with reference to the North Sea, only partial national lists have been provided by Denmark and UK.

The coastal strip along the Swedish west coast is protected against exploitation. Sweden has also designated a number of marine reserves i.e. reserves primarily to protect life below the surface of the sea. There are at present two west coast fjords afforded protection in this way and another two reserves are planned to be designated. Reserve status normally entails a ban on sand extraction, dredging and infilling, for example, and, in some cases on certain fishing methods such as demersal trawling.

Sweden is working on a classification programme for species and also habitats in close collaboration with the EC CORINE programme.

Closed areas
Within European Community legislation a number of areas are defined within which fishing activities are limited. The limitations may be defined as lasting for the whole year of for only part of the year. The conditions are repeated from year to year. Details of these areas, their associated time periods and their purpose are provided below.

About 70 closed areas have been designated along the Swedish west coast with regulations implying a total or partial prohibition on fishing for certain species in defined areas for defined time-periods. Target species to be protected are salmon and sea-trout.

In the UK, in 1990, conservation measures were introduced for the protection of juvenile bass (*Dicentrarchus labrax*). A system of 34 nursery areas (estuaries, harbours and power plant outfalls, all within territorial waters) was designated under national legislation.

Also in UK, British registered vessels are prohibited from fishing for salmon and migratory trout beyond six miles from baselines. Fishing for these species is also prohibited in many areas within the six mile limit. In areas where fishing is permitted, there are annual close seasons the timing and duration of which depend upon the fishery.

In UK, molluscan shellfish fisheries are subject to a number of national regulations. Fishing effort is limited by regulating periods of fishing, by setting catch limits in association with regular stock surveys. In addition, local Sea Fisheries Committees can make bylaws to manage and conserve (public) molluscan shellfish fisheries including the closure of shellfish beds, setting catch limits and the regulation of fishing gear. Sea Fishery Committees can also regulate other sea fisheries through bylaws and some operate restrictions on trawling and dredging in local areas or on the size of vessels allowed to operate in their districts which extend to six miles from baselines.

In France, there are no permanently-established closed areas under national legislation but, within territorial waters, national legislation permits the temporary establishment of closed during the reproductive period of fish stocks.

Undisturbed areas
No area has yet been established within Community waters on an experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem. [See response to Question 32.a.]

Common Wadden Sea Secretariat:

Type of protection	Location	Period	Purpose	Legal status
Protected areas 1)	Several bird an seal protection areas in Wadden Sea	Generally breeding or pupping period	Protection bird and seal populations	Law
Closed areas (permanently) 2)	NL: 25% of tidal flats (see national report);	All year	Exclusion cockle and mussel fisheries	Policy Planning Document, approved by Parliament
	D: Whole German Wadden Sea	All year	Exclusion cockle fishery	Law
	DK: 45% of Wadden Sea (see national report)	All year	Exclusion mussel fishery	Law (by executive order)
	DK: Whole Wadden Sea with exception of one out of four small areas	All year	Exclusion cockle fishery	Law (by executive order)

1) Areas assigned to protect certain species or habitats such as nature reserves
2) Areas closed to certain activities
3) Areas closed seasonally or temporarily to certain activities. In fisheries management, flexible closed areas are used to protect juvenile fish
4) Areas established, on experimental basis, in order to assess the recovery and redevelopment of the marine ecosystem

Additional comments
In 1991 (7th Trilateral Governmental Conference) it was decided to designate zero use areas for scientific purposes. These decisions has as yet not been implemented.

34.a. Indicate any possible locations of undisturbed areas within your North Sea territorial waters (12 mile zone). (The scientific criteria for the establishment of undisturbed areas in the North Sea for scientific purposes as developed by ICES are at Annex VII.)

Belgium: The dimensions of the Belgian territorial waters are too limited to envisage a possible location of an undisturbed area compatible with the ICES criteria.

Denmark: No specific plans. Reference is made to the answer by The European Commission.

France: No possible location planned.

Germany: As proposed by ICES it seems advisable to investigate the effect of no fishing in undisturbed areas before the installation of areas permanently closed to fishery.

The Netherlands: No possible locations planned.

Norway: The establishment of undisturbed areas was recommended as a scientific means to increase the knowledge of the impact of fisheries upon the ecosystem.

On a local scale the most direct impact of fishing activities upon the ecosystem is the disturbance of seabed and associated benthic communities. The fisheries conducted in the Norwegian part of the North Sea consists of fisheries that have little impact upon the seabed. An establishment of undisturbed areas in our territorial waters would therefore not be preferred from a scientific point of view. It could; however, be possible to establish reference areas in our territorial waters.

The United Kingdom: The UK agrees with the European Commission.

The European Commission: The European Commission is still considering possibilities for location of undisturbed areas and is, having requested the information, fully aware of the response from ICES.

34.b. If you are not in a position to indicate the location of such areas, e.g. due to lack of scientific knowledge, what are your programmes or plans in order to prepare for the establishment of such areas in the future?

Belgium: See 34.a.

Denmark: None.

France: None.

Germany: See 34.a.

The Netherlands: Possible future research on ecological values. See 34.c and 34.d.

Norway: A mapping of the marine life on the coast of Norway has been executed. The product is an overview of suitable localities for marine protected areas. (Brattegard, T. & T. Holthe (red) 1995. Kartlegging av marine verneområder i Norge. Tilråding fra rådgivende utvalg. -Utredning for DN 1995-3. Direktoratet for naturforvaltning.)

The United Kingdom: The UK agrees with the European Commission.

The European Commission: The European Commission intends to continue discussions with EU Member States, in the context of the North Sea Conference, to discuss possibilities for the establishment of such areas.

34.c. What plans exist for the establishment of marine closed or protected areas as part of management strategies?

Belgium: See 34.a.

Denmark: Within most of the EC-SPAs are planned smaller no access game reserves, generally not entailing restrictions being put on commercial fisheries.

A small number of sites where benthic flora is monitored several times annually are potential reserves.

Also the designation of a number of marine and coastal areas in the Kattegat as possible candidates for a system of HELCOM Baltic Sea Protected Areas (BSPAs) - biotope reference areas - may entail some sort of protection.

France: None.

Germany: With regard to Germany, reference should be made to the response by the European Commission.

The Netherlands: Area as mentioned under 33 B.2 (Voordelta) will be State Nature Monument in 1996/1997. Undisturbed areas for shrimp fishery to be studied in Wadden Sea and Voordelta.

Norway: There are plans to establish coastal marine areas in the North Sea area as well as further north. Scientists have recently proposed 8 localities on the North Sea coast which will be suitable for protection. 3 of these localities are transects from the coast out into deep waters. The criteria used to select suitable areas were representativity and rareness. It will take about 3-5 years to work out a formal proposal for protection.

Sweden: A number of areas have been proposed as marine reserves, e.g. Nidingen/ Sönnerbergen/Mönster and Koster channel/Koster archipelago/Tjärnö archipelago/ Väderöarna (Andersen *et al.* 1995).

The United Kingdom: We are not aware of any undisturbed areas in the UK's territorial waters but there are a number of areas which are closed to fishing. Research is being conducted and the UK will submit a separate note on this issue.

The European Commission:
Closed areas
The European Commission (DGXIV) is at present preparing a revision of its regulation on technical measures to be presented to Council on 1 June 1996. In this process, amendments to existing conditions for closed areas will be considered as will the possibility of establishment of new closed areas.

Protected areas
The Commission is actively pursuing with Member States the establishment of the Natura 2000 network (See response to Question 33.a) and, where appropriate, the development of management plans for such areas.

34.d. What is your experience and/or assessment of existing undisturbed, closed or protected areas?

Denmark: In areas closed to mussel and cockle fishery stocks of ageing mussels tend to exclude recruitment of new year classes, but these areas produce spat for the surrounding areas and evolve a more natural community structure with characteristic plant and animal species, some of which serve as food for fish and birds.

France: No experience.

Germany: With regard to Germany, reference should be made to the response by the European Commission.

The Netherlands: In 1997/1998 information on permanently closed areas available. Experiences so far with State Nature Monuments (protected areas for nature conservation): positive effects on all biota and non-biota.

Norway: North of 62°N, the Norwegian authorities have had positive experiences with regard to closed areas to protect juvenile fish. The closed areas have led to much lower catch of immature fish than what would have been the case without these closed areas.

Sweden: The effects of protection in Gullmarsfjord have not been evaluated to our knowledge.

The United Kingdom: See 34.c.

The European Commission:
Undisturbed areas
The EC has no experience of such areas.

Closed areas
All closed areas for the conservation of fish stocks established in Community regulations are firmly based on scientific advice. In that various fishing activities potentially directed at certain age groups of certain species are restricted or prohibited within these areas the existence of such areas can be justified and is beneficial. The European Commission believes, therefore, that the establishment of closed areas is an important tool for the conservation of fish stocks. There are, however, a number of problems which may arise with this approach.

Whenever it is suggested that an area should be closed to some type(s) of fishing activity, there are also counter-suggestions, usually on socio-economic grounds, for derogations to allow fishing within such areas by at least some, usually small, vessels using the same type(s) of fishing gear. The existence of such derogations reduces the intended effects of the closure.

Fishing vessels excluded from a closed area do not stop fishing. The effect of a closed area is often to transfer fishing effort from one geographical area to another and hence, possibly, from young fish to older fish or vice-versa, depending on the intention of the closure. The effect of the closure, therefore, may be unpredictable and, depending on the precise circumstances within which it is enacted, may be of limited conservation benefit.

The magnitude of the benefit achieved by closed areas is difficult to evaluate with precision. Attempts have been made in recent years, under the Commission's Scientific Technical and Economic Committee to set up computer models to provide such evaluation. However, it is not always possible to obtain adequate detailed data to feed the models and a number of theoretical problems, related particularly to migration of fish between areas, remain to be resolved.

The mathematical simulations of the possible effects of closed areas carried out by STCF (precursor of STECF) in recent years support the conclusion of limited benefit but their theoretical limitations should be borne in mind. On the other hand, mathematical simulations carried out by ICES with respect to the "plaice box" indicated that positive effects may be expected.

