Fifth International
Conference on
the Protection of
the North Sea

Progress Report

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the North Sea
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Contents

Preface

The North Sea Conference in Bergen is the fifth in a series of International Ministerial Conferences concerned with the protection of the North Sea environment.

At the Fourth International Conference on the Protection of the North Sea (4NSC) in Esbjerg, Denmark in 1995, the Ministers established the Committee of North Sea Senior Officials (CONSSO). The tasks of CONSSO are, *inter alia,* to review progress in the implementation of the actions agreed upon by the earlier North Sea Conferences, to take an overview of the marine environment and action being taken to protect it, to consider the need for further actions, and to prepare for the Fifth International Conference on the Protection of the North Sea (5NSC). Norway, as host to the 5NSC, has the chairmanship of CONSSO and has established a North Sea Secretariat to support CONSSO until the 5NSC has taken place.

The following parties take part in CONSSO: Belgium, Denmark, France, Germany, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the European Commission. In addition, several neighbouring countries and intergovernmental and non-governmental organizations take an active part in the meetings.

This is CONSSO's report on progress to the 5NSC. The Progress Report has been compiled in order to provide participants at the 5NSC with an overview of the measures taken and the results achieved to date. Its primary purpose is to report to Ministers on how the North Sea Conference Declarations, in particular the 1995 Esbjerg Declaration and the Statement of Conclusions from the 1997 Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues, have been implemented.

A detailed account of how the North Sea States and international organizations have implemented the commitments of the North Sea Conference Declarations is contained in chapters 3 to 10. These address the following issues: protection of species and habitats, fisheries, hazardous substances, nutrients, ships, offshore installations, radioactive substances and the development of harmonized reporting procedures. Each chapter concludes with an assessment of achievements, which summarizes the main areas of progress and, where relevant, identifies lack of progress in implementation.

In addition to presenting the actions taken to conserve, restore and protect the North Sea, the report presents the North Sea ecosystem and the development of an ecosystem approach to the management of human activities affecting the North Sea (chapter 2).

Executive Summary

The water quality and biodiversity of the North Sea are affected by the various human activities of the densely populated states bordering the North Sea. Nutrients and pollutants are distributed through the North Sea by the currents and transported along the Norwegian Trench out into the North Atlantic.

The North Sea is a biologically rich and productive sea area, due in part to large inputs of nutrients leading to high primary production, the basis for all food chains. The intricate webbing of the food chains in the North Sea makes the ecosystem durable, yet vulnerable to major alterations such as overexploitation of single species.

The North Sea provides goods and services to the human population. The value of this is not readily quantifiable, but fisheries, tourism and oil and gas production are economically the most important activities.

Over the last few years the need to take a cross-sectoral, integrated approach to environment-related management has become evident. At the Intermediate Ministerial Meeting in 1997 (IMM 97), Ministers responsible for the environment and fisheries in the North Sea agreed on the development and application of an ecosystem approach to managing human activities that affect the North Sea. Much work has been done by North Sea States within the frameworks of the EU, the OSPAR Commission (OSPAR) and the International Council for the Exploration of the Sea (ICES) to implement this agreement. A framework for an ecosystem approach has evolved, with the development of ecological quality objectives as an important part.

Main Achievements

An important achievement since the last North Sea Conference in Esbjerg has been the adoption in 1998 and entry into force in 2001 of a new annex to the OSPAR Convention, Annex V on biodiversity. In addition, important strategies with regard to protection and conservation of the ecosystems and biological diversity, hazardous substances, eutrophication, radioactive substances and offshore oil and gas activities have been adopted by OSPAR.

Species and Habitats
OSPAR has made substantial progress in the development of criteria for the identification of threatened and declining species and habitats. The implementation of its biodiversity strategy will contribute to an integrated view on the specific measures necessary to conserve, restore and protect ecologically important or key biodiversity species which are threatened or vulnerable, and their habitats.

Within the European Community, the designation of Natura 2000 sites is important for the conservation, restoration and protection of species and habitats. Red lists of biotopes, flora and fauna of the trilateral Wadden Sea area and the German North Sea have been developed. The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) adopted in 2000 a resolution setting a maximum limit to the total annual removal of small cetaceans as by-catch in fisheries. The EU has banned the use of drift nets in order to protect small cetaceans and certain other non-target species. The Trilateral Wadden Sea Cooperation has adopted a Seal Management Plan. The adoption by the UN Food and Agriculture Organization (FAO) in 1999 of the International Plans of Action for the Conservation and Management of Sharks and for the Reduction of Incidental Catch of Seabirds in Longline Fisheries are other important international initiatives. Some progress has been made in the development of technical solutions to avoid and reduce by-catch of non-economically exploited species in fisheries. In 1997, the International Maritime Organization (IMO) adopted guidelines for the control and management of ships' ballast water. Its current aim is to reach agreement upon a legally binding convention on the control and management of ballast water and sediments in 2003.

Fisheries
The European Community and Norway have made good progress in adopting guidelines incorporating the principles, objectives and strategies agreed at IMM 97. Norway is in the process of finding ways and means to implement ecosystem-based fisheries management.

Advice based on the precautionary approach was put into practice by ICES in 1998, and now constitutes the basis for the setting of quotas in the bilateral agreement between Norway and the EU.

As an integral part of the annual Norway–EU quota agreements, an emergency recovery plan for cod was implemented in 2001. New technical measures, limit reference points as well as management objectives have been established for several stocks.

Norway and several EU Member States have established bilateral agreements regarding cooperation on control and surveillance of fisheries activities.

Hazardous Substances
The inputs of many of the traditional hazardous substances are decreasing. Since 1985, the North Sea States have substantially reduced emissions, discharges and losses of the 37 hazardous substances included in the percentage reduction targets set by previous North Sea Conferences. The setting of specific reduction targets for inputs and emissions of hazardous substances has been an important stimulus for achieving reductions. The targets have largely been met, thereby contributing to reduced pressures on the North Sea environment. The more far-reaching target of the phasing out of hazardous substances within one generation has been taken up and is being implemented by OSPAR, and in a modified form, in the EU Water Framework Directive and the new EU Chemicals Policy. Transparent reporting was achieved by applying the first version of the harmonized reporting procedures (HARP-HAZ prototype). This

represents an important basis for achieving harmonized, useful reporting in other relevant frameworks.

Nutrients

In 1998, OSPAR adopted its Strategy to Combat Eutrophication. OSPAR's main objective with regard to eutrophication is to achieve and maintain by 2010 a healthy marine environment where eutrophication does not occur. In relation to this, OSPAR has made substantial progress in assessing the eutrophication status of the various parts of the OSPAR Maritime Area through the development and application of the OSPAR Common Procedure for the Identification of the Eutrophication Status of the Maritime Area.

The development of Harmonised Quantification and Reporting Procedures for Nutrients (HARP) resulted in a set of nine guidelines (of which eight were adopted by OSPAR 2000). They collectively cover quantification methodology and reporting requirements for all major nutrient sources, retention in surface waters and nutrient inputs to the sea. Thus, the first steps towards transparent, harmonized and comparable quantification have been taken.

Belgium, Denmark, Germany, the Netherlands, Norway and Switzerland have all reached the 50% reduction target on phosphorus between 1985 and 2000 from sources in areas draining into defined problem areas. Sweden has reached a reduction of 33%. The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target for phosphorus. For the period 1985 to 2000, none of the North Sea States reached the 50% reduction target on nitrogen losses/discharges from sources in areas draining into defined problem areas. The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target for nitrogen. The UK, which has to date not identified any problem area with regard to eutrophication and is therefore not committed to the 50% reduction targets, achieved a reduction in inputs of phosphorus of about 40% but saw little underlying change in the inputs of nitrogen.

Although it is ten years since the adoption of the EC Urban Waste Water Treatment Directive (91/271/EEC) and the Nitrates Directive (91/676/EEC), there are still major delays and shortcomings in their implementation by most of the Member States. The full implementation of these two directives is a necessary step towards successfully combating eutrophication of the coastal waters of the North Sea.

Shipping

Several international instruments are in place aimed at reducing the emissions of nitrogen oxides (NO_x) from traffic, ships and combustion plants. The adoption in 1999 of the Gothenburg Protocol to abate Acidification, Eutrophication and Ground-Level Ozone will, once fully implemented, contribute to the reduction of NO_x and ammonia emissions.

The North Sea States have succeeded by concerted action within the International Maritime Organization (IMO) in getting agreement on several of the goals as set out in the Statement of Conclusions from the 1993 Intermediate Ministerial Meeting in Copenhagen and in the Esbjerg Declaration. The most important are the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (the HNS Convention) and the agreement to phase out organotins acting as biocides on ships globally. However, the various measures within IMO aimed at reducing discharges of oil, controlling sulphur oxide (SO_x) emissions and preventing the loss of hazardous cargoes are also important. Reduction of waste from ships can be attained through the implementation of the IMO guidelines for the implementation of Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78). The European Parliament and Council Directive on Port Reception Facilities covers the proper disposal of such waste.

Offshore Activities

Discharges of cuttings with oil-based drilling muds have ceased after the full implementation in 1996 of PARCOM Decision 92/2, thereby reducing the discharges of oil from offshore activities to less than a third in 1999 compared to 1985. OSPAR has achieved progress in regulating uses and discharges of chemicals and oil in produced water. It has also agreed on a strategy to set environmental goals and to establish improved management mechanisms.

OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations prohibits the dumping, and leaving wholly or partly in place, of disused installations within the OSPAR Maritime Area. It recognises the difficulty of removing certain categories of installation, such as concrete installations and the footings of large steel installations, and provides for derogations to the general ban in accordance with an agreed assessment and consultation framework.

Radioactivity
Discharges of radioactive waste have in general decreased. The new International Atomic Energy Agency Waste Convention, which entered into force in 2001, will be important in ensuring the safe handling of spent nuclear fuel and radioactive waste management. Increased attention is being given to the protection of the environment from detrimental effects caused by radiation. The International Union of Radioecology has presented a first approach to an international framework for protection of the environment from radiation.

Remaining Problems and Future Challenges

A major challenge for the future is to ensure the implementation nationally of the significant international instruments, notably those of OSPAR, the European Community and IMO. When implemented, these instruments will lead to fulfilment of many of the actions agreed at previous North Sea Conferences.

Species and Habitats
Since the adoption of Annex V in 1998 there has been progress within OSPAR in identifying species and habitats in need of protection and conservation measures. OSPAR intends to complete the identification criteria and a priority list of threatened and declining species and habitats by 2003. Practical and legal tools are needed to avoid the release or spread of non-indigenous (alien) species and stocks and genetically modified organisms, which may potentially have adverse effects on the ecosystem and biodiversity. The EUNIS (European Nature Information System) habitat classification system must be further developed to include information on biota. Furthermore it must be validated, and the habitats have yet to be mapped.

Fisheries
In order to ensure the full application of the ecosystem approach in fisheries management, the implementation according to agreed principles, of strategies and actions agreed at the IMM 97, must be enhanced. Sustainable fishing practices should be further developed in order to reduce by-catch of non-commercially exploited species, damage to benthic species and habitats and overexploitation of fish stocks in the North Sea.

Hazardous Substances
Although the North Sea States have reduced inputs and emissions of many hazardous substances to a significant extent, many of these substances will persist in the North Sea ecosystem, potentially having effects on human health and the environment. A large number of chemicals that are either known to be hazardous, or for which the inherent properties or the ecological effects are still unknown, are still reaching the North Sea. It is necessary to focus efforts on closing the large gap in our knowledge concerning the basic properties of most chemicals, their exposure pattern and their fate in the marine environment.

The inputs and emissions of several hazardous substances to the North Sea are still too high, and action to achieve further reductions should be considered in all relevant forums. In order to sustain a healthy North Sea environment, it is now important to concentrate efforts on achieving the more general one-generation target. The future EC chemicals policy will generate more basic information on chemicals, and together with the selection mechanisms within OSPAR and within the EC Water Framework Directive, a more precise identification and prioritisation of hazardous substances should be possible. Further work is necessary to develop relevant methods to check and report on whether the progressive reductions necessary to achieve the one-generation target have been effectuated.

Nutrients
The North Sea States committed to the 50% reduction target for nitrogen, have not met this target.

The HARP Guidelines should be further implemented as a basis for improved harmonized reporting on nutrients. There is a need for harmonization on important subjects, including the timetable of implementation, between the EC Water Framework Directive and OSPAR's Strategy to Combat Eutrophication.

Shipping

The revision of MARPOL 73/78 Annexes I (oil) and II (noxious liquid substances in bulk) has been delayed and a true reduction in the sulphur content of fuel oil has not been achieved. Only two member countries have ratified MARPOL 73/78 Annex VI on air pollution from ships. Even though guidelines to prevent waste from ships have been adopted, little progress has been made in preventing and reducing waste generation from ships. In addition, MARPOL 73/78 Annex on sewage is still not yet in force. Few national measures have been taken to prevent the introduction of non-indigenous organisms via ballast water. In the cooperation between North Sea States to facilitate the enforcement of, and the prosecution of offenders to MARPOL 73/78 more progress is therefore needed.

Offshore Activities

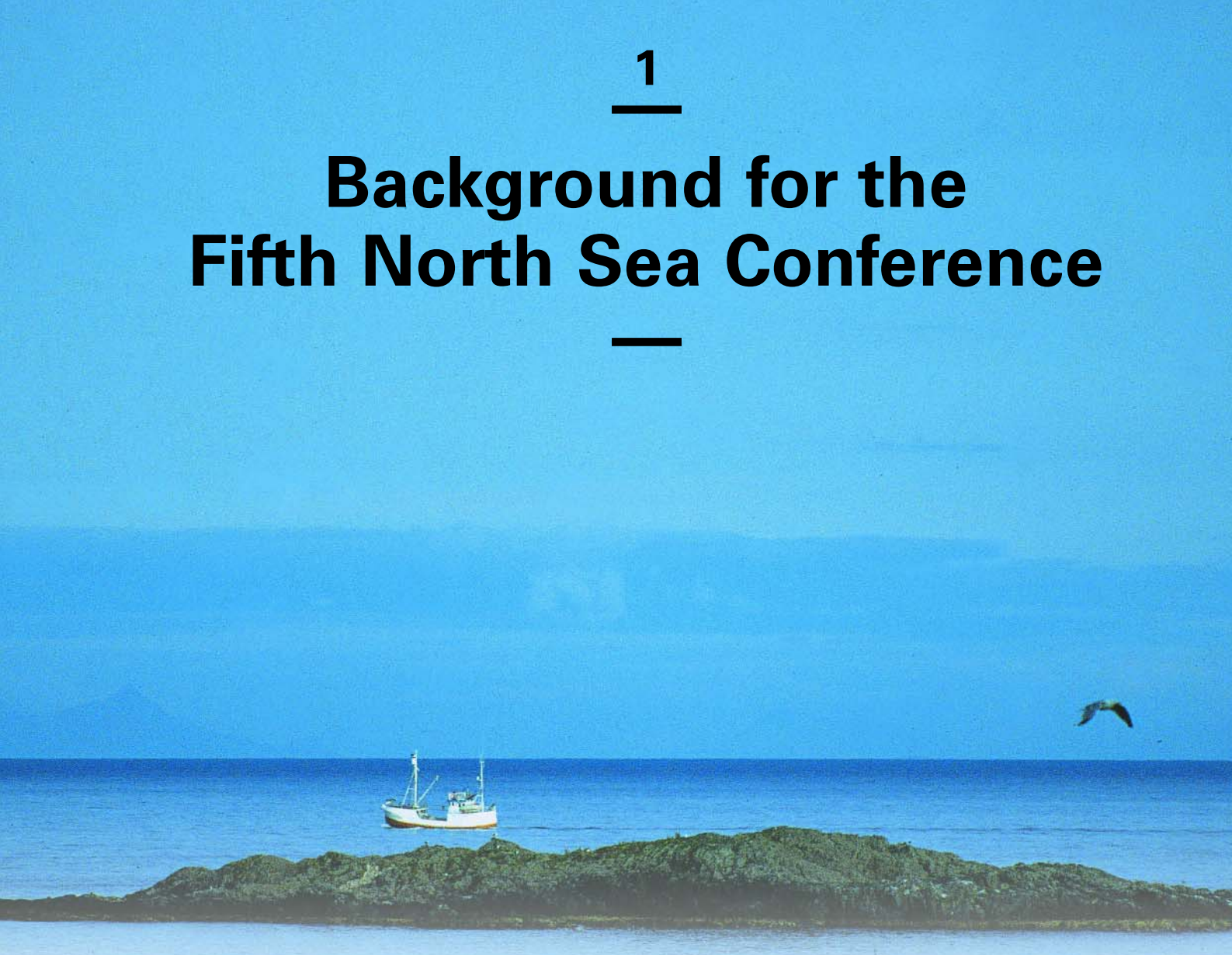
The main challenge with regard to the prevention of pollution from offshore installations is the development of effective ways of achieving the targets set by OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations, *e.g.* regarding the 15% reduction of oil discharged with produced water, and the setting of performance standards on aromatic hydrocarbons in produced water.

Radioactivity

Technical solutions to the handling of radioactive waste to reduce discharges into water bodies are still lacking.

1

Background for the Fifth North Sea Conference



In the early 1980s there was growing concern among the North Sea States that the large inputs of various harmful substances via rivers, direct discharges and dumping of waste at sea could cause irreversible damage to the North Sea ecosystems. Some countries were also dissatisfied with the lack of progress made by the competent international organizations charged with protecting the marine environment. In part this was due to the wider geographical coverage of the bodies concerned and the lack of focus at North Sea level. Eventually this resulted in the First International Conference on the Protection of the North Sea held in Bremen in 1984.

At that time the pertinent conventions (Oslo and Paris Conventions, MARPOL 73/78, London Convention 1972, Bonn Agreement) and their executive bodies were rather specialized in their scope. The International Conferences on the Protection of the North Sea have had the advantage of providing a political framework for a broad and comprehensive assessment of the measures needed to protect the North Sea. This has enabled Ministers to deal with a broad range of North Sea issues, and has allowed them to respond swiftly and to focus on key issues at each conference.

The North Sea Conferences have constituted political forums that have adopted far-reaching politically based commitments. Many of these political commitments have been adopted in national regulations as well as within the framework of legally binding conventions. Of particular importance for the protection of the North Sea are the frameworks of the OSPAR Commission (OSPAR), the European Union (EU) and the International Maritime Organization. Important agreements of the North Sea Ministers are now taken forward through the OSPAR Strategies, most of which were adopted at Ministerial level in 1998 and are aimed at guiding OSPAR's work.

Apart from the agreements on action to protect the North Sea, the North Sea Conferences have also

played an important role in influencing environmental management decisions in a much wider context. The adoption of the precautionary principle at the London Conference in 1987 is one of the most important agreements emanating from the North Sea Conferences. Once agreed at a political level, the precautionary principle has been adopted within the appropriate legislative forums and has become a generally accepted principle for the protection of the environment.

Until 1995, pollution was the main issue at the North Sea Conferences. Important agreements have been made, *inter alia*, regarding reduction of nutrient inputs, reduction and phasing out of hazardous substances, phasing out of TBT in anti-fouling agents on ships, a ban on dumping and incineration at sea and a general prohibition on the dumping of disused offshore installations. Annex 1 to this report records the history of the North Sea Conferences including the principal milestones.

Over the last decade there has been an increasing awareness that other impacts of human activities on the North Sea ecosystems are also very important, and that the combined effects could be detrimental to biological diversity.

This led to increasing concern about the development and status of the North Sea fish stocks, as well as to the impact of fisheries on the ecosystems. On this basis Norway organized the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues held in Bergen in 1997 (IMM 97), in which Ministers responsible for environmental protection and Ministers responsible for fisheries, as well as the respective EU Commissioners, participated.

One important outcome of IMM 97 was the agreement on the development and application of an ecosystem approach in the management of human activities and protection of the North Sea. Ministers invited the competent authorities for fisheries management and for the other aspects respectively, to consider such development and its possible implementation and to analyse periodically the progress achieved and the problems remaining, doing so for the first time preferably before the 5NSC.

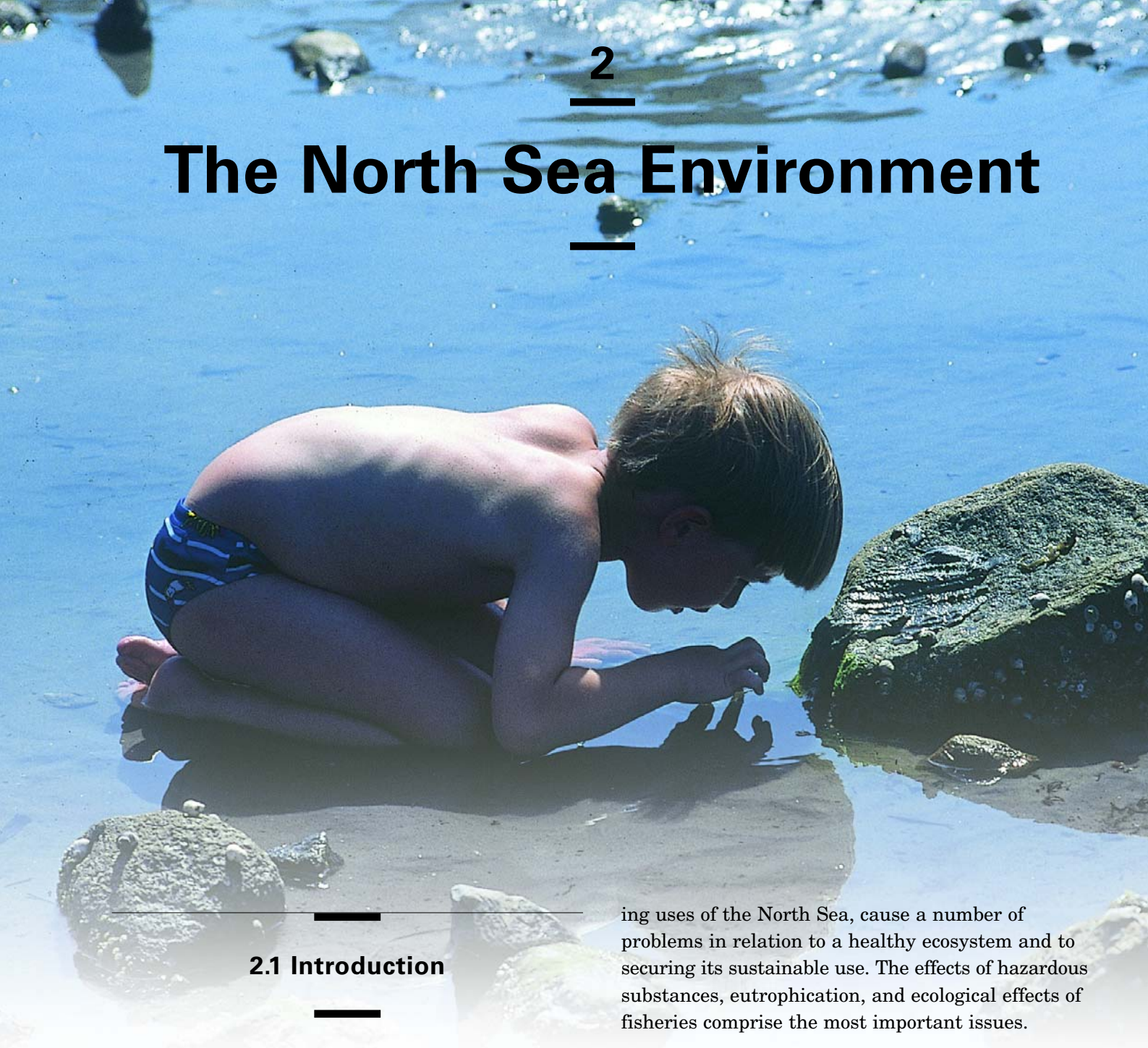
At the Ministerial Meeting of OSPAR held in Sintra in 1998, Ministers adopted a new Annex to the OSPAR Convention, Annex V, and a strategy to protect and conserve the ecosystems and biological diversity of the maritime area. The implementation of this strategy will contribute to the development of an ecosystem approach. Furthermore the integrated approach of the EC Water Framework Directive based on setting environmental objectives in catchment areas, is in line with an ecosystem approach.

In the Quality Status Report for the Greater North Sea published recently by OSPAR (OSPAR 2000), the effects of hazardous substances and eutrophication, and the direct as well as indirect impacts of fisheries, were identified as the issues of most concern.

This Progress Report has evolved from developments arising from the previous four Ministerial Conferences on the North Sea and the two Intermediate Ministerial Conferences. Although many of the developments described in this report have been incorporated into the work programmes of relevant organizations, much work is still required to implement these agreements. This document reports on progress made since the Fourth International Conference on the Protection of the North Sea held in Esbjerg in 1995 and IMM 97, and provides a basis for the Fifth Declaration of North Sea Ministers.

2

The North Sea Environment



2.1 Introduction

The North Sea is a biologically rich and productive region. The densely populated, highly industrialized countries bordering the North Sea conduct major fishing activities, carry out oil and gas offshore activities, extract sand and gravel, use it for dumping dredged material and for pipelines and cables. The North Sea is one of the most frequently traversed sea areas of the world and two of the world's largest ports are situated on the North Sea coast. In addition, the coastal zone is used intensively for recreation.

Healthy ecosystems provide both goods and services to humanity. The intensive and sometimes conflicting uses of the North Sea, cause a number of problems in relation to a healthy ecosystem and to securing its sustainable use. The effects of hazardous substances, eutrophication, and ecological effects of fisheries comprise the most important issues.

Regular assessment and monitoring of the North Sea have been carried out for years. The Quality Status Report 2000 for the Greater North Sea (OSPAR 2000) comprises the latest comprehensive assessment.

This chapter presents an overview of the physical and biological characteristics as well as the socio-economic importance of the North Sea. The impact of human activities of greatest concern is described. The chapter concludes with a description of the development of an ecosystem approach to the management of human activities affecting the North Sea.

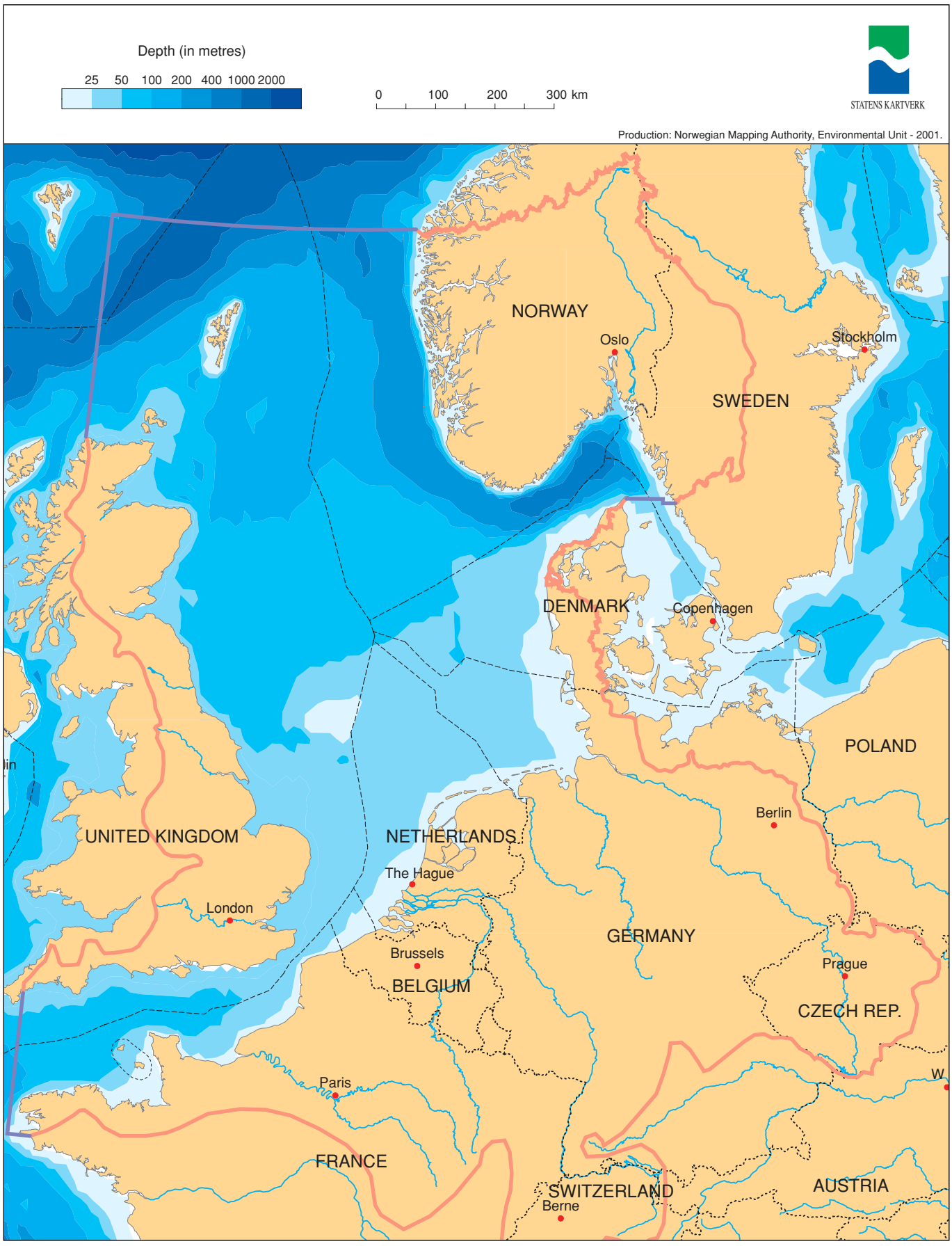


Figure 2.1 *The North Sea and its catchment area. The North Sea comprises the body of water:*
- *southwards of latitude 62° N, and eastwards of longitude 5° W at the north west side;*
- *northwards of latitude 57° 44.8′ N from the northern most point of Denmark to the coast of Sweden, and*
- *eastwards of longitude 5° W and northwards of latitude 48°30′ N, at the south side.*

2.2 Geography and Hydrography

The North Sea is a relatively shallow sea area located on the European continental shelf. The bottom depth gradually increases from less than 30 m in the south to about 200 m in the north. The Norwegian Trench cuts into the north-western part of the North Sea to a maximum depth of more than 700 m in the Skagerrak. Figure 2.1 shows the North Sea, its catchment area and its bathymetry.

The ocean currents of the North Sea form a cyclonic circulation (Figure 2.2). While this is a general pattern, there is considerable variability in the water circulation in response to meteorological variability. The mean residence time of water in the North Sea is about 1 to 2 years, being in general shorter for water in the northern North Sea and longer for water in the southern North Sea.

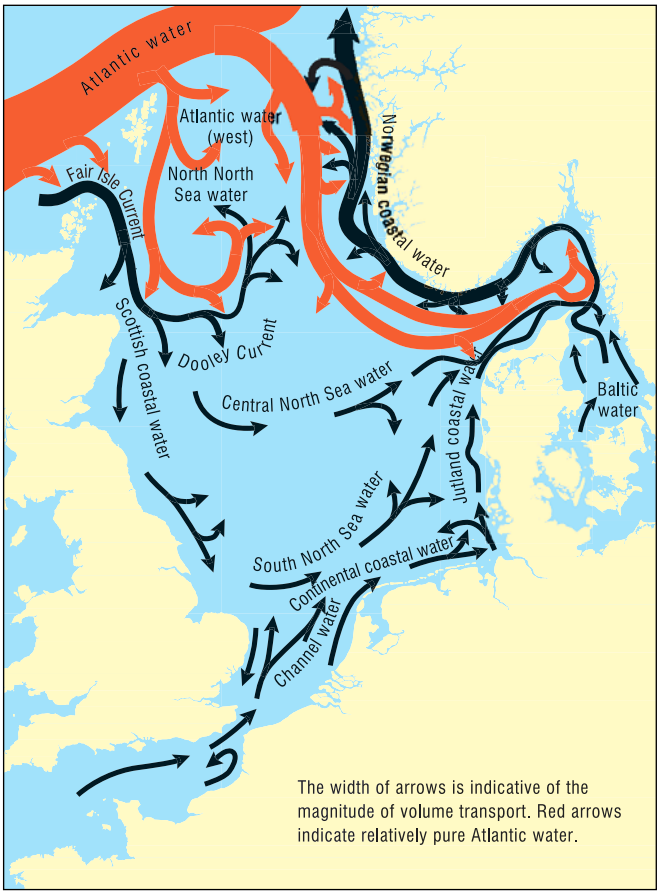


Figure 2.2 *Schematic diagram of the general circulation in the North Sea (after Turrell* 1992).

Various water types in different areas characterize the North Sea. The main inflows are:

- Atlantic water (clear, high salinity, moderate nutrient content) that enters from the north through the Shetland–Orkney region, and from the south through the Channel. The volume of water transport can vary considerably from year to year, partly due to climatic effects;
- brackish water from the Baltic Sea (fairly turbid, low salinity, moderate to low nutrient content) that flows in via the Kattegat; and
- brackish water from rivers and land run-off from the eastern UK and the continental coasts (highly turbid, low salinity, high nutrient content). The most important rivers in the catchment area are the Elbe, Weser, Rhine, Meuse, Scheldt, Seine, Thames and Humber.

These water masses are vertically layered according to their densities when they meet in the Skagerrak and exit from the North Sea as the northwards flowing Norwegian Coastal Current. Fronts or frontal zones mark the boundaries between water masses and are common features in the North Sea.

Tidal currents are the most energetic features in the North Sea, stirring the entire water column in most of the southern North Sea and the Channel.

These physical characteristics may affect the ecosystem in various ways. The distribution and circulation of the water masses are of utmost importance for the biological productivity, distribution and abundance of species, including commercial fish, and for transport and concentration of non-living matter, including suspended matter, organic matter, nutrients and pollutants.

The shallower areas of the North Sea mainly consist of sand and gravel deposits. Here, intensive sediment movements and associated sediment transport occur frequently, owing to currents, tides, wave action and sea swell. Tidal flats, estuaries and wetlands are habitats for many marine organisms, and form feeding grounds and nursery areas for birds, many fish and seals. However, these habitats may suffer from the accumulation of pollutants due to net sedimentation of particulates from upstream sources.

Sediment transport causes the topography of the seabed slowly to change and pollutants adsorbed onto settled particulate matter can be resuspended,

transported, and deposited elsewhere. The deep Norwegian Trench in the Skagerrak is the final repository for fine particulate material and associated pollutants that are discharged into and transported from the shallow southern North Sea.

The most serious environmental effects are found in the near shore areas of the North Sea. The most vulnerable areas are throughout the North Sea characterized by heavy inputs from rivers and land-based run-off, and ecologically sensitive littoral zones of importance to flora and fauna. Areas with restricted water exchange in combination with weak tides are sensitive to eutrophication. This is particularly the case where there is seasonal stratification in shallow water that can lead to oxygen depletion in the limited volume of water in the bottom layer.

In addition to the overall trend for increasing global warming due to human induced causes, data on hydrographic and climatic variability show that the North Sea exhibits shifts between colder and warmer periods, measured in years and decades, that have implications for the biological production of the area including the recruitment of fish species such as cod (*Gadus morhua*) and harvests from associated fisheries. Recently, particular attention has been focused on the North Atlantic Oscillation and its effect on the climate, productivity and the biological effects of pollution in the North Sea area.

It is difficult to determine the possible regional effects of climate change. This is partly because of limitations in knowledge about the functioning of the North Sea ecosystem, in particular how meteorological and climatic variability affects the various biological components. There is as yet no certain method for predicting the effects that climate change might have on the North Sea ecosystem.

2.3 Ecosystem Structure and Functioning

Article 2 of the Convention on Biological Diversity defines an ecosystem as 'a dynamic complex of plant, animal and microorganism communities and their non-living environment interacting as a functional unit'.

Description and prediction of ecosystem functioning, even at a lower level of complexity such as component fish stocks, is hampered by large natural variability. Incidents such as heavy storms, a shift in prevailing winds, a hot summer or a change in inflow of Atlantic water will affect the ecosystem considerably. Like any ecosystem, the North Sea will normally be capable of responding to such natural events, and show sufficient resilience to continue to function as a healthy ecosystem. However, when in addition to these natural phenomena, anthropogenic stress is put on the ecosystem, the system may become perturbed, and may drift significantly from its original state. This may then lead to a reduction in biological diversity.

The ecosystem consists of a complex network of interactions, not only between species, but also between biota and the physical and chemical environment. Humans are recognized as integral parts of ecosystems and human, social and economic systems constantly interact with other physical and biological parts of the system. The ecosystem interactions within the North Sea are shown in Figure 2.3.

Physical factors, notably horizontal gradients and vertical stratification, play a significant role in structuring the pelagic ecosystems of the North Sea. This is particularly manifested in the changes in the structure of planktonic food webs and associated changes in the sedimentation rates of organic material to the sea floor, where it provides energy input to the benthos.

The North Sea is made up of a mosaic of different habitats that are important for the ecological functioning of the North Sea. A general conservation strategy is to protect the quality and quantity of habitats to protect the organisms living in and contributing to the habitats, and to preserve the ecosystem structure and functioning.

The North Sea is very productive, due in part to large inputs of nutrients leading to high primary production, the basis for all food chains. The intricate webbing of the food chains in the North Sea makes the ecosystem durable, yet vulnerable to

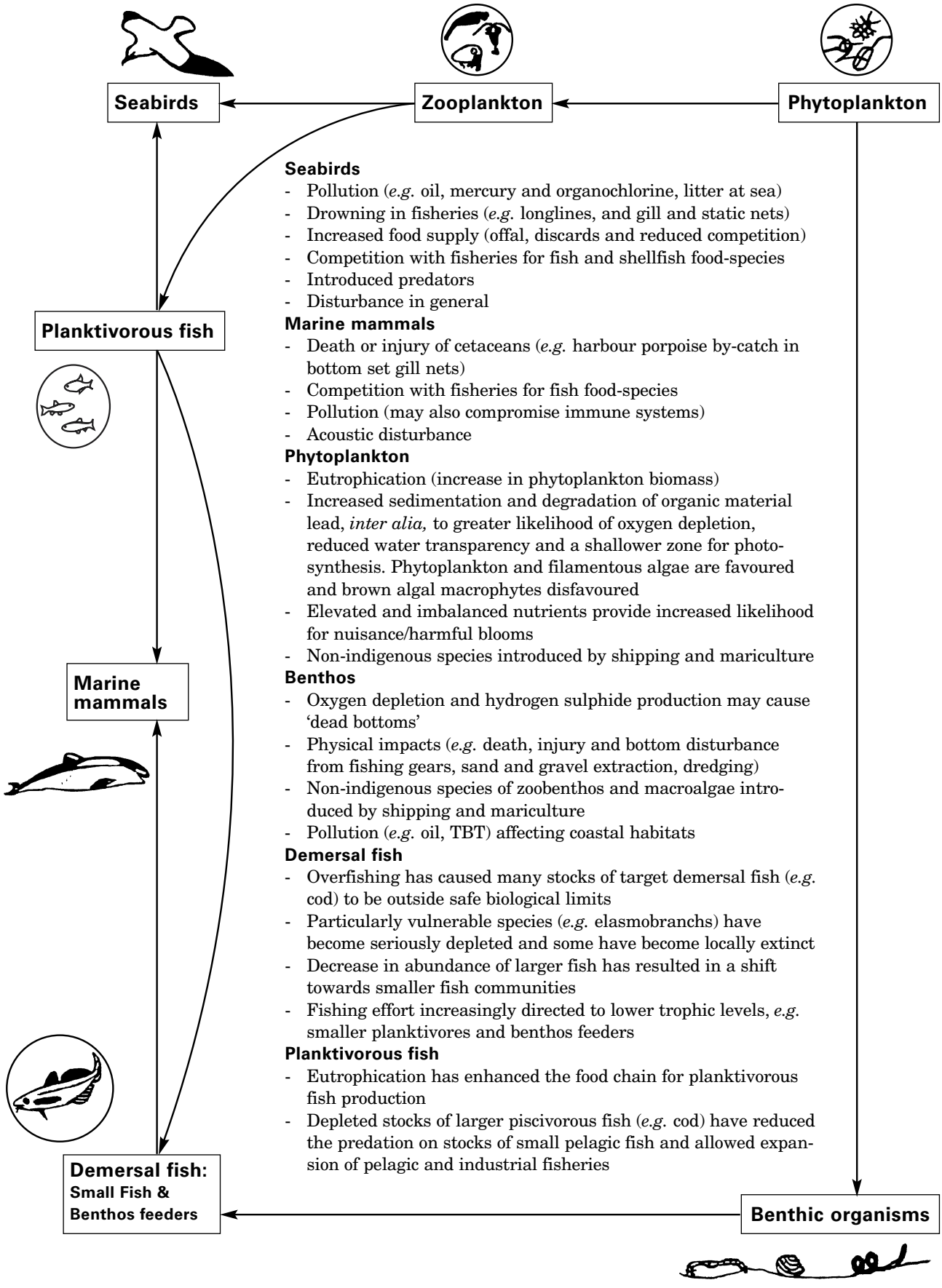


Figure 2.3 *Ecosystem interactions in the North Sea.*

major alterations such as overexploitation of single species, which can be deleterious.

Bacteria, viruses, and yeasts are microorganisms that play essential roles in the ecosystem by degrading organic material from algal blooms and other sources and by contributing to the recycling of nutrients. Viruses may play a special role in controlling the microbial biodiversity and may also be involved as a factor in the dynamics and fate of algal blooms.

Algal blooms are important natural events. Nutrient inputs from terrestrial and anthropogenic sources may increase nutrient availability and thus increase the duration and intensity of blooms. They may also initiate unusual blooms, for instance if the ratio between nitrogen and phosphorous is distorted from the common natural ratio in seawater. There have been a number of examples of unusual or exceptional blooms of phytoplankton in the North Sea. They are characterized by the presence of phytoplankton species that arouse public concern. This concern can be caused by water discoloration, foam production, fish or invertebrate mortality, or toxicity to humans.

Grazing by zooplankton is one of the major factors controlling phytoplankton populations. Zooplankton forms the link in the food web whereby the primary production by phytoplankton is channelled to higher trophic levels through plankton-feeders such as herring (*Clupea harengus*), mackerel (*Scomber scombrus*), and sandeels (*Ammodytes* spp.). Zooplankton abundance varies between areas owing to differences in production, predation, and transport.

The eggs and larvae of most fish species are planktonic for a few months, and this period is critical in determining their year-class abundance. The growth and survival of fish eggs and larvae depends on adequate feeding conditions, low levels of predation, and transport of larvae to suitable nursery areas. This transport occurs with the currents and the spawning grounds are located in relation to the general circulation features. Some fish species spawn on the seabed and are vulnerable to bottom trawling. There is in general a lack of detailed knowledge about the current spawning grounds of many of the fish populations of the North Sea.

In shallow shelf areas, such as the North Sea, benthic and pelagic processes are often strongly coupled and work in concert to make the region productive. Sediments in particular show many spatially tight and geochemically important relationships, many of which are subject to modification by human impact.

Organic enrichment of muddy sediments, with high organic content, leads to an increase in macrobenthic biomass only up to a certain point. Sediments become anoxic when overloaded with organic matter, which then leads to the death of the benthos.

Species of benthic macroalgae (*e.g.* kelp) may form dense zones and are exploited in several countries. The most developed macroalgal communities in the region are found on rocky shores and on hard bottoms in the sublittoral zone down to about 15–30 m.

Long-term changes in the size and species composition of benthic fauna have been observed particularly in the southern and south-eastern North Sea where smaller, opportunistic species have taken over in abundance. This has mainly been due to a combination of trawling and eutrophication.

Fish are important components in marine ecosystems on account of their frequently high biomass and role in food chains as predators on zooplankton, benthos and other fish. In turn, they provide food for higher trophic levels including seabirds, marine mammals and man. Several structural and functional properties of the fish community are related to the species composition and/or size-structure. Intensive and size-selective fishing has changed the size-structure of the North Sea fish community resulting in decreased body size. Smaller and early-maturing species have increased in relative abundance. The trophic structure has changed, as seen by the absolute and relative catches of smaller pelagic industrial species compared to large demersal species such as cod. Management and exploitation of both target and non-target species in various fisheries, must therefore be considered from an ecosystem perspective.

Seabirds and shorebirds play an important role in the North Sea marine ecosystem due to their abundance and position as predators at or near the top of food chains. The majority eat fish, some feed on benthos and a few feed on zooplankton. Seabirds

are affected by human activities in different ways, the effects of fisheries being prominent. Discards and offal from the fisheries have led to increased population sizes of many seabirds. Others are affected by the competition for fish prey.

Several species of marine mammal are resident in the North Sea, while other species occur on a temporary basis. Some marine mammals, particularly the harbour porpoise (*Phocoena phocoena*), may suffer where they are caught as by-catch in gillnets.

As a result of their position in the food web, seabirds, shorebirds and marine mammals are prone to accumulation of pollutants through their prey and the associated biological effects of pollution. Finally, some species of marine mammal and some seabirds and shorebirds can be affected by disturbance from shipping and recreational activities.

2.4 Socio-economic Importance of the North Sea

Many human activities take place in the North Sea:

- the North Sea is one of the world's most important areas for harvesting fish and shellfish;
- coastal industries of various types are located along the coasts and estuaries of the North Sea, discharging pollutants to marine waters and in some instances requiring large amounts of cooling water;
- the North Sea contains some of the busiest shipping routes in the world, and most of Europe's largest ports are situated on North Sea coasts and rivers;
- the offshore oil and gas industry has become a major economic activity in the North Sea since the late 1960s;
- mariculture for fish and shellfish is undertaken in many of the North Sea States;
- coastal engineering includes damming of rivers, but also beach nourishment, diking and land reclamation;
- tourism in North Sea coastal areas and adjacent land is an important social and economic activity with intense development pressure;
- mineral extraction (sand, gravel and rocks, calcium carbonate (shell aggregates, maerl)) takes place in many North Sea States;
- dumping of dredged material (for maintenance dredging, laying of cables and pipelines), waste from fish processing and inert material of natural origin;
- power generation by tidal or wave energy is limited to a few possible locations, but offshore windmills will increase in number; and
- military uses of the sea in peacetime include fishery protection patrols and NATO exercises.

Approximately 184 million people live within the catchment area of the North Sea. The population density of Europe puts great pressure on the North Sea. The number of people in coastal areas varies substantially with season due to tourism.

The marine environment of the North Sea provides socio-economic values mainly based on biodiversity, renewable and non-renewable resources. Leisure and tourism in the North Sea are also of socio-economic value. The importance of these issues is highlighted in this section. Few of these are, however, definitively quantified.

Other issues of socio-economic importance related to the use of the North Sea are the value of the North Sea in climate regulation, and the potential uses of living marine resources in the future development of *e.g.* medicines and pharmaceutical products. These issues are not covered in the following sections.

2.4.1 Intrinsic value of nature

The North Sea supports a rich coastal and marine wildlife and has a number of important habitats. Although the value of marine ecosystem services[1] are immense, there is a lack of assessments of the value of non-exploited natural capital and services, resulting in reduced priority attached to the maintenance of biodiversity. It is important, however, to recognize that the North Sea and its wildlife have an intrinsic value to coastal communities and affect the recreational value of coastal areas.

[1] Ecosystem services: the full range of benefits provided to society by ecosystems and their constituent biodiversity, encompassing more than just the capital value of its constituent parts.

2.4.2 Tourism and recreation

Local people and tourists use the coastal zones in the North Sea for recreation and leisure. There are growing demands for housing, commercial sites, rented accommodation and improved services in these areas. There is also an expanding market for clean beaches, water sports, sailing, angling, ecotourism and unspoilt coastal landscapes. Archaeological remains and shipwrecks are part of the marine heritage and also attract scholars and tourists.

The number of tourists shows a distinctly seasonal pattern. For example, in the Wadden Sea area 75–90% of all overnight stays are booked for the period April to October. In several areas the tourist season is increasingly concentrated in the summer months.

2.4.3 Renewable resources

Fisheries and harvesting of seaweeds
Fish and other living marine resources are important sources of food in terms of protein and essential fatty acids. Consequently there is clear evidence for direct links between diet and human health, food from the sea is important both in quality and quantity. In 1995, the combined landings of different species from the North Sea amounted to 3.4 million tonnes with a value of around 1 400 million Euros. The human consumption fisheries have a higher landing value than the industrial fisheries. The direct employment in fisheries in 1995 was 22 000 man-years. The fisheries may serve as the only viable option for employment for residents of small local communities.

Seaweeds are harvested for fertilization purposes and for the alginate industry where seaweed is used in a wide range of products, such as paper surfaces, dyes for textile printing, nutrients, welding rods and latex paint. In Norway there is a total annual harvest of about 200 000 tonnes of kelp and knotted wrack (*Ascophyllum nodosum*), about a third of this is harvested from the North Sea. In 1996, 57 000 tonnes of kelp and 15 000 tonnes of wrack were harvested along the French coast of the Channel. There is also some harvesting along the coast of the UK.

Mariculture
Fish, in particular salmon (*Salmo salar*), and shellfishes are grown in mariculture enterprises in coastal areas of the North Sea. Such activities occur in many North Sea States.

Wind and tidal energy
Tidal currents are locally used as a source of energy to produce electricity in particular in the southern North Sea. Parks for windpower generation have been developed all over the North Sea and are expected to extend in the near future. Windmills produce 15% of the electricity supply in some countries.

2.4.4 Non-renewable resources

Oil and gas
The North Sea holds Europe's largest oil and natural gas reserves and is one of the world's key non-OPEC producing regions. Norway and the UK hold the majority of the North Sea's reserves and production while Denmark, the Netherlands and Germany have smaller oil and gas holdings in the North Sea. North Sea oil and gas production reached new heights in 2000, with oil production exceeding 6 million barrels per day for the first time. However, the area is considered to be increasingly 'mature', with few additional large discoveries likely to be made. There were fewer exploration and appraisal wells drilled in the North Sea in 2000 than in any year since the early 1970s. (Denmark was an exception, as its exploratory activity actually increased.) Volatile and/or oversupplied world oil markets have negative implications for North Sea oil and gas exploration because of the region's high production costs.

The Netherlands has for years been one of the top gas suppliers for Western Europe. Unlike North Sea oil production, natural gas production is increasing. Energy demand in Europe is growing, and much of the growth is expected to be met by natural gas. It is estimated that within a few years Norway will become one of the major suppliers of gas to Europe. North Sea gas has a geographical advantage over other world gas producers, as gas is less expensive to transport over short distances. Most of continental Europe is already linked, directly or indirectly, to North Sea gas sources. The already substantial North Sea natural gas infrastructure continues to grow. The Netherlands and the UK have the most

extensive pipeline networks in place, while Norwegian export routes are expanding (Energy Information Administration 2001).

Sand and gravel
The marine aggregate extraction industry is well established and growing in a number of North Sea States, providing up to 15% of some nations' demands for sand and gravel. The area of the seabed dredged is extremely small relative to the total area of seabed. Most commercially workable deposits of sand and gravel occur in the shallower regions of the North Sea. Only 0.03% of the North Sea is dredged for aggregates each year.

The demand for large quantities of sand fill for land reclamation in connection with harbour construction and infrastructure projects will vary in line with the development of the national economy. In Denmark, there has been a substantial increase in the demand for sand for beach nourishment from 40 000 m^3 in 1980 to 3 million m^3 in 1997 mainly on the west coast of Jutland (Marine Sand and Gravel Information Service 2001). With the predicted rise in sea level the demand for sand for beach nourishment in certain areas is expected to double during this century.

2.5 Human Impacts

Human impacts on species and habitats are greatest in the coastal zone. Sensitive habitats with great ecological significance are often disturbed or may even vanish due to a range of human activities. The intensive, and sometimes conflicting, use of the North Sea causes a number of problems in relation to providing a healthy ecosystem and securing its sustainable use. The North Sea has a long history of multiple use by people from many nations. There is awareness of the need to safeguard the marine ecosystem and to achieve sustainability in respect of human use. Knowledge of the main human pressures and understanding their impact on the structure and functioning of the ecosystem and its resources is essential for the development and implementation of effective measures to achieve sustainable use.

In the Quality Status Report 2000 on the Greater North Sea, OSPAR identified a list of human pressures and ranked these into four priority classes (A–D) according to their relative impact on the ecosystem, including sustainable use.

A. *Highest impac*t: fisheries, trace organic contaminants, nutrients;
B. *Upper intermediate impact*: oil and polyaromatic hydrocarbons (PAHs), other hazardous substances, heavy metals, biological impacts;
C. *Lower intermediate impact*: litter and disturbance I, dredging and dumping, engineering operations, mariculture, radionuclides; and
D. *Lowest impact*: litter and disturbance II.

Although the impacts of the pressures in classes C and D are perceived to be less than those in classes A and B for the entire North Sea, they may, however, be of more serious concern in combination with other human pressures.

In addition 'human activities contributing to climate change' is also recognized as a pressure, but it was considered inappropriate to compare this item directly with the other human pressures in view of the very broad scope of its causes and effects.

The main pressures of highest priority are addressed in sections 2.5.1 and 2.5.2.

2.5.1 Priority Class A – highest impact

Fisheries
The effects of fisheries occur at all levels in the ecosystem, from benthos to mammals. The main impacts of fisheries result from the mortality and removal of target fish and shellfish species, from seabed disturbance and habitat degradation by towed demersal gear (bottom trawls and dredges), and from the by-catch and discarding of non-target species. Fishing has in some cases caused the reduction of stocks or populations of target or non-target species beyond sustainable levels.

Trace organic contaminants
Trace organic contaminants (excluding oil and PAHs) occur in elevated concentrations throughout the North Sea area even though there is evidence of decreasing levels of input for many of the traditional substances. The main human pressures concerned with trace organic contaminants are

inputs from land-based point and diffuse sources, and inputs of tributyltin (TBT) and other anti-fouling substances used on ships.

The priority substances are those which are persistent, liable to bioaccumulate and toxic (PBTs) or which have harmful properties giving rise to an equivalent level of concern (*e.g.* endocrine disrupters and substances that can damage immune systems). Substances which are both very persistent and very bioaccumulative (VPVB) are also of concern as in most cases they will become toxic at some stage of bioaccumulation. The priority substances will accumulate in the marine food chains and are, once discharged, practically impossible to remove from the environment. For these contaminants recovery times are long, for some of them of the order of a century.

The Quality Status Report 2000 for the Greater North Sea draws attention to the large number of man-made compounds, for which the ecological effects are largely unknown, which are still being discharged into, and detected in, the North Sea.

Nutrients
The main human pressure of nutrients, which may cause eutrophication effects, occurs from land-based activities and primarily affects the coastal zone. Nutrient-related problems are widespread, in particular in estuaries and some fjords, the Wadden Sea, the German Bight, the Kattegat and the eastern Skagerrak. The impacts of eutrophication include increased phytoplankton production and decay of the resulting organic matter, which may in turn cause oxygen depletion and mortality of benthic organisms, as well as changes in the abundance and diversity of different plant and animal communities.

2.5.2 Priority Class B – upper intermediate impact

Oil and PAHs
The main human pressures concerning oil and PAHs include their input from the offshore oil and gas industry as well as from shipping and inputs from land. Reliable estimates of oil from rivers and land-based run-off are lacking. Significant reductions have occurred for refineries and the offshore oil and gas industry, although inputs from produced water from the latter have increased progressively in recent years. PAHs are widespread in the North Sea, particularly in sediments. From the existing data there seems to be a distinct decrease in releases during the last decade. Many countries have, however, problems with providing consistent and transparent release data for PAHs. Several PAHs are toxic, liable to bioaccumulate, mutagenic and carcinogenic. The concentrations in North Sea sediments seem relatively constant.

The effects of oil pollution on organisms include kills and fouling of biota (*e.g.* fish, birds and benthos) from initial contact with the toxic fractions of petroleum, or chronic biological effects (*e.g.* impaired reproductive success). Oil spillage can cause economic losses such as the loss of a fishery or recreation amenities and tourism. Exposed shorelines, shallow reef environments, estuaries and wetlands are particularly susceptible to damage and degradation from oil spillages.

Heavy metals
Heavy metals reach the North Sea via airborne and waterborne inputs. Inputs are also generated by some sea-based activities such as sand and aggregate extraction and dumping of dredged materials. Discharges and emissions have been successfully reduced for cadmium, mercury, lead and copper resulting in reductions in their concentration in sediments, water and several species of biota.

Heavy metals do not degrade and anthropogenic contributions to naturally occurring levels may cause serious biological effects. Ecological risks mainly concern the marine life in estuaries and in the coastal zone. Some of these areas where heavy metal concentrations are highest, may also be of major ecological importance as habitats, containing breeding and feeding grounds for numerous species. Cadmium, mercury and lead accumulate in organisms and end up in top predators (fish, birds, marine mammals or even humans), while copper can affect phytoplankton species composition and productivity. Recovery times are in the order of decades. In most North Sea areas mean concentrations of cadmium, lead, mercury and copper in sediments and biota are either decreasing or constant.

Other hazardous substances from sea-based sources
Inputs of hazardous substances occur from the offshore oil and gas industry, particularly via drilling discharges and produced water and from shipping, originating from the cleaning of tanks, burning fuel, discharges of wastes and loss of cargo.

Many of these substances are characterized by slow degradation in the environment, and thus often exhibit bioaccumulation in the food chain with serious biological effects.

Biological impacts
The main human pressures concerning biological impacts are the introduction and transfer of non-indigenous species and genetically modified organisms (GMOs) via shipping and mariculture, and inputs of microbiological pollution from land-based sources.

Biological impacts pose serious detrimental, ecological and economic effects, mainly due to the high potential risks of introducing parasites and pathogens/diseases, changes in species composition, the introduction of toxic algal species, and genetic changes to indigenous populations such as wild Atlantic salmon. In recent years, increased attention has been focused on the risk of GMOs escaping into the natural environment.

2.6 Development of an Ecosystem Approach

2.6.1 The concept

Humanity's rights to rationally utilize living resources – subject to responsible conservation and protection of species, habitats, and the environment – has been established as a principle through several international treaties and instruments (*e.g.* Rio Declaration of UNCED, 1992). The Precautionary Principle, as set out in the Rio Declaration, states that 'where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation'.

At the IMM 97, Ministers recognized the desirability of an 'ecosystem approach', with the aim of ensuring that fisheries and environmental protection, conservation and management measures are consistent with maintaining the characteristics, structure and functioning, productivity and biological diversity of ecosystems, and a higher level of protection, consistent with the needs of food production, of species and their habitats.

The ecosystem approach has become the primary framework for action under the Convention on Biological Diversity.

The International Council for the Exploration of the Sea (ICES) has defined the ecosystem approach to management as the 'integrated management of human activities based on knowledge of ecosystem dynamics to achieve sustainable use of ecosystem goods and services, and maintenance of ecosystem integrity'.

This definition points to the need for a comprehensive and holistic approach to understanding and anticipating ecological change, assessing the full range of consequences, and developing appropriate responses. The 'ecosystem approach to management', 'ecosystem management', and 'ecosystem-based management' are all synonymous terms for an integrated or holistic approach to the management of human activities. It is important to emphasize that implementing an ecosystem approach is a process and should be considered as a tool to help comprehensively and systematically redress the root causes of human induced problems.

Healthy ecosystems perform a diverse array of essential functions that provide both goods and services to humanity, in which 'goods' refers to items given monetary value in the market place, whereas 'services' from ecosystems are valued but rarely bought or sold (Table 2.1). Thus, the sustainability concept carries two aspects: sustainability of use (sustainable use) and sustainability of ecological resources and their associated ecosystem. The two are tightly linked since sustainable use of ecological

resources can only be achieved if these resources are themselves sustainable. Thus, an ecosystem approach to management involves, *inter alia*, a paradigm shift from managing commodities towards sustaining the production potential for both ecosystem goods and services ('natural capital').

Table 2.1 *Examples of goods and services provided by healthy ecosystems to humans (after Lubchenco 1994).*

Goods	Services
Food Medicinal materials Raw materials Wild genes	Absorbing and detoxifying pollutants Cleansing water and air Generating and maintaining soils and reefs Maintaining hydrological cycles Maintaining the composition of the atmosphere Pollinating crops and other important plants Providing sites for tourism, recreation and research Regulating climate Storing and cycling essential nutrients

2.6.2 A developing framework

As a follow-up to IMM 97, a workshop on the Ecosystem Approach to the Management and Protection of the North Sea was held in 1998. This workshop concluded on a conceptual framework for an ecosystem approach, with four elements supporting policy decisions and management actions (Figure 2.4). These four elements were objectives, scientific knowledge, assessment, and scientific advice. The workshop also recognized the importance of involving stakeholders, along with scientists, managers and politicians, in the decision process to promote openness, transparency, and responsibility.

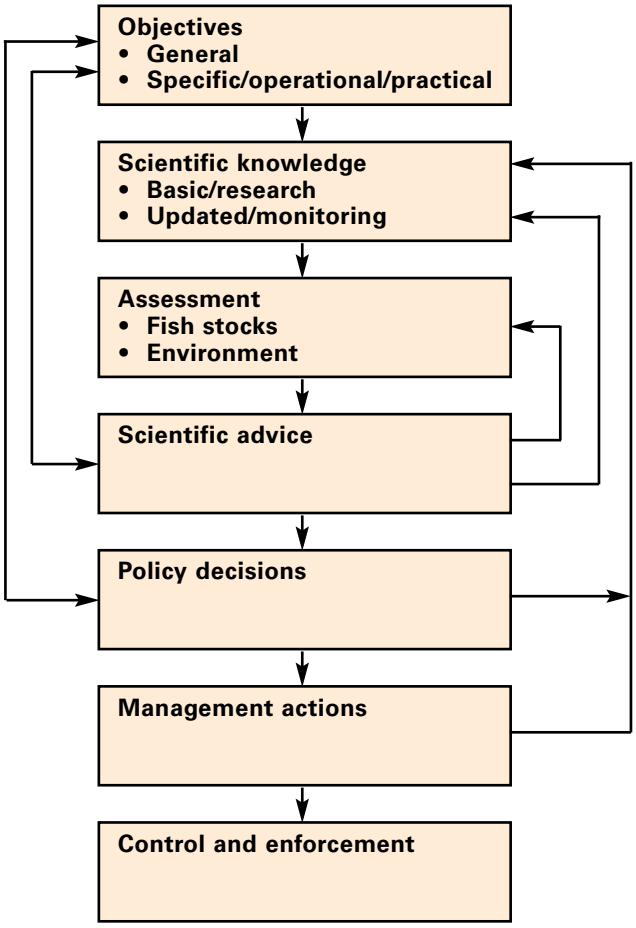


Figure 2.4 *A conceptual framework for an ecosystem approach to the management and protection of the North Sea. The flowchart shows elements in a stepwise and scientifically-based management process. Stakeholders, along with scientists, managers and politicians, should be involved at different stages of the decision process to promote openness, transparency and responsibility (TemaNord 1998).*

ICES has in recent years considered and reported on a framework for an ecosystem approach to management. In 2000, ICES established a new Advisory Committee on Ecosystems with the aim to provide integrated ecosystem advice to support an ecosystem approach to management.

In order to maintain the quality of marine ecosystems, there is a need to formulate clear objectives for the management of human activities in the ecosystem, both at the general level, as overall or integrated objectives, and at the specific level, as more detailed and operational objectives. Scientific knowledge is required as a basis for assessing whether objectives are met and whether additional measures are required. Monitoring provides updated information on the state of components of the ecosystem, while research provides insight into the mechanisms and relationships among the components. Assessment at regular intervals of the status of the marine environment, its ecosystem, and the degree of anthropogenic influence on the ecosystem, forms the basis for scientific advice to managers.

2.6.3 Ecological quality objectives

The need for ecological objectives was recognized at the Third International Conference on the Protection of the North Sea (3NSC) in the Hague in 1990. Since then the North Sea Task Force and subsequently OSPAR have worked on developing a concept and methodology for setting ecological objectives. Ecological Quality Objectives (EcoQOs) are one of a number of options for the implementation of the ecosystem approach to the management of human activities.

- Ecological Quality (EcoQ) has been defined as an 'overall expression of the structure and function of the marine ecosystem taking into account the biological community and natural physiographic, geographic and climatic factors as well as physical and chemical conditions including those resulting from human activities'.
- Ecological Quality Metrics are measurement scales or dimensions by which the EcoQ may be measured quantitatively (or, when appropriate, qualitatively) and can at least be considered as a suitable way to measure the ecological property that the EcoQ is intended to capture. Various points on these metrics can be defined either by science or by society.
- EcoQO is 'the desired level of the Ecological Quality relative to the reference level'.
- The EcoQ reference level has been defined as the level of EcoQ where the anthropogenic influence on the ecological system is minimal.

It can be very difficult or impossible to determine reference levels for pristine conditions. This can be the case for both naturally occurring chemical substances and biological conditions. Therefore a pragmatic approach is frequently required to establish and use reference levels.

The EcoQOs are seen as an important contribution to the development of operational objectives as part of an ecosystem approach to management. Individual ecological quality elements are selected that have a clear relationship between an ecosystem component and a particular human use. The whole suite of EcoQOs should in the end form a holistic and internally consistent set that will help to achieve the overall management objectives as stated by the Ministers at IMM 97. EcoQOs give guidance to management actions to be taken and should be the common language ('the glue') between the parties involved.

OSPAR decided to develop EcoQOs for the North Sea as a test case for the general concept and methodology. The Netherlands and Norway are co-lead countries for the work on EcoQOs within OSPAR. A workshop on EcoQOs for the North Sea was held in the Netherlands in 1999 (TemaNord 1999). At the workshop a set of ten issues was identified as a basis for the development of specific EcoQOs:

- reference points for commercial fish species;
- threatened and declining species;
- sea mammals;
- seabirds;
- fish communities;
- benthic communities;
- plankton communities;
- habitats;
- nutrient budgets and production; and
- oxygen consumption.

The EcoQOs relate to both structural and functional aspects of the ecosystem, and divide the ecosystem into broad compartments for which specific EcoQOs can be developed. It has been acknowledged that a two-track approach is required when developing EcoQOs: one focusing on the ecosystem and identifying the crucial processes, and one focusing on the human activities and how they affect the ecosystem. Thus, the set of EcoQOs should be a holistic entity, taking into account the linkages in the ecosystem and the total impact by human activities. Each EcoQO should represent linkage between ecosystem features and one or more human activities. Management objectives should then be formulated for these activities. Since EcoQ and management actions are dynamic, the development of operational EcoQOs must by necessity be an iterative and adaptive process.

Work within OSPAR on the development of EcoQOs for the North Sea as a test case is ongoing within its Eutrophication Committee and its Biodiversity Committee. The Eutrophication Committee will consider the issues related to nutrients and eutrophication effects (EcoQOs-eutro Greater North Sea: nutrients, phytoplankton, oxygen, benthic communities). The development of EcoQOs-eutro runs in parallel to the application of assessment criteria for nutrients and eutrophication effects. The progress made within the framework of OSPAR on the development of EcoQOs was reported by the Biodiversity Committee meeting 2001. The content of the Report has not been formally agreed within OSPAR. An overview of the proposed EcoQOs is in Annex 4.

2.6.4 Monitoring

It is important that monitoring activities are linked to objectives. Monitoring programmes for the collection of ecological and socio-economic information must therefore be adjusted as new objectives are being developed as part of an ecosystem approach.

All North Sea States operate national monitoring and reporting systems for the marine environment. The most extensive sampling is of the fisheries and of the abundance of the fish stocks. The sampling is coordinated through ICES and recently EC-funded sampling programmes have been established. Data collection for environmental parameters is coordinated by OSPAR through its Coordinated Environmental Monitoring Programme, by ICES and by the EU in accordance with various directives or through initiatives such as SeaNet. Much of the ecosystem information produced, however, does not contribute to international programmes and is only available nationally. Considerable effort has been directed towards the production of assessment reports. ICES continues to provide an annual status report covering the major fish stocks occurring in the North Sea. More infrequently OSPAR and the Nordic Council of Ministers produce status reports on the North Sea ecosystem. All these reports identify the inadequacy of current systems for the collection of information on the North Sea ecosystem. Progress on making data on various parts of the North Sea ecosystem more available have been achieved through OSPAR and ICES.

In response to the requirement for integrated monitoring, plans for designing and implementing the Global Ocean Observing System (GOOS) regionally, were considered at an ICES/IOC/OSPAR/Euro-GOOS workshop on a North Sea Ecosystem Component for GOOS held in Norway in 2001. The workshop has resulted in inaugurating moves towards an agreed strategy for a coordinated and harmonized observation network in order to progress the development of an ecosystem approach to the management of human activities in the North Sea. The aim is, *inter alia*, to increase the efficiency and cost-effectiveness of current national and international monitoring systems through the implementation of a pilot North Sea Ecosystem GOOS project for integrating fisheries and oceanographic data. An ICES/Euro-GOOS Planning Group on the North Sea Pilot Project has been established.

Although considerable progress has been made recently on monitoring, modelling, and forecasting physical parameters, until now no attempt has been made to establish a permanent integrated information system for the North Sea that includes ecosystem parameters. Such an approach would have the synergistic effect of integrating many current national activities.

3

The Protection of Species and Habitats in Coastal and Offshore Waters

3.1 Introduction

At the 4NSC, the Ministers agreed on two levels of action for the protection of the marine ecosystem of the North Sea:

- action within territorial waters, a significant component of this being the implementation of the EC Wild Birds and Habitats Directives, including Natura 2000 (an EU-wide coordinated ecological network of areas for species and habitat conservation); and
- action within the rest of the North Sea.

Ministers further agreed:

- to develop an integrated view on the specific conservation measures necessary to protect threatened or vulnerable species and habitats. This includes, *inter alia*, identifying and mapping threatened or vulnerable or ecologically important species and habitats, defining ecological objectives for the protection of such species and habitats in order to sustain or restore them to favourable conservation status, evaluating the use of protected areas as a means to protect threatened and vulnerable species, developing monitoring programmes and research to assess progress towards such objectives, and implementation of adopted management regimes; and
- to request the competent management authorities to select possible locations for areas undisturbed by fisheries, and reduce the mortality on birds, mammals, and non-target benthic organisms.

At the IMM 97, the Ministers agreed with regard to the North Sea, *inter alia*:

- to ensure sustainable, sound and healthy ecosystems, thereby restoring and/or maintaining their characteristic structure and functioning, productivity and biological diversity;

- to take appropriate measures to minimize, in accordance with the UN Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries, adverse impact of fishing activities on species and their habitats;
- to apply a precautionary approach to all human activities involving non-indigenous stocks, non-indigenous species and genetically modified organisms (GMOs);
- that fishing practices should be adjusted to minimize the deterioration of sensitive habitats and unacceptable incidental mortality generated by such practices, including considering a) restrictions/prohibitions on fishing in areas and with gears and practices that have disproportionately harmful ecological impacts on species and habitats, b) implementation of appropriate steps to restore biological diversity and habitats including the establishment of closed or protected areas, c) establishment of procedures to undertake environmental assessments of new fishing practices; and
- to further integrate fisheries and environmental protection, conservation and management measures drawing upon the application of an ecosystem approach.

The OSPAR Quality Status Report (QSR) 2000 for the Greater North Sea (OSPAR 2000) ranked human pressures within the North Sea according to their relative impact on the ecosystem and sustainable use of the North Sea. The human pressures were, as mentioned in chapter 2, ranked into four priority classes (A to D). The two most substantial priority classes are: Class A 'highest impact', namely fisheries, nutrients, and trace organic contaminants; and Class B 'upper intermediate impact', namely oil and polyaromatic hydrocarbons (PAHs), other hazardous substances, heavy metals, and biological impacts. This chapter focuses mainly on the effects of fisheries on the environment.

3.2 Threatened and Ecologically Important Species and Habitats

3.2.1 General framework

Several conventions, agreements and instruments contribute to the conservation, restoration and protection of the North Sea. These include the Convention on Wetlands of International Importance, especially as Waterfowl Habitat (the Ramsar Convention), the Convention on the Conservation of European Wildlife (the Berne Convention), the Convention on the Conservation of Migratory Species of Wild Animals (the Bonn Convention), under which is the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS), the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention) and the European Union instruments.

In July 1998, Ministers adopted an Annex V to the OSPAR Convention, entitled 'The Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area'. The Annex entered into force in 2001. The accompanying Strategy for Annex V is the vehicle for developing programmes and measures to implement, *inter alia*, an ecosystem approach. Fundamental to this for the North Sea area is the OSPAR QSR 2000 for the Greater North Sea.

In accordance with the requirements of the CBD, work has recently progressed within the North Sea States on the identification and mapping of those species and habitats that are threatened or declining within their national territories. In several cases, Biodiversity Action Plans have been drawn up for the conservation and/or enhancement of priority species or groups of species and their habitats. Evaluations of the implementation of these action plans have started in several North Sea States.

3.2.2 Criteria for the identification of species and habitats needing protection

(ED 9b)
Criteria for the selection of species and habitats needing protection (the 'Texel/Faial Criteria') are being developed by OSPAR as the first step in the implementation of its Strategy for Annex V. At the OSPAR Biodiversity Committee meeting in November 2001 high priority was given to the preparation of a final version of the Texel/Faial Criteria for approval at its meeting in 2002 and subsequent submission to OSPAR. Some preliminary material on the implementation that would follow on from the adoption of the list of species and habitats for programmes and measures will be prepared for consideration by the Biodiversity Committee.

In a parallel process, the Netherlands (lead country within OSPAR for species and habitats) collated initial priority lists of species and habitats undergoing rapid decline or under immediate threat, as well as preliminary indications of possible programmes and measures for discussion at the meeting of the Biodiversity Committee in November 2001. These initial lists were based on information submitted by OSPAR Contracting Parties and non-governmental observers. The OSPAR workshop held in the Netherlands in September 2001 proposed four lists of such species and habitats:

- threatened and/or declining species and habitats;
- species and habitats for which indications for serious decline and/or threat exist, but for which the exact status needs clarification;
- priority threatened and/or declining species and habitats across their entire range within the OSPAR maritime area; and
- priority threatened and/or declining species and habitats in specific regions.

