chapter 6

Overall assessment

6.1 Introduction

This chapter sets out OSPAR's overall assessment of the quality status of the maritime area covered by the OSPAR Convention. Under each main theme, this chapter provides, in summary form, a description of the impact of human activities on the maritime area; an evaluation of the effectiveness of the measures that have been taken, both internationally and at the national level, to safeguard the marine environment against that impact; a statement of the limitations of knowledge which constrain these descriptions and evaluations; and (in accordance with Article 6(b) of the OSPAR Convention) an identification of priorities for action.

The degree of human impact varies enormously between the different Regions of the maritime area. The much greater concentrations of human population in catchments draining into Region II (the Greater North Sea, which includes the Channel) produce significantly different pressures from those affecting Region V (the Wider Atlantic), where the only human population is that of the Azores archipelago. Nevertheless, common types of pressure exist, particularly from intensive (and sometimes conflicting) uses of the coastal zone.

This overall assessment is based upon a common effort by the OSPAR Contracting Parties to interpret and assess the available scientific information. The value of such an assessment depends crucially on the quality of the information available. As this assessment shows, in spite of the major efforts made by OSPAR Contracting Parties over the last twenty-five years, there are still major gaps in understanding of the marine environment. To provide the basis for effective decision-making on the management of the ocean and human activities affecting it, it is necessary both to maintain and update the current marine environmental information and the other information essential for management decisions, and to try to fill the most urgent gaps in knowledge. For this purpose, both cost-effective monitoring systems and other means of gathering information and a better allocation of the available resources to the various needs are essential. Efforts are needed in all fields to improve the efficiency and effectiveness of capturing and analysing data: it is, for instance, regrettable that the assessment of so many time series of contaminant concentrations in biota failed to result in any statistical trend. This is because of imperfections in the nature of the data, even where sufficient quality assurance of those data was available.

Although the OSPAR Convention gives the OSPAR Commission a wide competence, OSPAR does not cover all aspects of the marine environment. As the Convention recognises, questions related to the management of fisheries are appropriately regulated under international and regional agreements dealing specifically with such questions, while others (such as shipping) are by their nature more effectively handled on a global basis. Furthermore, the European Community and the European Economic Area have competence for regulating the marketing and use of products. The identification of priorities for action is therefore not intended to set an agenda for OSPAR, but to draw attention to questions that the OSPAR Contracting Parties should consider the best way to resolve. Some of these questions will be appropriate for consideration by OSPAR, while others will fall to other international bodies, or will best be handled at the national level.

In considering priorities between the various themes covered in this assessment, there is agreement that:

a. the most important issues raised by the assessment in all five Regions are:
   i) the resolution of the questions on the subject of fisheries; and
   ii) the implementation of the OSPAR Strategy with regard to Hazardous Substances (particularly with regard to organotin antifouling treatments and the newly developing concerns about endocrine disrupters);
b. another important issue is that of climate change, which raises questions well beyond those of the marine environment;
c. other generally important issues are, in order of priority:
   i) those covered by the OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area, the OSPAR Strategy with regard to Radioactive Substances and the OSPAR Strategy to Combat Eutrophication;
   ii) the impacts of oil spills and discharges of ballast water from shipping; and
   iii) the improvement of the knowledge base.

Other issues can have great significance in specific Regions. In particular, these include:

a. in Regions I and II, organochlorine pesticides and PCBs;
b. in Regions II and III, issues covered by the OSPAR Strategy on Environmental Goals and Management Mechanisms for Offshore Activities, and the impacts of mariculture; and
c. in Regions III and IV, the impacts of coastal development.

On this basis, the implementation of the OSPAR Strategies should remain a high priority for the Commission.

6.2 Fisheries

6.2.1 Capture fisheries

Description of the impact

Management systems for the exploitation of fisheries resources have been implemented by all OSPAR Contracting Parties. This has led to sustainable practices for about half of the commercially exploited fish species. Among the stocks of the commercially exploited fish species, nevertheless, many are either exploited beyond their safe biological limit or are exploited within that limit to an extent that risks the limit being breached. Fisheries for 40 out of 60 stocks of these species in specific areas are believed to be unsustainable (see *Table 5.1*). Even for stocks that are within safe biological limits, the size composition has been altered by fishing. Age compositions have also become truncated. With fewer age groups in the exploited population, the spawning populations and fisheries become progressively more dependent on incoming recruitment and, consequently, more variable.

Assessments for many of the other species are inconclusive. Assessments are not produced for all exploited stocks. There are few population estimates for stocks of the ~ 1000 non-exploited species found in the maritime area, including sharks, skates and rays. In regions where typical commercial stocks decline, fishing pressure is often transferred to other stocks, or to deep-sea populations where management is particularly difficult. The slow growth rates and low fecundity of many deep-sea fish makes them particularly vulnerable to overexploitation.

By-catch of undersized or unwanted commercial species, mortality of non-target species including benthic animals and marine mammals and high levels of discards are continuing problems in many areas. The discarded fish represent an extra pressure on stocks since they do not normally survive. Since they are usually smaller than landed fish, weight for weight they represent a larger number of fish. Therefore, discarding half the weight of the catch (as happens in fisheries for some stocks) can result in many more fish (in terms of numbers) being discarded than are actually landed. This makes discards a significant source of mortality. The discards also alter the competitive relationships within communities by favouring scavenging species.

Harbour porpoises, dolphins and seals are the most common mammals entangled in fishing gear. Harbour porpoises are particularly vulnerable to bottom-set

gillnets. Dolphins are vulnerable to drift nets. There are strong indications that the mortality rates of harbour porpoises caught in fishing nets which have been estimated for Regions II, III and IV are unsustainable.

Increases in seabird populations over the past decades have been attributed to a number of factors (for example, better protection, increases in small prey fish and an increase in fish discards and offal from commercial fishing boats). Periodically, some species have experienced a sharp fall in numbers. Some changes may be due to natural variability; others are directly related to a decrease in fish prey – for example, the decline in some common guillemot and puffin populations in some parts of the Arctic area following the decrease in stocks of capelin and herring, respectively. The decrease in fish prey may be due to natural variability, but may also be caused or aggravated by fishing activities. There has also been an impact from fisheries by-catch.

Disturbance of the seabed by fishing gear can change the species and size composition of the benthos especially where the disturbance is repeated. For example, where bottom trawling has occurred in the North Sea over a long period of time, there has been a shift in benthic diversity and composition from larger, more long-lived benthic species to smaller, more opportunistic species. Recent investigations along the Norwegian coast show that the damage caused to deepwater coral formations by past trawling activities is quite extensive. Information from other areas with such formations is not available, but the situation is likely to be similar where there has been similar bottom trawling.

Effectiveness of measures

With the aim of matching fishing effort to the sustainable exploitation of the fisheries, recent measures taken within the framework of the EU Common Fisheries Policy, and by Norway and Iceland, focus on controlling fishing effort. Among the main regulatory measures used are a reduction of the fishing fleet, the yearly setting of Total Allowable Catches and, in some areas, the setting of Individual Transferable Quotas. Furthermore, technical conservation measures, such as mesh sizes and sorting grids, are widely used to reduce the capture and consequent discarding of juvenile fish. A wide range of national conservation measures has been introduced to protect vulnerable life stages of different stocks. Such measures include permanent inshore nursery areas, temporary closures to protect juvenile fish and spawning-area closures at peak times of the year. In most regions, large trawlers are excluded within 12 nautical miles of the coast.

Although effective in some fisheries, overall these measures have had limited effectiveness, given the existing overcapacity of some European fishing fleets. Since most regulatory measures imply a short-term economic loss, there is an incentive on the part of the fishing industry either to improve fishing efficiency in order to compensate, or simply not to comply with regulations. This makes the enforcement of management measures extremely difficult, both because of the costs of policing at sea and because of the dispersed nature of the activity. For socio-economic reasons, TACs set by international bodies have often been set above scientifically recommended limits. In view of uncertainties in total stock assessments, such high TACs have frequently contributed to the exploitation of stocks beyond safe biological limits.