Protected areas
The effects of protected areas are difficult to evaluate and generalise. Some areas, such as the Wadden Sea, have very complex management requirements which are being addressed within the framework of the Trilateral Arrangement. The Community has supported the development of a management plan and is co-financing the development and testing of an integrated monitoring programme for the Wadden Sea.

8. Education and Participation

Questions 35-36: All North Sea states and the European Commission

35.a. Describe the kind of educational and information programmes established or planned in order to make fishermen and other agents affected by the fisheries management processes aware of the ecological impact of fisheries.

Belgium: In the official programme of the fishing school, there are no lectures specifically dedicated to the ecological effects of the fisheries.

Denmark: Various topics concerning the marine environment are covered by national education programmes.

Germany: With regard to Germany, reference should be made to the response by the European Commission.

The Netherlands: In the professional education of fishermen navigation, handling of the vessel and handling of the fishing gears are very important subjects. The time available for training in the field of biology in comparison, is rather reduced.

The ministry of Agriculture, Nature management and Fisheries has taken the initiative to demonstrate that that a better orientated education is needed. This ministry also issues a studybook on the fisheries legislation giving an insight into the background for it. This book is used in the schools.

To date, after school, there exists no further information programme on ecology or so. However, there is a national steering committee (BEON) that co-ordinates the national research for the North Sea with regard to environmental effects. It is the aim of this committee to enlarge the interest of policy makers, research workers and the fishing industry for the relationships between fishing and ecology. This is done by means of work shops and public discussions.

Norway: The Norwegian Fishermen's Union are consisting of several regional unions. Each regional union has an annual meeting where regulations and fisheries management are discussed. Scientists and representatives from the Ministry or/and The Directorate of Fisheries are present and gives their contribution.

The European Commission: No such programmes are established by the European Commission on this topic. Planning of such programmes is being considered but has not yet commenced.

In France, topics of this type are included in the educational programme of the Ecoles Maritimes et Aquacoles.

In Netherlands, the Ministry of Agriculture, Nature Management and Fisheries has taken an initiative to improve the education of fishermen in this respect by restructuring the professional education of fishermen to include more education of the required type. In addition, this Ministry has also issued a reference book on fisheries legislation and

the requirement for it. Also in the Netherlands, a national steering Committee (BEON) which co-ordinates research in the North Sea on environmental effects intends to enlarge the interest of policy makers, research workers and the fishing industry on the relationships between fishing and the environment by means of workshops and public discussions.

In Sweden, within the national Action Plan on the Environmental Problems of the Fishery Sector, there has been a dialogue with fishermen's organisations.

In UK, the Sea Fish Industry Authority is the recognised industry training organisation for all sectors of the fishing industry. It has developed national and Scottish Vocational quqlificqtions which include aspects of sea fisheries management. Fisheries ecology is included in courses on gear technology run by SFIA's Fisheries Training Centre in Hull.

35.b. What kind of educational or information material is developed for this purpose?

Belgium: See 35.a.

Denmark: See 35.a.

Germany: With regard to Germany, reference should be made to the response by the European Commission.

The Netherlands: See the reply under 35.a.

Norway: Annually reports from IMR on resources and environment.
Weekly magazine "Fiskets Gang" on fisheries from the Directorate of Fisheries.
Pamphlets on interesting subjects.

In the revised school-system "Reform 94" educational books in all subjects on the fisheries sector are developed.

The European Commission: See response to Question 35.a.

36. How do fishermen influence the policy and decision making in respect of fisheries management and fisheries related species and habitats issues?

Germany: List of the German fishermen organisations:
Deutscher Fischereiverband e.V.
Venusberg 36
20459 Hamburg
Tel: 040/314884
Fax: 040/3194449

Landesfischereiverband Schleswig-Holstein
Holstenstrasse 108
24103 Kiel
Tel: 0431 9797287

Landesfischereiverband Weser-Ems e.V.
Mars-la-Tour-Strasse 6
26121 Oldenburg

Landesfischereiverband Niedersachsen
Johannsenstrasse 10
30159 Hannover
Tel: 0511 3665498
Fax: 0511 3665521

Verband der Deutschen Hochseefischereien e.V.
Postfach 540
27455 Cuxhaven
Tel: 04721 7050
Fax: 04721 705201

The Netherlands: By means of the fisheries commodity board funds are raised to carry out research on the alleged negative effects of fishing or more ecological fishing techniques. There is on a regular base consultation with the fishermen's organisations in the framework of the commodity board.

Norway: The need for strict regulations is recognised by Norwegian fishermen and their organisations. Norwegian fishermen and processors play an active role through their organisations at all levels in the decision making process, leading to specific management measures. They are not only consulted, but participate in all our quota negotiations with other countries. They also take part when quotas are fixed and national regulations decided.

The European Commission:
Fisheries management
Within Member States there exist a number of fishermen's organisations which are consulted by national administrations and through which the fishermen represent their points of view to national administrations.

National administrations take account of the representations of their fishermen when formulating their policy positions. The national positions are presented to the

Commission during discussions leading to the adoption of legislation. These discussions take place either within technical meetings, policy working groups (at the level of government officials), Committee of permanent representatives (COREPER - Ambassador level) and at the level of the Council of Ministers.

The Commission also provides a forum for representation of fishermen and other parties with interests in the fisheries industries in the Advisory Committee on Fisheries. The seats on the Committee are apportioned as follows:

21	to representatives of producers of fishery products
3	to representatives of fisheries co-operatives
1	to a representatives of commercial banks financing marine activities
2	to representatives of specialised co-operative credit institutions
5	to representatives of the trade in fishery products
5	to representatives of the fishery industries
5	to representatives of workers in the fishing and fishery products industries
3	to consumers' representatives

Fishermen's representatives are also included among the members of the Economic and Social Committee. When this committee prepares opinions on Community policy, the experts it consults are usually officers of the fishermen's organisations.

In the relatively new Committee of the Regions, fishermen will be represented through their locally and regionally elected politicians.

The Fisheries Committee of the European Parliament also provides a route through which fishermen's organisations can influence policy either as a result of representation of their points of view via their parliamentary representative or directly to the committee at the invitation of the latter.

Finally, individual fishermen and their organisations are always at liberty to write or otherwise contact directly the various groups indicated above and often make use of this opportunity.

9. Budgetary Appropriations

Question 37: The European Commission and all North Sea states

37. Indicate the magnitude and ratio between annual expenditure on research projects aimed at the integration of environmental issues into the fishery sector, and the total annual value of fish caught? (When identifying budgetary grants for research both national and EU-budgets should be included.)

Belgium: Total annual expenditure on research projects aimed at the integration of environmental issues into the fishery sector: 5,000,000 BEF; total annual value of fish caught: 2,900,000,000 BEF; ratio: 0,17%.

Denmark: The total value of fish caught from Danish vessels and landed in Denmark and foreign harbours was 3.017 mio. Dkr. in 1995 (Provisional). It is not possible to estimate the annual expenditure on research projects because several institutions and ministers are involved.

France: The total value of fish caught is estimated at 5 500 millions Francs. It is very difficult to give a precise assessment of the budget for research projects aimed at the integration of environmental issues into the fishery sector. Roughly speaking, we could estimate at 3,7 million francs the relevant budget from Ifremer.

Germany: The total value of fish caught from German vessels and landed in German and foreign harbours was 277 Mio. DM in 1994. It is not possible to estimate the annual expenditure on research projects aimed at the integration of environmental issues into the fishery sector because several institutions and ministries are involved.

The Netherlands: A rough estimate of the annual expenditure on research with regard to environmental issues and fisheries amounts f 8.000.000, including the costs of the vessels. The value of the fish caught, at landing, is about f 1.000.000.000. So the ratio between the two is 8 : 1000.

Norway: 240 million Norwegian Kroner (including aquaculture research) - capture fishing catch value + 8 billion, aquaculture production value + 5 billion

The United Kingdom: Estimated value of catch £ 561 million
Estimated research expenditure (as defined above) £ 3.3 million
Ratio-1:170 (or 0.6%)

10. Joint Actions to Be Undertaken by the EU and Norway within the Framework of the Bilateral Fisheries Agreement

Question 38: The European Commission and Norway

38. Please report on progress on the work to :

Preliminary agreed actions (The European Commission and Norway):

i Convene joint scientific working groups to develop common views in respect of management on shared stocks.

See response to questions iii, vi and viii.

ii Work jointly towards a responsible and sustainable utilisation of North Sea fish stocks;

This is always the intention of any cooperation between Norway and EU. The main operative fora are the technical working meetings and the annual bilateral consultations.

In the context of the quota agreement for 1996, Norway and the EU decided to implement a multi-annual management strategy for i.a. herring, mackerel and plaice. In the consultation for fisheries for 1997 it was agreed to intensify the work on new management systems for herring and mackerel. The purpose of such a strategy is to take management decisions that will apply over more than one year in light of the current scientific knowledge of the stocks. This in turn should provide for greater stability of exploitation, and for the setting of limit and target reference points in accordance with a precautionary approach. The strategy incorporates the objective of successively rebuilding stocks to higher levels, thus increasing current yields.

iii Continue work on evaluating the effectiveness of management measures presently in use for demersal stocks in the Community and Norwegian parts of the North Sea.

A working group was convened in the autumn of 1995. The report, SEC(95) 2159/6 December 1995, contains useful and updated information on the state of affairs relating to demersal fisheries in the North Sea.

A main conclusion of the report is that the manner in which current fisheries are conducted causes removal of a very high proportion of the stocks annually, resulting in a high dependency on fishing for the younger age-groups, and hence a high dependency on recruitment. In this context it is recognized that quantitative management decisions in the form of TACs (total allowable catches) must be accompanied by appropriate technical measures that will ensure better selectivity in catches to ensure a more rational exploitation pattern.

In light of the above, the EU and Norway have decide to follow up work relating to i.a. discards, selectivity of fishing gears and management relating to closed seasons/areas and other technical measures.

iv Assess the probable effectiveness of any new measures that may contribute to the recovery of fish stocks.

See response to questions iii, vi and viii.

v Continue jointly to develop catch reporting and catch statistics with the aim of reducing discrepancies between reported catches and ICES catch statistics, by assessing misreporting, inadequate accounting of discards, by-catches and other factors contributing to the total out-take of the stocks.

vi Jointly evaluate the management regimes for North Sea herring in order to improve the management regimes of the direct herring fisheries as well as fisheries in which herring constitutes a significant by-catch.