Red lists of biotopes, flora and fauna, comprising threatened species and habitats in the Trilateral Wadden Sea Area and the German North Sea were produced in 1995 and 1996.

3.2.3 Ecosystem effects of fishing

(SoC 9.5, 14, 15.1 and 15.2)
Although the value of marine ecosystem services (see section 2.4.1) are immense, there is a lack of assessments of the value of non-exploited natural capital and services, resulting in reduced priority attached to the maintenance of biodiversity. Fishing effort has increased continuously during most of the twentieth century due to increased capacity and developments in vessels navigational and fishing technologies. In addition, direct and indirect effects on the ecosystem have become more severe due to the development of bottom otter trawls and the introduction of the modern beam trawl with larger and heavier gear and increased numbers of tickler chains. The long-standing application of high and unsustainable fishing mortalities directed at many target fish species has also resulted in serious impacts on the rest of the ecosystem including vulnerable non-target species and their associated marine habitats (OSPAR 2000).

Assessing the long-term effects of fisheries on ecosystems in the North Sea is hindered due to: a) fluctuations due to causes other than fishing, particularly natural variability; b) few time-series data that allow for the identification or interpretation of trends that span several decades; c) long-term data on activities of fishing vessels and the fishing gear used are scarce and do not provide statistics that enable fully quantitative assessments to be made of the fishery on the ecosystem; d) studies on the impacts of by-catches and discards on non-commercial species have tended to be given low priority in fisheries research and have mainly started after heavy exploitation of the ecosystem; e) the effects of fisheries on the ecosystem must often be constructed from a range of available information not collected for the purpose of examining the ecosystem impacts of fisheries on non-target species and habitats; f) the long duration of intensive fishing has made it difficult to discern the characteristics of intact or pristine habitats, and so *post hoc* detection of fishing induced changes in marine ecosystems is hard to document scientifically.

By-catch and discards
(ED Annex 1.2; SoC 9.1)
By-catch including discards, constitutes one of the major ecosystem effects of fishing; potentially even greater than the direct harvest of target species (ICES 1998b). Most of the studies attempting to improve methods for quantifying by-catches and discards have been designed to improve fish stock assessment and fisheries management. Thus, these studies tend to focus on commercially exploited

Table 3.1 *Estimated quantities (tonnes) of offal and discards from North Sea fisheries in 1990. (For assumptions and sources see Camphuysen et al. (1995); Garthe et al. (1999).)*

Roundfish	Flatfish	Elasmobranchs	Invertebrates	Offal	Total
273 000	307 300	15 000	287 500	62 800	945 600

species of fish and there is a pressing need to improve the state of knowledge on all species that are caught, including non-target species. The quantity and quality of data on discards also need to be improved, in order to make a proper evaluation of the ecosystem effects of fishing possible and to increase the reliability of present single and multi-species assessments. The estimated quantity of discards and offal in the North Sea region in 1990 was about one million tonnes (see Table 3.1). Further information on discarding is found in section 4.1.

The International Council for the Exploration of the Sea (ICES) has recently advised that all the effects on species, including by-catches, would be reduced with measurable benefits if fishing effort overall, and specifically with bottom gears, were reduced by 30% or more relative to previous years (ICES 2000).

Changes in fish communities

(ED Annex 1.2; SoC 14)

Fish are important components in the marine ecosystem on account of their frequently high biomass and role in food chains as predators on zooplankton, benthos and other fish, as well as in turn providing food for higher trophic levels including seabirds, marine mammals and man. Their management and exploitation, both as target and non-target (*i.e.* incidental mortality and by-catch) species in various fisheries are, therefore, an ecological concern and need to be seen in an ecosystem perspective.

Fish community data collected during the twentieth century have demonstrated a decrease in the abundance of larger fish resulting in a shift in both relative and absolute abundance towards smaller-sized fish as well as fish species. This applies to both target and non-target fish species. These changes have occurred primarily as a result of selective and increasing fishing pressure on larger fish, in terms of both the species and the size groups within species that are caught. Changes in fishing mortality have been shown to result in a long-term change in the slope of the size spectrum of the fish community. The decrease in abundance with size is more pronounced in the North Sea than in less heavily fished areas. Overfishing of the higher trophic level stocks (*e.g.* larger piscivorous fish like cod) has resulted in 'fishing down the food web' whereby fishing effort has been increasingly directed at lower trophic levels (*e.g.* smaller planktivores and benthos feeders), resulting in a disturbance of the structure and functioning of the food web. The average weight and average maximum length of fish are the two most suitable metrics of fish community structure (ICES 2001a). In the North Sea, the average size of an individual fish in the community as sampled in the International Bottom Trawl Survey decreased substantially between 1974 and 2000 (Figure 3.1), with this reduction being relatable to increasing fishing pressure. Thus, measures should aim at building diverse fish communities with larger numbers of bigger and older individuals and hence larger spawning stocks, especially larger species.

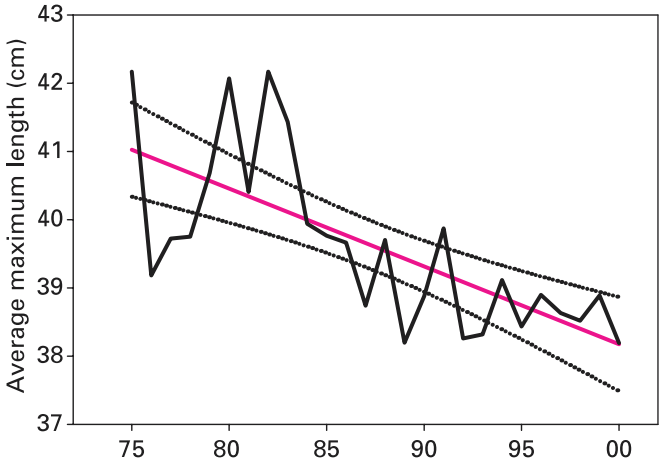


Figure 3.1 *Average maximum length of an individual fish in the fish community of the North Sea proper (i.e. excluding the Kattegat and Skagerrak) between 1974 and 2000. The lines show the fit to the data points with 95% confidence intervals (after Piet 2001).*

These changes in structure and biodiversity of fish communities induced by fishing are a special reason of concern, specifically when they affect certain

sensitive groups of species such as elasmobranchs (sharks, skates and rays). These fish are generally highly vulnerable to exploitation due to their life strategies, and in some circumstances they play an important role in the ecosystem as top predators, such as the large pelagic sharks. Extended information on the status of the stocks of elasmobranchs is given in section 4.1.2.

Because of the complexity of the ecosystem it is rarely possible to relate changes in the abundance of particular species to changes in the fishing regime. However, it is known that sustained fishing pressure has effects on the relative abundance of non-target species. Some studies on differences in catches per unit effort, in fisheries using comparable fishing gears, indicate *e.g.* substantial decreases in the abundance of several species of fish in the southern and south-eastern North Sea between two periods (1906–1909 and 1990–1995). For spurdog (*Squalus acanthias*), thornback ray, lesser weever (*Echiichthys vipera*) and greater weever (*Trachinus draco*) this decline was probably due to unsustainable high fishing mortality.

The International Plan of Action for the Conservation and Management of Sharks[2] (IPOA-SHARKS) was adopted by FAO in 1999. Accordingly, a preliminary draft European Community Plan of Action for the Conservation and Management of Sharks (EC 2001) was presented to FAO in 2001. Integrated action to support research and monitoring activities regarding elasmobranchs should extend beyond classical management strategies to include the role of elasmobranchs in the structure and functioning of the marine ecosystem and more specifically fish assemblages (EC 2001).

3.2.4 Marine mammals

(ED 1.9, Annex 1.2 and Annex 1.3; SoC 9.2, 9.3, 14, 19.1, 19.2, 19.3 and 20)

Prior to the Second World War, hunting was the major source of mortality for marine mammals, particularly seals, of the North Sea. In modern times mortality is caused by incidental take in fisheries and possibly also by pollution, which may have an indirect effect by compromising immune systems. OSPAR asked Contracting Parties and ICES for information on the health status of marine mammals in relation to habitat quality, but little information exists in this area and suggestions were made for future approaches on this issue.

By-catches of marine mammals in commercial fishing operations usually result in serious injury or mortality to the marine mammals, and may result in loss of fishing gear and catch, and lost fishing time.

The most abundant cetacean in the North Sea is the harbour porpoise (*Phocoena phocoena*). This species is distributed throughout the North Sea and adjacent waters, but has become rare in the Southern Bight, the Channel, and the Baltic Sea (ICES 1998b). The by-catch levels of small cetaceans within the North Sea are best documented for harbour porpoises. This is the species occurring most frequently as by-catch in the central and southern North Sea, particularly in bottom-set gillnets. In the combined Danish fisheries alone, the by-catch was estimated by extrapolation to be about 3 000 individuals in 2000. In the recent past, this figure has been as high as 8 000 per year. It is estimated that UK fisheries in the same area took about 800 individuals in 1995, and 440 individuals in 1999. Total by-catch levels probably exceed the sustainable levels for harbour porpoises in this area of the North Sea and, if continued, they may lead to population decline. The full impact of by-catches of harbour porpoise cannot be evaluated because other fisheries (in particular Norwegian fisheries) operating in the same area are not yet monitored for by-catches.

The recent decline in by-catch levels of Danish and UK fisheries is a result of reduced fishing effort due to decreased Total Allowable Catches (TACs) set for demersal fish. Denmark requires fishermen to use acoustic deterrents 'pingers' in gillnet fisheries over wrecks, where the by-catch rate of harbour porpoises was estimated to be high. Preliminary results indicate that pingers are effective in reducing by-catch in these fisheries. In the UK, trials of acoustic pingers as warning devices, in the Cornish hake (*Merluccius merluccius*) gillnet fishery proved that pingers are capable of reducing porpoise by-catch rates by about 90% (SMRU 2001).

[2] The term 'shark' is taken to include all species of sharks, skates, rays and chimaeras, and the term 'shark catch' is taken to include directed, by-catch, commercial, recreational and other forms of taken sharks.

International agreements on conservation of marine mammals

In recent years, management and conservation measures have been proposed or implemented to reduce by-catches on both global (*e.g.* UN Resolution 44/225 § 4a that called upon member states to impose a moratorium on high seas drift nets by 30 June 1992) and regional levels (*e.g.* ASCOBANS).

The Conservation and Management Plan for the Wadden Sea Seal Population (the Seal Management Plan) has established seal reserves in the entire Wadden Sea.

Although research on small cetaceans is conducted throughout the ASCOBANS area, including the North Sea, increased data collection on seasonal and spatial distribution as well as on long-term monitoring of population trends is needed. A second full survey (SCANS II) is being planned.

ASCOBANS has collated information on disturbance by high-speed ferries and seismic surveys and contributes to discussions on protected areas for harbour porpoises in other relevant forums. Additionally, ASCOBANS is working on the most important threat facing small cetaceans, the problem of incidental take or by-catch. A study on potential measures for by-catch reduction in the Agreement area commissioned by ASCOBANS is currently under review. Belgium has adopted legislation requiring an environmental impact assessment (EIA) for certain seismic surveys conducted for commercial purposes. The UK has developed Regulatory Guidelines on Seismic Surveys, and has adopted guidelines on whale watching and on reduction of recreational disturbance. A small cetacean sanctuary was established in German waters off the Islands of Sylt and Amrum, extending the boundaries of the National Park 'Schleswig-Holstein Wadden Sea' into offshore waters. The area was further nominated as a Special Area of Conservation (SAC), with management measures still to be developed. The Danish Wadden Sea has been designated as a SAC based in part on the occurrence of harbour porpoises. An environmental impact assessment conducted in connection with the establishment of a windmill farm in Danish waters in the south-eastern North Sea includes possible effects on harbour porpoise.

The Third Meeting of Parties to ASCOBANS (July 2000) adopted a resolution that recommended that competent authorities take precautionary measures to ensure that the total anthropogenic removal of small cetaceans in the Agreement area and its adjacent waters be reduced as soon as possible to below 1.7% annually of the best available abundance estimate. Moreover, as a precautionary objective, an annual by-catch of less than 1% of the best available population estimate has been set.

Scientific advice on threats, and measures to reduce by-catch

ICES has advised on marine mammal issues for many years such as advice on small cetaceans. In recent years ICES has reviewed requirements for scientifically sound programmes for collection and handling of data on by-catches, including a review of methods for monitoring cetacean by-catch. ICES Member Countries have been urged to monitor their fisheries to identify gear types, areas and seasons where by-catches of marine mammals occur (ICES 1998b). In order to assess the impact of by-catches on marine mammal populations, it is recommended that robust estimates of abundance and information on the distribution (stock identity) of affected species need to be obtained in addition to estimates of total by-catch.

The EC Council Regulation No. 1239/98 of 8 June 1998 banned the utilization of drift nets from 1 January 2002 in order to help protect small cetaceans and other non-target species. The UK has encouraged a more rapid phasing-out of the drift net fishery, by restricting licences in the intervening period to those vessels that had used drift nets in either 1996 or 1997.

ICES has recommended that, if by-catches are to be reduced below the agreed target of 1.7%, mitigation measures should be put in place, giving particular priority to the southern North Sea and the Celtic Sea, where by-catches of harbour porpoise appear to be the most serious problem. No single mitigation measure has been shown as universally superior to all alternatives; a mixture of measures will be preferred. Effort reductions will be efficient since they will reduce the opportunities for the by-catch of small cetaceans while reducing the overall impact on the ecosystem. The balance of evidence about the use of pingers indicates that they are effective in reducing cetacean by-catch of porpoises in gillnets.

Further scientific evidence is required to propose closed areas or seasons.

Trials of acoustic pingers, as warning devices, have indicated that they are capable of reducing porpoise by-catch rates by up to 90%. Discussions about the possible deployment of pingers on a large scale are ongoing, also in the fishing industry. Unilateral deployment of pingers on the vessels of a single state alone might discriminate against its fishermen so an EU-wide approach is required. So far the European Commission has not made any Europe-wide proposals on this matter.

Seal-safe eel traps (fyke nets and pond nets) are also being devised, and methods are being developed for scaring seals away from fishing operations; mechanical means of protecting fishing gear and alternative fishing methods. Financial inducements are also being used to enable fishermen to purchase seal-safe fishing gear (*e.g.* to replace old salmon traps).

ICES has proposed three Ecological Quality Objectives (EcoQOs) for marine mammals: a) seal population trends, b) number of occupied seal breeding sites, and c) annual by-catch of harbour porpoises (ICES 2001a) (see also Annex 4).

3.2.5 Seabirds and shorebirds

(ED Annex 1.2; SoC 9.1 and 9.2)
Seabirds and shorebirds play important roles in the North Sea marine ecosystem due to their abundance and position as predators at or near the top of food chains. The majority of offshore seabirds eat fish, both live and as discards and offal, many feed on benthos, and a few on zooplankton. Accordingly, these birds are prone to ingest and further accumulate contaminants already accumulated in their prey and to experiencing the associated biological effects of pollution.

Human induced factors that have affected overall population levels of seabirds include: factors leading to increases, such as increase in food supply due to reduction in large fish competitors, dumping of offal and discards from fishing, and the reduction of directed hunting; and factors leading to decreases such as introduced predators, oil pollution, disturbance in general, and other pollutants including litter at sea.

Introduced predators that eat eggs, young and adults, are a major threat to seabirds and shorebirds in the North Sea region, especially rats and American mink (*Mustela vison*). Such predators have affected the distribution of black guillemot (*Cepphus grylle*) and reduced the breeding success of several seabird species in Scotland during the 1990s.

Oil pollution causes death and sub-lethal effects on organisms, destruction of habitats, and disruption of food chains. The impacts of spills are variable and even the smallest spill may cause numerous casualties. The scale of impact depends on the location and seasonal timing of the spill, as well as on the type of oil. Most oil enters the sea from land-based sources or deliberate discharges from ships and most seabird mortalities from oil pollution occur as a result of these events. Seabird species that congregate on the sea surface are at greatest risk, *e.g.* divers, seaduck, Manx shearwater (*Puffinus puffinus*), razorbill (*Alca torda*), guillemot (*Uria aalge*), black guillemot, and puffin (*Fratercula arctica*).

Marine litter is a substantial problem in the North Sea. In the OSPAR project on marine litter, a litter website has been established together with UNEP/GPA in order to provide information about the problem and to promote actions against marine litter from land-based as well as sea-based sources. Marine litter, including small items of plastic (*e.g.* such as can be eaten by seabirds and shorebirds), may cause death through entanglement or ingestion, or through reduced feeding opportunities.

A few studies have been carried out to evaluate the effects of windmill constructions (*e.g.* 'windmill farms') at sea on aquatic birds. These studies have either shown equivocal results or a positive effect due to the reduction in other sources of disturbance. However, concerns about wider effects have led to the initiation of several studies that have yet to be reported on.

ICES has proposed seven possible EcoQOs of relevance to seabirds (ICES 2001a) with associated reference levels, current levels and suggested target levels. These EcoQOs are: 1) the proportion of oiled common guillemots among those found dead or dying on beaches, 2) mercury concentrations in eggs of selected seabird species, 3) mercury concentra-

tions in body feathers of selected seabird species, 4) organochlorine concentrations in seabird eggs, 5) number of plastic particles in gizzards of fulmars (*Fulmarus* sp.), 6) breeding productivity of black-legged kittiwakes (*Rissa tridactyla*), and 7) seabird population trends (see also Annex 4).

Seabird surveys are conducted in the North Sea by many states in order to estimate bird abundance and identify concentrations. These surveys use standardized methodologies and most observations have been compiled to form the world's largest effort-correlated database on the distribution of seabirds and marine mammals at sea. This database is useful for producing vulnerability atlases for seabirds and oil pollution, guiding oil exploration and development activities in the North Sea regarding the most sensitive times of year for birds offshore and to guide oil spill responses. Important areas for piscivorous birds that might be vulnerable to local overfishing of prey species have been identified. The database and other information on birds in nearshore waters may also be used to identify areas suitable for designation as Special Protection Areas or by other special measures, under the EC Wild Birds Directive. Surveys of seabird beachings also occur, and for this purpose several coastal authorities and communities around the North Sea agreed in 2000 not to clean and remove bird corpses from certain parts of their coastline during the winter months.

Seabirds and fisheries

The growth of commercial fisheries in the North Sea has had the following consequences on some seabirds.

- Processes affecting trophic ecology
  a) the removal of large piscivorous fish by fisheries has enhanced the stocks of some small pelagic fish (*e.g.* sandeels (*Ammodytes* spp.)) and has probably contributed to an increase in some seabird populations. On the other hand, collapses in stocks of small pelagic fish (*e.g.* herring (*Clupea harengus*)) – from fisheries and/or natural causes – can lead to marked declines in the breeding success of a number of seabirds. Fisheries may also compete directly for the same prey as seabirds, *e.g.* inshore fisheries for mussels and cockles and industrial fisheries for sandeel and sprat (*Sprattus sprattus*); and
  b) discards and offal form a major by-product of fisheries, and these have supported substantial population increases in several seabird species (*e.g.* fulmar, gannet (*Morus bassanus*), great skua (*Catharacta skua*), kittiwake) that can scavenge.
- Incidental mortality
  Seabirds can become drowned by long-lines and most types of fishing nets. However, amongst these, gill- and other static nets appear to pose the greatest risk to seabird populations.

The impact of seabirds on the recruitment of fish stocks occurs predominantly through the consumption of young fish. In the majority of situations the impact of this predation is likely to be less than from predatory fish. Cormorants (*Phalacrocorax* spp.) fishing inside Danish pound nets compete directly with fishermen.

Studies of the consumption of offal and discarded fish and benthic organisms constitute an important food source for seabirds in the North Sea. It has been estimated that a maximum of 800 000 tonnes of discards are eaten annually by seabirds in the North Sea, not including the Channel. However, despite the consumption of offal and discards by many species of gull, more offspring are produced in seasons when their natural prey is available and consumed in abundance than in years when discards form the greater part of their diet.

ICES has advised on how an ecosystem approach can be applied involving seabird breeding colonies and industrial fisheries. Accordingly, the Council of EU Fisheries Ministers accepted in December 1999 the Commission's proposal to close an area of the north-western North Sea to sandeel fisheries for the 2000 season, and this has subsequently been extended for a further two years following annual reviews. The resulting EC Council Regulation No. 1239/98 of 8 June 2000 restricts fishing for sandeels, on the grounds that the quantities of this fish were currently insufficient to support both fisheries directed at them and the requirements of various populations of species for which sandeels are a major component of their diet.

UK and Danish institutes undertook a study of the effects of changes in sandeel stocks (size and age structure) on predators in 1997 and 1998 in an area off eastern Scotland. The aim of the study was to

evaluate how a fishery on the same sandeels might affect the predators. The study indicated that sandeel stock size and behaviour had a greater effect on the predators than did the fishery.

Actions to reduce the incidental catch of seabirds in fisheries

Concerns have arisen about the incidental catch of seabirds in various commercial longline fisheries, and such incidental catches may also have an adverse impact on fishing productivity and profitability. Accordingly, the International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-SEABIRDS) was adopted by FAO in 1999.

In Norway, research is being conducted on the mortality of birds in fishing equipment, with special focus on longline fisheries, and the development of seabird-friendly fishing gear. Measures that can significantly reduce seabird by-catches include bird-scaring devices towed behind the fishing vessel during the shooting of the longline, and setting of the lines through a protective tube into deeper water.

There is no evidence of a large impact from by-catch on birds in UK waters, and any problems are localized. In one limited area (St Ives Bay, Cornwall), a by-catch of razorbills and other auks has occurred in some years in a fixed gear bass (*Dicentrarchus labrax*) fishery carried out in winter. Specific local rules have been introduced that halt the fishery temporarily if the scale of the by-catch exceeds a specified level.

3.2.6 Benthos

Combined effects of physical disturbance and eutrophication

(ED I.3, I.9, Annex 1.2; SoC 14 and 15.1)

For more than a century, human induced physical impacts (*e.g.* mortality and bottom disturbance from towed demersal fishing gears, the extraction of sand, gravel and rocks, and dredging) and organic input (*e.g.* from increased biomass enhancement via eutrophication and discarded by-catch and offal) have increased. These impacts have favoured opportunistic species with flexible life history traits and eliminated vulnerable species with conservative life histories. The resulting changes in the benthic fauna and flora in the shallower heavily trawled and more eutrophic areas have been shifts towards non-fragile fast growing and mobile scavengers, predators, and sediment or suspension feeders such as polychaetes, amphipods, and starfish. These shifts have occurred at the expense of slow-growing and longer-lived organisms such as many of the larger, sessile and frequently fragile filter-feeding bivalves, reef forming polychaetes, maerl and corals. The impacts of the previously mentioned anthropogenic activities have combined to result in elevated productivity and biomass, and a change in the structure of the demersal and benthic communities. None of the sources of anthropogenic disturbance and natural disturbance (*e.g.* sediment movements caused by storms exposing or burying organisms) affecting the benthos, produce as far-reaching effects as are caused by demersal trawl fisheries (using *e.g.* otter trawls and especially beam trawls), by physically crushing and damaging benthic species and habitats.

In North Sea States dredging is conducted as maintenance dredging on shipping routes and in harbours. In the case of marine aggregate extraction (*e.g.* sand and gravel), restrictions are enforced and in some cases aggregate extraction is not allowed on environmental grounds.

The results from a major project on the effects of fishing gear on the North Sea benthic ecosystem (the 'IMPACT-II Study'), financed by the European Community, have been published (Lindeboom and de Groot 1998). ICES reviewed the scientific information from the IMPACT II report and additional literature with a view to evaluating the effects of bottom trawling on macrobenthos and associated fish, and thereby proposed measures to reduce the effects of fisheries on benthic species and habitats (ICES 2001b). A list was prepared of the possible effects that bottom trawling might have on species, communities, and habitats. ICES concluded that there is clear scientific evidence of the following effects in the North Sea:

- *effects on habitats*: removal of major physical features, reduction of structural biota, reduction in habitat complexity, changes in sea floor structure; and
- *effects on species*: reduction in geographic range, decrease in species with low turn-over rates, changes in relative abundance of species, fragile species more affected, surface-living species more affected than burrowing species, sub-lethal effects

on individuals, increase in species with high turnover rates, increase in scavenger populations.

The study found that mortalities of benthic infauna occur most frequently from damage by tickler chains, the teeth of scallop dredges, and the doors of otter trawls. Ground ropes of otter trawls rigged without chains mainly affect epifauna. For those gears where there is little penetration of the gear into the seabed, the main effect is on epibenthos, either as the gear passes or by capture with consequent damage in the cod-end or on deck. The quantity of epibenthos that is brought on board can be minimized when the ground rope is rigged with rollers or bobbins or other devices to keep it clear of the bottom. Fixed gill- and tangle nets have minimal effects on benthic taxa, with the exception of crabs and certain echinoderms that become entangled.

The method of rigging the gear substantially affects the level of disturbance, and in the case of the beam trawl there is a clear positive relationship between the number of tickler chains used and the biomass of benthos caught. Traditionally, modifying gear to enable greater catches of the target finfish and shellfish has resulted in a subsequent increase in the by-catch of non-target invertebrates and fish. Although nets have been refined to reduce the by-catch of non-target and undersized fish and fish species, little practical progress has yet been made in reducing the by-catch and subsequent discards of invertebrate benthic species. The catch of beam trawl hauls is substantially greater than for otter trawls for both marketable fish and for discards, the mortality of non-target benthos caused by beam trawl hauls is on average at least ten times greater than that caused by otter trawls.

On local scales in the North Sea, recent studies have documented the marked decline and loss of both target (*e.g.* commercial shellfish) and non-target populations, including degradation of their habitats, due to bottom fishing operations. The duration of the effects may vary from days to decades, and may be permanent, depending on the species and habitats involved. In the southern and south-eastern North Sea in particular, high levels of long-term impact on benthic fauna and flora as well as on non-target species of groundfish have occurred due to fishing (ICES 2000; ICES 2001c) (Figure 3.2).

The assessment of ecosystem effects of fishing is hampered by lack of data on the fine scale spatial and temporal distribution of fishing vessels and target and non-target species and their habitats. In the south-eastern North Sea, several studies have been conducted by the Netherlands (*e.g.* on the distribution of fishing effort by the Dutch beam trawling fleet) from 1993 to 2001 with funding from the European Commission and the fishing industry. These studies have provided important information on the spatial and temporal impact of beam trawling on the benthic communities, including the relation between fishing effort and fishing mortality. The results indicate that in the south-eastern North Sea, the Dutch fleet contributed more than 80% of the beam trawling effort. However, the beam trawling fleet has a very heterogeneous fishing pattern with some seabed areas being trawled heavily (*e.g.* more than 20 times a year) and some hardly at all. About 63% of the south-eastern North Sea is trawled less than once a year, whereas only 4% is trawled five times a year or more. Population fishing mortality rates for a variety of benthic organisms occurring in the Dutch sector of the North Sea were estimated to be between 5% and 50%.

Studies to develop more selective fishing techniques (*e.g.* escape panels and sorting grids in nets) for reducing by-catch, as well as alternative fishing techniques that reduce the pressure on the bottom and the impact on the associated benthic communities, have been undertaken both nationally (*e.g.* the Puls trawl study, the Netherlands) and internationally (*e.g.* EU project REDUCE, the Netherlands with Belgium, Germany and Ireland). Several promising techniques have been identified for improving otter trawls and beam trawls. For the beam trawl a combination of net configuration (escape panels) and electrical stimulation (alternative to heavy gear) has potential. An initiative by the Dutch fishing industry in cooperation with various management departments and research institutes is being undertaken to further develop the Puls trawl with electrical stimulation as an alternative to using heavy ticklerchains.

The RESCUE project (1995–1997) obtained more accurate information on the extent of by-catch in the benthic brown shrimp (*Crangon crangon*) fisheries allowed within the national 12 nm limits,

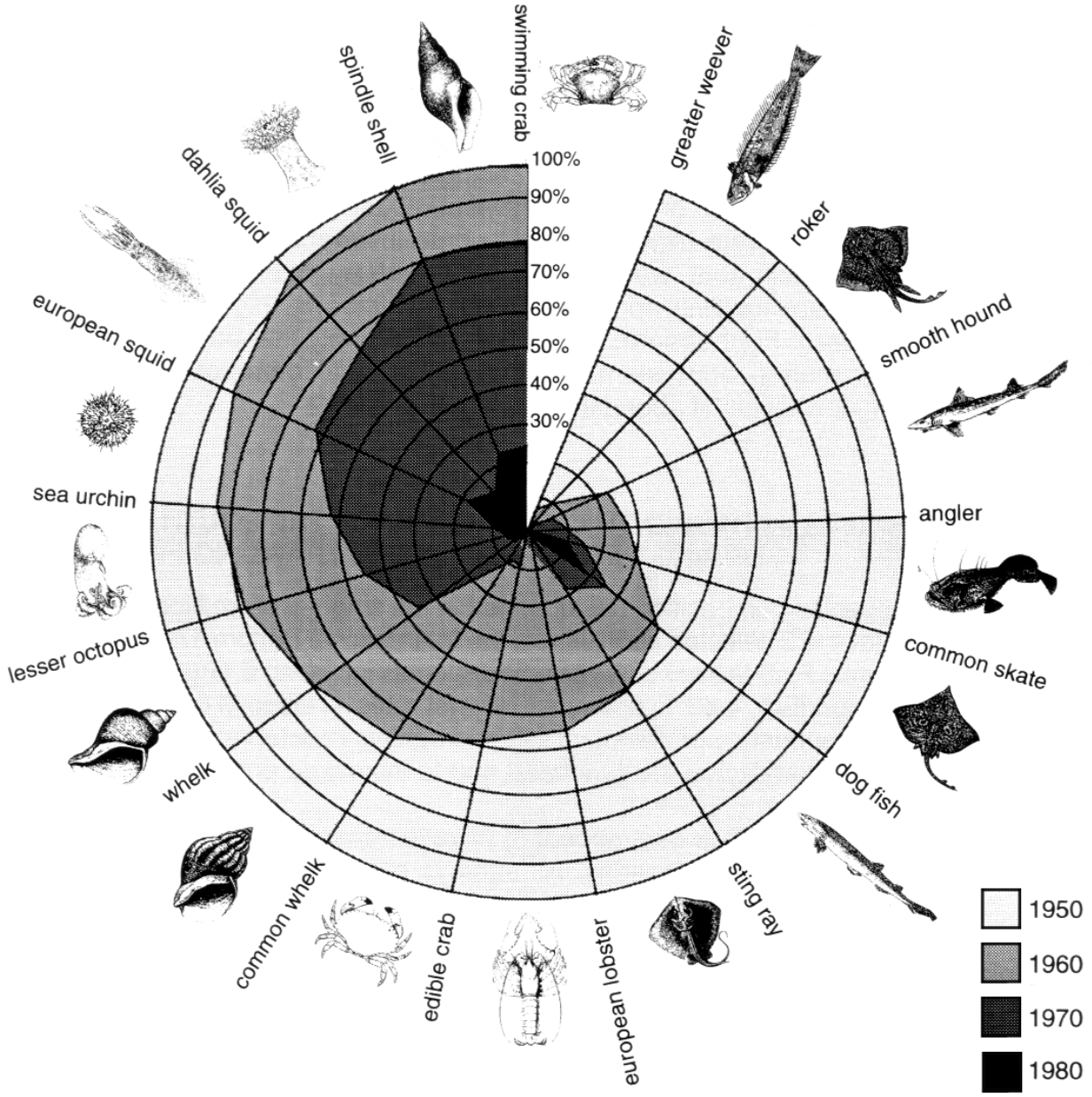


Figure 3.2 *Long-term trends in relative abundance of demersal fish and benthic invertebrates in the south-eastern North Sea between 1947 and 1981. Relative abundance in 1960, 1970 and 1980, respectively, is expressed as a percentage of the original relative abundance in 1950 as estimated by means of a catchability model. The species are ranked from greater weever to swimming crab (clockwise) based on their estimated decline due to otter trawling and beam trawling, respectively. The data are based on the supply of specimens provided by fishermen for museum and educational collections (Lindeboom and de Groot 1998).*

for the major fleets in the North Sea (*i.e.* Belgium, Denmark, France, Germany, the Netherlands and the UK). High levels of discarded juvenile plaice (*Pleuronectes platessa*) and sole (*Solea solea*) were found, which emphasized the need to promote more selective gear in the shrimp fisheries.

Several North Sea States have applied restrictions on fishing operations in order to protect vulnerable benthic species and habitats. In 1999, legislation was passed in Norway under the Seawater Fisheries Act making it illegal to destroy *Lophelia* coral reefs intentionally, and two areas protected from trawling activities have been established. Regulations for the sustainable cyclical trawling of kelp (*Laminaria* spp.) have been implemented in Norway in order to allow the redevelopment of kelp communities. Fisheries on living, sedentary organisms (bivalves) are prohibited in Belgian territorial waters (Royal Decree of 12 April 2000) partly to

conserve overwintering birds in the shallow area of the western part of the Belgian coast where bivalves are an important food source for the birds.

Limitations on bottom trawling, including the use of zoning, in coastal areas (*e.g.* straits, bays or fjords) exist in several North Sea States (*e.g.* Denmark, Sweden and Norway) in order to protect benthos or especially juvenile demersal fish as well as for environmental and biodiversity protection reasons.

Scientific advice on measures to reduce the effects of fisheries on benthic species and habitats

(ED Annex 1.1, Annex 1.2; SoC 9.2, 9.3, 14 and 15.1)

Several changes can be made that will contribute to meaningful reductions in the effects of bottom trawls on the benthos of the North Sea and reduce the ecosystem effects of fishing. ICES has advised the European Commission that the most serious effects could be mitigated, without unduly reducing the possibilities of catching commercially important species, through the following priorities: 1) a major reduction in fishing effort, 2) establishing closed areas (*e.g.* spatial and real time closures), 3) making gear substitution, 4) modifying gear, 5) habitat restoration, and 6) governance changes (ICES 2000). A number of changes to the management system of the North Sea (IMM 1997) that would greatly facilitate major reductions in the effects of fishing on marine ecosystems are under consideration. Despite lack of complete knowledge of the ecosystem effects of fishing, ICES notes that the precautionary approach requires that immediate action be taken, to ensure that conservation is not compromised while greater knowledge bases are being built. Thus, the following specific immediate actions have been recommended: a) prevent expansion of areas impacted by bottom trawls, b) prevent increase in numbers of bottom trawlers, c) strengthen interactions with groups working on conservation of the marine ecosystem, and d) improve the ability to detect and measure impacts.

ICES has reviewed possible indices for Ecological Quality (EcoQ) for the benthic community, and concluded that the presence of indicator or sensitive species would be the most suitable metric of ecological quality in these communities (ICES 2001a). There are several indicator species, often consisting of habitat-forming species such as corals and epifaunal organisms, that are known to be sensitive to bottom fishing disturbance. The use of indicator species obviates the need to identify all species in benthic samples. In addition, attention has been drawn to three metrics for benthic communities that may be developed further: biomass, *K*-dominance curves, and the presence of non-indigenous species. The adoption of these may address some of the shortcomings of the application of 'the presence of indicator or sensitive taxa'. Further to the ICES review, a workshop held in 2001 in which stakeholders participated, discussed the further elaboration of the following benthos-related EcoQO metrics: the density of fragile species and opportunistic indicator species, and the population size and distribution range of ocean quahog (*Arctica islandica*).

3.3 Conservation, Classification and Mapping of Habitats, and the Development of a System of Marine Protected Areas

The conservation of habitats is a precondition for conserving the species that are associated with and dependent on the habitats for their viability. Degradation, fragmentation and eventually complete loss of habitat caused by physical alteration as well as water quality impairment from a range of human activities, represent the most serious threats to marine biodiversity, especially if contiguous but different habitats forming landscape diversity are lost (GESAMP 1997).

The coastal zone includes some of the most productive areas of the North Sea, providing habitats and essential breeding and nursery grounds for biota, including fish and shellfish for commercially and recreationally important fisheries, aquatic birds and marine mammals, and benthos.

According to the Red Lists of Biotopes, Flora and Fauna of the Trilateral Wadden Sea Area, the most threatened or degraded habitats/species are the sublittoral European oyster (*Ostrea edulis*) and *Sabellaria* reefs and subtidal seagrass beds. Following expert judgement, the main threats to

these habitats are pollution, eutrophication and fishing activities. In addition, land claim and coastal defence measures pose threats to tidal flats and salt marshes.

In the IMM 97 Statement of Conclusions, the Ministers reaffirmed their request, made at the 4NSC, to the competent authorities to facilitate research on areas undisturbed by fisheries. Since then, however, no undisturbed areas have been closed to study the effects of fisheries disturbance in the North Sea area.

3.3.1 Classification and mapping of habitats

(ED 6 and 7)
The OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area, adopted in 1998 to implement Annex V of the OSPAR Convention, requires OSPAR to assess which habitats need to be protected. Further protection requires knowledge of where the habitats are to be found. OSPAR is collaborating with relevant scientific institutions including ICES and the European Environment Agency (EEA) to classify and map habitats. The EUNIS (European Nature Information System) classification being developed by the EEA is particularly important. The collaborative work has comprised:

- *habitat classification*: developing a classification system, for all marine habitats within the OSPAR area (inshore and offshore shelf rock and sediment, deep water and pelagic), which is fully compatible with the EUNIS classification; and
- *habitat mapping*: preparing maps of the OSPAR maritime area including the North Sea, showing the spatial distribution and extent of habitats according to a consistent classification system, to meet the needs of OSPAR in the assessment and protection of marine habitats.

Progress towards these aims has been made through a series of three workshops held in 1999, 2000 and 2001. These workshops have confirmed that, subject to adequate testing and refinement, the overall approach and structure of the EUNIS marine classification is generally applicable for use in the OSPAR and ICES areas, including the North Sea. The EUNIS classification scheme has been improved regarding: a) the intertidal and shelf-seas rock and offshore sediment habitats, b) the deep-sea and pelagic habitats, and c) the need to better reflect biogeographic variation. A preliminary classification of marine landscapes (habitat complexes) has been developed to complement the habitat classification approach, often being at a more appropriate scale for ecosystem management and site protection. Further, an integrated approach to deep-water habitat mapping has been developed to ensure that techniques and standards for data storage, interpretation and presentation are compatible.

In 1999, the ICES Study Group on Marine Habitat Mapping was established to provide impetus to this field of work, leading in 2000 to the start of a trial Geographic Information System mapping project for the southern North Sea.

Despite substantial progress in developing and further validating the EUNIS classification, it is recognized that its full application to meet EEA, OSPAR and ICES requirements for assessment and mapping needs further work. Not least is the need to include information on biota (*i.e*. EUNIS level 4 and above) in addition to the current information levels focused on the physical characteristics of habitats. Otherwise there is a risk that the classification will fail to operate effectively at a European and North Atlantic level. There is also a need to test and validate the classification. In ongoing OSPAR activities (*e.g.* the identification of habitats requiring protection and the development of EcoQOs) attempts will be made to use the classification, both to provide consistency across the OSPAR area in this work and to further test the classification.

Recent activities within OSPAR include: a) preparation of a correlation between the marine EUNIS classification and the marine habitats in Annex I of the EC Habitats Directive, b) further development of the marine landscapes (habitat complexes) approach and its correlation with the habitat classification, and c) consideration as to how best to incorporate into the habitat classification system those habitats which appear to be degraded. It is the aim to complete the habitat classification for the OSPAR area to a satisfactory level of detail by 2002 or 2003.

The North Sea States are conducting many activities of direct relevance to marine habitat mapping, including surveying and monitoring of marine

fauna and flora (fish, seabirds, marine mammals, and macrobenthos) and their associated biological, chemical, and physical environment. A series of strategic environmental assessments have been carried out or are planned in several countries. Further, the oil industry in the North Sea has conducted numerous environmental surveys. Surveying and mapping activities are also being conducted in order to determine sites suitable as protected areas such as those within the Natura 2000 network.

3.3.2 Development of a system for marine protected areas

(ED 9f, Annex 1.1, Annex 1.2.7; SoC 9.2 and 9.3)
In accordance with Annex V and the associated Strategy for its implementation, it is necessary for OSPAR Contracting Parties to take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected. In order to facilitate this, it has been proposed to establish a system of Marine Protected Areas (MPAs) and to agree on measures to ensure the sustainable use of the marine ecosystem.

The establishment of OSPAR MPAs takes account of the obligations of Contracting Parties under other international conventions and directives.

OSPAR MPAs, individually and collectively, aim:
- to protect, conserve and restore species, habitats and ecological processes which are adversely affected as result of human activities;
- to prevent degradation of and damage to species, habitats and ecological processes following the precautionary approach; and
- to protect and conserve areas which best represent the range of species, habitats and ecological processes in the OSPAR area.

A system of OSPAR MPAs should take into account the linkages between different parts of the marine ecosystem and the dependence of some species and habitats on processes that occur outside the MPAs. These relationships are often more complex and occur on a larger scale than those of terrestrial ecosystems. OSPAR MPAs should form an ecologically coherent system of well-managed MPAs. The selection and establishment of MPAs is being carried out in connection with and for the mutual benefits of the work related to the assessment of species and habitats in need of protection, to habitat classification and biogeographic regions, and to developing the ecosystem approach including the development of EcoQOs.

As a result of three OSPAR workshops (held in 1998, 2000 and 2001) draft Guidelines for the Identification and Selection of Marine Protected Areas in the OSPAR Maritime Area have been developed, but remain to be adopted and applied. These have been supplemented by draft Guidelines for the Management of Marine Protected Areas in the OSPAR Maritime Area. Further, an Expert Workshop on Managing Risks to Biodiversity and the Environment of the High Seas, Including Tools Such As Marine Protected Areas was held in 2001, to discuss the legal and scientific aspects of MPAs on the high seas.

An inventory of existing maritime areas which have been protected in the OSPAR maritime area, has been established to assist the programme to develop the system of MPAs. An analysis of the inventory indicates that there appears to be a reasonable coverage of the (near) coastal zone with MPAs in most of the OSPAR Contracting Parties. Only very few protected areas occur beyond 3 nm from national baselines, apart from areas where fisheries restrictions apply. For this reason, the considerations on identification and establishment of OSPAR MPAs place particular emphasis on waters beyond 3 nm from national baselines.

BirdLife International and the World Wide Fund for Nature (WWF) have made particularly substantial contributions towards the development of MPAs through the production of reports and organization of workshops (WWF 2000, 2001; BirdLife 2000).

The Belgian MMM-law of 20 January 1999, Official Journal 12 March 1999, which is applicable to the territorial waters and the Exclusive Economic Zone (EEZ), provides for the establishment of MPAs, as well as for the effective protection of a number of species, the requirement of an EIA for certain activities and a regime for compensation and restoration.

In May 2001, the Norwegian government initiated a process on the establishment of a representative

network of MPAs to include representative areas of different marine habitats. These areas will be important as references for use in monitoring and research, and shall remain as undisturbed as possible. MPAs shall be established to protect special, threatened and vulnerable marine nature values. The first set of MPAs will mainly be located in the coastal zone and should be completed by 2004. After the completion of the first network of MPAs, the total need for MPAs in Norwegian waters will be evaluated according to updated knowledge and national and international objectives, conventions and agreements. The process has been initiated by the environmental management authorities in close cooperation with the fisheries management authorities, and contributes to the integration of fisheries and environmental policies.

3.3.3 Habitats, including Natura 2000

(ED 4, 5; SoC 9.3)
Natura 2000 is designed to establish a coherent European ecological network of Sites of Community Importance (SCIs) in order to maintain the distribution and abundance of all naturally occurring species and habitats in the EU, both terrestrial and marine. Natura 2000 is to comprise a network or a system of Special Areas of Conservation (SACs) under the Habitats Directive and Special Protection Areas (SPAs) under the Wild Birds Directive. The aim is to enable the habitats and the species to be maintained, or where appropriate, restored to a favourable conservation status in their natural range.

In order to conserve Natura 2000 sites, member states are establishing conservation measures involving appropriate management plans and statutory, administrative or contractual measures. For the North Sea area, the number of marine sites proposed as sites of community importance up to May 2001 amounted to about 60, mainly in the coastal area. The surface covered by these sites is about 900 000 hectares. The overall procedure for the adoption of Community lists of sites has been unduly slow and the Commission is taking all appropriate steps in order to accelerate this procedure, including legal action.

Although the designation of sites is behind schedule, the management of threatened sites is essential. Some member states have already put conservation measures in place for relevant sites ahead of their formal adoption by the European Community. The European Commission has drafted a document to facilitate the understanding of the broad mechanics of the Habitats Directive. However, site-specific questions will need to be dealt with on a case-by-case basis.

The European Commission has clarified in several communications that the Habitats and Wild Birds Directives apply to the whole EEZ of the Member States, and not just in territorial waters. However, implementation of these directives outside the 12-mile limits seems still hampered by judicial problems (*e.g.* inconsistency with the UN Convention on the Law of the Sea (UNCLOS)) in some Member States. Most North Sea States are now applying the directives to all waters and have already proposed or will propose Natura 2000 sites in the offshore zone in the near future.

Measures underway, initially in the UK, to identify the important details that will determine the location and protection of Natura 2000 sites will necessarily inform consideration among other North Sea States. The European Commission has indicated its interest in these questions for the selection of Natura 2000 networks and has asked OSPAR to contribute to the process.

In Norway, plans for wetland and seabird sanctuaries have been completed for each county of the North Sea coastal area under the Nature Conservation Act. Breeding localities are the main focus of these protected areas, but sea areas are included because they have a functional and close ecological connection with the land areas. Ten of these areas are designated as Ramsar sites.

3.3.4 The Wadden Sea

(ED 2iii, 9f; SoC 9.2 and 9.3)
The trilateral Wadden Sea Plan (WSP) was adopted in 1997 based on the principles and objectives of the trilateral Wadden Sea Cooperation. The guiding principle of this cooperation is 'to achieve, as far as possible, a natural and dynamic ecosystem in which natural processes proceed in an undisturbed way', specified by means of a series of common 'targets'. The WSP is structured by these common targets and associated measures and projects to implement them.

Common targets for ecological and cultural and landscape values were adopted in 1994. The main element of the ecological targets is the presence of all typical Wadden Sea habitats in their natural state. In addition, it was agreed to aim for background concentrations of naturally occurring hazardous substances (heavy metals) and concentrations resulting from zero discharges for xenobiotic substances and, with regard to nutrients, Eutrophication Non-problem Area conditions. Indicator species and community targets have been adopted. The community targets comprise the presence of stable blue mussel (*Mytilus edulis*) beds, seagrass stands and *Sabellaria* reefs.

The Target concept has been useful with regard to the Wadden Sea policy and management and has provided substantial guidance to the elaboration of the Trilateral Monitoring and Assessment Program (TMAP). The Targets have, because of their general and open-ended nature, proved suitable for communication with a wide range of stakeholders.

The TMAP was adopted in 1997. The TMAP is subdivided into 28 features that were selected on the basis of relevance for trilateral conservation policies, most notably the assessment of the status of the common Targets. In the period 1995 to 2001, common guidelines for the monitoring of the TMAP parameters and a trilateral data management system were developed, co-funded by the European Commission. Most of the TMAP has been implemented. Comparable monitoring methods are now applied in all three countries. Further efforts are necessary to develop the existing system into a fully operational data exchange system and to guarantee a steady data flow into the TMAP assessment work. A major future challenge is to tune the TMAP with the requirements of the EC Habitats and Wild Birds Directives and the EC Water Framework Directive.

3.4 Non-indigenous and Genetically Modified Organisms

(SoC 4.3)

3.4.1 Non-indigenous species

The issue of non-indigenous marine organisms is one of the most critical environmental issues facing aquatic species and habitats, and biodiversity in general. Introductions and transfers of non-indigenous organisms are potentially hazardous in terms of ecology, biodiversity and economics. Thus, there are international obligations (*e.g.* under the CBD) to 'prevent, the introduction of, control and eradicate those alien species which threaten ecosystems, habitats and species'. Recent studies have shown that aquaculture and shipping are the main vectors responsible for the introduction of marine non-indigenous organisms. In connection with aquaculture, this occurs either as intentional introductions of non-indigenous species (*e.g.* macroalgae, bivalve molluscs and fish) for industrial production purposes or as non-intentional introductions and further transfers of the organisms via, for example, escapement and spreading from their originally confined environment. In shipping, introductions and transfers of non-indigenous species mainly occur by the transport and discharge of ballast water and, to a lesser extent, by transport as fouling organisms on ships' hulls.

The number of 'established and probably established' non-indigenous marine species (not including subspecies or hybrid forms) in the North Sea has been estimated at 28 for plants (phytoplankton, macroalgae and angiosperms) and 61 for animals (*i.e.* invertebrates, chordates and vertebrates). However, this is likely to be an underestimate as recording is not comprehensive.

The North Atlantic Salmon Conservation Organization (NASCO) has expressed increasing concern that interactions between farmed and wild salmon (*Salmo salar*) lead to changes in the genetic composition of wild salmon, the introduction of pathogens/diseases and parasites, and other effects

with adverse ecological consequences. Recent work carried out by NASCO includes measurements to minimize impacts from salmon farming on wild populations and implementation of the precautionary approach. Activities related to the precautionary approach include guidelines to limit escapees from salmon farming and an action plan to rehabilitate wild salmon habitats adopted in June 2001.

ICES and NASCO have collaborated on the genetic threats to wild salmon posed by aquaculture as well as other relevant interactions. Thus, a symposium was arranged in 1997 that provided an overview of the problems (*e.g.* threats to the natural genomes, parasites and pathogens/diseases) faced by wild salmon and possible measures to redress the situation.

ICES provides advice for management and regulatory purposes on marine non-indigenous organisms. In 1995, ICES published a Code of Practice on introductions and transfers, to be reviewed in 2002. Since 1995, there has been close collaboration between ICES, the Intergovernmental Oceanographic Commission (IOC) and the International Maritime Organization (IMO) on ballast water and shipping vector matters including the formation of a joint study group on this topic. The code will be updated in 2002.

IMO is working towards completion of a self-standing International Convention for the Control and Management of Ships' Ballast Water and Sediments and associated guidelines (see section 7.5.2). The convention is expected to be adopted in 2003.

Within OSPAR, non-indigenous organisms are included within the Joint Assessment and Monitoring Programme, but scant activity has occurred on this issue since 1998, and the Quality Status Report 2000 for the Greater North Sea provides little information on this matter. The apparent reason for this lack of priority in OSPAR is that non-indigenous species issues are currently being handled within ICES and IMO.

In 1997 to 1998, the Nordic Council of Ministers funded the project 'Risk Assessment for Marine Alien Species in the Nordic Area', which includes the North Sea. The Nordic Council of Ministers also funded a project on 'Introduced Species in the Nordic Countries', which included an overview of introduced species in the Nordic countries. A network of administrators and scientists within the field of introduced species has been established as the Internet-based 'Nordic Network on Introduced Species'. This network has also: 1) made information available on introduced species in the Nordic countries accessible and provided links to other important sites on the web regarding aliens/introduced species, 2) established a marine biome database involving the marine introduced species, and 3) produced a report containing detailed descriptions of some of the more invasive introductions in the Nordic countries.

Many North Sea States have either established or are preparing policy and legislation reviews on the introduction and transfer of non-indigenous aquatic organisms. There is a growing policy when rearing and releasing fish for stock enhancement to use local wild fish rather than reared strains as parent fish in order not to dilute the natural gene pool. Additionally, national strategies on sustainable development and Biodiversity Action Plans are highlighting the risks from non-indigenous species and GMOs and increasing public awareness. The threat to biodiversity and its use occurring from the introduction of non-indigenous organisms via ballast water from ships has received increasing awareness and concern. Several North Sea States have published reviews and inventories of non-native species in national waters, and the issues arising from the introduction of non-native organisms are undergoing review.

As a result of the European Economic Area Agreement, Norway must harmonize its legal framework on disease control with the EU framework and so it can no longer maintain current regulations regarding the introduction of non-indigenous species. Reports produced in 2000 and 2001 will form the basis for Norway's national policy concerning non-indigenous marine species and will also be an important part of Norway's input in various international forums.

As a substantial 'pool' of non-indigenous species is already present in European waters, effective measures to limit unintentional and unwanted introductions into regional or local European waters in general, and the North Sea area in particular,

are needed. Secondary introductions by human means between European countries account for the greatest further dispersal of species within Europe, so measures aimed at better controlling the intra-regional movement of species are required to prevent further unintentional dispersal. Secondary introductions that are mediated by natural dispersal cannot, however, be stopped by regulations. The developing IMO Convention, in its present draft form, will apply to all ships engaged in international traffic that carry ballast water. Ships vary in their ability to undertake ballast management measures and those that rely on ballast exchange at sea may be unable to complete the process during the voyage or in the prevailing weather conditions. A ship on a coastal voyage may encourage the spread of non-indigenous organisms by exchanging ballast water near to shore. Effective monitoring programmes are needed to aid in the early detection and in determining the status of non-indigenous organisms if effective combat and control measures are to be taken. Further, introductions and transfers of non-indigenous marine organisms are likely to increase, due to expanding free-trade agreements and climate warming favouring the wider establishment of more cosmopolitan species.

3.4.2 Genetically modified organisms

Genetically modified organisms are a form of non-indigenous organism. In recent years, increased attention has been focused on the risk of GMOs escaping into the natural environment and causing similar adverse effects on indigenous species and their environment as certain non-indigenous species have done.

EC Directive 90/220/EEC on the deliberate release into the environment of GMOs has now been replaced by Directive 2001/18/EC, which must be implemented by member states by October 2002. Both these directives prohibit the release of GMOs into the environment without explicit prior consent.

In 1997, the Council of NASCO adopted Guidelines for Action on Transgenic Salmon, and as recently as 2001 NASCO reiterated its concern about the threats posed to wild salmon from genetically manipulated salmon. In particular, emphasis has been given to the potential escape of genetically modified Atlantic salmon that may grow up to six times faster than their natural counterpart. Such transgenic salmon have recently been promoted for future farming, despite firm opposition to the development of genetically modified salmon being voiced by the salmon culture industry, custodians of wild salmon stocks, consumers and environmentalists.

The ICES recommended procedure for the consideration of the release of GMOs requires that the transgenic organisms must be reproductively sterile in order to minimize impacts on the genetic structure of natural populations. However, ICES stressed in 1999 that unless procedures are controlled, the risk of sterilization of the whole population (wild and cultivated) exists.

The Belgian MMM-law of 1999 prohibits the release of GMOs into the marine environment.

Norway applies national legislation in addition to the EC Directive implemented according to the European Economic Area Agreement. Health and environmental risk assessment, and ethical and socio-economic concerns should be considered before releasing GMOs into the natural environment. The precautionary principle indicates that consent for such release should not be given if unacceptable adverse effects may arise. The introduction of organisms is one of the items highlighted in a White Paper on biodiversity presented to the Norwegian Parliament in spring 2001. Because of the potential risk of using GMOs, Norway has strong regulations in this field. Production and use of GMOs shall be based on ethical and social considerations according to the principles of the precautionary approach and without negative effects on health and the environment. No GMOs are known to have been introduced into Norwegian waters.

Fish-farming, stock enhancement and sea ranching

The EC Biodiversity Action Plan foresees a generalized use of EIAs for all fish-farming operations, stock enhancement and sea ranching. Furthermore, the release of GMOs requires, under Directive 90/220/EEC, a very strict and comprehensive assessment to prevent damage to the environment or to health.

In Norway, releases of farmed salmon are in general prohibited, and special permission is required to

release salmon for enhancement purposes. Such permission includes conditions regarding the brood-stock, and the use of local brood-stocks will be required whenever this is possible. With the present knowledge and level of costs, industrial sea ranching based on fish species is not economically feasible.

3.5 Assessment of Achievements

3.5.1 Threatened and ecologically important species and habitats

General framework
The Quality Status Report 2000 for the Greater North Sea identifies and ranks priority classes of human impacts and pressures on the North Sea ecosystem.

Annex V to the OSPAR Convention, on the protection and conservation of the ecosystems and biological diversity of the maritime area, provides an important new framework for protection and conservation of species and habitats in the North Sea.

There have been some important developments with regard to the implementation of EC directives. The European Commission has clarified in several communications that the Habitats and Wild Birds directives apply to the whole EEZ of the Member States, not just to territorial waters. However, implementation of these directives outside the 12-mile boundaries in some Member States is still hampered by judicial problems on a national and international level, *e.g.* incongruence with UNCLOS. Most North Sea States are now applying the directives to all waters and will propose Natura 2000 sites in the offshore zone in the near future.

In accordance with the requirements of the CBD, there has been recent work on developing and implementing Biodiversity Action Plans by the European Commission and nationally by North Sea States.

Criteria for the selection of species and habitats needing protection
The work within OSPAR to identify species and habitats in need of protection and conservation measures has been demanding and the progress has therefore been slower than initially expected. The application of a set of criteria (the Texel/Faial Criteria) is now in a final stage of testing before they can be formally agreed. An initial list of species and habitats undergoing rapid decline or under immediate threat has been produced. This list will be further developed using the agreed Texel/Faial Criteria. OSPAR intends to complete the selection criteria for such species and habitats (Texel/Faial Criteria) and adopt a priority list of threatened or declining species and habitats in 2003.

Ecosystem effects of fishing
The generally high fishing pressure on targeted fish stocks, driven by excessive fishing capacity relative to the available resources, has also resulted in high by-catch mortality of non-target organisms and damage to the North Sea benthic communities and habitats. Some aspects of the North Sea fisheries management have not performed adequately in this respect.

There has to date been a lack of achievement in dealing with the long-term effects of fisheries on the ecosystem. No progress has been made in restoring the fish community towards diverse fish communities with larger numbers of bigger and older individuals and hence larger spawning stocks. There has been little progress in reducing the high levels of by-catch and discards of non-target species. Data on the effects of fishing on vulnerable species (*e.g.* many elasmobranchs) and habitats is scarce compared with data on commercial species.

Integrated action to support research and monitoring activities regarding elasmobranchs should extend beyond classical management strategies to include the role of elasmobranchs in the structure and functioning of marine ecosystems and more specifically in fish assemblages.

There is a growing awareness in fishing communities about the importance of a healthy environment for a continuation of fisheries. Negative effects of discards, for example, are a concern of both fishermen and environmentalists.

Marine mammals
In 2000, ASCOBANS adopted a resolution that recommended that competent authorities take precautionary measures to ensure that the total anthropogenic removal of small cetaceans in the Agreement area and its adjacent waters be reduced as soon as possible to below the level of 'unacceptable interaction'. The full impact of by-catches of harbour porpoise cannot be evaluated because other fisheries operating in the North Sea are not yet monitored for by-catches.

The recent decline in harbour porpoise by-catch levels of Danish and UK fisheries is a result of reduced fishing effort due to decreased TACs set for demersal fish. In Danish fisheries this decline in by-catch is also the result of using acoustic deterrents ('pingers'), which warn harbour porpoises of gillnets. The Danish Wadden Sea has been designated as a SAC based in part on the occurrence of harbour porpoises. A small cetacean sanctuary has also been established in German waters off the Islands of Sylt and Amrum, extending the boundaries of the National Park 'Schleswig-Holstein Wadden Sea' into offshore waters. The EC Council Regulation No.1239/98 of 8 June 1998 banning the utilization of drift nets will also help protect small cetaceans and other non-target species.

The UK has developed Regulatory Guidelines on Seismic Surveys, and has adopted Guidelines on whale watching and on reduction of recreational disturbance.

Seabirds and shorebirds
The IPOA-SEABIRDS was adopted by FAO in 1999. In Norway, research is being conducted on the mortality of birds in fishing equipment, with special focus on longline fisheries, and the development of methodology to reduce such mortality.

The EC ban on the use of drift nets will probably also be to the benefit of seabirds. Long time series are available from seabird and beached bird surveys. However, in some countries these surveys are not being implemented in national monitoring programmes. The maintenance and continuity of these surveys are, therefore, not assured.
ICES has advised on how an ecosystem approach can be applied involving seabird breeding colonies and industrial fisheries. Accordingly, the Council of EU Fisheries Ministers accepted in December 1999 the Commission's proposal to close an area of the north-western North Sea to sandeel fisheries for the 2000 season and this has subsequently been extended for a further two years following annual reviews.

Discards and offal have provided a food source that has contributed to an increase in many seabird populations. The potential ecological effects of applying a discard ban have not been evaluated.

Benthos
There is clear scientific evidence of the effects of bottom trawling on species and habitats in the North Sea. Several changes can be made that contribute to meaningful reductions in the effects of bottom trawls on the benthos of the North Sea and reduce the ecosystem effects of fishing. ICES has advised on how the most serious effects can be mitigated, without unduly reducing the possibilities of catching commercially important species.

Although nets have been refined to reduce the by-catch of non-target and undersized fish species and several promising improvements in otter trawls and beam trawls have been identified, little practical progress has yet been made in reducing the by-catch and subsequent discards of invertebrate benthic species. Few North Sea States have applied restrictions on fishing operations in order to protect vulnerable benthic species and habitats.

3.5.2 Conservation, classification and mapping of habitats, and the development of a system of marine protected areas

Establishment of undisturbed areas with regard to fisheries
In the IMM 97 Statement of Conclusions, Ministers reaffirmed their request, made at the 4NSC, to the competent authorities to facilitate research on areas undisturbed by fisheries. Since then, no undisturbed areas with regard to fisheries have been established.

Classification and mapping of habitats
There is an urgent need for habitat maps as a basis for protection and conservation of habitats and for

spatial planning purposes. A project to develop a North Sea habitat map is being planned, building upon the EUNIS classification system for habitats.

Development of a system for marine protected areas
OSPAR has developed Guidelines for the Identification and Selection of Marine Protected Areas in the OSPAR Maritime Area, but these remain to be adopted and applied. These have been supplemented by the development of draft Guidelines for the Management of Marine Protected Areas in the OSPAR Maritime Area.

An inventory of existing MPAs in the OSPAR maritime area has been established to assist the programme to develop the system of MPAs. Only very few protected areas occur beyond 3 nm, apart from areas where fisheries restrictions apply.

Habitats, including Natura 2000
In order to conserve Natura 2000 sites, member states are establishing conservation measures involving appropriate management plans and statutory, administrative or contractual measures. For the North Sea area, the number of marine sites proposed as sites of community importance up to May 2001 amounts to about 60. The area covered by these sites is about 900 000 hectares. The overall procedure for the adoption of Community lists of sites has been unduly slow and the Commission is taking all appropriate steps in order to accelerate this procedure, including legal action.

In Norway, plans for wetland and seabird sanctuaries have been completed for each county of the North Sea coastal area under the Nature Conservation Act.

The Wadden Sea
The WSP is structured by common targets and associated measures and projects to implement them. The targets have, because of their general and open-ended nature, proved suitable for communication with a wide range of stakeholders. This provides a good example of international collaboration for developing monitoring and assessment programmes.

3.5.3 Non-indigenous species and genetically modified organisms

Non-indigenous species
In 1995 ICES published a Code of Practice on introductions and transfers. Since 1995, there has been close collaboration between ICES, IOC and IMO on ballast water and shipping vector matters including the formation of a joint study group on this topic.

IMO is working towards completion of legally binding provisions on ballast water management in the form of a self-standing International Convention for the Control and Management of Ships' Ballast Water and Sediments and associated guidelines. However, IMO is unlikely to adopt the finalized version of this convention before 2003.

ICES and NASCO have collaborated on the genetic threats to wild salmon posed by aquaculture and have provided an overview of the problems (*e.g.* threats to the natural genomes, parasites and pathogens/diseases) faced by wild salmon and possible measures to improve the situation.

The Nordic Council of Ministers funded from 1997 to 1998 the project 'Risk Assessment for Marine Alien Species in the Nordic Area', and sponsored an overview of introduced species in the Nordic countries.

Many North Sea States have either established or are preparing policy and legislation reviews on the introduction and transfer of non-indigenous aquatic organisms. However, better measures are needed if inter- and intra-regional movements of non-indigenous species are to be prevented. Effective monitoring programmes are needed to aid the early detection and determination of the status of non-indigenous organisms in order to take combat and control measures.

Genetically modified organisms
In 1997, NASCO adopted Guidelines for Action on Transgenic Salmon, and as recently as 2001 NASCO reiterated its concern about the threats posed to wild salmon from genetically manipulated salmon.

EC Directive 90/220/EEC on the deliberate release into the environment of GMOs has now been replaced by directive 2001/18/EC, which must be implemented by member states by October 2002. Both directives prohibit the release of GMOs into the environment without explicit prior consent.

The EC Biodiversity Action Plan foresees a generalized use of EIAs for all fish-farming operations, stock enhancement and sea ranching.

4 Fisheries

4.1 Introduction

4.1.1 Fisheries and ecosystem effects of fisheries

The fish stocks are the immediate resource base of fisheries. The productivity of the stocks is dependent on the surrounding marine ecosystem and the ecosystem can, therefore, be considered the resource base in a wider sense.

Sustainability can be considered from several perspectives:

- the resource perspective, focusing on conserving the reproductive capacity of the fish stocks;
- the ecosystem perspective, focusing on the continued functioning of the ecosystem as a productive and healthy environment;
- the fishing industry perspective, focusing on harvesting and further processing and distribution of fisheries products; and
- the social and economic viability of fisheries. This is a very broad topic ranging from the functioning of the fishing communities, the economy of the fishing industry and of the fishing sector. Furthermore, the institutions and governance must also be considered.

Fishing effects on non-target species and on the ecosystem are addressed in section 3.2. With regard to the fisheries effects on commercial species the following issues of concern were listed in the Assessment Report prepared for the IMM 97:

- the high fishing pressure on many North Sea fish stocks driven by excessive fishing capacity relative to the available resources;
- the extent of change in age structure and size composition of the fish stocks as a result of fisheries; and

- the decrease in abundance of some fish species, mostly species with a low reproduction rate.

In 2001 this list still reflects the main concerns.

4.1.2 Status of North Sea fisheries

Catches and fish stocks

The North Sea and adjacent seas constitute one of the world's major shelf areas and, as such, one of the major fish producing ecosystems in the world. With an annual production in the range of 3 million tonnes, the area contributes 4% of the world's fish production of 90 million tonnes. At the beginning of the last century the annual catch from the North Sea was in the range of 1 million tonnes and comprised 50% demersal and 50% pelagic species fished for human consumption. Fisheries may be divided into the following three categories: pelagic fisheries and demersal fisheries for human consumption purposes and industrial fisheries for reduction purposes, *i.e.* fishmeal and oil.

The total landings remained reasonably stable at 1.0 to 1.3 million tonnes until the Second World War. After the Second World War there was an increase in fishing. The total landings rose to a higher level in the 1950s, mainly due to increased exploitation of herring (*Clupea harengus*) and mackerel (*Scomber scombrus*). The pelagic catches peaked in the late 1960s and then fell dramatically during the 1970s when the herring fisheries were closed and the North Sea mackerel stock was severely depleted. Major changes in the catches of demersal fish took place in the 1960s and 1970s with the so-called 'gadoid outburst'. The demersal landings have steadily declined over the past 25 years. The fishing pressure has remained high for demersal fish until now and many of the stocks have been fished beyond safe biological limits. A fishery for industrial purposes started in 1960. It increased up to 1980, and the landings have remained relatively stable in the range 1 to 3 million tonnes since then. Landings from major stocks in the North Sea, Skagerrak, and the eastern Channel are presented in Figure 4.1.

Today, demersal human consumption fisheries usually target a mixture of roundfish species (cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*) and whiting (*Merlangius merlangus*))

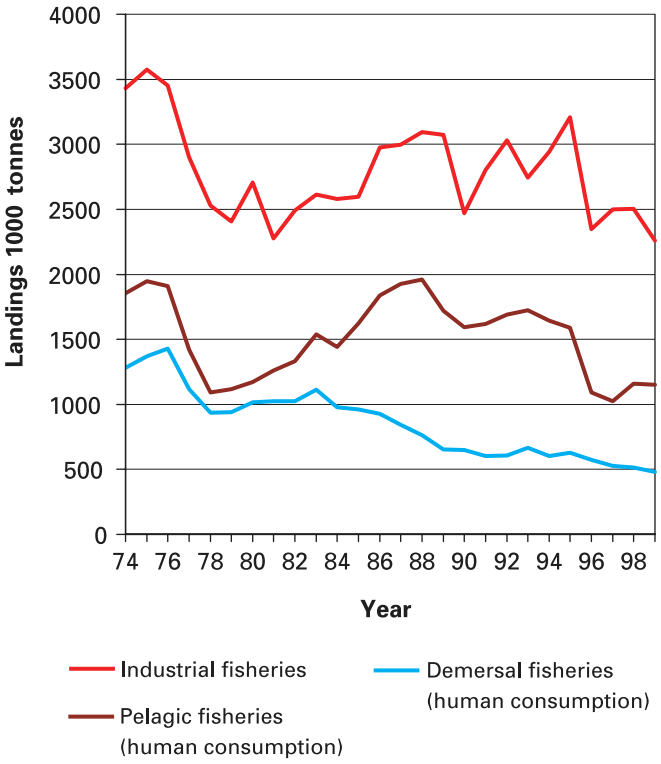


Figure 4.1 *Landings of major fish stocks in the North Sea (NS), Skagerrak, and the eastern Channel (eC) in 1974 to 1999. The major fish stocks are: Demersal stocks: sole (NS); plaice (NS); saithe (NS and ICES area IIIa); haddock (NS and ICES area IIIa); whiting (NS and eC) and cod (NS, Skagerrak and eC). Pelagic stocks: mackerel (NS) and herring (NS). Industrial fisheries: blue whiting (ICES area IV and IIIa); sprat (NS); Norway pout (NS) and sandeel (NS). (ICES 2001b.)*

or a mixture of flatfish species (plaice (*Pleuronectes platessa*) and sole (*Solea solea*)) with a by-catch of roundfish. Landings in the period 1967 to 1999 are given in Figure 4.2. A fishery directed at saithe (*Pollachius virens*) exists along the shelf edge. The mean annual catch for demersal species in the 1990s was 0.6 million tonnes. The catch of these fisheries is landed for human consumption. The pelagic fisheries mainly target herring, mackerel and horse mackerel (*Trachurus trachurus*). Although most of the landings of these species may be intended for human consumption purposes, part of the landings are used for fishmeal and fish oil. The mean annual catch for pelagic species in the 1990s was about 1.0 million tonnes. The most important fish species fished for reduction to fishmeal and oil are sandeels (*Ammodytes* spp.), sprat (*Sprattus sprattus*) and Norway pout (*Trisopterus*

esmarkii). The industrial catches also contain by-catches of other species including herring, haddock and whiting. The mean annual catch for industrial purposes in the 1990s was about 1.3 million tonnes.

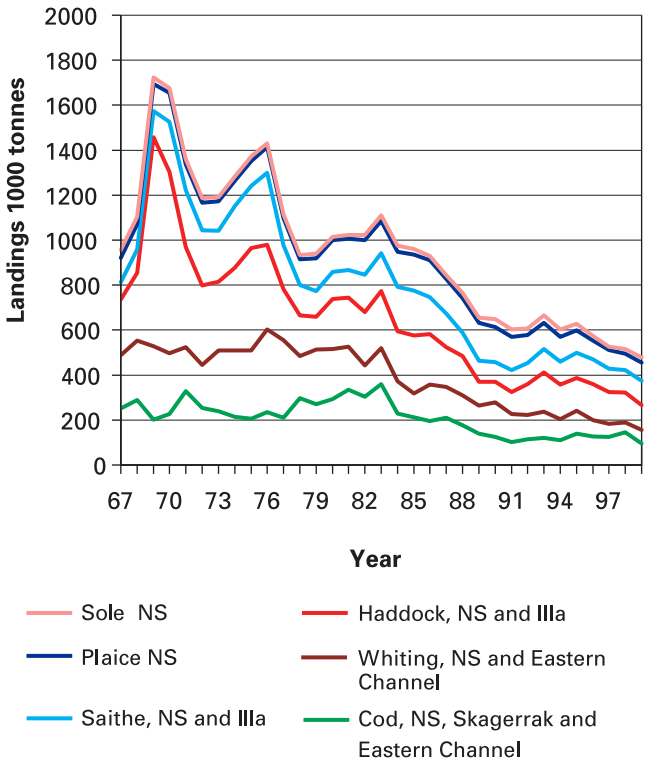


Figure 4.2 *Landings of demersal stocks for human consumption, 1967 to 1999 (ICES 2001b).*

In the North Sea proper, all stocks of roundfish and flatfish species have been exposed to high fishing mortality for many years. Many North Sea commercial fish stocks are 'outside safe biological limits' (see Annex 2). The cod stock is in an especially precarious state and the biological advice mentions the danger of stock collapse.

The herring stock in the North Sea collapsed in the mid-1970s due to a combination of small year classes and heavy exploitation. Effective management measures such as closure of the fisheries between 1977 and 1981 were implemented to reduce the catches. At the beginning of the 1990s the herring stock again declined to low levels of spawning stock and in 1996 effective management measures were implemented. The herring stock is now recovering although still exploited with a fishing mortality outside safe biological limits. The North Sea component of the mackerel stock also collapsed in the 1970s and shows no sign of recovery. The fisheries for mackerel in the North Sea rely on a much larger stock component, the western mackerel stock, which spawns outside the North Sea and is present in the northern North Sea in the second half of the year. The overall mackerel stock is inside safe biological limits. The developments of the herring and mackerel stocks are presented in Figure 4.3.

Both the sandeel and Norway pout stocks are considered to be inside safe biological limits, while no reference points are set for sprat and its present state is unknown.

