chapter 3

Human activities

3.1 Introduction

This chapter is devoted to the various human activities that influence the coastal and offshore environments of the North-East Atlantic. The changes that are occurring especially to coastal marine ecosystems are largely a function of human intervention and an assessment of these changes needs to be made in relation to those activities that have large-scale and persistent consequences for habitats, biological diversity and productivity. In attempting to assess the causes of environmental change, it is particularly important to understand how these activities (i.e. the sources of change) are themselves changing with time.

At present, a balanced description of human activities affecting the marine environment is difficult. Most countries do not routinely compile demographic statistics, and related land-use (industrial and tourist) data, specifically for the coastal zone (e.g. within 10 km of the sea) and trends are therefore difficult to assess accurately. In addition, there is a lack of harmonised data on economic parameters associated with human activities. Although efforts have been made to gather the most readily available data for the current assessment, the information presented is far from balanced and complete and there are considerable disparities between countries and regions. Nevertheless, this chapter gives an indication of the general patterns of the human activities across the maritime area.

Many of the coastal states bordering the North-East Atlantic are densely populated, highly industrialised or use land intensively for agriculture. As a consequence, the region is affected by many human activities that result in inputs of nutrients and harmful substances, and the introduction of hazardous substances through rivers, the atmosphere and direct domestic and industrial discharges.

The OSPAR countries make use of the seas for fishing activities, offshore oil and gas exploration, the laying of pipelines, extraction of sand and gravel, dumping of dredged material, the laying of cable routes and energy cables and as transport routes. There is growing traffic between European States and other parts of the world, and the North Sea is one of the most frequently traversed sea territories in the world.

Many coastal zones are intensively used for recreation. In several regions there is increasing competition for the use of certain facilities and amenities on, or adjacent to, the coasts. There is growing demand for housing, commercial sites, rented accommodation and improved services. There is also an expanding market for clean beaches, watersports, angling, ecotourism and unspoilt coastal landscapes. These interests are not always compatible.

Most States in the North-East Atlantic have declared an Exclusive Economic Zone (EEZ), making use of the UN Convention on the Law of the Sea (UNCLOS), which distinguishes between three categories:

- the 'territorial seas' (mostly 12 nm), subject to coastal state jurisdiction;
- the EEZ extending up to 200 nm offshore (350 nm including the continental shelf); in the EEZ the coastal state has the exclusive right of exploitation and fisheries and is responsible for regulating pollution from seabed installations, dumping, and other activities; and
- the 'high seas' beyond the EEZ, neither subject to national jurisdiction nor sovereignty.

International conventions and regulations, such as the International Convention for the Prevention of Pollution from Ships (MARPOL) and the London Convention, apply both within and outside of the EEZs.

Measures and regulatory framework for the protection of 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 are described under Section 3.16. Adopted measures concern hazardous substances known for their environmental risk and mentioned in the various OSPAR Strategies, such as polychlorinated biphenyls (PCBs), and heavy metals, radioactive substances and nutrients. Another OSPAR Strategy concerns the protection and conservation of ecosystems and biological diversity of the maritime area. Measures have been adopted to address several industrial sectors and diffuse sources (e.g. inputs of phosphorus and heavy metals have been substantially reduced, but other substances (e.g. nitrogen) have not been substantially reduced). Traffic separation schemes have been established in order to reduce the risk of accidents. Fisheries have been regulated through the application of technical measures and Total Allowable Catches (TACs).

The framework for environmental protection of the Convention area has developed extensively during the past twenty years through initiatives by the European Union (EU) and the International Maritime Organization (IMO). Furthermore, initiatives were taken in accordance with the OSPAR and preceding Oslo and Paris Conventions, and through the Bonn Agreement, the Helsinki Convention, the International Conferences on the Protection of the North Sea and the Trilateral Wadden Sea Conferences. There are no special agreements between East Atlantic and West Atlantic coastal states.

Table 3.1 Estimated population size and density in the catchment areas of the OSPAR Regions.

	Population size (millions)	Population density (inh/km^2)
Region I		
Faroe Islands	0.04	
Finland (1997)	0.009	2
Greenland (1995)	0.004	
Iceland (1996)	0.27	2.4
Norway (1996)	1.1	7
Russia (1989)	1.2	
Region II		
Belgium	10.1	333*†
Czech Republic (1996)	10.3	131*†
Denmark	2.2	122*†
France	25.3	107†
Germany	72.5	229*†
Liechtenstein (1996)	0.031	194*†
Luxembourg (1996)	0.4	161*†
Netherlands	15.6	381†
Norway	3.3	14*†
Sweden	2.4	20*†
Switzerland	5.7	171*†
UK	36.4	280
Region III		
Ireland	3.6†	52†
UK	22.3	203
Region IV	47.2	71
France	16.7	64
Portugal	9.5	106
Spain	21.1	67
Region V		
Azores – Portugal	0.24	103

* relates to the whole country not just the catchment area; † data from 1996 Fischer Weltalmanach (1999) (all other data from the regional QSRs).