Limitations in knowledge

There are a number of topics where understanding is relatively poor and towards which research should be directed in the future:

a. more accurate fish-catch statistics, including improvements in the monitoring and reporting of by-catch and discards;
b. information to establish sustainable catch rates for those fish stocks (including deep-water fish species) which are being exploited commercially despite insufficient data and knowledge to assess their status reliably;
c. better knowledge of the reproductive capacity and population dynamics of commercially exploited fish species, including the effects of climatically driven variability, fishing, and biological (multi-species) interactions;
d. information on the effects of fishing on non-target species such as benthic organisms, sharks, rays, turtles, seabirds and marine mammals, and on benthic habitats, including deep-sea environments; and
e. information on the socio-economic factors which influence the behaviour of fishermen and fishing fleets, and ways to incorporate the knowledge and experience of fishermen into assessment and management.

Identification of priorities for action

It is generally recognised that fisheries management and environmental policies must be further integrated, within the framework of the ecosystem approach. It is also important that the scientific basis for fisheries management should be continually improved and that the application of the Code of Conduct for Responsible Fisheries be further promoted. With a view to achieving stock sizes and exploitation rates that are within safe biological limits and to minimise ecological damage, action on the following issues could be considered by the appropriate authorities:

a. excessive fishing effort and overcapacity in the fishing fleet in some regions;

b. lack of precautionary reference points for the biomass and mortality of some commercially exploited stocks;
c. how to address the particular vulnerability of deep-sea species;
d. the risks posed to certain ecosystems and habitats, for example, seamounts, hydrothermal vents, sponge associations and deep-water coral communities;
e. adverse environmental impacts of certain fishing gear, especially those leading to excessive catches of non-target organisms and habitat disturbance; and
f. the benefits for fisheries and/or the marine environment of the temporary or permanent closure or other protection of certain areas.

6.2.2 Mariculture

Description of the impact

During the last few decades intensive forms of mariculture have increased considerably, in particular salmon farming. In some countries, mariculture production has become comparable in economic value to that of the demersal and pelagic fishing. It is now a major industry in many areas, and is likely to expand in the future both in the volume and range of fish species cultivated. On the national level, licensing systems and associated monitoring systems have been established to limit the areas and the extent of environmental changes inherent in mariculture. Concerns exist over the extent to which diseases and parasites, such as sea lice, are transferred from cultured to wild stocks, and *vice versa*. Interbreeding from escaped cultured salmonids can affect the genetics of wild stocks. Mariculture is also one of the sources of unintentional introduction of non-indigenous species, because the introduction and transfer of marine organisms create risks of transporting competitors, predators, parasites, pests and diseases. A few non-indigenous species were deliberately introduced to the maritime area, mainly for mariculture purposes. In addition, the release of nutrients, organic matter and chemicals (such as antifouling agents, biocides, antibiotics and other therapeutants and colouring agents) may cause local pollution, particularly of sediments.

Effectiveness of measures

Lack of information on the implementation by Contracting Parties of PARCOM Recommendation 94/6 concerning Best Environmental Practice for the Reduction of Inputs of Potentially Toxic Chemicals from Aquaculture Use prevents an assessment of the effectiveness of this measure. Nevertheless, progress has been made in eliminating the use of the pesticide dichlorvos. Further work is needed to assess the effect of implementation of the ICES Code of Practice on the Introductions and Transfer of Marine Organisms and its consequent effectiveness.

Limitations in knowledge

Gaps remain in the understanding of the environmental effects of mariculture, in particular regarding:
a. better documentation of the effect of escaped salmon on the genetic composition of wild salmon stocks; and
b. knowledge of the risk of spread of diseases from mariculture to wild stocks and *vice versa.*

Identification of priorities for action

Given the combination of risks posed by escape of cultured stock and the high degree of uncertainty surrounding the impacts of escapees on wild populations, there is a need to develop more appropriate management measures, taking account of what has been achieved through EC Directives such as 91/67/EEC on aquaculture animals and products. Furthermore, efforts to fill the gaps in knowledge should continue.

6.3 **Land and sea use**

6.3.1 Use of the coastal zone and continental shelf

Description of the impact

Sparsely populated areas (for example, in Iceland, Norway, the Azores and parts of the west coasts of Scotland and Ireland) have relatively little pressure from coastal development. However, in other areas there is considerable pressure for more extensive use of coastal land for industry, housing and tourism. At the same time, the land available for coastal development has decreased as the number of areas recognised for their conservation interest has increased. The main developments offshore are those relating to the established offshore oil and gas sector, to the emerging offshore wind power generation industry, and possibly to wave power developments.

Densely populated urban developments are found in a band along much of the coasts of Regions II, IV and part of Region III. During the summer the population rises substantially because of tourism. These high concentrations of people lead to complex interactions between environmental, economic and social needs, with the potential for serious conflicts of interest.

In all OSPAR Regions tourism has been growing steadily. In spite of planning controls and sensible development policies, many of the habitats and locations that attract visitors are jeopardised by the sheer number of visitors, increased traffic and growing demands for accommodation and improved services. In the North Sea, bird-breeding areas on sandy beaches have been almost completely lost because of recreational activities.

Coast protection, land reclamation and development of industries, ports and harbours affect coastal habitats. In many cases habitats and associated ecological processes have been changed and, occasionally, destroyed. There is a growing awareness that proper management of coastal protection measures can result in the creation of new habitats.

In some countries, energy is increasingly generated from coastal wind power stations. There are extensive searches in progress for new sites with sufficient wind energy, where human population would not be disturbed. Apart from the space required, the impact of this activity includes some visual and acoustic disturbance and the presence of rotating blades that may be dangerous to birds.

The development of offshore power generation may involve the construction of many installations of a range of sizes, which can either be built on artificial islands or placed directly on the seabed, and which will have land links (for example, cables). Depending upon the relative cost/benefits of the different power generation options for the future, offshore wind and wave power generation may be a significant, long-term prospect. Several countries have wind power generation parks (for example, Ireland) or have plans to build them (for example, Belgium, Denmark, Germany, the Netherlands and the UK).

Oil and gas activities are widespread in the OSPAR area ***(Figure 3.10)***, although the majority of offshore installations are located in the North Sea. There is scope for considerable expansion in the future. In other regions, for example, the Arctic, the wider Atlantic and in Irish waters, offshore exploration is at an early stage of development but it is anticipated that the sector will continue to expand there in future.

Offshore oil and gas activities can cause impacts at all stages of exploration, development and operation. Discharges of oil and other chemicals are the main problems (see Section 6.7). Habitat modification by the introduction of artificial hard substrates and physical disturbance is also a problem, although more localised in extent. The introduction of artificial hard substrates is a complex issue. For example, hard substrates may benefit organisms that use them for shelter, but hard substrates may also attract and concentrate predators that prey on organisms in surrounding habitats.

About 800 offshore platforms are currently operating in OSPAR waters. It is anticipated that over the next ten to twenty years, as fields become unproductive, an increasing number of structures will need to be decommissioned. Decommissioning will ensure that disused installations do not become a danger to navigation or the fishing industry, or a potential source of pollution. Only a small number of installations have been decommissioned to date. These have mainly been from the shallow waters of the southern North Sea and have been returned to land. No large fixed installation has so far been decommissioned.

As a result of an initiative of the Fourth International Conference on the Protection of the North Sea (1995), the 1998 Ministerial Meeting of the OSPAR Commission adopted Decision 98/3 on the Disposal of Disused Offshore Installations, prohibiting the dumping and the leaving wholly or partly in place of disused offshore installations within the maritime area. Subject to assessment and consultation under agreed procedures, derogations are possible for the footings of steel installations weighing more than 10 000 t, and for concrete installations.

Effectiveness of measures

Many coastal areas are recognised as important for conservation and are designated with various levels of legal protection. National legislation, international conventions and EC Directives, especially the Bird Directive (79/409/EEC) and Habitat Directive (92/43/EEC), are important instruments, although the implementation of these directives is behind schedule. All OSPAR Contracting Parties have established conservation areas and more areas are being identified. The European Community has developed a demonstration programme on coastal zone management. In 1998 OSPAR adopted a new Annex to the 1992 OSPAR Convention concerning the protection and conservation of the ecosystems and biological diversity of the maritime area covered by the Convention.