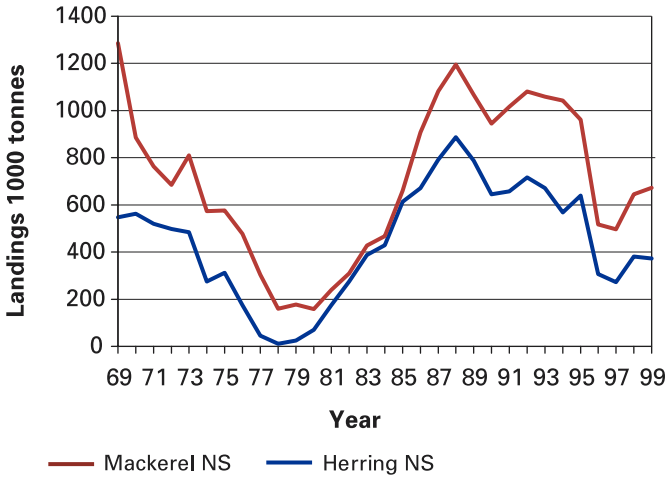


Figure 4.3 *Landings of pelagic stocks for human consumption, 1967 to 1999 (ICES 2001b). For mackerel the catches before 1980 consisted of the North Sea component. After 1980 the mackerel catches consisted of the western component.*

The fisheries in the North Sea take much more biomass from this area than they used to do a hundred years ago. The relative species and size composition is altered to a great extent. Large species with long lifespans are fished almost to extinction, while stocks of small opportunistic species like sprat and sandeels are quite numerous.

Unintended catches in demersal fisheries for human consumption

Discarding varies between fishing methods – depending on mesh sizes, season, fishing grounds, abundance of fish fry and so on. Extensive discarding occurs in many fisheries on roundfish and flatfish in the North Sea, Skagerrak, and the Channel. Overall, the published information on discarding is still scarce and often not up to date; data are not available for all fleets and not directly comparable between fleets. It is therefore not possible to provide an overall assessment of total discard rates. Discard data have been collected in large-scale projects – financed by the EC – in the latter half of the 1990s. These data are being compiled at present and ICES published summaries of the data in 2001. The general pattern is that high discard rates are found in most flatfish fisheries, in *Nephrops* fisheries, and in some mixed gadoid fisheries targeting haddock. The information mainly covers by-catches of species that are exploited commercially. By-catches, however, also include a multitude of fish (and invertebrate) species that are of little or no commercial interest. Most of the present monitoring programmes record these species, but the data are generally not available.

Unintended catches in pelagic fisheries

Discarding, including high-grading[3], also takes place in pelagic fisheries, but little and incomplete information on discarding practices in these fisheries is available. Some data have been published from the Dutch herring (trawler) fishery for the years 1990 to 1996. In these fisheries, discards were generally 3–6% for herring (weight discarded relative to weight caught per species). Discarding is also known to occur in the purse seiner fleets ('slippage'), but again data are not available.

Unintended catches in industrial fisheries

By-catch information from the industrial fisheries has been sampled regularly from the landings. The catch composition in the industrial fisheries has changed considerably over time, reflecting partly the size of the non-target fish stocks and a change in the fishing pattern. Unintended catches in industrial fisheries are not discarded.

Vulnerable fish species

A significant number of elasmobranch fish (*e.g.* sharks, rays, and skates) are slow growing, long-lived, attain sexual maturity at a large size, and have a low fecundity compared with other exploited fish species. These life history strategies make them particularly vulnerable to unsustainable fishery practices. The general pattern found in most elasmobranch fisheries has been one of high initial exploitation followed by a rapid collapse. In the North Sea, landings of skates and rays have decreased by more than half during the last 50 years. The thornback ray (*Raja clavata*) has nearly disappeared from the south-eastern North Sea. The common skate (*Raja batis*) has virtually disappeared from the North Sea, and the only effective protection for this critically endangered species is a drastic reduction or a complete halt to all kinds of demersal fishery, *e.g.* through establishing closed areas, where relict populations exist (ICES 1998). Unless this occurs, similar species will probably be fished out as a consequence of their vulnerability to demersal fisheries. The vulnerabilities of these stocks are presented in Table 4.1 and the status of the stock in Annex 2.

The thornback ray can serve as a biological reference point because it is still abundant enough to be caught in statistically usable numbers. In 1997,

Table 4.1 *Vulnerability, in decreasing ranking, of five resident North Sea ray species according to life history characteristics (ICES 1997). Life history characteristics include: maximum length, length and age at first maturity, number of eggs produced per year, maximum mortality that the species is able to withstand, and estimated level of mortality based on recent survey catches.*

Species	Rank
Common skate *(Raja batis)*	1
Thornback ray *(R. clavata)*	2
Spotted ray *(R. montagui)*	3
Cuckoo ray *(R. naevus)*	4
Starry ray *(R. radiata)*	5

[3] High-grading is sorting of fish to maximize the value of the catch retained for the market, with associated discarding of legal-sized but lower value species or sizes.

ICES advised limiting the impact of demersal fisheries in areas where the thornback ray still occurred in order to conserve the stock in the North Sea. ICES also requested improved data on landings, discards and disturbance of eggs by demersal gears, as a prerequisite to making an accurate estimate of the fishing mortality, which is a major and controllable part of the total mortality, and as an aid in formulating the most effective fisheries measures in the areas of concern.

4.1.3 Main goals and actions agreed at the 4NSC and IMM 97

The Ministers at the 4NSC agreed that further integration of fisheries and environmental policies must be elaborated in order to protect the North Sea environment and ensure the sustainability of the fish stocks and the associated fisheries. The Ministers therefore recommended that the precautionary principle should be applied in fisheries management policies, that exploitation rates for fish stocks within safe biological limits should be established, to minimize by-catches and other negative impacts on marine mammals, seabirds and benthic organisms and to minimize discarding of fish and benthic organisms, and agreed that competent authorities should facilitate research on a number of identified topics. The Ministers also invited competent authorities to establish undisturbed areas for scientific purposes.

The Ministers at the IMM 97 agreed on guiding principles, management objectives, strategies and actions for the future fisheries and environmental protection, conservation and management measures.

4.2 Further Integration of Fisheries and Environmental Policies

(ED 13; SoC 2, 3, 4, 19 and 20)
The European Community has adopted the Guiding Principles agreed at the IMM 97, *e.g.* sustainable development and use, precautionary approach, best available scientific knowledge, ecosystem approach, integration of environmental objectives into fisheries policy, involvement of stakeholders *etc.,* either as relevant articles of the Treaty, within secondary legislation or in policy documents such as regulations, decisions, and communications *etc.* Several international agreements also incorporate guiding principles similar to those of the Ministerial Statement of Conclusions (SoC) from IMM 97.

Recent developments to accomplish these requirements can be illustrated by reference to a number of policy documents that have appeared during the last two years:

- Fisheries Management and Nature Conservation in the Marine Environment (COM(1999)363).
- Application of the Precautionary Principle and Multi-annual Arrangements for Setting TACs (COM(2000)803).
- Elements of a Strategy for the Integration of Environmental Protection Requirements into the Common Fisheries Policy (COM(2001)143).
- Conclusions from the Council of 25 April 2001 on Integration of Environmental Concerns and Sustainable Development into the Common Fisheries Policy (Doc No 7885/01 Pêche 78, Env 188).
- Conclusions from the Council of the 18 June 2001 on a Biodiversity Action Plan for Fisheries.
- Biodiversity Action Plan for Fisheries (COM (2001) 162 vol. IV).
- Sixth Environmental Action Programme of the European Community, 2001 to 2010 (not yet adopted).
- Sustainable Development Strategy (the Gothenburg Summit, June 2001, see Annex 3).

From this documentation it can be inferred that the European Community is working towards a comprehensive environmental integration, of which the main elements have been identified as:

- a progressive adoption of an ecosystem approach to fisheries management;
- the incorporation into the Common Fisheries Policy (CFP) of the environmental principles defined in Article 174 of the Treaty as: i) the precautionary principle, ii) the principle of prevention, iii) the principle of correction at source, and iv) the polluter-pays principle; and
- the carrying out of specific management action, mostly described in the Biodiversity Action Plan for Fisheries.

On the issue of the precautionary principle, the Community is discussing its operational consequences as a general matter on the basis of Communication COM(2001)1 on the precautionary principle, and specifically on the issue of setting Total Allowable Catches (TACs) in a multi-annual framework on the basis of Communication COM(2000)803. The Council adopted its conclusions on the latter on 25 April 2001.

The Community's ideas and suggestions about the ecosystem-based approach to fisheries management have been developed succinctly in its contribution to the FAO Conference on Responsible Fisheries in the Marine Ecosystem held in Reykjavik, October 2001. A fundamental aspect of the ecosystem-based approach to fisheries management described in the contribution to the FAO conference is that it cannot replace as from now the traditional, stock-based approach, but rather it constitutes a long-term goal which cannot be achieved without a long, evolutionary process, based on a progressive improvement of the scientific basis. The contribution also described which steps could be taken in the short, medium and long-term, to progress towards an ecosystem-based approach to fisheries management.

Finally, the Commission has initiated a process to reform the CFP in response to the challenges faced by the Community fishing sector. As part of this process, the Commission issued in March 2001 a Green Paper (COM(2001)135) analysing the current situation and suggesting possible options for the future in terms of a renewed CFP. These options include principles, objectives and strategies perfectly compatible with those outlined in the SoC.

Norway acknowledges that a more coherent policy is required with respect to sea quality and marine resources, clearly defining policy, actions to be taken and clarifying responsibilities. Work has therefore started between relevant ministries in Norway with the aim of developing integrated ecosystem-based management of the coastal and sea areas. The Norwegian responses in the last two years are the following.

- The Environmental Action Plan, for the period 2000 to 2004, issued by the Norwegian Ministry of Fisheries. In this plan, general environmental goals and specific targets are set for fisheries, aquaculture and coastal management. The plan also includes the actions regarded as necessary to reach these goals. Reporting on progress is done on an annual basis to the Norwegian Parliament ('Stortinget').
- The White Paper on biodiversity, 2001, which outlines a management system for biodiversity in Norway. It will be of importance to the fisheries sector.
- The Norwegian Law on Fish Farming has been amended to strengthen the environmental application of the law. This new law entered into force 1 January 2001. This amendment enables the introduction of requirements related to environmental surveillance, internal control and approval of plants and equipment.
- A new Marine Law ('Havlov') is being developed. When finished, this will improve the focus on environmental considerations in the fisheries.
- The fishing industry (capture and aquaculture) is currently developing an environmental strategy for the sector.

The EU and Norway request scientific advice from ICES concerning the harvesting of commercially important fish stocks and on the status of the marine environment. The fishing industry and societal perspectives are not covered by ICES advice. In 2000, the ICES committees were restructured to enable ecosystem considerations to form the basis for fisheries advice.

The precautionary principle has been well developed in its operational dimension, in particular within the context of ICES, and has constituted the basis for important decisions on the management of joint stocks in the North Sea. However, full application of the precautionary principle for all management measures concerned, including those

related to the conservation of non-commercial items, still requires considerable development. In particular, continuing dialogue must be maintained between ICES and managers to discuss the setting of precautionary reference points on the basis of agreed risk levels (see section 4.4.2).

4.3 Application of the Precautionary Approach to Minimize Adverse Effects of Non-indigenous Stocks and Species and Genetically Modified Organisms

(SoC 4)
Non-indigenous and genetically modified organisms (GMOs) are addressed in section 3.4.

4.4 Rebuilding or Maintenance of Spawning Stock Biomass

(SoC 6)
Many demersal stocks that are exploited for human consumption are outside safe biological limits, *e.g.* cod and plaice. Important pelagic stocks are inside safe biological levels, *e.g.* the combined mackerel stock. The herring stock is recovering and fishing mortality decreasing. The herring TAC is set based on the agreed fishing mortality but estimates suggest that the mortality is actually higher. The industrial stocks are harvested within safe biological limits. For details see Annex 2. TACs have not been effective in reducing fishing mortality on demersal stocks and have been only partly effective on pelagic stocks, even in those cases where TACs have been set according to the biological advice. Supplementary effort reduction measures have not been put in place to prevent stocks from falling outside safe biological limits.

4.4.1 Priorities for the elaboration of stock assessments and forecasts

(SoC 6.1 and Annex)
The European Commission has requested ICES to provide assessments for, *inter alia*, the stocks referred to in the annex of the SoC, except for gurnards (Triglidae) and flatfishes (*Pleuronectiformes*). For these, considerable improvement of the basic data is still required before assessments and catch forecasts can be carried out.

In order to overcome the insufficiency of the basic data, the Commission launched in 1999 a call for proposals of studies in support of the CFP. Among the first priority domains for proposals was the collection of basic data necessary for the assessment of stocks not having recently been subject to an assessment. In 2000, the Commission also launched a call for proposals on data collection, but without specifying priority stocks.

In 2000, Regulation (EC) No 1543/2000 was adopted establishing a binding framework for the collection of basic data, together with a funding framework (Council Decision 200/439/EC). This system will replace, starting in 2002, the old system based on voluntary schemes presented by research institutions.

Norway and the Community are participating actively within the ICES system and in EU-funded projects. In Norway, priority is given to research on herring, saithe, cod, haddock, mackerel, sandeel and Norway pout.

4.4.2 Target and limit reference points

(SoC 6.2 and Annex)
The concept of 'safe biological limits' is explicitly referred to in the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks. ICES uses it in an expanded way with a specific meaning. A stock 'outside safe biological limits' suffers increased risk of low recruitment, *i.e.* average recruitment will be lower than if the stock were at its full reproductive capacity. This causes a reduction of the potential catch fisheries can take from the stock. A stock that suffers severely reduced productivity is considered to be 'collapsed'. A stock

'outside safe biological limits' is not, however, usually at risk of extinction. A fish stock can be 'outside safe biological limits' even if the number of spawners is several orders of magnitude larger than levels considered when evaluating whether stocks are at risk of extinction.

Limit reference points are established for most of the species, and the European Commission and Norway are cooperating with ICES to establish target reference points. Figure 4.4 illustrates the four ICES reference points. Annex 2 lists agreed reference points and stock status for important North Sea stocks.

F_{lim} is the limit fishing mortality which should be avoided with high probability because it is associated with unknown population dynamics or stock collapse. B_{lim} is the limit spawning stock biomass, below which recruitment is impaired or the dynamics of the stock are unknown.

ICES has defined B_{pa} ('PA' stands for precautionary approach) as the biomass below which action should be taken and F_{pa} as the fishing mortality above which management action should be taken. The distance between the limit and the precautionary approach reference points includes considerations of natural variability in the stock dynamics, assessment uncertainty and the risk of spawning stock biomass (SSB) falling below B_{lim}.

The fishing industry considers that the setting of reference points, which involves discussions on acceptable risk levels and trigger actions, should take place by a consultation process involving industry, management and science. They consider that hitherto this process has not been satisfactory.

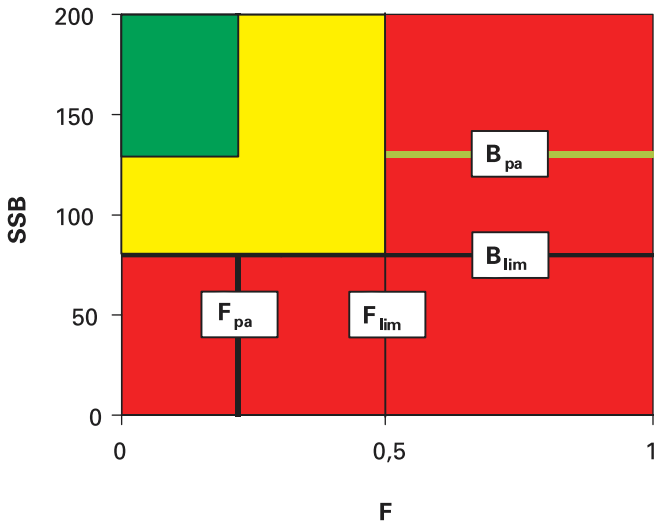


Figure 4.4 *The four ICES reference points within the context of fishing mortality (F) and spawning stock biomass (SSB). The green area is the desired situation, the yellow area is intermediate and the red is the absolute danger zone to be avoided.*

ICES has been requested to give advice based on the precautionary approach: 'in order for stocks and fisheries exploiting them to be within safe biological limits, there should be a high probability that: 1) the spawning stock biomass is above the threshold where recruitment is impaired, and 2) the fishing mortality is below that which will drive the spawning stock to the biomass threshold which must be avoided'. The present form of the advice provided by ICES contains some but not all of the requested information. The European Commission has requested ICES to develop the advice further by clear statements about the nature of the risk incurred by crossing the reference points, the time horizon over which the risk is assessed and the consequences for long-term yield of various fishing mortality rates. It is therefore important that the advice is accompanied by statements in relation to: the nature of the risk of immediate collapse as opposed to risks in the medium or long term, and the risk created by not taking appropriate remedial actions, including the risk created by not taking actions at all.

Limit reference points have been established for those stocks for which this was required within two years (in the SoC Annex), except for *Pandalus* (for which a precautionary 'pa' reference point is established), but not for other stocks, including sprat and horse mackerel, for which the require-

ment was six to seven years. Stock assessments have been developed for Norway pout and sandeel as required, but not for sprat and horse mackerel for which the time frame was six to seven years.

Besides limit reference points, the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks and the Code of Conduct for Responsible Fisheries (FAO 1995), which entered into force 11 December 2001, call for target reference points for stocks (*i.e.* optimum stock size) and pre-agreed action measures if reference points are exceeded.

The system of setting precautionary (pa) reference points for commercial fish populations has been considered a relevant contribution to the set of Ecological Quality Objectives (EcoQOs). The EcoQO stakeholder workshop in the Netherlands (October 2001) and the meeting of the OSPAR Biodiversity Committee in 2001 considered that their effective implementation would represent an important improvement, but that there was a need to develop target-based reference points in a next step.

4.4.3 Measures to ensure that fishing mortality rates are in accord with reference points

(SoC 6.3)
For most stocks (herring, mackerel, cod, haddock, saithe and plaice) subject to joint management between Norway and the European Community, the parties have agreed on long term management strategies that are fully consistent with the precautionary approach outlined by ICES. In its proposals for autonomous TACs, the Commission has always chosen those options leading to fishing mortalities below the limit reference points and consistent with a policy of rebuilding stocks above limit reference points as quickly as possible. The Council, in deciding on the Commission's proposals, has also been consistent with this policy. The Community measures on control, especially on ensuring compliance with quotas, are embedded in Regulation (EC) No 2847/1993 and subsequent implementation legislation. Detailed implementation of these measures corresponds to the competence of Member States, and includes licensing, effort control, individual quotas by vessel, *etc.*

Participation in Norwegian commercial fisheries in general, as well as the fishing effort in specific fisheries, is restricted and regulated by legislative and administrative instruments. The restrictions on fishing effort can be divided into restrictions on licences, fishing gear and outtake.

4.4.4 Criteria for safe biological limits

(SoC 6.4)
The Council[4] has explicitly allocated to scientists the task of defining, where possible, the upper limit of fishing mortality and the lower limit for spawning stock biomass beyond which the replenishment of stocks is threatened. Plans for stock management and stock recovery should aim at having stocks within safe biological limits. The Community and Norway accept the criteria established by ICES in 1998 to indicate whether a stock is within or outside safe biological limits.

4.4.5 Recovery plans

(SoC 6.3, 6.5 and 6.10)
In 1997, the Ministers invited the competent authorities to consider within the appropriate forums and without delay the establishment of recovery plans for stocks considered to be outside safe biological limits. Priority was given to the North Sea cod. Since 1999, the Community and Norway have initiated agreement to long-term management plans for most commercially important species in the North Sea (cod, haddock, saithe, plaice, mackerel and herring) consistent with a precautionary approach. These are integral parts of the annual bilateral EU–Norway quota agreements. Their aim is, beyond preventing these stocks from falling below safe biological limits, to rebuild them in order to allow for economically and biologically healthy fisheries. The management plans include provisions stating that remedial actions should be taken if the SSB falls under an agreed limit. These long-term management plans have been endorsed by ICES as falling within a precautionary approach.

[4] Conclusions of the Council of 25 April 2001 on the application of the precautionary principle and multi-annual TACs.

The generic text of the agreement states that the EU and Norway have:

'agreed to implement a long-term management plan for the (…) stock, which is consistent with the precautionary approach and is intended to constrain harvesting within safe biological limits and designed to provide for sustainable fisheries and greater potential yield. The plan shall consist of the following elements:

1. Every effort shall be made to maintain a minimum level of SSB greater than (..B_{lim}..) tonnes (B_{lim}).
2. For 2000 and subsequent years the Parties agreed to restrict their fishing on the basis of a TAC consistent with a fishing mortality rate of (..F..) for appropriate age groups as defined by ICES.
3. Should the SSB fall below a reference point of (..B_{pa}..) tonnes (B_{pa}), the fishing mortality referred to under paragraph 2 shall be adapted in the light of scientific estimates of the conditions then prevailing. Such adaptation shall ensure a safe and rapid recovery of SSB to a level in excess of (..B_{pa}..) tonnes.
4. In order to reduce discarding and to enhance the spawning biomass of cod, the Parties agreed that the exploitation pattern shall, while recalling that other demersal species are harvested in these fisheries, be improved in the light of new scientific advice from, *inter alia*, ICES.

The Parties shall, as appropriate, review and revise these management measures and strategies on the basis of any new advice provided by ICES.'

In 2000, and given the delicate situation of the stock of cod, Norway and the EU also agreed to emergency measures for the rebuilding of the stock, applicable in 2001, as follows:

- a TAC for 2001 of 48 600 tonnes, designed to reduce fishing mortality by 50% in accordance with ICES advice;
- an area in the central North Sea closed to fishing with demersal gear from 14 February to 30 April 2001, in order to protect the spawners;
- a reinforced system of control in order to guarantee minimal by-catch of cod in that area; and
- the adoption of satellite vessel monitoring systems to support this recovery plan.

As a complement to the emergency measures adopted for cod, TACs for 2001 were reduced for stocks whose fishing would inevitably lead to by-catch of cod, such as other roundfish (haddock and whiting), flatfish (plaice and sole) and crustaceans (shrimp and *Nephrops*).

Moreover, with an aim to efficiently rebuild the stock of cod, the Community and Norway have agreed in 2001 to a mid-term rebuilding plan, with measures complementary to those of the emergency plan. These measures include:

- conditions on the structure of towed demersal nets, specifying a mesh size of 120 mm, and details on net construction and rigging leading to increased selectivity and survival of fish escaping from the net;
- special conditions for fishing in the Community zone, relative to mesh size, netting and rigging of gears and catch composition in any other fisheries for roundfish where cod is a by-catch. Beam trawls should be equipped with a window of 180 mm diamond mesh;
- special conditions relative to any fishery using nets of mesh size below 120 mm. These include a maximum by-catch of cod of 20%, netting specifications, use of sorting grids and square mesh panels, in order to protect young cod;
- increased mesh size for static nets (148 mm in the Norwegian zone and 140 mm in the Community zone);
- an area in the Norwegian zone closed to fisheries for industrial purposes; and
- research provisions including organization of future meetings and at-sea selectivity trials.

4.4.6 TACs and other appropriate measures

(SoC 6.6 and 6.8)

Fisheries may be managed by catch control, effort control, and technical measures. In the North Sea area, fisheries are mainly managed by TACs. Since 1998, new TACs have been adopted in Community legislation for sandeel, anglerfish (*Lophius* sp.), megrim (*Lepidorhombus whiffiagonis*), turbot (*Psetta maxima*) and brill (*Scophthalamus rhombus*), dab (*Limanda limanda*) and flounder (*Platichthys flesus*), lemon sole (*Microstomus kitt*) and witch (*Glyptocephalus cynoglossus*), spurdog (*Squalus acanthias*), skates and rays and Northern prawn (*Pandalus borealis*). A proposal in 2000 on

setting TACs for several deep-sea species was not accepted by the Council, and new proposals were presented in December 2001.

In order to establish a national quota or TAC, the Norwegian system is based on a scientifically agreed assessment on the biomass. If ICES cannot do an assessment, Norwegian authorities normally will not set a national quota, unless the scientific advisory body recommends precautionary actions. Vessel quotas are based on the same criteria. For stocks without an operational TAC, Norway has for several years introduced a great number of other appropriate measures, such as minimum sizes, mesh size, mesh design and prohibition of the use of certain types of gear. They also prohibit fishing during certain periods to protect certain species such as sandeel and lobster (*Homarus gammarus*).

For the last few years, ICES has been able to provide a scientifically-based assessment for the blue whiting (*Micromesistius poutassou*) stock, and a coastal state process has been initiated in order to bring about a regulation of the blue whiting fisheries. Both the European Community and Norway are taking part in this process.

4.4.7 Protective measures for aggregations of spawning fish

(SoC 6.7)
Community and Norwegian policies on technical measures in general, and on closed areas with regard to fishery activities in particular, are generally orientated towards the protection of juvenile fish. However, closed areas for the protection of the spawning stock may be envisaged in order to reinforce other management measures when there is a need for immediate rebuilding of the stock. At present, within the emergency measures for North Sea cod, the closure of the central North Sea during the months of February to April 2001 is one example of such a policy. Temporal closures of herring spawning grounds have been in place for several years and have been maintained in the relevant recent legislation.

Dutch fishermen have voluntarily set up a tie-up scheme for spring 2002 to protect spawning plaice. Except for these occasions, situations where measures to protect dense aggregations of spawning fish would be appropriate have not been identified so the benefits of such measures without otherwise reducing exploitation have not yet been demonstrated.

4.4.8 Reduction of fishing capacity/ effort consistent with the fishery resources

(SoC 6.9)
In the European Community reduction of fishing capacity and/or fishing effort had been planned to be achieved through Multi-annual Guidance Programmes (MAGPs). These programmes fixed objectives for fishing capacity and fishing effort as a function of the state of the stocks targeted by each segment of the fleet. It is not possible to evaluate the reduction of the capacity for the fleets operating in the North Sea, given that in many cases the fleet segments defined include vessels fishing in other areas as well. However, in view of the modest overall objectives of MAGP IV, *e.g.* 3% in capacity and 2% in activity, it is believed that the reduction in fishing capacity achieved in December 2000 for fleets fishing for the main demersal species will not be sufficient to ensure consistency with the available fishery resources.

Member States have implemented strategies to adapt their capacity to the targets imposed by MAGPs by combining effective measures to reduce capacity (scrapping of vessels) with entry-exit regimes which ensure that no new capacity is built unless the equivalent or greater capacity is removed from the fleet. For instance, Denmark has set up the obligation to withdraw 130% of capacity as a condition for aids to new construction.

Some Member States have also tailored measures to adapt the fishing effort of their fleets to the resources made available to them (quotas). The Dutch system of effort and quota allocation to individual vessels of the cutter fleet is a good example of this fine tuning of effort and resources.

Within the context of the CFP reform, the Commission will present to the Council new proposals on capacity and fishing effort. On capacity, the measures will have a structural, permanent or semi-permanent character, whereas measures on

fishing effort will target specific fisheries, with a high priority to fleets operating on stocks subject to recovery plans.

The Norwegian government supports programmes to reduce the fleet capacity and effort to levels that will ensure a long-term balance with the available resources. This has been done by supporting decommissioning programmes and by preventing the increase in number of vessels taking part in the fisheries. There is also a programme that allows vessel-owners to add one quota to another, and then to decommission the vessel to which the one quota was attached. This scheme receives financial support from the government.

For mackerel and shrimps, only vessels that can present a history in fishing activity are allowed to participate in these fisheries. This principle is gradually being extended to other fisheries, in order to limit participation.

4.4.9 Actions to ensure that fisheries do not hamper the rebuilding or maintenance of stocks

(SoC 6.10 and 7)
The EU TAC policy has been tailored to ensure that it does not have negative effects on cod recovery. Similarly, TACs for all other stocks have been consistently adopted taking into account, where possible, technical interactions between different fisheries.

Fishing areas may be closed at a national level. There are, however, no legal instruments at Community level for the temporary closure at short notice of areas with high concentrations of juvenile fish (real time closure) and there is no obligation on fishermen to change their fishing grounds when they haul in an excessive catch of juveniles. In the Norwegian fisheries the fishing vessels are obliged to change fishing grounds when the catches of undersized fish, or by-catch of certain species, are too high.

In accordance with the agreement between the EU and Norway on recovery measures for cod in the North Sea, Norway has increased the minimum mesh size of towed nets used to fish demersal species from 100 mm to 120 mm in the Norwegian Economic Zone. The use of a sorting grid system has been made compulsory for Norwegian vessels fishing for shrimps with towed demersal nets. Technical measures have also been implemented for towed demersal nets in the *Nephrops* fisheries. Furthermore, Norway has enacted legislation prohibiting the fishing of Norway pout, blue whiting and sandeel for industrial purposes within a restricted area in the Norwegian Economic Zone.

Deep-water fishes have received increased attention from national and international management authorities, conventions and non-governmental organizations. Increasing fishing effort on such species – many of which are generally considered to be long-lived, slow growing, with low reproductive potential for replacement – is a potentially serious threat to deep-water fish stocks and their associated ecosystem. Moreover, for most stocks the effect of increased levels of fishing is difficult to determine because of a lack of scientific data.

In response to these concerns, information has been provided by ICES since 1994 on what is known about deep-water fish species and their stocks and fisheries within the ICES area (including ICES Fishing Areas IVa, Vb and VI, parts of which lie within the North Sea area).

The urgent need to implement the precautionary approach to manage deep-water fish stocks is exacerbated by the low survival rate of discarded species and escapees. Thus, increasing fishing effort will affect deep-water fish assemblages in general and not just species of commercial importance. To cope with this situation, the European Commission has presented two proposals for Council regulations setting out, respectively, catch quotas and an effort limitation scheme.

Landing of sea trout (*Salmo trutta*) and salmon (*Salmo salar*) caught by towed gear outside the 6 nm limit has been banned in Community legislation. Although by-catch may be inevitable, this measure is believed to discourage direct fishing at sea for salmon and sea trout and in this manner to contribute to the recovery of the Rhine stocks.

4.5 Protection of Juvenile Fish, Crustaceans and Molluscs

(SoC 8)

4.5.1 Minimize or ban discards

(SoC 8.1)
Information from discard monitoring programmes is now beginning to emerge in the stock assessment documents.

Council Regulation (EC) No 850/98 entered into force 1 January 2000 and has been specifically tailored and subsequently adapted to reduce the need to discard fish. For example, the requirements about the composition of the catch for a given gear have been set in accordance with the expected results of legitimate fishing with the appropriate mesh. Beam trawls have been more selective since then. Moreover the basic text of the CFP foresees the use of incentives, including those of an economic nature, to encourage selective fishing practices. Reduction of discards has been considered as a priority issue in the Green Paper on the reform of the CFP.

To prevent high-grading Denmark has introduced a discard ban on some target species which when caught are above the minimum landing sizes. Additional examples are the German Bight real time closure, in spring 1998, to protect juvenile cod and the voluntary tie-up scheme initiated by the UK fishermen to protect juvenile haddock from overfishing in spring 2001.

Norway has prohibited the discarding of the most economically important species to ensure that the fishing mortality rate will not exceed the agreed quota limits. The discard ban is combined with other measures such as temporary closure of sensitive areas, obligations to change fishing grounds when the intermixture of undersized fish exceeds certain levels, and the requirement of improved gear selectivity.

4.5.2 Avoidance of by-catch of juvenile fish, crustaceans and molluscs

(SoC 8.2, 8.3, 8.4 and 8.5)
The objective of minimum mesh sizes is to allow the escape of small fish and to optimize the total catch in relation to the rate of fishing. Norway and the EU are cooperating on the establishment of minimum mesh sizes for new species and adjustments of the existing minimum mesh sizes.

Apart from the setting of appropriate mesh sizes, Regulation (EC) No 850/98 and associated secondary legislation stipulates measures to increase the selectivity of the gear. Examples of these are the mandatory use of square mesh panels in towed gear, detailed specifications on twine diameter, restrictions of number of meshes around the codend, and the mandatory use of sorting grids in shrimp trawls. The cod recovery plan now being devised (see section 4.4.5) includes specific provisions on improved gear selectivity.

Regulation (EC) No 850/98 also sets out minimum landing sizes for fish, crustaceans and molluscs in accordance with the selectivity of the gears appropriate for their capture.

A study on species selectivity of the shrimp trawl showed that the total proportion of fish in the catch was reduced by 85% when the Nordmøre grid was used. No significant loss of shrimp could be seen. Use of the Nordmøre grid is now legislated for in the Swedish coastal shrimp trawling industry.

Norway has developed several sorting grid systems and other devices for towed gears and seines with a view to reducing undesired by-catch. Sorting grid systems have become compulsory when fishing for shrimps both within the Norwegian and Swedish Economic Zones. Research in this field is continued.

Closed areas with regard to certain fishing activities are generally set out with a view to protecting concentrations of juvenile individuals. Regulation (EC) No 850/98 specifies a number of closures or 'boxes', where certain types of fishing have been restricted for a number of years. The most important boxes are found:

- off the west coast of Denmark and to the east of the UK, to protect juvenile herring;

- in the area known as the 'Norway pout box', to protect juveniles of several roundfish species; and
- in the vicinity of the German Bight, the 'plaice box', to protect juvenile plaice and sole. The plaice box was not totally closed to small fishing vessels.

The setting of boxes does not always have the expected results. For example, the plaice box was established to reduce the discarding of plaice in the nursery grounds and therefore to protect the species. However, after ten years of scientific research it was concluded that this goal has not been reached. One of the factors that could negatively influence the predicted positive effect of the box is natural change in the North Sea ecosystem which negatively influences plaice growth or survival.

Norway introduced a surveillance system for the Barents Sea as early as 1985. This is a system comprising the closing and opening of sensitive areas with a high incidence of juvenile fish and by-catches which is directly adapted to the actual biological conditions of the fishing grounds. The system is based on extensive monitoring of sensitive areas, and follows objective criteria for determining when areas should be closed. Norway and the EU are currently discussing the possibility of establishing a similar surveillance system for the North Sea.

4.5.3 Minimize high-grading

(SoC 8.6)
Improved technical selectivity of fishing gear in the pelagic fisheries, as is intended by the legislative framework of the EU, is expected to result in less high-grading of the catch. This legislation includes a prohibition on the use of automatic grading equipment, except under certain specific conditions, in order to prevent large-scale high-grading in certain pelagic fisheries.

In Norway there is close cooperation between the Coastguard and the Directorate of Fisheries to minimize high-grading. To reduce high-grading and discard of fish the best solution is to have inspectors on board the fishing vessels during the fishing operation. In some fisheries, particularly in the mackerel fisheries, Norwegian vessels do have inspectors on board. In addition, the Coastguard randomly checks fishing vessels at sea, examining both the catches and the catch documentation schemes.

Until 2000, Norway had a special regulation applicable to mackerel above 600 grammes (the G-6-regulation). Only a maximum share of the vessel's landings, relative to the entire vessel quota, can be landed as G-6 mackerel. If the share is reached or exceeded by a vessel, the whole vessel quota is defined as exhausted despite a possible remaining quantity. In 2001, the sales organizations tested a new price system for mackerel that will serve the same purpose. This was successful and the system will be continued in 2002. This arrangement is replacing the G-6 system.

4.6 Protection of Species and Habitats

(SoC 9)
The protection of non-target species and habitats is addressed in detail in chapter 3.

4.6.1 Development of selective fishing gear and restriction on fishing in areas that require protection

(SoC 9.2)
The Commission has requested ICES to increase its efforts to provide information and advice on other fish stocks, on cetaceans and on marine organisms other than those targeted by the commercial fisheries. Further information is given in chapter 3. In December 1999, the Commission proposed, and the Council adopted, a prohibition to fishing for sandeel in an area to the east of the UK (Council Regulation (EC) No 2742/1999), based on ICES advice indicating that this was required to guarantee the availability of sandeel as prey for other forms of marine life (see section 3.2.5).

Sweden has developed a long-term action plan designed to protect 23 wild salmon populations on the Swedish west coast. It has the overall objective of achieving at least 75% of the possible smolt

production by 2010 and that all original wild salmon populations should be kept and that their reproduction areas should be rehabilitated.

In recent years it has been revealed that Norwegian deep-water coral reefs have been damaged to a considerable extent. This damage is most likely due to the accumulated result of fishing with bottom trawls over several decades. Based on scientific advice legislation was passed in 1999 under the Seawater Fisheries Act that made it illegal to destroy coral reefs intentionally. The legislation also contains a provision to establish areas protected from fishing activities. To date, two areas of about 1000 km^2 (Sula Ridge) and 600 km^2 (Iver Ridge) have been established as areas protected from bottom trawling. Both areas lie north of the North Sea.

4.6.2 Avoidance of ghost fishing

(SoC 9.4)
No measures to avoid ghost fishing exist yet at Community level. Scientists in the EU and Norway are involved in a three-year EU-funded study (FANTARED 2) which began in 1999 and aims to establish the extent of loss of fishing nets, to discuss actions to reduce such losses and to reduce the effects of lost nets. Existing progress indicates that the problem of lost nets is greater for deeper waters (*i.e.* waters deeper than 300 to 400 m) where algal growth (fouling) on the nets is very limited.

In Norway, work has started in cooperation with the fishing industry, to identify measures that can be taken to prevent the loss of fishing gear. This work includes an assessment of the present rules and regulations related to net fisheries. The work is planned to end in 2002. For several years, Norway has also had a governmental funded programme to remove lost gear.

The 'Fishing for Litter' project of the North Sea Directorate of the Dutch Ministry of Transport, Public Works and Water Management, in cooperation with the fisheries association, lands North Sea litter which is gathered in the nets during fishing. This litter consists, *inter alia*, of lost fishing gear and therefore the project contributes to the avoidance of ghost fishing.

4.6.3 Environmental assessments of new fishing practices

(ED 6.3; SoC 9.5)
No new fishing activities as such have been developed, except for certain practices such as the multiple cod rigging in shrimp trawls. The possible impact on the environment of these developments, like increased fuel consumption with corresponding increase in exhaust emissions, has not yet been studied. There is a need to design appropriate methodology to conduct such assessments. However, as mentioned in sections 3.2 and 4.5, improved technology may reduce the by-catch of target as well as non-target species. An objective official procedure for assessing the environmental impact of fisheries in general is not available.

4.7 Protection from Activities other than Fisheries

(SoC 10)
Human activities on land or at sea are of importance to fisheries particularly in relation to spawning grounds and nursery areas for fisheries resources. These activities, their effects and the measures taken since IMM 97, are addressed in other chapters of the Progress Report and have not been specifically related to effects on spawning grounds and nursery areas. The general measures taken, *e.g.* to reduce inputs to the marine environment, will, however, also be of benefit to these areas.

In Denmark, a committee examines the effects on fisheries of activities other than fisheries and effects on the environment by fisheries.

4.8 Control and Enforcement

(SoC 11)
Most measures in the North Sea, and more specifically TACs and technical measures applicable to joint stocks, are taken after consultation between Norway and the European Community, so as to ensure that they have equivalent conservation effects when applied in one or another fishery zone. This includes the procedures for the registration and accounting of catches. During 1998, the control system applicable to the CFP was thoroughly reviewed within the Community.

In 1998 the Council adopted a regulation, Council Regulation (EC) No 2846/98 of 17 December 1998, amending Council Regulation (EEC) No 2847/93 establishing a control system applicable to the CFP.

These initiatives entered into force in 1999 and provide for:
- enhanced cooperation between all authorities involved in fisheries control, inspection and surveillance throughout all stages (from the catch to the consumer);
- enhanced transparency, notably with regard to the follow-up of major infringements;
- more autonomy for the Commission's fisheries inspectors; and
- enhanced monitoring of third-country vessel landings in the Community.

Early in 1999 the Commission submitted to the Council a proposal for a regulation 'establishing a list of types of behaviour which seriously infringe the rules of the Common Fisheries Policy' (COM(99) 70).

Norway has established bilateral agreements with most North Sea countries in the field of cooperation on monitoring, control and surveillance. Cooperation takes place in various forms, such as meetings, seminars and daily contact at an operational level.

Several exchanges of fisheries inspectors between EU Member States, Norway and third parties surrounding the North Sea, have taken place in which fisheries inspectors from the Commission also took part. These exchanges familiarized inspectors with inspection procedures and practices applied by other parties and have improved communication between authorities by the establishment of personal contacts.

The EU and Norway are also committed bilaterally to improve control in the mackerel fisheries. A working group has been established in order to review landing procedures and notably the weighing of landed fish. The first report from the group was presented in 1999. It is expected that this process will continue in 2002.

Norwegian fisheries authorities have in recent years been given more powers and a wider range of sanctions to enforce fisheries regulations, as well as strengthened control of vessels at sea. Sanctions include the possibility of temporary or permanent loss of fishing licences for Norwegian vessels.

Experts from the EU, Norway and the Faroe Islands meet bilaterally and trilaterally, as well as within the framework of the North-East Atlantic Fisheries Commission (NEAFC), to discuss matters pertaining to control and enforcement of conservation measures. The exchange of information on landings by flag vessels has improved considerably. The parties contributed to the establishment of an electronic data exchange system within the NEAFC, which will be implemented in the near future and may be used for bilateral data exchanges.

4.8.1 Develop and apply more effective and consistent control methods

(SoC 11.2)
Control in the EU is undertaken within the framework of Council Regulation 2847/93. Council Decision 95/527/EC allows EC member states to receive a community financial contribution for improving control and enforcement. Moreover, the Community has initiated a process of harmonization of the system of sanctions (Regulation (EC) No 1447/1999 establishing the types of behaviour which seriously infringe the rules of the CFP), which will contribute to enhance the fairness and effectiveness of enforcing schemes. A similar process is taking place in Norway.

4.8.2 Develop further cooperation and transparency in control and enforcement

(SoC 11.3)
Progress in developing cooperation and transparency in control and enforcement and in the exchange of practical knowledge is moving in a clear positive direction. Member states and Norway cooperate on a routine basis. The Commission regularly organizes coordination meetings with experts from the member states and from Norway. Moreover, the Community and Norway as Contracting Parties to the NEAFC, contribute to the efforts of this organization to implement a better control of fishing activities, including the implementation of the FAO International Plan of Action to prevent, deter and eliminate Illegal, Unreported and Unregulated Fishing.

To achieve increased and more effective control in the North Sea area in the future, cooperation between control bodies at sea and on-shore in different countries should be improved, especially when it comes to the exchange of correct information on landings by flag.

4.8.3 Satellite monitoring

(SoC 11.4)
In 1996 a satellite monitoring system was tested within the framework of the North Atlantic Fisheries Organization (NAFO). Based on this experience the European Community introduced satellite tracking as an operational tool for monitoring, control and surveillance in 1998. Since 1 January 2000 all Community fishing vessels exceeding 20 metres between perpendiculars or 24 metres overall length are subject to Vessel Monitoring Systems (VMSs), as well as third country vessels of the same size operating in Community waters.

In Norway there has been a similar process and VMS has been applied progressively in bilateral fisheries agreements (*e.g.* NEAFC and NAFO). Norway and the EU have been in the forefront of this development.

The VMS agreement between the EU and Norway was concluded 28 January 2001 with a view to implementing an operational VMS scheme. The basic provisions of the agreement are that vessels from both Parties are tracked by their flag state Fisheries Monitoring Centre and that when a vessel operates in the waters of the other Party the position reports are retransmitted to the Fisheries Monitoring Centre of the relevant coastal state. Furthermore, specific entry and exit messages are sent when a vessel enters and leaves the waters of the other Party. The scheme became fully operational on 1 July 2000. Vessels transmit every hour in the Norwegian zone and every two hours in the EU zone.

4.8.4 Exchange of data

(SoC 11.5)
Within the framework of Council Regulation 2847/93, member states endeavour to develop databases on monitoring, control and surveillance of fishing activities. In addition, the Commission is putting in place a Fisheries Inspection Information System (FISIS). Norway has established several databases for control purposes, based on activity reports and catch reports from both Norwegian and foreign vessels to Norwegian fisheries authorities.

Exchange of catch statistics for control purposes takes place regularly between Community and Norwegian control authorities, in accordance with the bilateral fisheries agreement. Norway has also signed control agreements with Denmark, France, Ireland, Iceland, the Netherlands, Great Britain, Sweden and Germany and exchanges data with these countries on a regular basis.

According to ICES, present landings statistics may not reflect the true scale of the recent fishing activity in waters outside the national Exclusive Economic Zones (EEZs), and thus North Sea States should collect area-specific catch, landings, effort and biological data from exploratory and commercial fishing activities in international waters and report these data to ICES.

4.9 Science, Technology and Economic Impacts

(SoC 12–15)

4.9.1 Facilitate and conduct research

Much research on the North Sea ecosystem is undertaken jointly involving many laboratories around the North Sea both in Norway and the EU, this research is often coordinated through ICES.

In June 2000 the Commission launched a call for proposals for studies and pilot projects in support of the CFP. Within the Fifth Research Framework Programme, the Commission has promoted research on the impact of fisheries on the marine ecosystems, with a special emphasis on the food webs, on the physical impact of fishing gear on the seabed, on the demographic structures of exploited fish stocks and by-catches, and on genetic diversity.

Germany initiated a study focusing on the specific areas identified in Articles 12 to 15 of the SoC. The study (German Federal Environmental Agency 2000) supplies an overview of research conducted in these areas, identifies promising developments and suggests areas on which future efforts should be focused.

Work is also ongoing in Norway to improve the knowledge of fish stocks and their interaction with the other components of the marine environment. In addition, the Norwegian government is funding numerous research projects on the development of selective gear technology.

According to ICES the relation between the spawning stock, *e.g.* size and composition, and recruitment is complex, and gaining deeper insight into this relationship is one of the greatest challenges for present fisheries biology.

Ministers at the 4NSC and the IMM 97 noted the need for the establishment of reference areas allowing comparison between undisturbed areas and areas affected by fishing, in particular areas fished by bottom (beam and otter board) trawls. The IMPACT II Study on the effects of bottom trawling on macrobenthos and associated fish also recommended the establishment of such areas. However, no such areas undisturbed by fisheries have been established.

4.9.2 Effects of fisheries on the ecosystem, especially beam trawling and industrial fisheries

(SoC 15.1)
The effects of fisheries on the ecosystem are addressed in section 3.2.3.

4.9.3 Research needed for the development of an ecosystem approach

(SoC 15.2)
The research and studies encouraged by European Community funding are intended to lead to a better understanding of the functioning of marine ecosystems and, thus, towards the operative implementation of an ecosystem-based approach.

Fishery and environment scientists have met several times in recent years in order to establish the state of play and future developments of fisheries and environmental sciences in order to progress on the implementation of fisheries and environmental sciences and on the implementation of the ecosystem approach.

Work is ongoing in Norway to improve knowledge of fish stocks and interactions with other components of the marine environment; furthermore, environmental data are increasingly taken into account in modelling work.

4.9.4 Incentives to encourage more support for protection and sustainable use of resources

(SoC 15.3 and 15.4)
In 1999, the Council adopted Regulation (EC) No 2792/1999 on the financial instrument for fisheries guidance. This regulation gives indications on how structural funds can be invested in practices adding value to environmental integration, such as:

- capital investment in fixed or movable facilities aimed at the protection and development of aquatic resources, except restocking (Article 13);

- promotion of products obtained using environmentally friendly methods (Article 14);
- short-term operations of collective interest serving to attain the objectives of the CFP (Article 15); and
- studies, pilot projects, demonstration projects, training measures, experimental fishing, *etc.* (Article 17).

Regulation (EC) No 104/2000 on the common organization of the markets in fishery and aquaculture products, contributes to encouraging producers, processors, retailers and consumers to become partners in the development of responsible fisheries. The new mechanisms of this common organization of the markets aim to programme fishing activities in order to prevent squandering and to discourage interventions (*e.g.* operational programmes, planning of captures and marketing strategies) and are designed to promote coordination among actors and good information to consumers.

4.9.5 Socio-economic effects

(SoC 15.5)
Within the Fifth Framework Programme, the Commission has funded Concerted Action 97/3900 aimed at giving an insight into the definition and allocation of user rights in European fisheries. Tradable user rights, such as Individual Transferable Quotas (ITQs), may under certain circumstances be an alternative to traditional management tools. In these, the management authority allocates fishing rights to the fishermen, who can then trade these among themselves. The Concerted Action is exploring whether market forces may be more efficient in allocating fishing rights, the efficiency being measured as the extent to which production may be obtained at lower cost. Obstacles to the 'market' approach are of a very diverse nature and may be insurmountable in some fisheries, but for others they may be overridden by the expected advantages. The Scientific, Technical and Economic Committee for Fisheries (STECF) will continue to give an insight into these problems. Since 1999, STECF has produced an assessment of the economic status of fisheries.

A second Concerted Action 97/3541 was founded to give an overview of Economic Performance of Selected European Fishing Fleets. The report shows that nearly two-thirds of the fleet segments achieved satisfactory to good economic performance for the period 1997 to 1999. But there is a lack of segments from the coastal fisheries because of the better database from the open seas fleet segments. This should be changed because of the importance of the coastal fisheries in itself and additionally for the tourist sector *etc.* Coastal fisheries also often use ecologically sound fishing techniques. The work will now continue in a new Concerted Action from 2002 to 2004.

A project with the goal to develop general bio-economic models for Swedish coastal fisheries was carried out during 1997 to 2000. The bio-economic model for the Swedish west coast fishery for Norway lobster (*Nephrops norvegicus*) shows that a maximum economic yield equilibrium requires effort reductions of more than 50%, leading to a potential resource rent of almost US$ 3 million, compared to the open-access situation in 1995. Further increase of the resource rent is possible if a more selective trawl is introduced and enforced.

The Dutch pilot project 'ECOTOETS' aims to develop an assessment tool with underlying socio-economic/ecological indicators for beam trawl fisheries, so that the integrated effects of measures for beam trawl fisheries can be calculated and visualized.

4.9.6 Ecological and economic effects of a discard ban and monitoring of discard level

(SoC 15.6 and 15.7)
The Commission has encouraged and supported discard studies for several years and many more data are becoming available to the assessment work carried out by ICES. In June 2000 the Council adopted Regulation (EC) No 1543/2000 establishing a framework for the collection and management of the data needed to conduct CFP and other associated legislation. This framework foresees that member states should draw up scientific sampling programmes to collect information relevant to fish stock assessment and fisheries economics. These include the collection of data on discards and will constitute a continuation of the ongoing discard studies. However, there has been no investigation of the ecological and economic effects of or the practicability of applying a discard ban.

4.10 Information and Involvement

(SoC 16-18)

4.10.1 Improve the provision of information for fishing communities

(SoC 16 and 17)
From the end of 1999 to early 2001, the European Commission participated in a number of events organized by non-governmental organizations and supported by Community funding. These events covered various aspects of the integration of environmental concerns into the CFP, including integration strategies and the implementation of the Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (the Århus Convention). These events constitute an extensive forum for the dissemination of information, the discussion of problems and the generation of new management ideas.

Furthermore, the European Commission also has close contact with specialized media and journalists and has released a number of press notes to explain the European Community position on various issues of interest, including North Sea matters. The European Commission has a web site containing a section on 'hot topics', such as the recent emergency measures for North Sea cod. The web site is also a public forum for questions and answers. The European Commission also publishes a free magazine called 'Fishing in Europe', produced in eleven European Community languages and which looks at the various elements related to the fisheries sector.

The Norwegian fishery administration has in meetings with national, regional and local organizations improved the provision of information about the effects of fisheries on the ecosystems and on fish stock conservation. For the last few years, 'the Internet' has also been an important means of communicating such information.

The fishing industry appreciates the effort made to improve the provisions of information for and the involvement of fishermen, however, there is room for improvement, as the information to fishermen should be given in a more accessible language.

4.10.2 Involvement of fishermen and other parties in the decision-making process

(SoC 18)
The EC Advisory Committee on Fisheries and Aquaculture (ACFA) was renewed and strengthened in July 1999. The new committee comprises representatives of the following interests: professional organizations representing the producer companies, the processing industry and traders in fishery and aquaculture products and non-governmental organizations representing the interests of consumers, the environment and development.

The ACFA may be consulted by the European Commission or take up, at the initiative of its chairman or at the request of its members, questions concerning the rules of the CFP as well as economic and social questions in the fisheries sector. To prepare its opinion, ACFA convenes working groups where scientists, chosen by the STECF, are also present. The existing working groups cover access to resources and management of fishing activity, aquaculture, markets and trade, and general questions.

In addition, the European Commission convenes regularly 'regional fisheries workshops', where national administrations, the fisheries sector, scientists, the Commission services and other stakeholders are represented in order to discuss issues of regional or sectoral interest. These meetings constitute an open forum of debate and have proven very useful in devising management measures on the basis of the opinion of interested parties. Since the latter half of 1999, six regional meetings were convened; two dealing specifically with North Sea fisheries.

The Norwegian management system has developed during close cooperation between the authorities and the industry, and the regulatory instruments and decision-taking procedures are designed to reflect the need for rapid adoption and implementation, as well as to enhance the awareness and support of the fishermen.

Over the last few years Norway has conducted regular meetings between the fishing industry and scientists in order to arrive at a common understanding, particularly in terms of stock assessments, of the precautionary approach and its implementation in management advice.

In Norway every region has a local advisory committee, working on regional matters. Fisheries authorities and politicians are represented at meetings held by the Norwegian Fishermen's Association both at a regional and a national level, and the industry is represented in working groups and in international delegations to meetings with the EU. This two-way communication and high level of contact between the fishing industry and the authorities, is necessary to achieve the best possible management regime.

Both the Norwegian Fishermen's Association and the Federation of Norwegian Fishing Industries are members of the Regulatory Board, where proposals for next year's regulations are discussed.

Other initiatives strengthening the mutual understanding of stakeholders include an inter-regional meeting held in Sweden in September 2000 entitled 'Dialogue between professionals and scientists in the fisheries sector' and the undertaking of a study entitled 'Misunderstandings between scientists and professionals in the fisheries sector. Their characteristics and ways of solving them'.

ICES has continued and strengthened the exchange of views on stock status and advice between science, management and the fishing industry, *e.g.* through the ICES Dialogue meetings. ICES has also taken initiatives to use other channels to improve the dialogue, particularly with the fishing industry.

The fishing industry finds that ICES assessments are not transparent and often the industry is surprised that the assessments do not reflect changes in fishing practice and fishing strategy. This means that the fishermen sometimes are unable to relate the assessment results to their fishing experience. The industry considers that improvements could be achieved by the introduction of a certification scheme for the assessment process, improved communication and most importantly by including data collected by the fishermen into the stock assessments.

4.11 Reporting Related to the 1995 Esbjerg Declaration – Joint Actions Norway–EU

(ED Annex 1, section 3)

Convene joint scientific working groups to develop common views in respect of management on common stocks *(Annex 1, 3.1)*
Joint scientific working groups have mainly worked within the ICES framework. Two specific joint scientific groups have been convened in the bi-lateral framework to advise on the appropriate emergency measures to halt the decline of the cod stock, and to examine, within the context of a long-term recovery plan, how the exploitation pattern could be improved.

Work jointly towards a responsible and sustainable utilization of North Sea fish stocks *(Annex 1, 3.2)*
The EU and Norway meet regularly to work jointly towards responsible utilization of North Sea stocks. Consultations are held to design management strategies, to allocate reciprocal fishing rights in the respective fishery zones, to establish licensing regimes and to discuss issues of mutual interest within the context of responsible fishing.

Set up a working group to evaluate the effectiveness of management measures presently in use for demersal stocks in the Community and Norwegian parts of the North Sea *(Annex 1, 3.3)*
No specific group has been established to evaluate the effectiveness of management measures in general. However, this issue is the subject of discussions during regular consultations.

In addition, the measures implemented to improve the exploitation pattern of demersal species according to the agreement between Norway and the EU of 21 June 2001, will be reviewed on the basis of experience gained during 2002, new scientific information and advice and other relevant data.

Assess the probable effectiveness of any new measures that may contribute to the recovery of key stocks *(Annex 1, 3.4)*
The North Sea cod TAC was significantly reduced between 2000 and 2001 with additional emergency measures agreed in February and June 2001 and these measures together with the reduced TAC affected the fisheries in 2001. The long-term recovery plan for North Sea cod was agreed late in 2001 and will affect the fisheries beginning in 2002. Recovery of fairly long-lived fish stocks such as North Sea cod – it takes about three years before a North Sea cod is mature – means that several years are required before the stock will recover even with the very severe measures taken. The area closures that were part of the emergency measures apparently did not achieve effort reduction, but only effort reallocation. Experience with other stocks suggests that rebuilding can be rather quick (~5 years) while other stocks have taken about 25 years before they recovered.

Set up a working group on catch reporting and catch statistics which will work on 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 *(Annex 1, 3.5)*
The EU and Norway have noted that there is a recurring problem in relation to discrepancies between the official catches or landings reported and catch statistics utilized by ICES. In this context, the parties have agreed to set up a working group. This working group has not yet been convened. However, the issue is regularly discussed during the annual consultations and in other context of fishery statistics (Eurostat, OECD).

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 *(Annex 1, 3.6)*
Norway and the EU agreed to implement a new management regime for North Sea herring in 1996. This regime includes, *inter alia*, a medium-term management strategy in which annual quotas shall be set for the directed fishery and for the by-catches in other fisheries, as defined by ICES and by-catch limits for herring in fisheries for purposes other than human consumption. According to ICES reports, the exploitation pattern of North Sea herring has considerably improved.

Norway and the EU shall before the end of 2001 review the existing arrangement concerning management of herring of North Sea origin.

Increase exchange of catch statistics which may contribute to promotion of effective control of relevant fisheries *(Annex 1, 3.7)*
As part of the bilateral control agreements between Norway and other countries around the North Sea basin, the exchange of catch statistics has increased over recent years. However, exchange of catch statistics could be further increased. At present, exchange of fishery statistics takes place monthly. To ensure a timely monitoring of the utilization of fish quotas, the control regimes established during the consultations foresee a mechanism of reporting of catches which includes radio communication from vessels to the control authorities of coastal states.

Consult on fishery regulations in the North Sea, with a view to achieving, as far as possible, the harmonization of regulatory measures in the fishery zones of the two parties *(Annex 1, 3.8)*
EU–Norway consultations also aim at the harmonization of regulatory measures in the fishery zones of the two parties. Technical and control measures have reached a higher degree of harmonization but major discrepancies still exist.

Additional effort has been made within the context of the recovery of the demersal stocks in the North Sea. The European Union and Norway have agreed on new measures to improve the exploitation pattern in the North Sea. These measures include an increase in the mesh sizes used in demersal fisheries and the use of selective devices in fishing gears to prevent the capture of young fish. From 1 January 2002, the minimum mesh size of towed nets used to fish demersal species will increase from 100 mm to 120 mm.

Promote the development and introduction of fishing gear and fisheries practices which will improve selectivity and reduce unwanted and/or harmful by-catches of fish, marine mammals as well as birds *(Annex 1, 3.9)*
Co-operation between Norway and the EU on research and studies is good. Community funding of research projects can be extended to Norway and joint research projects are now common practice. Research priorities include the promotion of fishing techniques less damaging to the environment.

The results of these studies have led to the implementation of several measures, some of them common to Norway and the EU, aiming at the reduction of unwanted by-catch of fish and marine mammals.

4.12 Assessment of Achievements

4.12.1 Guiding principles, management objectives and strategies

The Community and Norway have made important advances in adopting guidelines, especially during the last year, in the form of principles, objectives and strategies (see section 4.2). For those guidelines, which have not yet been specifically set in a political or legislative act, there is a good opportunity to ensure that they are taken up in the reform of the CFP. A good understanding of the operational implications of the guidelines is missing, however. Thus their implementation can be only partial and is likely to be inefficient. There is clearly a need to undertake research on this matter and to examine the outcome so that the appropriate measures can be adopted and enforced.

4.12.2 Status of North Sea fish stocks

The majority of the commercially important stocks in the North Sea are outside 'safe biological limits'. As most achievements in fisheries management have been completed very recently, or are still in the process of implementation, it is not possible at this stage to assess and predict their effectiveness now and in the near future. However, in view of the evolution of fish stocks in recent years, which, despite some improvements, continues to show a rather negative picture, and taking into account the management measures which were in place for a relatively long period, spectacular results can not be expected in the near future unless the most pressing problem – excessive fishing pressure – is properly addressed. The present state of fish stocks is described in Annex 2.

4.12.3 Further integration of fisheries and environment policies

Integration of fisheries and environmental policies has always been present in both EU and Norwegian fisheries management. However, this requirement received particular attention in 2000 and 2001, where a number of policy guidelines and commitments were made (see section 4.2). What is required now is that these commitments become progressively a reality.

The first step would be to remove the main obstacle to environmental integration, which continues to be the excess fishing pressure. Technological improvements to remove or diminish the environmental impact of fishing will never be sufficient if this is not addressed as a priority.

A second obstacle to implementing environmental integration is the lack or insufficiency of scientific knowledge. Research priorities should be addressed to improve the understanding of the structure and functioning of the North Sea ecosystem and to develop operational procedures to implement an ecosystem-based fisheries management, including the setting of precautionary reference points or similar management guidelines for non-commercial items affected by fishing.

However, even the current scientific knowledge is a sufficient basis on which to progress the development of environmental protection within fisheries management. Measures in this respect have been described in the EC Biodiversity Action Plan and in the Norwegian Environmental Action Plan for 2000 to 2004.

Finally, it is important that both Norway and the EU continue to contribute to the international

efforts being undertaken within the international forums, within both the fields of research and management, since environmental integration has become a worldwide concern.

4.12.4 Rebuilding or maintenance of spawning stock biomass and protection of juvenile fish, crustaceans and molluscs

Both Norway and the EU have made considerable progress on a number of topics related to the rebuilding or maintenance of spawning stock biomass, and the protection of juvenile fish, crustaceans and molluscs, particularly in recent times. Progress has been evident in the field of long-term management plans and recovery plans, improved selectivity, implementation of a precautionary approach, and improved control and enforcement, *etc.*

There is still an excessive fishing effort, mostly driven by excess fishing capacity coupled with technological improvements. None of the achievements by Norway and the EU have so far contributed substantially to solving this problem. There is one field above all where urgent action is required in order to take full advantage of all other common achievements by both management partners, this is a permanent reduction in fishing capacity and effort.

The other important fields where further progress is needed are:

- in parallel to measures on fishing capacity, which of necessity are of a medium- to long-term nature, there is a pressing need to adapt fishing effort to real fishing possibilities as determined by TACs and quotas;
- reduction in by-catch and discards;
- spatial management, by a better use of areal restrictions to fishing. This may include the setting of nursery areas, spawning areas and non-disturbed areas; and
- information and encouragement, including economic incentives, to ensure that the necessary management measures are better understood, accepted and adhered to by the fishing industry.

4.12.5 Protection of species and habitats

Section 3.5 addresses the assessment of achievements for the protection of species and habitats. Some research, in relation to ghost fishing, has been carried out on the removal of lost fishing gear but there is need for further research. For several years, Norway has had a government-funded programme to remove lost gear. The North Sea Directorate of the Dutch Ministry of Transport, Public Works and Water Management, in cooperation with the fisheries association, lands North Sea litter which is gathered in the nets during fishing.

4.12.6 Control and enforcement and further collaboration

Progress is still to be achieved on this issue and, as is the case for the protection of spawners and juvenile fish, inevitably the limiting factor for compliance is the excess fishing capacity of the fleet. Enforcement is difficult or, at least, cost-ineffective under such conditions. The individual countries are required to increase their efforts to ensure better compliance, improved monitoring systems and a harmonization of sanctions.

Collaboration between the Community and Norway is excellent and is also expected to continue to develop. Progress has been particularly rapid within the context of the recent cod crisis. Fields for improvement could include the formalization of some cooperative relationships into institutional working groups, and the harmonization of regulatory frameworks, particularly concerning discards.

4.12.7 Science, technology and economic impacts

The European Community has made a considerable effort to promote progress in the fields of science, technology and economic impacts. The response by the scientific community has, however, been limited. Although good projects were presented to the Call for Proposals, these did not cover all the fields required. The new regulatory framework for the collection of basic data (Regulation No 1543/2000 and associated legislation), as well as the coordination work undertaken by ICES, is likely to give a new impetus to progress in these fields. The reform of

the Sixth Framework Programme of Research will also make an important contribution to the same objective, particularly in terms of its Action 8 which is designed specifically to help implement European Community policies.
There is a need for further progress in the application of the precautionary approach in fisheries management, especially for non-target species, in the development of the operational aspects of an ecosystem-based approach, and to achieve a reduction in by-catch and discarding. There has been no study of the economic effects of applying a discard ban in Community waters or the practicality of such a ban.

No areas undisturbed by fishing have been established although research on the impacts of bottom trawling in the southern North Sea has clarified the criteria for creating undisturbed areas.

As most research on effects of 'activities other than fisheries' (*e.g.* windmills, power cables, offshore activities, climate change) tends to focus on effects on the environment, there is a strong demand from the fishing industry for research on the effects of such activities on the fisheries.

4.12.8 Information and involvement

The European Community considers the work achieved under the existing legal framework to be satisfactory. Any improvements are likely to involve a better use of modern communication technology and increase the participation of stakeholders in the decision-taking process. These elements are addressed in the Green Paper on the reform of the CFP.

The Norwegian fishing industry has a considerable involvement in the decision-making process for fisheries management.

Although the industry agrees that steps to enhance the dialogue have been taken, there is still ample room for improving the dialogue between stakeholders, science and management.

5

The Prevention of Pollution by Hazardous Substances

5.1 Introduction

This chapter examines the current status of emissions, discharges and losses of hazardous substances to the marine environment and sets out the progress which has been made in various areas for reducing inputs of hazardous substances since the 4NSC. It also examines how the North Sea States have complied with the various targets and goals which were set at previous Conferences; this includes the progress made within international organizations in this field (EU, OSPAR). Individual reports from the North Sea States are available on the North Sea Conference website (until 2003) or by contacting the Norwegian Ministry of the Environment. The gaps and problems with implementation and reporting are identified.

5.1.1 General progress since the 4NSC

The Esbjerg Declaration introduced a number of goals and targets for hazardous substances (see Table 5.1).

The main effort has been directed at substances which are persistent, liable to bioaccumulate and toxic (PBTs) or which have harmful properties giving rise to an equivalent level of concern (*e.g.* endocrine disruptors and substances that can damage immune systems). In this context, chemicals which are both very persistent and very bioaccumulative (VPVB) have also been addressed. Both groups are of particular concern, since they will accumulate in marine food chains and because, once discharged, they are practically impossible to remove from the environment. Some of the so-called Persistent Organic Pollutants (POPs) may also be subject to long-range transport. Their occurrence in remote areas such as the Arctic provides evidence for this. Mixtures of such substances are also of

Table 5.1 *Overview of valid goals and action points for hazardous substances agreed upon by Ministers at the previous North Sea Conferences.*

Reference	**Goals/action points of North Sea Conference Ministerial Declarations** ED = Esbjerg Declaration (1995), IMM = Statement of Conclusions from the Intermediate Ministerial Meeting (1993), HD = The Hague Declaration (1990)	
ED 23 i), Annex 2, 4.1 (i)	**50/70% reduction targets** To continue to take action with the aim of achieving by the year 2000, those reduction targets set by the 3NSC which have as yet not been met.	**Quantitative Reporting**
IMM 4.6	To achieve a significant reductions (of 50% or more) of PAH inputs from all sources.	
HD 2 and 3	To achieve a significant reduction (of 50/70% or more) of inputs via rivers and estuaries and atmospheric emissions between 1985 and 1995 as specified for each of the substances in HD Annex 1A.	
ED 17	**One generation target** To prevent pollution of the North Sea by continuously reducing discharges, emissions and losses of hazardous substances thereby moving towards the target of their cessation within one generation (25 years) with the ultimate aim of concentrations in the environment near background values for naturally occurring substances and close to zero concentrations for man-made synthetic substances.	
ED 23 i), Annex 2, 4.1(xii), HD 9	**PCB and DDT** Phasing out use and destruction of waste. Remediation of contaminated land and sediments.	**Quantitative Reporting**
ED 23 i), Annex 2, 4.1 (viii)+(xiii)	**Substitution of substances and products** Substitution of listed substances and products and substances with hormone-like effects.	
HD 2ii) and 4i), Annex 1A and 1B (c), ED 27, Annex 2, App.1	**Pesticides** Banning or strict limitations of listed pesticides + Giving priority to review under PPP-directive of pesticides detected in marine environment.	
ED 23 i) and 25, Annex 2, 4.1 (ii)	**BAT/BEP** Implementation in relevant discharge permits.	
ED 23 i), Annex 2, 4.1 (xii)	**Contaminated land and waste disposal sites** Prevent losses. Trace sources and map sites. Abatement/other action.	
ED 23 i), Annex 2, 4.1 (x) + (xi)	**Waste including recycling of plastics** Minimize generation of hazardous waste. Recycling. Safe disposal.	
ED 25 ii)	**Economic instruments and voluntary agreements**	
ED 24 iii)	**Integrated product policy**	

concern, even at low concentrations due to their harmful, sometimes synergistic, effects on biota.

OSPAR and the EC have developed prioritization mechanisms for selecting those substances of greatest concern to the marine and aquatic environments and both have priority lists containing around 30 chemicals for which measures are being developed with the aim of meeting the one generation target or the corresponding aims of the Water Framework Directive, respectively. PBT-substances are also addressed under various EC priority lists on dangerous substances and pesticides.

The Quality Status Report 2000 for the Greater North Sea (OSPAR 2000) shows evidence of decreasing levels of input of many of the traditional hazardous substances, but draws attention to the fact that a large number of man-made compounds for which the ecological effects are largely unknown are still being discharged into, and detected in, the North Sea.

5.1.2 Main actions/goals agreed

At previous North Sea Conferences, Ministers agreed on a number of goals and action points with respect to hazardous substances (Table 5.1), which are still valid and the implementation of which are discussed in sections 5.2 to 5.10.

At the 4NSC Ministers noted the lack of harmonized procedures for reporting and that comparisons between the results achieved by North Sea States therefore are difficult. They thus agreed (ED 66 and 67) to develop and implement a system for transparent, reliable and comparable reporting. To fulfil these requirements, harmonized reporting procedures for hazardous substances were developed by the HARP HAZ Contact group with Norway as lead country (see chapter 10).

5.2 The 50/70% Reduction Target

(HD 2 and 3; ED 23 i, Annex 2, 4.1 i)

North Sea States report that they have met the 50% reduction target for a large number of the 36 substances listed in HD Annex 1A and for PAH (see Table 5.3), but there are still some shortcomings. For some substances, there is a lack of 1985 reference data, e.g. for dioxins and PAH. The 70% reduction target for mercury, lead, cadmium and dioxins has been achieved by several, but not all North Sea States. Some have been able to report to a detailed level for a large number of substances. Previous problems with lack of harmonized reporting have, however, still not been resolved. For those countries that report in detail, the reporting system provides a comparable picture of the contribution from the various sources.

At the 3NSC, Ministers agreed:

- to achieve a significant reduction (of 50% or more) of:
  - (i) inputs via rivers and estuaries between 1985 and 1995 for each of the 36 substances listed in HD Annex 1A;
  - (ii) atmospheric emissions by 1995, or by 1999 at the latest, for 17 substances out of the 36 substances listed in HD Annex 1A, provided that the application of Best Available Techniques (BAT), including the use of strict emission standards, enables such a reduction; and
- for substances that cause a major threat to the marine environment, and at least for dioxins, mercury (Hg), cadmium (Cd) and lead (Pb), to achieve reductions between 1985 and 1995 of total inputs (via all pathways) of the order of 70% or more, provided that the use of BAT or other low waste technology measures enables such reductions.

Furthermore, Ministers at IMM 93 agreed to make significant reductions of anthropogenic inputs of the order of 50% or more between 1985 and 2000 from all sources of polyaromatic hydrocarbons (PAHs) of concern to the marine environment, thereby increasing the number of substances subject to the 50% reduction target to 37.

Progress on the implementation of the 50/70% reduction target on inputs of hazardous substances is presented below.

5.2.1 Data reported

The report to the 4NSC in 1995 on achievements in meeting the 50/70% reduction target revealed major differences in approach and detail amongst the North Sea States. The reporting format developed for the 5NSC was based on new procedures (HARP-HAZ Prototype) intended to increase harmonization, comparability and transparency in the reporting process, particularly on how data were derived. Some, but not all North Sea States, have been able to follow the new procedure and report to the requested level of detail necessary to obtain full transparency.

Background for developing new procedures
A new set of procedures for quantification and reporting on hazardous substances (the HARP-HAZ Prototype) has been developed since the 4NSC in 1995. The objective of reporting on a common basis was to increase transparency and thus comparability of the quantitative data on the 50/70% reduction target as this was considered in 1995 to limit the evaluation of progress.

For the sake of transparency, and to justify comments made in the following assessment, the individual country reports on the 50/70% reduction targets are incorporated in the document Compilation of Submitted Inputs.

The procedures give two main options for the quantification of inputs: the source-orientated approach (SOA) and the load-orientated approach (LOA). The SOA is based on the quantification of discharges and emissions from identified sources. The LOA measures the loads entering the marine environment via rivers, estuaries and direct discharges. In both cases, procedures were introduced to improve the transparency of how data were collected and results calculated in order to enable a comparable assessment of achievements and the pinpointing of the remaining most significant sources of hazardous substances entering the North Sea.

Extent to which transparency was achieved

North Sea States were asked to report quantitative data for all significant emissions, discharges and losses of the 37 hazardous substances for the years 1985 and 1999/2000. The data were to be reported by making use of a new nomenclature[5] for sources or entry routes; a unique identification of individual sources or entry routes intended to provide for transparency and comparability. The reporting system was computerized to enable the automatic aggregation of data and the calculation of the corresponding percentage reduction for each substance.

However, the reports provided by North Sea States showed that only a few countries were able to submit their data and information in accordance with these requirements.

Most countries used the SOA for reporting on both inputs to air and water. Only one country, the UK, reported inputs to water using the LOA for most substances. Only a few countries were able to report to the requested level of detail for a large number of substances. Several countries reported to different levels of detail for different substances. The various countries also included different sources in their reports. The differences need to be taken into account and will to some extent limit the scope for comparing results between countries. For example, it is not possible to compare the percentage reduction targets achieved by countries which only reported on industrial sources with those who reported on both industrial and diffuse sources.