Both the EU and Norway are concerned about the quantities of herring taken as by-catch in fisheries directed at other species than herring. These catches are taken in addition to existing agreements on TACs for herring and work against the intention of the TACs to ensure acceptable levels of spawning stock biomass and fishing mortality rate.

The report of a joint working group on North Sea Herring, (SEC(95) 1600/ 27 September 1995), reviews current problems relating to the management of this stock. A main conclusion of the review conducted is the assumption that the most effective way to improve the exploitation pattern and improve the overall management of herring catches, particularly by-catches of predominantly juvenile herring, will be achieved by enlarging the scope and application of quantitative measures by the use of monitoring and sampling schemes.

Further discussions carried out during the last bilateral consultations have led to the intention to institute a new management regime for North Sea herring by the start of 1998.

vii Consult on fishery regulations in the North Sea, with a view to achieving, as far as possible, the harmonisation of regulatory measures in the fishery zones of the two parties.

See response to questions vi and viii.

viii Promote the development and introduction of fishing gear and fishing practices which will improve selectivity and reduce unwanted and/or harmful by-catches of fish, marine mammals as well as birds.

Norway and EU have agreed to meet early in 1997 to discuss possible means to reduce discards, to improve the exploitation pattern of various fisheries and to improve selectivity of fishing gears.

ix Increase exchange of catch statistics which may contribute to promotion of effective control of relevant fisheries.

To strengthen the co-operation on control and enforcement, the EU and Norway have agreed to broaden the scope of the system of exchange of information on catches/ landings, including 3. country landings, in the respective ports of the parties. Such co-operation will be accompanied by increased contact between control and enforcement experts and exchange of observers.

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References from Common Wadden Sea Secretariat:

The information provided in this questionnaire relates to results of the trilateral Wadden Sea co-operation, mainly the outcomes of the 6th and 8th trilateral Wadden Sea Conferences (Esbjerg 1991, Leeuwarden 1994). In some cases also relevant national information is given.

ANNEX I

MAP OF THE NORTH SEA

Thick line: North Sea and North Sea Catchment Area
Thin line: ICES Areas

The North Sea comprises the body of water:

a) southwards of latitude 62°N, and eastwards of longitude 5°W at the north west side;
b) northwards of latitude 57°44.8'N from the northern most point of Denmark to the coast of Sweden; and
c) eastwards of longitude 5°W and northwards of latitude 48°30'N, at the south side.

ANNEX II

DEFINITIONS

Fish includes all fish species and shellfish including crustaceans and molluscs. (Defined on the basis of consultations with ICES.)

Fishing activity is defined as all commercial activity inside and outside territorial waters in the North Sea in order to exploit fish resources. (Defined after consultations with ICES.)

By-catch is defined as discarded catch plus incidental catch. (Definition proposed by a by-catch workshop in Newport, Oregon, USA in February 1992 (McCaughran 1992).)

Discarded catch is defined as that portion of the catch returned to the sea as a result of economic, legal or personal considerations. (Definition proposed by a by-catch workshop in Newport, Oregon, USA in February 1992 (McCaughran 1992).)

Incidental catch is defined as retained catch of non-target species. (Definition proposed by a by-catch workshop in Newport, Oregon, USA in February 1992 (McCaughran 1992).) **(Non-target species may in this context also be commercial fish-species.)**

Within **Safe biological limits** means that the spawning stock is above "Minimum Biologically Acceptable Level" (MBAL) as defined by ICES or is likely to become so at current levels of exploitation.

For the time being there is no commonly approved definition of Habitats. In order to avoid unnecessary discussions we have therefore not included any such definition.

ANNEX III

LIST OF MAJOR FISH SPECIES

Provided by ICES

Defined as fish species with catches of over 5000 t and shellfish species with catches of over 2000 t in one of the years 1988, 1992 or 1993. Officially reported catches in the North Sea (Sub-area IV), Skagerrak and Kattegat (Division IIIa) and the English Channel (Divisions VIId and e).

FISH SPECIES	1988	1992	1993
Turbot	4776	6860	6574
Plaice	164594	143045	132853
Common dab	12563	5626	6578
Lemon sole	7946	8680	8276
Common sole	18398	31823	24431
Tusk	4493	5045	5239
Cod	177157	122555	120123
Hake	4542	5932	5423
Ling	14885	13974	15766
Haddock	107957	54298	81379
Saithe	111968	91254	99050
Pollack	6425	7706	8444
Norway pout	235634	419238	278831
Bib	6171	5893	5004
Blue whiting	143994	65853	109678
Whiting	77673	56331	55816
Sandeels	1017203	1060391	738387
Anglerfish	14268	16796	18735
Gurnards	43991	14046	7054
Horse mackerel	128246	180716	222222
Herring	685806	569194	556122
Pilcard	5478	43247	59069
Sprat	161877	118400	163659
Mackerel	112531	232627	245011
Dogfish	17548	12545	8375
Skates and rays	10217	7504	7387
SHELLFISH			
Edible crab	14794	11834	11830
Spinous spider crab	2845	3263	3368
Norway lobster	13877	12527	15849
Northern prawn	13793	14412	14110
Common shrimp	19907	25734	26730
Whelk	13611	2247	1574
Mussels	122984	173245	34350
Scallops	12667	13134	14007
Common cockle	20143	9398	4281
Cuttlefish and squid	8249	10239	17203

ANNEX IV

LIST OF SPECIES MENTIONED IN THE REPORT

ENGLISH	LATIN	FRENCH	GERMAN
Birds:			
Arctic skua	*Stercorarius parasiticus*	Labbe parasite	Kleine jager
Arctic tern	*Sterna paradisaea*	Sterne arctique	Küstenseeschwalbe
Black guillemot	*Cepphus grylle*	Guillemot à miroir	Gryllteiste
Black-headed gull	*Larus ridibundus*	Mouette rieuse	Lachmöwe
Cormorant	*Phalacrocorax carbo*	Grand cormoran	Kormoran
Common gull	*Larus canus*	Goéland cendré	Sturmmöwe
Common scoter	*Melanitta nigra*	Macreuse noire	Trauerente
Eider	*Somateria mollissima*	Eider à duvet	Eiderente
Fulmar	*Fulmarus glacialis*	Fulmar	Eissturmfogel
Gannet	*Morus bassanus*	Fou de Bassan	Basstölpel
Great black-backed gull	*Larus marinus*	Goéland marin	Mantelmöwe
Great crested grebe	*Podiceps cristatus*	Grèbe huppé	Haubentaucher
Great skua	*Cataracta skua*	Grand labbe	Skua
Guillemot	*Uria aalge*	Guillemot de Troil	Trottellumme
Herring gull	*Larus argentatus*	Goéland argenté	Silbermöwe
Kittiwake	*Rissa tridactyla*	Mouette tridactyle	Dreizenmöwe
Lesser black-backed gull	*Larus fuscus*	Goéland brun	Heringmöwe
Oystercatcher	*Haematopus ostralegus*	Huîtrier pie	Austernfischer
Puffin	*Fratercula arctica*	Macareux moine	Papageitaucher
Razorbill	*Alca torda*	Pinguine torda	Tordalk
Roseate tern	*Sterna dougallii*	Sterne de Dougall	Rosenseeschwalbe
Sandwich tern	*Sterna sandvicensis*	Sterne caugek	Brandseeschwalbe
Shag	*Phalacrocorax aristotelis*	Cormoran huppé	Krähenscharbe
Storm petrel	*Hydrobates pelagicus*	Pétrel tempête	Sturmschwalbe
Marine mammals:			
Bearded seal	*Erignathus barbatus*	Phoque à barbe	Bartrobbe
Blue ling	*Molva dypterygia*	Lingue bleu	Blauleng
Bottlenose dolphin	*Tursiops truncatus*	Hyperoodon	Nördlicher Entenwal
Common dolphin	*Delphinus delphis*	Dauphin des anciens	Gemeiner Delphin
Common seal	*Phoca vitulina*	Phoque commun	Seehund
Fin whale	*Balaenoptera physalus*	Rorqual commun	Finwal
Grey seal	*Halichoerus grypus*	Phoque gris	Kegelrobbe
Harp seal	*Phoca groenlandica*	Phoque de Groënland	Grönländische Robbe
Hooded seal	*Cystophora cristata*	Phoque à capuchon	Klappmütze
Humpback whales	*Megaptera novaeangliae*	Mégaptrère	Buckelwal
Killer whale	*Orcinus orca*	Orque	Schwertwal
Minke whale	*Balaenoptera acutorostrata*	Petit rorqual	Zwergwal
Pilot whale	*Globicephala malaena*	Globicéphale noir	Grindwal
Ringed seal	*Phoca hispida*	Phoque marbré	Ringelrobbe
Risso's dolphin	*Grampus griseus*	Dauphin gris	Rissos Delphin
Sperm whale	*Physeter macrocephalus*	Cachalot	Pottwal
Walrus	*Odobenus rosmarus*	Morse	Walross