Although these measures have established a general framework for the protection of coastal areas, their effectiveness depends on local implementation. It is difficult to obtain comprehensive and consistent information on such implementation. With regard to coastal areas, what is particularly lacking is comparable information on sensitive or unique habitats and on human activities in such areas.

Identification of priorities for action

The economic, environmental and social issues involved are often complex. Careful consideration is needed to avoid serious conflicts of interest between the need to protect designated conservation areas and pressure of human requirements for housing, leisure etc. There is a need for the application of codes of good practice in Coastal Zone Management to identify sensitive coastal areas and apply effective control regimes to minimise human impact. In the future, these problems could be exacerbated by global sea level rise as a result of climate change. In light of increasing sea levels, future coastal protection policies will have to address the question of how to guarantee adequate coastal protection in a way that is compatible with the needs of conservation.

The environmental impact of the present plans both for more land-based power generators at a number of coastal sites and for wind and possibly wave power generation systems offshore needs to be carefully considered. In addition, new developments should

minimise interference with other users of the sea, particularly fishing and shipping.

The expansion of the offshore oil and gas industry may increase the scale of habitat modification and disturbance. Consequently, an assessment is needed of these possible impacts, both for existing and new installations.

6.3.2 Mineral exploitation

Description of the impact

Sand and gravel are essential materials for private and industrial construction work, for coastal protection and beach replenishment. Annually, 43 million m^3 are extracted from the OSPAR area. By far the largest amount is taken from the North Sea, where extraction increased from 34 to 40 million m^3 in the period 1989 to 1996. Along the Atlantic coast of France annual extractions amount to around 4 million t. Maërl banks (calcarean algae) which support fragile ecosystems and shell sands are exploited mainly along the Brittany coast.

The exploitation of marine aggregates can have negative effects on the marine environment. Turbidity is temporarily increased during operation. The main impact on the ecosystem is the disturbance and loss of benthic organisms from the extraction site. There can be damage to sites that act as spawning areas for fish that lay their eggs directly on gravel (for example, herring). In addition, extraction activities can increase the instability of shallow banks and increase the potential for coastal erosion. The rate of recovery of a site depends on the modifications made to the substrate and the potential of the benthos to recolonise the area. This may take from a few months to more than a decade.

Effectiveness of measures

Various measures have been introduced at national and international levels to minimise the environmental impact of marine aggregate extraction (for example, the ICES Code of Practice on Commercial Extraction of Marine Sediments (ICES, 1992)). Nevertheless, extraction continues at high rates and in some areas there is only limited control on quantities removed. Although some countries are developing more stringent licensing systems, in many cases the overall aim of national approaches to the regulation of this practice appear unclear and need to be considered in relation to the national policy on land-based exploitation of aggregates. The OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area will also cover the impacts of mineral exploitation on benthic habitats.

Limitations in knowledge

There is limited information on short-term and long-term effects of exploitation of marine aggregates, especially of shells and maërl. Such information is necessary to set controls and quotas to ensure sustainable exploitation.

Identification of priorities for action

As demands are gradually increasing, more widespread and effective implementation of the ICES Code of Practice on Commercial Extraction of Marine Sediments is required, in particular through national licences. In addition, effective controls should be established and the assessments of short- and long-term impacts of extraction should be improved. The areas concerned should also be considered in relation to the measures referred to in the section on the use of the coastal zone (Section 6.3.1).

6.3.3 Dredging and dumping

Description of the impact

Dredging activities cause physical disturbance and may result in the redistribution, and possibility of changing the form, of contamination (see Chapter 4 and section 6.5). Physical disturbance includes increases in suspended matter, which affects primary production and growth of filter-feeding organisms, burial of benthic organisms, and changes in substrate character, which may affect benthic communities. These effects appear to be of a localised nature. Dredging may change the balance of natural coastal processes, sometimes accelerating coastline erosion and changing the morphology of natural channels and affecting habitats on a larger scale. Dredging of ship channels (capital dredging) has been necessary over recent years to accommodate larger vessels.

Effectiveness of measures

With the entry into force of the OSPAR Convention, dumping has in practice ceased, with the exception of the dumping of dredged material and fish waste from industrial fish processing operations. In general, dumping of dredged material is well managed by licences and controls on contaminant levels but not on total loads. According to the OSPAR Dredged Material Guidelines, measures to keep the volume of dredged material to a minimum are regarded as Best Environmental Practice for minimising the effects on the environment. The impacts of these activities will be considered under the OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area.

Identification of priorities for action

In future, maintenance dredging may increase, but natural variability (the number of storms) also has an effect on the total amount of dredging required from year to year. It will be necessary to assess and mitigate the possible

impacts. Existing management systems will also need careful monitoring to ensure that they continue to be effective.

6.3.4 Litter

Description of the impact

Sources of marine litter (for 95% consisting of non-degradable plastics) are mainly related to waste generated by shipping (fishing and commercial) and tourist and recreational activities. Floating litter and sunken pieces have been found in large quantities in all regions of the OSPAR maritime area. Impacts on marine life include the drowning of birds entangled in plastic sheeting, and the death of birds, turtles and cetaceans caused by ingested plastic objects. Litter has also been found to carry a variety of epiphytic organisms to sea areas that these organisms would not normally reach. Economically, the recreational and commercial fishing sectors are likely to be most affected by litter. As tourism, urban development and industrial pressure for development in the coastal zone increase, the problem of litter may also increase.

Effectiveness of measures

Under MARPOL Annex V, which entered into force on 3 December 1988, the discharge to sea from ships of all plastics is prohibited. An amendment to this Annex, adopted in 1995, requires all ships of 400 t and above, or transporting more than 15 people, to file a plan for garbage management. The North Sea (1991) and the Baltic Sea (1988) have been designated as MARPOL Special Areas for the purpose of Annex V, and the dumping of all garbage and litter from ships is therefore prohibited. However, there seems to have been no subsequent improvement in the situation with regard to litter. Within the OSPAR Strategy on Marine Biodiversity and Ecosystems attention will be given to the ecological impacts of litter.

Limitations in knowledge

Improved and more standardised methodologies, including the establishment of reference areas, will be needed to assess properly the scale and impact of litter both on coasts and offshore. These, in turn, will provide a basis for assessing trends in the quantities and significance of litter throughout the OSPAR area.

Identification of priorities for action

The following actions should be considered by the appropriate international, national and local authorities:

a. adequate enforcement of the requirements of MARPOL Annex V;
b. rapid adoption, implementation and adequate enforcement of the (draft) European Parliament and Council Directive on port reception facilities for ships-operated waste and cargo residues (OJ C10/4, 13 January 2000);
c. consideration of the designation of a larger part of the OSPAR maritime area as MARPOL Special Areas (Annex V);
d. campaigns to educate the public and those involved in tourism, fishing and shipping industries; and
e. relocation and/or improved management of coastal landfill sites from which garbage may escape to the sea.

6.4 Shipping

Description of the impact

Shipping can impact upon the marine environment in a number of ways. In the OSPAR maritime area, such impacts are mainly the result of either accidental or intentional inputs of noxious substances and/or organisms to the environment. These inputs can include the introduction of non-indigenous species in ballast water, the use of antifouling paints (see Section 6.5), litter (see Section 6.3.4), air pollution emissions, operational discharges, or the loss of a vessel and/or cargo. In recent years, cargo lost from ships has included phosphorus ore, pesticides and both mineral and vegetable oil. Discharges of the latter group of substances, although permitted in some cases, have still caused the death of many seabirds and continue to be a major concern.

The greatest potential for damage from shipping disasters lies in the spilling of hazardous materials close to ecologically sensitive areas (e.g. spawning grounds, bird colonies, nature conservation areas), or centres of human activities (e.g. mariculture sites, tourist centres). Oil spills from tanker accidents do have major economic and biological impacts, including effects on mariculture and loss of wildlife. Clean-up efforts to protect tourist interests and temporary restrictions on fixed fisheries are often required, particularly in the short-term.