Table 5.2 *Categorization of the approaches referred to, and level of detail contained, in reports from North Sea States on the 50/70% reduction target.*

Category (Ref. No)	Approach	Level of detail of the data reported
1	**Source Oriented Approach (SOA)**	Quantitative data assigned to main sources and their sub-sources (SOA, full compliance with HARP-HAZ Prototype)
2		Quantitative data assigned to main sources (SOA, compliance only with the main sources of the HARP-HAZ Prototype)
3		Total quantitative data only (amounts in kg/yr)
4	**Load Oriented Approach (LOA)**	Quantitative data assigned to main entry routes (LOA, compliance with the main entry routes of the HARP-HAZ Prototype)
5	**Not specified**	Only percentage reduction reported for the period 1985–1999/2000
6	**Sales statistics**	Sales statistics for pesticides

[5] Developed in the HARP-HAZ Prototype and based on Eurostat NOSE code nomenclature.

Furthermore, in view of the difficulties in dealing with diffuse pollution, it is probably easier for countries just reporting on industrial sources to achieve the required percentage reduction targets.

In order to show the extent to which countries made use of the guidance provided by the HARP-HAZ Prototype and the corresponding level of detail reported, six categories were established (Table 5.2) and their reference numbers were used in Table 5.3 to characterize the level of detail reported by North Sea States in relation to a particular substance.

A general problem, which also occurred in the reporting on the 50/70% reduction target to the 4NSC, is the lack of available data for the reference year 1985. This also applies to hazardous substances from the offshore industry. The data availability for 1999/2000 seems to be better, generally speaking, and of a higher degree of transparency. There are still, however, shortcomings in obtaining relevant quantitative data, as several countries have not been able to provide data on all relevant substances, sources, and pathways. Data for other years may have been reported, in some cases resulting in considerably shorter reporting periods than the required 14/15 years from 1985 to 1999/2000.

In general, data sets for 1999/2000 are more complete than those for 1985. In several cases new knowledge on source patterns has lead to updates of the national 1985 data. Accordingly, these data are no longer consistent with the data reported in the Progress Report to the 4NSC in 1995.

Some North Sea States (the Netherlands, Norway, Denmark) have been able to report in detail on a wide range of sub-sources using the Nomenclature for Sources of Emissions (NOSE) code assigned to the individual source.

Differences in the way North Sea States reported their data, seem in some cases to be related to a lack of national release data, rather than to true differences in source profile, *e.g.* for emissions and discharges of nickel (Ni) and zinc (Zn) from transport.

The discrepancies as regards the level of detail in the reported data sets limit a further comparative analysis and make it impossible to establish general, reliable trends in the discharges and emissions from specific primary sources (*inter alia,* from individual industrial sectors), although realistic 'snapshots' can be obtained from individual reports.

To the extent that calculation methods are specified in the reports, they indicate that different methods are being used among the countries. Furthermore, each figure reported often consists of a number of different quantifications. It is difficult to assess the influence of the different ways of carrying out the estimations as long as it is not possible to clearly follow how sources have been identified and inputs calculated. In this respect there are still major shortcomings in many of the reports.

Despite these shortcomings, the footnotes to Table 5.3 indicate that a certain degree of transparency has been achieved. However, there is a long way to go to obtain harmonized reporting, namely that figures are both transparent and comparable.

Reasons why transparency was not achieved

The following causes of non-compliance with the reporting system based on the HARP-HAZ Prototype have been identified:

- the reporting was based on either monitoring data of riverine loads (LOA) or on emissions and discharge data monitored at the source (SOA). For the LOA, only one country had available monitoring of riverine inputs for a large number of substances. For the SOA, the 'main groups of sources' to report on defined in the HARP-HAZ Prototype (*e.g.* transport, households, industrial activities, waste/disposal) are comprehensive and include a large number of sub-sources, which needed to be reported on to ensure full transparency and comparability;
- reporting data for the reference year 1985 was a problem for several North Sea States. Some countries had made a considerable effort to update previously established estimations for 1985, but generating data *a posteriori* was a problem in some cases. However, when other sources were to be taken into account, problems with lack of reference data could not be resolved in many cases. Furthermore, for some substances (*e.g.* dioxins and PAHs), the monitoring methodologies were rudimentary compared with those of today; and

Table 5.3 *Achievement by North Sea States of the 50/70% reduction target for the 36 substances listed in Annex 1A of The Hague Declaration and for PAH. (W: discharges/releases to water, A: emissions to air.)*

	B		CH		D		DK		F		N		NL		S		UK	
Substance	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**	**A**	**W**
Mercury, 50%	2	3	2	2	5	2	1	1	3	3	1	1	1	1	2	2	3	4
Mercury, 70%																		
Cadmium, 50%	2	2	2	5	5	2	1	1	3	3	1	1	1	1	2	2	3	4
Cadmium, 70%																		
Copper	3	2	5	5	5	2	1*	1*	3	3	1	1	1	1	2	2	3	4
Zinc	3	3	2	5	5	2	1*	1*	3	3	1	1	1	1	2	2	3	4
Lead, 50%	2	2	2	5	5	1	1	1	3	3	1	1	1	1	2	2	3	4
Lead, 70%																		
Arsenic	3	3	5	5	5		1	1	3	3*	1	1	1	1	2		3	4
Chromium	3	3	5	5	5	2	1	1	3	3	1	1	1	1	2	2	3	4
Nickel	3	3	5	5	5	2	1	1	3	3	1	1	1	1	2	2	3	4
Drins	–		–		–		–		–		–		–		–		–	
HCH (incl. lindane)	6	6															5	4
DDT	–		–		–		–		–		–		–		–		–	
Pentachlorophenol							2	2					1	1			3	4
Hexachlorobenzene																	3	4
Hexachloro-butadiene	–		–	2	–		–		–		–		–	1	–	5	–	4
Carbontetrachloride	3	3	5	5	5	5	2				1	1	1	1	5	5	3	4
Chloroform	–	3	–	5	–	5	–	5	–		–	1	–	1	–	5	–	4
Trifluralin	–	6	–	6	–	6	–		–	6	–		–		–		–	4
Endosulfan	–	6	–	6	–		–		–	6	–		–		–		–	4
Simazine	–	6	–	6*	–		–	2	–	6	–		–	1	–		–	4
Atrazine	–	6	–	6	–		–		–	6	–		–		–		–	4
TBT-compounds	–	6	–	6*	–		–	2	–		–	1	–	1	–	5	–	4
TPT-compounds	–	6	–	6*	–		–	6*	–		–		–	1	–		–	4
Azinphos-ethyl	–		–		–		–		–		–		–		–		–	4
Azinphos-methyl	–		–	6	–		–		–	6	–	6	–		–	6	–	4
Fenitrothion	–	6	–	6	–		–		–	6	–		–		–		–	4
Fenthion	–		–		–	6	–		–	6	–	6	–		–		–	4
Malathion	–	6	–		–		–	6	–	6	–		–	1	–		–	4
Parathion	–	6	–	6	–	6	–		–	6	–		–	1	–		–	4
Parathion-methyl	–		–		–	6	–		–	6	–		–		–		–	4
Dichlorvos	–	6	–	6	–	6	–		–	6	–	6	–	1	–		–	4
Trichloroethylene	3	3	5	5	5	5	2	2*	3		1	1	1	1	5	5	3	4
Tetrachloroethylene	3	3	5	5	5	5	2	2*	3		1	1	1	1	5	5	3	4
Trichlorobenzene	3	3	5	5		5							1	1	5	5		4
Dichloroethane, 1,2 -	–	3	–	5	–	5	–	5	–		–	1	–	1	–		–	4
Trichloroethane	3	3	5	5		5	2	2*	3		1	1	1	1	5	5	3	4
Dioxins, 50%	3	3	5	5	5		1*	2*	3		1	1	1	1	2		3	
Dioxins, 70%																		
PAH	2	2					1*	1*	3*		1	1	1	1	2		3	

The 50/70% reduction target has been achieved. This includes cases where the substance is phased out, banned or not in use

The 50/70% reduction target has not been achieved

No reporting or no accurate figures given to calculate the percentage reduction

– The HD does not require the reduction of atmospheric emissions for these substances

Categorization of the approach and level of detail contained in national reports (see Table 5.2):
1 - quantitative data assigned to main sources and their sub-sources
2 - quantitative data assigned only to main sources (SOA)
3 - total quantitative data only (based on sources)
4 - quantitative data assigned to main entry routes (LOA)
5 - only percentage reduction reported for the period 1985 – 1999/2000
6 - ales statistics for pesticides
* Insufficient data for either 1985 or 1999/2000

- release data for industry covered by the Integrated Pollution Prevention and Control (IPPC) Directive will be reported to the European Pollutant Emission Register (EPER) for the first time in 2003. The implementation of the NOSE nomenclature into national systems was generally not expected to be in place until around 2002.

Most countries have reported on their discharges, emissions and losses from sources without distinguishing between the fractions that drain to the North Sea and those which drain to other seas. Thus, it should be noted that reported data do not necessarily correspond to the total input to the North Sea from North Sea States.

5.2.2 General overview of progress on the 50% and 70% reduction target

North Sea States report that they have met the 50% reduction target for a large number of the 37 substances. Where information is available, it can be concluded that the 70% reduction target for mercury, cadmium, lead and dioxins has been achieved by most North Sea States. However, in some cases, especially for copper, nickel, zinc, tributyltin (TBT) compounds, trichloroethylene, PAH, dioxins and the pesticides trifluralin, malathion and dichlorvos, the targets have not been consistently met.

Table 5.3 presents the reported figures on the achieved reduction for 37 substances, with respect to both discharges to water and emissions to air (where relevant). Four of the substances (mercury, lead, cadmium and dioxins) have in addition to a 50% reduction target an overall 70% reduction target for total inputs via all pathways (the sum of discharges to water and emissions to air). For these substances an additional row has been included indicating the status in achieving the 70% reduction target.

Several countries did not specify the sources that are included in the reported reduction achieved. In these cases, it is expected that the largest reductions have been achieved with respect to emissions and discharges from industry/point sources and North Sea States only including such sources may have a better possibility of achieving the target reduction than those countries which included diffuse sources as well as industrial sources. For example, Germany only achieved the 41% reduction for nickel as a result of including groundwater (50% of the total load) as a diffuse source which has a big naturally occurring load and a much smaller anthropogenic load. It is not possible to distinguish between these loads. Had the groundwater path not been included, a 52% reduction would have been achieved.

Table 5.3 indicates that the reduction target has been achieved for a large number of hazardous substances. There are still shortcomings, both with respect to actual reductions, as well as for the quantification and reporting of the emissions and discharges for the two reference years (especially for 1985).

The categorization of the approach taken and the level of detail contained in the national reports illustrates that the quantification of reductions has been carried out on a different basis among the countries, which limits the scope for comparisons between countries with different categorization numbers.

The reduction percentages achieved per country for mercury, lead, cadmium, copper (Cu), dioxins, PAH, trichloroethylene, hexachlorocyclohexane isomers (HCH), and TBT are presented in Figures 5.1 (atmospheric emissions) and 5.2 (discharges to water).

5.2.3 Detailed information on substances and related sources

In this section more detailed results are presented on how North Sea States have moved towards the reduction targets for air and water and some trends for individual substances are examined. The detailed information indicates that the source profiles have changed for many substances, mainly due to large reductions in industrial sources. The picture for dioxins and PAH remains incomplete due to a lack of data for these substances.

In order to structure and facilitate the presentation of results, the 37 substances which are subject to reduction targets have been divided into heavy metals, organic substances not mainly used as pesticides, and pesticides.

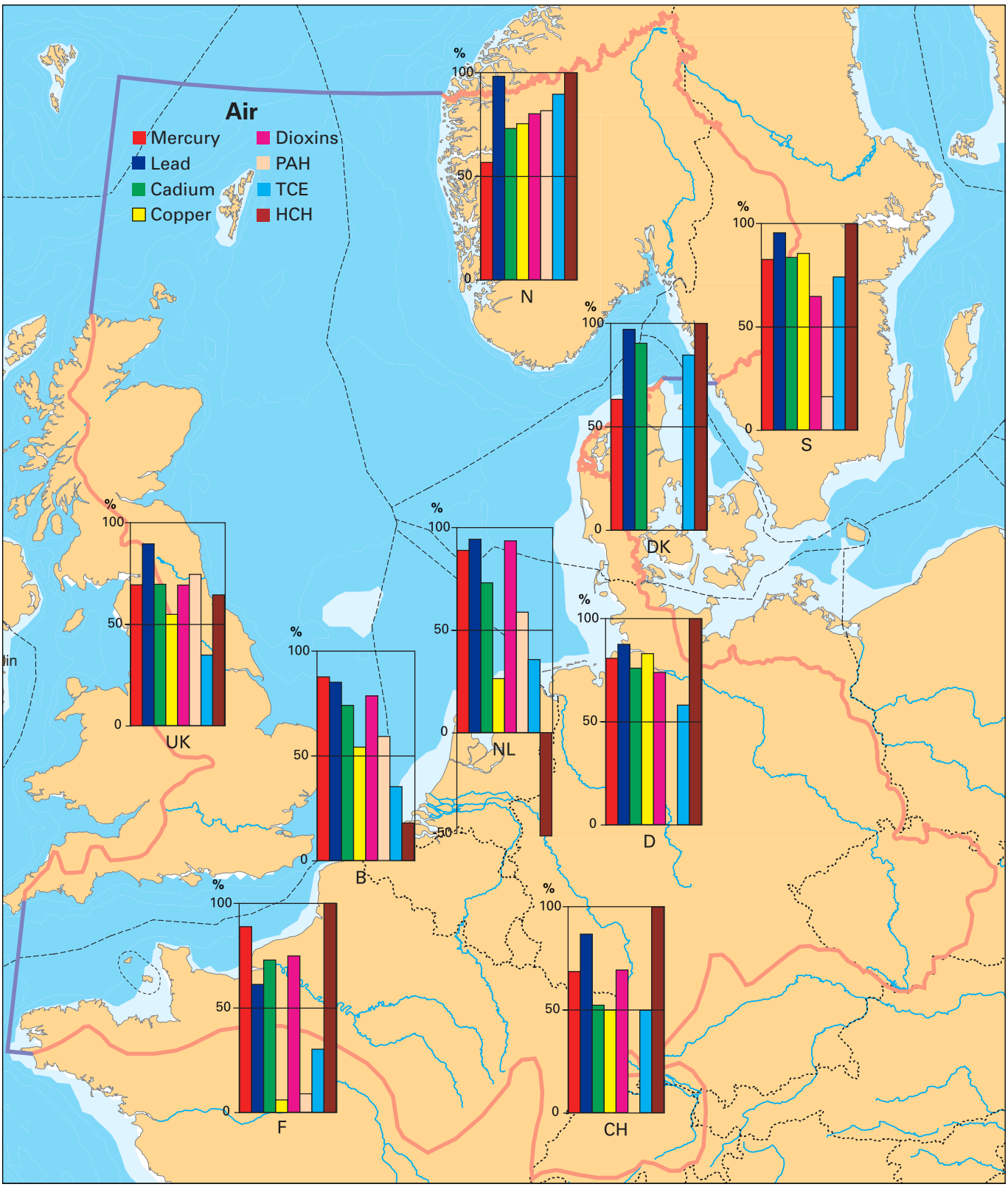


Figure 5.1 *Percentage reductions in atmospheric emission of mercury, lead, cadmium, copper, dioxins, polyaromatic hydrocarbons (PAH), tricloroethylene (TCE) and hexachlorocyclohexane isomers (HCH) over the period 1985 to 1999/2000. The 50% reduction target is indicated by a black line.*

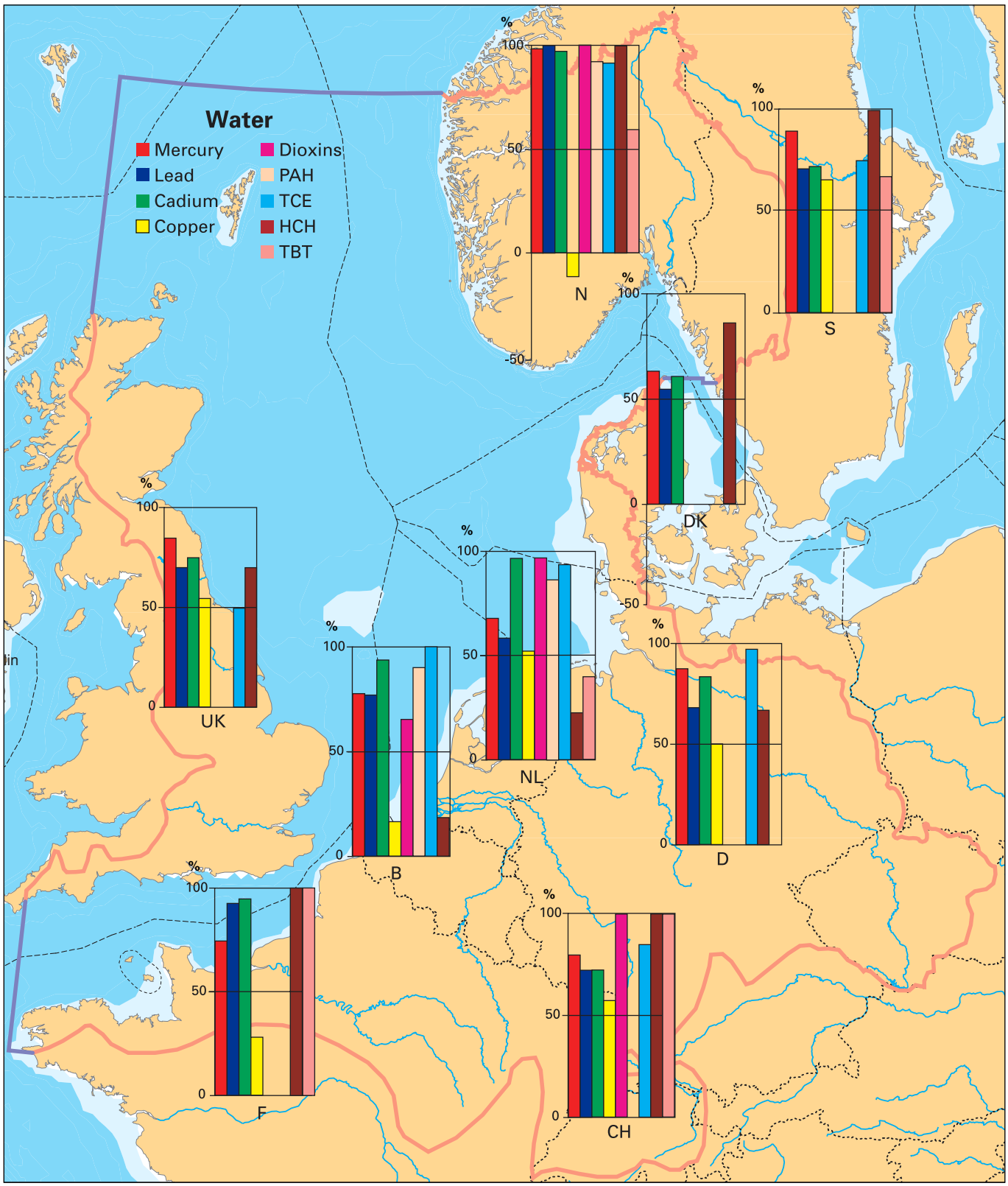


Figure 5.2 *Percentage reductions in aquatic inputs to the North Sea of mercury, lead, cadmium, copper, dioxins, polyaromatic hydrocarbons (PAH), tricloroethylene (TCE), hexachlorocyclohexane isomers (HCH) and tributyltin (TBT) over the period 1985 to 1999/2000. The 50% reduction target is indicated by a black line.*

Heavy metals
The heavy metals listed in the HD Annex 1A encompass the following substances:

• Mercury (70%)	• Cadmium (70%)
• Copper	• Zinc
• Lead (70%)	• Arsenic
• Chromium	• Nickel

All countries have met the reduction target of 50% for mercury, lead and cadmium releases to air and water. For mercury, the reductions in eight countries total at least 70% and one country has reported a 64% reduction. Correspondingly, it is clear that all countries have achieved the 70% reduction target for lead, while all but one country have done so for cadmium.

For copper, zinc, arsenic (As), chromium and nickel the 50% reduction targets have been achieved in several, but not all, cases. Lack of progress in reductions is especially relevant for nickel and copper. For copper, emissions to air have been reduced more than discharges to water, while for nickel and zinc reductions are larger for discharges to water than for emissions to air.

Importance of sources
Figure 5.3 visualizes the importance of the main sources of heavy metal releases in 1985 and 1999/2000 respectively. It should be noted that data presented in this figure are not based on reports from all North Sea States and that reported amounts discharged/emitted as well as the trends outlined below relate only to the countries mentioned in footnotes 6 and 7.

Figure 5.3 indicates that the source profiles and the importance of individual sources for mercury, cadmium, lead, copper and nickel have changed between 1985 and 1999/2000. In 1985, 'industrial activities' were a major source, but due to the large reductions achieved especially as regards discharges/releases to water from various industry sectors, other sources now seem to be of greater importance.

For emissions to air, large reductions have been achieved between 1985 and 1999/2000. Mercury emissions were reduced from all sources, especially from 'waste disposal' and 'industrial activities', which nevertheless remain the predominant main sources in 1999/2000.

For cadmium, large reductions are recorded in emissions from 'industrial activities' and from 'waste disposal', whereas the relative significance of 'transport and infrastructure' and 'small and medium enterprises (SMEs)' as sources has increased.

The major reductions in emissions to air for lead are not surprisingly connected to the transport sector and the decline in use of leaded petrol. Considerable decreases are also recorded in the total emissions from 'industrial activities' and 'waste disposal'. Industry, *i.e.* industry covered by the IPPC Directive and SMEs, remains an important source.

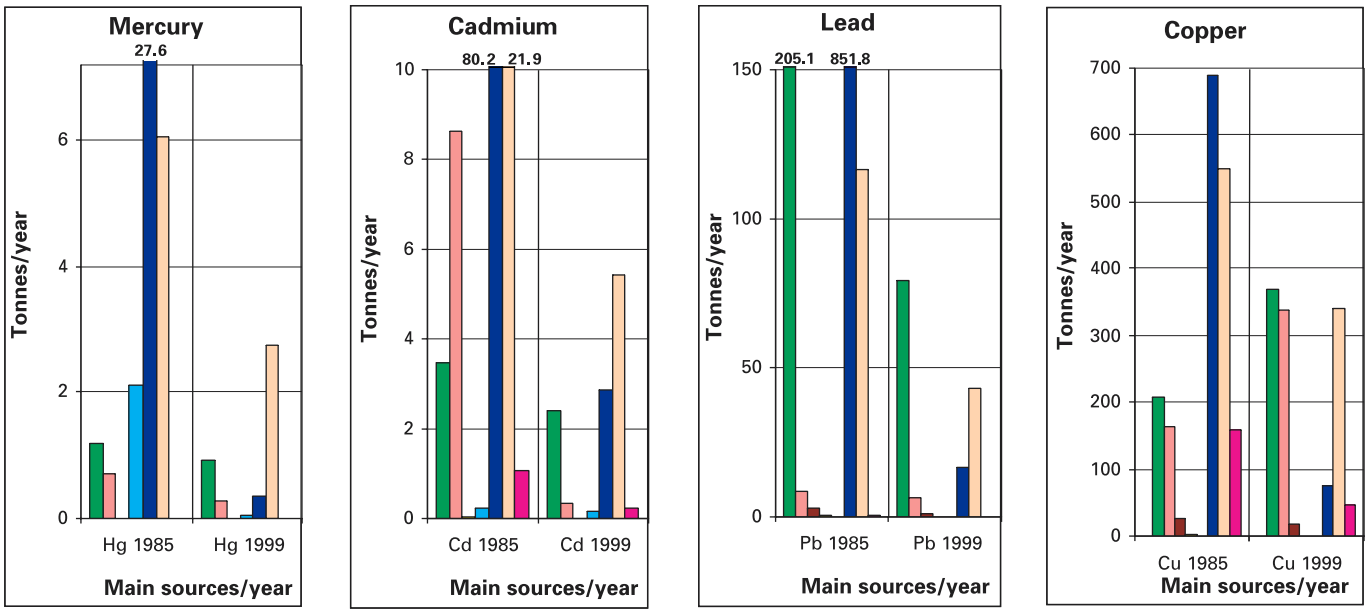
'Agricultural activities' are a dominating main source for lead discharges to water in 1999/2000 for the countries shown in Figure 5.3. This is due to the sub-source 'fishing equipment' which is included in this main source and constitutes the main amount of lead discharges.

For copper, large reductions have been achieved in many countries for discharges to water from 'industrial activities', 'contaminated land and sediments' and 'waste disposal' (including municipal wastewater). Regarding emissions to air, the largest reductions are again recorded for 'industrial activities', while other sources show no distinct trends. Increases can be observed in discharges/releases from 'transport and infrastructure' (includes boats) and 'agricultural activities' (includes fish farming nets) due to its use as an antifoulant.

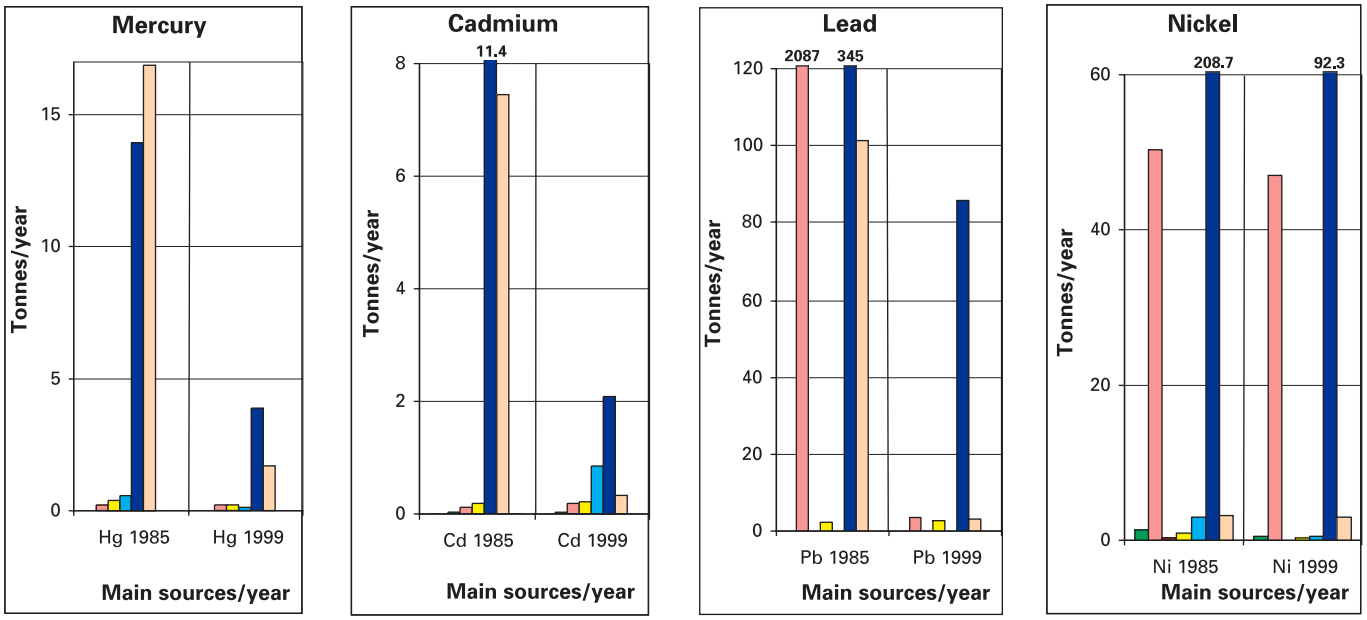
Discharges/releases from transport, including copper, are high compared with other sources in some countries which have not fulfilled the reduction target.

For nickel, the reports indicate large reductions in discharges to water from both 'industrial activities' and 'waste disposal'. For emissions to air, where more countries have not achieved the reduction target, a substantial reduction for 'industrial activities' is indicated, while emissions to air from 'transport and infrastructure' are of the same order in 1985 and 1999/2000.

Water



Air



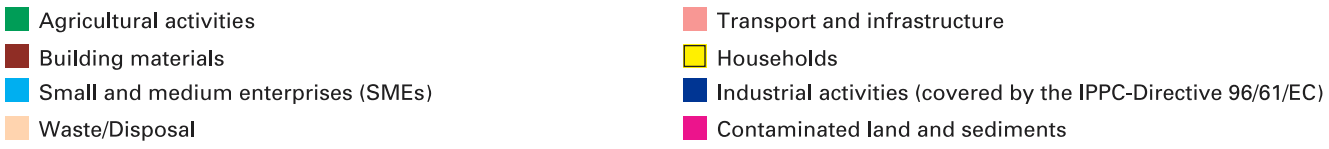


Figure 5.3 *Main sources (see HARP-HAZ Prototype) of discharges/releases to water*[6] *and emissions to air*[7] *of mercury, cadmium, lead, copper and nickel in 1985 and 1999/2000.*

[6] Based on data reported by Denmark (Hg, Cd, Pb), Germany (Hg, Cd, Cu), Norway (Hg, Cd, Pb, Cu), the Netherlands (Hg, Cd, Pb, Cu) and Sweden (Hg, Cd, Pb, Cu).

[7] Based on data reported by Belgium (Hg), Denmark (Ni), Norway (Hg, Cd, Pb, Ni), the Netherlands (Hg, Cd, Pb, Ni), and Sweden (Hg, Cd, Pb, Ni).

For zinc, reported data indicate that the main remaining sources are 'industrial activities', 'transport and infrastructure' and 'waste disposal', including municipal wastewater.

Organic substances not mainly used as pesticides

Annex 1A of The Hague Declaration lists the following twelve organic substances, which are subject to reduction and which are not mainly used as pesticides. PAH also belongs to this group.

- Pentachlorophenol
- Hexachlorobutadiene
- Chloroform
- Trichloroethylene
- Trichlorobenzene
- Trichloroethane
- PAH
- Hexachlorobenzene
- Carbontetrachloride
- TBT-compounds
- Tetrachloroethylene
- Dichloroethane, 1,2-
- Dioxins (70%)

The reduction target for many of these organic substances has been achieved by a number of North Sea States. For hexachlorobenzene, hexachlorobutadiene, carbontetrachloride, chloroform and 1,2 dichloroethane, all countries that are reporting on these substances confirm the achievement of the 50% reduction target for releases to water and/or air.

For pentachlorophenol and tetrachloroethylene, reduction targets have been achieved by all but one country.

The reduction target has been achieved to a lesser extent for TBT-compounds, trichloroethylene, trichlorobenzene and PAH.

For TBT-compounds, four countries have reported achieving the reduction target. For trichloroethylene, lack of progress in either reducing emissions to air or discharges to water has been reported by four countries. For trichlorobenzene, three countries confirm having achieved the target for both pathways.

For both dioxins and PAH, the lack of data makes it difficult to assess the achievements made in several countries. The problems with reporting on dioxins and PAH can partially be explained by the fact that for both these substances reliable monitoring methodology only became available in the last decade.

A 50% reduction for dioxin releases has been achieved in some countries, mostly with respect to emissions to air. However, data on dioxin releases are in many cases uncertain, especially with respect to dioxin discharges to water. Reported data indicate that four countries have achieved the 70% reduction target, while the total reductions achieved in other countries are more uncertain. Germany was not in a position to report on discharges of dioxins to water since Germany regulates the adsorbable organically bound halogens (AOX) as a sum parameter for which dioxin is a sub-set.

For PAH, three countries confirm that they have achieved sufficient reductions in releases to both air and water. However, the reports also indicate that many countries have problems with providing consistent and transparent data for PAH.

Problems with reporting for dioxins and PAH can partially be explained by the fact that for both of these substances, reliable monitoring methodology only became available in the last decade.

The report submitted by Denmark does not contain sufficient data for 1985 to quantify the reduction for discharges to water of organic chlorinated compounds. However, an analysis of the data for 1999 indicates that the remaining discharges and emissions are extremely low.

Importance of sources

Figure 5.4 visualizes the importance of the main sources of dioxins and PAH releases in 1985 and 1999/2000 respectively. It should be noted that data presented in this figure are not based on reports from all North Sea States and that reported amounts discharged/emitted as well as the trends outlined below relate only to the countries mentioned in footnotes 8 and 9. Nevertheless, Figure 5.4 indicates that there have been substantial reductions in both discharges to water and emissions to air of dioxins and PAH. A similar trend has also been reported by more North Sea States, for which data are not included in the figure.

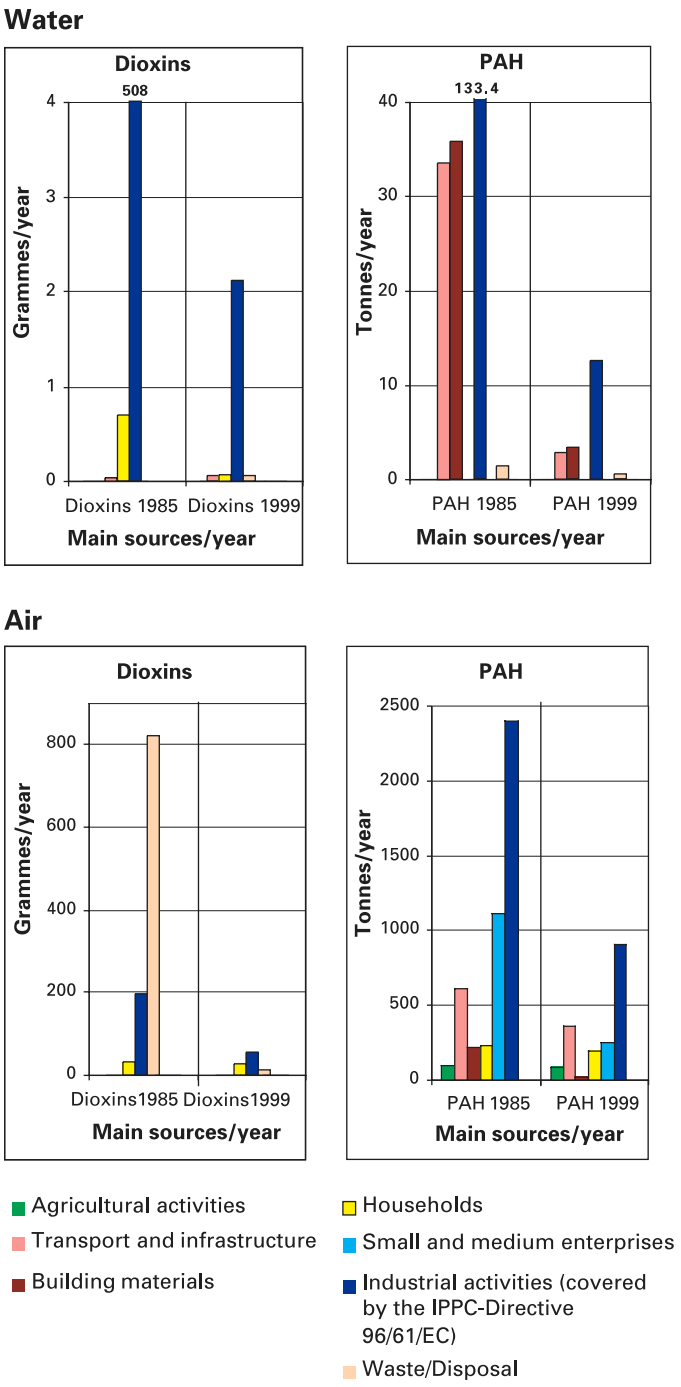


Figure 5.4 *Main sources (see HARP-HAZ Prototype) of discharges to water and emissions to air of dioxins[8] and PAH[9] in 1985 and 1999/2000.*

The largest reduction in discharges of dioxins has been achieved in industry, although 'industrial activities' (covered by the IPPC Directive) still remains the most important source. In addition, there have been significant reductions in the discharges from 'households'. For PAH, the figure indicates that large reductions have been achieved in discharges/releases from 'transport and infrastructure', 'building materials' and 'industrial activities'.

For emissions of dioxins to air, there have also been significant total reductions. The emissions from 'waste disposal', in 1985 by far the largest source, have been substantially reduced. Emissions from 'industrial activities' have also been reduced in the period from 1985 to 1999/2000, whereas reported emissions from 'households' remained more or less constant.

For PAH, the emissions seem to have been reduced between 1985 and 1999/2000 to a larger extent from 'transport and infrastructure', 'building materials', 'industrial activities' and 'small and medium enterprises (SMEs)', and to a lesser degree from 'agricultural activities' and 'households'. The largest remaining source is still industry covered by the IPPC Directive.

Analysis of the individual reports of North Sea States further revealed that the main remaining source for discharges and losses of TBT is 'transport and infrastructure', which includes the use of TBT as an antifoulant. For trichlorobenzenes, 'waste disposal', which includes municipal wastewater, is an important source for discharges and losses to water, while most emissions to air originate from 'industrial activities'. For trichloroethylene, the reports indicate that the main source is 'industrial activities', in particular those related to the degreasing and manufacture of metals.

For the organic compounds in general, fewer countries have reported detailed data. A lack of data is especially apparent for trichlorobenzene, dioxins (for water discharges) and PAH.

[8] Based on dioxin data reported by the Netherlands and Norway (discharges to water) and from the Netherlands, Norway and Sweden (emissions to air).

[9] Based on PAH data reported by Belgium, the Netherlands and Norway (discharges to water) and by Belgium, the Netherlands, Norway and Sweden (emissions to air).

Pesticides

The following 16 substances listed in HD Annex 1A are mainly used as pesticides:

- Drins
- Endosulfan
- Atrazine
- Azinphos-ethyl
- Fenitrothion
- Malathion
- Parathion-methyl
- HCH (including lindane)
- Trifluralin
- Simazine
- TPT-compounds
- Azinphos-methyl
- Fenthion
- Parathion
- Dichlorvos
- DDT

The data on pesticides contained in the national reports received from North Sea States are in most cases based on sales statistics. Three countries reported in some cases both sales statistics and amounts emitted/discharged and the UK reported on use data.

Table 5.4 shows that the 50% reduction target has been achieved for many of the 16 pesticides. All countries have met the reduction target of 50% for drins, azinphos-ethyl and DDT.

For fenthion and HCH (lindane) all but one country reports a 50% reduction in sales or discharges.

Table 5.4 *Reported reduction between 1985 and 1999/2000 of the 16 pesticides in HD Annex 1A, given as discontinued (or never in use), greater than 50% (or insignificant use) and less than 50% (or insufficient data). Sales statistics in 1999/2000 are given in tonnes/year (use data for UK).*

Pesticide	B	CH [1]	D [4]	DK	F	N	NL	S	UK
Drins									
HCH (including lindane)	41.5						39.4 [2]		39.2 [3]
DDT									
Trifluralin	15.1	0.5	<102		1600				657
Endosulfan	18.1	0.05			200				1.7
Simazine	27.8			18.8	100		58.4		139
Atrazine	164	19			3000		116.6 [2]		126
TPT-compounds	84.2						83.7		
Azinphos-ethyl									
Azinphos-methyl					20	2.3	0.8 [2]	1.5	
Fenitrothion	1				60				4.1
Fenthion					10	1.1			
Malathion	13.5			7.7	20		0.5		1.9
Parathion	1.7	0.1	<80 [4]		100		32.2		
Parathion-methyl			<26 [4]		150				
Dichlorvos	40.4	0.05	<16 [4]		100	3	0.4		1.2

Discontinued (or never in use)
Greater than 50% reduction or insignificant amounts sold
Less than 50% reduction
No basis for calculating a percentage reduction

[1] Data relate to the Rhine watershed downstream of the lakes inside Switzerland.
[2] The Netherlands reported that authorizations expired for lindane and azinphos-methyl in October 1999 and for atrazine in November 1999.
[3] The use of lindane for all seed treatments and some other uses was withdrawn in July 1999.
[4] The reported figures relate to all of Germany. The TPT authorization ended in August 2001. The authorizations for parathion and parathion-methyl expired in January 2002.

For triphenyltin (TPT) compounds, three countries have not reported sufficient data to calculate the reduction. For other pesticides, the national reports substantiate that a 50% reduction has taken place in six or seven out of nine States (endosulfan, simazine, atrazine, azinphos-methyl, fenitrothion, malathion, parathion and dichlorvos).

It should be noted that sales statistics do not always correspond to the actual amount of the pesticide used in the same year. They also will not give a complete picture of the actual discharges, as Best Environmental Practice (BEP) measures, *e.g.* integrated pest management, the use of sophisticated spraying techniques and buffer zones, are not taken into account. This may explain the fact that in some cases, reduced discharges have been reported, despite an increase having been recorded in the amounts used.

It should also be noted that the amount and type of pesticides used differs between countries depending on the type of agriculture, the nature of the crops and the climatic conditions.

The sales statistics for 1999/2000 in Table 5.4 indicate large variations between the amounts of the pesticides sold in various countries. In some cases, where the 50% reduction target was not achieved, the remaining use is low compared to other North Sea States. However, the remaining use in some countries still makes up considerable amounts, despite the 50% reduction target having been achieved.

Table 5.5 *Trends in discharges to water and emissions to air of selected heavy metals and organic substances.*

	B	CH	D	DK	F	N	NL	S	UK
Emissions to air									
Hg									
Pb									
Cd									
Cu									
Discharges									
Hg									
Pb									
Cd									
Cu									
Emissions to air									
Dioxin									
Trichloroethylene									
Discharges to water									
Dioxin									
Trichloroethylene									
HCH									
TBT									

Negative trend (target achieved in 1995, but is no longer achieved)
Positive trend (target achieved now, but not in 1995)
Insufficient data to decide trend
Unchanged, target still achieved, both in 1995 and 1999/2000
Unchanged, target still not achieved

One country (Switzerland) points out that the amounts of the actual pesticides still in use are considered to be low, and a further reduction in the order of 50% would be difficult to achieve because pesticides were drastically reduced just prior to 1985 by applying BEP measures.

5.2.4 Reductions achieved since 1995

In general, North Sea States have reduced emissions, discharges and losses of the 37 reduction target substances considerably since 1995. However, for some substances, e.g. copper, trichloroethylene and TBT the target is no longer achieved.

Table 5.5 illustrates the typical developments and trends in the achievements of the 50/70% reduction targets for a selected number of important heavy metals and organic substances, based on a comparison of the data and information on reductions included in the current national reports with the status in achievements contained in the Progress Report presented to the 4NSC in 1995.

In addition, it should be noted that there are limitations to the scope and extent for comparison of data between countries, mainly due to North Sea States reporting on different sources (see also section 5.2.1).

Table 5.5 shows for several countries a positive trend since 1995 for mercury, lead and cadmium. For copper, there has been both negative and positive trends over the last few years.

The overall positive trend in the reduction of discharges and emissions is more prominent for the selected organic substances than for the heavy metals. There are also shortcomings related to insufficient data reported, especially for discharges of dioxins to water, which make an overall assessment difficult. In several countries, there is a lack of progress for reducing emissions of trichloroethylene to air and discharges of TBT to water. One country reports not to have achieved the 50% reduction of discharges of HCH (lindane) to water.

5.3 The One Generation Target

(ED 17)

Main elements of the 4NSC one generation cessation target were taken onboard in OSPAR's Strategy with regard to Hazardous Substances, the EC Water Framework Directive and the EC's new Chemicals Policy. There have been substantial reductions in discharges and emissions of many priority substances since 1985, but there is still a long way to go in order to reach a complete cessation or phase out.

5.3.1 Cessation of discharges, emissions and losses within one generation (25 years/2020)

In paragraph 17 of the Esbjerg Declaration the objective of cessation of discharges, emissions and losses of hazardous substances within one generation (25 years) was introduced for the first time as an internationally agreed political goal. In addition to aiming at very ambitious limitations of discharges, emissions and losses, it changes the focus from a static target (related to percentage reductions of a fixed list of hazardous substances) to a more dynamic target. This new target enables the North Sea States to tackle with priority the control of those substances that at any time are considered to be of highest concern.

The 1998 OSPAR Ministerial Meeting took up the one generation cessation target as the key objective in its Strategy with regard to Hazardous Substances. In doing so, Ministers agreed to make every endeavour to move towards the target of cessation of discharges, emissions and losses of hazardous substances by the year 2020. The Ministers also adopted an OSPAR List of Chemicals for Priority Action for which the drawing up of programmes and measures for the control of discharges, emissions and losses had to be carried forward and a time frame for the implementation of the strategy and the commitments made thereunder. The adoption of this target by OSPAR enlarged the geographical applicability of the original 4NSC agreement to the North East Atlantic. To the extent

that measures are taken in the form of OSPAR 'Decisions' such measures will be legally binding.

The Helsinki Commission (HELCOM) has also taken up the one generation target. HELCOM now aims to phase out the discharges, emissions and losses of selected hazardous substances by 2020.

In 2000, a concept similar to the one generation target was integrated into the EC Water Framework Directive (2000/60/EC). The directive introduces the concept of a combined approach, whereby the reduction (and for some substances cessation) of discharges, emissions and losses of hazardous substances is achieved through a mutually reinforcing combination of (i) setting environmental quality objectives and (ii) adopting control measures on emissions and products. The one generation cessation target concept addresses specifically a group of chemicals designated as 'priority hazardous substances'. The directive requires the cessation or phase-out of discharges, emissions and losses of these substances within 20 years of the adoption of the relevant measures. A list of priority substances, including the 'priority hazardous substances', has recently been adopted, together with a time schedule for the development of cost effective and proportionate control measures for these substances and a system for updating of the list. The adoption of the one generation target for the 'priority hazardous substances' identified under the Water Framework Directive implies that the resulting measures taken under this directive will be legally binding.

When discussing the new EC Chemicals Policy outlined in a recent white paper (COM(2001) 88), both the European Council and the European Parliament recognized that the new policy should aim to achieve that, within one generation (2020), chemicals are only produced and used in ways that do not lead to a significant negative impact on human health and the environment, which is also in line with the Water Framework Directive and with commitments that member states and the Community have undertaken in international forums. The white paper also proposes a common regime for the registration, evaluation and authorization of new and existing substances and foresees a shift in the burden of data generation and evaluation from regulators to producer and user industries. Various EC working groups are currently elaborating possible elements for a new legal instrument.

5.3.2 Selection processes (DYNAMEC (OSPAR), COMMPS and WFD (EU))

Based on the available data on their PBT (Persistent, Bioaccumulative, Toxic) characteristics, a Draft List of Substances of Possible Concern has been established by OSPAR, which at present contains almost 400 substances. These substances were ranked according to relative risk considering toxicity profiles, and monitoring and modelling of the concentrations in the aquatic environment (the dynamic selection and prioritization mechanism for hazardous substances; DYNAMEC). The outcome of the ranking procedure led to a selection of 12 priority substances in 2000 and another 16 priority substances in 2001. The current OSPAR List of Chemicals for Priority Action contains a total of 42 priority substances[10].

Based on a similar procedure (COMMPS), 33 substances have been selected for the list of priority substances within the context of the Water Framework Directive. Of these, 11 are identified as priority hazardous substances[11] and 14 are subject to a review for identification as possible priority hazardous substances[12]. The list (Decision

[10] Benzene, pentabromoethyl, benzene, 1,3,5-tribromo-2-(2,3-dibromo-2-methylpropoxy), 2,4,6-*tri-tert*-butylphenol, 4-*tert*-butyltoluene, brominated flame retardants, cadmium, certain phthalates – dibutylphthalate and diethylhexylphthalate, 1,3-cyclopentadiene, 1,2,3,4,5,5-hexachloro, dicofol, EPN, endosulphan, flucythrinate, heptachloronorbornene, hexachlorocyclohexane isomers (HCH), HMDS, isodrin, lead and organic lead compounds, mercury and organic mercury compounds, methoxychlor, musk xylene, naphthalene (heptachloro, hexachloro octachloro tetrachloro trichloro), neodecanoic acid, ethenyl ester, nonylphenol/ethoxylates (NP/NPEOs) and related substances, octylphenol, organic tin compounds, pentachloroanisole, pentachlorophenol (PCP), phosphine, triphenyl-, polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCB), polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), short chained chlorinated paraffins (SCCPs), TBBA, tetrasul, trichlorobenzene, 1,2,4-trichlorobenzene, 1,3,5-trichlorobenzene, urea, N,N'-*bis* (5-isocyanato-1,3,3-trimethylcyclohexyl)methyl-.

[11] Brominated diphenylether (only pentabromodiphenylether), cadmium, chloroalkanes (C10-13), hexachlorobenzene, hexachlorobutadiene, HCH (lindane), mercury, nonylphenols, polyaromatic hydrocarbons (PAHs), pentachlorobenzene, tributyltin compounds.

[12] Anthracene, atrazine, chlorpyrifos, Di (ethylhexyl) phthalate (DEHP), diuron, endosulfan, fluoranthene, lead, naphthalene, octylphenol, pentachlorophenol, simazine, trichlorobenzenes, trifluralin.

2455/2001/EC) has been adopted by the European Parliament and the Council.

5.3.3 Identification of substances of equal concern

The OSPAR Strategy with regard to Hazardous Substances defines hazardous substances as 'substances or groups of substances that are toxic, persistent and liable to bioaccumulate' or substances which require a similar approach '…even if they do not meet all the criteria for toxicity, persistence and bioaccumulation, but which give rise to an equivalent level of concern'. The term 'substances, which give rise to an equivalent level of concern' includes, *inter alia*, substances with (potential) endocrine disrupting or hormone-like effects.

A safety-net procedure established under the DYNAMEC process covers substances which do not meet the set PTB criteria, such as metals and inorganic substances. So far, six substances suspected to have endocrine disrupting effects, have been identified and included in the 'Draft List of Substances of Possible Concern'.

The EC strategy on endocrine disruptors provides for a multi-stage process of identifying endocrine disruptors, research, assessment and management measures.

5.3.4 Implementation processes and achievements

Timetable for implementation
Table 5.6 gives an overview of the activities and time frames for implementing the one generation target within OSPAR and the EU.

International activities with respect to the cessation of specific 50/70% reduction target substances
Table 5.7 provides an overview of past, present and future international activities with respect to those substances which are subject to the 50% and 70% reduction targets.

Table 5.6 *Timetables for implementation of the one generation target within the EC Chemicals Policy, the EC Water Framework Directive and OSPAR.*

Activities to implement the one generation target	**Time frame for implementation**
EC Strategy for a future Chemicals Policy *REACH[1] system:*	
• Submission of registration dossiers for existing substances (about 30 000 substances having production volumes >1t)	*Proposed time frame* Production volume > 1000t: Before the end of 2005 Production volume > 100t: Before the end of 2008 Production volume > 1t: Before the end of 2012
• Testing and evaluation of existing substances (about 5000 substances having production volumes >100t)	Production volume > 1000t: Level 2 testing by 2010 Production volume > 100t: Level 1 testing by 2012
• Authorization of substances of very high concern (CMR-substances, POPs, VPVBs, PBTs, endocrine disruptors, other properties of concern)	
EC Water Framework Directive	
• Review of 14 'priority hazardous substances under review'	Within 12 month from adoption of directive on priority substances. (November 2002)
• Review of list of priority substances by progressively adding substances to the list	At least every 4th year. First time before December 2004.
• Submit proposals of controls for: - progressive reduction of discharges, emissions and losses (priority substances) - cessation or phasing-out of discharges, emissions and losses (priority hazardous substances)	Commission within two years after the inclusion on list of priority substances. For the existing list: November 2003. In the absence of agreement at community level, member states shall establish Environmental Quality Standards and emission controls on principal sources within five to six years from the entry into force of the Water Framework Directive.
• Implement measures to phase out or cease discharges, emissions and losses	Cessation or phase-out within 20 years after adoption of control measures.
OSPAR Strategy with regard to Hazardous Substances	
• Update OSPAR List of Chemicals for Priority Action	Agreed for the first time in 1998. Updated in 2000 and 2001. Expected new update 2002.
• Carry forward the drawing up of programmes and measures for the control of discharges, emissions and losses of the substances on the OSPAR List of Chemicals for Priority Action, 1998	By 2003.
• Develop the necessary programmes and measures on a substance or group of substances	Within three years of agreeing on the need for OSPAR action.
• Implement the strategy progressively by making every endeavour to move towards the target of the cessation of discharges, emissions and losses of hazardous substances	By 2020.
• Prepare reviews of progress achieved through this strategy	By 2003, then every five years.

1) REACH (Registration, Evaluation and Authorization of Chemicals).

Table 5.7 *Overview of past, present and future international activities with respect to those substances subject to the 50% and 70% reduction targets. (Bold indicates substances where three or more countries have not achieved the reduction target.)*

Substance	**OSPAR 'List for priority action'**	**Water Framework Directive**	**EC Directive 76/464/EC**	**EC Pesticides Directive 91/414/EEC**	**IPPC Directive (EPER reporting requirements)**	**EC Limitations Directive 76/769/EEC**	**EC Risk Assessment under Regulation 793/93**	**Other relevant international forums**
Mercury	X	PHS	List 1		X	X		HELCOM UN/ECE
Cadmium	X	PHS	List 1		X	X	X	HELCOM UN/ECE
Copper			List 2		X			
Zinc			List 2		X		X	
Lead	X	PS ur*	List 2		X	X (salts)		HELCOM UN/ECE
Arsenic			List 2		X	X		
Chromium			List 2		X			
Nickel		PS	List 2		X	X	X	
Drins			List 1					HELCOM UN POP UN/ECE
HCH (including Lindane)	X	PHS	List 2	To be phased out by June 2002	X	X		HELCOM UN/ECE
DDT			List 1					HELCOM UN POP UN/ECE
Pentachlorophenol	X	PS ur*	List 1	To be phased out by June 2002	X	X		HELCOM
Hexachlorobenzene		PHS	List 1					HELCOM UN POP UN/ECE
Hexachlorobutadiene		PHS	List 1					
Carbontetrachloride			List 1			X		
Chloroform		PS	List 1			X	X	HELCOM
Trifluralin		PS ur*	List 2	Assessment ongoing				
Endosulfan	X	PS ur*	List 2	Assessment ongoing				
Simazine		PS ur*	List 2	Assessment ongoing				
Atrazine		PS ur*	List 2	Assessment ongoing				
TBT-compounds	X	PHS	List 2		X	X		HELCOM IMO, ban anti-foul. from 2003
TPT-compounds	X		List 2	Assessment ongoing	X	X		HELCOM
Azinphos-ethyl			List 2	Phaseout decided from January 1996				
Azinphos-methyl			List 2	Assessment ongoing				
Fenitrothion			List 2	Assessment ongoing				
Fenthion			List 2	Assessment ongoing				
Malathion			List 2	Assessment ongoing				
Parathion			List 2	To be phased out by 2002				
Parathion-methyl			List 2					
Dichlorvos			List 2	Assessment ongoing	X			
Trichloroethylene			List 1		X		X	
Tetrachloroethylene			List 1		X		X	
Trichlorobenzene	X	PS ur*	List 1		X			
Dichloroethane, 1,2-		PS	List 1		X			
Trichloroethane			List 2		X	X		
Dioxins	X				X			HELCOM UN POP UN/ECE
PAH	X	PHS	List 2		X	X (anthracene creosote)	X (anthracene creosote)	HELCOM UN/ECE

OSPAR: Subject to the cessation target set out in the OSPAR Strategy with regard to Hazardous Substances

EC Water Framework Directive: PHS: subject to cessation target; PS: priority substance without cessation target; *PS ur: under review November 2002) to determine whether PHS or PS

EC Pesticides Directive: Progress on the assessment under the directive

EC Risk Assessment Regulation: Ongoing risk assessment under EC existing substances regulation

From Table 5.7 it can be concluded that for most of the substances where the 50/70% target has not yet been met by several North Sea States, international actions are underway that may lead in future to the achievement of the target.

Based on the present knowledge of risk, it is, however, clear that in many cases a higher priority should be given to achieve further reductions beyond the 50/70% target for the most hazardous substances, rather than reaching the target for the less hazardous ones.

OSPAR agreed in 2000 and 2001 on the publication of Background documents for nine priority substances (organotin compounds, mercury, musk xylene, Short Chained Chlorinated Paraffins (SCCPs), brominated flame retardants (BFRs), nonylphenol/nonylphenolethoxylates (NP/NPEOs), PAHs, pentachlorophenol (PCP) and polychlorinated biphenyls (PCBs). At the same time, OSPAR agreed on action to reach the cessation target for those substances in the year 2020.

In October 2001, a list of 11 priority hazardous substances for which a 20-year cessation target concept is specifically addressed, was adopted under the EC Water Framework Directive.

Out of the 37 substances for which the North Sea Conference 50/70% reduction target applies, seven (mercury, cadmium, HCH, hexachlorobenzene, hexachlorobutadiene, organotin compounds and PAH) are among the Water Framework Directive priority hazardous substances. A further seven North Sea Conference substances (lead, PCP, trifluralin, endosulfan, simazine, atrazine, and triclorobenzene) are among altogether 14 substances which will be subject to review for the possible identification as priority hazardous substances in 2002.

Although there has been no specific reporting on the one generation target to the 5NSC, it is nevertheless possible from the data reported on the achievement of the 50/70% reduction target to draw some indicative conclusions with respect to some of the substances on the 'OSPAR List of Chemicals for Priority Action' and the EC Water Framework Directive 'list of priority hazardous substances'. There have been substantial reductions in discharges and emissions of the heavy metals mercury, cadmium and lead since 1985 (see Figure 5.3). Measures taken since then have been particularly successful in reducing discharges and emissions from industrial (point) sources, leaving diffuse sources such as products and transport as equally important remaining problems. Despite these achievements, there is broad agreement within, *inter alia*, OSPAR and the EU (*e.g.* under the Water Framework Directive) to keep these heavy metals as substances for priority action.

The reductions in discharges and emissions of persistent organic substances, such as PAHs and dioxins (see Figure 5.4), have also been significant, but not as distinct as for mercury, cadmium and lead.

5.4 PCBs and DDT

(ED 23 i, Annex 2, 4.1 xii; HD 9)

Progress in the collection and destruction of PCBs contained in transformers and big capacitors is satisfactory. Small PCB-containing capacitors are still in use. Most of the PCBs in these small capacitors and the PCBs used in open applications have until now not been collected and treated properly as hazardous waste. During the last few years, however, some countries have set up collection and treatment systems for PCB-containing components in waste. The use of DDT has been banned in the EU for many years. PCBs and DDT pose major problems in sediments in several countries.

5.4.1 PCBs – main sources and existing legislation

All North Sea States have made inventories of PCB-contaminated large-scale electrical equipment (transformers and capacitors with more than 5 dm^3 PCB) and the destruction of this equipment has been performed or is underway. There has been less

action on releases from smaller electrical equipment (capacitors with less than 5 dm^3 PCB) and the use of other products which contain PCB (*e.g.* sealants, concrete additives, and paints) due to the practical difficulties in controlling these sources, though most North Sea States have surveyed such applications/ products.

Because the largest volumes of PCBs are found in large applications which have mostly been phased out, the potential environmental problems connected to the collection and safe disposal of smaller applications are of more concern. The small applications represent an important potential source of future pollution if not taken proper care of at the end of their lifecycle.

The report from Norway shows that of the initial amount of PCBs originally placed on the market in Norway, roughly one third is considered properly destroyed, one third is considered disposed of in an unsatisfactorily manner and one third is considered still in use.

The main areas of application for PCBs are shown in Table 5.8.

Table 5.8 *Applications of PCBs*

Category	Application
Closed systems	Transformers Capacitors (large and small) Hydraulic oils for mining
Open applications	Plasticisers Paints Concrete additives Sealants Glue in window frames Carbonless copy paper

EC legislation

The use of PCBs in open applications such as printing inks and adhesives was banned in the European Community in 1976 under Directive 76/403/EEC. The use of PCBs as a raw material or chemical intermediate has been banned in the EU since 1985 (Limitation Directive 76/769/EEC). The Directive 96/59/EEC has regulated the disposal of PCBs and polychlorinated terphenyls (PCTs). In the proposal for a Directive on waste electrical and electronic equipment (WEEE) (2000/0158(COD)) it is foreseen, *inter alia*, that WEEE-equipment containing PCBs can be returned free of charge, giving the reception facilities a responsibility to separate the PCB parts and to ensure their environmentally sound disposal/destruction.

The Commission Communication on a Community Strategy on dioxins, furans and PCBs foresees the assessment of the current state of the environment with respect to these substances and the reduction of the human exposure and the environmental effects of these substances.

International agreements

Since 1998, PCBs are on the OSPAR List of Chemicals for Priority Action. Both the UN Convention on Persistent Organic Pollutants (the Stockholm Convention) and the UN ECE Protocol on Persistent Organic Pollutants include a ban on PCB production and use and set out requirements concerning the destruction of stockpiles and the handling of wastes.

In 2001, OSPAR recommended that, in the absence of more specific OSPAR measures, OSPAR Contracting Parties should continue to report on the implementation of OSPAR Decision 92/3 on the phasing out of PCBs and hazardous PCB substitutes. Furthermore, OSPAR 2001 asked the European Commission to contribute, in good time, (i) to the process of developing a Community Strategy to reduce the presence of dioxins and PCBs in the environment and (ii) to the inclusion of cut-off values for PCBs (such as 5 ppm for the purpose of recycling cable sheatings) in the proposed WEEE Directive in order to restrict the use of certain hazardous substances in electrical and electronic equipment.

5.4.2 PCBs – transformers and large capacitors (with more than 5 dm^3 PCB)

With regard to closed applications, PCBs can be released accidentally through leaks in appliances and fires in electrical plants.

Directive 96/59/EC has regulated the disposal of PCBs and PCTs in equipment containing more than 5 litres of these substances. Key features of this directive are:

- within three years of its adoption in 1996, EU member states must submit an inventory and detailed plans for the disposal of the relevant PCB wastes and the decontamination/disposal of the relevant equipment; and
- 2010 has been set as a deadline for complete disposal or decontamination of equipment containing PCBs[13]. The only exception is for transformers containing between 500 and 50 ppm of PCB, which are allowed to remain in service until the end of their lifetime.

According to this directive, PCB-containing waste is classified as hazardous waste and accordingly transformers and big capacitors are collected, grouped, and brought to authorized installations to be decontaminated. PCB-contaminated liquids, capacitors, paper and wood resulting from these operations are destroyed by high temperature incineration. In Germany PCB-containing equipment is also stored in deep underground disposal sites.

In some countries, some PCB-containing equipment has been decontaminated abroad.

A number of countries have banned the use of such transformers and big capacitors as from 1995 and adopted national disposal legislation for equipment containing more than 1 kg of PCB.

5.4.3 PCBs – small capacitors and open applications

Small capacitors

To date, about a third of the small capacitors containing PCBs are still in use. These mainly involve capacitors in strip light fittings, but a lot of capacitors were also installed in lights along motorways and municipal roads. Many PCB-containing capacitors have been used in consumer electronics like washing machines, refrigerators, domestic fuel oil burners and central heating circulation pumps. In the light shredder fraction, the small capacitors are the largest source of PCB contamination.

From 2005 the use of PCB-containing capacitors in strip light fittings will be banned in Norway.

Most of the small capacitors have not been collected and treated properly as hazardous waste when taken out of use. Several countries have, however, during the last few years, set up collection systems to separate PCB-containing components in waste to allow their proper treatment and disposal.

Open applications

All open applications can be considered as uncontrolled. As most of the relevant products have a service life of 15 to 25 years, most of these open applications would have been forwarded to waste disposal or are due for disposal in the near future. On the other hand, certain applications, (*e.g.* construction materials) were designed for longer periods of use (40 years or more). Consequently, these construction materials probably represent the most important future source of PCB releases from open applications.

Discharges of PCB-containing paint from shipyards has been an important source of contamination of harbour sediments.

So far, most of the PCB-containing open applications have not been collected and treated properly as hazardous waste when taken out of use. Some countries have, however, set up collection systems during the last years to take care of PCB-containing waste (*e.g.* building waste) properly.

5.4.4 PCBs – measures to prevent losses from contaminated land and sediments

There is a clear priority to deal with the problems in combating the primary sources of PCBs. In addition, contaminated marine sediments and dredged materials are an important secondary source of PCB releases and represent a major problem in several countries.

In Norway, mapping of about 80 marine sites revealed several PCB-polluted areas. Measures (capping and dredging) have been taken against PCB-contaminated sediments outside a smelter and

[13] PARCOM Decision 92/3 on the Phasing Out of PCBs and Hazardous PCB Substitutes requires OSPAR Contracting Parties to do so by 1999.

on a naval base; both located in the western region of Norway and closer investigations or some corrective measures were carried out at about 40 sites.

In Sweden, one case of remediation has been carried out in a lake with sediments containing PCBs from a paper mill that recycled paper waste. The total amount of PCBs discharged was about 400 kg with resulting transport/input to the Baltic Sea of around 6 kg/yr. A total of 150 000 m^3 of dredged spoil was removed and disposed of in a separate landfill.

5.4.5 DDT

The use of dichlor-diphenylic-trichloroethane (DDT) is banned in the EU by Directive 79/117/EEC and all North Sea States have accordingly imposed regulations to ban this pesticide. Actions related to releases of DDT from contaminated land and sediments are normally placed within the frame of the general policy on contaminated land and aquatic sediments (see section 5.8.1). Two countries report that land contaminated with DDT has been remediated.

5.5 Substitution of Substances and Products

(ED 23 i, Annex 2, 4.1 viii and xiii)

Implementation of EU legislation is an important means for reducing the use of nickel-cadmium and mercury-oxide batteries. Five North Sea States have imposed restrictions on the production and marketing of mercury thermometers. In addition North Sea States have different national policies to promote substitution of hazardous substances. Two countries have introduced legislation requiring enterprises to substitute chemicals by less hazardous ones and in three countries lists of chemicals have been published to point out substances where substitution should be considered by users. Significant reductions are reported from several countries on the substitution of SCCPs, trichlorobenzenes, musk xylenes, NP/NPEs and BFRs, for which concerted substitution action is required. Risk assessments and associated Risk Reduction Strategies have been or are being performed under the EU Existing Substances Regulation and several countries prefer to await the outcome of the resulting Risk Reduction strategies before further national measures are adopted.

5.5.1 Substitution of products

Small NiCd-batteries

The relevant EU legislation is Council Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances (the Battery Directive), as adapted to technical progress by Commission Directive 93/86/EEC and 98/101/EC, which require the separate collection of batteries and accumulators containing mercury, lead and cadmium. The European Commission plans a revision of the current Battery Directive. Directive 2000/53/EC already bans nickel-cadmium (NiCd) batteries for electric cars as from 2003.

PARCOM Decision 90/2 on Programmes and Measures for Mercury and Cadmium Containing Batteries requires that Contracting Parties take appropriate steps to ensure that the NiCd-batteries are collected separately with a view to their recovery or disposal. In addition, NiCd-batteries shall be removable from any appliance without the aid of special tools.

North Sea States reported to have implemented the Battery Directive or are going to do so in the near future. The requirements of the Battery Directive and PARCOM Decision 90/2 will both assist with the substitution of NiCd-batteries. In Switzerland, a deposit on NiCd batteries is considered from 2002 onwards, if their collection target will not be reached.

Substitution of small NiCd-batteries has taken place naturally in some appliances, as alternative battery technology with superior performance has been developed. In the Netherlands, accordingly, a substantial reduction has been observed in the sale of NiCd-batteries. In Norway, however, there has not been any significant change in the annual sale of small NiCd-batteries over the last 15 years, despite the change to alternatives in major use areas such as mobile telephones and other electronic applications. Producers of some portable rechargeable machines (*e.g.* screw drivers, drills, and vacuum cleaners) still prefer NiCd-batteries.

The North Sea States have different policies to promote the substitution of small NiCd-batteries. As the price of the alternatives (NiMH or Lithium-ion batteries) is 30–40% higher than for the NiCd-batteries, Denmark and Sweden have introduced environmental taxes on NiCd-batteries to level the price and ease their substitution.

Mercury oxide batteries
The EC Battery Directive is also important in reducing the use of mercury in batteries. On 1 January 2000, a ban on mercury in batteries (limit 0.0005% by weight) became effective. Only button cell batteries may contain up to 2% mercury by weight. Mercury oxide batteries, which typically contain about 30% mercury, are banned according to the directive.

North Sea States reported to have implemented the Battery Directive or are going to do so in the near future. Switzerland has implemented equivalent restrictions.

In 2000 OSPAR published a Background Document on Mercury and Organic Mercury Compounds. In order to protect the marine environment and further reduce discharges, emissions and losses of mercury, OSPAR 2000 invited the European Commission to consider the need for further controls (*inter alia,* as regards mercury oxide batteries) in its intended amendment of Council Directive 76/769/EEC.

Mercury thermometers
The European Commission is considering regulatory measures on products containing mercury, including the use of mercury in thermometers.

In Norway, Sweden and the Netherlands, it is forbidden to produce and market mercury thermometers. Also, in Denmark mercury-containing thermometers are, with few exceptions, banned. France has banned the placement of medical mercury thermometers for private households on the market and the use of medical mercury thermometers in health-centres is restricted. In Switzerland, regulations to restrict the use of mercury thermometers are under preparation.

In Germany, a ban on the production and marketing of mercury thermometers, especially for private households, is under discussion.

In the remaining countries, mercury thermometers are still used, but the mercury-free alternatives have gained market share during the last few years.

As a follow-up to the OSPAR Background document on mercury, OSPAR 2000 also invited the European Commission to consider the need for further controls in its intended amendment of Council Directive 76/769/EEC for, *inter alia*, laboratory and medical instruments.

5.5.2 Substitution of hazardous substances

In the EU, Council Directive 76/769/EEC provides for limitations on the marketing and use of specific particularly hazardous substances and thereby facilitates their substitution with less hazardous alternatives.

In order to adapt this directive to technical progress, several amendments have been made since 1995 by introducing new substances and revising existing restrictions. According to the EC, the directive now covers 42 substances or groups of substances, comprising some 900 individual chemicals.

The issue of substitution is also addressed within the context of the Water Framework Directive and in the Directives on biocidal products. Substitution is also on the agenda for further work on the Directives for plant protection products. In the Directives on biocidal products there are provisions for a comparative assessment of substances. Furthermore, non-inclusion of substances in the lists of substances that may be used (pesticides and biocides) will trigger substitution, as do restrictions under EC Directive 76/769/EEC.

In addition, the issue of substitution is addressed by waste legislation (*e.g.* for mercury, cadmium, lead and chromium VI) and is proposed for mercury, cadmium, lead, chromium VI, and BFRs in electrical and electronic equipment (COM(2000), 347 final).

Within the framework of OSPAR, the substitution of hazardous substances by less hazardous substances or preferably non-hazardous substances is one of the guiding principles for the OSPAR Strategy with regard to Hazardous Substances.

Norway and Sweden have introduced legislation requiring enterprises to substitute chemicals by less hazardous ones if technically and economically feasible.

In Norway, all enterprises are required to evaluate their use of any substances that may be hazardous to human health and the environment. A statutory requirement to apply the substitution principle has been introduced in a new section of the Norwegian Product Control Act, which, as a general preventive strategy, has the intention to reduce the risks associated with the use of chemicals. The requirement implies that enterprises must evaluate whether they can replace hazardous substances with less hazardous substances or introduce alternative processes which avoid the use of hazardous substances and perform substitution if this can be done without involving unreasonable cost or inconvenience.

In Sweden, the Swedish Environmental code contains general rules which state that all persons managing any type of business shall avoid selling or using chemical products or biotechnical organisms that may present a hazard to the environment if they can be substituted by a less hazardous product. This is also valid for products which contain or have been treated with a chemical product or biotechnical organism.

Norwegian, Swedish and Danish authorities have drawn up observation lists containing hazardous substances requiring special caution. These observation lists are to be used as a tool for reducing the amounts of hazardous substances entering the environment and are primarily intended for manufacturers, importers, distributors and professional users of chemicals and chemical products, but may also provide useful guidance for other groups.

In the Netherlands, a clean technology programme accommodates and stimulates research on alternative techniques for industrial processes. A general evaluation methodology for substances and preparations within the context of the national Pollution of Surface Waters Act will be implemented in 2001. Companies can make use of this methodology in order to evaluate alternatives and choose the alternative with less water pollution impact. Single companies are encouraged to use alternatives by requirements set out in discharge permits and by the establishment of certified corporate environmental care systems.

5.5.3 Substitution of specific substances

Short-chained chlorinated paraffins (SCCP)
OSPAR
In PARCOM Decision 95/1 on the Phasing Out of Short-Chained Chlorinated Paraffins, Contracting Parties agreed (with a reservation from the UK) on the phasing out of short chained, highly chlorinated paraffins, defined as C10-13 with more than 48% of chlorine by weight. The decision applies to the use of SCCPs as a plasticiser in paints and coatings, as a plasticiser in sealants, in metal working fluids and as flame retardant in rubber, plastics and textiles.

Since 1998, SCCPs are on the OSPAR List of Chemicals for Priority Action and are therefore subject to the target on cessation of discharges, emissions and losses by the year 2020 under the OSPAR Strategy for Hazardous Substances.

The OSPAR Background Document on SCCPs published in 2001 included a number of recommendations for control measures and invited the EC to consider these.

European Union
SCCPs are, according to the Directive on the Classification, Packaging and Labelling of Dangerous Substances (67/548/EEC), classified as 'Dangerous for the Environment' (R50/53) and 'Harmful, Carcinogen' (cat. 3).

The Commission has proposed an amendment to Directive 76/769/EEC based on an agreed risk reduction strategy under Regulation 793/93 which largely addresses the applications of SCCPs covered by PARCOM Decision 95/1. The proposed amendment concluded that (i) limitations on marketing and use within the framework of the 76/769/EEC

Directive, in particular for metal working and leather finishing, should be considered to limit the risks, (ii) a review should take place within three years to take account of, *inter alia*, the issues raised in PARCOM Decision 95/1. A common position on this amendment was agreed in June 2001 and its adoption is expected by spring 2002. In November 2001, the European Parliament discussed the Council common position and adopted the inclusion of two further recitals in the directive:

- one recital calls for the amendment of the directive in full accordance with PARCOM Decision 95/1 (when reviewing the Directive); and
- the other calls on the Commission to make proposals to reduce the uses of all chlorinated paraffins (not just SCCPs) in the light of the results of studies undertaken within OSPAR.