3.2 Demography

The human population in the catchments of the five OSPAR Regions ranges from 240 000 in Region V (Azores only) to 184 million in Region II *(Table 3.1)*. Population densities vary from 2.4 inh/km^2 (Iceland, northern Norway, Scottish Highlands) to 381 inh/km^2 in the Netherlands *(Table 3.1)*. Populations in coastal areas often show considerable seasonal variation due to tourism. The human population in Regions III, IV and V tend to concentrate in coastal towns creating growing competition and conflict between the exploitation of natural resources, and the consequent development, and the need for nature conservation. The same is also true for Region I, but because of the low population density the pressure on the coast is not nearly as high as in Region II. Population density and land cover in coastal areas are shown in *Figure 3.1*.

The mean annual population growth between 1990 and 1996 recorded in Iceland was 1% and in Norway 0.5%. In 1996 the population in the EU grew by more than 1 million people (0.3%) to a total population of 373 million *(Figure 3.2)*. Since the mid-1980s, immigration has influenced population growth in the EU; approximately 80% of the growth in 1995 was due to immigration.

Extrapolating present trends in birth rates, death rates and migration, results in the population of the OSPAR Member States (with exception of Finland, Luxembourg and Switzerland) reaching a maximum of about 312 million in 2025 (Eurostat, 1997).

3.3 Conservation

3.3.1 Ecological conservation

Modifications to coastal areas resulting from human activities have been accompanied by changes to and losses of habitats and ecological disturbance. In recognition of this, OSPAR Contracting Parties are signatories to several international conventions concerning the conservation of coastal and offshore environments, and all OSPAR Contracting Parties have established conservation areas within the framework of international conventions or national regulations *(Table 3.2)*. Some offshore areas and some species (e.g. whales and migratory birds) are also protected by conventions. In 1998, the OSPAR Convention was expanded by a further Annex to include protection and conservation of ecosystems and biological diversity.

Table 3.2 International conventions for ecological conservation.

	Region
The Bird Directive focuses on the preservation, maintenance and re-establishment of a sufficient diversity and surface area of appropriate habitats to classify Special Protection Areas (SPAs)	SPAs have been designated or are still being designated in all OSPAR Regions
The Habitats Directive concerns the conservation of natural habitats as well as wild plants and animals and plans for the designation of special areas of conservation (SACs) before 2004. These zones will be coupled with specific plans for management and restoration. Under this directive all whales and turtles are fully protected	SACs have been designated or are still being designated in all OSPAR Regions
The Ramsar Convention protects wetland areas of international importance, particularly those containing waterfowl habitat	several areas and sites in Regions I, II, III and IV are protected by this convention
Biosphere Reserves are areas of terrestrial and coastal ecosystems which are internationally recognised within the framework of UNESCO's Man and the Biosphere (MAB) Program. Each Biosphere Reserve is intended to fulfil three basic functions: conservation, development and logistics	several areas in Regions II, III and IV are parts of the MAB
The Bonn Convention on Migratory Species (1979) protects migrating species by a number of subsidiary agreements: **the Agreement on the Conservation of Seals in the Wadden Sea** *(1990)* (as a consequence of the 1988 seal epidemic the Wadden Sea States gave special protection to the common seal population); **the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS)** (all small cetaceans are protected)	
The African Eurasian Waterbird Agreement for the protection of migrating waterbirds aims at protecting the most important breeding, feeding, resting and overwintering areas in the African-European region	

Figure 3.1 **Population density and land cover in coastal areas. Source: EEA (1999).**