Since August 1999, discharges of oil or oil mixtures from shipping are prohibited in the North West European Waters Special Area (established by the IMO under MARPOL Annex 1 (oil)). There have also been improvements in the availability of harbour reception facilities in many ports. However, there are still many ships cleaning tanks or discharging bilge water with an oil content of more than 15 ppm at sea, resulting in the oiling of seabirds, shellfish, other organisms and the coastline. Pollution from such illegal activities remains at an unacceptably high level, so far without a clear downward trend.

In the OSPAR maritime area, over 100 non-indigenous species have been recorded, mainly in the North Sea, the Celtic Sea, the Bay of Biscay and along the Iberian coast. The main vectors of such unintentional introductions are ships' ballast water and associated sediments, and fouling on ships' hulls, although mariculture is also a significant vector (see Section 6.2.2).

Effectiveness of measures

Several IMO Conventions address the issue of ship safety, while traffic separation schemes have significantly reduced the risk of ships colliding on passage. Loss of cargo or vessel is far harder to manage. Marked increases in the size of vessels and the volume of goods being transported have not led to an increase in the number of accidents. The number of incidents involving losses of vessels at sea has stabilised. However, the potential for accidents, damage or the requirements for emergency response across the North-east Atlantic as a whole is difficult to assess because data on the type of movement and cargoes involved are difficult to access.

No effective methods to control unintentional introductions of non-indigenous species are in place. The means of preventing such introductions are under review by IMO, which is preparing regulations for ballast water management.

Insufficient time has elapsed since the introduction of the MARPOL Annex 1 Special Area in August 1999 to determine the effectiveness of this new regulation. In order to improve the effectiveness of prosecution for violations, in 1999 the Bonn Agreement adopted Guidelines on International Co-operation on Facilitating Effective Prosecution of Offenders (Bonn Agreement, 2000).

Despite improvements, adequate waste reception facilities in ports are still not widely available. The charges levied and pressure of time discourage a minority of operators from using the facilities that are available, often resulting in illegal discharges. The EU Common Position 1/2000 on (draft) European Parliament and Council Directive on port reception facilities for ships-operated waste and cargo residues (OJ C10/4, 13 January 2000) could be a major step forward in the reduction of waste discharges.

Limitations in knowledge

It is very difficult to identify and assess the impact of the introduction of non-indigenous species. One of the reasons is that knowledge of the geographical distribution of indigenous species is limited. Better inventories are needed to identify rare species and unique habitats. More strategically targeted studies are needed to determine which species are indigenous/non-indigenous to each OSPAR Contracting Party.

Identification of priorities for action

With a view to reducing further the impact from shipping, Contracting Parties should consider taking action, individually and/or jointly as appropriate, with the view to:

a. establishing reception facilities for litter and oily wastes where such facilities are not yet available, providing incentives for the use of such facilities and improving the enforcement of compliance with existing rules and regulations with regard to litter and oil (including the application of chemical finger-printing and tagging of oil);
b. reducing the risk of collisions and related impacts from accidental spills and losses of cargo through:
    i) improving the effectiveness of traffic separation schemes and promoting their introduction, measures to ensure that routing measures are complied with and the installation of collision warning devices;
    ii) ensuring that ships are operated to the highest safety standards, including checks of the structural integrity of the ships and regular training of the crews;
    iii) improved access to advance information on the movements of ships and on their cargo; and
    iv) the promotion of measures in international fora to recover lost cargo by for instance tags and transponders;
c. improving, through appropriate IMO regulations, the fuel quality in order to prevent both the risk of engine failure (and consequent risk of the loss of vessels) and problems arising from the environmentally hazardous combustion residues of bunker oil;
d. developing, within the framework of IMO, global and regional measures for the prevention of the spreading of non-indigenous species via ballast water and promoting the development of globally intercompared sampling techniques as well as monitoring programmes for the most likely points of entry of non-indigenous species, and to consider whether there is need for complementary action by OSPAR; and
e. establishing within the framework of IMO the legal basis for the intended global prohibition on the application of organotin compounds which act as biocides in antifouling systems in ships by 1 January 2003, and the requirement to remove organotin compounds acting as biocides on ships by 1 January 2008.

6.5 Hazardous substances

6.5.1 Introduction

OSPAR adopted in 1998 a Strategy with regard to Hazardous Substances (OSPAR ref. no. 1998-16). This

sets out, *inter alia*, the objective of

> 'prevent[ing] pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances…, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances'

within a time frame of making every endeavour to move towards the target of the cessation of discharges, emissions and losses of hazardous substances by 2020. This Strategy is also incorporated into the OSPAR Strategy for the offshore oil and gas industry (see Section 6.7).

An important element of the strategy is the OSPAR list of chemicals for priority action (i.e. Annex 2 of the Strategy, which will be updated from time to time). Several of the substances mentioned in this section are already included in this list (i.e., mercury, lead, cadmium, PAHs, PCBs, organotin compounds, lindane (and isomers), nonylphenols, dioxins). Others are being considered in the current revision. Background documents for individual substances or groups of substances on the list will be prepared which will provide an overview of existing information on sources, pathways, inputs and concentrations in the environment, and on existing measures. This will provide a basis on which to take forward the development of appropriate action. The Ministerial Statement arising from the OSPAR Ministerial Meeting in Sintra (Portugal) in 1998 contains a commitment to such action within three years of the identification of a substance for priority action.

Point sources of these substances are generally controlled by the application of Best Available Technology and/or the setting of discharge and emission limit values, whereas diffuse sources are controlled by applying Best Environmental Practice and controls on the marketing and use of products.

Discharges, emission and losses of most of the substances in this section are the object of various EC Directives (many of which also apply in states which form part of the European Economic Area). These Directives include Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (which is intended to be replaced by the forthcoming Directive establishing a framework for Community action in the field of water policy), Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations, Council Directive 79/117/EEC of 21 December 1978 prohibiting the placing on the market and use of plant protection products containing certain active substances, Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market, Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control and Council Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

These directives, as well as work within OSPAR and under the UN Economic Commission for Europe's Convention on Long-Range Transboundary Air Pollution (UNECE-LRTAP) provide an international regulatory framework for the application of BAT and BEP.

6.5.2 Description of impacts

There are a number of metallic and organic substances which OSPAR has identified as being of concern, on account either of their intrinsic properties of toxicity, persistence and liability to bioaccumulate or of other effects such as endocrine disruption or of both.

Metals

Heavy metals can pose a risk to the marine environment in a number of ways. Dissolved copper can affect lower trophic levels such as phytoplankton. Other metals, such as cadmium, mercury and lead, can accumulate in shellfish and in top predators (including man). The trends found in levels of metal contamination are generally downward. The effects are normally localised and occur most frequently in estuaries and in the coastal zone. In these areas, metal concentrations in water and sediments can exceed the ecotoxicological assessment criteria, indicating concern for effects on biota. This is the case for cadmium concentrations in the water of some estuaries in the North Sea and mercury in near shore areas in Region IV. Cadmium, lead, mercury and copper in sediments have been found to exceed the EACs in certain specific areas close to current or past inputs. Furthermore, several heavy metals have been observed to travel long distances in the atmosphere, causing transboundary pollution in pristine areas such as the Arctic.

Organic substances

Apart from their intrinsic properties of toxicity, persistence, and liability to bioaccumulate, there is clear evidence that a diverse range of natural and man-made substances (including TBT and various other organometallic compounds, PCBs, dioxins, and certain pesticides, pharmaceuticals and industrial chemicals), have potential to impair the reproductive process in aquatic organisms, for example through interference with their endocrine (hormonal) systems. Studies have shown that these endocrine-disrupting effects can occur even at very low ambient concentrations, considerably less than concentrations that are either mutagenic or acutely toxic.