Under the Water Framework Directive, SCCPs are identified as priority hazardous substances for which the Commission should bring forward proposals by 2003 for the cessation of discharges, emissions and losses within 20 years of adoption of measures.

National trends and initiatives within North Sea States

In most countries SCCPs have already been phased out to a large extent. Their use in the aeronautical industry will end before 2005.

The Netherlands and Norway have integrated PARCOM Decision 95/1 into national legislation. Belgium has notified a draft decree. Several other North Sea States have achieved substantial reductions in SCCP use and releases through voluntary phase-out activities. In Switzerland, a draft amendment of an ordinance will be circulated for comments by the end of 2002. The intension is to phase out the uses of SCCPs covered by PARCOM Decision 95/1.

The proposed EU regulation gives restrictions for metal working and leather finishing, however, their use as a plasticiser in paints and coatings, as a plasticiser in sealants and as a flame retardant in rubber, plastics and textiles, are not included as it is in PARCOM Decision 95/1.

Trichlorobenzenes (TCB)

OSPAR

Trichlorobenzenes (TCBs) are used in wire and cable manufacturing, lead/tin plating and in laboratories (minor uses as gel permeation chromatography).

Three trichlorobenzene substances (trichlorobenzene, 1,2,4-trichlorobenzene and 1,3,5-trichlorobenzene) were included in the update of the OSPAR List of Chemicals for Priority Action at OSPAR 2000. Belgium and Luxembourg, as co-lead countries within OSPAR, are in the process of developing a draft OSPAR background document for these substances.

European Union

TCBs are classified as 'Dangerous for the Environment' (R50/53) according to the Directive on the Classification, Packaging and Labelling of Dangerous Substances (67/548/EEC).

The risk assessment carried out under Regulation 793/93 concluded that 'There is a need for a risk reduction in relation to downstream open use resulting in environmental exposure. This is indicated because of risks identified for sewage treatment plants and soil receiving sludge from sewage treatment plants. This conclusion is supported by the identified risks to the aquatic environment (including the sediment compartment) in relation to the use of the substance as dye carrier and for other downstream uses.'

Under the Water Framework Directive, TCB is on the list of priority substances and may, subject to a review in 2002, be identified as a priority hazardous substance.

National trends and initiatives within North Sea States

TCB is reported not to be in use in Belgium, Norway and Sweden and has nearly been phased out in Denmark. Other countries have not reported any clear trends in use or emissions. The Netherlands and the UK have established national quality objectives and Environmental Quality Standards for TCB.

The considerable amount of TCBs stored in transformers represents the largest potential source of future TCB releases, if not safely disposed of.

Musk xylenes

OSPAR

Since 1998, musk xylenes are on the OSPAR List of Chemicals for Priority Action and are therefore subject to the target on cessation of discharges, emissions and losses by the year 2020 under the OSPAR Strategy for Hazardous Substances.

The main use areas for musk xylenes are consumer products (soaps, fabric softeners, cosmetics etc.) and the main discharge route to the environment is through domestic wastewater. Nitro musks are not produced in Europe.

In 2000 OSPAR published a Background Document on musk xylene and other musks. In order to achieve the 2020 cessation target, OSPAR 2000 proposed that, depending on the outcome of a refined environmental assessment, additional measures have to be envisaged at a later stage. These additional measures include the promotion of alternatives with a more favourable hazard profile (*e.g.* by introducing stricter degradation requirements in the EU detergents directive which also applies for other than surface-active ingredients). As regards activities to be taken in the short term, OSPAR recommended, *inter alia*, that Contracting Parties should negotiate on a national level with their industry associations the phasing out of musk ingredients in laundry detergents.

European Union

Musk ambrette, musk tibetene and moskene are on the EU list of banned components in cosmetics established under Directive 76/768/EC.

Musk ketone and musk xylene have been included in the third EU priority list of existing substances (Regulation 793/93) and the Netherlands was appointed as rapporteur. Work on a risk assessment for these substances is ongoing and follow-up actions of the EU risk assessment cannot be expected in the near future.

Musk xylenes are not on the list of priority substances within the Water Framework Directive.

National trends and initiatives within North Sea States

Several countries commented that there is a general lack of data on the use of musk xylenes. Available data in other countries indicate that the use of musk xylene is decreasing and that there is a switch to polycyclic musks. In Germany and Switzerland, voluntary agreements with industry on reductions in use of musk xylenes have been successful.

So far, no Contracting Party to the OSPAR Convention has taken legally binding measures to restrict the use of musk xylene or other musks in washing and cleaning agents.

Some countries referred to initiatives as eco-labelling of products (Germany, Sweden) or information from authorities in the form of lists of undesirable substances (Denmark, Norway, Sweden) and press releases (Germany).

Several countries will take appropriate action following the outcome of the EU work under the Existing Substances Programme.

Nonylphenols/nonylphenolethoxylates (NP/NPE)

NP/NPEOs are used in polymerisation, plastic stabilisers, epoxy resins, paint, metal working fluids, textiles, industrial and institutional cleaning, impregnated and emulsion coated paper, pesticides, personal care products, contact adhesives.

OSPAR

PARCOM Recommendation 92/8 on nonylphenol-ethoxylates sets out that the use of NP/NPEs as cleaning agents should be phased out by the year 1995 for domestic uses and by the year 2000 for industrial uses.

Since 1998, NP/NPEOs are on the OSPAR List of Chemicals for Priority Action and are therefore subject to the target on cessation of discharges, emissions and losses by the year 2020 under the OSPAR Strategy for Hazardous Substances.

The OSPAR Background Document on nonylphenol and nonylphenol ethoxylates published in 2001 included a number of recommendations for control measures and invited the EC to consider these.

European Union
NPEOs are classified as 'Dangerous for the Environment' (R50/53) according to the Directive on the Classification, Packaging and Labelling of Dangerous Substances (67/548/EEC).

The Draft Risk Reduction Strategy for NP/NPEOs developed under the EU existing substances regulation recommends that:
- the use of NPEOs should be banned under the Marketing and Use Directive (76/769/EEC) in industrial, institutional and domestic cleaning, textile processing, leather processing, agricultural biocidal products, metal working, the pulp and paper industry and in personal cosmetics and other personal care products; and
- environmental quality standards should be set for residual risks in remaining use categories.

For the use of sludge containing NP/NPEOs, it is expected that concentration limit values for NP/NPEOs will be included in the revision of the Directive on Sewage Sludge used in Agriculture (86/278/EEC).

Under the Water Framework Directive, NPs are identified as priority hazardous substances for which the Commission should bring forward proposals by 2003 for the cessation of discharges, emissions and losses within 20 years of adoption of measures. Octylphenol is on the list of substances which are subject to a review in 2002 for the possible identification as priority hazardous substances.

National trends and initiatives within North Sea States
Several North Sea Countries report significant reduced discharges of NP/NPEOs recent years, in particular as components in cleaning products.

Most North Sea States are awaiting the implementation of the EU risk reduction strategy before further measures are considered/proposed nationally. Most countries have implemented PARCOM Recommendation 92/8 on cleaning agents for domestic and industrial uses through voluntary agreements with industry.

Norway has put into force a regulation to phase out alkylphenols and alkylphenolethoxylates (APEOs) in all uses, except for minor uses in the formulation of paints. The regulation includes uses in the offshore industry.

Work is ongoing in Sweden and Denmark to substitute NPEOs in paint. Denmark and Norway have abandoned their use in agricultural pesticides. The aim in Sweden is to achieve that by 2005 only NPEOs and APEOs free alternatives are used in water-based emulsion polymers in pulp and paper, textiles, paints, adhesives and plastics. In Switzerland, detergents shall not contain octyl- and nonylphenol ethoxylates. Further restrictions are planned for applications such as industrial and institutional cleaning, textile and leather processing and metal finishing. A draft amendment of the ordinance will be circulated for comments by the end of 2002.

Research for substitutes for NP/NPEOs is ongoing in several North Sea States.

Brominated flame retardants (BFR)
The following BFRs are, or have been used until recently:
- polybrominated diphenylethers (PBDEs):
  - pentabromodiphenyl ether (PentaBDE),
  - octabromodiphenyl ether (OctaBDE),
  - decabromodiphenyl ether (DecaBDE);
- polybrominated biphenyls (PBBs):
  - decabromobiphenyl (DecaBB);
- hexabromocyclododecane (HBCDD); and
- tetrabromobisphenol A (TBBP-A).

OSPAR
Since 1998, BFRs are on the OSPAR List of Chemicals for Priority Action and are therefore subject to the target on cessation of discharges, emissions and losses by the year 2020 under the OSPAR Strategy for Hazardous Substances.

The OSPAR Background Document on Certain Brominated Flame Retardants – polybrominated diphenylethers, polybrominated biphenyls, hexabromocyclododecane published in 2001 included a number of recommendations for control measures and invited the EC to consider these. A separate draft OSPAR Background Document on TBBP-A is in preparation.

European Union
BFRs (PentaBDE) is classified as 'Dangerous for the Environment' (R50/53) according to the Directive on

the Classification, Packaging and Labelling of Dangerous Substances (67/548/EEC).

The Draft Risk Reduction Strategy for PentaBDE developed under the EU existing substances regulation has concluded that in order to limit risks, a ban of all marketing and use of PentaBDE is needed under Directive 76/769/EEC. The European Council reached a common position on such a ban in October 2001. Risk assessment and risk reduction strategies on OctaBDE and DecaBDE are expected to be finalized in the near future.

The draft directive on restrictions on use of hazardous substances in electric and electronic equipment includes obligations and requirements for substitution of PBDEs and PBBs.

Under the Water Framework Directive, brominated diphenylethers (PentaBDE, OctaBDE and DecaBDE) are on the list of priority substances for which the Commission shall submit proposals of control for the progressive reduction of discharges, emission and losses. PentaBDE is identified as a priority hazardous substance for which the Commission should bring forward proposals by 2003 for the cessation of discharges, emissions and losses within 20 years of adoption of measures.

National trends and initiatives within North Sea States
Most North Sea States have reported some decline in the use of selected BFRs.

In line with the voluntary commitment made by industry in the framework of the Organization for Economic Co-operation and Development (OECD) chemicals area, the production of PBBs ceased during 2000.

Most North Sea States are awaiting EC directives on waste and PentaBDE before further measures are considered/proposed nationally. Switzerland plans to implement regulations corresponding to these EC directives. In Denmark, an action plan was launched in 2001, which advises on the substitution of BFRs and requests the production/use of BFR-free electric products.

Research for substitutes is ongoing in several North Sea States, however, due to the effectiveness of PBDEs as flame retardants and their low price, it will be difficult to develop and successfully implement relevant alternatives.

5.6 Pesticides

(HD 2 ii and 4 i, Annex 1A and 1B (c), ED 27, Annex 2, App.1)

Most North Sea States have discontinued the use of the substances listed in HD Annex 1 Part (c) as pesticides.

5.6.1 Pesticides which should have been strictly limited or banned

Council Directive 79/117/EEC provides for limitations, and in some cases outright bans, on the use of some plant protection substances. Council Directive 91/414/EEC provides for an assessment procedure. A positive outcome of the assessment means that the substance may be used in plant protection products.

Ministers at the 3NSC agreed that the use of the 18 substances listed in HD Annex 1 Part (c) as pesticides must be strictly limited or banned. The current reports received from North Sea States on the status of those substances showed that the compounds have been phased out as pesticides by most of the North Sea States.

Only two countries reported to have some of the chemicals still in use as pesticides today. France still uses atrazine, chloropicrin, fluoroacetic acid and derivates, hexachlorobenzene, pentachlorophenol and quintozene, and Belgium still uses atrazine.

For those substances listed in HD Annex 1 Part (c) that were not included in the list of 18 substances because they had not been in use as pesticides in 1990, all but one North Sea State reported that none of these substances are in use as pesticides. Only in France, lead-, selenium- and cadmium-

compounds as well as crimidine are still in use as pesticides today.

5.6.2 Pesticides detected in the North Sea or posing a risk

Within the framework of Council Directive 91/414/EEC, substances that are used as plant protection products and new active plant protection substances are being assessed with a view to determining which of these substances are (or are not) allowed for use.

At the 4NSC, Ministers agreed to give priority to review the 16 pesticides given in ED Annex 2, Appendix 1, which had been detected in the North Sea or might pose a risk to the marine environment. In addition, this Appendix also mentioned 18 pesticides which, in 1995, were either not allowed on the market or were already under review (Table 5.9).

Assessments of pesticides have in total been finalized for approximately 30 substances. Fourteen of them were included in the positive list (Annex I of Directive 91/414), which means that their use is allowed. The authorizations for the other substances, including lindane, have been withdrawn or will be withdrawn in the near future (*see* the EC's overview of current authorizations, status October 2001).

Commission Regulation (EC) No. 2266/2000 of 12 October 2000 and Commission Regulation (EC) No. 451/2000 of 28 February 2000 contain provisions to speed up this assessment process. These provisions are the following:

- The necessary (missing) information to defend the continuation of use has to be delivered before the 25 of May 2002.
- If the information is not delivered before this deadline and thus the continuation of use is not defended, the authorization for plant protection products containing these active substances will be withdrawn. This withdrawal has to be implemented by member states at 25 July 2003 at the latest.
- If the missing information is delivered in time, a final assessment will take place which might result in a withdrawal of the authorization or an inclusion in Annex 1 of Directive 91/414. This final assessment might be completed after 2003.

It is expected that for more than 300 substances the continuation of use will not be defended and therefore the use of products containing these substances will not be allowed after 25 July 2003.

Table 5.9 shows that as regards the 16 pesticides that were given priority for review at the 4NSC, a final decision has only been reached for six substances and their use will not be allowed after July 2003. For the 18 pesticides that were, in 1995, not allowed on the market or that were already under review, the assessment has been finalized for nine. Of these nine pesticides two were included in the positive list and their use is thus allowed.

5.7 BAT/BEP

(ED 23 i and 25, Annex 2, 4.1 ii)

EU/EEA member states are required to ensure that all large industrial installations comply with the IPPC Directive. Under this directive, BAT reference documents (BREFs) are developed and an integrated permitting system for large point sources will be introduced by 2007. Since 1995, a large number of BAT documents have been developed within the frameworks of OSPAR and the EC, some covering the same industrial sectors. Several programmes to develop cleaner production processes and treatment technology have been established and are still continuing in most of the North Sea States.

5.7.1 Development of BAT/BEP

Most of the North Sea States have developed procedures for applying BAT and BEP which have been implemented nationally. The IPPC Directive and OSPAR Recommendations on BEP and BAT have led to the development of a European framework for the control of industrial installations. In addition, it is expected that the Water Framework Directive will also be of importance in the further implementation and follow-up of BAT.

Table 5.9 *Status of the EC review of pesticides listed in Esbjerg Declaration Annex 2, Appendix 1.*

Pesticide	**Pending the finalization of the assessment**	**Notified Assessment initiated**	**Out (Date) Assessment finalize use no longer allowed**	**Use allowed Assessment finalized on Annex 1**
chloridazon		x		
cyanazine			x (7/2003)	
1,3-dichloropropene		x		
dichlorvos		x		
diuron		x		
dimethoate		x		
disulfonton			x (7/2003)	
1,2-dichloropropane			x (7/2003)	
hexazinone			x (7/2003)	
metabenzthiazuron		x		
metazachlor		x		
metolachlor			x (7/2003)	
metoxuron			x (7/2003)	
mevinphos		x		
	x			
organotin compounds	(fentinacetate, fentinhyroxide)			
propachlor		x		
Not allowed on the market or already under review in 1995				
alachlor	x			
atrazine	x			
azinphos-ethyl			x (1/1996)	
chlorotoluron		x		
dinoseb			x (1991)	
dinitro-o-cresol (DNOC)			x (6/2000)	
2,4-D				x
2,4-DP (dichlorprop)			x (7/2003)	
2,4,5-T			x (7/2003)	
isoproturon	x			
lindane			x (6/2002)	
linuron	x			
MCPA	x			
MCPP (mecoprop)	x			
paraquat	x			
parathion-ethyl			x (2002)	
simazine	x			
thiobendazole				x

The IPPC Directive introduced a new integrated permitting system for large industrial point sources. This system requires EU/EEA member states to ensure that all appropriate preventive measures (in particular through application of BAT) are taken against pollution. In doing so, they should first of all require preventive action such as the use of less hazardous substances in raw and auxiliary materials and cleaner production processes. As a second priority, if prevention is not possible/feasible, end-of-pipe technology should be required in order to reduce emissions. To assist member states and their

competent authorities as well as the operators of installations concerned, the directive provides for an exchange of information existing, and the development of new, BAT and associated monitoring techniques. The result of this work takes the form of BAT Reference documents, which in most cases focus on specific industrial sectors. These BREFs must be taken into account by member states and their competent authorities when determining BAT in general or specific cases on the national level.

The IPPC Directive requires EU/EEA member states to ensure that from 30 October 1999 onwards, no new installations are to be operated without a permit issued according to the rules of the Directive. Likewise, any substantial change to an existing installation should be subject to a permit in compliance with IPPC requirements. As regards existing installations, the IPPC Directive stipulates that by 30 October 2007, member states have to ensure that all existing installations comply with the obligations of the Directive.

Mandatory reporting to the EC is being introduced for 50 pollutants (or groups of pollutants) if emissions/discharges exceed set threshold values to air and water.

The EPER will provide evidence of the effectiveness of the IPPC Directive. This register covers releases of 50 substances to air and water from IPPC-relevant installations and the first results are expected to be published in 2003.

OSPAR has developed a number of background documents, Recommendations and Decisions on BAT and BEP for different industrial sectors/activities. An overview of these documents and measures is given in the Compilation Document and is also available at the OSPAR homepage (www.ospar.org).

For some sectors, BAT documents have been prepared in the past under both OSPAR and the EU. However, in recent years a close OSPAR/EC cooperation has been set up to exchange information and to coordinate the relevant work carried out within both frameworks, in particular as regards the examination of existing BAT descriptions and the development of new BAT for additional sectors.

Table 5.10 gives an overview of sectors covered in EC BREF documents and OSPAR BAT/BEP background documents, which were finalized in the period from 1995 to October 2001.

The level and detail of reporting from North Sea States to the 5NSC did not allow an assessment of the quantitative effects with respect to reductions achieved in individual sectors due to the introduction of OSPAR BAT.

Table 5.10 *Sectors covered by finalized EC BREFs and/or OSPAR BAT/BEPs after 1995. (Italics indicate industry sectors for which both OSPAR BAT descriptions and EC BREF exist.)*

EC BREF (1997–2001)	**OSPAR BAT/BEP (1995–2001)**
Pulp and Paper Manufacture	*Pulp and Paper industries*
Iron and Steel production	Organic chemical industries (PVC[1]), VCM[2]))
Cement and Lime production	Textile processing
Cooling systems	Large combustion plants
Chlor-Alkali manufacture	Offshore industry
Ferrous Metal processing	Pesticides
Non-ferrous Metal processes (including aluminium)	*Non-ferrous Metal industries* *Primary Aluminium Industry*
Glass manufacture	
Tanning of hides and skins	

1) Polyvinylchloride
2) Vinylchloridemonomer

5.7.2 Development and use of clean technology and treatment technology

North Sea States report that cleaner production processes and treatment technology have been established and a number of associated programmes are underway. Further information on the situation and developments in North Sea States is given in the Compilation Document.

5.8 Contaminated Land and Waste Disposal Sites

All North Sea countries have implemented national legislation for handling contaminated land including the prevention of releases of pollutants from these sites. Efforts at remediation are targeted at the worst cases. Most countries report extensive national legislation in compliance with EC waste directives, with special emphasis on hazardous waste. The amounts of plastics recycled have increased substantially in most countries over the last years.

5.8.1 Contaminated land

(ED 23 i, Annex 2, 4.1 xii)
All North Sea States have implemented national legislation for handling contaminated land including the prevention of releases of pollutants from these sites.

In some countries mapping and assessment of polluted land is carried out by the authorities, and in some countries this is carried out by the operators and owners of possibly polluting installations.

The clean-up efforts are targeted at the worst cases after a prioritization has been made. Some countries have set limit values for when remediation has to take place depending on the proposed use of the sites and the type of resources that could be threatened, including run-off to water bodies.

In the Netherlands, a 10 billion NLG long-term programme has been set up with the goal that in 2023 all seriously contaminated sites have to be cleaned up or managed in such a way that no dispersion of contaminants is possible. A full picture of the soil quality in the whole country will be available in 2004.

In Denmark, approximately 55 million Euros were spent in 2000 for activities related to the mapping, investigation, or remediation of polluted land.

In Sweden, the goal is that all seriously contaminated areas should be remediated by 2020. Mapping and investigations will be completed in 2005. Around 170 million Euros will be available for remediation of contaminated sites in the period 2000 to 2004.

5.8.2 Waste generation and waste disposal sites

(ED 23 i, Annex 2, 4.1 x and xi)
Most countries reported that extensive national legislation has been established in compliance with EC waste directives, with special emphasis on hazardous waste. Increased efforts are put on measures to reduce the quantity and harmfulness of the waste. Limitations have been placed on the use of landfills in many countries.

In the Netherlands final disposal (incineration or landfills) is only acceptable if more sophisticated treatment/processing/recycling is not possible.

In the UK, a control system has been set up for the movement of the approximately 5 million tonnes of hazardous waste that are generated annually in England and Wales. Under this system, every shipment is traced and billed, which provides an economic incentive to reduce hazardous waste production.

In Sweden, measures have been introduced to reduce the landfilling of waste. Since 1 January 2000, there is a tax on waste sent to landfills and from 1 January 2002, there is a ban on sending sorted, combustible waste to landfills. The ban will be extended from 2005 to cover all organic waste.

5.8.3 Recycling of plastics

(ED 23 i, Annex 2, 4.1 xi)
The amounts of plastic waste generated and recycled in North Sea States are given in Table 5.11.

EC Directive 94/62/EC on packaging and packaging waste focuses among other things on the recycling of plastics. The goal of this Directive is that 15% of packaging plastics are being recycled by 2001, which apparently only three member states have accomplished so far. All North Sea States are currently working on strategies to achieve this goal, or even stricter national targets imposed by some countries, and efforts are being made to include recycling of plastics used in other applications as well as in packaging. Voluntary agreements with the sectors involved have been developed in some countries. Due to all these efforts, the amounts recycled have increased substantially in most countries over the last few years and work is also being carried out to develop markets for a range of recycled materials.

5.9 Economic Instruments and Voluntary Agreements

(ED 25 ii)

Both environmental taxes and voluntary agreements are used in some of the North Sea States to reduce the use of hazardous substances. However, policies on which substances should be addressed differ between countries.

5.9.1 Environmental taxes

Environmental taxes are used in most of the North Sea States as a tool to encourage a reduction in the use of hazardous substances. Environmental taxes can be highly effective in both cost and environmental terms, as shown by the differentiated tax rates on leaded versus unleaded petrol. The arguments

Table 5.11 *Amounts of plastic waste generated and recycled in North Sea States.*

	Plastic waste generated (tonnes/year)	Plastic waste recycled (tonnes/year)	Percentage recycled
Belgium	-	-	-
Denmark	-	38 000 (19 000 t packaging plastics)	11
Germany	1 600 000 (packaging)	600 000 (packaging)	38
France	-	-	9
Netherlands	1 200 000	-	25
Norway	-	-	19 (+57% for energy recovery)
Sweden	-	20 000	15+
Switzerland	570 000	50 000	9 (+87% for energy recovery)
UK	2 800 000 (including 1 700 000 t packaging plastics)	-	-

for economic instruments as part of environmental policies have in some countries evolved into an interest for a broader environmental tax reform. However, it has been difficult to increase the scope for Community-wide environmental taxes in the EU because such new taxes need unanimity among EU member states.

In Denmark, a tax on pesticides has been introduced and the tax rates have been regularly increased. A tax on three chlorinated organic solvents (tethrachloroethylene, trichloroethylene and dichloromethane) was introduced in 1996.

In Norway, environmental taxes have been introduced on trichloroethylene and tetrachloroethylene. After one year, the sales statistics show large and satisfactory reductions in the use of both trichloroethylene (85%) and tetrachloroethylene (95%). For trichloroethylene, a system has been introduced for repayment of half the tax when the chemical is delivered after use for recycling and/or for safe waste handling. Norway also has a tax on disposal of waste (except for hazardous waste and inert waste). In the case of incineration, the tax is partly reduced proportionally with energy utilization.

At the moment the policies in the Netherlands are developing towards incorporating more environmental considerations into the fiscal system. Various acts on taxes with an environmental rationale exist, but none are primarily meant to reduce discharges and emissions of hazardous substances.

In Germany, the Waste Water Charges Act implements the polluter pays principle by charging for direct discharges of wastewater to waters. The amount charged depends on the quantity and the hazardous properties of the wastewater discharged.

In Switzerland, restrictions and prohibitions are increasingly being replaced by economic instruments.

5.9.2 Voluntary agreements

Voluntary agreements with industry and organizations are used in most of the North Sea States as an instrument to reduce the use of hazardous substances.

Denmark has several voluntary agreements between the Ministry of Environment and Energy and relevant industrial branches or groups of companies, *e.g.* as regards the phasing out of organic solvents, NPEOs and surfactants in detergents and softeners.

In Germany, industry has undertaken voluntary commitments with respect to APEOs in products for domestic use and as ingredients in industrial applications (1986) and a phase-out of musk xylenes in detergents and cleaning agents in 1993.

Since 1989, the Netherlands has gained much experience with the instrument of voluntary agreements, which proved to be successful and efficient for achieving reductions of emissions and discharges of hazardous substances by large industrial companies. Emission reductions of 80–90% required a fundamental adaptation of production processes. Under the adopted environment and industry target group policy, companies may decide to a large extent on how they will contribute to reducing emissions.

In the new Swedish Bill on Chemicals Policies, a phase-out within a period of 10 to 15 years has been set as a target for the use of certain hazardous chemicals, including a phase out for lead and cadmium by 2010. The main elements of the phase-out activities for lead have so far been to try to reach voluntary agreements with the interest organizations on the phase-out of use, *inter alia*, in accumulators, lead shots, paint, crystal glass, PVC, cables and lead sinkers.

In Switzerland, the principle of cooperation between authorities and industrial organizations was introduced into regulation. The authorities are first under obligation to consider whether or not an environmental problem can be resolved by voluntary means, before issuing new regulations.

In the UK, a number of voluntary agreements are in place to reduce discharges, emissions and losses of hazardous substances. The government will negotiate binding voluntary agreements with industry to implement risk management strategies. Where such voluntary agreements are insufficient or impracticable, the government will consider alternative measures at a national or European level.

5.10 Integrated Product Policy

(ED 24 iii)

Following an EU Green Paper, the Council has invited the Commission to develop a common vision on Integrated Product Policy (IPP) with prioritised implementation measures. Several Countries have developed national IPPs. Important implemented IPP instruments are eco-label systems and support for the development of eco-designed products.

The EU Commission has recently presented a Green Paper on Integrated Product Policy, which was discussed by the European Council in June 2001. An IPP should aim for a continuous improvement of the environmental and health performance of products throughout their entire life cycle. The long-term aim should be products that are highly efficient in terms of materials and energy use, and that they do not contain nor require the use of substances that may give rise to adverse effects during their life cycle on human health and the environment. To these ends, specific objectives for improvement should be established as part of the IPP. The Council invited the Commission to develop the general IPP approach set out in the Green Paper into a common vision with specific and prioritized implementation measures, and welcomed the Commission's intention to work out a Communication/White Paper on the IPP during the second half of 2001.

In Belgium, programmes on eco-design have been established to screen and determine the eco-design potential of different companies and industrial sectors.

The Danish EPA has issued a Product-oriented Environmental Strategy with the overall aim to stimulate the development and marketing of cleaner products in order to reduce the total environmental impact from production, use and disposal of the products. Important instruments are eco-labelling, international standardization, subsidy schemes for development of cleaner products and cleaner technologies, substitution of undesirable substances, as well as environmental management in public and private companies. Denmark, Norway and Sweden have participated in the development of a Nordic Product orientated environmental strategy, which was finalized in March 2001.

In France, the French Ministry of the Environment has for many years promoted the development of environmentally-friendly, 'green' products. In order to allow the consumers to distinguish these products, France gave particular support to the European Ecolabel and created a national ecolabel, named 'NF Environnement'.

In Germany, the German Environmental Label ('Umweltzeichen', frequently called the 'Blue Eco Angel') marks products that are comparatively eco-friendly. Well over 4 000 products bear this mark.

In Norway, IPP is established as an environmental target. The government has given financial support to several IPP programmes in previous years, including programmes on paints and varnishes, building materials and furniture. The Nordic eco-label system 'the Swan' is also an important IPP measure in Norway.

In 2000, the Swedish government presented 'A strategy for an Environmentally Sound Product Policy' with the aim to prevent and reduce the impact of products on human health or the environment throughout their life cycle. The sales of products with the Nordic eco-label 'the Swan' have increased three times since 1995. A statutory producer responsibility has been introduced in Sweden for packaging materials, waste paper, tyres, cars and electrical and electronic products. Voluntary agreements were set up, *e.g.* for (i) collection and re-use of office paper and (ii) the elimination of hazardous substances in the building sector and recycling of building materials. At present, the producer responsibility system is reviewed to decide if statutory systems need to be introduced for other product categories. Health and environmental information should as a target be available for products by 2010.

In the Netherlands, the government has financed programmes/projects to promote and advise industry on how to improve their products

environmentally, including the development of eco-designed products. In addition, more than 100 companies and industry organizations have been subsidised to introduce Product Oriented Environmental Management Systems (POEMS). POEMS have been proven to stimulate eco-design more continuously than the above mentioned eco-design projects.

In the UK, the government is helping to develop a more integrated approach to consumer product policies, which looks at the impacts of products on the environment over their whole life cycle and develops a set of measures to tackle the most significant impacts. This involves working with the market and using a range of measures, such as better information for consumers, the promotion of best practice in making environmental declarations on products, support for research and innovation, and the use of regulatory and fiscal instruments, where necessary. The government is also promoting the supply of good environmental information to consumers.

5.11 Assessment of Achievements

5.11.1 Assessment of the achievements on the 50% and 70% reduction target

According to the submitted national reports, the inputs to the North Sea of the substances for which reduction targets were agreed at previous North Sea Conferences have, in general, decreased significantly from 1985 to 1999/2000.

Although current differences in reporting limits the possibilities for a full comparative assessment between countries of the reductions which have been achieved, there is generally a consistency of approach by individual countries and it can be concluded that the 50% reduction target has been met for a large number of the actual substances. For some substances the targets have not been reached by all countries, particularly for copper, nickel, zinc, TBT-compounds, trichloroethylene, and the pesticides dichlorvos, malathion and trifluralin. Where information is available, it can be concluded that the 70% reduction target for mercury, lead, cadmium and dioxins has been achieved by most countries.

It can be concluded (see section 5.3.4) that for nearly all substances where the target has not been met, actions are underway that may in the future lead to the achievement of the target.

The main outstanding sources for zinc and nickel are transport and industry (as regards air emissions) and industry and municipal wastewater (as regards discharges to water). Both nickel and zinc are subject to EPER-reporting under the IPPC Directive. Nickel is a priority substance under the EC Water Framework Directive and is subject to risk assessment under Regulation No. 793/93. Zinc is also subject to such a risk assessment. These assessment processes will lead to decisions on measures.

The use of copper as an anti-fouling agent represents the main source in the countries where the 50% reduction target had not been met. The coming ban on TBT in anti-fouling paints will further stimulate the use of copper in this respect. Copper-based antifoulants are less hazardous than TBT-based antifoulants, and it has to be acknowledged that they currently represent an intermediate step to substitute TBT, with the final goal a non-hazardous alternative.

No recent international initiatives have been taken for copper. After thorough evaluation, copper was not included in the Water Framework Directive List of Priority substances.

Present uses of TBT have not changed much since 1995. However, this situation is expected to improve considerably when the forthcoming global International Maritime Organization (IMO) convention enters into force, which will ban the use of TBT in antifouling paint. It is therefore essential to strive for a rapid ratification and implementation of the new IMO Convention.

The main sources for trichloroethylene are reported to be degreasing and manufacture of metals. Trichloroethylene is subject to risk assessment under Regulation No. 793/93. This assessment process will lead to a decision on measures.

For trifluralin, dichlorvos, and malathion, international action will mainly depend on the results of the assessment under the Pesticides Directive (91/414/EEC).

For a number of the substances mentioned above (nickel, zinc, trichloroethylene, trifluralin, dichlorvos, and malathion), the EC would be the most appropriate forum to take forward relevant actions on the main sources identified in this report.

Several of the 37 substances included in the 50/70% target, including substances for which the target has broadly been achieved, still pose a substantial risk to the marine environment. Through comprehensive evaluations several of these substances have been identified by OSPAR and the EC to be of great concern and thus to be covered by their respective targets. Future measures should primarily be directed towards achieving further reductions for these substances and other hazardous substances that have been prioritized under the one generation target concept.

However, measures for further reducing inputs of those of the 37 substances that presently have not been prioritized under the one generation target should be continued and not neglected.

5.11.2 Assessment of other achievements

Until now, focus has mainly been directed towards equipment containing large quantities of PCBs and progress in this is satisfactory. During the last few years, some countries have established collection and treatment systems for small PCB-containing components in waste. Although banned, PCBs and DDT still pose major problems in sediments in several countries.

The discharges and emissions of hazardous substances under the IPPC Directive have been substantially reduced in the time period 1985 to 1999/2000. Since 1995, a number of BAT documents have been developed within the frameworks of OSPAR and the EC, and several programmes to develop cleaner technology are in place.

Getting the market to work in favour of the environment is crucial. Significant reductions are reported from several countries on the substitution of the five substances[14] for which concerted action on substitution is required. Following an EU Green Paper, the Council has invited the Commission to develop a common vision on IPP with prioritized implementation measures – several countries have developed national IPPs. Economic instruments are used in some of the North Sea States to reduce the use of hazardous substances, although policies differ between countries.

Hazardous substances in contaminated land and sediments will need increased attention due to potential adverse effects for human health and the environment. All North Sea States have implemented national legislation for handling contaminated land including the prevention of releases of pollutants from these sites. Efforts at remediation are targeted at the worst cases.

5.11.3 Further work to achieve the one generation target

Main achievements

The one generation target and associated commitments on hazardous substances which were agreed at the 4NSC, have generally been taken up within the frameworks of OSPAR and the EU, which have further developed and implemented the one generation target into various objectives, policies and legislation, to which all North Sea States are committed. About one third of the 37 substances included in the 50/70% reduction target have been identified as hazardous substances and selected for priority action under the one generation target in these forums. Thus, the work to achieve the percentage reduction targets has contributed to moving towards the one generation target as well.

The OSPAR Strategy with regard to Hazardous Substances provides a comprehensive policy framework to achieve a sound and healthy ecosystem. In particular, OSPAR has developed a mechanism to identify hazardous substances of particular concern to the marine environment with the aim of achieving the one generation target for these substances.

[14] SCCPs, trichlorobenzene, musk xylene, NP/NPEOs and BFRs.

Since the 4NSC, the European Community has adopted the Directive concerning Integrated Pollution Prevention and Control and the Directive establishing a Framework for Community Action in the Field of Water Policy. The Council of Ministers has also agreed on conclusions of an EC Strategy for a Future Chemicals Policy, and has agreed a list of priority substances identified for action under the Water Framework Directive.

Remaining challenges
The lack of basic information on the properties of most chemicals, their exposure pattern and effects in the environment is a fundamental challenge. When addressing the environmental challenges for the North Sea, the huge knowledge gap about chemicals in general and in particular in relation to releases to the marine environment must be taken into account.

There is no doubt that the setting of 50% and 70% reduction targets at earlier North Sea Conferences has been an important stimulus for achieving reductions in emissions and discharges for a number of hazardous substances. However, it is now necessary to re-focus efforts away from achieving the specific, but static, 'first generation' percentage reductions adopted at the 2NSC and 3NSC and to concentrate efforts on achieving the more general One Generation Target agreed at the 4NSC, which represents a more dynamic strategy/approach. In addition, reporting on progress on the one generation target will overcome the difficulties with lack of data for set baseline years (*e.g.* for 1985) that was experienced when reporting on the achievement of the reduction percentage targets.

A remaining challenge for the One Generation Target is to provide information on releases to enable an evaluation of some of the 'new' substances (*e.g.* NPEOs and SCCPs) which are, for the time being, not part of any emission registration systems.

The recently agreed EC chemicals policy framework is designed, *inter alia*, to close gaps in the knowledge on chemicals. According to the strategy, basic information on the health and environmental properties of most chemicals will be required in order to market the substances after 2012. This will generate more basic information on chemicals, and together with OSPAR's selection mechanism, it should be possible to identify and prioritize hazardous substances more precisely.

These actions within the frameworks of OSPAR and the EC constitute a robust programme which should, with suitable development, ensure that discharges, emissions and losses of hazardous substances from both point and diffuse sources are progressively reduced, and that only sufficiently safe chemicals are put on the market for use.

Cooperation between OSPAR and the EU is especially important for hazardous substances which are identified for priority action within OSPAR and, at the same time, as priority hazardous substances under the Water Framework Directive and the future EC Chemical Policy. Substances subject to the one generation target concept, both within OSPAR and the Water Framework Directive, are to date cadmium, HCH, mercury, NP/NPEOs, brominated flame retardants (PentaBDE), TBT, specified PAHs and SCCPs.

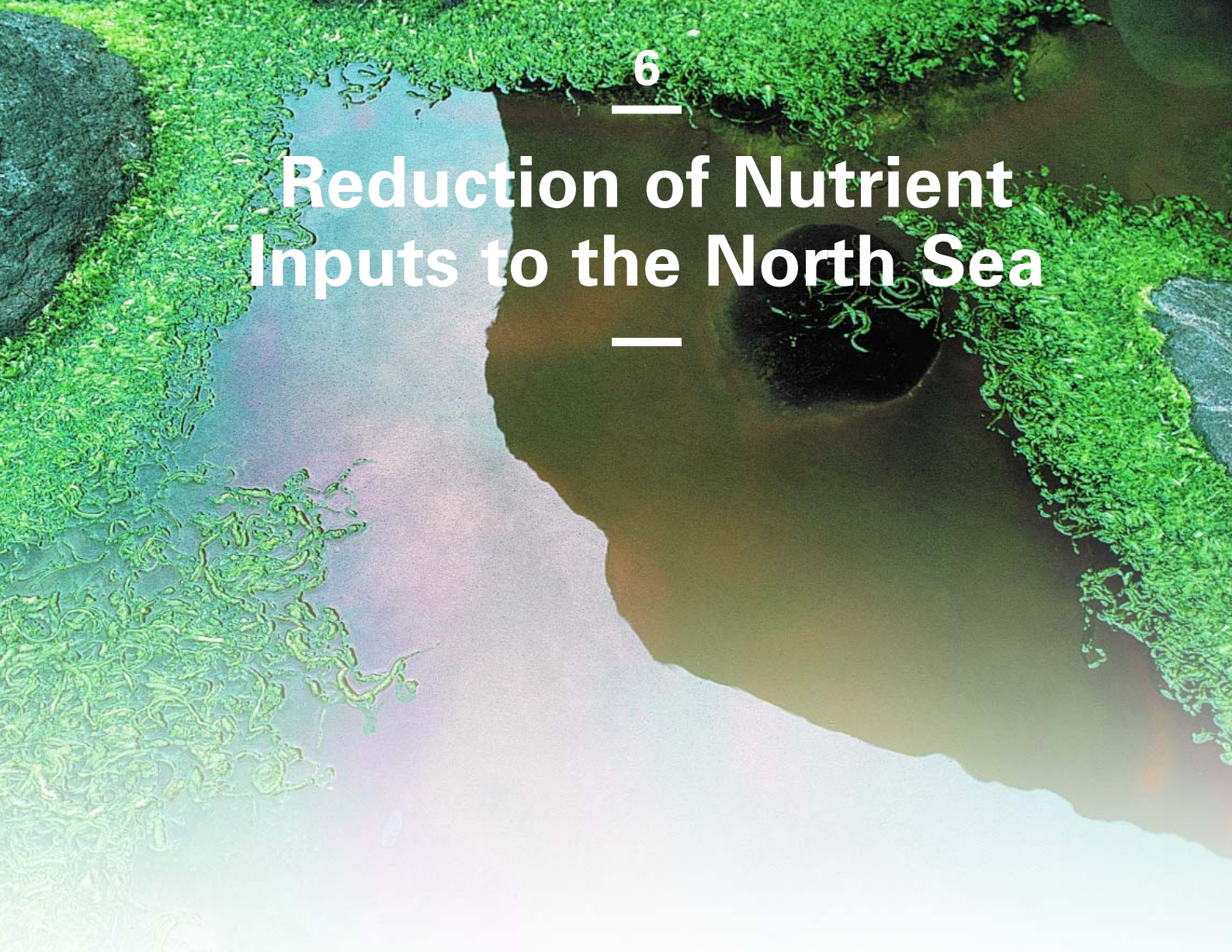
5.11.4 Future reporting on targets

Main achievements
The HARP-HAZ reporting format allowed the North Sea States to report on emissions to air and discharges to water from an extensive number of diffuse and point sources arranged according to the standard European NOSE-codes (see section 10.3). An advantage of the new reporting procedures was that they provided for substance-specific source profiles (patterns) for the various reporting years and allowed the identification of the main remaining sources. Differences in the ways of reporting in this first attempt to implement these new procedures, however, limited the scope for comparing reported inputs between countries. When applied properly, source profiles would, to an even larger extent, pinpoint important sources and would also be of help in the evaluation of the need for further measures.

Remaining challenges
An essential task for monitoring the actual progress towards fulfilment of the one generation target is to develop suitable reporting and assessment strategies for the selected priority substances. In the further development of its reporting procedures,

OSPAR has agreed to build on the experiences gained from implementing the HARP-HAZ Prototype methodology under the North Sea Conference framework. The part of HARP-HAZ that deals with large industrial sources will in any case be of considerable future use as it is the same as the EPER system for the IPPC industry, for which reports have to be produced in 2003. Any future system will also need to take into account the emerging monitoring requirements of the Water Framework Directive in order to make best use of limited resources.

The implementation of the Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (the Århus Convention) on the right to environmental information will increase the need to have knowledge of the pressure on the environment from hazardous substances. This demand for data on sources for emissions and releases of substances should in the future also make it possible to have better information on hazardous substances to be used in reporting on the one generation target.



6 Reduction of Nutrient Inputs to the North Sea

6.1 Introduction

6.1.1 The problem of eutrophication

Land-based activities, such as industry, households, traffic and agriculture, represent significant sources of input of nutrients to coastal and open waters of the North Sea, via rivers, direct discharges, diffuse losses and atmospheric deposition. The process of marine eutrophication starts with increasing inputs of nutrients, followed by an increase in primary production (algal biomass), which leads to an increased quantity of carbon (organic matter) circulating in the marine ecosystem. A number of primary and secondary effects may be attributed to this process. The issue for environmental management is to what degree this process influences ecosystem functionality and human use of influenced waters and resources.

Mitigation efforts made after 1987, when Ministers from North Sea States for the first time agreed on the reduction targets on nutrients, *i.e.* to reduce nutrient inputs (by the order of 50%) into areas where these inputs are likely, directly or indirectly, to cause pollution, have been more effective in reducing the inputs of phosphorus than nitrogen. The reductions in phosphorus inputs are primarily due to improved collection and treatment of urban and industrial wastewater, as well as the introduction of phosphate-free detergents. The inability to reach the 50% reduction target for nitrogen is primarily because the reduction of diffuse losses from the agriculture sector is progressing much slower than expected.

6.1.2 State of the environment

The present inputs of nutrients lead to concentrations in the environment of nutrients that significantly deviate from pre-1950 winter concentrations, especially in areas that are directly under the influence of anthropogenic inputs. Degradation of algal biomass produced on the basis of excessive anthropogenic inputs of nutrients requires large quantities of oxygen and may lead, *inter alia*, to depletion of the oxygen content of the waters. Such depletion may lead to severe adverse effects on the ecological quality of the waters. Improvements have been detected for phosphorus; significantly reduced phosphorus concentrations have been detected for example in the German Bight and in Danish waters. Furthermore, some improvements with respect to nuisance algal blooms, oxygen deficiency and benthos/fish kills are observed in many areas of the North Sea. However, trends of decreasing oxygen concentration have been documented for the deep waters of the Kattegat and the basin waters in Swedish and Norwegian fjords. In 1993, OSPAR Contracting Parties identified their problem areas with regard to eutrophication. A second more rigorous assessment of eutrophication status is currently underway within OSPAR through the development and application of the Comprehensive Procedure (see section 6.2.2).

6.1.3 Agreed measures

In 1995, Ministers at the Fourth International Conference on the Protection of the North Sea (4NSC) agreed to remain committed to reaching the 50% reduction targets on phosphorus and nitrogen set by the Ministers at the 2NSC in 1987. They agreed to strengthen the implementation of existing measures on all sectors as soon as possible and put special emphasis on agriculture policies. Furthermore, they invited OSPAR to adopt a strategy to combat and prevent eutrophication and urged national and appropriate international bodies to integrate the outcome of this strategy in their work. They also agreed that the concept of balanced fertilization should take account of the principles of the future OSPAR Strategy to Combat Eutrophication. The European Commission, Norway and Switzerland were invited to consider how their agricultural policies and policies for rural developments could contribute to the objective of reducing losses of nutrients to the aquatic environment and, furthermore, invited them to continue to limit atmospheric emissions of nitrogen oxides (NO_x). They also invited OSPAR, in cooperation with other appropriate bodies, to consider the justification for further reduction targets for the different sources of ammonia emissions.

6.2 OSPAR Strategy to Combat Eutrophication

(ED 32, 33, 34 and 35)

6.2.1 Adoption of the OSPAR Strategy to Combat Eutrophication

In 1998, OSPAR adopted a Strategy to Combat Eutrophication. OSPAR's main objective with regard to eutrophication is to achieve by 2010, and maintain, a healthy marine environment where eutrophication does not occur. The Strategy comprises an integrated target-orientated and source-orientated approach. The target-orientated approach prepares the setting of ecological quality objectives, followed by quantification of necessary reductions in input of nutrients to meet the objectives. The source-orientated approach focuses on the implementation of all agreed measures without delay. The Strategy also provides for the development and implementation of additional measures that are necessary to meet the (quality) objectives.

6.2.2 The Common Procedure to Identify Eutrophication Status

In 1997, OSPAR adopted a Common Procedure for the Identification of the Eutrophication Status of the Maritime Area (the 'Common Procedure'). The Common Procedure comprises two phases, starting with simplified screening intending to identify areas of obvious 'no concern' (*i.e.* non-problem areas), followed by a Comprehensive Procedure applied to all remaining areas. The intention of the Common Procedure is to characterize the various parts of the

OSPAR Maritime Area as problem areas, potential problem areas or non-problem areas with regard to eutrophication. In implementing the Common Procedure, OSPAR will develop and adopt common assessment criteria and will assess the results of OSPAR Contracting Parties' application of the Procedure. Presently, a selection of assessment criteria, their respective assessment levels, including a procedure for how to apply them, and a reporting format for how to report in a harmonized way have been forwarded for endorsement by OSPAR. In 2002, OSPAR's Contracting Parties will use these criteria in their application of the Comprehensive Procedure. The repeated application of the Comprehensive Procedure will identify any change in the eutrophication status of a particular area.

The results of the Screening Procedure were presented to OSPAR in 2000. The Screening Procedure identified the obvious non-problem areas with regard to eutrophication. All other areas, *i.e.* major parts of the North Sea, will be subject to the Comprehensive Procedure (OSPAR Agreement 2001-5; see Figure 6.1) and the results are expected to be available in 2002.

6.2.3 Ecological Quality Objectives for the Greater North Sea

In 2001, OSPAR developed a draft integrated set of Ecological Quality Objectives for nutrients and eutrophication effects (EcoQOs-eutro) for the Greater North Sea. The EcoQOs-eutro were selected from the common assessment criteria and their respective assessment levels to be used within the Comprehensive Procedure. The selection of EcoQOs-eutro is restricted to those assessment criteria for which their respective assessment levels have become available.

The elaborated EcoQOs-eutro should, *inter alia*, be considered as an integrated set to serve as a tool for establishing whether the measures for the nutrient reduction at source are sufficient in order to achieve by the year 2010 a healthy marine environment where eutrophication does not occur.

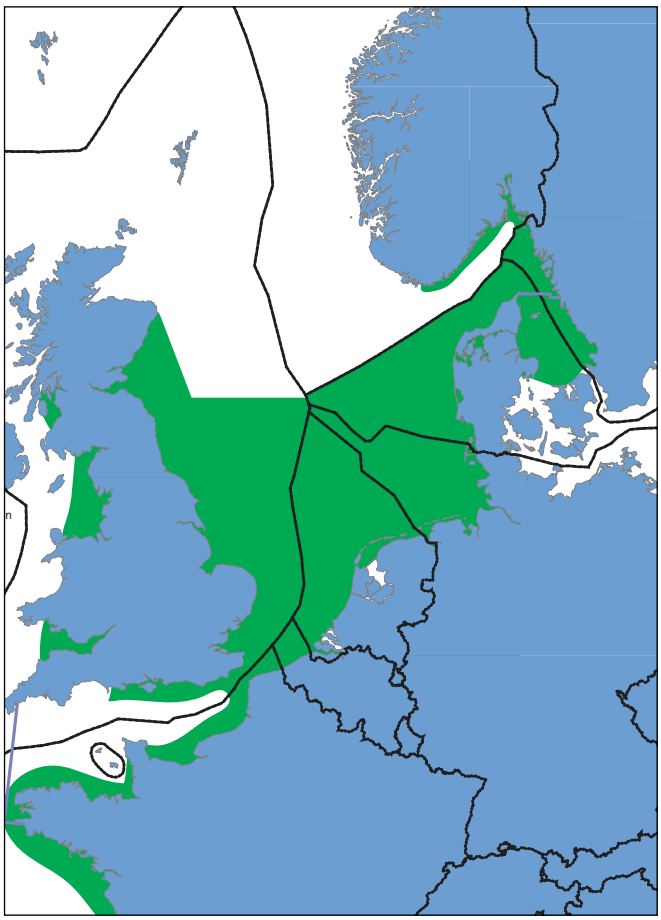


Figure 6.1 *Locations where the Comprehensive Procedure will be applied. In applying the Screening Procedure (not completed in all areas) not all local areas of possible concern have been identified and these areas will also be considered by OSPAR Contracting Parties under the Comprehensive Procedure.*

The elaborated integrated set of EcoQOs-eutro is as follows:

- Nutrients (winter dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP)). Winter nutrient concentrations of DIN and DIP should remain below elevated levels, defined as concentrations of more than 50%[15] above background concentrations (salinity-related and/or region-specific background concentrations).

- Phytoplankton (chlorophyll a and eutrophication indicator species)
  - maximum and mean chlorophyll a concentrations during the growing season should remain below elevated levels, defined as concentrations of more than 50% above the spatial (offshore)/ historical background concentration;

[15] Other values less than 50% can be used, if justified.

- region/area-specific phytoplankton eutrophication indicator species should remain below respective noxious and/or toxic levels (and increased duration).

- Oxygen
  The oxygen concentration, decreased as an indirect effect of nutrient enrichment, should remain above region-specific oxygen deficiency levels, ranging from 4–6 mg O_2/l.

- Benthos (affected by eutrophication)
  There should be no kills in benthic species as a result of low oxygen concentrations and/or the presence of toxic phytoplankton species in the OSPAR maritime area.

6.2.4 Is a 50% reduction in input of nutrients sufficient?

Predictive methods suggest that the environmental conditions in the OSPAR maritime area may improve by up to 25–30% as a result of a 50% reduction of inputs of nutrients for many coastal waters. This assumption is reinforced by results from intensive environmental monitoring in Denmark, which has shown, for example, positive effects of reduced inputs as a consequence of the dry years 1996 and 1997. However, considerable work is needed in order to obtain more precise predictions regarding the situation in the OSPAR maritime area that is expected following the implementation of agreed measures.

6.3 The EC Water Framework Directive

6.3.1 General

The Water Framework Directive (WFD), Directive 2000/60/EC of the European Parliament and the Council of the European Union, was adopted in 2000. The purpose of this directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which, *inter alia*, prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems. The implementation of the WFD in the Member States, accession countries and the European Economic Area member states will require better knowledge about all sources of pollution and disturbance having an impact on the water quality and the ecological status of European surface and ground waters. The directive has a holistic approach to the management of waters, where the resources are linked to the uses, the terrestrial environment, the aquatic environment and finally to development and human health. European Community Member States shall implement the necessary measures to prevent the deterioration of the status of all bodies of surface water. They shall also protect, enhance and restore all bodies of surface water, except for artificial and heavily modified water bodies, with the aim of achieving good surface water status by the end of 2015. The WFD defines five classes of ecological status: 'bad', 'insufficient', 'moderate', 'good' and 'high'.

Implementing the WFD is a challenge that resides fully in the competence of each individual state. However, a coherent and harmonized implementation of the directive is an imperative. In this respect, a common strategy for the implementation is developed with the aim to allow, as far as possible, a coherent and harmonized implementation of the directive. The strategy calls on a common understanding of the technical and scientific implications of the WFD, and work on these issues is in progress.

6.3.2 Correspondence between the OSPAR Strategy to Combat Eutrophication and the WFD

The WFD has a geographical coverage that includes parts of the North Sea. The OSPAR Strategy to Combat Eutrophication encompasses the whole OSPAR maritime area. It follows that there is an overlap between the OSPAR maritime area and the coastal areas in the WFD.

The WFD advocates an integrated approach where the catchment and the related coastal areas are

considered as one river basin district. OSPAR intends to perform integrated assessments where the use of data on sources of nutrient discharges and losses, as well as data on inputs of nutrients to the maritime area are interlinked with the assessment of eutrophication status. The use of the HARP Guidelines for Harmonised Quantification and Reporting Procedures for Nutrients enables a catchment approach for presentation and analysis of riverine input and source-related data. The development of an OSPAR tool to establish the connection between input data and the marine state data obtained by monitoring and modelling activities in quantitative terms would be beneficial for development of cost-effective abatement plans according to both the OSPAR Strategy to Combat Eutrophication and the WFD.

The WFD focuses on the ecological status of the river basin districts and, where necessary, the development of abatement plans to reach good ecological status. OSPAR uses the concept of ' non-problem areas' or 'ecological quality objectives' for describing its target situation.

Within the framework of OSPAR, common assessment criteria for the eutrophication of the OSPAR maritime area are under development. These criteria could also be used in the application of the WFD, in particular when working with its ecological quality objectives.

In a first proposal for integrating the OSPAR Comprehensive Procedure of the Common Procedure and the WFD with respect to eutrophication, OSPAR has tried to relate the borders set between the OSPAR classes (problem areas/potential problem areas – non-problem areas) and the Water Framework Classification on Ecological Quality of estuarine and coastal areas (insufficient/moderate – good).

The developments as regards assessment criteria, their assessment levels and ecological quality objectives (EcoQOs) within OSPAR could be of help for the further elaboration of assessment criteria for eutrophication under the WFD.

The approaches in the WFD and in the Strategy to Combat Eutrophication are similar, but there is a need for harmonization on important subjects, including the timetable of implementation. The WFD has a target date of 2015 for river basin districts to achieve 'good ecological status', while OSPAR has a target date of 2010 for obtaining 'no occurrence of eutrophication in marine waters'.

6.4 Discharges, Losses and Inputs of Nutrients, using the HARP Guidelines

(ED 30)

6.4.1 Background

At the 2NSC in 1987 North Sea States agreed:

- to take effective national steps to reduce nutrient inputs into areas where these inputs are likely, directly or indirectly, to cause pollution; and
- to aim to achieve a substantial reduction (of the order of 50%) in the inputs of phosphorus and nitrogen into these areas between 1985 and 1995, or earlier if possible.

These commitments were reiterated at the 3NSC in 1990, at IMM 93 and at the 4NSC (at which the deadline was postponed from 1995 to 'as soon as possible').

Ministers at the 3NSC and 4NSC asked for harmonized reporting systems and procedures for nutrients. Thus began the development of the HARP Guidelines (see chapter 10).

The background to the request for harmonized reporting was, *inter alia*, that the Ministerial Declaration of 1987 and PARCOM Recommendation 88/2 do not, for example, explicitly specify whether the reduction targets are related to nutrient inputs to the sea or to discharges/losses at source, and do not provide guidance as to the calculation methods to be applied. The results were that:

- there were different practices among North Sea States concerning reporting on discharges and losses of nutrients to freshwater systems and marine waters;

- the reports were generally based on 'national interpretation' on how elements such as sampling frequency, calculation methods and the sources to be taken into account should be considered;
- there was considerable uncertainty related to the calculations of the nutrient inputs, in particular with regard to the 1985 input figures, but also with regard to current nutrient inputs; and
- the calculation methods and the sources to be taken into account when reporting on inputs/discharges/losses of nutrients were, to varying degrees, left to the discretion of each country within the relevant international organizations where reporting took place.

The national reports on nutrients received in the preparations for the 5NSC were mostly based on the HARP system. For the purpose of increased comparability between North Sea States' figures (*i.e.* the most comprehensive data basis), the 50% reduction targets have been assessed in the light of discharges/losses of nutrients at source as very few North Sea States have provided sufficient information to allow an assessment of the inputs into the sea.

Both the Committee of North Sea Senior Officials (CONSSO) and OSPAR agreed that the reporting on discharges/losses and inputs of nitrogen and phosphorus to the 5NSC should be based on the HARP Guidelines (as adopted on a trial basis by OSPAR 2000), both with regard to the recommended quantification methodologies applied and the reporting formats. It should be noted that emissions to air are not a part of the reporting requirement, but the deposition of nitrogen on inland surface waters is included. This should allow:

- harmonized, transparent and comparable reporting;
- reporting on both the Load Orientated Approach and the Source Orientated Approach;
- more reliable quantification and reporting; and
- quantification and reporting on a catchment basis, and which is thus in line with the Water Framework Directive (see section 6.3).

6.4.2 Data submission

The reports provided by North Sea States are the basis for this section on data submissions. All figures on discharges/losses of nutrients at source to surface waters are related to anthropogenic discharges/losses. Nutrient emissions to air have not been taken into account (see section 6.7).

Data from 2000 are to a large extent based on the HARP Guidelines and are reported accordingly. As the HARP Guidelines were adopted in 2000, it could not be guaranteed that all countries had a data structure allowing them to report on the same basis for previous years. Therefore only some countries could re-establish data from 1985 on the basis of the HARP Guidelines, thus ensuring improved reliability of their reduction estimates.

The HARP Guidelines require reporting on a catchment-by-catchment basis. It is, however, a national task to decide on the number and size of the catchments to be reported on, provided that the whole territory draining to the parts of the North Sea identified as problem areas with regard to eutrophication, is reported on.

Although North Sea States have reported on a catchment-by-catchment basis, the data in this Progress Report are presented as the totals per country. This because the 50% reduction targets are related to a country's defined problem area (and are not catchment specific; see Figure 6.1) and because of the complexity and comprehensiveness of presenting data from all catchments reported on.

The HARP Guidelines distinguish between two types of data:

- data on nutrient discharges/losses at source; and
- data on the riverine load at the monitoring point closest to the river mouth.

When estimating nutrient inputs to the sea, HARP describes two approaches:

- the quantification of the nitrogen and phosphorus discharges/losses at source with the subtraction of the permanent retention in inland waters (the Source Orientated Approach); and
- the quantification of the nitrogen and phosphorus inputs at the river mouths, with the addition of the direct nitrogen and phosphorus discharges/diffuse losses into the sea (the Load Orientated Approach).

Table 6.1 *Discharges/losses (tonnes) at source in 1985 and 2000 and the reductions achieved.*

North Sea State	No. catchments	Catchment area (km²)	Discharges/losses of Nitrogen		Reduction (%) for Nitrogen	Discharges/losses of Phosphorus		Reduction (%) for Phosphorus
			1985	2000		1985	2000	
Belgium	4	14670	100820	81902	19	17800	7429	58
Denmark[1)]	12	27763	75151	42991	43	5875	1605	73
France	8	64741	NI	NI		NI	NI	
Germany	4	264112	763700	469800	38	73365	25018	66
Netherlands[2)]	4	37181	168245	94148	44	31618	11638	63
Norway[4)]	5	98990	38889	26631	32	2122	910	57
Sweden[3)]	41	76495	31393	17458	44	996	668	33
Switzerland	1	9500	31612	26403	16	3121	1218	61

NI: no information

1) The data for 1985 are extracted from the 1998 OSPAR report on the implementation of PARCOM Recommendation 88/2.
2) 1999 data.
3) Based on data from a number of years varying according to the different sources. However, they are listed as 1985 and 2000 data.
4) The contributions from diffuse losses from agriculture are based on preliminary estimates

6.4.3 Nutrient discharges and losses at source

Reductions achieved per country at source towards the 50% reduction targets

Table 6.1 shows the reported nutrient discharges/losses at source within North Sea States' problem areas in 1985 and 2000, and the reductions achieved (see also Figure 6.2).

Belgium, Denmark, Germany, the Netherlands, Norway and Switzerland have all reached the 50% reduction target on phosphorus between 1985 and 2000 from sources in areas draining into defined problem areas. Sweden's discharges/losses of phosphorus were reduced by about 33% between 1985 and 2000. The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target.

No North Sea State has reached the 50% reduction target on nitrogen losses/discharges from sources in areas draining into defined problem areas, but Denmark, the Netherlands and Sweden achieved a reduction of about 43–44%. The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target.

The UK has, to date, not identified any problem area with regard to eutrophication and is therefore not committed to the 50% reduction target on nitrogen and phosphorus.

The general picture is that diffuse sources, of which agriculture constitutes the largest portion, are the largest single source of nutrient discharges/losses at source. The losses of nitrogen and phosphorus from diffuse sources represented 64% and 46% respectively of the total discharges/losses from all North Sea States in 2000. Discharges from sewage treatment works and sewerage also represented a large source in many areas. The discharges of nitrogen and phosphorus from sewage treatment works and sewerage represented 27 and 35% respectively of the total discharges/losses from all North Sea States in 2000.

The reported achieved reductions per sector show that the overall reduction target for nitrogen inputs has not been reached mainly because the reductions expected from agricultural activities, and for some countries also wastewater, have only partially been achieved. The reduction target for phosphorus has been met by most countries due to a high percentage reduction for the wastewater and industrial sectors, whereas the measures implemented within the agriculture sector have contributed to a limited extent.

For some catchments, losses of nitrogen to a large extent enter surface waters via groundwater. Due

to a long residence time in the groundwater in some catchments (*e.g.* up to 30 years is reported for the river Elbe), it may take several years before the achieved reductions of nutrient discharges/losses at source are reflected in a decrease in the inputs into the sea.

All North Sea States have reported on discharges/losses of nutrients in 1999/2000 according to the HARP Guidelines. The structure of the 1985 data on discharges/losses of nutrients in four of these countries (Germany, the Netherlands, Norway and Switzerland) also allowed them to report according to the HARP Guidelines for 1985. For Belgium, in addition to the HARP exercise, parallel work was carried out in order to produce year 2000 figures, separately covering diffuse sources, all industrial sectors and all households, which allows coherent calculations of the reductions achieved between 1985 and 2000.

Diffuse losses at source
Diffuse losses at source mainly represent losses from agricultural activities, but the contribution from paved areas and direct deposition onto water bodies may be significant in some catchments.

The estimated reductions in losses from diffuse sources for the period 1985 to 2000 vary between 4% in Germany and 31% in Sweden for the phosphorus losses (Table 6.2). The phosphorus losses from diffuse sources in Denmark increased by 65% in the same period. The figures on nitrogen losses varied between a reduction of 48% in Sweden to an increase of 15% in Belgium.

In all North Sea States, the losses from diffuse sources (mainly agriculture sector) represented the most important source of nitrogen losses in 2000, between 50% in Switzerland and 89% in Denmark of the total losses/discharges in 2000. For phosphorus, the losses from diffuse sources represented the most important source of phosphorus losses for all countries (40% of the total discharges/losses in Sweden, 61% in Denmark), except for Belgium and Switzerland where the discharges from wastewater treatment plants were larger.

Discharges from sewage treatment works, sewerage and households not connected to public sewerage
In many North Sea States the treatment capacity for municipal wastewater increased significantly between 1985 and 2000. This is a result of an increase in the number of treatment plants, and/or of an increase in the capacity at existing treatment plants.

The estimated reductions in losses from waste water treatment plants for the period 1985 to 2000 vary between 40% in Sweden and 89% in Denmark for the phosphorus inputs, and between 4% in Belgium and 80% in Denmark for nitrogen (Table 6.3).

Discharges from sewage treatment works and sewerage was an important source of nitrogen discharges/losses in 2000 in most North Sea States, between 25% of the total discharges/losses in Germany and 47% in Switzerland, but only 5% in Denmark. It was also an important source of phosphorus discharges in most countries; it was the most important source in Belgium and Switzerland where it represented 58% and 74% respectively of the total discharges/losses of phosphorus in 2000.

Table 6.2 *Nutrient losses (tonnes) from diffuse anthropogenic sources and the reductions achieved.*

North Sea State	Nitrogen 1985	Nitrogen 2000	Reduction (%)	Phosphorus 1985	Phosphorus 2000	Reduction (%)
Belgium	39580	45560	-15	2470	2313	6
Denmark	59600	38167	36	600	987	-65
France	NI	NI	NI	NI	NI	NI
Germany	364200	304300	16	13507	12943	4
Netherlands[1)]	101825	57852	43	5623	5183	8
Norway[3)]	20802	17033	18	723	543	25
Sweden	17660	9100	48	390	270	31
Switzerland	11612	13173	[2)]	418	285	[2)]

- : increase
NI : no information
1) Figures for 1985 and 1999.
2) Different quantification methodologies (land use statistics) have been used for 1985 and 2000; thus the figures are not comparable.
3) Preliminary estimates.

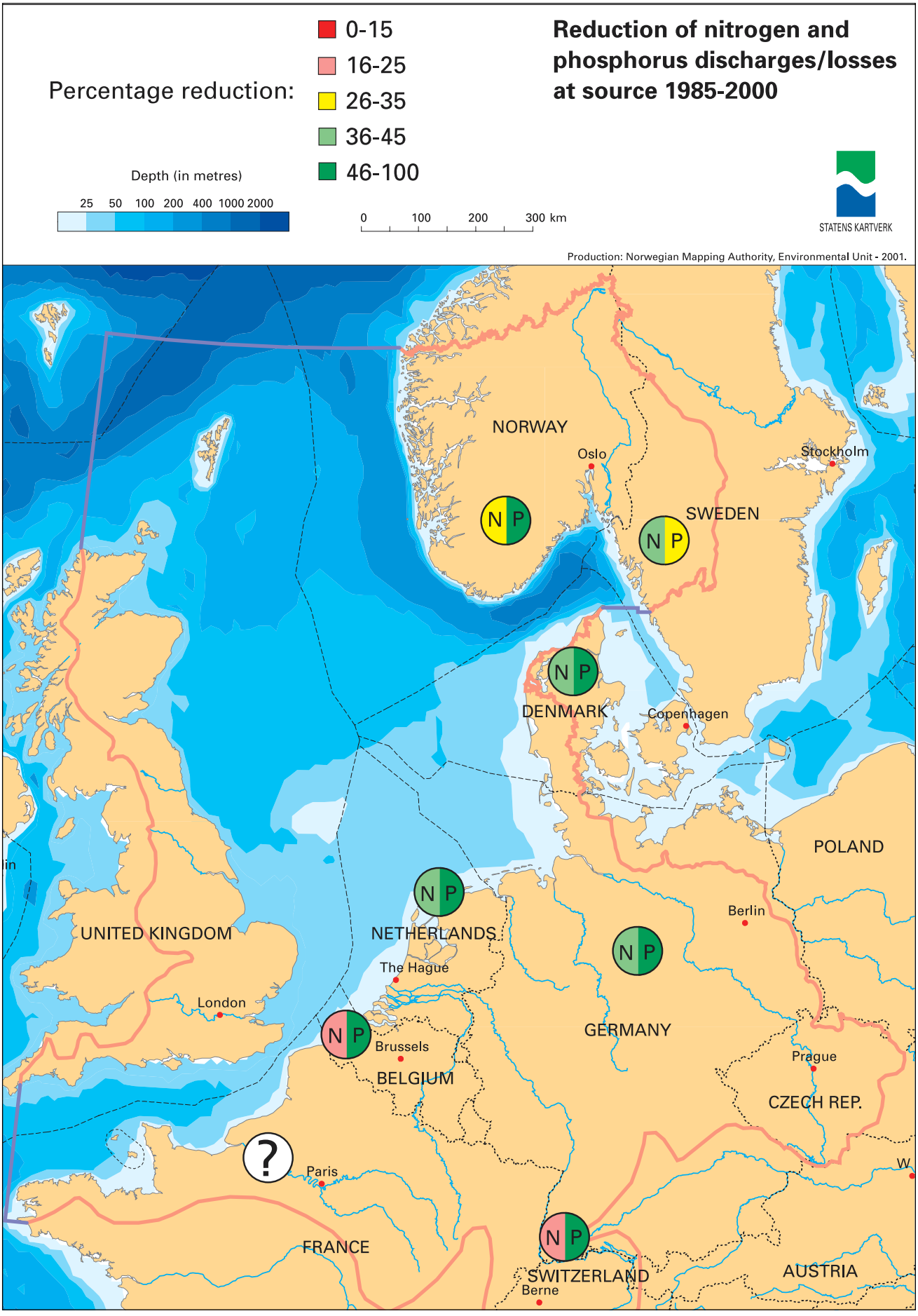


Figure 6.2 *Reductions of nitrogen and phosphorus achieved between 1985 and 1999/2000.*

Table 6.3 *Nutrient discharges (tonnes) from sewage treatment works and sewerage.*

North Sea State	Nitrogen 1985	Nitrogen 2000/ 1999	Reduction (%)	Phosphorus 1985	Phosphorus 2000/ 1999	Reduction (%)	Remarks
Belgium	31960	30614	4	9870	4319	56	Includes households not connected
Denmark	10000	1981	80	1900	207	89	
France	NI	NI	NI	NI	NI	NI	
Germany	245500	119700	51	46858	8139	83	
Netherlands	38410	31000	19	10800	3000	72	
Norway	10510	6688	36	964	134	86	
Sweden	9200	5446	41	262	157	40	
Switzerland	18000	12300	32	2300	900	61	

NI: no information.

The proportion of the nitrogen and phosphorus discharges in sewage from households not connected to public sewerage, compared to the total discharges in sewage from waste water treatment plants and households, represented a relatively high figure for Germany, Norway and Sweden in 2000 (see Table 6.4).

Aquaculture

The aquaculture industry has an insignificant discharge of nutrients into the defined problem areas with regard to eutrophication. In Denmark, the discharges of nitrogen and phosphorus represented about 1 and 5% respectively of the total discharges/ losses in 2000 (Tables 6.5 and 6.7A). The discharges from Norwegian aquaculture plants in the area that Norway has identified as a problem area with regard to eutrophication were insignificant (1% or less) (Tables 6.5 and 6.7B).

However, most of the Norwegian aquaculture plants are located in marine non-problem areas on the Norwegian west coast. The contribution of nutrients from the Norwegian aquaculture sector from the southernmost part of Norway (Lindesnes), along the Norwegian west coast up to 62° N, represented 44% and 76% of the total discharges/losses in that area for nitrogen and phosphorus respectively.

Industry

The estimated reductions in losses from industrial plants in the period 1985 to 2000 vary between 25%

Table 6.4 *Nutrient losses (tonnes) from households not connected to public sewerage.*

North Sea State	Nitrogen 1985	Nitrogen 2000/ 1999	Reduction (%)	Phosphorus 1985	Phosphorus 2000/ 1999	Reduction (%)
Belgium	1)	1350		1)	204	
Denmark	NI	1254		NI	288	
France	NI	NI	NI	NI	NI	NI
Germany	31800	20700	35	6854	2832	59
Netherlands	8481	665	92	1773	72	96
Norway	1779	1299	27	271	121	55
Sweden	3288	1995	39	216	143	34
Switzerland	1000	100	90	250	10	96

NI: no information.

1) The 1985 nutrient losses from households not connected to public sewerage are included in the figures on discharges from sewage treatment works and sewerage (see Table 6.3).

Table 6.5 *Nutrient discharges (tonnes) from aquaculture plants.*

North Sea State	Nitrogen 1985	Nitrogen 2000	Reduction (%)	Phosphorus 1985	Phosphorus 2000	Reduction (%)
Belgium	1)	84		1)	14	
Denmark	2351	1106	53	275	85	69
France	NI	NI		NI	NI	
Germany	Zero for marine waters: no information for freshwaters					
Netherlands	0	0		0	0	
Norway	2	49	Increase	0.3	10	Increase
Sweden	76	62	18	10	9	10
Switzerland	2)	30		2)	3	

NI: no information.

1) Considered to be negligible in 1985.
2) No data for 1985 available.

in Sweden and 99% in Denmark for the phosphorus inputs, and between 20% in Switzerland and 85% in Denmark for nitrogen (Table 6.6).

The discharges from industrial plants represent less than 7% of the total nitrogen discharges in all North Sea States in 2000. The contribution from the industrial sector in the Netherlands to the total Dutch phosphorus discharges/losses represented about 29% in 2000, for Belgium, Norway and Sweden about 11–13%, whereas for Denmark, Germany and Switzerland the contribution was less than 7% of the total discharges/losses in 2000.

Table 6.7A shows discharges/losses from the various sources of phosphorus and nitrogen in North Sea States in 2000, whereas Table 6.7B shows the reductions achieved by North Sea States per sector in the period 1985 to 2000.