White-beaked dolphin	*Lagenorhynchus albirostris*	Dauphin à bec blanc	Langfinnendelphin
White-sided dolphin	*Lagenorhynchus acutus*	Dauphin à flancs blancs	Weisseiten-Delphin
Fish:			
Angler (Monkfish)	*Lophius piscatorius*	Braudroie commune	Seeteufel
Arctic cod	*Boreogadus saida*	Morue polaire	Polardorsch
Bass	*Dicentrarchus labrax*	Bar commun	Meerbarsch
Bib	*Trisopterus luscus*	Tacaud commun	Franzosendorch
Blue-fin tuna	*Thunnus thynnus*	Thon rouge	Roter Thun
Blue-mouth	*Helicolenus dactylopterus*	Sébaste chèvre	Blaumaul
Blue Whiting	*Micromesistius poutassou*	Merlan bleu	Blauer Wittling
Boarfish	*Capros aper*	Sanglier	Eberfisch
Catfish	*Anarrhichas lupus*	Loup	Katfisch
Cod	*Gadus morhua*	Morue commune	Dorsch
Coho salmon	*Oncorhyncus kisutch*	Saumon argénte	Silberlachs
Common dab	*Limanda limanda*	Limanade commune	Scharbe
Common skate	*Raja batis*	Raie grise	Glattroche
Common sole	*Solea vulgaris*	Sole	Seezunge
Cuckoo ray	*Raja naevus*	Raie fleurie	Kuckucks-rochen
Dogfish	*Scyliorhinus canicula*	Aiguillat	Katzenhai
Dragonet	*Callionymus lyra*	Dragonet	Gemeiner leierfisch
Eel	*Anguilla anguilla*	Anguille	Aal
Four-bearded rockling	*Rhinonemus cimbrius*	Motelle à quatre barbillions	Vierbärtelige Seequappe
Grey gurnard	*Eutrigla gurnardus*	Grondin gris	Grauer Knurrhahn
Greater weever	*Trachinus draco*	Grande vive	Petermann
Greater silver smelt	*Argentina silus*	Grande argentine	Goldlachs
Haddock	*Melanogrammus aeglefinus*	Eglefin	Schellfisch
Hake	*Merluccius merluccius*	Merlu	Seehecht
Halibut	*Hippoglossus hippoglossus*	Flétan de l'Atlantique	Heilbutt
Herring	*Clupea harengus*	Hareng commun	Hering
Horse mackerel	*Trachurus trachurus*	Chinchard commun	Stöcker
Houting	*Coregonus lavaretus*	Lavaret	Schnerpel
John Dory	*Zeus faber*	Saint-Pierre	Herings-König
Lemon sole	*Microstomus kitt*	Limanade-sole commune	Echte Rotzunge
Lesser weever	*Trachinus vipera*	Peterman	Vive
Ling	*Molva molva*	Grande lingue	Leng
Long rough dab	*Hippoglossoides platessoides*	Balai de l'Atlantique	Rauhe Scharbe
Mackerel	*Scomber scombrus*	Maquereau commun	Makrele
Megrims	*Lepidorhombus spp*	Cardines	Butte
Mullet	*Mullus surmulletus*	Mulet	Meeräsche
Norway pout	*Trisopterus esmarkii*	Tacaud norvégien	Stintdorsch
Pieterman (dragonet?)			
Pilchard	*Sardina pilchardus*	Sardine commune	Sardine
Plaice	*Pleuronectes platessa*	Plie commune	Scholle
Poor cod	*Trisopterus minutus*	Petit tacaud	Zwergdorch
Pollack	*Pollachius pollachius*	Lieu jaune	Pollack
Rainbow trout	*Oncorhynchus mykiss*	Truite arc-en-ciel	Regenbogenforelle
Red gurnard	*Aspitrigla cuculus*	Grondin rouge	Kuckucksknurrhahn
Roundnous grenardier	*Coryphaenoides rupestris*	Grenardier de roche	Grenaridierfisch
Saithe	*Pollachius virens*	Lieu noir	Köhler
Salmon	*Salmo salar*	Saumon	Lachs

Sandeel	*Ammodytes* spp	Lançon	Sandaal
Sea lamprey	*Petromyzon marinus*	Lamproie marine	Seelamprete
Sea trout	*Salmo trutta*	Truite	Forelle
Smooth hound	*Mustelus mustelus*	Émissole lisse	Südlicher glatthai
Solenette	*Buglossidium luteum*	Petite sole jaune	Zwergzunge
Sprat	*Sprattus sprattus*	Sprat	Sprotte
Spurdog	*Squalus acanthias*	Aiguillat commun	Dornhai
Starry ray	*Raja radiata*	Raie radièe	Atlantischer Stechrochen
Stingray	*Dasyatis pastinaca*	Pastenague commune	Gewöhnlicher Sternrochen
Thornback ray	*Raja clavata*	Raie bouclèe	Nagelroche
Tuna	*Euthynnus quadripunctatus*	Thon	Thunfish
Tusk	*Brosme brosme*	Brosme	Lumb
Turbot	*Psetta maxima*	Turbot	Steinbutt
Whiting	*Merlangius merlangus*	Merlan	Wittling
Lampern	*Lampetra fluviatilis*	Petite lamproie de mer	Flussneunauge
Porbeagle	*Lamna nasus*	Taupe	Heringshai
Blonde	*Raja brachyura*	Raie lisse	Blonde
Spotted ray	*Raja montagui*	Raie	Fleckroche
Sturgon	*Acipenser sturio*	Esturgon	Gemeiner Stör

Shellfish (edible types)

Common cockle	*Cerastoderma edule*	Coque commune	Essbar Herzmuschel
Common shrimp (Northern prawn/ Northern shrimp)	*Crangon vulgaris* *Pandalus borealis*	Crevette grise Crevette nordique	Garnele Tiefseegarnele
Dog welk	*Nucella lapillus*	Bigorneau	Strandschnecke
Edible crab	*Cancer pagurus*	Tourteau	Taschenkrebs
Horse mussel	*Modiolus modiolus*	Moule appât	Grosse Miesmuschel
Lobster	*Homarus gammarus*	Homard	Hummer
Mussel/blue mussel	*Mytilus edulis*	Moule commune	Miesmuschel
Norway lobster	*Nephrops norvegicus*	Langoustine	Kaisergranat
Oyster	*Ostrea edulis*	Huître	Europäische Auster
Pacific oyster	*Crassostrea gigas*	Huître creuse japonaise	Passificshe Felsenauster
Queen scallop	*Chlamys opercularis*	Vanneau	Gedeckelte Kamm-Muschel
Razor clam	*Ensis ensis*	Couteau courbe	Schwertförmige
Scallop	*Pecten maximus*	Coquille Saint-Jacques	Pilgermuschel
Spider crab	*Maja squinado*	Araignèe de mer	Seespinne
Spisula (Surf clam/ Trough shell)	*Spisula solida / Spisula subtruncata*		
Whelk	*Buccinum undatum*	Buccin	Wellhornschnecke
Wincle	*Littorina littorea*	Bigorneau	Strandschnecke

Other species

American tingle	*Urosalpinx cineria*		
Balanus	*Balanus spp.*	Balanes	Seepocken
Banded wedge shell	*Donax vitatis*		
Breadcrumb sponge	*Halichondria panicea*		
Chinese mitten crab	*Eriocheir sinensis*	Crabe chinois	Chinesische Wollhandcrabbe
Cuttlefish	*Sepia officinalis*	Sèche	Sepia
Crysochromulina			

Dead Man's Fingers	*Alcyonium digitatum*		
Dinophysis	*Dinophysis* spp		
Eel gras	*Zostara marina*		
Edible sea-urchin	*Echinus esculentus*	Oursin	Seeigel
Elliptical trough shell	*Spisula elliptica*		
Green sea-urchin	*Psammechinus miliaris*		
Gyrodactylus	*Gyrodactylus salaris*		
Hard-shell clam	*Mercenaria mercenaria*	Praire	Venusmuschel
Helmet crab	*Corystes cassivelaunus*		
Hermit crab	*Paguridae*	Pagures	Einsiedlerkrebse
Knot	*Caladris canatus*		
Maerl			
Manilla clam	*Ruditapes philippinarum*	Palourde japonaise	Islandsmuschel
Mink	*Mustella vison*		
Quahog	*Arctica islandica*	Cyprine	Islandsmuschel
Rag worm	*Nereis diversicolor*		
Rayed trough shell	*Mactra corallina*		
Razor clam	*Ensis directus*	de l'Atlantique	Amerikanische Schwertmuschel
Sabellaria	*Sabellaria* sp.		
	Sabellaria spuinulosa		
Sea-mouse	*Aphrodite aculeata*		
Sea -potato	*Ecinocardium cordatum*		
Ship worm	*Teredo navali*		
Slipper limpet	*Crepidula fornicata*		
Squid	*Loligo* sp.	Calmar	Kalmar
Starfish	*Asteria rubens*	Etoile de mer	Seestern
Striped venus	*Chamelea gallina*	Petite praire	Gestreifte Venusmuschel
Swimming crab	*Liocarcinus holsatus*		
Tower shell	*Turritella communis*		
Zostera	*Zostera* sp.		
	Anthozoa:		
	Sagartiogeton undatus		
	Metridium senile		
	Lophelia pertusa		
	Prosobranchia:		
	Aporrhais pespelecani		
	Bivalvia:		
	Ensis americanus		
	Acanthocordia echinata		
	Parvicardium ovale		
	Dosinia lupidus		
	D. exoleata		
	Acanthocardium		
	Thracia		
	Neptunia antiqua		
	Venus		
	Placopecten		
	Tellinya ferrigunosa		
	Dorsinia lupinus		
	Gastropoda:		
	Neptunea antiqua		
	Paludestrina jenkinsi		

Astropecten irregularis
Solaster papposus
Marenzellaria viridis
Anguillicola crassus

Crepidula fornicata Crèpidule
Odontalla sinesis
Goninemus fornicata
Sargassum muticum
Anguillicola crassus
Paciastacus leniusculus
Bonamia ostreae
Pectinaria korenii

ANNEX V

STATE OF STOCKS IN RELATION TO SAFE BIOLOGICAL LIMITS

(EXTRACTS FROM 1995 ICES ACFM REPORT)

The estimated spawning stock size (tonnes) in 1994 or 1995 and the minimum biologically acceptable level (MBAL) are given where available.

STOCKS IN THE SKAGERRAK AND KATTEGAT (DIVISION IIIa):

Cod in the Skagerrak (8,030 t in 1994)
The state of the stock is uncertain. This stock is part of or closely related to the North Sea stock. As in the North Sea, spawning stock biomass has shown a decline over the period 1982 to 1993. There has been evidence from surveys of strong juvenile abundance in this area.

Cod in the Kattegat
The state of the stock cannot be estimated precisely. The spawning stock has declined steadily for two decades and reached a historically low level in 1991. The fishing mortality has more than doubled over the same period. Due to recent improved recruitment the stock size is increasing. It is, however, evident that fishing mortality is high and that a continuation of this level will hamper stock recovery.

Haddock in Division IIIa
State of stock unknown.

Whiting in Division IIIa
State of stock unknown.

Plaice in Division IIIa
The stock assessment is regarded as uncertain but suggests that fisheries mortality and yield have remained stable over the last decade.