Exposure to TBT, originating from antifouling treatments, produces distinctive endocrine-disrupting responses in a number of organisms, including shell thickening in Pacific oysters and 'imposex' (development of the sexual characteristics of the other sex) in gastropods. Significant levels of imposex in dogwhelks are found in those estuarine and coastal areas of the Convention area with the heaviest concentrations of shipping and ship-related activity. Imposex has been documented in dogwhelks and common whelks in harbours in northern Portugal, north-west Spain, Iceland, Norway and Svalbard, as well as in British and Irish waters and the North Sea region, including the Kattegat. Surveys of imposex in Region III during 1997 indicate that because of the very low levels of TBT at which they occur biological effects are still evident at all but the most remote coastal sites ten years after enforcement of TBT restrictions on small vessels (< 25 m in length).

There is a significant correlation between shipping intensity and TBT levels in biota/sediments and the occurrence of imposex. This suggests that vessels with a length of more than 25 m using TBT-based antifouling paints represent the main source of TBT for the marine environment.

PCBs emitted and deposited during the years of intensive production and use are still a diffuse source of pollution and contamination of the global environment, despite a ban on the production of, and the introduction of controls on the marketing and use of, PCBs in many countries. As a consequence of their hydrophobic and persistent character, PCBs are bioaccumulated. High concentrations are found in biota, especially in the fatty tissues of piscivorous birds and marine mammals. Concentrations in mussels exceeding the EAC have been reported in all Regions, except Region V. PCBs can disturb enzyme and endocrine systems in marine mammals as, for example, observed in harbour seals (*Phoca vitulina*) in the Wadden Sea. High levels have also been shown to affect the immune system of the polar bear.

Sources of PAHs include domestic and industrial combustion of fossil fuels, oil spills, emissions from offshore installations and ship exhausts. Sediments represent the most important reservoir of PAHs in the marine environment. Concentrations in sediments often exceed the EACs, especially in some estuaries in Region II. PAHs are less prone to bioaccumulation or biomagnification than organochlorine compounds. Fish and organisms higher in the food chain tend to metabolise and excrete the compounds quite rapidly. From mesocosm studies, there is evidence of a correlation between the occurrences of pre-stages of liver tumours in North Sea flatfish and of contaminants, particularly PAHs and possibly chlorinated hydrocarbons.

Organochlorine pesticides enter the marine environment mainly through diffuse inputs from water and air as a result of their use in agriculture or on amenity areas and through transboundary pollution resulting from their use outside the Convention area. Various studies indicate that some organochlorine pesticides are detected in various marine species at low levels which may give rise for concern. However, levels are generally decreasing and restricted to local situations but further work is needed on toxaphenes. Although the use of most organochlorine pesticides has been phased out for sometime (for example, DDT since 1979 see Council Directive 79/117/EEC), they are still detected in the marine environment, due to their extreme persistence, to illegal use or to use elsewhere. Concentrations of DDE, a metabolite of DDT, still exceed EACs in mussels and fish in some areas.

Other persistent organic substances identified for action by OSPAR are not yet included in any OSPAR long-term monitoring programmes. Occurrence in the marine environment can either be predicted on the basis of information about their production and use, or has been demonstrated in various national studies or one-off surveys, either of actual concentrations in water or biota, or of biological effects on particular species.

These substances include:

- brominated flame retardants, used as additives to polymers and textiles;
- chlorinated paraffins that are used as plasticisers, flame retardants and as additives in metal working fluids and the leather industry;
- synthetic musks, used as fragrances in cosmetics, soaps and detergents;
- octyl- and nonylphenol ethoxylates (which are known endocrine disrupters), used in industrial detergents and in the textile and leather industry; and
- dioxins, which are highly toxic chemicals, but which are not manufactured but rather produced as combustion by-products, or during the production of certain chlorinated chemicals and pulp bleaching.

Just as spills of oil from shipping can directly impact on the sea, so can discharges and losses of oil from refineries and land-transport accidents have an impact, through riverine inputs and sewage discharges.

6.5.3 Effectiveness of measures

Metals

Point source discharges and emissions are the most amenable to control. A number of measures have been taken at international level to reduce discharges, emissions and losses of heavy metals (e.g. various OSPAR Decisions and Recommendations and EC Directives). As a result, inputs of metals have generally

decreased. Future regulations arising from the UNECE-LRTAP Convention will complement this. Diffuse inputs from the use of products containing heavy metals and the consequent run-off into rivers and the sea are now the main challenge.

The presence of high concentrations of metals and man-made substances in marine seafood could pose a problem for the human consumer. To protect consumers, OSPAR countries have established regulations and monitoring programmes for contaminants in seafood.

Organic substances

The application of TBT on ships less than 25 m in length was prohibited in 1990. IMO has decided to develop a binding international instrument to ban the use of organotin compounds in antifouling treatments on ships longer than 25 m. The target is to prohibit their application from 2003 and to require the removal of TBT from ships' hulls by 2008. Within the EC, the control on other TBT applications has been intensified with the 1999 amendment of Annex I of Council Directive 76/769/EEC (on the marketing and use of dangerous substances). This has resulted in a shift to the use of other harmful chemicals for antifoulant treatments. Recent studies have predicted that copper and booster biocides might be present in certain areas of the marine environment at concentrations that might cause an adverse impact on biota.

Many areas still show the legacy of historic TBT inputs. However, in countries where effective regulations were introduced, concentrations have decreased substantially over the past decade and biological recovery has been observed in areas of small-boat use. This is an indication that implementation of control measures can be effective.

The production of PCBs is banned. Several countries have phased out all PCB usage in large installations. However, substantial quantities of PCBs still remain in use in smaller installations. Spills from such installations and from electrical equipment are still important. Concentrations in marine biota at several locations have decreased considerably. However, the rate of reduction decreased in the 1990s, and concentrations appear to have levelled out.

Since 1976, uses of PCBs, PCTs and preparations including waste oils, with a PCB or PCT content higher, currently, than 0.005% by weight, have been prohibited on the basis of Council Directive 76/769/EEC. Certain use categories have been exempted until 30 June 1986. PARCOM Decision 92/3 on the Phasing Out of PCBs and Hazardous PCB Substitutes requires, *inter alia*, that Contracting Parties take measures to phase out and to destroy in an environmentally safe manner all identifiable PCBs (i) by 1995, or by the end of 1999 at the latest, for Iceland and the Contracting Parties which are riparian to the North Sea and (ii) by 2005, or by the end of 2010 at the latest, for the remaining Contracting Parties. The overview assessment of the reports on implementation of PARCOM Decision 92/3 showed that implementation (compliance only) was not yet complete in 1997. The controlled disposal of PCBs, the decontamination or disposal of equipment containing PCBs and/or the disposal of used PCBs in order to eliminate them completely has been regulated on the basis of Council Directive 96/56/EC. Further elimination of production and use of PCBs has been agreed under the UNECE-LRTAP Convention.

In parallel with other international organisations, and focusing on the marine environment, an OSPAR approach to addressing endocrine disrupters is being developed.

OSPAR has agreed on a number of measures relevant to the control of PAHs. These include PARCOM Recommendation 96/4 on one-component coal-tar coatings on ships, PARCOM agreement 1997-10 on two-component coal-tar coatings on ships, and OSPAR Recommendation 98/2 on limit values for the aluminium industry. Proposals are currently being developed for the control of PAH releases from domestic combustion and for the use of creosote on timber. The effectiveness of these measures is under evaluation within OSPAR.

The use of most organochlorine pesticides has now been phased out (for example, lindane in 1981,see Council Directive 79/117/EEC), and only some uses are still authorised. The protocol to the UNECE-LRTAP Convention on Persistent Organic Pollutants has identified a number of organochlorine pesticides as being persistent organic pollutants, and the development of binding measures to deal with these at a global level is under way. The dynamic selection and prioritisation mechanism (DYNAMEC) under the OSPAR Strategy with regard to Hazardous Substances will identify any further pesticides of possible concern for the maritime area on the basis of their intrinsic properties regarding persistence, bioaccumulation and toxicity for the development of further measures. All pesticides which are still subject to authorisation will be reviewed in the coming years under Council Directive 91/414/EEC (on the placing of plant protection products on the market). In order to restrict inputs of pesticides, a number of codes of practice have been developed. Recommendations on codes of practice concerning integrated crop management and the use of pesticides on amenity areas were adopted by OSPAR in June 2000.