Table 6.6 *Discharges of nutrients (tonnes) from industries not connected to municipal sewerage systems.*

North Sea State	Nitrogen 1985	Nitrogen 2000/ 1999	Reduction (%)	Phosphorus 1985	Phosphorus 2000/ 1999	Reduction (%)	Remarks
Belgium	29280	5728	80	5460	797	85	The data cover all industries
Denmark	3200	484	85	3100	38	99	
France	NI	NI	NI	NI	NI	NI	
Germany	122200	25100	79	6146	1104	82	
Netherlands	19529	4631	76	13422	3384	75	
Norway	5796	1562	73	164	102	38	
Sweden	1169	855	27	118	88	25	
Switzerland	1000	800	20	153	20	87	

NI: no information.

Table 6.7A *Losses and discharges of nutrients (tonnes) per country and source in 2000.*

North Sea State	Diffuse losses		Sewage treatment works, sewerage[1)]		Households not connected [2)]		Industry[3)]		Aquaculture	
	N	P	N	P	N	P	N	P	N	P
Belgium	45560	2313	30614	4319	1350	204	5728	797	84	14
Denmark	38167	987	1981	207	1254	288	484	38	1106	85
France	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Germany	304300	12943	119700	8139	20700	2832	25100	1104	NI	NI
Netherlands[4)]	57852	5183	31000	3000	665	72	4631	3384	0	0
Norway	17033[5)]	543[5)]	6688	134	1299	121	1562	102	49	10
Sweden	9100	270	5446	157	1995	143	855	88	62	9
Switzerland	13173	285	12300	900	100	10	800	20	30	3

1) Includes discharges of nitrogen and phosphorus by combined sewer systems, by separate sewer systems, by systems that are not connected to waste water treatment plants and households within the agglomeration which are not connected to a public sewer system, but that are expected to be connected in the near future.
2) Households not connected to public sewage systems include both scattered dwellings and households within urban areas that are not likely to be connected in the near future (five to ten years).
3) Concerns industrial plants with direct discharges of nitrogen and phosphorus from production water into surface waters.
4) Reported on 1985 and 1999 data.
5) Preliminary estimates.

Table 6.7B *Achieved percentage reductions of nutrients per source at source between 1985 and 2000 by North Sea States in areas draining into their defined problem areas with regard to eutrophication.*

North Sea State	Diffuse losses		Sewage treatment works, sewerage[1)]		Households not connected[2)]		Industry[3)]	
	N	P	N	P	N	P	N	P
Belgium	-15	6	4[4)]	26[4)]			85	89
Denmark	36	-65	80	89			85	99
France	NI	NI	NI	NI	NI	NI	NI	NI
Germany	16	4	51	83	35	59	79	82
Netherlands[5)]	43	8	19	72	92	96	76	75
Norway	18[7)]	25[7)]	36	86	27	55	73	38
Sweden	48	31	14	36			48	
Switzerland	[6)]	[6)]	32	61	90	96	20	87

\- : increase
NI : no information

1) Includes discharges of nitrogen and phosphorus by combined sewer systems, by separate sewer systems, by systems that are not connected to waste water treatment plants and households within the agglomeration which are not connected to a public sewer system, but that are expected to be connected in the near future.
2) Households not connected to public sewage systems include both scattered dwellings and households within urban areas that are not connected in the near future (5–10 years).
3) Industrial plants with direct discharges of nitrogen and phosphorus from production water into surface waters.
4) Data covering all households.
5) 1985 and 1999 data.
6) Different quantification methodologies (land use statistics) have been used for 1985 and 2000; thus the figures are not comparable
7) Prelimminary estimates.

6.4.4 Riverine data

A riverine input is the load conveyed by a river at a point of entry to the maritime area, which is usually at a point of freshwater unidirectional flow immediately upstream of tidal influence, but may be in the tidal zone of a river. The riverine loads reported represent the loads coming from the whole of the river catchment areas. In the case of international rivers, loads from upstream countries are ascribed to the most downstream countries.

The riverine discharges to the landward ends of estuaries and direct discharges to estuaries and coastal waters are combined to give estimates of the gross input of each substance to the maritime area (Load Orientated Approach, see section 6.8.6). It is not feasible at the present time to estimate how much of these inputs are retained within estuaries and near-shore areas and how much passes into the open sea.

Input data for substances carried to the maritime area by rivers and direct discharges are important in that they provide one of the key links between the sources of substances of concern and their presence and effects in the maritime area. The comparison of riverine and source data can give an indication of the effectiveness of the measures implemented and assist in the interpretation of monitoring data, such as those collected under the OSPAR Nutrient Monitoring and Riverine Inputs and Direct Discharges (RID) programmes.

The Quality Status Report 2000 for the Greater North Sea (OSPAR 2000) presented data on riverine inputs and direct discharges to the Greater North Sea between 1990 and 1996. Direct inputs decreased for nitrogen and phosphorus, while river inputs increased for nitrogen and phosphorus until 1995, before decreasing in 1996. A major part of the nutrient inputs from point and diffuse sources within a catchment area enter the North Sea via rivers. They account for 65–80% of the total nitrogen inputs and for 80–85% of the total phosphorus inputs.

A direct input is assumed to have a precision of the order ±30%. Precision may be increased when the annual estimate is based on a larger number of samples and/or continuous flow records, or is the aggregate of a number of individual inputs.

6.4.5 Nutrient inputs into the sea

Two methods can be distinguished to estimate the nutrient inputs to the sea.

1. The use of the HARP Guidelines to quantify and report on the individual components of nitrogen and phosphorus discharges/losses to inland surfaces waters allows the aggregation of the discharges/losses of nitrogen and phosphorus in each catchment. By taking account, where appropriate, of nitrogen and phosphorus retention processes in river systems and background losses of nitrogen and phosphorus, the inputs to the sea can be derived from the data on discharges and losses at source.
2. Nutrient inputs to the sea can also be estimated via the measurement of riverine loads at downstream monitoring points accompanied by estimates of the discharges/losses from unmonitored areas below the monitoring point, as described in HARP Guideline 7 (Quantification and reporting of the monitored riverine load of nitrogen and phosphorous, including water flow normalization procedures).

Nitrogen and phosphorus retention in river systems represents the link which allows a comparison between discharges/losses at source and measured riverine loads. HARP Guideline 9 (Quantification and reporting of the retention of nitrogen and phosphorous in river catchments) deals with the quantification of retention.

Nutrient inputs to the sea estimated by measured riverine loads

Belgium, Denmark, the Netherlands, Norway and Sweden have provided information on measured riverine loads, as described in method 2 above. Belgium and the Netherlands do not base their assessment of the achievement of the 50% reduction target on this information.

Table 6.8 provides an overall summary of reductions achieved in inputs of nutrients to the sea for the UK as a whole and for the Thames catchment respectively, by using method 2 above.

Table 6.8 *Reductions 1985–1999 in UK inputs of nutrients (kt/year) for the UK as a whole and for the Thames Catchment.*

Catchment Area	1985 Input Nitrogen	1985 Input Phosphorus	1999 Input Nitrogen	1999 Input Phosphorus	Reduction Nitrogen (%)	Reduction Phosphorus (%)
All UK	319 [1)]	58.4	355	33.0	-11	43
Thames	40.5	10.9	29.0	6.0	28	45

1) This 1985 baseline figure reported to the 3NSC appears to be an underestimate, so the indicated increase will be a worst case. The 'All UK' data for 1990 to 1999 indicate no underlying change in inputs of nitrogen.

Table 6.9 shows the riverine inputs of nutrients for all North Sea States except Switzerland which has no coastline. There is an increase in riverine inputs of phosphorus and nitrogen in both Norway and Sweden.

Estimates derived from source data and retention

Only Denmark and Norway have provided sufficient information to allow an estimate of the nutrient inputs to the sea by using nutrient discharges/losses at source and the retention in the water bodies.

Table 6.9 *Riverine inputs (tonnes) of nitrogen and phosphorus.*

North Sea State	Nitrogen		Phosphorus	
	1985	**2000**	**1985**	**2000**
Belgium[1)]	NI	58352	NI	4170
Denmark[2)]	60220	47039	2376	1267
France[3)]	142969	40343	16604	11867
Germany[4)]	247410	199250	16560	8350
Netherlands[5)]	455000	372860	43300	24250
Norway	20972	23160	643	1035
Sweden	39524	42702	880	935
Switzerland	NA	NA	NA	NA
UK[6)]	319000	355000	58400	33000

NA : not applicable
NI : no information

1) Only applicable to the basin referred to as 'Scheldt'.
2) Data for 1991 and 2000.
3) Data for 1990 and 1999.
4) Data from the transboundary river Elbe (without the tributaries below the monitoring point), Weser, Ems and Eider.
5) Data from three transboundary rivers: Meuse, Rhine and Scheldt. The data include loads from countries upstream.
6) Riverine and direct inputs, which represent some 90% of total UK inputs; 1985 and flow adjusted 1999 data. Phosphorus as orthophosphate.

6.5 Urban and Industrial Sewage

(ED 31)

6.5.1 Background

Council Directive 91/271/EEC on Urban Waste Water Treatment, which was adopted in 1991, aims to protect the environment from the adverse effects of the discharge of urban waste water and biodegradable waste water from the food-processing industry. The main obligation imposed by the directive concerns the establishment of waste water collection systems and provision of treatment.

There are four major deadlines in the Urban Waste Water Treatment Directive:

- by 31 December 1998 all sewage treatment works serving agglomerations with more than 10 000 population equivalents (p.e.) discharging their effluent into or upstream of an area regarded as sensitive should have been equipped with a collection system and more stringent treatment. Some countries decided to apply the alternative approach whereby the minimum percentage of reduction of the overall load entering all waste water treatment plants in the sensitive area has to be at least 75% for total phosphorus and at least 75% for total nitrogen. In this alternative approach, the discharges of all agglomerations have to be considered, not only the discharges from agglomerations of more than 10 000 p.e.;
- by the end of 2000 EU Member States should have established collection systems and secondary treatment (usually biological treatment) for discharges from agglomerations with more than 15 000 p.e.;
- by 31 December 2005. Establishment of collection systems and secondary treatment for coastal, freshwater and estuarine discharges from agglomerations with more that 10 000 and 2 000 p.e. respectively; and
- by 31 December 2005. Establishment of appropriate secondary treatment in small agglomerations with more than 2 000 p.e., or less if a collection system does not yet exist.

6.5.2 Implementation status

In its second report on the implementation of Council Directive 91/271/EEC, adopted by the Commission on 20 November 2001, the Commission considers that most EU Member States have major shortcomings with regard to the deadlines listed in section 6.5.1 and with the identification of sensitive areas.

Major delays in implementation
Ten years after the adoption of Council Directive 91/271/EEC, the vast majority of Member States show major delays and shortcomings in its implementation. Almost all Member States are very slow in providing the Commission with information about the treatment of city sewage.

According to the Commission, for the 3 247 agglomerations with more than 10 000 inhabitants which affect sensitive areas, only Denmark of the North Sea States is close to compliance with the 1998 deadline (see Table 6.11). The Netherlands and Germany applied the alternative approach given in the directive with regard to nutrients removal, not linked to individual treatment plants with more than 10 000 p.e., but to the requirement of 75% nutrients removal to be achieved by all waste water treatment plants. By 31 December 1998, the minimum rate of 75% had been achieved for phosphorus in the Netherlands, for nitrogen a reduction of 60% was reached by that date. In the sensitive areas of Germany, loads from urban areas with more than 2 000 p.e. had been reduced by 90% as regards phosphorus and 74% with regard to nitrogen.

With regard to the provision of secondary treatment for discharges from agglomerations of more than 150 000 inhabitants, where the deadline was 31 December 2000 unless they affected designated sensitive areas, the Commission considers that a considerable number of the 527 European cities of more than 150 000 inhabitants are equipped with adequate treatment, but that 37 are still discharging all their waste water into the environment without prior treatment (see Table 6.10), 57 discharge a large proportion of their waste water without treatment or after inadequate treatment, while for 134 others no complete information has been provided to the Commission. These figures refer to the European Community as a whole and

Table 6.10 *Progress on the provision of treatment for cities with more than 150 000 p.e., which were without waste water treatment at the end of 1998.*

Belgium	Brussels	The City of Brussels had no waste water treatment on 31 December 1998. The first treatment plant has been treating one third of the waste water at secondary level since autumn 2000, *i.e*. below the level required by Council Directive 91/271/EEC. The second treatment plant in Brussels is at the planning stage and should be operational before 2004–2005
UK	Dundee	Secondary treatment to be provided by 31/12/2001
	Sunderland/Whitburn	Complied with Council Directive 91/271/EEC as secondary treatment provided by 31/12/2000
	Middlesborough	Complied with Council Directive 91/271/EEC as secondary treatment provided by 31/12/2000
	Hull	Secondary treatment to be provided by 31/12/2001
	Bebington	Secondary treatment provided by 31/12/2000
	Torbay	50% of discharge to receive secondary treatment by 30/4/2002. Work is underway to complete the rest as soon as practicable
	Portsmouth	Work underway, secondary treatment to be provided as soon as practicable
	Hastings	Work underway, secondary treatment to be provided as soon as practicable
	Dover/Folkstone	Secondary treatment to be provided by October 2002
	Brighton	Work underway, secondary treatment to be provided as soon as practicable

not just to the seven Member States or the parts thereof which drain into the North Sea.

Since France and Germany had not informed the Commission about the treatment situation in their large cities in 1998, the Commission could not undertake an analysis of their situation. In 2001 Germany advised that it would apply the article 5.4 procedure of the WFD (see the alternative approach in bullet one in section 6.5.1). In France in 2001, Lille, Marseille and Bordeaux did not seem to be in compliance with the directive (due to insufficient secondary treatment).

Identification of sensitive areas

EU Member States have proceeded in a restrictive fashion when designating sensitive areas and have not taken into account the fact that discharged waste water migrates and contributes to an increase in the level of pollution of downstream water. The choice of the treatment level for a town should take into account the degree of sensitivity of the receiving water bodies situated downstream from the towns concerned. The incomplete designation of sensitive areas results in an under-assessment of the waste water treatment targets for many agglomerations, which are sometimes very large, *e.g.* London[16] and Paris.

Member states slow in providing information

During 1999 and 2000 – on the basis of the information transmitted by the Member States – the Commission checked the degree of compliance with the first requirements of the directive. Information from the European Environment Agency confirms that where efforts have been made

[16] The UK does not agree that the London agglomeration discharges directly or indirectly to any sensitive areas and that the current secondary treatment provisions are, therefore, in accordance with the requirements of the Urban Waste Water Directive.

to implement the directive the result is a significant improvement in the water quality of many European rivers and lakes. Nevertheless, the Commission considers that the situation remains worrying with regard to eutrophication in the North Sea.

Furthermore, the Commission found that its work has been slowed, in some cases substantially, by the delays with which almost all Member States have provided the information.

6.5.3 Implementation improvement – prospects for the future

To achieve better implementation, the Commission will continue to check and help ensure compliance. It will also continue to apply traditional measures such as infringement proceedings for any failure to comply with the requirements of the directive.

The Commission is also encouraging Member States to implement the directive by granting financial aid under the Structural and Cohesion Funds. It is also active in the accession candidate countries via the Financial Instrument for Structural Policies for Pre-Accession (ISPA). Furthermore, it will grant financial aid conditional on stringent compliance with the requirements of the directive.

EU Member States welcomed the Commission's proposal to establish an expert eutrophication group for both the Urban Waste Water Treatment Directive and Nitrates Directives with the target to harmonize criteria in close cooperation and in accordance with the work on the Water Framework Directive.

During the next few years the Commission will step up these activities with regard to local and regional decision makers, authorities and other bodies, by raising awareness within the general public, activating networks of cities and by means of technical assistance to help small and medium-sized agglomerations comply by 2005.

The EU has announced that it will launch a transparent and comprehensive discussion on urban water management. This discussion will address in particular preventative action at source by raising the awareness of water consumers, utilization of the end products of treatment, and rainwater management. All the stakeholders – towns and cities, non-governmental organizations, water industries, consumers, and national, regional and local administrations – will be involved in this discussion.

Table 6.11 *Cities with more than 10 000 p.e. affected by a sensitive area (SA) and organic load as at 31 December 1998.*

Member State	Agglomerations concerned				In conformity				Not in conformity			
	No.	SA load (p.e.)	Total load (p.e.)	% [1]	No.	%	Load (p.e.)	%	No.	%	Load (p.e.)	%
Belgium	189	7 801 350	9 164 000	85.1	12	6.3	468 081	6.0	177	93.7	7 333 268	94.0
Denmark	125	6 876 605	8 393 000	81.9	123	98.4	6 848 167	99.6	2	1.6	28 439	0.4
Germany[2]	1685	109 831 358	141 458 400	77.6	-	-	-	-	-	-	-	-
France[5]	267	17 868 530	70 510 000	25.3								
	(281)	(15 183 525)		(21.5)	(151)	(53.7)	(7 424 404)	(48.9)	(130)	(46.3)	(7 756 121)	(51.1)
Netherlands[3]	263	15 473 498	17 218 000	89.9	-	-	-	-	-	-	-	-
Sweden	144	7263 240	7 496 000	96.9	34	23.6	2 451 910	33.8	110	76.4	4 811 330	66.2
UK[4]	212	13 386 805	76 528 000	17.6	19	9.0	1 536 902	11.5	150	70.7	10 180 629	76.0

1) Percentage in relation to the total organic load of the EU Member State.
2) Germany had not provided data and it advised in 2001 that it would apply the Article 5.4 provisions.
3) The Netherlands apply the regulations of Article 5.4.
4) The UK does not accept that 150 agglomerations are not compliant with the directive because nitrogen does not play a significant part in eutrophication in freshwater areas. The issue of sensitive areas is a matter of dispute between the UK and the Commission.
5) Although France did not submit information in 1998, more recent information (2000 data) has been included in parentheses for comparative purposes.

6.6 Agriculture

(ED 31, 35, 36 and 37)
The 4NSC focused on the strengthening of the implementation of measures as soon as possible. The progress within OSPAR and the EU is described in section 6.6.1, together with developments in Norway and Switzerland on their agriculture policies.

6.6.1 Progress made

European Commission
The Nitrates Directive (91/676/EEC) provides for a stepwise process comprising:
(i) detection of polluted or threatened water;
(ii) designation of vulnerable zones;
(iii) voluntary codes of good agricultural practice;
(iv) action programmes within the nitrate vulnerable zones (NVZs) where the codes are mandatory and other measures such as nutrient balance, spreading and storage are taken; and
(v) national monitoring and reporting on nitrate concentrations and eutrophication.

The European Commission will shortly publish its second report on the implementation of this directive.

In the designation of vulnerable zones, which cover around 40% of the total EU area, there are differences in opinion between some North Sea States on the extent of these zones. Recently communicated proposals with the UK and Belgium will significantly reduce this discrepancy.

The overall trends, based on an assessment of the monitoring programmes, are a clear decrease in nitrate concentrations in groundwater in Finland, increases in Sweden and France, a relatively stable situation in Denmark and contrasting trends in Germany, the Netherlands and Belgium. Where decreases in surface water concentrations have been detected, it is not clear whether this is due to the action programmes or to other measures or climatic reasons.

In general, there are gaps in the action programmes with respect to comprehensiveness and precision, in particular with effluent storage, crop rotation and balanced fertilization. Most countries fail to comply with measures on restricted periods for fertilizer application. Generally, manure handling is better addressed than the use of mineral fertilizers. The restrictions on application on sloping land, soil winter cover and definition of measures for application near watercourses are poorly addressed.

Since 1994 the Commission has initiated some 50 legal actions, and this has stimulated implementation to the extent that half of the cases are now closed. However, six have resulted in judgements against Member States, including North Sea States. Considering the 21 types of infringement, almost all Member States are involved in one infringement or another.

Initially, the legal actions concerned delays in transposition, and the absence of monitoring and reports, more recently the focus has been on lack of designation of vulnerable zones (including three North Sea States) and action programmes (including three North Sea States).

This legal pressure, together with technical cooperation, has lead to a situation where all Member States now have comprehensive monitoring networks and codes of good practice and the quality of their action programmes is increasing. Although not all Member States have produced forecasts, and it is not possible to predict the effect of the more recent action programmes, the overall signs are more promising, with positive results on chemical fertilizer use and contamination of water at route zone level (in for example Denmark, some German Länder and eastern France).

The European Commission recently prepared a report on the state of application of Regulation (EEC) 2078/92 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside. Council Regulation (EEC) 2078/92 has recently been repealed by Council Regulation (EC) 1257/1999 on support for rural development,

containing the provisions for the current programming period, for which no evaluation data are yet available. This analysis is an abstract of the essential elements pertaining to reduction in nutrient inputs. The section of the report on input reduction, which, *inter alia*, seeks to minimize use of inputs and to promote organic farming covers a series of programmes, and addresses reduced use of fertilizer and plant protection products.

The results described represent the outcome of the various national programmes to implement the regulation, which provides for premium payments to encourage environmentally friendly farming to cover income foregone, costs incurred and an incentive to provide environmental services.

So far the regulation has been applied to 20% of all agricultural land in the EU. There is nevertheless much variation between the different Member States, from less than 5% to more than 50%. As the application of the programme is not yet widespread in many EU Member States, the results indicate their potentiality rather than substantive achievement. The lack of uptake is often cited to be due to low level of payments.

In Sachsen, Germany, it was found that a 20% decrease in nitrogen input lead to yield decreases of 17–20% in 1995 and 1996 for winter crops (wheat, barley, rye, rape and silage wheat). For grassland a 33% decrease in nitrogen input lead to a 14% yield decrease. On average the nitrate surplus in soil in Sachsen was estimated to be 73 kg N/ha in 1999; for the whole of Germany it was estimated to be 83.5 kg N/ha in 1999.

In Denmark, a 69% reduction of nitrogen leaching was recorded by the participating farmers which given the low coverage of the programme meant very little (positive) environmental impact overall. Interestingly while the purpose of the programme was to reduce nitrate leaching, the major benefit was in enhancing biodiversity.

In the UK, fertilizer use fell by 10–40 kg N/ha on average where target values of 150 kg N/ha of inorganic nitrogen and 225 kg N/ha manure were established.

As regards the significance of actual fertilizer reduction, the environmental benefit will vary depending on the type of soil as well as on uptake by the crops. The quantified change in use gives a somewhat uncertain indication of the likely change in stress on the environment.

It is premature to comment on the potentiality of programmes on extensification of livestock given the lower level of implementation.

The conclusion by the European Commission is that Regulation (EEC) 2078/92 is likely to make a greater contribution to nutrient reduction from agriculture if it were to be applied broadly in all EU Member States. However, as there is little or no Common Agricultural Policy (CAP) support on non-land intensive sectors (including pigs and poultry), and it is clear that substantive measures to reduce eutrophication must rely on environmental legislation (including the Nitrates and Urban Waste Water Directives, the Integrated Pollution Prevention and Control Directive and the Water Framework Directive).

Norway

The North Sea Declarations were considered a basic challenging target with regard to reducing water pollution. White Paper No 19 (1999–2000) concerning Norwegian agriculture and food production gave a basis for more ecologically-orientated farming and for introducing an extensive environmental planning system at the farm level. Combined use of legal and economic instruments supported with information and control has been an important strategy and is being developed further. In addition, research and development of various measures and more environmentally sound practices will provide better knowledge of the effectiveness of measures.

The reduction of nitrogen losses from agriculture to the nearest recipient (stream/small river) within Norway's defined problem area has been estimated at 24% during the period 1985–2000, whereas the reduction of phosphorus losses is 32%. The relative percentage reductions are related to the anthropogenic part of the agricultural nutrient losses. The loss estimates relate to normalized losses (*i.e.* long-term mean losses).

The measures implemented include soil tillage methods, catch crops, various aspects related to nutrient management (fertilizers and manure), drainage and surface water management, changes in crop composition and technical improvements of point sources in agriculture (*e.g.* silage and manure storage).

Further reductions in both nitrogen and phosphorus losses are possible. For nitrogen, the potential reductions are mainly associated with further increase in conservation tillage, including the use of catch crops on arable land and more efficient use of nutrients in livestock feeding and plant production. Appropriate governmental measures have already been established to enhance further decreases in the nutrient losses.

Switzerland

In the revised Federal Law on Agriculture (Agricultural Policy 2002) general ecological aspects and the specific reduction of nutrient inputs into water bodies are fully considered. For example:

- reduced prize support to farmers. Prize support will decrease within five years (by 2003) to about 33%;
- to receive direct payment, farmers must fulfil requirements concerning fertilizing, soil protection, crop rotation, crop protection and extensification (by 1999); and
- a special programme of measures for catchments with high nitrate contents in their groundwater and surface waters (by 1999).

The result of the Programme Agricultural Policy 2002 was examined in 2001. The Federal Council will decide the programme for the next four years on the basis of the outcome of this examination.

OSPAR

On the basis that a majority of EU Member States in 1996 did not support an initiative of the European Commission to harmonize codes of good agricultural practice, OSPAR agreed that the revision of PARCOM Recommendation 92/7 (on the Reduction of Nutrient Inputs from Agriculture) or the development of any additional OSPAR measure, should not take place earlier than in the 2002/2003 intersessional period. By which point OSPAR would have been able to examine, *inter alia*, the outcome of the 5NSC on these issues.

However, it is generally acknowledged within OSPAR that the inability to reach the 50% reduction target for nitrogen is primarily because the measures to reduce the diffuse losses from the agriculture sector are either inadequate or inadequately implemented.

Balanced fertilization

After the encouragement from the Ministers at the 4NSC to OSPAR to pursue its efforts on balanced fertilization, OSPAR called on new discussions for an operational definition of balanced fertilization. It soon became apparent, however, that no common understanding was within reach and consequently, OSPAR concluded in 1996 that there was no scope for reaching a common definition of balanced fertilization.

Despite the lack of a common definition of balanced fertilization, guidelines for calculating mineral balances had been developed within OSPAR in 1992. They were finally adopted as a PARCOM Guideline for Calculating Mineral Balance in 1995. However, the intention expressed in the PARCOM guideline for countries to perform frequent calculations of a national/regional agricultural nutrient balance has not been taken up in regular international reporting routines. The guideline on mineral balance has, however, been annexed to the draft HARP Guideline on the quantification of nutrient losses from diffuse sources, as an optional quantification procedure.

Since 1996, OSPAR has investigated, under the lead of Belgium, the possibility of developing a Best Environmental Practice (BEP) for agriculture based on balanced fertilization and to investigate any connection between mineral surplus and environmentally acceptable levels of nutrient losses. However, the work within OSPAR on this item concluded that, on the basis of present studies, for most agriculture systems, there is no correlation between mineral surplus and losses to surface waters. It follows that mineral surplus is more an indicator of management practice than nutrient losses to surface waters.

It is concluded that the target of achievement of balanced fertilization by the year 2000 or 2002, which many North Sea States agreed upon at IMM 93 and which was recalled by Ministers at the 4NSC, has not been met.

New developments
Regardless of the lack of any common BEP in this field, a management practice optimizing the housekeeping of nutrients on a field scale in order to minimize nutrient losses to receiving waters is now technically feasible. This is due to recent advances in sensor technology and controllers that allow variable rate applications of materials across a field. The concept of Precision Farming has a goal of optimizing the use of soil and water resources and chemical inputs (fertilizers and pesticides) on a site-specific basis. Technological advances in remote sensing, grain yield monitoring, geographic information systems (GIS) and global positioning systems (GPS), provide new opportunities for characterizing variability in crop fields and adapt management practice to the local conditions. These opportunities seem to be less promising for small parcels of land.

6.7 Atmospheric Emissions of Nitrogen

(ED 38)

6.7.1 Introduction

Atmospheric deposition of oxidized or reduced nitrogen compounds is considerable throughout Europe and may represent a significant source of the total input of nutrients to surface water systems. It should be taken into account in any eutrophication assessment involving quantitative source related data. There is a need to link modelling of atmospheric emissions/deposition with catchment related estimates including modelling of marine areas. This is clearly shown in the integrated assessment and management principles of the Water Framework Directive and is a prerequisite to implementing an ecosystem approach for the North Sea and its catchments.

Within the context of marine conventions and waterborne pollution, atmospheric deposition of nitrogen has often been considered as a part of the background loss of nitrogen, and is therefore not linked to its original sources. The modelling concepts used within the framework of the Convention on Long-Range Transboundary Air Pollution (LRTAP) enable the identification of the different diffuse sources of nitrogen (*e.g.* agriculture, industry and traffic). The task of keeping track of these sources in estimating diffuse losses of nitrogen from agriculture and other sources has not been given priority in relation to waterborne pollution. Subsequently it is still a scientific challenge to take account of this when quantifying nutrient losses from diffuse sources.

At the 4NSC, several countries and international organizations were invited to take up or to continue work on keeping track of atmospheric emissions, as laid down in paragraph 38 of the Esbjerg Declaration. The progress achieved is presented in section 6.7.2.

6.7.2 Progress within the European Commission, OSPAR, Norway and Switzerland

(ED 38 i)

EC – NECs Directive (Directive 2001/81/EC on National Emission Ceilings for Certain Atmospheric Pollutants)
The final text of this new Directive was adopted in September 2001. The core of this regulation is represented by national ceilings for emissions of major air pollutants, including nitrogen (NO_X and ammonia).

The NECs' directive covers emissions within the territory of the Member States and their Exclusive Economic Zones from all sources which arise as a result of human activities except:
- emissions from international maritime traffic; and
- aircraft emissions beyond the landing and take-off cycle.

EC – large combustion plants
The review of the 1988 EC Directive for large combustion plants was finalized recently. The final text of the new directive on large combustion plants was adopted in September 2001 and will be published in the near future. The new directive contains emission limit values for amongst others NO_X. The limit

values are more stringent for all specified categories of installation (built before 1988, between 1988 and 2001, and after 2001) than in the former directive.

EC – Integrated pollution prevention and control

The EU has a set of common rules on permitting for large industrial installations. These rules are set out in the Integrated Pollution Prevention and Control Directive (the IPPC Directive) of 1996. In essence, the IPPC Directive is about minimizing pollution of the environment (including air) from various point sources. For nitrogen emissions to air the main sectors addressed by this directive are intensive livestock farming, large combustion plants, refineries and large volume inorganic chemicals (ammonia, acids and fertilizers).

OSPAR

OSPAR's Strategy to Combat Eutrophication foresees developments toward improved quantitative links between the effects and the sources for nutrient inputs. In respect of the atmospheric sources of nutrients, the HARP Guidelines only take account of nitrogen deposition on inland water bodies, and there is no division into sources of the total nitrogen deposition.

The OSPAR Strategy to Combat Eutrophication states that any further OSPAR measures should be complemented, as appropriate, by steps by the competent international bodies for the reduction of atmospheric emission of nitrogen. While presently, there is no particular focus on measures related to atmospheric deposition within OSPAR, it is sufficient for OSPAR to assess from time to time the progress made within other international forums (EU, UN/ECE). Furthermore, due to the implementation of measures within for example the EU, considerable reductions of NO_x emissions from traffic are expected to be achieved in most OSPAR Contracting Parties within the next 15 years. OSPAR has therefore agreed that there is currently neither need nor scope for OSPAR to address nitrogen emissions from traffic.

There is a need for an overview and evaluation of atmospheric emissions of nitrogen and of nitrogen deposition on fresh- and marine waters in order to assess:

- the effectiveness of agreed international measures that could contribute to achieving the year 2010 objective of the OSPAR Strategy to Combat Eutrophication; and
- whether there is a need for any additional measures.

Norway

From 1992 to 1999, NO_x emissions in Norway increased from 208 000 tonnes to 230 000 tonnes, due to increased activity in the transportation sector and increased flaring offshore (Figure 6.3). This was about 1000 tonnes over the figures for 1987, and the obligation according to the Sofia Protocol.

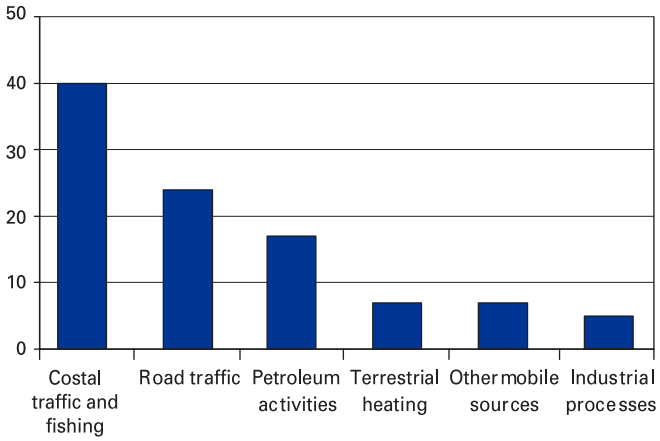


Figure 6.3 *Percentage distribution of NO_x emissions in Norway in 1999.*

The projection towards 2010 shows a decrease in the overall NO_x emissions, among others because of already approved tighter emission standards for vehicles.

Norway has signed the Sofia Protocol and among other countries Norway undertook to reduce the emissions by 30% from 1986 levels by 1998. The target was not met.

Under the Gothenburg Protocol Norway has undertaken to reduce its emissions to 156 000 tonnes of NO_x in 2010. This corresponds to a reduction of 28% compared with the 1990 level, or 74 000 tonnes below the level in 1999.

To limit the emissions of NO_X a number of measures have been implemented. The most important are:

- implementation of tighter emission standards for road traffic;
- implementation of 88/609/ECE standards for big stationary combustion plants;
- an NO_X reduction programme for vessels in coastal navigation. The programme 1996–2000 provided financial support and technical assistance to measures for reduction of NO_X emissions and resulted in a slight reduction of NO_X/yr;
- implementation of International Maritime Organization (IMO) emission standards for new engines in ships (the Technical Code on Control of Emission of NOx from Marine Diesel Engines);
- funding of measures to lower the emissions from domestic ferries; and
- a cross sectional analysis of possible measures to reduce the emissions of NO_X carried out in 1999. The analysis comprised both cost and effect of measures and showed that a reduction of about 30% compared with the 1990 level can be obtained in 2010 with reasonable costs. Reductions of up to 75% are technically possible. However, the realization of these measures is dependent upon introduction of new instruments.

Other policies and measures aiming at targets such as reductions of greenhouse gas emissions, noise, and improvements of local air quality, can in many cases also lead to lower NOx emissions.

Switzerland
In 2001, a mileage, weight and emission-dependent tax for heavy-duty vehicles was introduced. Switzerland also adopted the tight exhaust standards of the EU for light-duty vehicles (EURO 3 as from 2000, EURO 4 as from 2005) and for heavy-duty vehicles (EURO 3 as from 2000, EURO 4 as from 2005, EURO 5 as from 2008). They will lower the atmospheric emissions of NO_X substantially. An incentive tax on non-renewable energy and an energy fee to promote renewable energy use were rejected by public vote in 2000. Large infrastructure projects to enhance capacity and attractiveness of public transport and to transfer freight traffic from the road to the rail are being carried out.

6.7.3 Progress within the UN-ECE Convention on Long-range Transboundary Air Pollution

(ED 38 ii)

The 1988 NO_X Protocol
The 1988 Sofia Protocol to the 1979 Convention on Long-range Transboundary Air Pollution covers NO_X emissions. The Sofia Protocol on the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes had, as of 15 March 2001, 28 parties. Its main obligation requires parties to stabilize by 1994 their NO_X emissions at 1987 levels, but parties may choose an alternative base year. The Implementation Committee established under the Convention to review compliance by parties with their protocol obligations reviewed the implementation of this obligation in 2000 and reported the following results to the Executive Body for the Convention:

'The emission reduction obligation for the parties to the NO_X Protocol is to control and/or reduce their total annual emissions of nitrogen oxides or their transboundary fluxes so that these, at the latest by 31 December 1994, do not exceed such emissions for 1987. At its fourteenth session in December 1996, the Executive Body confirmed its understanding that the obligation should be taken to mean that emission levels for the years after 1994 should not exceed those specified in that paragraph.'

Under the protocol, parties are required to report annually their levels of national emissions of nitrogen oxides. The European Community has not reported NO_X emissions for any year nor emission data for the base year. It has not been possible to assess their compliance.

The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone
The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone was adopted in 1999. Thirty-one parties to the convention signed this protocol.

The protocol sets emission ceilings for 2010 for four pollutants: sulphur, NO_X, volatile organic compounds (VOCs) and ammonia. The ceilings were

negotiated on the basis of scientific assessments of pollution effects and abatement options. Countries whose emissions have severe environmental or health impacts and whose emissions are relatively cheap to reduce will have to make the biggest cuts. Once the protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63%, its NO_x emissions by 41%, its VOC emissions by 40% and its ammonia emissions by 17% compared to 1990.

The protocol also sets tight limit values for specific emission sources (*e.g.* combustion plant, electricity production, dry cleaning, cars and lorries) and requires use of best available techniques (BAT) to be used to keep emissions down. Farmers will have to take specific measures to control ammonia emissions. Guidance provides a wide range of abatement techniques and economic instruments for the reduction of emissions in the relevant sectors.

It has been estimated that once the protocol is implemented, the area in Europe with excessive levels of acidification will shrink from 93 million hectares in 1990 to 15 million hectares. The area with excessive levels of eutrophication will decrease from 165 million hectares in 1990 to 108 million hectares.

The emissions of NO_x in the EMEP (Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe) area are characterized by relatively high releases in the late 1980s and an easing-off in the 1990s. The reduction was 15% between 1980 and 1998. The projection towards the year 2010 shows the emissions will be on the same level.

6.7.4 Progress within OSPAR

(ED 38 iii)
In 1996 it was indicated within the OSPAR framework that 'ammonia from agriculture contributed to the atmospheric emissions, and the resulting deposition, of nutrients. Taking into account that the draft OSPAR measure on the Reduction of Nutrient Inputs from Agriculture should address ammonia emissions, and that a considerable amount of work and action concerning ammonia emissions was being carried out by other international organizations (*e.g.* LRTAP, EMEP), there was currently no justification or need for further work on reduction measures to be initiated within the framework of OSPAR. However, the re-assessment of the need and scope for additional reduction measures on ammonia emissions should be a part of the effectiveness assessment of such an OSPAR measure on the Reduction of Nutrient Inputs from Agriculture'.

Further discussion within OSPAR took place within the context of a discussion regarding further measures with respect to agriculture and discussion on the implementation of the OSPAR Strategy to Combat Eutrophication (in which the reduction of ammonia emissions is also mentioned). Until now, it has not lead to concrete initiatives within OSPAR in relation to ammonia emissions.

The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone as adopted in 1999 (see section 6.7.3) and the EC Directive on national emission ceilings for certain atmospheric pollutants adopted in 2001 (see section 6.7.2) both address ammonia emissions.

6.8 Assessment of Achievements and Progress

6.8.1 OSPAR

The OSPAR Strategy to Combat Eutrophication
The OSPAR Strategy to Combat Eutrophication was adopted in 1998. The main objective is to combat eutrophication in the OSPAR maritime area, in order to achieve by 2010 a healthy marine environment where eutrophication does not occur. The Common Procedure for the identification of the Eutrophication Status of the OSPAR maritime area was adopted by OSPAR in 1997. The Common Procedure comprises two phases, a screening procedure to identify the obvious non-problem areas, followed by a Comprehensive Procedure applied to all remaining areas. The aim of the Common Procedure is to characterize the various parts of the OSPAR maritime area as a problem

area, potential problem area or a non-problem area with regard to eutrophication. The common assessment criteria and their respective assessment levels for use in the classification of problem areas, potential problem areas and non-problem areas within the Comprehensive Procedure have been agreed. Results of this application will become available for the whole OSPAR maritime area in 2002 and will be put forward to the OSPAR Ministerial Meeting in 2003.

Also, as part of the strategy OSPAR developed in 2001 a draft integrated set of Ecological Quality Objectives for nutrients and eutrophication effects for the Greater North Sea. The EcoQOs-eutro concern the following issues: winter nutrients (DIN and DIP), phytoplankton (chlorophyll a and indicator species), oxygen and benthos (as affected by eutrophication). Further work on EcoQOs-eutro is required for the whole OSPAR Convention Area.

OSPAR has made substantial progress in assessing the eutrophication status of the various parts of the OSPAR maritime area through the development and application of the Common Procedure.

Balanced fertilization

After the encouragement from Ministers at the 4NSC to OSPAR to pursue its efforts on balanced fertilization, OSPAR called on new discussions for an operational definition of balanced fertilization. It soon became apparent, however, that no common understanding was within reach and consequently, OSPAR concluded in 1996 that there was no scope for reaching a common definition of balanced fertilization.

The target of achieving balanced fertilization by 2000 or 2002, which many North Sea States agreed upon at IMM 93 and which was recalled by Ministers at the 4NSC, has not been met.

6.8.2 Urban Waste Water Treatment Directive

Council Directive 91/271/EEC on Urban Waste Water Treatment, which was adopted in 1991, aims to protect the environment from the adverse effects of the discharge of urban waste water and biodegradable waste water from the food-processing industry. The main obligation imposed by the Directive concerns the establishment of waste water collection systems and provision of treatment. There are four major deadlines within the Urban Waste Water Directive, two of which have already been reached (31 December 1998 – collection system and more stringent treatment; and by the end of 2000 collection systems and secondary treatment).

Ten years after the adoption of the Urban Waste Water Directive, the Commission reported that the vast majority of Member States show major delays and shortcomings in its implementation. Almost all Member States are very slow in providing the Commission with information about the treatment of city sewage. EU Member States have proceeded in a restrictive fashion when designating sensitive areas and have not taken into account the fact that discharged waste water migrates and contributes to an increase in the level of pollution of downstream water. To achieve better implementation the Commission will continue to check and help ensure compliance. It will also continue to apply traditional measures such as infringement proceedings for any failure to comply with the requirements of the Directive.

6.8.3 Nitrates Directive

The Nitrates Directive (91/676/EEC) provides for a stepwise process comprising:

(i) detection of polluted or threatened water;
(ii) designation of vulnerable zones;
(iii) voluntary codes of good agricultural practice;
(iv) action programmes within the NVZs' where the codes are mandatory and other measures such as nutrient balance, spreading and storage are taken; and
(vi) national monitoring and reporting on nitrate concentrations and eutrophication.

The European Commission will shortly publish its second report on the implementation of this directive.

In the designation of vulnerable zones, which cover around 40% of the total EU area, there are differences in opinion between some North Sea States on the extent of these zones. Recently communicated proposals with the UK and Belgium will significantly reduce this discrepancy.

Since 1994 the Commission has initiated some 50 legal actions, and this has stimulated implementation to the extent that half of the cases are now closed. However, six have resulted in judgements against Member States, including North Sea States. Considering the range of infringements, almost all Member States are involved in one infringement or another.

6.8.4 Sensitive areas and vulnerable zones

The agreement (ED 31i) to apply in the North Sea and its catchments, measures for Sensitive Areas under the Urban Waste Water Treatment Directive and measures for Vulnerable Zones under the Nitrates Directive have been implemented by most of the North Sea States concerned.

6.8.5 Atmospheric emissions

The Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone was adopted in 1999. Thirty-one parties to the convention signed this protocol, which sets emission ceilings for 2010 for sulphur, NO_X, VOCs and ammonia. Atmospheric deposition of oxidized or reduced nitrogen compounds is considerable throughout Europe and may represent a significant source of the total input of nutrients to surface water systems.

There is a need for further overview and evaluation of atmospheric emissions and deposition in order to assess the importance of the contribution to eutrophication of marine waters.

6.8.6 50% Reduction targets on discharges and losses of nutrients into surface waters

Data from 2000 are to a large extent based on the HARP Guidelines and reported accordingly. However, not all countries had a data-structure that allowed them to re-establish data from 1985 on the basis of the HARP Guidelines. In some cases this may reduce the comparability between 1985 and 2000 data, and thereby the reliability of the estimates of the nutrient reductions achieved.

The assessment of the 50% reduction targets on nutrients was based on source data. That means that no assessment has been made on the reduction of nutrient inputs to the sea. For the latter there are two approaches, the Source Orientated Approach, based on discharges/losses and estimates of the permanent nutrient retention in the watercourses, and the Load Orientated Approach, based on riverine inputs, estimates of the discharges/losses from unmonitored areas below the monitoring point and quantification of direct discharges of nutrients to the sea.

The general picture is that diffuse sources, of which agriculture constitutes the largest portion, are the largest single source of nutrient discharge/loss at source. Discharges from sewage treatment works and sewerage also represent a large source in many areas.

Aquaculture has become a more significant source for nitrogen and especially phosphorus in some North Sea States since 1985. Denmark, Norway and the UK all have important aquaculture activities, but all Norwegian aquaculture plants are located outside the Norwegian problem area with regard to eutrophication.

Belgium, Denmark, Germany, the Netherlands, Norway and Switzerland have all reached the 50% reduction target on phosphorus between 1985 and 2000 from sources in areas draining into defined problem areas. Sweden has reached a reduction of 33%. The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target.

For the period 1985 to 2000, no North Sea State reached the 50% reduction target on nitrogen losses/discharges from sources in areas draining into defined problem areas (see section 6.4, Table 6.1). The report from France was insufficient to allow an assessment of its progress towards achieving the 50% reduction target.

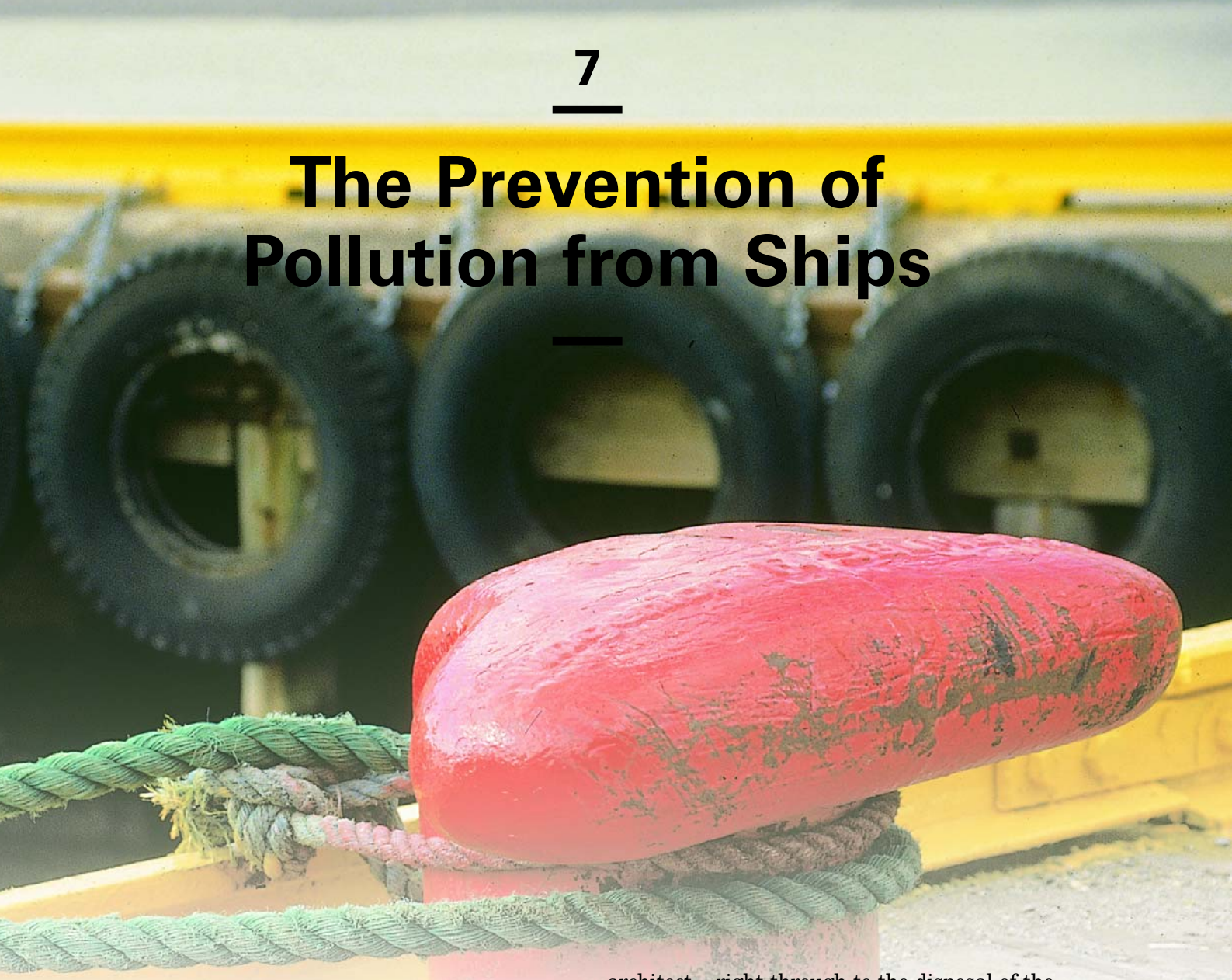
The UK, which has to date not identified any problem area with regard to eutrophication and is therefore not committed to the 50% reduction targets, achieved a reduction in inputs of phosphorus of about 40% but saw little underlying change in the inputs of nitrogen.

As a consequence of the reduction of inputs from point sources between 1985 and 2000 the relative share of the total anthropogenic nitrogen inputs from diffuse sources increased. The most important diffuse source for nitrogen is agriculture (mainly drainage and leaching via groundwater). The reported reductions achieved per sector indicate that the overall reduction target for nitrogen inputs has not been reached mainly because the reductions expected from agriculture, and for some countries also wastewater, have only partially been achieved.

The inability to reach the 50% reduction target for nitrogen is primarily because the measures to reduce the diffuse losses from the agriculture sector are progressing much slower than expected, and because the measures in many cases are either inadequate or inadequately implemented. However, the time lag between the implementation of the measures and the decrease of inputs into the sea, which is due to slow groundwater transport of nitrogen, should also be taken into account.

7

The Prevention of Pollution from Ships



7.1 Introduction

Shipping activity in the North Sea is affected by changing patterns of trade in the world economy. Increases in trade and prosperity can also lead to the potential for increased operational and accidental pollution. To guard against this it is necessary to be aware of the risks posed by shipping and to strive to manage them through cost-effective measures. The traditional understanding and focus of action to deal with this challenge has been to prevent operational pollution by implementing discharge requirements and by combating accidental oil spills. However, ships pose a much wider variety of environmental challenges from cradle to grave. These challenges all need managing – from conception on the drawing board of the naval architect – right through to the disposal of the waste streams from the breakers yard.

It is necessary to tackle these challenges in order to defend shipping as an environmentally friendly means of transport. Action must be taken to enforce existing legislation, to enact legislation where agreements of principle already exist, and to review whether further cost-effective measures are available. It is also important to monitor and evaluate the legislation that is currently in force.

7.1.1 Areas of environmental concern

When considering the contribution of shipping to environmental problems in the North Sea, shipping should not be considered in isolation. Developments such as reduced discharges and/or emissions from other sources must be taken into account. For example, the emissions of sulphur oxides (SO_x) and nitrogen oxides (NO_x) from land-based sources have been reduced over the course of several years

through the Convention on Long-Range Transboundary Air Pollution (LRTAP) and the protocols thereto, whereas emissions from ships have increased due to increased traffic. If the requirements of the environmental framework of the International Maritime Organization (IMO) do not bring about sufficient reductions in discharges and emissions from ships, the pressure to develop regional measures may increase.

One should be careful to rank the different environmental problems related to shipping activities. The North Sea has one of the highest shipping activities in the world and is served by several large ports, such as Hamburg, Bremen, Amsterdam, Rotterdam, Antwerp, Le Havre and London, leading to discharges and uptake of ballast water. The North Sea has already experienced several introductions of non-indigenous species from ballast water, and the probability of introducing other species is high. Although the associated harm is difficult to predict, few doubt that the spread of harmful aquatic organisms from ballast water is a major environmental challenge. Emissions of SO_x and NO_x are well documented as the second major challenge. The contribution from international shipping in the North Sea to acidification in Europe increased during the 1990s and currently ranges from around 10% of the NO_x and SO_x deposition in large areas of Europe to over 15% in some coastal areas (Jonson *et al*. 2000).

Another significant environmental problem caused by shipping in the North Sea is the threat from illegal discharges of oil, as is the case in all maritime routes of the world oceans. These are difficult to estimate, but observations of beached birds, small oil slicks and tar balls in coastal areas indicate that their frequency and volume appear to have decreased.

7.1.2 Main actions agreed upon

Several of the action paragraphs of the Esbjerg Declaration (ED) from the Fourth International Conference on the Protection of the North Sea (4NSC) contain the notion 'to take concerted action within IMO'. The ability to take concerted action has been a crucial factor in the follow-up work. Therefore Norway, as lead country, organized North Sea coordination meetings prior to meetings of IMO's Marine Environment Protection Committee (MEPC) in order to establish common positions.

The main actions in the ED were to protect the North Sea from operational discharges of oil, chemicals and emissions of SO_x, through stricter IMO requirements. Reduction of illegal discharges through improved enforcement and the establishment of mechanisms aiming at increasing the use of waste reception facilities were also highlighted in the ED.

7.2 Air Pollution

(ED 42 v a and b, 44 iii, Annex 3, 1.1 and 1.5)

7.2.1 Action agreed upon at the 4NSC

Ministers agreed to take concerted action within IMO to reduce air pollution from ships in the North Sea. The need to reduce sulphur emissions from ships was specifically addressed. Ministers held the view that the annex concerning the prevention of air pollution from ships (International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) Annex VI; which has not yet entered into force) should minimize the sulphur content in fuel oil by introducing a global sulphur cap, resulting in a true reduction in the sulphur content in fuel oil. They also agreed to take concerted action within IMO to designate the North Sea as a Special Area under Annex VI. In addition, North Sea States agreed to an expeditious ratification of Annex VI.

It is noteworthy that North Sea action on air pollution was directed towards IMO and the development of the annex on Air Pollution, and that reduction of sulphur emissions was the most important issue.

7.2.2 Reported progress

Reduction of air pollution from ships was placed on the IMO agenda after the topic was addressed by the London Declaration of 1987. IMO held a Diplomatic Conference on the prevention of air pollution from ships ten years later in September 1997. This conference was the direct result of cooperation between North Sea States. Annex VI, when it comes into force, will regulate emissions of ozone-depleting substances, nitrogen oxides, sulphur oxides and volatile organic compounds, in addition to shipboard incineration and fuel oil quality. Carbon dioxide emissions from ships were addressed in a Conference Resolution that outlined future work on this topic.

In general, the outcome of the Diplomatic Conference met the aim agreed by Ministers in the ED of reducing air pollution from ships in the North Sea. However, in terms of the sulphur content of fuel oil, the results of the Diplomatic Conference did not fully meet the expectations of the ED. In summary, the IMO Diplomatic Conference agreed:

- to require, in Regulation 14 of Annex VI of MARPOL 73/78, that the sulphur content of any fuel oil used on board ships shall not exceed 4.5% m/m;
- to a conference resolution on monitoring the worldwide average sulphur content of residual fuel oil supplied for use on board ships;
- to procedures for establishing SO_x emission control areas, and to establish the Baltic Sea area as such an area; and
- to require that the sulphur content of any fuel oil used on board ships shall not exceed 1.5% m/m within an SO_x Emission Control Area.

After the Diplomatic Conference the MEPC agreed (at its 44th Session in March 2000) to establish the North West European Waters as an SO_x Emission Control Area.

The monitoring mechanism was initiated by the North Sea States and is administered by the Netherlands. In 2000, the calculated average sulphur content was 2.7% m/m, and none of the samples were above 4.5% m/m. The expectations of the ED were not met in respect of the global cap on sulphur, but they were clearly met by the North West European Waters being established as an SO_x Emission Control Area when Annex VI enters into force. It should be noted that the Council Directive 1999/32/EC calls for a much lower sulphur content in marine gas oil.

Figure 7.1 shows the spatial distribution of sulphur dioxide (SO_2) and NO_x emissions from shipping in the North-East Atlantic. Total deposition of oxidized sulphur and nitrogen from all sources and contributions from international shipping added for all sea areas.

The objective of the ED to improve fuel oil quality is also embedded in Annex VI. Contamination of fuel with chemical waste is not only an air pollution problem, but can also lead to engine breakdowns followed by grounding.

With regard to the regulation of other emissions to air, the adoption of the 1997 Protocol to amend MARPOL 73/78 by adding Annex VI to the Convention represents fulfilment of the ED. Some North Sea States hold the view that the requirements of Annex VI to MARPOL 73/78 are weak, and will not lead to major emission reductions, but that it is a major improvement to the previous non-regulatory regime. However, it should be stressed that although IMO can strengthen the requirements of Annex VI before it enters into force, the effects of doing so will not become apparent until after Annex VI has been implemented. The Annex enters into force 12 months after being ratified by 15 IMO member states whose combined fleets of merchant shipping constitute at least 50% of the world fleet.

To date, only two North Sea States, Norway and Sweden, have ratified Annex VI. Other North Sea States are in the process of ratifying. Hence only two North Sea States have fulfilled the ED agreement on expeditious ratification of Annex VI.

The IMO Assembly 22 adopted a resolution on the entry into force of Annex VI of MARPOL 73/78 and a resolution on the availability and use of low sulphur bunker fuel oils in SO_x Emission Control Areas designated in accordance with regulation 14(3) of Annex VI of MARPOL 73/78.

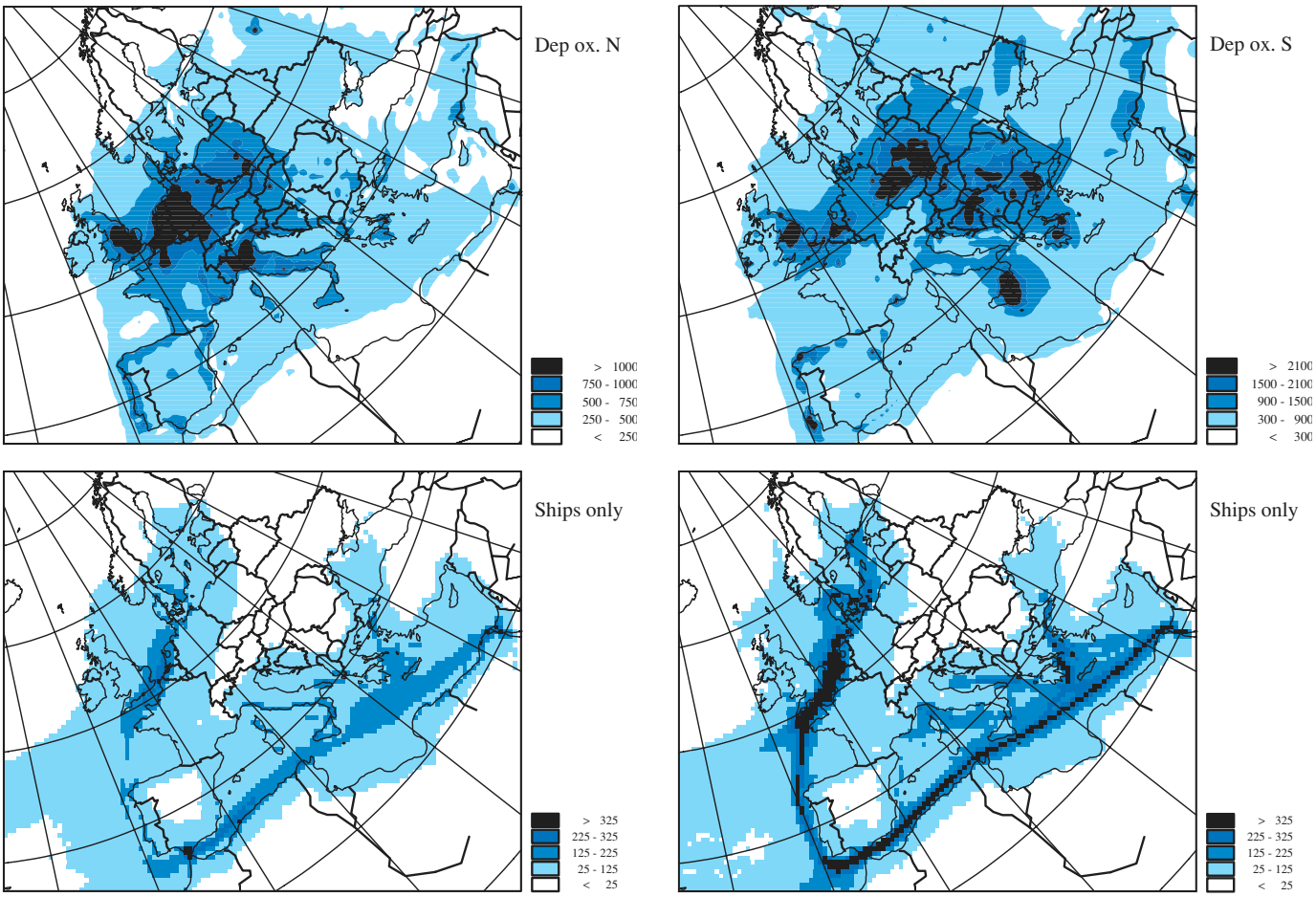


Figure 7.1 *Total depositions of oxidized sulphur (mg(S)m^{-2}) and oxidized nitrogen (mg(N)m^{-2}) from all sources (top) and contributions from international shipping only (bottom) (Jonson et.al 2000)*

7.3 Oil Pollution

(ED 44 i)

7.3.1 Action agreed upon at the 4NSC

Several paragraphs of the ED concern discharges of oil, as well as other pollutants, from ships. Reduction of oil discharges was addressed specifically by agreeing to take concerted action within IMO to designate the North Sea as a Special Area for the purpose of MARPOL 73/78 Annex I.

7.3.2 Reported progress

North Sea States and Ireland successfully promoted an Annex I Special Area encompassing the North Sea and all waters to the west of the UK and Ireland, as well as an area to the south of the UK and to the west of France. This is now known as the NW European waters Annex I Special Area, and it entered into force 1 August 1999. Verification of its achievement will need to be included in the terms of reference for the Bonn Agreement annual aerial surveillance reports. Thus the ED agreement (paragraph 44 i) has been achieved and exceeded.

When preparing the joint proposal to IMO it was estimated that this amendment to MARPOL 73/78 would reduce the discharge of oil into the NW European waters by approximately 2 000 m^3 annually, as long as the rules are fully enforced through effective prosecution of offenders.

Actions, such as the implementation of Council Directive 95/21/EC as amended, concerning international standards for ship safety, pollution prevention and shipboard living and working conditions (Port State Control), have been taken to minimize effects on adjoining sea areas. This enhanced Port State Control in the North Sea (and European Region) by introducing expanded inspections on high-risk ship types. It should also be noted that since the 4NSC, a number of North Sea States have achieved successes in the enforcement of marine pollution legislation. These include the UK, which has introduced higher fines for illegal discharge of oil from shipping. The UK Maritime and Coastguard Agency publishes the names of those it successfully prosecutes for pollution or other offences. France also significantly raised fines and jail penalties for illegal discharges from 2001.

7.4 Hazardous Substances

(ED 42 v c, 44 ii, Annex 3, 1.3.)

7.4.1 Action agreed upon at the 4NSC

Two paragraphs of the ED address the reduction of input of hazardous substances from ships. Firstly, Ministers agreed to take concerted action within IMO to ultimately phase out the use of tributyltin (TBT) compounds on all ships worldwide and secondly, Ministers agreed to actively support the revision of Annex II of MARPOL 73/78 to obtain new and more stringent discharge requirements.

7.4.2 Reported progress

Progress has been dependent on the ability of North Sea States to take concerted action within IMO, and the ability to succeed within IMO.

The phase out of organotin compounds as biocides in anti-fouling paints has been an urgent matter for the North Sea States. If adequate progress had not been made within IMO by the end of 1997, regional measures were to be considered. The Committee of North Sea Senior Officials (CONSSO) meeting in 1998 agreed, however, that IMO had made adequate progress. IMO adopted Assembly Resolution A.895(21) on 25 November 1999 where the phase out dates and the need to work towards the expeditious development of a global legally binding instrument to address the harmful effects of anti-fouling systems used on ships were agreed.

The International Convention on the Control of Harmful Anti-fouling Systems on Ships was adopted 5 October 2001. This convention will prohibit the use of harmful organotin compounds in anti-fouling paints used on ships and will establish a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.

The convention states that by an effective date of 1 January 2003, all ships shall not apply or re-apply organotin compounds which act as biocides in anti-fouling systems.

By 1 January 2008 (effective date), ships either:
- shall not bear such compounds on their hulls or external parts or surfaces; or
- shall bear a coating that forms a barrier to such compounds leaching from the underlying non-compliant anti-fouling systems.

The convention also recognizes that it is necessary to take appropriate measures to ensure that wastes from the application or removal of an anti-fouling system are collected, handled, treated and disposed of in a safe and environmentally sound manner to protect human health and the environment.

The convention will enter into force 12 months after it has been ratified by 25 states representing 25% of the world's merchant shipping tonnage. A resolution was adopted at the IMO Assembly 22 on the early and effective application of the convention.

The testing of alternative anti-fouling systems is shown in Figure 7.2.

Discharge from noxious liquid substances in bulk is regulated by MARPOL 73/78 Annex II. This is under revision and the final target date is 2004. The revision has been delayed for several reasons, the main one being the amount of work required to re-categorize all substances in the International

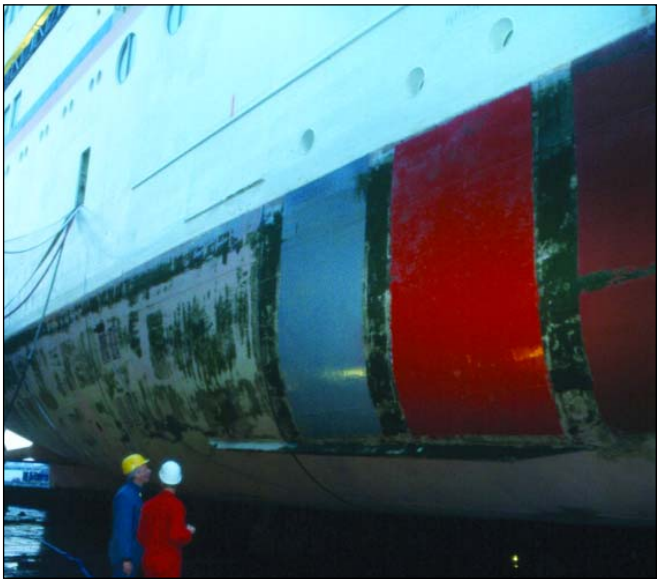


Figure 7.2 *After an 11-month worldwide cruise, biocide-free patches on the cruise liner Columbus (Hapag Lloyd Kreuzfahrten) proved more efficient against fouling than the copper-based paint on the rest of the hull. Columbus is one of 19 vessels taking part in a multi-stakeholder project initiated and coordinated by the World Wide Fund for Nature (WWF 2001).*

Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (the IBC Code) by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). The UK and the Netherlands have provided funding to GESAMP to speed up this work. The outcome of the revision with regard to discharge limits is not yet decided. A crucial question is to decide upon new discharge requirements and the application of these limits. Whether the stricter requirements only apply to new chemical tankers, or if new requirements should also apply to existing ships is still under discussion within IMO.

The North Sea States have achieved the objective stated in paragraph 44 ii of the ED and have supported the current revision of MARPOL 73/78 Annex II actively. In terms of a possible proposal to designate the North Sea as a Special Area for the purpose of Annex II of MARPOL 73/78, the delay in revising Annex II has delayed such a decision.

7.5 Non-indigenous Species and Sediments in Ballast Water

(ED Annex 3, 1.6)

7.5.1 Action agreed upon at the 4NSC

The issue of non-indigenous (alien) species and sediments in ballast water was not singled out as an item for North Sea action in the chapter on the prevention of pollution from ships in the ED, but was addressed in Annex 3 to the Declaration in a more all-embracing manner. Ministers agreed to work nationally, regionally and/or through IMO to develop measures aimed at preventing the introduction of alien or new aquatic organisms.

7.5.2 Reported progress

The North Sea States have clearly supported the IMO process to protect the marine environment from invasive marine species. In 1997, IMO adopted Assembly Resolution A.868(20) entitled 'Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens', with a view to providing guidelines before the mandatory regulations were in place. The resolution requested governments to take urgent action in applying the guidelines as a basis for national requirements and measures.

IMO is also aiming at legally binding measures. A Diplomatic Conference aiming at the adoption of an International Convention for the Control and Management of Ships' Ballast Water and Sediments is planned for 2003.

However, no or few regional and national North Sea measures have been reported since the 4NSC. Legal steps to facilitate future implementation of a ballast water convention have been taken by Belgium, and several North Sea States have contributed to research and development on treatment technologies, decision support systems, sampling methods, and research directed towards the nature and understanding of this environmental problem. The

UK has actively communicated the guidelines to the industry, and Norway used the provisions of the guidelines for *Chattonella* sp. blooms in spring 2001. However, the full implementation of the guidelines is not reported.

7.6 Reduction of Waste and Development of a Zero Discharge Regime

(ED 46, Annex 3, 1.2, 3, 4 and 6.3)

7.6.1 Action agreed upon at the 4NSC

The ED addresses the need to develop measures to reduce the generation of wastes in order to eliminate and/or reduce discharges to the North Sea. Ministers also agreed to take action to improve surveillance and control, to request waste stream management plans in harbours, to increase information on existing regulations, and to develop regulations that make it mandatory for ships to deliver all garbage to a port reception facility.

The Ministers further agreed to continue to secure the availability and continue to improve the quality of shore reception facilities, and to study alternative methods of charging the costs of the use of these facilities aiming to encourage their use.

The Ministers agreed to initiate surveys to quantify the amount of waste generated on the ship and delivered to the reception facility in order to improve the control of on-board waste management.

Ministers also outlined a conceptual approach to developing a zero discharge regime.

7.6.2 Reported progress

To reduce the generation of waste is a challenging task, and has been addressed in the Guidelines for the implementation of Annex V of MARPOL 73/78, published by IMO in 1997. The guidelines provide advice on issues such as minimizing the amount of potential garbage, and shipboard garbage handling, storage and processing. The extent to which this section of the guidelines has been implemented is not reported. It should be noted, however, that the guidelines do not meet the conceptual approach to developing a zero discharge regime outlined in Annex 3 to the ED (paragraph 6.3). No reports have been received for studies or research in relation to this concept.

All the issues concerning the prevention and/or reduction of garbage disposal addressed in Annex 3 to the ED (paragraph 1.2.2), except actions to improve surveillance of wastes from ships and information on existing regulations and environmental effects, have been achieved through the European Parliament and Council Directive 2000/59/EC on Port Reception Facilities for Ship-generated Waste and Cargo Residues, which was adopted 27 December 2000 and will enter into force 28 December 2002. The purpose of the directive is to reduce the discharge of ship-generated waste and cargo residues to sea, especially illegal discharges, from ships using ports in the Community. It aims to do this by improving the availability and use of port reception facilities for ship-generated waste and cargo residues. The directive will enhance protection of the marine environment by removing any incentive – practical or financial – for ships to discharge their waste at sea illegally. As a general rule, ships will have to off-load waste before leaving port, unless the ship has sufficient storage capacity for the next voyage. For this purpose the directive also requires ports to develop waste management plans.

The Directive on Port Reception Facilities also answers the objectives of the ED in terms of financial arrangements for reception facilities (Annex 3, paragraph 3). The directive introduces the principle that a 'no special fee', *i.e.* the vessel has to pay irrespective of the quantity and quality of ship generated waste actually disposed of, should cover a significant share, which the European Commission interprets as at least 30%, of the cost involved. Sweden, Denmark, Germany, the Netherlands and Norway will implement a full 'no special fee' system.

Regarding quantification of the amount of waste generated on ships, Belgium, the Netherlands, Norway, Sweden and the UK report that information on waste produced and/or delivered is available

or under development. There is little, however, current use of such information. There is still insufficient knowledge of the amount of waste discharged illegally to sea.

7.7 Enforcement and Illegal Discharges

(ED 42 ii and 43, Annex 3, 6)

7.7.1 Action agreed upon at the 4NSC

The ED identified different cooperative arrangements, such as a coordinated reporting system on criminal cases, cooperation between operators of airborne surveillance and other enforcement authorities, as well as national prosecutors and courts, as the main means to improve enforcement. Ministers identified the Bonn Agreement as being an important mechanism for improving enforcement.

7.7.2 Reported progress

As a follow-up to the *Erika* accident[17] the European Commission has made a series of proposals for more rigorous inspection of ships calling at Community ports. It is also monitoring the performance of classification societies and accelerating the phasing in of double-hulled tankers. Further measures include a shipping information and monitoring system, a compensation scheme and an agency to ensure a high and uniform level of maritime safety and to monitor the Port State Control system.

Other achievements have taken place within the Bonn Agreement, including publication of the Manual on Oil Pollution at Sea – Part 2 (Bonn Agreement 2000). The manual describes the administrative and judicial practices of North Sea States with regard to infringements of marine discharge regulations. It reviews authorities responsible, evidence required (with some case studies), and the type of evidence usually collected during surveillance activities and its compilation into a dossier. The manual advocates the organization of communications on such cases through a central office. The final chapter describes the various global instruments involved. The Bonn Agreement thus considers that it has progressed the facilitation of effective prosecution of offences to the extent possible under the Agreement. This section of the manual complements the first Manual on Oil Pollution at Sea (Bonn Agreement 1993), which briefly describes, and for a non-technical audience, observation methods practised during marine aerial surveillance activities.

The usefulness of the 1993 Manual on Oil Pollution at Sea is demonstrated by its wide distribution. It is used, for example, for the training of prosecutors and police, and as a general information tool. In several countries the normal methods of surveillance have been supplemented by satellite surveillance. Although satellite surveillance cannot replace verification by aircraft, it can help to focus and target the hours flown by surveillance aircraft.

During the development of the second Manual on Oil Pollution at Sea, experience concerning the types of evidence regularly collected by surveillance operators and forwarded to enforcement authorities was exchanged. This has clarified the processes used by different countries to collect the necessary evidence.

Table 7.1 and Figure 7.3 illustrates flight hours and slicks observed by the Bonn Agreement Aerial Surveillance Programme.