Sole in Division IIIa
The stock size is not known precisely, but both the fishery and surveys indicate that it has been exceptionally high in the period 1988-1994. Surveys in 1995 indicate that recruitment is back to the level before 1988.

***Pandalus borealis* in Division IIIa and Division IVa East (Skagerrak and Norwegian Deeps) (15,700 t in 1995)**
The stock is within safe biological limits. The spawning stock biomass increased in 1994 to a high level, due to the very rich 1992 year class. Both 1993 and 1994 year classes are close to the average level.

Herring in Baltic Sub-divisions 22-24 and Division IIIa (spring-spawners)
The state of the stock is uncertain as available information is conflicting. Landings have decreased in spite of increasing abundance indices and apparently large stock size. Uncertainties in data sources preclude an analytical assessment.

Sprat in Division IIIa
The data available do not allow an evaluation of stock size.

Norway pout in Division IIIa
State of stock unknown.

Sandeel in Division IIIa
State of stock uncertain.

***Nephrops* in Division IIIa**
The state of the stock cannot be precisely assessed but landings per unit effort (LPUE) in recent years are considerably lower than in the mid-1980s and there are indications of overexploitation. The fishing effort in the Skagerrak is now stabilising but effort in the Kattegat continues to decline. Preliminary assessments suggest that current F is above F_{max} in males and close to F_{max} in females.

STOCKS IN THE NORTH SEA (SUB-AREA IV):

Cod in Sub-area IV (North Sea) (78,000 t in 1995; MBAL = 150,000 t)
The stock is considered to be outside safe biological limits. Spawning stock biomass is close to an historical low level and is well below the minimum biologically acceptable level (MBAL) (150,000 t). Only two year classes (1985 and 1993) in the past 10 years have been above average. The stock is considered to be at a level where there is evidence that the low spawning stock biomass has an impact on recruitment. *Status quo* fishing mortality is somewhat above F_{med} (0.81).

Haddock in Sub-area IV (North Sea) (177,000 t in 1995)
The stock is considered to be within safe biological limits. Apart from 1993, all year classes since 1990 have been above average. This has resulted in an increase in the spawning stock from the historical low in 1991. Fishing mortality continues to be high and above F_{med} (0.57).
At current levels of F, the stock will continue to be dependent on the strength of incoming year classes. The 0-group and 1-group survey indices suggest that the 1994 year class is strong.

Whiting in Sub-area IV (North Sea) (256,000 t in 1994)
The state of the stock is uncertain. VPA estimates indicate that SSB has been stable since 1984, whereas an analysis using survey data indicates that it has increased during 1986-1992, followed by a decrease. However, the stock is probably within safe biological limits. Fishing mortality is at a high level.

Saithe in Sub-area IV and Division IIIa (North Sea) (134,000 t in 1995)
This stock is considered to be close to safe biological limits. Total biomass and spawning stock biomass show a continuous downward trend until 1990 when they were at historically low levels, but the present assessment indicates an improvement of the stock. Fishing mortality has shown a decreasing trend since 1986 and is now close to F_{med} (0.47).

North Sea plaice (236,000 t in 1995; MBAL = 300,000 t)
The stock is considered to be outside safe biological limits. Fishing mortality has increased steadily since the 1950s and is currently fluctuating around a record high level. Spawning stock biomass has varied in relation to recruitment, but has declined rapidly since 1990 to a historical low in 1995. The minimum biologically acceptable level (MBAL) for this stock is considered to be 300,000 t. Since the mid 1980s a decrease has been observed in mean weight at age which has contributed to the recent reduction in yield and SSB.

North Sea sole (72,000 t in 1995; MBAL = 35,000 t)
The stock is considered to be within safe biological limits. The spawning stock is presently slightly above average, and is well above the minimum biologically acceptable level (MBAL) (35,000 t). The two very strong year classes of 1987 and 1991 have rebuilt SSB from historical low levels in the 1980s. Fishing mortality is stable at a high level. Recruitment is highly variable. Three recent year classes (1992-1994) are estimated as average or below average.

Hake - Northern stock (Division EIII, Sub-areas IV, VI and VII, and Divisions VIIIa,b) (125,600 t in 1995)
The stock is considered to be outside safe biological limits. SSB has been decreasing continuously since 1987, reaching new record-low levels in each year since 1991. Current SSB is 30% below the long-term average. Fishing mortality has been increasing in recent years and is 20% above average.

Herring in Sub-area IV, Division VIId and Division IIIa (autumn-spawners)

> **Total stock complex (764,000 t in 1995; MBAL = 800,000 t)**
> This stock is now considered to be outside safe biological limits. SSB has declined since 1989 and the most recent assessment indicates that it has fallen below 800,000 t - the level which is considered to be the minimum biologically acceptable level (MBAL) for this stock. Exploitation has been high since the early 1980's, and since 1990 has caused erosion of the older stock so that the fishery has again become dependent upon recruiting year classes. There is evidence of reduced recruitment in this stock when SSB is below 800,000 t.
>
> **Herring in Divisions IVc and VIId (Downs herring)**
> The current state of the stock is not known.

Sprat in the North Sea (Sub-area IV)
The present state of the stock is not known. However, both recruitment and biomass appear to be high at present.

Mackerel (Combined Southern, Western and North Sea spawning components) (2,121,000 t in 1995)
The stock may be outside safe biological limits. The time series is too short to evaluate this fully from the combined assessment, but the assessment of the Western component indicates that the SSB is at the lowest recorded level. The North Sea component was above 3 million t in the early 1960's. No information is available on the size of the other stock components during this period. The combined assessment indicates increasing fishing mortalities in recent years.

Western component
Large catches of this component are taken in the North Sea and Norwegian Sea.

The spawning component of the Western area was estimated in international egg surveys in 1995, and a preliminary estimate is 1.97 million t which is close to the historical minimum and close to the spawning biomass predicted by ACFM in 1994. This component declined and is at its lowest level since 1972.

North Sea component
From tagging experiments a spawning biomass was estimated in the early sixties, before the boom in the purse seine fishery, of over 3 million t. The last big year class observed in this stock was the 1969 year class which was produced by a spawning biomass of 1.1 million t. The stock rapidly declined. The spawning biomass declined to less than 200,000 t in the early 1980s, and to 78,000 t (about 3% of the Western component) in 1990. There have been no signs of any strong year classes in the international bottom trawl surveys in the North Sea.

The component is severely depleted. Limited egg surveys in 1991 and 1992 indicate no change in the SSB since 1990. A new egg survey will be carried out in June-July 1996.

North Sea horse mackerel (Division IIIa (eastern part), Divisions IVb,c, VIId)
Egg surveys in 1988 and 1990 indicated a spawning stock biomass of more than 200,000 t. There is no information as to the present state of the stock.

Western horse mackerel (Divisions IIa, IVa, Vb, VIa, VIIa-c, e-k, VIIIa,b,d,e) (1,640,000 t in 1995)
Changes in migration pattern became evident at the end of the 1980s when the largest fish in the stock (mainly the 1982 year class) migrated into Divisions IVa and IIa during the 3rd and 4th quarters. Since 1987 considerable catches have been taken by the Norwegian purse seine fleet for reduction purposes particularly in Division IVa, while most catches of other countries have been taken for human consumption purposes in Sub-areas VI, VII and Division VIIIa,b,d,e. The 1982 year class has dominated the catches for many years and still constitutes in 1994 a major part (56% by weight and 38% in numbers) of the catches.

The stock is considered to be within safe biological limits. The preliminary spawning stock biomass estimate of 1.64 million t based on the 1995 egg surveys, is well above the SSB producing the 1982 year class. Egg surveys in 1992 and 1995 and an analytical evaluation show a reduction in SSB from 2.5 million t in 1992 to 1.6 million t in 1995.

Norway pout in Sub-area IV (183,710 t in 1994)
The stock is considered to be within safe biological limits. Recruitment is highly variable and can influence the SSB rapidly due to the short life span of the species. The 1993 year class is likely to be very strong but the estimate is still uncertain. SSB has increased in recent years and is at a high level. Fishing mortality has declined.

Sandeel in Sub-area IV (989,000 t in 1994)
The stock appears to be within safe biological limits. For the last 20 years, SSB and recruitment have fluctuated without any particular trend. The spawning stock has fluctuated between 500,000 and 1,200,000 t except in 1987 and 1988 when the strong 1985 year class brought the SSB up to around 1,700,000 t. Fishing mortality has decreased in recent years and is estimated to be approximately half F_{med} (0.63) in 1994.

Sandeel in the Shetland area
Spawning biomass has increased due to maturation of the strong 1991 year class and the protection afforded by the closure of the fishery, but the precise level is uncertain. The 1993 year class is above average. The stock is probably within safe biological limits.

Blue whiting combined stock (Sub-areas I-IX, XII and XIV)
Most of the catches are taken in the directed pelagic trawl fishery in the spawning and post-spawning areas (Divisions Vb, VIa,b and VIIb,c) but they are also caught in an industrial mixed fishery in Sub-area IV and Division IIIa and in the pelagic trawl fishery in the Norwegian Sea (Sub-areas I and II, Divisions Va, XIVa, b).

The stock size is not precisely known. The acoustic data series indicates a decrease in SSB from 1982 to 1992 and an increase in 1995. The strong 1989 year class is still dominating in the adult stock and the acoustic surveys in 1995 indicate that the 1994 year class is also strong.

***Pandalus borealis* in Division IVa Fladen Ground**
State of stock not known.

***Pandalus borealis* in Division IVb Farn Deeps**
No information on the state of the stock.

***Nephrops* in Division IVa Rectangles 44-48 E6-E7+44E8**
a) Moray Firth: long-term data series show LPUE with a low value in 1994. Effort is relatively stable at a level well below the high values of 1986-1990. Yield per recruit analysis from the length-based assessment suggests that the stock is fully exploited at current levels of effort, with current F slightly above F_{max} in males, but well below F_{max} in females. The age-based assessment suggests that F in males has fallen in line with effort.

b) Noup: LPUE fluctuating and relatively high in 1994. Effort has expanded rapidly to its highest level in 1994.

The stocks in this Management Area are fully exploited.