OSPAR has already adopted measures on chlorinated paraffins (PARCOM Decision 95/1 on the Phasing Out of the use of Short-Chained Chlorinated Paraffins), and nonylphenol ethoxylates (PARCOM Recommendation 92/8 on Nonylphenol-Ethoxylates), and has set limit values for dioxins in several measures controlling point sources either directly (OSPAR Decision 98/4, manufacture of Vinyl Chloride Monomer) or indirectly by the use of the AOX parameter (PARCOM Decision 92/1, production of bleached kraft and sulphite pulp), or by phasing out the

use of molecular chlorine (PARCOM Decision 96/2 on the bleaching of kraft and sulphite pulp). Reports of OSPAR Contracting Parties on the implementation of these measures show that, in general, there is a reduction in the use of these substances, and that limit values are being respected. These substances are all on the OSPAR List of Chemicals for Priority Action. Background documents are being prepared which will identify the main sources and pathways to the marine environment with a view to taking forward appropriate control measures by 2001.

Except for dioxins, all of these substances are the subject of risk assessments under the EC Existing Substances Regulation (Commission Regulation (EC) No 1488/94). This will in many cases lead to binding risk reduction measures, mainly under the EC Directive on the marketing and use of dangerous substances (Council Directive 76/769/EEC). With respect to dioxins, emissions are being restricted by the application of BAT to several industrial processes and by EC Directives on combustion and incineration (Council Directives 88/609/EEC on large combustion plants, Council Directive 89/369/EEC on new waste incineration plants, Council Directive 89/429/EEC on municipal waste incineration plants, Council Directive 94/67/EC on the incineration of hazardous waste and Council Directive 96/61/EC on integrated pollution prevention and control).

Measures to reduce discharges of oil from refineries (PARCOM Recommendation 89/5) have been very effective (a reduction of over 90% between 1981 and 1997).

6.5.4 Limitations in knowledge

There are a number of topics where understanding is relatively poor and which should be considered for future investigation or research:

a. there is a lack of reliable data on emissions, discharges and losses, and on concentrations and effects, for several of the hazardous substances which are currently on the OSPAR List of Chemicals for Priority Action (see Annex 2 of the OSPAR Strategy with regard to Hazardous Substances). The same is true for many of the substances that are currently being considered for inclusion in this list. Furthermore, the application of the OSPAR DYNAMEC is hampered by lack of such information;
b. there is only limited information available on the range and concentrations of anthropogenic chemicals released to the marine environment that may cause endocrine disruption in marine organisms. Furthermore, the way in which potential endocrine-disrupting chemicals affect organisms is not fully understood. More information is needed on endocrine-disrupting effects other than œstrogenic effects; and
c. little is known about the degradation products of PAHs in the sea, such as their sulphone, hydroxy and nitro analogues, which are often appreciably more toxic than their parent compounds. Some of these can be expected to have a greater persistence than their precursors.

6.5.5 Identification of priorities for action

With sufficient resources to underpin the ambitious programme of work it implies, the OSPAR Strategy with regard to Hazardous Substances will provide a comprehensive and coherent approach to:

a. identifying the hazardous substances of concern in relation to the OSPAR maritime area, ranking the priorities for action on them;
b. identifying their sources and the pathways by which they reach the marine environment; and
c. developing programmes and measures to achieve the aims of the strategy where adequate action is not being taken elsewhere.

It will also be important to ensure that there is a corresponding effort in observing developments in the marine environment of the maritime area and in inputs to it, in order to chart the progress of the Strategy with regard to Hazardous Substances towards its objective. Innovation will be required to develop quality-assured monitoring techniques for the hazardous substances newly identified for priority action as well as strategies for the collection of information on such substances, to monitor new types of source (especially diffuse sources) and to establish baselines against which to measure progress. Since resources will inevitably be limited, it will be necessary to revise monitoring and assessment programmes to ensure that:

a. resources are concentrated on monitoring the aspects that are of most significance;
b. monitoring for specific substances is proportionate to the need and is reduced after appropriate goals have been reached; and
c. the benefits of these programmes are optimised in relation to their costs.

The programmes and measures adopted by OSPAR contain provisions for reporting on implementation, both on the arrangements adopted and on effectiveness. There is a need to improve coverage of reporting and to ensure that the information collected in this way on the effectiveness of measures is brought together with programmes for monitoring and assessment.

In addition, actions should be considered on certain specific points:

a. in relation to antifouling treatments,
   i) the measures in PARCOM Recommendation 87/1 (on the use of tributyl-tin compounds) and PARCOM Recommendation 88/1 (on docking facilities) should be completed with the development of a measure on BAT for the disposal of organotin wastes resulting from the removal of such antifouling treatments from ships;
   ii) monitoring should be urgently undertaken on the impacts of alternatives to organotin antifouling treatments (for example, copper and booster biocides);
b. a review of action at the national level to implement PARCOM Decision 90/3 (emissions from mercury-cell chlor-alkali plants) and, if need be, OSPAR measures to facilitate this implementation;
c. an assessment of the implementation of PARCOM Decision 92/3 (phasing out of PCBs); and
d. carrying forward work under the UNECE-LRTAP Convention on Persistent Organic Pollutants and completing the negotiations on a global convention on this topic under the aegis of the UN Environment Programme.

6.6 Radioactive substances

Description of the impact

Nuclear weapons testing, the dumping of wastes in deep water, the foundering of a nuclear submarine, accidents during transportation and discharges from coastal installations have all added to the radionuclides present in the marine environment. The majority of these inputs have been drastically reduced. Remaining inputs are largely due to ongoing releases from nuclear-fuel reprocessing plants. The greatest threats in the future are accidents in the civilian and military nuclear sectors. Releases from dumpsites are considered to pose negligible radiological risk to man, although it is difficult to draw firm conclusions about environmental impacts.

The question of radioactive contamination, particularly that arising from the Cap de la Hague and Sellafield nuclear-fuel reprocessing plants, is a matter of public concern. This stems from the higher levels of radioactivity discharged in the past and from recent increases in the discharge of certain less radiologically significant radionuclides, particularly technetium-99. There are now more sophisticated detection systems and there have been substantial net reductions in the levels of some more harmful radionuclides over the last decade. Low concentrations of some man-made radionuclides are found in seaweeds, shellfish and wildlife far from the sources. Impacts of radionuclides on wildlife have not been assessed. There are no internationally agreed standards for the assessment of the impact of man-made radionuclides on wildlife.

Fallout of caesium-134 and caesium-137, a major fraction from the Chernobyl accident in 1986, made an additional contribution to radionuclide contamination. Generally, since then the levels of these artificial radionuclides have been decreasing. However, in sediments, which have been particularly affected, there have been increases due to run-off from land, as well as redistribution within the ecosystem.

The entry into force of OSPAR Decision 98/2 has made permanent for all Contracting Parties the ban on the dumping of low-level and intermediate-level radioactive substances, including wastes, in the maritime area.

Effectiveness of measures

OSPAR adopted in 1998 a Strategy with regard to Radioactive Substances (OSPAR ref. no. 1998-17). This sets out, *inter alia*, the objective of

> 'prevent[ing] 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 values for naturally occurring radioactive substances and close to zero for artificial radioactive substances.'

within a time frame of 'ensure[ing] that discharges, emissions and losses of radioactive substances are reduced to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, emissions and losses, are close to zero by 2020'.

Recent commitments made within the framework of OSPAR, in particular in the context of the implementation of the OSPAR Strategy with regard to Radioactive Substances, indicate that a process for reducing anthropogenic emissions, discharges and losses of radioactive substances (including reductions in technetium) has started and will continue and that radioactivity levels associated with routine discharges will continue to decline.

Identification of priorities for action

Within the framework of the implementation of the OSPAR Strategy with regard to Radioactive Substances, it is important to develop environmental quality criteria for the protection of the marine environment from adverse effects of radioactive substances and to report on progress by 2003.