To classify floating oil and to detect substances other than oil, some countries are trying remote identification and volume calculation devices. So far, however, there are no reliable, calibrated results on their effectiveness, although this does seem to be a promising area on which work is needed. In Germany these systems are already operational.

Some countries have means that allow them to improve their chances of identifying a ship at night (*i.e.* night identification sensors). Some countries are developing additional methods for identifying

[17] 10 000 to 15 000 tonnes of heavy fuel oil were spilled when the *Erika* broke apart off the French Atlantic coast in December 1999.

Table 7.1 *Flight hours and slicks observed in the North Sea during 2000.(Bonn Agreement 2001)*

North Sea State	No of flights	No of BA flight hours			SLAR coverage	No of spills observed			No of spills per 10^6 km^2 observed			No of identified polluters		Estimated volume m^3
		daylight	darkness	sum	10^6 km^2	daylight	darkness	sum	daylight	darkness	total	rigs	ships	
Belgium	203	132	6.3	138.3	1.854	53	1	54			29.1	13	2	18.034
Denmark	84	231	0	231	3.126	33	0	33			10.6	5	4	0.21
France	117	255.4	0	255.4	3.422	24	0	24			7.0	0	10	41.4
Germany	377	887	104	991	13.281	91	29	120			9.0	17	9	215.26
Netherlands	397	545.5	219	764.5	10.244	273	107	380			37.1	27	28	118.4
Norway *	250	392.2	1	393.2	2.388	46	0	46			29.8	17	6	19.15
Sweden	111					6	2	8			75.0	0	2	0.288
UK	227	583	64	647	8.669	73	2	75			8.7	32	8	2.319
Total	1766	3032.1	394.3	3426.4	43.064	599	141	740			17.1	111	69	415.061

* In this summary table, the Norwegian data 'Norway BA' have been taken as these are more comparable with those of previous years.

BA=Bonn Agreement
SLAR=Side-looking airborne radar

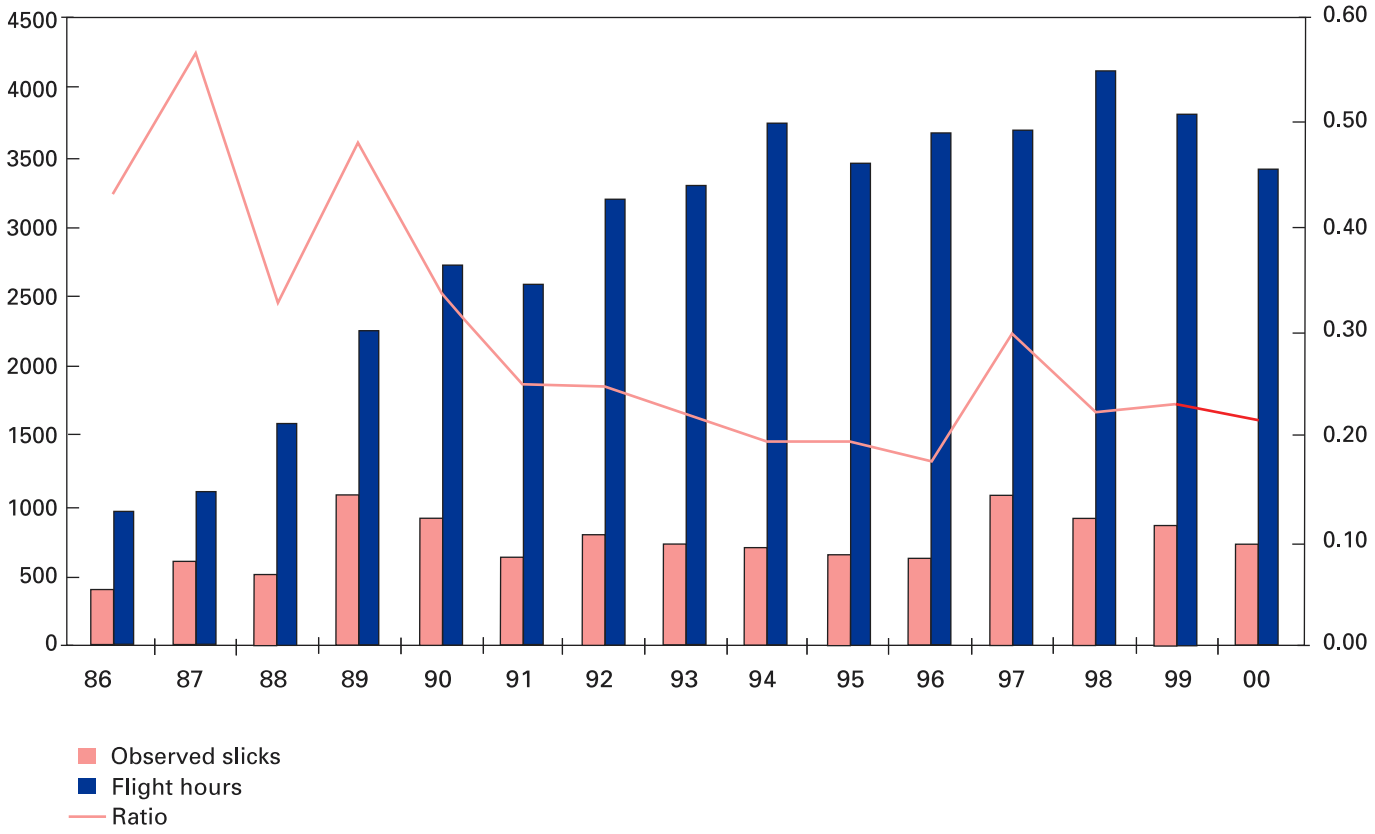


Figure 7.3 *Flight hours and slicks observed in the North Sea between 1986 and 2000. (Bonn Agreement 2001)*

floating objects (including spills) using Forward Looking Infrared Sensors. When a ship cannot be identified at the time the alleged infringement of the discharge regulation is observed, surveillance authorities generally use movements of ships in the area (*e.g.* from vessel traffic management systems, and arrival in ports *etc.*) to reduce the list of possible culprits.

A workshop was held in London in September 2001 to examine how enforcement authorities and courts in different jurisdictions could work together more effectively to enforce international rules and standards for the prevention, control and reduction of pollution from ships. The workshop noted that there was still a need to increase the likelihood of being caught following pollution incidents. It recommended that a better understanding be developed between those involved in collecting evidence and those involved in prosecuting offenders, both at the national level and for the North Sea region as a whole.

Monitoring the effectiveness of regulations is a complex matter. Beached Bird Surveys were included in the Esbjerg Declaration for that purpose. The Coastwatch project, which identifies and analyses beached birds along the entire North Atlantic coast of Europe, is a positive development which provides a general indication of a downward trend in the number of birds oiled in the North Sea over recent years. That said, there is no conclusive data available indicating any trend in oil discharges from ships and a better understanding of the situation must await the outcome of work in progress within GESAMP.

7.8 Accidents, Including Insurance, Compensation and Liability

(ED 45, Annex 3, section 5, 7 and 8)

7.8.1 Action agreed upon at the IMM 93 and at the 4NSC

The Ministers agreed at the Intermediate Ministerial Meeting in Copenhagen in 1993 to pursue the completion of the negotiations on an international convention on hazardous and noxious cargoes, and if this could not be achieved, to consider legal actions.

At the 4NSC the Ministers agreed to cooperate with the appropriate forums on reporting of ships carrying hazardous cargoes, identification of cargo lost overboard, cargo stowage and securing, and salvage capacity.

The prevention of accidents through navigation and routeing measures, the response to accidents and emergencies and insurance, compensation and liability are also addressed in Annex 3 to the ED.

7.8.2 Reported progress

In 1996, IMO adopted the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (the HNS Convention)

Since 1998 IMO has prescribed the Cargo Securing Manuals, which have provided masters, including those of fully cellular vessels, with all relevant information on the best use of cargo-securing facilities. This is an important achievement in preventing the loss of hazardous cargoes.

The HAZMAT Directive (Council Directive 93/75/EEC of 13 September 1993 concerning minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods, as amended by Commission Directive 98/74/EC) is implemented by the North Sea States. This directive also implements the IMO reporting requirements.

The directive prescribes reporting duties for vessels carrying dangerous and/or polluting goods. This enables states to respond properly in the case of an accident. Belgium, Germany, the Netherlands, Norway and Spain have developed a regional linking of national systems for the electronic exchange of data within the framework of Council Directive 93/75/EEC (the EU-EDI-HAZMAT system). As a result of the *Erika* accident on the French coast in 1999 the EU has initiated the development of a new directive establishing a Community monitoring, control and information system for maritime traffic.

Three North Sea States have undertaken feasibility studies for the identification and recovery of hazardous and/or noxious cargoes lost overboard.

All North Sea States regularly report instances of substantial pollution resulting from incidents at sea to the Bonn Agreement. Additionally, Member States to the European Community report such incidents to the Management Committee on Marine Pollution.

At the 4NSC Ministers recognized the need to take adequate measures to protect environmentally sensitive areas which are also at risk from shipping and agreed to cooperate in order to make use of the

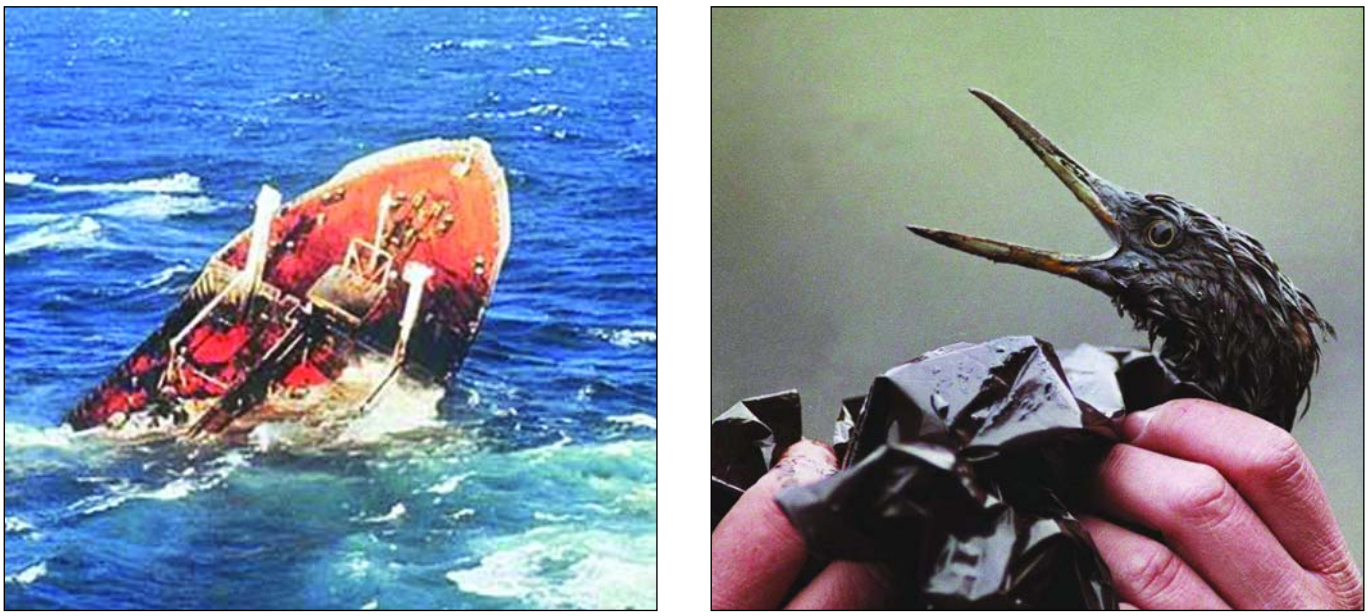


Figure 7.4 *Accidents which result in oil discharges to sea may cause extensive damage to marine life.*

range of routeing measures available through IMO (Annex 3, paragraph 5).

Since the 4NSC, Belgium, France, Germany, the Netherlands and the UK have taken steps to establish or consider such measures. A coherent mandatory shipping route for tankers carrying dangerous or hazardous goods has been created in the southern North Sea for the protection of the marine environment.

The UK keeps under review the need for routeing measures, both to protect environmentally sensitive areas and in the interests of safety of navigation. A programme of maritime traffic surveys is undertaken to inform decisions on additional routeing measures. Several vessel traffic surveillance systems have been established in the North Sea States in order to monitor entrance routes. The UK actively monitors compliance with routeing measures in the Dover Straits by means of the Channel Navigation Information Service. The UK also carries out *ad hoc* radar surveys of shipping movements at points around the UK coastline. Regulation V/8 of the International Convention for the Safety of Life at Sea (SOLAS) requires ships to install an automatic identification system to help with the monitoring of shipping activity. The schedule for phasing in this requirement begins 1 July 2002 and ends 1 July 2008.

Ministers also agreed that the North Sea States should actively support the work of the EU in establishing criteria for the identification of environmentally sensitive areas. This task has been superseded by international activities in IMO, whose 22nd Assembly adopted guidelines on the designation of Particularly Sensitive Sea Areas (PSSAs).

North Sea States report adequate availability of salvage vessels, and that tankers from the North Sea States comply with the new SOLAS requirements (V/15-1 of SOLAS 74) on emergency towing arrangements.

The International Convention on Civil Liability for Bunker Oil Pollution Damage (the Bunker Convention), which was adopted in March 2001, was a major achievement. Another achievement concerns the UK proposal, co-sponsored by all North Sea States and a number of other states, to increase the limits of compensation available under the 1992 Protocols to the International Convention on Civil Liability for Oil Pollution Damage 1969 and the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971. This proposal obtained the approval of the IMO Legal Committee in October 2000. As a result, with effect from November 2003, the amount of compensation available for any single

oil spill will rise by about 50% to 203 million Special Drawing Rights (approximately £ 180 million).

Ministers agreed to work within IMO to promote the early adoption of a convention on the removal or marking of hazardous wrecks. Negotiations within IMO on this issue have been constructive and it is anticipated that a draft wreck removal convention will be ready for consideration by a Diplomatic Conference in the 2004 to 2005 biennium. In October 2001 the Legal Committee reiterated this decision and agreed to continue this work as one of its priority items and asked the Netherlands to prepare intersessionally a substantive document for its session in April 2002.

7.9 Assessment of Achievements

7.9.1 Cooperation as an achievement

Almost every action agreed by Ministers at the 4NSC called for cooperation between North Sea States; Ministers agreed 'to take concerted action within IMO', 'to develop regional measures', and 'to exchange information'. The ability to take concerted action has been a crucial factor in the follow-up work to the 4NSC and all follow-up issues have been discussed regularly. Good cooperation between the North Sea States in the follow-up work is a major achievement.

The North Sea States have been sponsors of the documents submitted on the designation of the North Sea as a Special Area for the purpose of MARPOL 73/78 Annex I and Annex VI. There were extensive discussions in advance of the Air Pollution Conference during which the North Sea States took concerted action on the follow-up issues from the ED.

7.9.2 Main achievements

The North Sea States have managed to achieve agreement within IMO on several goals from the ED.

- Designation of the NW European waters as a Special Area for the purpose of MARPOL 73/78 Annex I. This entered into force 1 August 1999.
- Designation of the North West European Waters as an SO_X Emission Control Area. Adopted by MEPC March 2000.
- Requirements for fuel oil quality have been embedded in MARPOL 73/78 Annex VI and adopted at the Air Pollution Conference 26 September 1997.
- TBT is to be phased out. The International Convention on the Control of Harmful Anti-fouling Systems on Ships was adopted 5 October 2001 at a Diplomatic Conference.
- The precautionary principle is to apply to all IMO activities by the adoption of Resolution MEPC 67(37) in September 1995.
- Compensation to the victims of marine pollution is to be extended by the adoption of the HNS Convention in 1996 and the Bunker Convention in 2001.
- In April 2001 an amendment to MARPOL 73/78 (Regulation 13G of Annex I) was concluded concerning the accelerated phasing-out of single-hull oil tankers.
- Waste reduction can be achieved by applying the 'Guidelines for the implementation of Annex V of MARPOL 73/78' published in 1997.
- Since 1998 IMO has prescribed the Cargo Securing Manuals which provide masters, including those of fully cellular vessels, with all relevant information on the best use of cargo-securing facilities. These help to prevent the loss of hazardous cargoes.
- New SOLAS requirements on Safety of Navigation were adopted December 2000 and are due to enter into force 1 July 2002. The new requirements make the carriage of Voyage Data Recorders and Automatic Identification Systems mandatory for certain ships.
- Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens, Assembly Resolution A.868(20), were adopted in 1997.

- A Diplomatic Conference aiming at the adoption of an international convention for the control and management of ships' ballast water and sediments is planned for 2003.

Actions addressed within the Esbjerg Declaration have also been achieved within the Bonn Agreement and the EU.

- The Bonn Agreement Manual on Oil Pollution at Sea – Part 2, published in 2000.
- Reduction of waste discharged to the North Sea will be obtained through the European Parliament and Council Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, adopted 27 December 2000.
- The HAZMAT Directive (which concerns the reporting of ships carrying hazardous cargoes) has been implemented by the North Sea States. This directive also implements IMO reporting requirements.
- The establishment of a computer database, known as Equasis, which will meet the shipping industry's wish to have a single point of access to safety and environmental information on the world's merchant fleet.

7.9.3 Lack of progress

Although progress is considerable, there are also some items for which the ED goals have not been met.

- The North Sea States have not worked in concert to promote within IMO a review of existing regulations and procedures, with a view to identifying ways in which future environmental regulation of shipping might be conducted more effectively. Although MARPOL 73/78 Annex IV has been reviewed and Annexes I and II are currently under review, and although new environmental topics are taken up by MEPC, a holistic initiative, which the ED addresses in paragraph 42 i), has not been taken.
- Ministers agreed that a global sulphur cap resulting in a true reduction of the sulphur content in fuel oil is needed. This has not yet been achieved.
- Ministers agreed to take concerted action within IMO to develop measures for prevention and reduction of waste generation, for recycling and for closed loop processes in the conduct of shipping operations, with the final aim of the elimination of discharges. Although IMO has developed Guidelines for the implementation of MARPOL 73/78 Annex V, this is far from fulfilling the Ministers' goal on this topic.
- Four years after the adoption of Annex VI to MARPOL 73/78 only two North Sea States have ratified this annex. Ministers had undertaken to promote early adoption and expeditious ratification of Annex VI.
- Two North Sea States have not yet ratified Annex IV to MARPOL 73/78. Ministers had encouraged North Sea States that had not yet done so to ratify Annex IV and to bring about the early entry into force of its revised text.
- A zero discharge regime, as outlined by Ministers, has not yet been developed.
- Ministers had encouraged national and international coordination of the monitoring of beached birds, and analyses and dissemination of the monitoring results. Although the Coastwatch project addresses this goal, the ED was aiming for robust measures, and thus this goal is not fulfilled.

7.9.4 Overall assessment

The ED addressed a wide range of goals for the prevention of pollution from ships. Overall, the goals on shipping have had been systematically followed-up and with good results, although some goals are yet to be fulfilled.

The goals that were to be achieved through IMO, the Bonn Agreement or the Paris Memorandum of Understanding on Ports State Control have to a large extent been fulfilled. Goals that could be achieved within the EU have also been substantially fulfilled. Goals that are more dependent on a North Sea cooperation outside established cooperative arrangements have been fulfilled to a lesser extent.

Concerted action within IMO by the North Sea States has not always been successful. This is evident by reference to some of the regulations in Annex VI to MARPOL 73/78. Also, the ED sometimes called for faster progress than was actually achieved. Examples are the delay in revising Annexes I and II of MARPOL 73/78 and the decision to phase out TBT having been taken later than expected.

On the basis of the achievements reported on the prevention of pollution from ships, as addressed in

the ED, and information on environmental problems caused by shipping activities, there are still achievements which can be made within the international legal framework. Further work to reduce pollution from ships to the North Sea environment may take place within the context of regulations that are currently in force, regulations which have been developed but which are not yet in force, and within the context of no regulatory regime having been developed.

Regulations in force

Shipping has been subject to environmental regulation since the International Convention for the Prevention of Pollution of the Sea by Oil, 1954. But there are still significant challenges within areas subject to international regulation, such as MARPOL 73/78 Annexes I, II, III and V. The shipping industry must improve compliance with these regulations, and the authorities have an ongoing responsibility to improve enforcement as flag state, port state and coastal state. Strengthening the requirements of existing regulations is also under constant consideration.

Regulations not yet in force

Annexes to MARPOL 73/78 have been adopted to control the discharge of sewage and to regulate air pollution from ships. The International Convention on the Control of Harmful Anti-fouling Systems on Ships was adopted in October 2001, and in spring 2000 a protocol was adopted to extend the International Convention on Oil Pollution Preparedness, Response and Co-operation to cover hazardous and noxious substances. A liability and compensation regime for hazardous and noxious substances has been developed through the HNS Convention adopted in May 1996. A strict liability and compensation regime for bunker oil pollution was also agreed upon when the Bunker Convention was adopted in March 2001. However, the requirements of these international instruments have not yet been implemented because the instruments have not yet entered into force. The status of ratification varies among the North Sea States, and achieving the entry into force of these international instruments is a major challenge.

No regulatory regime

There are also environmental problems associated with shipping activities for which a legally binding international framework has not been developed. The spread of harmful aquatic organisms in ships' ballast water is a major problem which is not yet regulated internationally, although an IMO Diplomatic Conference planned for 2003 aims to adopt an international convention for the control and management of ships' ballast water and sediments. The emission of greenhouse gasses is another area where international shipping is so far unregulated. However, an MEPC working group is considering the development of an IMO strategy for greenhouse gas reduction. Although ship scrapping causes several environmental problems, an international legally binding regime is yet to be developed. Three United Nations agencies have ship recycling on their agenda: IMO, the United Nations Environment Programme, and the International Labour Organization. IMO will discuss its policy on ship recycling in 2002. Technical guidelines on the environmental aspects of dismantling ships are also being prepared in accordance with the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, which entered into force in May 1992.

The ED also includes agreements relating to regional measures. The progress reported shows there is still scope for achievements within regional measures to supplement the international framework.

8

The Prevention of Pollution from Offshore Installations

8.1 Introduction

8.1.1 Human pressures

The growing demand for oil and gas on the world market has led to considerable production activity.

Development and production of oil resources has primarily occurred in the central North Sea, while gas production dominates the southern North Sea. A net of pipelines connects the major fields to the markets (Figure 8.1). In general, the larger oil fields have been developed with concrete and steel platforms as production facilities. Smaller finds are often developed as satellites to larger fields, with smaller platforms or with sub-sea installations.

Increasing oil and gas activities means increasing pressure on the environment from the multiple activities necessary to find, produce and bring the resources to the markets. Impacts on the environment may arise from transportation, placement of structures on the seafloor, discharges to the sea, emissions to the atmosphere and accidental spills of oil or chemicals.

8.1.2 Impacts on the environment

At an early stage in the development of a field the source of most significant impact is discharges of drill cuttings to the seabed. At a later stage, production discharges to sea and air become the major sources of potential impact. Decommissioning of installations may pose particular problems concerning the disposal of platforms, sub-sea structures, pipelines and cables.

The earliest negative effects of oil and gas activities were detected on the seabed in the vicinity of

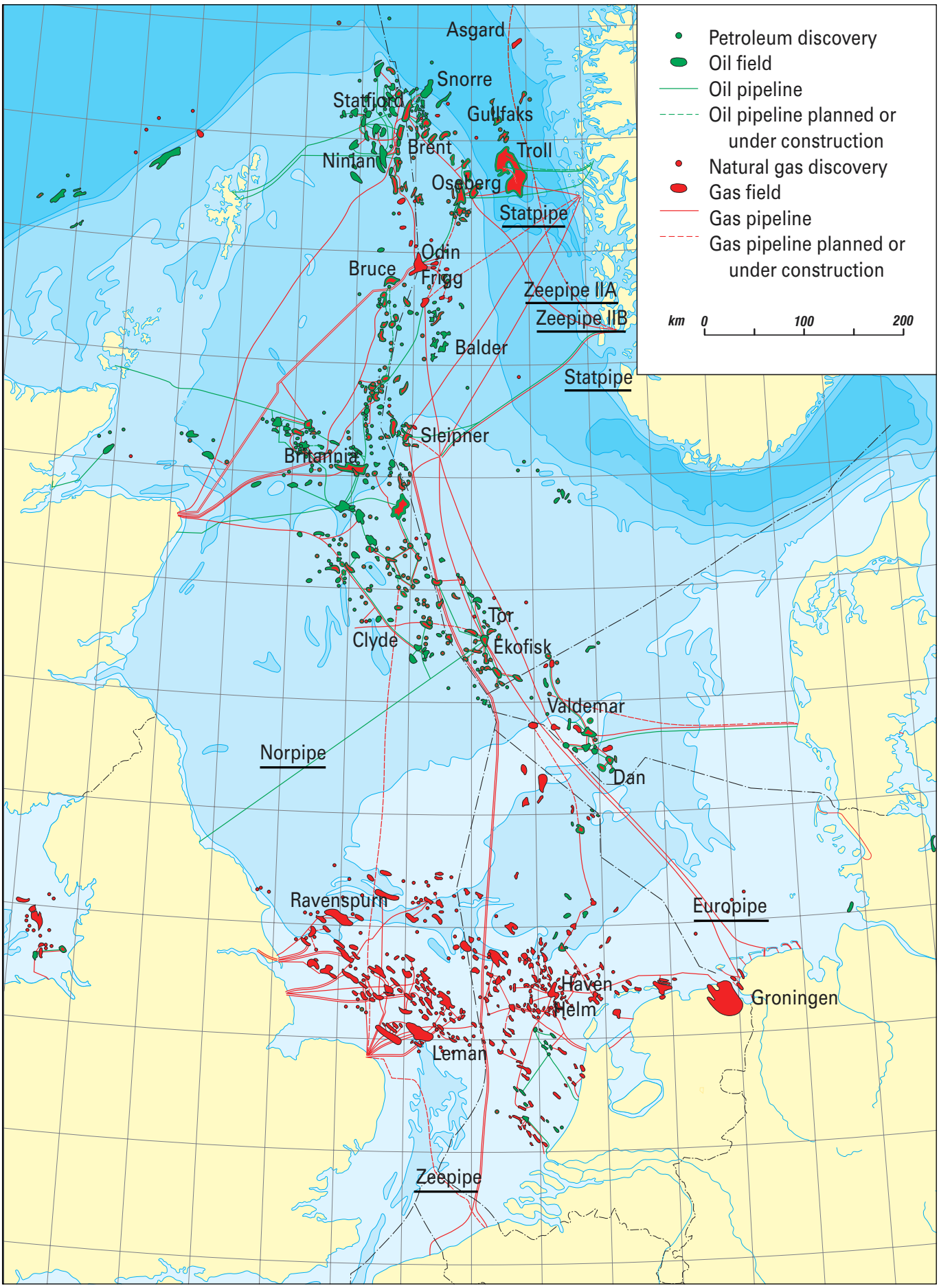


Figure 8.1 *Oil and gas installations in the North Sea (modified from OSPAR 2000).*

platforms and were due to discharges of drill cuttings contaminated with oil-based drilling fluids. Cuttings piles around older installations, created as a consequence of drilling with oil-based drilling fluids, may continue leaking oil and chemicals even many years after drilling has stopped.

Recently, produced water has come into focus as an increasing source of contamination, due to reservoirs in many oil fields producing higher amounts of water as they age. Produced water contains small concentrations of production chemicals, oil, heavy metals and a variety of natural components from the reservoir. Additionally, offshore activities are a source of emissions of gases which may contribute to acidic deposition over land and climate change. The large number of installations and pipelines also has impacts on the seabed, which is disturbed or permanently altered by levelling, stone dumping, trenching and anchoring activities.

8.1.3 Main actions and goals agreed

At the Fourth International Conference on the Protection of the North Sea (4NSC) the Ministers invited OSPAR to investigate further the extent and effects of pollution caused by produced water, and to aim at minimizing these effects. They further invited OSPAR to ban the discharges of oil-contaminated cuttings and to adopt a Harmonized Mandatory Control System (HMCS) for the use and reduction of the discharge of chemicals offshore, including addressing the aim of substitution of hazardous chemicals by non-hazardous chemicals. A majority of Ministers then also agreed that decommissioned offshore installations should either be reused or disposed of on land.

8.2 Discharges of Oil and Chemicals

8.2.1 Total discharges of oil from offshore installations

The highest total offshore discharges of oil to the North Sea, around 27 000 tonnes, were observed in 1986. In 1996, one year after the 4NSC, the total discharge was in the region of 12 000 tonnes (Figure 8.2). Total oil discharges from offshore sources in 1999 were just above 9 000 tonnes.

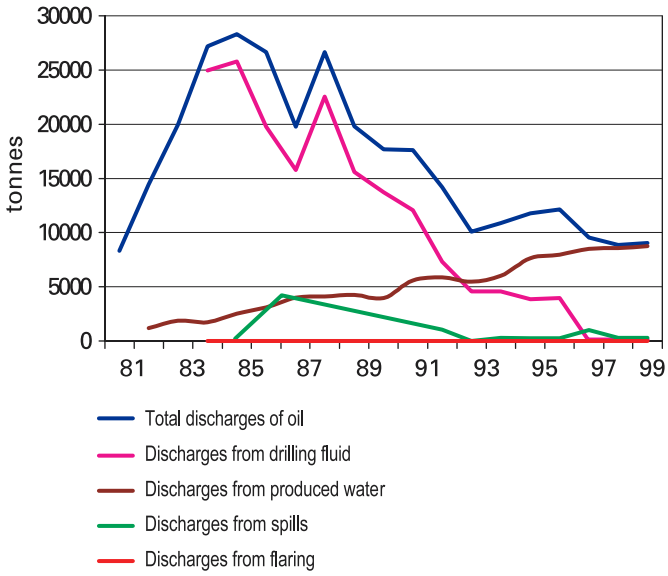


Figure 8.2 *Discharges of oil to the North Sea from offshore installations, total discharges of oil and discharges according to source. The data used are derived from reports to OSPAR (OSPAR 2001a). Included in the figure are discharges via cuttings with oil-based drilling fluids, produced water (including displacement water), spills and flaring from well testing. Discharges of synthetic drilling fluids are not included.*

The discharges of oil from the North Sea States vary widely, depending on the extent of offshore activities, phase in offshore development and types of hydrocarbon resources exploited. While the general trend in oil discharges is declining, discharges in the Danish and Norwegian sectors, are steadily rising, mainly due to increasing discharges of produced water (Figure 8.3).

8.2.2 Oil-contaminated cuttings

From 1990 to 1993 the discharges of oil on cuttings were reduced from 13 700 tonnes to 4 600 tonnes and zero discharge of oil-contaminated cuttings was reached in 1997 for North Sea States (see Figure 8.2).

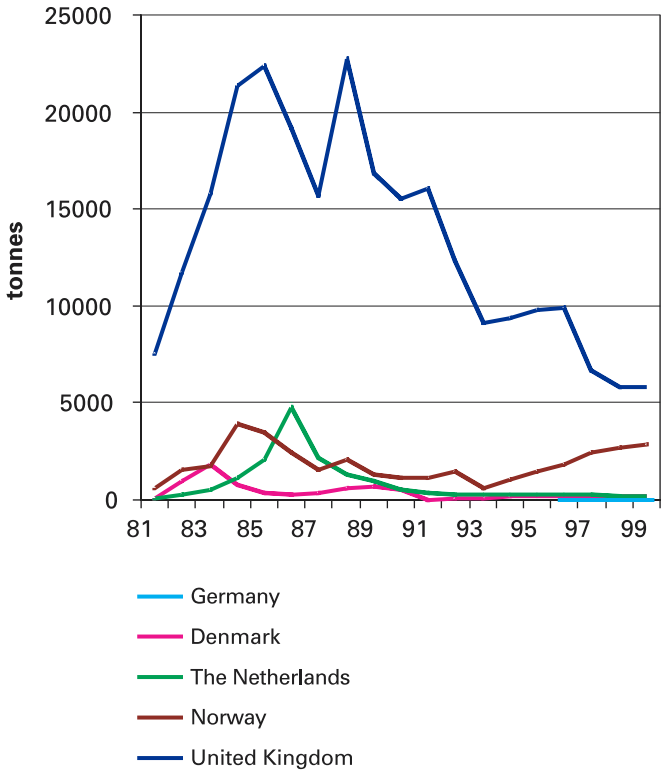


Figure 8.3 *Total oil discharges from North Sea States 1981–1999 (OSPAR 2001a).*

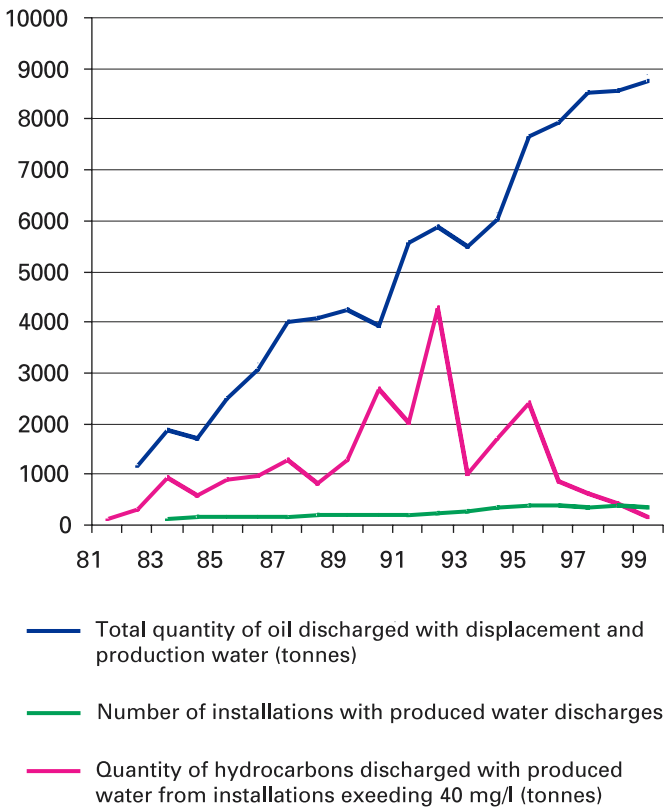


Figure 8.4 *Oil discharged with produced water. In 1999 only a small part of the oil discharged with produced water came from installations exceeding the 40 mg/l limit (OSPAR 2001a).*

8.2.3 Produced water

Produced water consists mainly of formation water, condensation water and re-produced injection water; it may also include water used for desalting oil. Water from the reservoir typically contains naturally occurring components from the reservoir itself (salts, hydrocarbons, heavy metals *etc.*), while condensed water may take up lighter hydrocarbon components. Produced water may in addition contain small concentrations of production chemicals and well completion and well cover chemicals.

The number of installations with discharges of produced water has been gradually increasing. In addition, the amount of water produced on a single field increases with time. The total quantity of oil discharged via produced water is therefore rapidly increasing (Figure 8.4).

Prior to the introduction of OSPAR Recommendation 2001/1 the input of oil from produced water was predicted to continue increasing, even if the oil content is at present substantially below the performance standard (40 mg dispersed oil/l) adopted by OSPAR in the early 1980s and, on average, is even below the revised standard (30 mg dispersed oil/l) that will come into force in 2006.

8.2.4 Oil spills

There are several hundred oil spills from offshore installations each year. Most are of less than one tonne. In the period from 1994 to 1999 the number of spills was between 600 and 800 each year, with a total annual quantity of oil of between 200 and 300 tonnes, except for 1997 when the total amount spilled exceeded 1 000 tonnes. Compared to produced water discharges, accidental oil spills contribute little to the general oil pollution from offshore installations (Figure 8.2). The acute effects on, for instance seabirds, of a large oil spill may be considerable, however, and this still constitutes one of the most significant concerns for the public even though the actual likelihood of such an occurrence is very low.

8.2.5 Use and discharges of chemicals

Preliminary data on the use and discharges of chemicals were presented at the OSPAR Offshore Industry Committee (OIC) meeting in 2001. There are at present no official and quality assured data on use and discharges of the most harmful chemicals (as defined by OSPAR) from offshore activities by North Sea States.

Data from the Norwegian offshore activities in 1999 illustrate the types of chemicals discharged offshore.

In 1999, 177 303 tonnes of chemicals were discharged to sea on the Norwegian shelf. Close to 90% (by weight) of the chemicals were residues of drilling fluid on cuttings discharged during drilling operations. The high proportion is due to weighting materials in the drilling fluids (barite). Chemicals are also discharged during production, water injection and during commissioning of pipelines. Spills constitute a minor part of the discharges. Most of the chemicals discharged are listed by OSPAR as posing little or no risk to the environment (known as the PLONOR list; the List of Substances/ Preparations Used and Discharged Offshore Which Are Considered to Pose Little or No Risk to the Environment (OSPAR 1999)).

Most heavy metals discharged from offshore activities are natural components of produced water or impurities in products used, mainly in weight materials in drilling fluids. The latter are normally not considered to be bioavailable. A relatively small proportion comprises additives to drilling chemicals. In Norway, these are not allowed for use under normal conditions, but only in cases of emergency for technical or safety reasons. For these chemicals, mainly lubricants (pipe dope), the priority hazardous heavy metals have been substituted with copper.

Drilling fluids (drilling muds) are used during all drilling operations offshore. The fluids are oil-based, synthetic-based or water-based. The drilling fluids consist of base fluids, weight chemicals and a number of additives such as pH and electrolyte modifiers, lubricants, cooling agents, corrosion inhibitors, biocides, and defoamers *etc.* Of the total amount of drilling chemicals discharged in Norway in1999, 96% were chemicals on the PLONOR list. Of the remaining 4%, corrosion inhibitors, demulsifiers and hydrogen sulphide scavengers are considered to be amongst the most potentially harmful production chemicals being discharged with produced water.

In the UK Continental Shelf, use and discharge of chemicals has been controlled through the Offshore Chemical Notification Scheme since 1979. This scheme will be replaced in 2002 by the Offshore Chemical Regulations 2002, which will oblige operators to apply for a use and discharge chemical permit. Under the new scheme more accurate models of estimating chemical discharge volumes will be used. Emissions from several UK installations where produced water reinjection takes place will decrease in the future.

8.3 Levels and Trends in Contamination

8.3.1 Drilling discharges

Metals

The most common weighting constituent of drilling fluids, barite (discharged as the highly insoluble barium sulphate), is also the most easily traceable of the drilling discharge constituents. Background concentration was in the range 7–160 mg/kg in the Danish sector between 1989 and 1998 (VKI 1999) and 6–554 mg/kg on the Norwegian shelf (Carrol *et al*. 2001). Concentrations appear to increase slightly from south to north. Several surveys have also recorded increased background concentrations of barium with depth (Akvaplan-niva 1999, 2000; DNV 1997). It appears that the highest concentrations of barium are found with the fine sediments in deposition areas.

For other metals monitored, generally cadmium, lead, copper, and zinc, no spatial or temporal trends in background concentration have been reported around Norwegian offshore sites. Recent information from other shelf areas has not been available. The extent of local contamination by other metals appears to be sporadic and in general modest and will be influenced by other industrial sources and river run-off.

Around installations, the present sediment concentrations of barium are found to be up to 10 000 mg/kg in the Norwegian sector and 4 000 mg/kg in the Danish sector at distances of 250 m and outwards. Areas contaminated with barium exceeded 100 km^2 around several individual Norwegian fields in the period 1990 to 1994, and 200 km^2 around some fields, but have been below 50 km^2 since then. The average contaminated area around individual fields was at a maximum of 32.5 km^2 in 1993, declining to a stable level of 4–6 km^2 after 1996. This apparent decrease in contamination is, however, difficult to verify since there has been a concurrent shift in sampling focus from field-related sampling to a regional strategy. For many fields the barium-contaminated area extends beyond the area covered by the sampling stations. In the Danish sector, where all the fields studied had ended their drilling activity, the highest concentrations of barium were found immediately after cessation of cuttings discharge. Within a year after that the mixing and transport of contaminated sediment reduced the barium concentrations close to the discharge points by about 25–50% (VKI 1999).

Oil

The background range in concentration of total hydrocarbons (THCs) was 1.0–13.6 mg/kg across the Norwegian sector as a whole. A similar background range, 0.6–13 mg/kg, was found in the Danish sector. In the UK sector of the North Sea slightly elevated background concentrations of hydrocarbons are indicated towards the north relative to the central region (UKOOA 2001). The latitudinal background gradient in the UK sector is partly explained by more intense drilling activity in the northern and central sectors than in the southern sector, and partly by less intense secondary dispersal in the muddy deep water areas to the north.

In the UK sector several lighter aromatic hydrocarbons, as well as several metals, show an opposite trend with an increase in concentration towards the south. This is thought to be due to heavy ship traffic and land runoff in this region rather than to offshore oil and gas activities.

It is difficult to assess the significance of any change over time in background concentrations of hydrocarbons in North Sea sediments, partly due to the scarcity of long-term data series and partly because there has been a simultaneous improvement in analytical skill and precision. A comparison of mean THC concentrations at a range of reference stations in the Norwegian sector from 1990 to 1999 showed no clear pattern of change over time. A similar lack of temporal change in background THC concentrations was observed at reference stations around Danish installations (VKI 1999). In the northern region of the UK sector a gradual increase in sediment oil concentration (of about five-fold) was seen at distances of more than 5 km from production platforms between the late 1970s and the mid 1980s. Since the late 1980s concentrations have decreased steadily. The timing correlates with the peak and subsequent decline in discharge of oil-based drill cuttings in this region.

The concentrations of THCs in bottom sediments around Norwegian offshore installations between 1996 and 1998, from about 250 m and outwards, varied from about 5 000 mg/kg to background. Concentrations of up to 500 mg/kg have been recorded at 250 m from Danish installations. Between 1999 and 2000 significant contamination was found at a maximum distance of 1 km, and on a few occasions to 2 km (Carrol *et al*. 2001). In comparison, the THC contamination extended to between 5 and 7 km downcurrent from the older Norwegian installations in 1993, the first year after cessation of the discharge of oil-based drill cuttings (Bakke *et al*. 1995). The most extensive contaminated areas were recorded in 1992 and 1993, and for one individual field exceeded 200 km^2 (SINTEF 1994). The average size of the contaminated area around individual fields was far less, in the range of 10–14 km^2 for the period 1990 to 1994, and had decreased significantly to 0.7–4 km^2 in 1996 to 1999. In the UK sector the degree of contamination from both hydrocarbons and barium is considerably less around platforms in the southern region than further north, due to more dispersive environmental conditions in the south, and is also lower in the northern than the central region. Both for the UK and Norwegian sectors, the contamination surrounding individual platforms varies widely in quantity and extent. The total area contaminated by hydrocarbons in the Norwegian sector peaked at about 550 km^2 in 1992, and has decreased gradually since then.

The contaminated areas still constitute a small fraction of the total bottom of the North Sea. In 1996 to 1999 the areas found to be contaminated by hydrocarbons in the North Sea extended to 0.01–0.3% of the total seabed (Carrol *et al*. 2001).

8.3.2 Components from produced water

Produced water discharges from oil and gas production are receiving increasing attention, as they now constitute the largest source of 'oil' inputs. Produced water may contain components with potential long-term effects, such as polyaromatic hydrocarbons (PAHs) and alkylated phenols (OLF 1998), and the chemical complexity of such discharges gives rise to concern regarding the combined effects of several contaminants. A report from a project by the Institute of Marine Research in Norway investigating the hormone disrupting effects of alkylated phenols on cod is under preparation. The bulk of the PAHs discharged comprise naphthalene which is subject to a review for identification as priority hazardous substance under the EC Water Framework Directive.

Increased levels of PAHs in seawater have been detected up to 10 km from the nearest discharge source, while dilution/dispersion models predict elevated levels at even greater distances (OLF 1998). Furthermore, recently measured and estimated concentrations of organic contaminants in the Ekofisk region suggest dispersed oil concentrations in the range 100–400 ng/l in the vicinity of the discharge sources and 30–60 ng/l some 50–60 km away (SINTEF 2000). These estimates have taken into account both the multi-source discharges in the Ekofisk region itself and the added produced water contribution from the nearby region of the UK sector. It should thus be representative for one of the oldest and most intensive exploitation regions in the North Sea. Comparison with chronic toxicity values suggest little or no risk to marine organisms living in these waters, except immediately adjacent to the outfalls (Utvik *et al*. 2000; Neff 2000).

8.3.3 Monitoring results

Most field investigations of the impact of drilling discharges have focussed on effects on the structure of the sediment macrofauna, expressed as the number and abundance of animals larger than 0.5 or 1 mm living in the sediment. The general response patterns are reasonably well known and appear to be fairly universal. At modest contamination, subtle changes in macrofauna community patterns, *i.e*. species composition and abundance, may be detected. As the impact becomes stronger there appears to be a decrease in species richness and diversity. Certain sea urchins and brittlestars considered to be characteristic for large areas of the North Sea, *e.g. Amphiura filiformis*, are regarded as highly sensitive to drilling related contamination (Daan *et al*. 1994). They tend to disappear with growing proximity to the drilling installations. Concurrently, certain species seem to prosper in the absence of competition from the more sensitive species. These 'opportunist' species increase the total macrofauna abundance close to the installation, but further reduce diversity. Although the species playing the key roles may shift geographically and over time, in general the same opportunistic species prosper close to the installations all over the North Sea.

Analysis of UK monitoring data from 1975 to 1995 has revealed a sustained temporal trend of decreasing background species diversity across the whole North Sea, but there is no evidence linking this to the activities of the oil industry. With few exceptions there is little evidence from available data that the zone of effects, as measured by the diversity index, extends much beyond 1 500 metres from installations (UKOOA 2001). Typical for conditions in the southern North Sea, with high rates of dispersal and water movements, is little evidence of change in diversity around active platforms (Mulder *et al*. 1988; UKOOA 2001).

Omitting the obvious near field effects of drilling discharges, the detection of subtle effects against a considerable spatial and temporal variability in natural fauna composition is difficult. From a recent analysis of approximately 660 Norwegian stations investigated during the period 1990 to 1998, of which 122 were undisturbed, it was concluded that only 8% of the fauna variability was explained by chemical factors assumed to be linked to offshore

activities (Carrol *et al*. 2001). Of these, the most important were hydrocarbons and cadmium (explaining 3% each). Just over 10% of the fauna variability was explained by significant natural environmental factors, primarily water depth (4.5%), sediment grain size composition (4%) and year-to-year changes (2%). Hence as much as 82% of the variability was attributed to unrecorded factors. Also, in the Danish and UK sectors natural environmental variables, *e.g.* location, time, water depth and sediment grain size, are more important fauna structuring factors than sediment contamination (VKI 1999; UKOOA 2001). In the Danish sector drilling impacts are only important locally.

8.4 Efforts to Reduce Discharges of Oil and Possible Effects on Fish

(ED 50 i)
At the 4NSC the Ministers expressed continued concern for the effects of oil discharges on the marine environment, in particular on fish, and asked that the reduction efforts should be continued.

8.4.1 Oil on cuttings

PARCOM Decision 92/2 on the Use of Oil-Based Muds has had a decisive effect on the discharges of oil-based drilling fluids. Oil-based drilling fluids are still used in the North Sea, but since 1 January 1997 oil-contaminated cuttings are now either brought to shore for treatment or injected into suitable formations.

At its meeting in June 2000, OSPAR adopted Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings. This legally binding decision entered into force formally in 2001. This decision prohibits the discharge of oil-based muds and cuttings contaminated with oil-based mud residues. Cuttings may only be discharged when the concentration of residual drilling fluid is less than 1%. There are no practical techniques available offshore for achieving this value. Moreover, there is a strong presumption against the discharge of cuttings contaminated with synthetic drilling fluids. The decision defines the 'exceptional circumstances' where such a discharge is permitted and there is an obligation on Contracting Parties to inform OSPAR of such discharges. Information submitted by OSPAR Contracting Parties shows that the quantity of oil discharged on cuttings has fallen substantially since the 4NSC.

8.4.2 Oil in produced water

Amounts of oil discharged from installations in the UK and Dutch sections of the North Sea are more or less stable. In Denmark and Norway discharges are increasing as established fields reach maturity and as new fields come on stream. Germany has only just commenced discharges. To combat the potential problems, Norway has developed a zero discharge philosophy on discharges of potentially harmful substances to sea from the oil and gas industry.

OSPAR Recommendation 2001/1 recommends a national total reduction of discharges of oil in produced water by a minimum of 15% by the year 2006 (reference year 2000). By the end of 2006 no individual offshore installation should exceed a performance standard for dispersed oil of 30 mg/l for produced water.

OSPAR is also pursuing the collection of information on concentrations of aromatic hydrocarbons in produced water, techniques for the analysis of aromatic hydrocarbons, and Best Available Techniques (BAT) and Best Environmental Practice (BEP) for the reduction of such substances in produced water with the aim of proposing one or more performance standards in 2003 and a timeframe for which the performance standard(s) should be met.

8.4.3 Monitoring of effects on fish

There has been no regular monitoring of ecological effects of oil on fish during recent years. Norway has regularly monitored the water column for oil and chemicals, and has included in its monitoring programme some effects on zooplankton and fish since 1987. Additional laboratory experiments have not documented any effects on marine life, including fish.

8.5 Efforts to Reduce Discharges of Chemicals

(ED 50 ii)
OSPAR has during a three-year trial period (1997–1999) assessed the use and discharge of hazardous substances from offshore installations. Examination of the data showed that reporting and assessment were not harmonized among Contracting Parties and therefore OSPAR cannot publish qualified data at the moment. However, it is expected that a revised and harmonized reporting format for the use and discharge of hazardous substances will be adopted by OSPAR in 2002. This will enable the Commission to assess both historical and future data on hazardous substances used and discharged offshore.

Potential endocrine disrupting chemicals such as the nonylphenol ethoxylates have been completely phased out by all North Sea States.

OSPAR has adopted Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharges of Offshore Chemicals. The decision requires pre-screening, ranking and risk assessment of chemicals used and discharged in connection with exploration and production activities in the Convention Area with the aim of identifying certain chemicals for substitution by less hazardous alternatives.

8.6 Implementation of Management Systems

(ED 52)
At the 4NSC the Ministers called upon oil and gas companies involved in the North Sea to develop and implement effective environmental management systems in order to protect the marine environment. They also called upon these oil and gas companies to further develop and to put into use environmentally sound techniques in order to eliminate the cases where alternatives to oil-based muds are not available.

In 1999, OSPAR adopted a Strategy on Environmental Goals and Management Mechanisms for Offshore Activities. In accordance with the general objective of the OSPAR Convention, and as stated in the strategy, the objective of the Commission with regard to the setting of environmental goals for the offshore oil and gas industry and the establishment of improved management mechanisms to achieve them is to prevent and eliminate pollution and take the necessary measures to protect the maritime area against the adverse effects of offshore activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected.

Health, Safety and Environmental (HSE) management systems have now to a large extent become an integral part of the day-to-day operation of the offshore industry. Most operating companies have an HSE management system, many of which are based on a model introduced by the International Association of Oil and Gas Producers (OGP) in 1994. Although there may be some minor elements of difference, it has been shown that this model is fully consistent with that contained in the International Organization for Standardisation's ISO 14000 series and the Eco-Management and Audit Scheme (EMAS) system. The ISO approach embodies a commitment to a continuous improvement in environmental performance.
The Netherlands has reported that, based on a vol-

untary agreement between the Netherlands government and the Dutch Association for the Exploration and Production (E&P) Industry, NOGEPA (Nederlandse olie-en gas exploratie en productie associatie), the E&P operators working offshore of the Netherlands are committed to have had an adequate environmental monitoring system in place since 1996. At this moment most of the Dutch operators do have an environmental monitoring system in place but some of these systems are not yet completely effective, mainly because the systems for monitoring their emissions to air, water and soil, and the amount of waste generated *etc.* are not fully validated. However, a very positive recent development is that most of the Dutch operators do intend to obtain ISO 14001 certification within a couple of years. One operator had already received its ISO 14001 certificate by the end of 2000.

In Norway, effective environmental management systems are implemented through the zero discharge philosophy and the operators' plans for reaching zero discharge, through an overall evaluation EIA, discharge permits and environmental monitoring, and through audits of the operators' internal control systems in relation to the environment and how they comply with ISO 14001/EMAS.

In the UK, an environmental monitoring system is an essential qualification for obtaining a licence to explore for or produce oil or gas. In addition, the UK Environmental Impact Assessment Regulations require the environmental impact of offshore oil and gas projects to be assessed by virtue of the Council Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment (85/337/EEC) as amended by Council Directive 97/11/EC.

8.7 Investigations of Effects of Produced Water and further Development of BAT and BEP

(ED 53)

Most countries report some activities to investigate the effects of produced water, notably laboratory experiments with selected components. The Netherlands and Norway have monitored produced water discharges and the water column. The Netherlands also carried out an active biological monitoring study in 1997 to validate the Chemical Hazard Assessment and Risk Management (CHARM) model. In the UK, a project began in September 2001 to validate CHARM predicted produced water concentrations and to increase the range of fraction released default values for surface active chemicals used by CHARM.

The adoption of OSPAR Recommendation 2001/1 for the Management of Produced Water from Offshore Installations is an important incentive to the development of BAT to reduce discharges of produced water.

During the past two to three years different projects have been undertaken by Denmark to investigate available and emerging techniques for cleaning/handling produced water before discharge, for the purpose of developing objective criteria that can be used in the comparison of different BAT. The results were presented at the OIC meeting in 2001. OSPAR asked the Netherlands to prepare a further revised version of the draft background document concerning BAT and BEP for produced water management and flaring from well testing on offshore oil and gas installations for consideration. As a consequence of the new OSPAR Recommendation on Produced Water Management, descriptions of BAT and BEP will be a task for the OSPAR OIC in future years.

In 1999, approximately 4% of the produced water on the Norwegian shelf was reinjected. At present, bottom separation and down hole separation of oil and water is being tested, and the bottom separation test unit – Troll Pilot – is current in production.

Even if these promising techniques may be implemented on many fields, water discharges are expected to increase in the near future due to the increasing number of ageing fields and new fields coming on stream.

8.8 Decommissioning of Offshore Installations

(ED 54)
As more and more installations will reach the end of their productive life in the near future, the question of their removal and the handling of the waste deposits on the seabed becomes imminent.

At the 4NSC Ministers agreed:
- that decommissioned offshore installations shall either be reused or be disposed of on land;
- to invite OSPAR to implement this agreement by 1997; and
- to also take concerted action within the London Convention 1972 with the aim that the revised Convention would require the disposal on land of decommissioned offshore installations.

At the Ministerial Meeting in Sintra in 1998, OSPAR adopted Decision 98/3 on the Disposal of Disused Offshore Installations. The Decision sets out a general prohibition on the dumping and the leaving wholly and partly in place, of disused offshore installations within the Maritime Area. By way of derogation, if the competent authority of the relevant Contracting Party is satisfied after consulting other Contracting Parties that an assessment in accordance with the framework provided for by the Decision shows that there are significant reasons why an alternative disposal to reuse or recycling or final disposal on land is preferable, exceptions may be considered for the footings of a large steel installation, concrete installation and other installation in exceptional circumstances.

The 1996 Protocol to the Convention on the Prevention of Marine Pollution by dumping of Wastes and Other Matter (the London Convention, 1972), stipulates that, *inter alia*, platforms or other man-made structures at sea may be considered for dumping. The 22nd Consultative Meeting of Contracting Parties to the London Convention 1972 (September 2000) adopted 'Specific Guidelines for Assessment of Platforms or Other Man-made Structures at Sea' which also require the assessment of disposal options other than dumping at sea.

Several offshore installations on the Norwegian continental shelf are redundant or will become redundant in the coming years. All installations that so far have been removed from the Norwegian continental shelf, three fixed installations and nine sub-sea installations, have been taken ashore. The UK installation 'Brent Spar' has been reused as a quay outside Stavanger in Norway. A cessation plan for the 14 Ekofisk installations was completed in 1999. In accordance with OSPAR Decision 98/3, all steel installations will be taken ashore for recycling. It is proposed to leave the Ekofisk Tank in place, and a consultation with other Contracting Parties, in accordance with Annex 3 to the OSPAR Decision, took place during 2001.

In relation to cuttings piles, it has been estimated (Cordah 1998) that over the years a total of 240 installations in the UK and Norwegian sectors of the North Sea are likely to have generated discrete accumulations of drilling waste, known as cuttings piles, on the seabed. The formation of cuttings piles is less likely in the shallow Danish, Dutch, and German sectors of the North Sea due to erosion of the seabed by currents and waves (Gerrard *et al*. 1998). The total cuttings pile volume in the Norwegian and UK sectors has been estimated at about 1.3 million m^3 (Cordah 1998). Individual piles range from 500 to 25 000 m^3, the largest covering areas of up to 22 000 m^2 (Cordah 1998), and having an estimated oil content of 1500–3100 tonnes (Gerrard *et al*. 1998).

A Joint Industry Project on Drill Cuttings, founded by the United Kingdom Offshore Operators Association (UKOOA) member companies and the UK government, and supported by other inter national and international industry associations has investigated a wide range of management solutions for old drill cuttings accumulated in the North Sea.

8.9 Assessment of Achievements

The assessment of achievements concentrates on the main goals agreed upon by the North Sea States, primarily those concerned with reducing the discharges of oil to the maritime area.

8.9.1 Drilling discharges

Work within the Paris Commission (PARCOM), from its establishment to the implementation of PARCOM Decision 92/2 on the Use of Oil-Based Muds (OBM), has played a decisive role in phasing out the input of oil to the North Sea from this source. Since 1997, no member state has discharged cuttings with oil-based mud. From a peak in discharges of more than 25 000 tonnes in 1985, discharges were reduced to zero, thereby reducing the discharges of oil from offshore activities to less than a third in 1999 compared to 1985, despite a considerable growth in oil production.

The spatial extent of the biological impact from drilling seems to have decreased slightly in the Norwegian sector since the discharge of oil-based drill cuttings ceased around 1993. Subtle macrofauna changes have also been detected over 5 km from installations in the UK sector for the period 1975 to 1995. In the period 1997 to 1999 detectable changes in the macrofauna community did not extend beyond 2 km from any Norwegian installation. The area around individual fields having an impacted fauna was mostly in the range 0–20 km^2 until 1996. After 1996 the impacted area has not exceeded 5 km^2 around any field.

8.9.2 Produced water

The discharges of oil via produced water are increasing, due to an increase in the number of production installations, and an increase in water production as the individual fields get older.

The PARCOM Recommendation of a 40 mg/l Emission Standard for Platforms 1986, and the BAT/BEP requirements, has brought the average dispersed oil content of produced water discharged from installations in the North Sea to below 25 mg/l, compared to 33 mg/l in 1991. Figure 8.4 shows that the contribution of oil from the installations exceeding 40 mg/l is now negligible. OSPAR Recommendation 2001/1 recommends a national total reduction of discharges of oil in produced water by a minimum of 15% by the year 2006 (reference year 2000). To bring about further improvements it thus seems necessary to restrict discharges of produced water, either by reinjection whenever feasible, or by developing and applying techniques such as water shut-off, bottom separation and down-hole separation of oil and water. This will also reduce the input of production chemicals and harmful natural components from the reservoir to the North Sea.

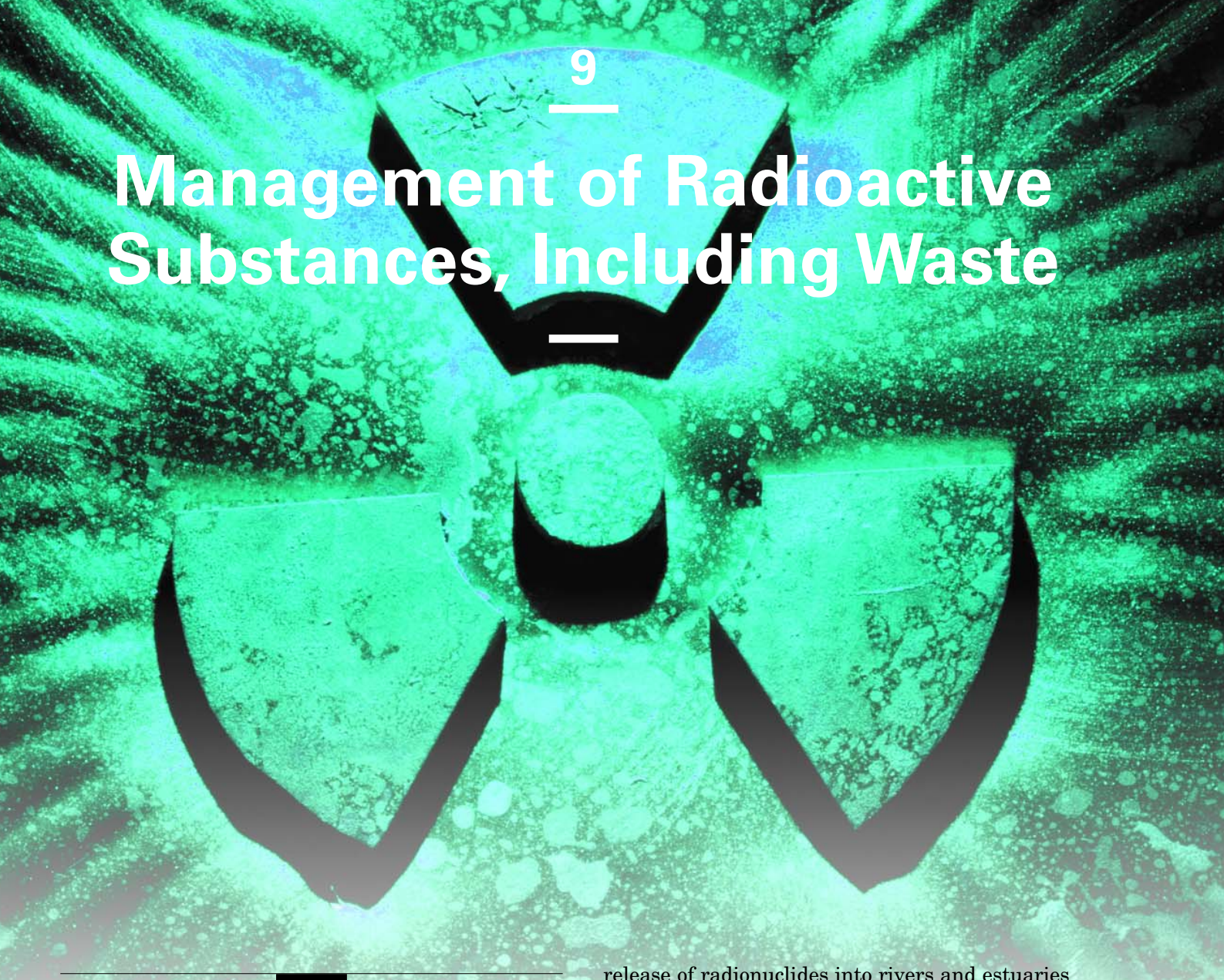
8.9.3 Offshore chemicals

OSPAR adopted OSPAR Decision 2000/2 on the Harmonised Mandatory Control System for the Use and Reduction of the Discharges of Offshore Chemicals. The Decision requires pre-screening, ranking and risk assessment of chemicals and the substitution of certain chemicals by less hazardous alternatives.

8.9.4 Decommissioning of installations/ cuttings piles

OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations prohibited the dumping, and leaving wholly or partly in place, of disused installations within the OSPAR Maritime Area. It recognized the difficulty of removing certain categories of installation, such as concrete installations and the footings of large steel installations, and provided for derogations to the general ban in accordance with an agreed assessment and consultation framework.

In relation to cuttings piles, knowledge of their structure and contaminant content is at present fragmentary, but they are expected to contain a mixture of all the chemicals and additives discharged with the cuttings over time. There is at present a strong initiative from the oil industry and authorities in the UK and Norway to generate the necessary information for an environmentally sound management of these deposits.



9

Management of Radioactive Substances, Including Waste

9.1 Introduction

There are several sources of radioactive substances, including waste management practices, which result in releases to the North Sea. Present day levels are influenced not only by present day management but also by the history of past releases and disposal practices. These include managed discharges from nuclear power related facilities, fallout from atmospheric nuclear weapons testing, fallout from the Chernobyl accident, and other processes involving the use of radioactivity, such as nuclear medical diagnosis and therapy. In addition, a wide variety of naturally occurring radionuclides has been released to the North Sea by human activities, such as oil exploration, phosphate production and terrestrial mining, which can result in enhanced release of radionuclides into rivers and estuaries discharging into the North Sea.

All living organisms are continually exposed to ionising radiation, which has always existed naturally. The sources of the great majority of that exposure are cosmic rays, terrestrial radionuclides in the Earth's crust, their presence in building materials and in the air, water and foods, and those present in the human body itself. In addition, exposure may arise from man-made radionuclides released into the terrestrial and marine environment.

With regard to levels of man-made radionuclides in the North Sea, considerable interest surrounds those discharged from reprocessing plants, particularly the larger facilities sited at Sellafield and La Hague. Discharges of radionuclides are transported from the Irish Sea and the Channel into the North Sea. Discharges of some radionuclides have been detected at low concentrations in the Norwegian Coastal Current, the Barents Sea and beyond.

The Fourth International Conference on the Protection of the North Sea (4NSC) resulted in the Esbjerg Declaration (ED). Several objectives relating to radioactive substances were created, for example, to ensure a sustainable, sound and healthy North Sea ecosystem. The guiding principle for achieving this objective is the precautionary principle. The Ministers at the 4NSC welcomed the adoption of the Safety Fundamentals for Radioactive Waste Management by the International Atomic Energy Agency (IAEA), and affirmed the commitment by the North Sea States to applying these principles. They further considered that preference should be given to all options for the prevention of the generation of radioactive wastes, and for their concentration and containment over other options such as discharges into a water body. They recognized, however, that as part of radioactive waste management, radioactive substances may be released to the environment within authorized limits as a legitimate practice. The Ministers emphasized their commitments within OSPAR to examine options for measures to reduce or eliminate discharges and emissions. The Ministers affirmed their commitment to the application of standards and practices agreed by the European Atomic Energy Community (EURATOM), IAEA, the Nuclear Energy Agency and OSPAR, and supported the IAEA efforts to seek an agreement for a global convention on the management of radioactive waste.

Generally, as noted in the OSPAR Quality Status Report 2000 for the Greater North Sea, inputs of radionuclides from land are in the 'lower intermediate impact' category in terms of the full range of human pressures on the North Sea and their respective priorities. All discharges comply with appropriate regulatory requirements, and in all cases the doses to the critical groups are significantly lower than the limits allowed in EU legislation, which are in accordance with recommendations from The International Commission on Radiological Protection (ICRP). In recent years there has also been an increasing focus on protection of the environment from possible detrimental effects of ionising radiation, and questions are raised whether the principle of protection of man is sufficient for protection of the environment (see section 9.4).

9.2 Discharges to the Marine Environment from European Nuclear Installations

The main sources of current arisings of anthropogenic radionuclides in the North Sea are discharges from reprocessing facilities (Cap de La Hague in France on the Channel coast and Sellafield on the Irish Sea coast). Releases of radionuclides also occur from nuclear fuel fabrication plants, nuclear power stations, and nuclear research and development facilities. Soluble radionuclides from these sources are subsequently transported at low concentrations further northwards with regional oceanic currents.

British Nuclear Fuel's (BNFL) Sellafield plant has been the main contributor to activity releases among the Western European reprocessing plants. Maximum discharges of caesium-137 (^{137}Cs) and the actinides plutonium-239 (^{239}Pu), plutonium-240 (^{240}Pu), and americium-241 (^{241}Am) from Sellafield occurred during the mid to late 1970s (Gray *et al*. 1995). The introduction of the Site Ion-Exchange Effluent Plant (SIXEP) in 1985 subsequently led to a dramatic reduction in discharges of strontium-90 (^{90}Sr), caesium-134 (^{134}Cs) and ^{137}Cs. Plutonium and americium discharges have also been dramatically reduced since that period, particularly since the Enhanced Actinide Removal Plant (EARP) came into operation in 1994.

Prior to 1981, liquid waste from Magnox reprocessing was discharged directly to sea, after several years of decay storage. A decision was taken to store these wastes in tanks, pending the commissioning of a new abatement plant. Consequently, throughout the 1980s and early 1990s (1981–1993), technetium-99 (^{99}Tc) was discharged from Sellafield at a low rate of 1.9–6.6 TBq/yr. In 1994, the EARP plant at Sellafield began operations to treat the backlog of stored wastes. However, while EARP is efficient in removing plutonium and americium it was not designed to remove the less radiologically significant ^{99}Tc from the waste, a fact known to regulators at the time. This resulted in a steep increase of

^{99}Tc, from a level of approximately 5 TBq/yr to a level of 72–190 TBq/yr in the period 1994 to 1996 when liquid waste from the legacy of past activities was processed. In effect, this represented a deferred discharge component. The discharge limit for ^{99}Tc discharges from Sellafield was more than halved in 1999 to 90 TBq/yr. Subject to decisions by Ministers, discharges of ^{99}Tc will remain within the 90 TBq/yr limit until around 2006 when the Environment Agency's proposed limit of 10 TBq/yr would come into effect, and from then onwards discharges will reduce to below the pre-1994 levels. The Magnox reprocessing plant is due to close by around 2012, after the closure of all the Magnox power stations in the UK.

The discharge of ^{99}Tc from Sellafield in the last ten years is shown in Figure 9.1. The illustration also shows the concentration of ^{99}Tc in the seaweed *Fucus vesiculosus* in the northern part of Norway for the period 1997 to 2000. A time delay of about four years is apparent for transport of ^{99}Tc from Sellafield and along the Norwegian coast.

Discharges to the marine environment of ^{99}Tc and ^{137}Cs from Cap de La Hague have been considerably lower than from Sellafield for most of the period from the 1950s to the present day. An exception is the period 1985 to 1992, when liquid waste was stored in tanks at Sellafield. Tritium (^{3}H) discharges from Cap de La Hague have in general been greater than from Sellafield, but the radiotoxicity of ^{3}H is very low.

The nuclear facilities at Dounreay on the northern coast of Scotland were established in 1955, and have mainly been used in the development of fast breeder reactors. Some reprocessing has taken place but, compared with the discharges from the Cap de La Hague and Sellafield reprocessing plants, the discharges to the marine environment have been small. The UK government has ruled out the reprocessing of prototype fast reactor fuel at Dounreay and the site is now being decommissioned.

Springfields in the UK is mainly concerned with the manufacture of fuel elements for nuclear reactors and the production of uranium hexafluoride (HEX). This facility is responsible for most of the discharges from nuclear fuel fabrication. The discharge of liquid radioactive waste from Springfields consists mainly of thorium and uranium and their daughter products. From 2006, manufacture of Magnox fuel and of the fuel intermediate HEX, will cease. Operational discharges of all nuclides from this facility will then rapidly decrease to very low levels. Decommissioning discharges must be considered separately, and no forward projections are currently available.

Nuclear power stations also discharge radionuclides to the environment. The discharges of radionuclides from these facilities are small in relation to the long-range transport of radionuclides.

The discharges of total beta (excluding ^{3}H) and total alpha activity from nuclear installations and reprocessing plants in the OSPAR countries during the decade 1990 to 1999 are shown in Figures 9.2 and 9.3, respectively. A decreasing trend can be seen for alpha discharges in the ten-year period with 1993 as an exception. In the last three years (1997–1999) the discharges of total alpha emitters have been fairly constant. A clear decreasing trend was not observed for beta emitting radionuclides during the ten-year period, but from 1995 a decrease in releases could be observed. However, the total amount of discharges in 1998 and 1999 was about the same level as in 1991 and 1992.

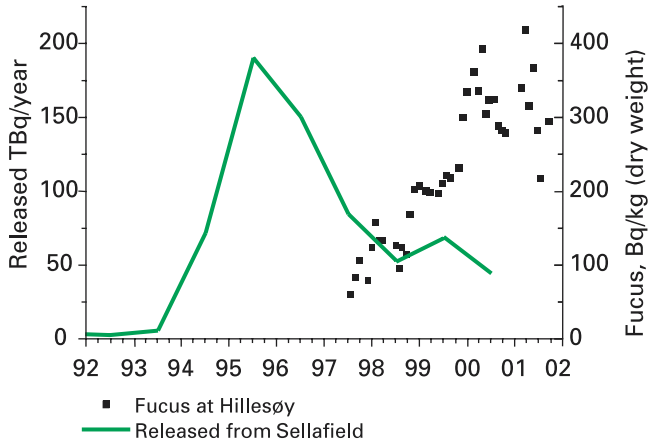


Figure 9.1 *Levels of ^{99}Tc in the seaweed Fucus vesiculosus at Hillesøy, Northern Norway (source of data: Norwegian Radiation Protection Authority (Rudjord et al. 2001), compared to releases from Sellafield (source of data: BNFL).*

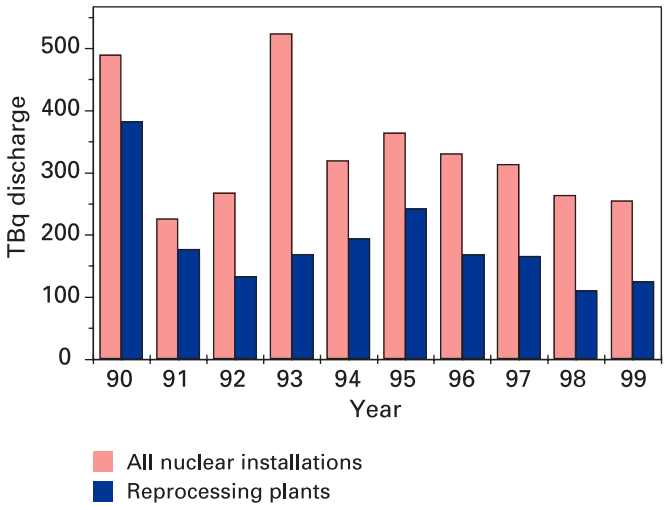


Figure 9.2 *Releases of total beta emitters (TBq), excluding tritium, in liquid discharges from nuclear installations in the OSPAR countries for 1990 to 1999 (Source of data: OSPAR 2001b).*

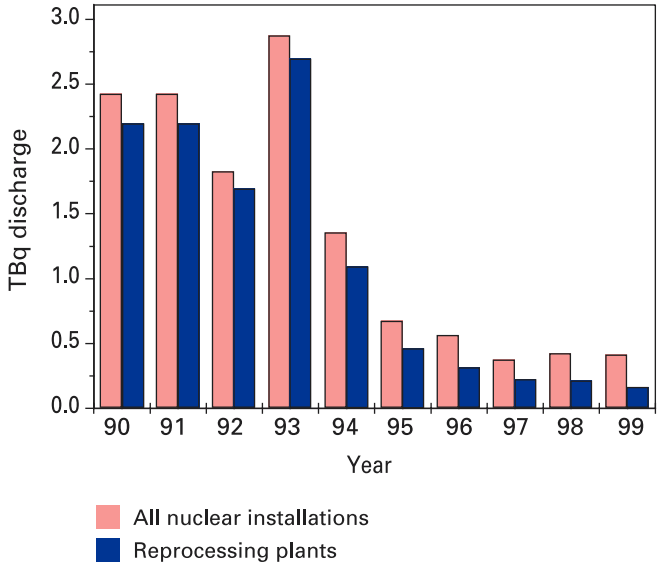


Figure 9.3 *Releases of total alpha emitters (TBq) in liquid discharges from nuclear installations in the OSPAR countries for 1990 to 1999 (Source of data: OSPAR 2001b).*

9.3 OSPAR Strategy with regard to Radioactive Substances – Progress and Achievements

(ED 59)

9.3.1 Progress within OSPAR

OSPAR has adopted a strategy to reduce discharges of radioactive substances to the marine area. The strategy outlines the goals and gives guidelines for evaluating whether work is in accordance with the strategy.