***Nephrops* in Division IVa (Rectangles not included above)**
LPUE remains high (Scotland) and very high (Denmark). TV camera surveys suggest that the stock is not fully exploited and that it could sustain increased fishing effort. Fishing effort by *Nephrops* trawlers is stabilising, but landings by other categories of vessels are rising rapidly. Effort is not considered to be high in relation to the area of ground available.

***Nephrops* in Divisions IVb,c east of 1°E**
LPUEs of males have increased since 1991. Female LPUEs fluctuating depending on availability in the third quarter. Mean size of males has decreased slightly, that of females stable over the time series 1986-1994.

Current F is close to F_{max} for males and far below F_{max} for females. The stock is considered to be fully exploited.

***Nephrops* in Divisions IVb,c west of 1°E**
a) Farn Deeps: Catch per unit effort (CPUE) fairly stable, while LPUE increased, probably due to a change in discarding pattern. Age-based assessment suggests that male stock has been stable but declined recently. F has again increased following previous lower values. Yield per recruit analysis suggests that current F is above F_{max} in males but below F_{max} in females.

b) Firth of Forth: LPUE at a relatively low level. Mean size in catch and landings declined in 1994. Age-based assessment suggests that F is high on males, although the stock biomass and recruitment are relatively stable. Yield per recruit analysis suggests that current F is well above F_{max} in males and below F_{max} in females.

STOCKS IN THE ENGLISH CHANNEL:

Cod in Division VIId (Eastern English Channel) (420 t in 1994)
The cod in Division VIId is considered to be outside safe biological limits similarly to the North Sea cod stock. An independent assessment of the cod stock in this area indicates the same trends in terms of spawning stock biomass (SSB) and recruitment as found in the North Sea. The cod stock in Division VIId cannot be considered to be separate from the North Sea stock and is therefore considered to be in the same state as the North Sea stock.

Cod in Division VIIe (Western English Channel)
State of stock unknown; catches suggest that the stock may be at a very low level.

Whiting in Division VIId (Eastern English Channel) (10,700 t in 1995)
The state of the stock is uncertain. The spawning stock is around its lowest recorded level. An independent assessment of the whiting stock in this area indicates the same trends in spawning biomass and recruitment as the North Sea whiting stock. The whiting stock in Division VIId cannot be considered to be separate from the North Sea stock and is therefore considered to be in the same state as the North Sea stock.

Whiting in Division VIIe (Western English Channel)
State of stock not known.

Sole in Division VIId (Eastern English Channel) (9,500 t in 1995)
The stock is considered to be within safe biological limits. Spawning stock biomass is above the average of a series that starts in 1982. Fishing mortality is relatively stable. Recent recruitment is above average.

Sole in Division VIIe (Western English Channel) (3,000 t in 1995)
The stock is considered to be close to safe biological limits. SSB has declined since 1980 due to high fishing mortality and poor recent recruitment. It has remained stable at a low level since 1989. The 1989 year class was strong but subsequent year classes have

been average or below average. There is evidence that recruitment is reduced at low SSB. Although fishing mortality has declined in recent years, it remains higher than levels in the early 1970s. Current F appears to be in the region of F_{med} (0.25). The lower values of recruitment at present low levels of SSB are a cause for concern.

Plaice in Division VIId (Eastern English Channel) (10,500 t in 1995)
The stock is considered to be within safe biological limits. SSB increased rapidly until 1989, following recruitment of the strong 1985 year class. Fishing mortality has decreased somewhat in recent years. Apart from one above average year class (1991), recent recruitment has been close to average.

Plaice in Division VIIe (Western English Channel) (1,590 t in 1995)
The stock is close to or outside safe biological limits. SSB reached a peak level in 1989-1990, following a series of good year classes in the mid 1980s, but has declined rapidly and is close to lowest recorded levels. This is due to both high fishing mortality and low recruitment. There is evidence that recruitment is reduced at low SSB. Fishing mortality has been increasing throughout the assessment period, is currently close to a record high and is above F_{med} (0.62).

Sprat in Divisions VIId,e
The present state of the stock is not known.

ANNEX VI

FAO CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

ARTICLE 6 - FISHERIES MANAGEMENT

6.1 General

6.1.1 States and all those engaged in fisheries management should, through an appropriate policy, legal and institutional framework, adopt measures for the long-term conservation and sustainable use of fisheries resources. Conservation and management measures, whether at local, national, subregional or regional levels, should be based on the best scientific evidence available and be designed to ensure the long-term sustainability of fishery resources at levels which promote the objective of their optimum utilization and maintain their availability for present and future generations; short term considerations should not compromise these objectives.

6.1.2 Within areas under national jurisdiction, States should seek to identify relevant domestic parties having a legitimate interest in the use and management of fisheries resources and establish arrangements for consulting them to gain their collaboration in achieving responsible fisheries.

6.1.3 For transboundary fish stocks, straddling fish stocks, highly migratory fish stocks and high seas fish stocks, where these are exploited by two or more States, the States concerned, including the relevant coastal States in the case of straddling and highly migratory stocks, should co-operate to ensure effective conservation and management of the resources. This should be achieved, where appropriate, through the establishment of a bilateral, subregional or regional fisheries organization or arrangement.

6.1.4 A subregional or regional fisheries management organization or arrangement should include representatives of States in whose jurisdictions the resources occur, as well as representatives from States which have a real interest in the fisheries on the resources outside national jurisdictions. Where a subregional or regional fisheries management organization or arrangement exists and has the competence to establish conservation and management measures, those States should co-operate by becoming a member of such organization or a participant in such arrangement, and actively participate in its work.

6.1.5 A State which is not a member of a subregional or regional fisheries management organization or is not a participant in a subregional or regional fisheries management arrangement should nevertheless co-operate, in accordance with relevant international agreements and international law, in the conservation and management of the relevant fisheries resources by giving effect to any conservation and management measures adopted by such organization or arrangement.

6.1.6 Representatives from relevant organizations, both governmental and non-governmental, concerned with fisheries should be afforded the opportunity to take part in meetings of subregional and regional fisheries management organizations and

arrangements as observers or otherwise, as appropriate, in accordance with the procedures of the organization or arrangement concerned. Such representatives should be given timely access to the records and reports of such meetings, subject to the procedural rules on access to them.

6.1.7 States should establish, within their respective competencies and capacities, effective mechanisms for fisheries monitoring, surveillance, control and enforcement to ensure compliance with their conservation and management measures, as well as those adopted by subregional or regional organizations or arrangements.

6.1.8 States should take measures to prevent or eliminate excess fishing capacity and should ensure that levels of fishing effort are commensurate with the sustainable use of fishery resources as a means of ensuring the effectiveness of conservation and management measures.

6.1.9 States and subregional or regional fisheries management organizations or arrangements should ensure transparency in the mechanisms for fisheries management and in the related decision-making process.

6.1.10 States and subregional or regional fisheries management organizations or arrangements should give due publicity to conservation and management measures and ensure that laws, regulations and other legal requirements governing their implementation are effectively disseminated. The bases and purposes of such measures should be explained to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures.

6.2 Management objectives

6.2.1 Recognizing that long-term sustainable use of fisheries resources is the overriding objective of conservation and management, States and subregional or regional fisheries management organizations or arrangements should, *inter alia*, adopt appropriate measures, based on the best scientific evidence available, which are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing States.

6.2.2 Such measures should provide that, *inter alia*:

(a) excess fishing capacity is avoided and exploitation of the stocks remains economically viable;

(b) the economic conditions under which fishing industries operate promote responsible fisheries;

(c) the interests of fishers, including those engaged in subsistence, small-scale and artisanal fisheries, are taken into account;

(d) biodiversity of aquatic habitats and ecosystems is conserved and endangered species are protected;

(e) depleted stocks are allowed to recover or, where appropriate, are actively restored;

(f) adverse environmental impacts on the resources from human activities are assessed and, where appropriate, corrected; and

(g) pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and impacts on associated or dependent species are minimized, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques.

6.2.3 States should assess the impacts of environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationships within the ecosystems.

6.3 Management framework and procedures

6.3.1 To be effective, fisheries management should be concerned with the whole stock unit over its entire area of distribution and take into account previously agreed management measures established and applied in the same region, all removals and the biological unity and other biological characteristics of the stock. The best scientific evidence available should be used to determine, *inter alia*, the area of distribution of the resource and the area through which it migrates during its life cycle.

6.3.2 In order to conserve and manage transboundary fish stocks, straddling fish stocks, highly migratory fish stocks and high seas fish stocks throughout their range, conservation and management measures established for such stocks in accordance with the respective competences of relevant States or, where appropriate, through subregional and regional fisheries management organizations and arrangements, should be compatible. Compatibility should be achieved in a manner consistent with the rights, competences and interests of the States concerned.

6.3.3 Long-term management objectives should be translated into management actions, formulated as a fishery management plan or other management framework.

6.3.4 States and, where appropriate, subregional or regional fisheries management organizations or arrangements should foster and promote international co-operation and co-ordination in all matters related to fisheries, including information gathering and exchange, fisheries research, management and development.

6.3.5 States seeking to take any action through a non-fishery organization which may affect the conservation and management measures taken by a competent subregional or regional fisheries management organization or arrangement should, to the extent practicable, consult in advance, with the latter, and take its views into account.

6.4 Management advice and data gathering

6.4.1 When considering the adoption of conservation and management measures, the best scientific evidence available should be taken into account in order to evaluate the current state of the fishery resources and the possible impact of the proposed measures on the resources.

6.4.2 Research in support of fishery conservation and management should be promoted, including research on the resources and on the effects of climatic, environmental and socio-economic factors. The results of such research should be disseminated to interested parties.

6.4.3 Studies should be promoted which provide an understanding of the costs, benefits and effects of alternative management options designed to rationalize fishing, in particular, options relating to excess fishing capacity and excessive levels of fishing effort.

6.4.4 States should ensure that timely, complete and reliable statistics on catch and fishing effort are collected and maintained in accordance with applicable international standards and practices and in sufficient detail to allow sound statistical analysis. Such data should be updated regularly and verified through an appropriate system. States should compile and disseminate such data in a manner consistent with any applicable confidentiality requirements.

6.4.5 In order to ensure sustainable management of fisheries and to enable social and economic objectives to be achieved, sufficient knowledge of social, economic and institutional factors should be developed through data gathering, analysis and research.