The investigations of the significance of possible leakage from the sunken nuclear submarines and from old dumpsites should be continued. If appropriate, an adequate policy to prevent pollution from such sources should be developed and implemented.

6.7 Offshore oil and gas

Description of the impact

Anthropogenic sources of oil to the marine environment include operational and accidental releases from oil and gas production platforms.

Oil inputs from produced water from offshore installations have increased progressively as oil fields have matured and the number of installations has increased, particularly in the North Sea. They now constitute the largest source of oil for the oil and gas sector. Leaching from old drill cuttings is a possible source of oil, but quantities released will be very small if the cuttings are not disturbed.

Changes to benthic communities have been identified over areas surrounding established oil and gas production platforms. Impacts are largely caused by past disposals of cuttings contaminated with oil and chemicals in the immediate vicinity of some platforms. There is a consequent reduction in species diversity near platforms, with opportunistic species dominating the biomass. Biological changes from this cause have been detected up to 3 km from such installations.

Discharges of produced water from the offshore oil and gas industry are increasing. In addition to 'oil', produced water also contains a range of other natural organic compounds including monocyclic aromatic hydrocarbons (i.e. BTEX), 2- and 3-ring PAHs, phenols and organic acids. Any toxicity of produced water is likely to arise from these compounds as well as from residues of production chemicals (including biocides) whose environmental fate and effects have been determined in advance by regulatory agencies. In the case of the relatively small discharges of produced water from gas platforms, the discharge of aromatics may exceed the discharge of dispersed oil. Total amounts of chemicals introduced from this source are projected to rise in parallel with an expected increase in the volume of produced water. There is uncertainty over the environmental effects of produced water.

Offshore oil and gas activities are expanding into deeper waters and into environments seasonally covered by ice. The risk of accidental releases of oil, and the potential effects of such releases, will increase because of the depth of operations and the difficulties of taking remedial actions in cold environments.

Effectiveness of measures

The target standard for oil of 40 mg/l in produced water from offshore installations (set by PARCOM Recommendation 92/6) was met by 90% of the installations in 1997. Oil discharged as part of the disposal of cuttings contaminated with oil-based drilling muds ceased at the end of 1996 (as a result of PARCOM Decision 92/2). Overall, inputs of oil from the offshore oil and gas sector have reduced by over 60% in the period 1985 to 1997.

In 1996, OSPAR adopted Decision 96/3 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals. This Decision is a key element in the international control of chemicals intended for use on offshore installations. It sets out, *inter alia*, what data and information relating specifically to substances or preparations must be notified to the competent national authorities and gives advice to be taken into account by the authorities with a view to harmonising the approach taken by all OSPAR Contracting Parties in their relevant authorisation and permitting procedures. Following a trial period its effectiveness was reviewed in the light of experience and a package of new OSPAR measures was established. These were adopted in June 2000 and supersede the previous OSPAR measures with respect to offshore chemicals. These new OSPAR measures take into account the provisions and requirements set out in the various OSPAR strategies and are one of the most advanced international agreements for the protection of the marine environment from the use of chemicals in the offshore oil and gas industry.

Limitations in knowledge

There are a number of issues that limit an assessment of the impact of the offshore oil and gas industry:

a. possible effects of disturbance of cutting piles;
b. lack of ecotoxicological assessment criteria and/or background/reference concentrations for oil; and
c. long-term impacts of the chemicals found in produced water.

Identification of priorities for action

In accordance with the OSPAR Strategy on Environmental Goals and Management Mechanisms for Offshore Activities (OSPAR ref. no. 1999-12), OSPAR should actively pursue the development and implementation by the offshore industry of environmental management mechanisms, including elements for auditing and transparent reporting, aimed at fulfilling the objective of this strategy. Furthermore, competent authorities and the oil industry should continue efforts aimed at a greater public openness regarding their activities.

6.8 Eutrophication

Description of the impact

The OSPAR Common Procedure for the Identification of the Eutrophication Status of the Maritime Area ('Common Procedure' (OSPAR ref. no. 1997-11)) is being used to characterise the maritime area in terms of problem areas,

potential problem areas and non-problem areas with regard to eutrophication. Preliminary results from the application of the Common Procedure and from Regional QSRs show that eutrophication, for example as indicated by periodically low oxygen levels, is confined to parts of Region II and to some coastal embayments and estuaries within Regions III and IV.

In Region II eutrophication is widespread in particular estuaries and fjords, coastal areas of the eastern part of the North Sea, the Wadden Sea, the German Bight, the Kattegat, and the eastern Skagerrak. Within the Irish Sea and some estuaries of Region III concentrations of nitrate and phosphate are elevated and oxygen depletion may occur at times as a result of human activity. There are indications that the Mersey Estuary / Liverpool Bay area and Belfast Lough may be showing signs of eutrophication. In Region IV, oxygen depletion has been recorded in some restricted areas of estuaries of coastal lagoons (for example, the Bay of Vilaine).

The majority of harmful algal blooms are natural events. However, in some circumstances, enhanced nutrient inputs and/or changes in the N/P ratios of the inputs, as well as inputs of micronutrients may have changed the phytoplankton community structure towards an increased likelihood of the occurrence of toxic species. Such effects have been suspected, and in some cases proven, to be responsible for the recent increases in space and time of blooms of such toxic species. The human health and economic consequences of harmful blooms and the accumulation of toxins in shellfish and other biota are a cause for concern. The presence of toxin-producing species does not always lead to the presence of toxins in shellfish and other biota, or to harm to fish and other marine life. On the other hand, algal toxins have been detected in shellfish in the presence of very low cell concentrations of toxic phytoplankton species.

Water rich in nutrients and with a high organic content may be transported outside eutrophication-affected areas to cause downstream reductions in water quality (for example, water of coastal southern North Sea origin impacting on waters of the Norwegian coastal Skagerrak).

Effectiveness of measures

OSPAR adopted in 1998 a Strategy to Combat Eutrophication (OSPAR ref. no. 1998-18). This sets out, *inter alia*, the objective of:

> 'combat[ing] eutrophication in the OSPAR maritime area, in order to achieve and maintain a healthy marine environment where eutrophication does not occur.'

within a time frame of making every effort to achieve this objective by the year 2010. Actions to achieve this comprise integrated target-orientated and source-orientated approaches.

The 1987 North Sea Ministerial Conference agreed that nutrient inputs (nitrogen and phosphorus) to areas affected, or likely to be affected, by eutrophication should be reduced by the order of 50% between 1985 and 1995. This aim was endorsed by OSPAR in 1988 for the whole maritime area and subsequently incorporated by OSPAR within the Strategy to Combat Eutrophication.

The 50% reduction commitments by North Sea states were substantially achieved for phosphorus, but reductions for nitrogen were estimated to be of the order of 25% between 1985 and 1995, based on discharges and losses at source. Efforts to collect and treat urban and industrial wastewater have resulted in reductions in direct inputs of nitrogen of 30% and of phosphorus of 20% between 1990 and 1996. However, because of fluctuations in river flow over the same period, no consistent reductions in riverine or atmospheric inputs to the North Sea were detected. Little success has been reported in reducing inputs from other diffuse sources such as the leaching of fertilisers and slurry from agricultural land.

While there are no clear trends in nutrient levels from the North Sea as a whole, this is not so for smaller coastal areas directly influenced by anthropogenic inputs. In Danish coastal waters, the Wadden Sea and German Bight there has been a significant downward trend (especially for phosphorus) between 1989 and 1997. In Danish waters the reductions are due to a decrease in loads from sewage, industry and detergents (80% for phosphorus).

Measures taken by the EC including the Urban WasteWater Treatment Directive (91/271/EEC) and the Nitrates Directive (91/676/EEC) of 1991 as well as a range of initiatives at national level are providing further impetus to the reduction of nutrient inputs. The Urban WasteWater Treatment Directive required a reduction of nutrients to eutrophication-sensitive areas by 1998 and the Nitrates Directive required the establishment of 'Action Programmes' to reduce agricultural inputs to 'Nitrate Vulnerable Zones' to be in place by the end of 1998. As these directives have yet to be fully implemented, their benefits have yet to be realised.