The Sintra Statement from the OSPAR Ministerial Meeting of 1998 brought agreement between the Contracting Parties on a number of important issues. The OSPAR Ministers agreed:

(i) to prevent pollution of the maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background levels for naturally occurring radioactive substances and close to zero for artificial radioactive substances. In achieving this objective, the following issues should, *inter alia*, be taken into account:
- legitimate uses of the sea;
- technical feasibility; and
- radiological impacts on man and biota;

(ii) to ensure that discharges, emissions and losses of radioactive substances are reduced by the year 2020 to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, emissions and losses, are close to zero;

(iii) to pay particular attention to the safety of workers in nuclear installations.

To this end, the OSPAR Commission will:
- undertake the development of environmental quality criteria for the protection of the marine environment from adverse effects of radioactive substances and report on progress by the year 2003;
- continue to reduce radioactive discharges from nuclear installations to the marine environment by applying best available technologies (BAT); and
- review activities which may give rise to concern of this kind, and assess them to identify and prioritize fields where action is required and develop the necessary measures.

To facilitate its work OSPAR has established a Radioactive Substances Committee (RSC) consisting of representatives from the Contracting Parties. At the annual meetings of RSC every Contracting Party reports on its discharges of radionuclides to the marine environment and selected countries describe their use of BAT for reducing discharges from nuclear installations. An important task for the group is to provide guidance on how to implement the OSPAR strategy within the Contracting Parties. On the basis of national reports of each of the Contracting Parties the OSPAR Commission adopted the '2000 Progress Report on the implementation of the OSPAR Strategy with regard to Radioactive Substances'. At the same OSPAR Commission meeting, a programme for the more detailed implementation of the strategy was adopted, which will lead to the establishment of a joint document for presentation at the OSPAR Ministerial meeting in 2003. To achieve that, each Contracting Party has to adopt a national plan for implementing the OSPAR Strategy and present this to the OSPAR Commission.

9.3.2 Achievements through national action

Some of the achievements of North Sea States are listed below.

In June 2000, the UK government published a radioactive discharges strategy for public consultation. This strategy describes how the UK intends to implement the agreements reached at the 1998 Ministerial meeting of the OSPAR Commission set out in the extract from the Sintra Statement quoted in section 9.3.1. BAT, the precautionary principle, the polluter pays principle and the As low As Reasonably Achievable (ALARA) principle all feature in the strategy. The Consultation ended on 22 September 2000, and a final UK Strategy will be published shortly. At the same time the government is issuing Statutory Guidance to the Environment Agencies to provide the vehicle through which the UK strategy will be implemented. Final Guidance is also expected shortly. The Environment Agency recognizes that there may be a need for BNFL to increase discharges in the short term as a consequence of measures to reduce the hazard potential associated with historic waste legacies and decommissioning of redundant plants. The Agency has indicated that it is prepared to increase discharge limits, subject to appropriate consultation, in those instances where they are essential to allow for decommissioning redundant plants to reduce the hazard potential associated with legacy waste.

France reports that BAT has been applied in all of its nuclear installations to reduce or eliminate radioactive discharges. An example is the introduction of the new effluent management system at Cap de La Hague. In May 1995, decree 95-540 set a new framework for the regulation of all types of Basic Nuclear Installation releases and water intake. The authorization order sets limits on radioactivity and radioactivity flow. A second order of November 1999 sets limits for specific radionuclides before and/or after dilution in water. The regulatory limits are consistent with the dose constraint principle. France has also introduced new release limit values for nuclear installations, which has lead to the industry adopting new processes in order to reduce or eliminate discharges to the marine environment.

New legislation and regulations in Sweden have included the concept of BAT and have suggested that it is the most effective measure available to limit the release of radioactive substances which may be harmful to health and the environment without entailing unreasonable costs. The nuclear facilities monitor all their discharges within the vicinity of the installation, and this has revealed that all discharges in 1999 and 2000 were below the dose constraint (0.1 mSv/yr to individuals of the critical group). Environmental monitoring of discharges plays an important role in assessing long-term trends. The Swedish Radiation Protection

Institute has not identified any evidence to indicate that discharges from nuclear power plants cause any upward trends in the concentrations of radioactive nuclides in biota. According to present knowledge, the low concentrations observed in the marine ecosystems have not been found to cause harm. There is increased awareness of the need to reduce radioactive discharges in Sweden, due to the demands of national authorities and the requirements of international conventions.

Germany has introduced BAT into the operation of all nuclear power plants to ensure that radioactive discharges, emissions and wastes are kept as low as reasonably possible. State-of-the-art scientific and technological advancements have been taken into account in the safety standards for activity control and management.

Between 2000 and 2004 the situation in the Netherlands is such that the installations with the largest liquid discharges of radioactive substances (the two phosphoric acid producing facilities and the nuclear power plant in Borssele) have ceased or will cease their activities. This will eliminate liquid discharges from these facilities. Also, liquid discharges due to the normal operation of the nuclear power plant at Dodewaard have already been eliminated, owing to its shut-down in 1997. In addition, the Netherlands uses the ALARA principle in licensing to ensure that radioactive discharges, emissions and wastes are kept as low as reasonably possible. ALARA is considered to be in line with BAT.

9.4 Establishing a Framework for Protection of the Environment

(ED 57 iii and 60)

International radiological protection has historically been focused on the protection of man. ICRP has stated the view that 'if man is adequately protected then other living things are also likely to be sufficiently protected' (ICRP 1977). In the 1991 publication, the ICRP added a sentence stating that 'individual members of non-human species might be harmed but not to the extent of endangering whole species or creating imbalance between species' (ICRP 1991). Under most circumstances this principle leads to sufficient protection of the environment from observable harm, largely due to the fact that dose limits to man are set at a low level where effects at even the most vulnerable part of a food web are unlikely. However, the ICRP has now established a working group to consider a need for guidelines and criteria to focus on the environment.

In 2000, the International Union of Radioecology (IUR) presented a first approach for an international framework for protection of the environment. This includes criteria and principles for protection, identification of endpoints, use of reference organisms, development of quantities and units, and dose-effect relationships. IUR is now further developing this framework. The European Commission has shown increasing interest in the field of environmental protection. At present, two European Commission research projects based on the idea of the IUR framework are underway. National research projects are also focusing on the subject of protecting the environment from detrimental effects caused by radiation.

One European Commission project, as part of the Fifth Framework Programme, aims to establish a framework for the assessment of the environmental impact of ionising radiation. This programme is called the Framework for the Assessment of Environmental Impact (FASSET), and will link current knowledge on sources, exposure, dosimetry, environmental effects and consequences for reference organisms and ecosystems. The aim is to take a practical approach to the assessment of detrimental environmental effects. It will be based on existing models and techniques, although these may be applied in new contexts and developed further in some areas. The project will develop operational criteria for regulations for the protection of human health and the environment and will provide an interface between the regulators and the end-users. This project will run until October 2003.

The UK's Environment Agency has reviewed the impact assessment of ionising radiation on wildlife (Environment Agency 2001). This work is due to feed into FASSET. The report summarizes the latest research on the behaviour, transfer and impact of

ionising radiation on wildlife, outlines and reviews international legislation that impacts upon national requirements, considers the role of regulatory bodies, and recommends an approach to assess the impacts to wildlife of ionising radiation.

Environmental protection issues constitute integral parts of environmental impact assessments (EIAs), which involve consultation procedures, reviews, inquiries, *etc.* Demands for EIAs are specified in EU legislation (*e.g.* Council Directives 85/337 and 97/11).

In a recent publication, the IAEA reviewed a number of international approaches to environmental radiation protection, as well as the approaches, criteria, and regulations currently being implemented in 12 IAEA member states (IAEA 1999). The majority of these states apply the ICRP approach, or develop approaches that are consistent with the ICRP approach. The ICRP is in the process of reviewing its recommendations, which includes its position on environmental protection.

9.5 Management of Radioactive Waste

(ED 57 and 62)

9.5.1 Presentation of the new IAEA Waste Convention

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the first legal instrument to directly address these issues on a global scale, was opened for signature on 29 September 1997 and entered into force on 18 June 2001.

The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear reactors and applications, and to spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes, or when declared as spent fuel or radioactive waste for the purpose of the Convention by the Contracting Party. The convention also applies to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities.

The procedure for preparing and reviewing national reports from each Contracting Party on the implementation of the Joint Convention will be decided at a preparatory meeting in December 2001. The deadline for the receipt of these reports will be June 2003, and the review meeting will take place in December 2003.

The obligations of the Contracting Parties with respect to the safety of spent fuel and radioactive waste management are based to a large extent on the principles contained in an IAEA Safety Fundamentals document (IAEA 1995). They include, in particular, the obligation to establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management and the obligation to ensure that individuals, society and the environment are adequately protected against radiological and other hazards, *inter alia*, by appropriate siting, design and construction of facilities, and by making provisions for ensuring the safety of facilities both during their operation and after their closure. The Convention imposes obligations on Contracting Parties in relation to the transboundary movement of spent fuel and radioactive waste, based on the concepts contained in the IAEA Code of Practice on the International Transboundary Movement of Radioactive Waste. Also, Contracting Parties have the obligation to take appropriate steps to ensure that disused sealed sources are managed safely.

9.5.2 National waste treatment strategies

Some of the achievements of North Sea States are listed below.

The UK government's policy on radioactive wastes is that they should be managed in ways that protect the safety of the public, the workforce and the envi-

ronment now and in the future. On 12 September 2001 the government published a consultation paper on the management of radioactive waste with the aim of starting the process that will ultimately lead to the implementation of a radioactive waste management policy that is capable of commanding widespread support across the UK. The public consultation will remain open until March 2002, when the government will consider the responses received. Any comments will then feed into the research and consultation programmes that are planned in the future.

In France, waste management has two objectives in relation to environmental protection: to avoid the dissemination of radioactive substances, and to limit the constraints for future generations. To enable these objectives to be met, the waste producers must comply with Law 75-633, July 1975, which states that it is the responsibility of the waste producer to look after the waste. This Law has been supplemented by the Order of December 31 1999, which ensures that the waste producers monitor and define all wastes, and maintain inventories (*i.e.* undertake waste surveys). Law 91-1381 of December 1991 defines the main areas of research for the management of radioactive waste in France, namely: separation and transmutation, underground laboratories, and waste packaging and long-term storage.

The Swedish Radiation Protection Institute has adopted three new regulations since the last North Sea Conference concerning the management of radioactive substances. These comply with the relevant statements from the 4NSC. The first regulation, SSI FS 1998:1, introduces the concept of BAT to the final management of spent nuclear fuel and nuclear waste, with the aim of protecting human health and the environment from the harmful effects of ionising radiation. The second regulation, SSI FS 2000:12, specifies limits and discharge reductions for radioactive substances from nuclear installations, it also enables the potential for reducing discharges further. The third regulation, SSI FS 2001:1, concerns means to ensure that radioactive waste is managed in such a way as to provide an acceptable level of radiation protection, minimize the generation of waste and limit the harmful effects of ionising radiation now and in the future.

In Germany, the nuclear power plants use procedures to minimize the production of waste, such as quality of design of fuel elements, monitoring of primary coolant, and treatment of waste water by filtration, ion exchange and evaporation. Radioactive discharges are kept as low as reasonably possible with the help of operating guidelines, specialized training of staff and differentiated preparatory work. Solid waste is stored on site until an interim facility is designed. Plans to use the Gorleben salt dome as a repository are currently on hold for at least three years, pending clarification of the safety case, and to allow alternative sites and other rock types to be investigated.

In Norway, authorizations for nuclear installations are issued on the basis of the Act of 12 May 2000 No. 36, relating to radiation protection and the use of radiation. The act, which came into force 1 July 2000, replaces the previous Norwegian legislation dealing with radiation protection of man. The new act states that the purpose of the law is also to contribute to the protection of the environment from possible harmful effects of radiation.

According to a policy statement on radioactive waste management, adopted by the Netherlands government in 1984, the conditioned waste is kept in storage in an engineered storage facility for an extended period of time. Storage is conceived to last for a period of at least 100 years. Currently only the facility for the storage of low and intermediate level waste is in operation. The storage facility for high level waste (HABOG) is under construction and is due to be commissioned in 2003. The latter storage facility is designed to accommodate reprocessed and vitrified spent fuel from the nuclear power stations, conditioned spent fuel from the research reactors as well as other types of high level waste. Meanwhile research on geological disposal is ongoing.

9.6 Anthropogenically Enhanced Concentrations of Natural Radionuclides

(ED 61)

Industry uses many different raw materials that contain naturally occurring radioactive materials (NORM). These raw materials are mined, transported, and processed for further use. The consequent emissions of radionuclides to air and water can lead to eventual exposure of humans. The oil and gas production in the North Sea can be regarded as an industry source of leakages or discharges of radionuclides to the marine environment.

9.6.1 Technologically enhanced NORM in oil and gas production

Two isotopes in the uranium and thorium series are important in relation to produced water discharges and radioactive deposits in oil and gas production – namely radium-226 (^{226}Ra) and radium-228 (^{228}Ra).

The occurrence of natural radionuclides in North Sea oil and gas production was first discovered in 1981, and enhanced levels of radioactivity are now found in the production system of several North Sea oil fields. Doses to workers involved in handling contaminated equipment or waste are usually low, and the main problems related to radioactive deposits are waste disposal and discharges of produced water.

Seawater is injected into the reservoir to maintain the pressure as the oil is removed. Mixing of seawater and formation water creates incompatible solutions, and sulphates are precipitated. The dominating radioactive elements in geologic formations in the sea floor are potassium and the elements in the uranium, thorium and radium series. Under certain circumstances, radium will leak from the formation and be dissolved in the formation water.

Generally, the activity concentrations of ^{226}Ra, ^{228}Ra and decay products in deposits and sludges vary from the normal levels in soils and rocks (less than 0.1 Bq/g) to more than 1000 Bq/g. In Norway in 1995, a temporary exemption level of 10 Bq/g of ^{226}Ra was introduced. All waste from the oil industry with activity above this level is defined as 'radioactive waste'. The amount of waste exceeds that expected when the Norwegian repository was planned, and the authorities have since then decided that other solutions should be found.

9.6.2 Discharges of production water

Most of the radioactivity from the reservoir is dissolved in produced water and discharged into the sea. A total volume of 160 x 10^6 m^3 was released in 1991. Assuming that the mean radium concentrations of production water in the Norwegian study are representative values for the oil production of the North Sea, this would correspond to a total annual release of 6.6 x 10^{11} Bq and 3.4 x 10^{11} Bq for ^{226}Ra and ^{228}Ra, respectively. Prior to the introduction of OSPAR Recommendation 2001/1, it had been estimated that the release of production water would increase in the years to come, owing to the fact that some of the larger production fields would reach a later stage in the production phase.

Scale inhibitors are often used to prevent the deposition of radium salts which may affect the production process, but in consequence they increase the concentration and the release of radioactivity in the produced water. The inhibitors are organic compounds, and they may increase the biological uptake of radioactivity in marine ecosystems. There has been an increase in the use of inhibitors during the last decade, and owing to present and future demands to reduce the production costs, the increase in the use of inhibitors in the years to come is assumed to be significant.

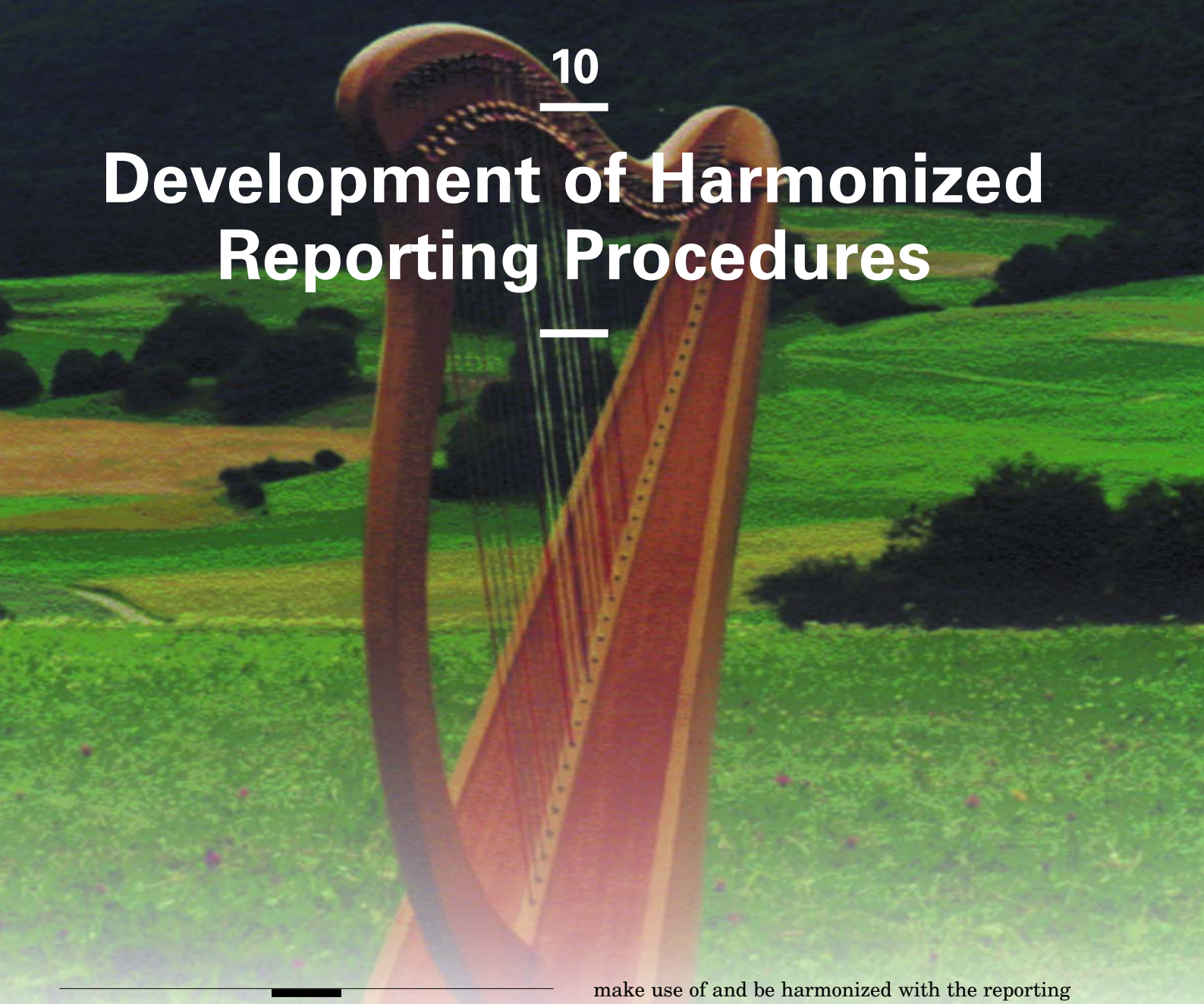
9.7 Assessment of Achievements

9.7.1 Discharges to the environment and management of radioactive waste

In general it can be concluded that the total release of radionuclides into the marine environment has decreased since 1995. New abatement technologies have been developed and implemented in certain countries. The present practices of releases to the environment are within the national and international accepted dose limits for critical groups and the general public. The OSPAR Sintra Statement sets out clear principles for progressively reducing discharges, the timetable for achieving these reductions and their ultimate objective. OSPAR Contracting Parties have committed themselves to the development and implementation of relevant strategies to achieve these reductions.

9.7.2 Protection of the environment

At the 4NSC Ministers agreed that protection of the environment from possible detrimental effects caused by radiation was an important issue. Now, seven years later, it is evident that there has been a growing interest in this field, and it has been put up as a target issue by several international organizations as well as within individual countries. In 2000, IUR presented a first approach for an international framework for protection of the environment. This can form the basis for further work in this area.



10 Development of Harmonized Reporting Procedures

10.1 Introduction

(ED 66 and 67)
At the Fourth International Conference on the Protection of the North Sea (4NSC), Ministers noted that the lack of harmonized procedures for collecting, handling and reporting of data made comparisons between states difficult. The Ministers therefore agreed to develop and implement a system for reporting regularly on measures taken to implement their commitments, the result from these measures and the effects observed in the environment as a consequence. They emphasized that such a system must be based on a common set of procedures and to the greatest extent possible, make use of and be harmonized with the reporting procedures of the European Commission, the European Environment Agency (EEA) and the OSPAR Commission (OSPAR).

The Ministers invited Norway, in cooperation with the European Commission and the EEA, to offer its services as lead country within OSPAR, to promote and coordinate the necessary reporting systems and procedures, as a basis for transparent, reliable and comparable reports, including relevant sources, basic figures, calculation methods and emission factors.

Norway gave priority to developing quantification and reporting procedures for nutrients and hazardous substances, because commitments to achieve quantitative reduction targets had been agreed for these substances at previous North Sea Conferences.

10.2 Harmonized Quantification and Reporting Systems for Nutrients

The background to the request for harmonized reporting systems for nutrients was, *inter alia*, that there were different practices among North Sea States concerning quantification and reporting on discharges and losses of nutrients to surface water systems, which resulted in a lack of transparency and comparability between the national reports.

10.2.1 Identification of key issues

Key issues/elements to be included in the development of Harmonised Quantification and Reporting Procedures for Nutrients (HARP) were the catchment approach, quantification of agricultural nutrient losses to surface waters, quantification of nutrient discharges from point sources to surface waters, nutrient background load, normalization of data, nutrient retention and riverine monitoring.

10.2.2 HARP Guidelines

The degree of harmonization required was one of the key issues addressed during the HARP project, as it had appeared unrealistic from the outset to think that a 'one-solution-system' could be developed and unanimously agreed by the parties concerned. Thus, a series of guidelines were developed which, in many cases, presented alternative quantification methods. These were developed between 1996 and 1999 under the lead of Norway, assisted by most OSPAR countries.

The project resulted in a set of nine guidelines, collectively covering quantification methodology and reporting requirements for all major nutrient sources, and retention and inputs to the sea, including monitored riverine inputs.

During the HARP project it became apparent that Harmonised Quantification and Reporting Procedures for Nutrients were also of great interest to organizations other than OSPAR, *e.g.* the Rhine Commission, the EEA, the Helsinki Commission (HELCOM), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Environment Programme (UNEP). However, taking into account that HARP needed to be operational within a relatively short time frame in order for a transparent and harmonized reporting system to be presented to Ministers at meetings within both the North Sea Conference and OSPAR frameworks (2002 and 2003 respectively), Norway considered that it was important to establish HARP within OSPAR, as a first step.

At its meeting in 2000 the OSPAR Commission adopted eight of the HARP Guidelines on a trial basis for three years. OSPAR also agreed on terms of reference for a working group on revisions of the guidelines. These revisions are to be based on experience from the first full-scale use of the guidelines, reporting on the 50% reduction targets, and on new developments regarding the quantification of diffuse sources. The remaining HARP Guideline, on the quantification and reporting on diffuse sources of nutrients, was not considered to be sufficiently developed for adoption.

It was therefore considered necessary to conduct an inter-comparison study of quantification methodologies. This EC-funded shared-cost project 'Towards European Harmonised Procedures for Quantification of Nutrient Losses from Diffuse Sources' (EUROHARP) related to the Water Framework Directive, is intended to run for four years with the participation of 22 European organizations from 17 European countries. It will assess the performance of eight quantification tools/methods used by European countries to quantify diffuse losses of nutrients. The outcome of EUROHARP is intended to facilitate the finalization of the guideline on diffuse sources.

The Guidelines were published by the Norwegian Pollution Control Authority (SFT 2000) and are contained in OSPAR Agreement 2000/12.

10.2.3 Experience with the use and need for further development

The main objectives of the HARP Guidelines are to achieve transparency, harmonization and comparability between countries. All North Sea States,

except France, have used the HARP Guidelines to a varying extent for reporting on discharges/losses and inputs of nitrogen and phosphorus in 1985 and 2000, as it was agreed to apply these guidelines for the reporting on nutrient inputs to the 5NSC. However, the late and varying reporting basis does not allow any assessment of nitrogen and phosphorus discharges/losses/inputs at the catchment scale.

The setting up of the HARP system, the reporting requirements and countries' compliance indicate relative weaknesses in the current national systems because few countries, if any, have been able to apply the guidelines completely, nor to provide all the information necessary for a harmonized, transparent, comparable reporting and a reliable assessment of progress towards achieving the 50% reduction targets. Even if the countries have completed the electronic HARP reporting format, it is often difficult to assess whether the methods recommended in the HARP Guidelines have been applied.

These objectives can only be achieved if countries report complete sets of data and use the recommended methods. The trial application of the HARP Guidelines may indicate that previous reporting on nutrient discharges and losses to the 3NSC and the 4NSC should not have allowed comparison between countries, because the quantification procedures applied varied considerably.

10.3 Harmonized Reporting Systems for Hazardous Substances

10.3.1 The HARP-HAZ Project

A prototype for harmonized quantification and reporting procedures for hazardous substances (the HARP-HAZ Prototype) has been developed by Norway, as lead country, assisted by a working group with representatives from DG Environment of the European Commission, the EEA, Belgium, Denmark, Finland, the Netherlands, Sweden, the UK, CEFIC (the Conseil Européen des Fédérations de l'Industrie Chimique), Eurostat and the 5NSC Secretariat. The procedures under the HARP-HAZ Prototype are, to some extent, substance-specific and have been designed to provide guidance in particular for hazardous substances selected for action within the North Sea-related frameworks. They draw on established procedures developed within OSPAR (the Riverine Inputs and Direct Discharges (RID) methodology), the European Commission and other international forums (*e.g.* the Rhine Commission) on the quantification of the sources of discharges, emissions and losses of hazardous substances and on the selection of hazardous substances for action. As regards the latter, relevant lists established at the international level were taken into account, *e.g.* the OSPAR List of Chemicals for Priority Action, the lists of 36+ hazardous substances mentioned in the Ministerial Declarations of the previous North Sea Conferences and the EC Water Framework Directive list of priority substances.

10.3.2 What has been achieved?

The work has resulted in the HARP-HAZ Prototype, which contains a general description of approaches and principles for quantification methods (the overall HARP-HAZ Guidance document) and separate guidance documents for 11 selected hazardous substances/groups of substances:

- dioxins (polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs));
- polychlorinated biphenyls (PCBs);
- polyaromatic hydrocarbons (PAHs);
- short chained chlorinated paraffins (SCCPs);
- mercury;
- cadmium;
- lead;
- lindane (y-HCH);
- tributyltin/triphenyltin (TBT/TPT);
- nonylphenol/ethoxylates (NP/NPEOs); and
- brominated flame retardants.

The first version of the HARP-HAZ Prototype has been tested in the reporting on hazardous substances to the 5NSC. The aim is that the HARP-HAZ Guidance documents and the experience gained in their application, will be of use within other international frameworks where reporting requirements are being developed or revised.

Although there is a need for further development, the guidance documents represent the first step towards harmonization and transparency as regards quantification and reporting on some of the most important hazardous substances/groups of substances.

The guidance documents deal with the quantification and reporting on discharges, emissions and losses of hazardous substances from various sources and their inputs/entry routes to the North Sea. They provide an indicative overview of the important sources of the selected hazardous substances, taking into account that the actual importance of the different sources may vary from country to country. The guidance documents also include a description of the general principles for this quantification/estimation, and emission loss factors are provided for some of the sources.

The general HARP-HAZ procedures (*e.g.* regarding nomenclature) may also be used when carrying out quantification of discharges, emissions and losses for other hazardous substances. Further relevant information and details are given in the report from the Norwegian Pollution Control Authority (SFT 2001).

10.3.3 Experience with using the HARP-HAZ Prototype and the need for further development

The experience gained by the North Sea States in applying the HARP-HAZ Prototype guidance documents for reporting to the 5NSC has provided valuable input and experience for their further elaboration.

Table 5.3 in chapter 5 indicate that a certain degree of transparency has been achieved in the reporting to the 5NSC. However, this first round of reporting shows that there are still some problems to be resolved before harmonized reporting can be achieved, which produces reliable, transparent and comparable data.

The 'main groups of sources' (*e.g.* agricultural activities, transport and infrastructure, households, industrial activities (IPPC), waste disposal) for which reporting is required each include a large number of sub-sources. These sub-sources contribute to the figures reported for each of the main groups of sources and must be identified in order to obtain full transparency and comparability of the data.

The following items were identified by North Sea States as problematic when reporting in accordance with the HARP-HAZ Prototype:

- reporting on reductions requires detailed data for a large number of substances (about 40);
- reporting on reductions requires detailed data for these substances from the reference year 1985 (although it was anticipated that 1985 data could not be provided retrospectively in all cases); and
- the Nomenclature for Sources of Emissions (NOSE), which is also used for the European Pollutant Emission Register (EPER) established under the EC Integrated Pollution Prevention and Control (IPPC) Directive, was new and had not been incorporated into the national systems of many countries since EPER reporting is not due to start until 2003.

In addition, it was very time-consuming and sometimes not feasible to obtain the large number of required release data and to adjust them, *e.g.* from other international reporting systems such as the EEA CORINAIR (CO-ordination of INformation on AIR emissions) Programme, to the new HARP-HAZ system.

The estimation and reporting of data for the reference year 1985 was a problem for several countries due to a lack of reliable information for a number of substances. If a reference year is required in future, it should preferably be a more recent year from which better data are available.

In order to be fully effective, the HARP-HAZ approach will need to mesh with the various international reporting requirements on hazardous substances, in particular those of the European Commission. There is still considerable work to be done before a coherent framework that will enable transparent and comparable reporting will be in place. However, the experience gained in the development and testing of the HARP-HAZ Prototype has been a significant step in this process and forms an important building block for further work.

As it is likely to take some time for countries to adjust their national routines and systems, it is clear that to comply fully with the requirements set out in the new reporting procedures, it will be important not to change new sets of reporting procedures too frequently.

10.4 Harmonized Reporting on other Issues

There is at present no standardized reporting to OSPAR on the use and discharge of chemicals from offshore installations. However, work is being done to establish a reporting system for the most harmful chemicals. Norway, as lead country, presented a proposal in 1998 which was agreed on a trial basis for two years. On the basis of the experience gained Norway will propose a revised reporting format for the most harmful chemicals to OSPAR 2002.

There is also a need for better coordination and harmonization of reporting on emissions and discharges from ships.

10.5 Assessment of Achievements

Harmonized reporting systems have been developed for the reporting on discharges, emissions and losses of nutrients and hazardous substances. Guidelines for harmonized reporting on nutrients (the HARP Guidelines) have been adopted on a trial basis by OSPAR. The guidelines for harmonized reporting on hazardous substances are at a prototype stage. There is still a need for revision and further development of both sets of guidelines and procedures.

The first round of reporting shows that there are still problems to be resolved before harmonized reporting, in the sense of data and data products being both transparent and comparable, can be achieved. For national purposes, all countries have sophisticated systems and procedures in place to monitor, calculate, model and report on nutrients and hazardous substances, and it will take time and a sensible approach to adapt and harmonize these national approaches to international requirements. In this context, the experience gained by applying the guidelines and procedures for reporting to the 5NSC is an important basis for the further development of harmonized procedures within OSPAR and the European Commission.

Other organizations, *e.g.* the Rhine Commission, the EEA, HELCOM, the OECD and UNEP, have shown great interest in the harmonized quantification and reporting procedures.

An essential task for monitoring the actual progress towards fulfilment of the one-generation target for hazardous substances is to develop suitable reporting and assessment strategies for the selected priority substances. OSPAR has agreed to build on the experience gained from implementing the HARP-HAZ Prototype methodology within the North Sea Conference framework in the development of its reporting procedures. The section of the HARP-HAZ Prototype that deals with large industrial sources will in any case be of future use as it is identical to the EPER system for the IPPC Directive, in accordance with which reports have to be produced in 2003. Any future system will also need to take account of the monitoring and reporting requirements being developed under the EC Water Framework Directive in order to make best use of limited resources.

Annex 1:

History of the North Sea Conferences

Reference: Chapter 2 of the Progress Report to the 4th International Conference on the Protection of the North Sea, Esbjerg, Denmark 8–9 June 1995.

Background

In June 1980 the Council of Environmental Advisors, an independent body of experts appointed by the German government, presented its report on the environmental problems of the North Sea. The report concluded that, although there was considerable difficulty in obtaining empirical ecological evidence, there was a case from the limited knowledge about pollution loads that certain harmful substances could cause long-term and perhaps irreversible damage as a result of their chronic toxicity. The growing inputs of heavy metals, chlorinated hydrocarbons (and especially PCBs) and other persistent substances were identified for action. The Council of Environmental Advisors concluded that:

- a successful environmental protection policy for the North Sea had to be based on the "precautionary principle" (Vorsorgeprinzip);
- protection of the North Sea was only possible through international cooperation.

The early 1980s were characterized by certain changes in the economic and sociological climate which, although they differed in their intensity from one country to another, nevertheless affected all North Sea riparian states to some degree. Many countries experienced severe recession affecting particularly the older, and generally more polluting, heavy industries; consequently, there were political pressures not to impose too stringent environmental conditions on industry.

On the other hand, there was growing environmental awareness, particularly in the countries of

northern Europe, which expressed itself in different forms, from the growth of dedicated non-governmental organizations (NGOs) to the formation of specific "green" parties with their own political agenda. Even though such parties did not constitute the parties of government, their opinions and actions were influential in requiring all political parties to reconsider and assess their own policies towards environmental protection.

Furthermore, some countries were dissatisfied with the lack of progress in the competent international organizations charged with protecting the marine environment. In part this was due to the wider geographical coverage of the bodies concerned and the lack of focus at North Sea level.

It was in this climate that in 1983 the government of the Federal Republic of Germany took the initiative of inviting the North Sea coastal states to an International Conference on the Protection of the North Sea at ministerial level. From the outset it was acknowledged that it would not be the aim of the Conference to create a new set of international agreements. On the contrary, the aim was to provide political impetus for the intensification of the work of the competent commissions and international bodies and to ensure more efficient and effective implementation of the existing international rules in all the North Sea States.

Bremen, 1984

History

The discovery of a number of oiled seabirds washed ashore in the German Bight during the winter of 1983 was a further occurrence which prompted the German government to propose an international conference for the protection of the North Sea environment. The purpose was to make a political declaration which, from a North Sea perspective, would stimulate and further ongoing work within the existing international conventions (*e.g.* the Oslo Convention for dumping at sea; the Paris Convention for pollution from land-based sources; the IMO Conventions for shipping issues).

At a preparatory meeting of all the North Sea coastal states in December 1983 an important agreement was reached that the Conference should not restrict itself to general principles but should examine all pollution sources and adopt definite decisions. The decision to address all pollution sources ensured that a holistic approach to the North Sea's environmental problems would be followed and it enabled both ministers and their advisors to look at the wider problems rather than through the constraints imposed by the respective scope of the existing international legal frameworks.

In preparation, expert groups compiled resolution proposals on the range of subjects to be discussed at the Conference. Subsequently, a hearing took place in August 1984 at which international associations and NGOs presented their suggestions. In September 1984 the preparatory work was concluded in Wilhelmshaven at a meeting of the permanent Secretaries of State responsible for North Sea affairs. Finally, the Conference itself was held in Bremen from 31 October to 1 November 1984 and was attended by the Ministers responsible for the protection of the North Sea of all the riparian states (Belgium, Denmark, France, the Federal Republic of Germany, the Netherlands, Norway, Sweden and the United Kingdom) and by the Member of the European Commission responsible for environmental protection. Observers from the states which were parties to the Oslo and Paris Conventions and member states of the EEC also attended the Conference, as did representatives of the international bodies concerned.

Although the Bremen Conference was initially envisaged as a unique event, the Ministers welcomed the invitation of the United Kingdom government to host a Second International Conference on the Protection of the North Sea for the purpose of reviewing the implementation and effectiveness of the decisions taken in Bremen and to adopt further concrete measures for the maintenance of the quality of the North Sea.

Principal outcome

In the Bremen Declaration the Ministers underlined their joint responsibility in safeguarding the North Sea as an important and irreplaceable ecosystem, and in doing so they undertook to bring

forward a number of initiatives to improve the protection of the North Sea. These initiatives focused on five main areas:

- reduction of inputs from rivers and coastal waters to the North Sea by quickly establishing further internationally binding measures;
- reduction of atmospheric pollution through the preparation of a new Protocol to the Paris Convention;
- reduction of pollution from ships, off-shore platforms and waste dumping at sea, as well as strengthening the possibilities to combat oil pollution by extension of existing conventions and cooperation (*e.g.* by coordinated aerial surveillance);
- promotion of environmentally compatible technologies and products;
- improvement of joint monitoring and assessment of the North Sea environment.

The Bremen Conference brought together for the first time the Ministers responsible for the protection of the North Sea environment to discuss common problems in a specific geographical context. It brought political focus on an important ecosystem which is the responsibility of all neighbouring states. It did indeed result in increased activity within the international fora as a result of the heightened political interest. Perhaps most significantly, it paved the way for further political activity on the North Sea at subsequent Ministerial Conferences.

London, 1987

History

The United Kingdom set out with the intention that the London Conference should reach conclusions about the state of the North Sea having regard to the best scientific evidence available, in other words that it should be science based and the preparatory work would produce a comprehensive quality status report (QSR) of the North Sea environment. The focus of the London Conference was essentially determined by the political priorities of the North Sea States. After 21 months, the preparatory work was concluded at a meeting of the permanent Secretaries of State in Edinburgh in September 1987. The Second International Conference on the Protection of the North Sea took place in London on 24 and 25 November 1987 and was attended by representatives of the same interests as the First Conference. For the first time, NGOs were permitted to attend the opening session only and make brief statements to the Conference.

Based on the gaps in the data in evidence in the QSR, the London Conference concluded that there was a need to enhance the scientific knowledge and understanding of the North Sea. Although a great deal was known, the QSR showed that there were still shortcomings in the data and that it was not possible to make links between contaminant levels and environmental changes. The Oslo and Paris Commissions and ICES were therefore charged with establishing a joint working group, which was subsequently instituted as the North Sea Task Force (NSTF), to organize a coordinated scientific programme leading, in a reasonable timescale, to a dependable and comprehensive statement of circulation patterns, inputs and dispersion of contaminants, ecological conditions and effects of human activities in the North Sea.

Principal outcome

One of the most important political decisions at the London Conference was the acceptance by all North Sea States that the basis of their action in regard to the reduction of inputs of substances that are persistent, toxic and liable to bioaccumulate should be based on "the principle of precautionary action" and that such inputs should be limited "by the use of the best available technology and other appropriate measures". The key elements of the political programme which was agreed at the London Conference were:

- a substantial reduction (of the order of 50 %) between 1985 and 1995 in total inputs to the North Sea via rivers and estuaries of substances that are persistent, toxic and liable to bioaccumulate;
- a substantial reduction (of the order of 50 %) between 1985 and 1995 in inputs of phosphorus and nitrogen to those areas of the North Sea where such inputs are likely, directly or indirectly, to cause pollution;

- to prepare national action plans to achieve both these goals;
- to reduce atmospheric emissions of pollutants from key industrial and other sectors by taking appropriate action, including the use of strict emission standards based upon best available technology, if practicable within 4 years;
- to phase out the dumping of industrial wastes in the North Sea by 31 December 1989;
- to reduce the use of marine incineration by not less than 65 % by 1 January 1991 and to phase out the practice totally by 31 December 1994;
- to initiate action within IMO for designating the North Sea a Special Area for the purpose of Annex V (garbage) of MARPOL 73/78.

Ministers repeated their commitment to renewed efforts, both nationally and within the framework of the international conventions, to take measures which would protect the North Sea. One of these measures was the decision to establish the North Sea Task Force to enhance the scientific knowledge and understanding of the North Sea.

The Hague, 1990

History
It was also decided in London that a Third Conference should be held at Ministerial level in the Netherlands in early 1990 in order to review the implementation of commitments entered into at the First and Second North Sea Conferences and, in particular, to evaluate the measures agreed in the London Declaration from a policy viewpoint. The international preparations began with a high level government executives' meeting at The Hague in October 1988 and was effected by the establishment of a Preparatory Working Group with several sub-groups. The Third International Conference on the Protection of the North Sea was held in The Hague on 7 and 8 March 1990 and was the subject of much media attention and public interest. In recognition of the importance of the contribution of riverine inputs to the North Sea, the ministers were joined for the first time by a colleague from the Swiss Confederation, whose government also endorsed the commitments entered into at Bremen and London. Observers from the former Czechoslovakia and the former German Democratic Republic also attended the Conference.

Principal outcome
The principal task of The Hague Conference was to review the implementation of the Bremen and London Conferences and to clarify the political decisions in measurable terms. For example, with respect to inputs of hazardous substances, a list of 36 substances was identified in respect of the 50% reduction target and a 70% reduction target was established for the most dangerous substances to the environment, *i.e.* dioxins, cadmium, mercury and lead. Further concrete steps were taken to alleviate eutrophication: notably measures with respect to municipal waste water and industrial effluents and measures in agriculture. The termination date for marine incineration was brought forward to 31 December 1991.

As regards new measures, agreement was reached to phase out and destroy PCBs and hazardous PCB-substitutes and to aim for a substantial reduction in the quantities of pesticides reaching the North Sea. The Ministers also turned their attention for the first time to matters concerning the protection of species and habitats (a Memorandum of Understanding on Small Cetaceans in the North Sea was adopted) and on the impact of fishing activities. It was further agreed to seek a global strengthening of the regulations for ships' operational discharges of oil and chemical residues, and to exercise greater control over the activities of the offshore industry.

Intermediate Ministerial Meeting, Copenhagen, 1993

History
The Hague Conference accepted the offer of the Danish government to host a Fourth International Conference on the Protection of the North Sea in 1995. It was also agreed to hold an Intermediate Ministerial Meeting in 1993:

- to discuss the 1993 Quality Status Report on the North Sea;
- to evaluate the actions taken within IMO on Annex I and Annex II of MARPOL 73/78 and to decide what additional measures might be required, including the possibility of declaring the North Sea a Special Area under these Annexes;
- to discuss problems of implementation of the North Sea Conference Declaration with regard to nutrients and pesticides, for which purpose Ministers of Agriculture would also participate.

The IMM 93 was held in Copenhagen on 7 and 8 December 1993. It was essentially a review meeting to determine at ministerial level what issues needed to be addressed in preparation for the Fourth North Sea Conference.

Principal outcome
In preparing for the Fourth North Sea Conference, the Intermediate Ministerial Meeting (IMM-93) in Copenhagen reached conclusions on:

- the need for measures to make significant reductions (of the order of 50%) of anthropogenic inputs of polyaromatic hydrocarbons (PAHs) between 1985 and 2000 from all sources of concern to the marine environment;
- the possible need for a joint initiative to designate the North Sea as a Special Area for the purposes of Annexes I and II of MARPOL 73/78 and to study intersessionally the possibility of declaring the North Sea a Special Area for the purposes of the new air pollution Annex;
- the need for proposals on economic arrangements, control and monitoring systems for port reception facilities;
- an agreement to work to adopt international rules as soon as possible concerning liability and compensation for damage caused by accidents involving ships carrying cargoes of hazardous and noxious substances;
- the acknowledgement that, although most North Sea States expect to reach the 50% reduction target for phosphorus, the 50% nitrogen target will not be achieved mainly because the reductions in the agriculture sector are insufficient, as well as the time lag between the application of measures and their effects; the Ministers encouraged the development of an operational definition of balanced fertilization with a view to adoption as a common international standard;
- the fact that insufficient progress had been made in reducing the use of pesticides to reach the goals of The Hague Declaration.

The IMM 93 was particularly noteworthy in that it provided the first opportunity for a cross-sectoral approach at political level to certain environmental problems affecting the North Sea. Ministers of agriculture were able to discuss issues of common concern, notably measures for nutrients and pesticides, with their colleagues responsible for the protection of the North Sea environment. The Ministers drew attention to the need for suitable regimes for the protection of coastal and marine areas (including species and habitats) and to the importance of fisheries management in the context of safeguarding the sustainability of the North Sea ecosystem as a whole.

Esbjerg, 1995

History
At The Hague Conference in 1990 it was decided that a Fourth International Conference on the Protection of the North Sea should be held at Ministerial level in Denmark in 1995. The purpose of the Conference in Denmark was to address the following issues:

- progress made in reducing pollution of the North Sea and in implementing measures agreed during the three previous Conferences as well as during

the Intermediate Ministerial Meeting in 1993;
- national experience regarding control and enforcement of measures taken with respect to the reduction of inputs of hazardous substances and the need for further improvements;
- the current environmental status of the North Sea and the need for further measures, based on the 1993 Quality Status Report;
- global perspectives of the experience gained through the joint efforts of the participants.

The approach to the work undertaken at the Conference reflected the significant changes that had occurred since the Hague Declaration. Progress had been made in converting the political initiatives launched by the previous Conferences into compulsory provisions of international and European Union law. These new and comprehensive requirements substantially transformed the approach to the protection of the North Sea in many fields by establishing or substantially extending legally binding frameworks. The signing of the OSPAR Convention in Paris in September 1992 (which superseded the 1972 Oslo Convention and the 1974 Paris Convention) represented important progress, particularly in adopting the precautionary principle and the 'polluter pays' principle and by making it possible to address all matters relating to the protection of the marine environment through one Convention. Instruments adopted by the European Union and OSPAR in the field of protection for the other issues addressed within the Esbjerg Declaration also contributed to the creation or improvement of these frameworks.

The Fourth International Conference on the Protection of the North Sea was held in Esbjerg, Denmark on 8 and 9 June 1995.

Principal outcome

One of the most important issues agreed upon by the Ministers was the prevention of the pollution of the North Sea by continuously reducing discharges, emissions and losses of hazardous substances thereby moving towards the target of their cessation within one generation (25 years) with the ultimate aim of concentrations in the environment near background values for naturally occurring substances and close to zero concentrations for man-made synthetic substances. Furthermore they agreed to take concerted action within the International Maritime Organization (IMO) to ultimately phase out the use of tributyltin (TBT) compounds on all ships worldwide. A majority agreed that decommissioned offshore installations shall either be reused or be disposed of on land. The Esbjerg Declaration also addressed actions with regard to the protection of species and habitats in coastal and offshore areas, fisheries, further reduction of nutrient inputs to the North Sea, other forms of pollution from ships and offshore installations and management of radioactive substances, including waste.

At the Esbjerg Conference it was also decided that there should be regular meetings of senior officials representing the North Sea States and the European Commission. The Committee of North Sea Senior Officials (CONSSO) was established to undertake the following:
- to organize the necessary follow-up work resulting from the Esbjerg Declaration;
- to review progress in the implementation of actions agreed upon at the four International Conferences;
- to take an overview of the North Sea environment and the action being taken to protect it;
- to consider the need for and means of undertaking additional actions;
- to prepare for the Fifth International Conference on the Protection of the North Sea.

Intermediate Ministerial Meeting, Bergen, 1997

History

At the Esbjerg Conference it was agreed to hold an Intermediate Ministerial Meeting in Norway before the next North Sea Conference. The purpose of the IMM was to focus on the integration of fisheries and environmental issues with the Ministers responsible for environmental protection and Ministers responsible for fisheries participating.

During preparations for the IMM 97, it was regarded as important to establish close cooperation

between the fisheries and the environmental sectors and to include all relevant stakeholders in a constructive dialogue. To provide a good basis for discussion, a thorough documentation of the status of the living resources and the habitats in the North Sea was needed. The Assessment Report on Fisheries and Fisheries related Species and Habitats Issues was duly completed as the result of a joint effort by scientists, managers and NGOs. This transparent and participatory approach contributed to mutual trust and improved understanding of the issues. The report was accepted by all stakeholders as a basis for the following negotiations on actions needed for the protection of North Sea fish stocks, other species and their habitats.

The IMM 97 was held in Bergen, Norway on 13 and 14 March 1997.

Principal outcome

Ministers agreed that the future fisheries and environmental protection, conservation and management measures, including the management of the North Sea fisheries, should be guided by the principle of further integration of fisheries and environmental protection, conservation and management measures, drawing upon the development and application of an ecosystem approach which, as far as the best available scientific understanding and information permit, is based on in particular:

- the identification of processes in, and influences on, the ecosystems which are critical for maintaining their characteristic structure and functioning, productivity and biological diversity;
- taking into account the interaction among the different components in the food-webs of the ecosystems (multi-species approach) and other important ecosystem interactions;
- providing for a chemical, physical and biological environment in these ecosystems consistent with a high level of protection of those critical ecosystem processes.

Ministers also agreed upon the following:

- guiding principles:
  - utilization of the ecosystems of the North Sea in a manner consistent with sustainable development;
  - conservation of biological diversity and the sustainable use of its components;
  - application of the precautionary approach management of living marine resources';
  - integration of environmental objectives into fisheries policy;
- management objectives:
  - to ensure sustainable, sound and healthy ecosystems;
  - to restore and/or maintain biological diversity;
  - to achieve sustainable exploitation of the living marine resources;
  - to ensure economically viable fisheries;
- strategies:
  - to take appropriate measures to minimize adverse impacts of fishing activities;
  - to take appropriate measures to minimize adverse impacts resulting from human activities other than fishing;
- main areas for action:
  - rebuilding or maintenance of spawning stock biomass;
  - protection of juvenile fish, crustaceans and molluscs;
  - protection of species and habitats;
  - protection from activities other than fisheries;
  - control and enforcement;
  - science, technology and economic impacts;
  - information and involvement;
  - urther integration of fisheries and environmental policies;
  - implementation of the guiding principles, strategies and foregoing actions and a review of progress.

Annex 2:

State of Stocks in the North Sea and Adjacent Seas

Based on reports from the ICES Advisory Committee on Fisheries Management 2000 and 2001.

Species	Stock definition	Reference points (Biomass in '000 t	Present state		
			$F < F_{pa}$ (F in 2000)	$SSB > B_{pa}$ (SSB in 2001)	Overall
Cod *(Gadus morhua)*	IV, VIId, Skagerrak	B_{lim}: 70 B_{pa}: 150 F_{lim}: 0.86 F_{pa}: 0.65	No (0.83)	No (55)	Outside safe biological limits
Haddock *(Melanogrammus aeglefinus)*	IV and IIIa	B_{lim}: 100 B_{pa}: 140 F_{lim}: 1.0 F_{pa}: 0.7	No (0.92)	Yes (215)	Harvested outside safe biological limits
Whiting *(Merlangius merlangus)*	IV and VIId	B_{lim}: 225 B_{pa}: 315 F_{lim}: 0.9 F_{pa}: 0.65	Yes (0.46)	No (257)	Outside safe biological limits
Saithe *(Pollachius virens)*	IV, IIIa and VI	B_{lim}: 106 B_{pa}: 200 F_{lim}: 0.60 F_{pa}: 0.40	Yes (0.29)	Yes (232)	Inside safe biological limits
Plaice *(Pleuronectes platessa)*	IV	B_{lim}: 210 B_{pa}: 300 F_{lim}: 0.6 F_{pa}: 0.3	No (0.43)	No (289)	Outside safe biological limits
Sole *(Solea solea)*	IV	B_{lim}: 25 B_{pa}: 35 F_{lim}: undefined F_{pa}: 0.4	No (0.46)	Yes (40)	Harvested outside safe biological limits
Nephrops norvegicus	IV				Exploited at sustainable levels or (in one area) scope for further cautious increase in landings and effort
Nephrops norvegicus	IIIa				Exploited at sustainable levels
Anglerfish *(Lophius piscatorius)*	IV and VI	Limit reference points not defined – currently no biological basis F_{pa}: 0.30	No (indication but assessment uncertain)		

Species	Stock definition	Reference points (Biomass in '000 t	Present state		
			$F < F_{pa}$ (F in 2000)	$SSB > B_{pa}$ (SSB in 2001)	Overall
Herring *(Clupea harengus)*	IV, VIId, IIIa (autumn spawners)	B_{lim}: 800 B_{pa}: 1300 F_{lim}: undefined F_{pa}: for juveniles 0.12, for adults 0.25	No (0.27 for adults)	No (1145)	Recovery plan in place. Stock is recovering
Sprat *(Sprattus sprattus)*	IV	None available			Stock biomass high in 2000
Mackerel *(Scomber scombrus)*	North Sea component	Not defined		Estimated by egg surveys to be 68 000 t in 1999	Severely depleted
Mackerel *(Scomber scombrus)*	Combined Northeast Atlantic stock	B_{lim}: not defined B_{pa}: 2300 F_{lim}: 0.26 F_{pa}: 0.17	Yes (0.17)	Yes (4023)	Inside safe biological limits overall, but see North Sea component above
Horse mackerel *(Trachurus trachurus)*	North Sea (IVb and c), eastern Skagerrak and eastern Channel	Not sufficient information			Not known
Horse mackerel *(Trachurus trachurus)*	Western (northeast Atlantic including the northern North Sea)	B_{lim}: not defined B_{pa}: (reference point withdrawn in 2001) No F-based points advised	? (0.23)	? (862)	
Norway pout *(Trisopterus esmarki)*	IV and IIIa	B_{lim}: 90 B_{pa}: 150 No F-based points advised	(0.48)	Yes (325)	Inside safe biological limits
Sandeel (*Ammodytes* sp.)	IV and Shetland	B_{lim}: 430 B_{pa}: 600 No F-based points advised	(0.55)	Yes (825)	Inside safe biological limits
Pandalus borealis	IIIa+IVa East	B_{pa} : not defined			Stock is around the long-term average
Sprat *(Sprattus sprattus)*	IIIa	Not known			Unknown
Sandeel (*Ammodytes* sp.)	IIIa	Not known			Not known
Plaice *(Pleuronectes platessa)*	VIId	B_{lim}: 5.6 B_{pa}: 8 F_{lim}: 0.54 F_{pa}: 0.45	No (0.52)	Yes (9.5)	Harvested outside safe biological limits
Sole *(Solea solea)*	VIId	B_{lim}: not defined B_{pa}: 8 F_{lim}: 0.55 F_{pa}: 0.4	Yes (0.34)	Yes (12.6)	Yes (12.6) Inside safe biological limits

State of Rays and Skates in the North Sea

11 species of rays and skates have been reported from the North Sea of which five species are considered resident. The evaluation is based on long-term trends as observed in research vessel surveys. Landings reported did not include starry ray.

Based on the Report from the ICES Advisory Committee on Fisheries Management 1997.

Species	Sub-area	Present state		
		Exploitation	Relative Vulnera-bility	Overall
Rays and Skates *(Raja spp.)*	IV	Most ray species are able to support only relatively low exploitation rates. Landings (by-catch) have been fairly constant since 1970.		Maximum length decreased for all species comparing data from 1930s to recent survey results
Common skate *(R. batis)*	IV		1	Virtually disappeared after the 1950s
Thornback ray *(R. clavata)*	IV		2	Decreased abundance
Spotted ray *(R. montagui)*	IV		3	Caught irregularly recently more frequently
Cuckoo ray *(R. naevus)*	IV		4	Abundance remained fairly constant
Starry ray *(R. radiata)*	IV	No commercial value	5	Increased abundance

Annex 3:

Presidency Conclusions – European Council, Gothenburg 15 and 16 June 2001

The conclusions most relevant to the management of North Sea Fisheries were parts of the points 31 and 32 regarding the management of natural resources and the finalization of the European Community Sustainable Development Strategy and conclusions number 4–10 and 12, 13, 15, 16, 18 and 19 in the fisheries council conclusions of 25 April 2001 as follows:

31. - that the review of the Common Fisheries Policy in 2002 should, based on a broad political debate, address the overall fishing pressure by adapting the EU fishing effort to the level of available resources, taking into account the social impact and the need to avoid over-fishing.

    - halting biodiversity decline with the aim to reach this objective by 2010 as set out in the 6th Environmental Action Programme.

32. The Council is invited to finalize and further develop sector strategies for integrating environment into all relevant Community policy areas with a view to implementing them as soon as possible and present the results of this work before the Spring European Council in 2002. Relevant objectives set out in the forthcoming 6th Environmental Action Programme and the Sustainable Development Strategy should be taken into account.

Conclusions from the Council meeting of 25 April 2001 on the integration of environmental concerns and sustainable development into the Common Fisheries Policy (CFP).

4. The Council recognizes that heavy fishing pressure and use of inappropriate fishing techniques, along with a series of other factors unrelated to fisheries, threatens marine biodiversity and the long-term sustainability of the

European fisheries sector. Continued fishing pressure may have influenced the genetic variability of some commercially harvested stocks. Possible changes of genetic variability, sensitive species and the level of biodiversity need to be monitored. The impact of fisheries on biodiversity still requires thorough study, particularly in relation to genetic diversity, long-living species, non-target species and the ecological functions of various ecosystems.

5. The Council agrees that targeted reductions in fishing pressure are the most important management measures in order to achieve sustainable development. Total allowable catches (TACs) are a key instrument in limiting fishing pressure. This instrument needs to be further developed in the light of the Council conclusions on the application of the precautionary principle and multi-annual arrangements for setting TACs.

6. The Community has not yet succeeded in establishing a sustainable balance between fishing effort (the product of capacity and activity) and available fish resources, and this also may have a negative effect on the marine environment as a whole. The Council therefore invites the Commission to develop a fleet policy which would secure appropriate targeted reductions in fishing effort.

7. The Council considers that significantly enhanced technical conservation measures should also be a central part of the overall strategy to integrate fisheries and environment policy. In this context, the Council supports the development and implementation of more selective fishing gears in order to reduce discards, incidental by-catch and impact on habitats. Time and site-specific protection measures should be considered in order to protect juveniles or sensitive and threatened species. The Council invites the Commission to continue to develop actively this important dimension of fisheries conservation policy in consultation with all players.

8. The Council notes the importance of adequate data collection and that scientific knowledge of the marine environment must improve so that appropriate and scientifically based environmental actions can be taken. The contribution of scientific research from both the fisheries and the environmental sector must be further developed and a higher level of cooperation is needed in order better to focus research on ensuring sustainable, sound and healthy ecosystems.

9. The Council stresses the crucial importance of effective and comprehensive use of fishery control and enforcement instruments applied in a consistent manner across all Member States. In also notes the importance of satellite monitoring and the progress in its use.

10. The Council is aware of the need for greater involvement of the individual fishermen and other relevant stakeholders in fisheries management with a view to improving the conservation of living marine resources and securing a sustainable use of these resources.

12. The Council acknowledges the critical economic and social situation in coastal regions, which are highly dependent on fisheries. In particular, further consideration should be given, within the CFP review, to small-scale coastal fisheries, which are a force for balance in regional development.

13. The Council agrees that the impact of subsidies on the fisheries sector should be assessed as part of the CFP review. Where they are provided, subsidies should, in accordance with the principles of the Common Fisheries Policy, take full account of the need to conserve fishery resources and to protect the environment.

15. The Council recognizes the importance of international cooperation to fully achieve the integration objectives and that the Community should adopt a leading role in promoting sustainable management and environmental integration in regional fisheries organizations (RFOs), in other relevant international fora and in the framework of third country agreements, in accordance with the Fisheries Council's conclusions of October 1997.

16. The Council welcomes the Commission's initiative in presenting, after its communication on fisheries management and nature conservation in the marine environment of July 1999, a communication on elements of a strategy for the integration of environmental protection requirements into the Common Fisheries Policy (CFP) as well as a biodiversity action plan for fisheries and aquaculture.

18. The Council encourages the Commission's initiative to develop a set of indicators in order to measure in an integrated way ecological, economic and social sustainability as well as specific indicators to monitor long term effects on and changes in biodiversity for key target and non-target species and their habitats.

19. The Council invites the Commission to monitor and evaluate the process of the integration of environment and sustainable development into the CFP. The Council calls on the European Council to invite the Commission to present, within the CFP review, concrete proposals for the integration of environment and sustainable development into the CFP, including priority actions such as reduction in fishing pressure and increased selectivity of fishing gear, measurable targets, timetables, improved protection of marine biodiversity and progress towards an ecosystem-based management.

[18] Doc. No. 10078/99PECHE 148 ENV 261 – COM(1999)363 final.

Annex 4:

Proposals for Ecological Quality Objectives in the North Sea

Proposals for EcoQOs for the ten issues identified for development

Table 1 *List of proposed Ecological Quality Objectives (EcoQOs) for 10 issues identified for development in the North Sea. Report from OSPAR to CONSSO January 2002: 'Background Document on the Development (within the OSPAR framework) of Ecological Quality Objectives (EcoQOs) for the North Sea'. This report of progress and its contents have not been formally agreed within OSPAR, and as such the report does not contain any formal OSPAR agreements, or provide any recommendations from OSPAR to CONSSO, on EcoQOs.*

Issue	**EcoQOs proposed**
1. Reference points for commercial fish species	• Reference points[1]) for commercial fish species†
2. Threatened and declining species	• Presence and extent of threatened and declining species in the North Sea#
3. Sea mammals	• Seal population trends in the North Sea† • Utilisation of seal breeding sites in the North Sea† • By-catch of harbour porpoises†
4. Seabirds	• Proportion of oiled Common Guillemots among those found dead or dying on beaches† • Mercury concentrations in seabird eggs and feathers† • Organochlorine concentrations in seabird eggs† • Plastic particles in stomachs of seabirds# • Local sandeel availability to black-legged Kittiwakes† • Seabird populations trends as an index of seabird community health†
5. Fish communities	• Changes in the proportion of large fish and hence the average weight and average maximum length of the fish community†
6. Benthic communities	• Changes/kills in zoobenthos in relation to eutrophication* • Imposex in dog whelk† • Density of sensitive (*e.g.* fragile) species# • Density of opportunistic species#
7. Plankton communities	• Phytoplankton chlorophyll a* • Phytoplankton indicator species for eutrophication*
8. Habitats	• Restore and/or maintain habitat quality#
9. Nutrient budgets and production	• Winter nutrient (DIN and DIP) concentrations*
10. Oxygen consumption	• Oxygen*

† See paragraph 37 for progress on developing these EcoQOs.
# See paragraph 40 for progress on developing these EcoQOs.
* See Paragraph 38 for progress on developing these EcoQOs. These EcoQOs proposed for nutrients and eutrophication effects are elaborated based upon their cause-effect relationship with nutrient enrichment (see EUC 01/5/3-Rev.1). The development of these four was carried out on the basis of the common assessment criteria, and their respective assessment levels used for the classification of the eutrophication status of the OSPAR Maritime Areas under the Comprehensive procedure (see EUC 01/2/2, Annex 2). The elaborated EcoQOs-eutro should, *inter alia*, be considered as an integrated set to help evaluate the 50% nutrient (N and P) reduction target in relation to the general objective, which is to achieve by the year 2010 a healthy marine environment where eutrophication does not occur.

1) In this context, "reference points" are defined as those used in advice given by ICES in relation to fisheries management, and not as defined by "reference levels" set by OSPAR.

The further Development of Ecological Quality Objectives

Report from OSPAR to CONSSO January 2002: 'Background Document on the Development (within the OSPAR framework) of Ecological Quality Objectives (EcoQOs) for the North Sea'. The following paragraphs are mentioned in footnotes to Table 1 in this Annex:

36. The proposed EcoQOs for the 10 issues are in different stages of development. They can be broadly classified into those which are in an advanced stage and those which are in a less advanced stage and where therefore more work remains.

37. The EcoQOs which BDC considered to be in an advanced stage are the following:
    - Reference points for commercial fish species (issue 1)
    - Seal population trends in the North Sea (issue 3)
    - Utilisation of seal breeding sites in the North Sea (issue 3)
    - By-catch of harbour porpoises (issue 3)
    - Proportion of oiled guillemots among those found dead or dying on beaches (issue 4)
    - Local sandeel availability to black-legged Kittiwakes (issue 4)
    - Seabird population trends as an index of seabird community health (issue 4)
    - Mercury concentrations in seabird eggs and feathers (issue 4)
    - Organochlorine concentrations in seabird eggs (issue 4)
    - Changes in the proportion of large fish and hence the average weight and average maximum length of the fish community (issue 5)
    - Imposex in dog whelk (issue 6)

38. The EcoQOs which EUC considered to be in an advanced stage are the following:
    - Winter nutrient (DIN and DIP) concentrations (issue 9)
    - Phytoplankton chlorophyll a (issue 7)
    - Phytoplankton indicator species for eutrophication (issue 7)
    - Oxygen (issue 10)
    - Changes/kills in zoobenthos in relation to eutrophication (issue 6)

39. These proposed EcoQOs are developed to a stage where they could be considered by CONSSO with the aim of the 5NSC concluding on whether to recommend their implementation. Some work to finalize details remains for several of these EcoQOs. The lead countries (Netherlands and Norway) and CONSSO are encouraged to complete as much as possible of this work prior to the 5NSC, in consultation or co-operation with ICES.

40. The following EcoQOs are in a less advanced stage and more work remains to finalize them:
    - Presence and extent of threatened and declining species in the North Sea (issue 2)
    - Plastic particles in stomachs of seabirds (issue 4)
    - Density of sensitive (*e.g.* fragile) species (issue 6)
    - Density of opportunistic species (issue 6)
    - Restore and/or maintain habitat quality (issue 8)

Annex 5:

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Annex 6:

Acronyms and Abbreviations

ACFA	Advisory Committee on Fisheries and Aquaculture (EC)
ALARA	As low As Reasonably Achievable
Am	Americium
AOX	Adsorbable organically bound halogens
APEOs	Alkylphenolethoxylates
As	Arsenic
ASCOBANS	Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas
BAT	Best Available Techniques
BEP	Best Environmental Practice
BFR	Brominated flame retardants
B_{lim}	Limit spawning stock biomass
BNFL	British Nuclear Fuel
B_{pa}	Biomass below which action should be taken (pa stands for precautionary approach)
Bq	Becquerel (1 disintegration per second)
BREF	BAT Reference document
Bunker Convention	International Convention on Civil Liability for Bunker Oil Pollution Damage
CBD	Convention on Biological Diversity
Cd	Cadmium
CHARM	Chemical Hazard Assessment and Risk Management
CEFIC	The Conseil Européen des Fédérations de l'Industrie Chimique
CFP	Common Fisheries Policy
CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
Common Procedure	Common Procedure for the Identification of the Eutrophication Status of the Maritime Area (OSPAR)
CONSSO	Committee of North Sea Senior Officials
Cs	Caesium
Cu	Copper
DDT	Dichlor-diphenylic-trichloroethane
DecaBB	Decabromobiphenyl

DecaBDE	Decabromodiphenyl ether
DIN	Dissolved inorganic nitrogen
DIP	Dissolved inorganic phosphorus
DYNAMEC	Dynamic selection and prioritization mechanism for hazardous substances (OSPAR)
EARP	Enhanced Actinide Removal Plant
EcoQ	Ecological Quality
EcoQO	Ecological Quality Objective
EcoQOs-eutro	Ecological Quality Objectives for nutrients and eutrophication effects
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental impact assessment
EMAS	Eco-Management and Audit Scheme
EMEP	Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe
E&P	Dutch Association for the Exploration and Production (E&P) Industry
EPER	European Pollutant Emission Register
EUNIS	European Nature Information System
EURATOM	European Atomic Energy Community
EUROHARP	Towards European Harmonised Procedures for Quantification of Nutrient Losses from Diffuse Sources
F	Fishing Mortality
FAO	Food and Agriculture Organization (UN)
FASSET	Framework for the Assessment of Environmental Impact
FISIS	Fisheries Inspection Information System
F_{lim}	Limit fishing mortality
F_{pa}	Fishing mortality above which management action should be taken (pa stands for precautionary approach)
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GMO	Genetically modified organism
GOOS	Global Ocean Observing System
ha	Hectare
HARP	Harmonized Quantification and Reporting Procedures for Nutrients
HARP-HAZ Prototype	Harmonized Quantification and Reporting Procedures for Hazardous Substances
HBCDD	Hexabromocyclododecane
HCH	Hexachlorocyclohexane
HELCOM	Helsinki Commission
HEX	Uranium hexafluoride
Hg	Mercury
HMCS	Harmonized Mandatory Control System
HNS Convention	International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea
IAEA	International Atomic Energy Agency
IBC Code	International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk
ICES	International Council for the Exploration of the Sea
ICRP	International Commission on Radiological Protection
IMM 93	Intermediate Ministerial Meeting held in Copenhagen in 1993
IMM 97	Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues held in Bergen in 1997
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission

IPOA-SEABIRDS	International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries
IPOA-SHARKS	International Plan of Action for the Conservation and Management of Sharks
IPP	Integrated Product Policy
IPPC Directive	Integrated Pollution Prevention and Control Directive
ISO	International Organization for Standardisation
ISPA	Financial Instrument for Structural Policies for Pre-Assession
ITQ	Individual Transferable Quota
IUR	International Union of Radioecology
kt	Kilotonne
LOA	Load-orientated approach
LRTAP	Convention on Long-Range Transboundary Air Pollution
MAGP	Multi-annual Guidance Programme
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
MEPC	Marine Environment Protection Committee (IMO)
MPA	Marine Protected Area
mSv	Millisievert
N	Nitrogen
NAFO	North Atlantic Fisheries Organization
NASCO	North Atlantic Salmon Conservation Organization
Natura 2000	EU-wide coordinated ecological network of areas for species and habitat conservation
NEAFC	North-East Atlantic Fisheries Commission
ng	Nanogramme
Ni	Nickel
nm	Nautical mile
NOGEPA	Nederlandse olie-en gas exploratie en productie associatie
NORM	Naturally occurring radioactive materials
NOSE	Nomenclature for Sources of Emissions
NO_x	Nitrogen oxides
NP	Nonylphenol
NPEOs	Nonylphenol ethoxylates
NVZ	Nitrate vulnerable zones
O_2	Oxygen
OBM	Oil-Based Mud
OctaBDE	Octabromodiphenyl ether
OECD	Organization for Economic Co-operation and Development
OIC	Offshore Industry Committee (OSPAR)
OPF	Organic-Phase Drilling Fluid
OSPAR	OSPAR Commission
P	Phosphorus
PAHs	Polyaromatic hydrocarbons
PARCOM	Paris Commission
Pb	Lead
PBBs	Polybrominated biphenyls
PBDEs	Polybrominated diphenylethers
PBTs	Compounds that are persistent, liable to bioaccumulate and toxic
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzodioxins
PCDFs	Polychlorinated dibenzofurans

PCP	Pentachlorophenol
PCTs	Polychlorinated terphenyls
p.e.	Population equivalent
PentaBDE	Pentabromodiphenyl ether
PLONOR list	List of Substances / Preparations Used and Discharged Offshore Which Are Considered to Pose Little or No Risk to the Environment (OSPAR)
POP	Persistent Organic Pollutant
PSSA	Particularly Sensitive Sea Area
Pu	Plutonium
Ra	Radium
RSC	Radioactive Substances Committee (OSPAR)
SAC	Special Area of Conservation
SCCPs	Short chained chlorinated paraffins
SFT	Norwegian Pollution Control Authority
SIXEP	Site Ion-Exchange Effluent Plant
SMEs	Small and medium enterprises
SMRU	Sea Mammal Research Unit
SOA	Source-orientated approach
SoC	Ministerial Statement of Conclusions
SOLAS	International Convention for the Safety of Life at Sea
SO_x	Sulphur oxides
SPA	Special Protection Area
Sr	Strontium
SSB	Spawning Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries
STP	Sewage treatment plants
TAC	Total Allowable Catch
TBBP-A	Tetrabromobisphenol A
TBq	Terabecquerel
TBT	Tributyltin
Tc	Technetium
TCBs	Trichlorobenzenes
THCs	Total hydrocarbons
TMAP	Trilateral Monitoring and Assessment Program
TPT	Triphenyltin
UKOOA	United Kingdom Offshore Operators Association
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
VMS	Vessel monitoring system
VOC	Volatile organic compounds
VPVB	Substances that are very persistent and very bioaccumulative
WEEE	Directive on waste electrical and electronic equipment (EC)
WFD	Water Framework Directive (EC)
WSP	Wadden Sea Plan
WWF	World Wide Fund for Nature
Zn	Zinc
2NSC	Second International Conference on the Protection of the North Sea, held in London 1987
^3H	Tritium

3NSC	Third International Conference on the Protection of the North Sea, held in the Hague in 1990
4NSC	Fourth International Conference on the Protection of the North Sea, held in Esbjerg in 1995
5NSC	Fifth International Conference on the Protection of North Sea, held in Bergen in 2002
% m/m	Mass percentage