6.4.6 States should compile fishery-related and other supporting scientific data relating to fish stocks covered by subregional or regional fisheries management organizations or arrangements in an internationally agreed format and provide them in a timely manner to the organization or arrangement. In cases of stocks which occur in the jurisdiction of more than one State and for which there is no such organization or arrangement, the States concerned should agree on a mechanism for co-operation to compile and exchange such data.

6.4.7 Subregional or regional fisheries management organizations or arrangements should compile data and make them available, in a manner consistent with any applicable confidentiality requirements, in a timely manner and in an agreed format to all members of these organizations and other interested parties in accordance with agreed procedures.

6.5 Precautionary approach

6.5.1 States should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.

6.5.2 In implementing the precautionary approach, States should take into account, *inter alia*, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distributions of fishing mortality and the impact of fishing activities, including discards, on non-target and associated or dependent species, as well as environmental and socio-economic conditions.

6.5.3 States and subregional or regional fisheries management organizations or arrangements should, on the basis of the best scientific evidence available, *inter alia*, determine:

(a) stock specific target reference points, and, at the same time, the action to be taken if they are exceeded; and

(b) stock-specific limit reference points, and, at the same time, the action to be taken if they are exceeded; when a limit reference point is approached, measures should be taken to ensure that it will not be exceeded.

6.5.4 In the case of new or exploratory fisheries, States should adopt as soon as possible cautious conservation and management measures, including, *inter alia*, catch limits and effort limits. Such measures should remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment should be implemented. The latter measures should, if appropriate, allow for the gradual development of the fisheries.

6.5.5 If a natural phenomenon has a significant adverse impact on the status of living aquatic resources, States should adopt conservation and management measures on an emergency basis to ensure that fishing activity does not exacerbate such adverse impact. States should also adopt such measures on an emergency basis where fishing activity presents a serious threat to the sustainability of such resources. Measures taken on an emergency basis should be temporary and should be based on the best scientific evidence available.

6.6 Management measures

6.6.1 States should ensure that the level of fishing permitted is commensurate with the state of fisheries resources.

6.6.2 States should adopt measures to ensure that no vessel be allowed to fish unless so authorized in a manner consistent with international law for the high seas or in conformity with national legislation within areas of national jurisdiction.

6.6.3 Where excess fishing capacity exists, mechanisms should be established to reduce capacity to levels commensurate with the sustainable use of fisheries resources so as to ensure that fishers operate under economic conditions that promote responsible fisheries. Such mechanisms should include monitoring the capacity of fishing fleets.

6.6.4 The performance of all existing fishing gear, methods and practices should be examined and measures taken to ensure that fishing gear, methods and practices which are not consistent with responsible fishing are phased out and replaced with more acceptable alternatives. In this process, particular attention should be given to the impact of such measures on fishing communities, including their ability to exploit the resource.

6.6.5 States and fisheries management organizations or arrangements should regulate fishing in such a way as to avoid the risk of conflict among fishers using different vessels, gear and fishing methods.

6.6.6 When deciding on the use, conservation and management of fisheries resources, due recognition should be given, as appropriate, in accordance with national laws and regulations, to the traditional practices, needs and interests of indigenous people and local fishing communities which are highly dependent on fishery resources for their livelihood.

6.6.7 The cost-effectiveness and social impact of alternative conservation and management measures should be considered in the evaluation of such measures.

6.6.8 The efficacy of conservation and management measures and their possible interactions should be kept under continuous review. Such measures should, as appropriate, be revised or abolished in the light of new information.

6.6.9 States should take appropriate measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, and negative impacts on associated or dependent species, in particular endangered species. Where appropriate, such measures may include technical measures related to fish size, mesh size or gear, discards, closed seasons and areas, zones reserved for selected fisheries, particularly artisanal fisheries. Such measures should be applied, where appropriate, to protect juveniles and spawners. States and subregional or regional fisheries management organizations or arrangements should promote, to the extent practicable, the development and use of selective and environmentally safe gear and techniques.

6.6.10 States and subregional and regional fisheries management organizations and arrangements, in the framework of their respective competences, should introduce measures for depleted resources and those threatened with depletion that facilitate the sustained recovery of such stocks. They should make every effort to ensure that resources and habitats critical to the well-being of such resources, which have been adversely affected by fishing or other human activities, are restored.

6.7 Implementation

6.7.1 States should ensure that an effective legal and administrative framework at the local and national level, as appropriate, is established for fisheries resource conservation and fisheries management.

6.7.2 States should ensure that laws and regulations provide for sanctions applicable in respect of violations that are adequate in severity to be effective, including sanctions which allow for the refusal, withdrawal or suspension of authorizations to fish in the event of non-compliance with conservation and management measures in force.

6.7.3 States, in conformity with their national laws, should implement effective fisheries monitoring, control, surveillance and law enforcement measures including, where appropriate, observer programmes, inspection schemes and vessel monitoring systems. Such measures should be promoted and, where appropriate, implemented by subregional or regional fisheries management organizations or arrangements in accordance with procedures agreed by such organizations or arrangements.

6.7.4 States and subregional or regional fisheries management organizations or arrangements, as appropriate, should agree on the means by which the activities of such

organizations or arrangements will be financed, bearing in mind, *inter alia*, the relative benefits derived from the fishery and the differing capacities of countries to provide financial and other contributions. Where appropriate, and when possible, such organizations and arrangements should aim to recover the costs of fisheries conservation, management and research.

6.7.5 States which are members of, or participants in, subregional or regional fisheries management organizations or arrangements, should implement internationally agreed measures adopted in the framework of such organizations or arrangements and consistent with international law, to deter the activities of vessels flying the flag of non-members or non-participants, which engage in activities which undermine the effectiveness of conservation and management measures established by such organizations or arrangements.

6.8 Financial institutions

6.8.1 Without prejudice to relevant international agreements, States should encourage banks and financial institutions not to require, as a condition of a loan or mortgage, fishing vessels or fishing support vessels to be flagged in a jurisdiction other than that of the State of beneficial ownership where such a requirement would have the effect of increasing the likelihood of non-compliance with international conservation and management measures.

GUIDELINES FOR APPLICATION OF PRECAUTIONARY REFERENCE POINTS IN CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

1. A precautionary reference point is an estimated value derived through an agreed scientific procedure, which corresponds to the state of the resource and of the fishery, and which can be used as a guide for fisheries management.

2. Two types of precautionary reference points should be used; conservation, or limit, reference points and management, or target, reference points. Limit reference points set boundaries which are intended to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield. Target reference points are intended to meet management objectives.

3. Precautionary reference points should be stock-specific to account, *inter alia*, for the reproductive capacity, the resilience of each stock and the characteristics of fisheries exploiting the stock, as well as other sources of mortality and major sources of uncertainty.

4. Management strategies shall seek to maintain or restore populations of harvested stocks, and where necessary associated or dependent species, at levels consistent with previously agreed precautionary reference points. Such reference points shall be used to trigger pre-agreed conservation and management action. Management strategies shall

include measures which can be implemented when precautionary reference points are approached.

5. Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low. If a stock falls below a limit reference point or is at risk of falling below such a reference point, conservation and management action should be initiated to facilitate stock recovery. Fishery management strategies shall ensure that target reference points are not exceeded on average.

6. When information for determining reference points for a fishery is poor or absent, provisional reference points shall be set. Provisional reference points may be established by analogy to similar and better-known stocks. In such situations, the fishery shall be subject to enhanced monitoring so as to enable revision of provisional reference points as improved information becomes available.

7. The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points. For stocks which are not over-fished, fishery management strategies shall ensure that fishing mortality does not exceed that which corresponds to maximum sustainable yield, and that the biomass does not fall below a pre-defined threshold. For over-fished stocks, the biomass which would produce maximum sustainable yield can serve as a rebuilding target.

ANNEX VII

CRITERIA FOR THE SELECTION OF CLOSED AREAS

Developed by ICES

1. LOCATION

Fishing impact

In order to study the effect of fishing, an area must be selected which at present is heavily exploited by bottom trawl fisheries, because only then can a maximum response of the benthic communities to the cessation of fishing be expected. In selecting potential locations for a closed area, possible confounding factors must be taken into account. Thus, areas should be avoided where the expected background level of natural disturbances of the seabed due to tidal currents and storm surges are large. These effects are directly related to water depth, and shallow areas are therefore less suitable. Another important confounding factor would be if during a closure the benthic community were affected by oxygen deficiencies, because the direct and indirect effects of such events are undoubtedly larger than those caused by fisheries. Therefore, areas should be avoided in which mass mortalities caused by lack of dissolved oxygen in bottom waters have been reported.

Representativeness

Areas to be selected for experimental closure should be representative of larger marine areas in terms of habitat types, the fauna they support, and the fishing activity they experience. The habitat type and the benthic communities are mainly determined by the sediment type and the water depth and, therefore, such factors must be taken into account.

Homogeneity

Uniformity of sediments and communities within the closed area is an important criterion in order to minimize sampling variance. This is particularly important, because it is likely that any differences in sediment types and associated communities will also be reflected in the microdistribution of fishing effort before the area was closed. Therefore, coastal areas showing marked depth gradients are in general less suitable, but also deeper areas with marked variations in depth or substrate should be avoided.

The development of the communities within closed areas must be evaluated against the development in the surrounding areas which will continue to be fished. Therefore, the homogeneity of a larger region, in which the closed area is chosen, is an important criterion.

Sensitivity of the communities

As a general rule, benthic communities in rocky areas or in areas with gravel and stones are characterized by higher biomasses of epifauna, whereas in the more silty areas the infauna is better developed. All trawl fisheries can be expected to have an impact on the epifauna, but beam trawls and dredges also disturb the surface layers of the sediment and therefore impact the infauna to a varying degree, depending on sediment type and the preferred depth of the organisms. Because sedentary organisms are probably more sensitive to gear scraping over the bottom than many free-moving animals, gravel and rocky areas are probably more sensitive to bottom trawling in general, whereas silty areas will be particularly affected by beam trawls. The sensitivity of the bottom fauna to trawling gear obviously varies and effects of trawl fisheries can therefore be expected to be very different in different regions. Extrapolation of the results from one habitat type to another will be problematic if not impossible.