Limitations in knowledge

There are a number of topics where understanding is relatively poor and which should be considered for future investigation or research:

a. the response of the marine ecosystem (for example, through the formation of harmful algal blooms, changing algal community structure and succession) to inputs of nutrients, especially the impact of changing nutrient ratios (N/P) and the contribution of dissolved and particulate nitrogen and phosphorus;

b. the appropriate form of ecological quality objectives with respect to eutrophication;
c. natural variability in nutrients and ecosystem response, including the measurement and assessment of long-term trends;
d. the causes of occurrence of toxin-forming algal species linked to oceanographic events and the implications for toxin presence in shellfish; and
e. reliable modelling tools to underpin investigations of environmental variability and consequences of management action.

Identification of priorities for action

Within the framework of implementing the Strategy to Combat Eutrophication, OSPAR Contracting Parties should give particular attention to pursuing, without delay, the target-orientated and source-orientated approaches of the strategy, and in particular:

a. implementation of existing measures aimed at reducing emissions, discharges and losses of nutrients from agriculture and urban sources. In this respect, emphasis should be placed on:
   i) increased effectiveness of the implementation of the Urban WasteWater Treatment Directive and the Nitrates Directive; and
   ii) mechanisms to reduce input from diffuse sources, particularly agricultural fertilisers, livestock and atmospheric deposition; and
b. the further development and application of the Common Procedure and the development and adoption of ecological quality objectives.

The existing monitoring activities should be harmonised throughout the maritime area in order to establish links between nutrient enrichment and eutrophication effects. Work to model the consequences of various reduction scenarios should continue in parallel with spatial surveys and laboratory experiments to obtain necessary data for validation and testing. There is a need for further research on a range of topics to improve understanding of the causes and dynamics of blooms, their potential links to eutrophication, toxin production by phytoplankton, and the accumulation of toxins in shellfish and other biota.

6.9 Climate change and climate variability

Description of the impact

There is general agreement by the IPCC that increases in greenhouse gases are contributing to global warming. Work by the IPCC using Global Circulation Models predicts that, by 2100, the surface air temperature of the North-east Atlantic will have increased by approximately 1.5 °C, the sea level will have risen by 25 to 95 cm, mean precipitation will have risen and there will be an increased frequency and intensity of extreme events such as storms. Projections of future climate indicate that precipitation in high latitudes of Europe may increase, with mixed results for the other parts of Europe. Water supply may be affected by floods in northern Europe and by droughts in southern Europe. These changes may lead to major climate system changes with resulting impacts on the ocean and its biota.

Potential consequences of climate change are far reaching. Changes may occur in ocean current strength and transport, water mass formation rates, sea level height, the strength and frequency of weather systems, and rainfall and run-off with downstream effects on ecosystems and fisheries. Predicted rises in sea level are of particular concern especially for the Dutch coastal zone, other low-lying areas and intertidal habitats of the OSPAR region. The formation of North Atlantic Deep Water in Region I constitutes one of the deepest branches of the thermohaline circulation of the world's oceans; any changes in the level of formation of this water in the Arctic may change the thermohaline circulation and result in a colder climate in Europe.

Existing measures

The United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1992 by 166 countries and entered into force March 1994. The Convention provides a mechanism for agreeing international action, with the ultimate objective of the 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'.

Thirty-eight developed nations, including European countries, Japan, the Russian Federation and the United States, have accepted their historical responsibility for climate change. In December 1997, as part of the Kyoto Protocol, these countries agreed to individual emission reduction commitments, which, as a whole, would reduce overall emissions to 5% below levels emitted in 1990 by 2008 to 2012. These reductions are intended to be achieved through the 'Kyoto flexibility mechanisms' that aim to maximise economic efficiency through trading in carbon credits.

Limitations in knowledge

There are a number of topics where understanding is relatively poor and towards which research should be directed in the future:

a. a lack of knowledge exists concerning the relationship between climate variability and changes in physical conditions and how this might influence patterns of water circulation and biological production;

b. the mechanisms behind the observed strong relationship between the NAO and fluctuations in sea surface temperature are unclear;
c. the source and cause of observed multi-annual oceanic anomalies is not known;
d. the extent to which changes in the volume of deep water formed in the Arctic may affect the North Atlantic thermohaline circulation and weather needs clarification;
e. the interaction of mesoscale features such as eddies with larger entities such as the Gulf Stream as a response to atmospheric oscillations such as the NAO and climate variability is not clear; and
f. a greater emphasis needs to be placed on understanding the relative contributions of natural and anthropogenic forcing to climate variability in the North Atlantic.

Identification of priorities for action

Long-term monitoring of key atmospheric and oceanic indices and a resolution of mesoscale and synoptic patterns of change through the development of operational monitoring and modelling is needed to resolve this situation. Such monitoring could be included in the developing plans of the Global Ocean Observation System (GOOS).

A high priority should be given to improving scientific understanding of the factors governing climate change so that uncertainty is removed concerning the anthropogenic contribution, timing and severity of climate change impacts.

The possibility of sea level rise needs to be considered when planning coastal defences or development and when considering measures to protect species and habitats.

6.10 Other issues

6.10.1 Microbiological contamination

Description of the impact

Bacteria and viruses associated with (treated and untreated) discharges of sewage in all coastal regions of the OSPAR Convention area and other sources such as agricultural run-off can affect marine biota, including invertebrates, fish, and seals. The most important possible concerns in the OSPAR area in respect of microbiological contamination are the quality of bathing water and of shellfish for human consumption. There are still a number of beaches where the standards of the EC Directive for bathing water quality (76/160/EEC) are not met. Contamination of shellfish with *E. coli* has led to restrictions on marketing shellfish (in accordance with the EC Directive for shellfish hygiene (91/492/EEC)). The associated increased processing costs have caused concern within the shellfish industry.

Effectiveness of measures

Since monitoring work began there has been a marked improvement in quality of bathing water throughout the region and the vast majority of bathing waters in the OSPAR area now meet the standards under the EC Directive for bathing water quality (76/160/EEC). Where standards are not met, action has been initiated by the responsible authority within each country to improve bacterial quality of the bathing water.

Due to limitations inherent in the existing standards for the microbiological quality of bathing water and shellfish, compliance with these standards, although important in the protection of public health, may not protect all individuals against the entire range of human pathogens to which they might be exposed either through bathing or seafood consumption.

Limitations in knowledge

Current information is restricted to compliance with standards for the microbiological quality of bathing water and seafood. No assessment can be made of ecological effects due to the lack of knowledge. For example, little is known about the risk to mammals and seabirds from human pathogens in the marine environment.

Identification of priorities for action

If sewage discharges continue to affect bathing waters or shellfish growing waters further action (for example, the disinfecting of effluents or relocation of discharge points) should be taken by the responsible authorities to improve the bacterial quality of these waters. Furthermore, there is a need to take greater account of exceptional events such as primary rainwater run-off from combined sewage systems (where rainwater and sewage are collected together) after storm events, these being highly polluting.

6.10.2 Dumped ammunition

From time to time munitions such as incendiary devices and smoke bombs are washed up on beaches along the east coast of Ireland, the Isle of Man and the west coast of Scotland. This presents a hazard to the public. OSPAR is considering a course of action for dealing with dumped munitions.

6.11 Conclusion

The efforts of the OSPAR Contracting Parties since the adoption in 1972 of the Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships

and Aircraft, and in 1974 of the Paris Convention for the Prevention of Marine Pollution from Land-based Sources have produced a significant effect in improving the protection of the marine environment of the North-east Atlantic. The trends towards worsening pollution have been reversed, and in a substantial number of significant cases the source of the pollution has been stopped.

Nevertheless, a number of important actions remain to be undertaken. The OSPAR Strategies have, however, established a framework for pursuing these. If the necessary resources can be made available, these Strategies offer the possibility for making real improvements over the next generation in the condition of the marine environment of the North-east Atlantic.