Biodiversity

Although biodiversity would clearly be a criterion for protecting marine habitats, this does not apply to experimental closures, because in this case the primary interest would be to investigate whether the number of species would increase in an area after it has been heavily impacted relative to reference areas.

Historic data

If possible, the areas to be closed should include sites which have been the subject of intensive study of the benthic communities in the past, so that historic trends in various parameters can be used in order to evaluate future developments.

2. SIZE AND SHAPE

There is no general *a priori* criterion for defining the size and shape of a closed area for investigating the impact of trawl fisheries and they will largely be determined by the type of hypotheses that one might wish to include in the research programme. However, an important consideration is the grid system on which data have been collected in the past. For instance, in the ICES area, an extensive database has been built up regarding the distribution of fishing effort, commercial catches and survey abundance based on the approximately 30 nm by 30 nm grid system, as defined by ICES statistical rectangles. Therefore, scientific evaluation of the effects of experimental closures would be greatly facilitated if the boundaries of a closed area corresponded to one or a multiple of ICES rectangles. Other considerations that might be taken into account are existing regulations with respect to fisheries management in order to facilitate legal enforcement.

Important means of monitoring the development of benthic communities and fish assemblages include the use of grab sampling and bottom trawling gear by research vessels. Because the latter in particular should not interfere with the undisturbed development of biota, the areas chosen must be large enough to reduce the amount affected by sampling to a negligible fraction. Trawl hauls typically sweep an area of approximately 30 nm by 1.5 nm and some ten repetitive hauls might have to be made during any one survey. This suggests that a closed area should cover an area of at least 30 nm x 30 nm. For the less mobile benthic species, such a size would make it possible to identify border effects of the closure and/or the development of possible gradients within the area. Larger areas undoubtedly offer greater protection to more mobile animals such

as fish, and possible radiating effects on the surrounding areas would undoubtedly also be more pronounced.

3. DURATION

Marine biota at temperate latitudes typically reproduce on an annual cycle, which means that there is only one period of settlement or arrival of young organisms each year. Given the marked interannual variation in recruitment and the longevity of many of the organisms belonging to the benthic fauna and the demersal fish assemblages, it cannot be expected that the community response in an undisturbed area will be very rapid. It would probably take at least five years before statistically significant trends might be observed. The ultimate goal of closing an area for scientific purposes is to give advice on the consequences of closed areas in the marine environment compared with other possible management measures. There is no basis for predicting how many years a box must be closed before the scientific evidence is available to give advice on the utility of the concept of closed areas in general. Still, it would seem appropriate to evaluate the results after a period of five years. If at that stage either no response or a significant response is detected, then a continuation of expensive research may not be the logical road to follow. If there are still scientific uncertainties as to the effects, then a prolongation by another five years may be required. However, if scientific research into the development of benthic communities in the absence of fishing were accepted as a goal in itself, then the area should be closed indefinitely.

4. CONSEQUENCES FOR FISHERIES

Closing an area to all fishing will undoubtedly be perceived as causing an economic loss and, therefore, the fishing industry might strongly argue for selecting an area where fishing is not very intensive. However, as stated under the scientific considerations, the basic idea of setting closed areas is to study the development in regions which have been subjected to heavy fishing pressure after this impact is removed. If information is available on the relative amount of fishing in the area selected for closure or, even better, if the value of the fishery in the area is known, this is useful in obtaining a first estimate of the extent to which the industry will be affected. However, such data cannot be used to estimate the true losses. Because the closure of an area may merely result in a shift of fishing effort to other areas, the losses will partly be compensated, particularly because many commercially important fish species perform considerable annual migrations and dispersal is generally high. The partial protection of these species in the closed area is therefore expected to be small, because the fish will be caught sooner or later when they move out of the box. If a loss in overall yield were to be observed, this might be interpreted as a significant result, because it would imply that a closed area contributes to the protection of the species in question. The same argument does not apply to, e.g., *Nephtops* and shrimp fisheries, because of the sedentary habits of these species. There is no virtue in investigating the relevance of closed areas for protecting such species, because that is self-evident. If coastal areas are closed, this may also impact the artisan fishermen relative to commercial fleets, because the former may have no choice to fish elsewhere.

5. CONSEQUENCES FOR OTHER USES OF THE SEA

Apart from fisheries, there are several other uses of the sea that need to be taken into account when closed areas are considered. The major ones are sand and gravel extraction, the offshore industry, cable laying, shipping, military activities, and dumping. Due to the scale of these activities, the effects on the benthic systems are thought to be less than those of fisheries. However, when selecting the location of areas closed to fishing on the criteria set out above, it is likely that a number of alternative sites may be possible. Since pollution and contamination may have an additional impact on benthic communities, it would seem wise to choose an area for study as far away as possible from point sources of discharges and major sources of contaminants, such as estuaries of rivers draining highly industrialised catchment areas.

Sand extraction and maintenance dredging

Sand extraction, especially with standard dredging techniques using outwash to remove the very fine sand particles, creates so called "dredge plumes" of fine material. These plumes may spread over large distances (up to 10 - 20 km) before the material is completely dispersed and resettled on the bottom. The same is true when shipping channels are deepened using maintenance dredging. Hence, closed areas should not be situated near shipping routes which are regularly dredged.

Licences for sand extraction should not be given for sites close to closed areas where there is a realistic risk that fine material from the outwash will resettle within the closed area. Thus, a closed area and reference sites should have an additional buffer zone where no sand extraction is allowed. The width of such a zone should be determined by the hydrological and sedimentological characteristics of the area involved. In consequence, the buffer zone may be wider on some sides of the closed area than on others.

Gravel extraction

Deposits with an adequate concentration of gravel to support exploitation are relatively rare and are mainly found off England, in areas such as on the Channel coast and the Norfolk coast, and on the French Channel coast, e.g., in the Dieppe area. Smaller gravel areas are found in the central North Sea, e.g., the Silver Pit area and on the Cleaver Bank. It is now becoming a more common practice to mine gravel resources rather than simply to dredge them. The difference is that, when mined, a sand and gravel mix is dredged in an area with a high gravel content and it is brought in total to the port of delivery. When gravel is dredged the former way, the sand is washed out at the hold via an overflow (outwash).

Gravel deposits are leased by governments for a number of years with a limit on the amount allowed to be taken. Black boxes and various control systems ensure that only the leased area is affected. Gravel extraction will only take place in areas with a high gravel content. The more favourable economics of gravel extraction should make it possible to carry out such extraction in areas well removed from closed areas. Gravel, commanding a much higher price than sand, can be economically transported over much greater distances. Hence, it should be possible to avoid conflicts between industry requirements and closed areas.

Offshore oil and gas industry

Governments control the exploitation of offshore oil and gas reserves by a system of concessions. Initial reconnaissance licences are given for exploratory seismic surveys. However, once an area has been investigated with 3D seismic (in a few cases, with 2D seismic) surveys, further surveys are generally not required. Seismic surveys cause limited damage from the arrays (up to six meters) for most species. However, fish with swim bladders that are swimming above hard bottoms or in enclosed areas (fjords) may be affected over greater distances (several kilometres). Seismic surveys are carried out within restricted time frames after which exploration licences may be issued and exploratory drilling takes place. When apparent reserves warrant exploitation, platforms of a different nature are installed for longer periods (10 - 20 years). Closed areas should not be established near new oil or gas fields. Near established fields it should be recognised that occasionally additional wells may be drilled. Also, there will be a daily stream of traffic to and from the working and manned platforms, and production water will be discharged. At an early date administrators dealing with the licensing of oil and gas exploration activities should be counselled concerning whether the establishment of a closed area is in conflict and/or whether measures can be taken to avoid conflicts. When determining the location of closed areas, all information on concessions granted should be available before a final decision is made.

Marine pipelines are the safest method of transporting gas and oil over long distances. The life span of a pipe-line is about 30 - 50 years depending on the diameter. Small-diameter pipelines have a shorter life span than larger ones. In very few cases are pipelines taken up and reused after a field becomes exhausted. The effects of burying pipelines (trenching) are of short duration. In some areas of the North Sea, pipelines sand themselves in via a process of self-burial. Even if a pipeline has to cross a closed area, the disturbing effects will be local and of short duration: one-half to two years, depending on the method of laying.

Telephone cables and power cables

Old wire telephone cables are being phased out and are often recovered. The new glass fibre cables are very easily damaged. They are therefore ploughed directly into the seabed. Power cables, due to their weight, usually sand themselves in. However, in areas with a high risk of damage they are directly buried. International laws regulate the laying of cables. Governments have no right to interfere with cables connecting other countries, even if these cables run over their continental shelves. For a closed area, cables offer no serious hindrance.

Shipping

Large areas in the southern North Sea are designated as shipping routes. Except when disasters occur, shipping causes no great impact on the organisms on the sea bottom. Fishing vessels and research vessels operating in shipping routes may cause a danger. Notwithstanding recommended shipping routes based on sound safety regulations, vessels at present cannot be forced to follow the routes. Areas with heavy shipping traffic should be avoided when establishing closed areas. In relatively shallow water, large draught ships may disturb the bottom with their pressure waves and propeller wash.

Military exercise areas

All military exercise areas are well indicated on charts. It is known that fish with swim bladders may be affected, and that sea urchins crawl out of the sediment when exposed to pressure waves from large explosions. Therefore, areas where these type of activities take place should be avoided.

Dumping areas of dredged material

It is common practice to dump clean or lightly contaminated harbour dredgings into the sea. Also, when maintenance dredging is carried out in seaways, the material is dumped in the vicinity. Closed areas should be chosen far away from dumping sites and regularly dredged shipping lanes.

6. OTHER CONSIDERATIONS

There are a number of other issues directly related to the establishment of closed areas for scientific purposes which should be carefully considered before actually embarking on their establishment. Probably the most important issue is the funding of the appropriate research programmes, both in the closed area and in the reference areas. This also requires the continued commitment of research institutes over the duration of the closure. A second important issue is the adequacy of the legal instruments to enforce the restrictions imposed on fisheries, because only when enforcement can be guaranteed can significant scientific results be anticipated. Lastly, the ultimate application of closed areas lies within the management of the marine environment, with emphasis on habitat protection and nature conservation. Therefore, all other things being equal, wildlife protection criteria could form the basis for the selection of the area.