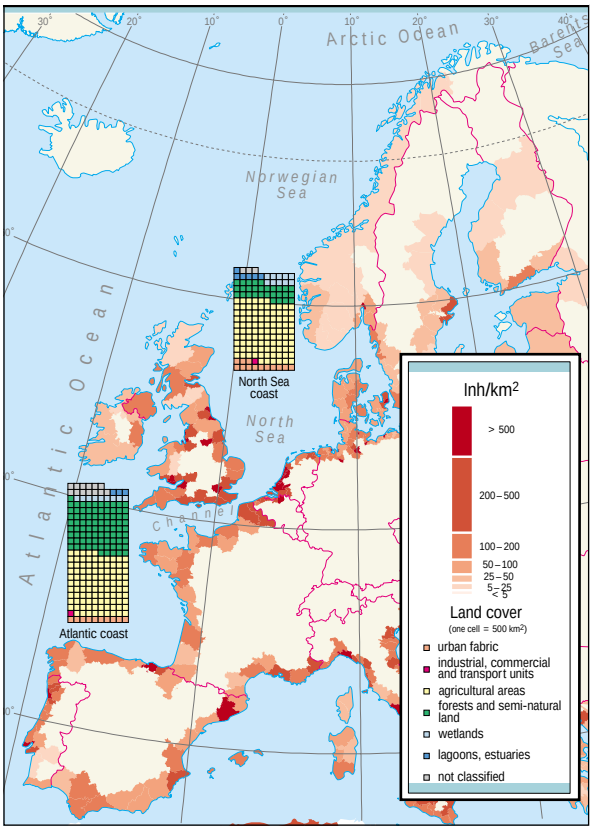
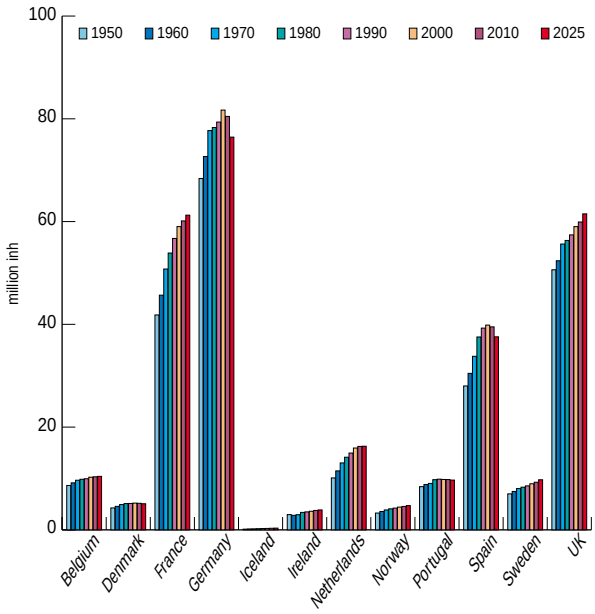


Figure 3.2 **Population change between 1988 and 1996. Source: Statistisches Bundesamt (1995).**



Both national legislation and EC directives are important instruments in protecting marine ecosystems. Examples are the EC Directive on the conservation of wild birds (79/409/EEC) and the EC Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC). Within that framework a coherent ecological network of habitats shall be established (NATURA 2000). Additionally, countries have developed a number of national designations. In Iceland and Norway where these EC directives do not apply, nature protection areas are predominantly land-based, although some coastal areas are protected or have been identified for protection.

3.3.2 Archaeological conservation

Numerous old wrecks and other features of archaeological importance such as ancient tombs and buildings can be found on the coasts of the OSPAR area. They have little significance for the ecology of the area but they are part of its marine heritage, may attract scholars and tourists and are worthy of protection. Examples are the submerged villages off the south-east coast of England and the numerous archaeological remains.

Numerous old shipwrecks can be found on the seabed around the coastline of all Regions (3000 off the coast of Northern Ireland alone). Many vessels foundered during the Fifteenth Century in the Azores (800 wrecks) and between the Sixteenth and Nineteenth Centuries around Spain and Portugal.

Archaeological remains and shipwrecks are subject to the risks of disturbance and destruction by mineral extraction, navigational dredging, pipe laying and pollution. Special legislation for protecting marine archaeological relics exists in all Regions. The European Convention on the Protection of the Archaeological Heritage (1992; ratified by Norway 1995) regulates sites of cultural heritage significance, both on land and in the sea. Moreover, a draft convention on the underwater cultural heritage is under discussion within the UN system.

3.4 Tourism and recreation

Coastal areas provide many opportunities for leisure and recreation that attract both local people and tourists from inland and abroad. Camping and bathing, sailing, recreational fishing, surfing, scuba diving and bird- and whale-watching are among the most popular activities. The number of tourists shows a distinctly seasonal pattern. For example, in the Wadden Sea area 75 to 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.

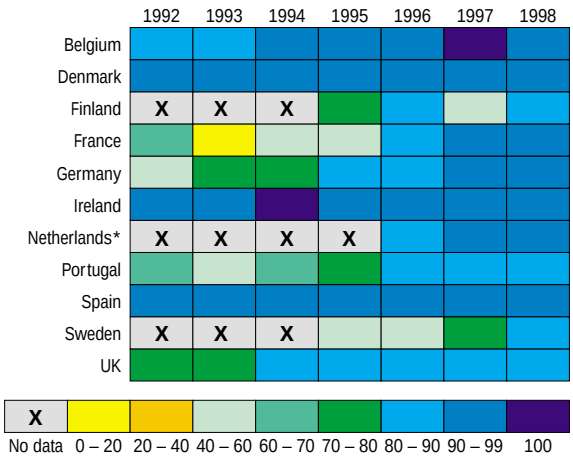
In all OSPAR Regions tourism has been growing

steadily. For example, in Norway the number of overnight stays in hotels increased during the mid-1990s by 20 to 25%. In the Republic of Ireland it is estimated that since the 1970s the number of day trips to the coasts has increased by almost 600%. Tourist accommodation in the Azores has increased by 83% since 1980. Tourists visiting Iceland increased by about 62% over the period 1990 to 1998. The number of car ferries operating in the area and their carrying capacities have been expanding rapidly and these facilitate the tourist trade.

In the absence of stringent planning controls and sensitive development policies, the attributes of coastal areas that are most attractive to visitors such as unspoilt landscapes, clean uncrowded beaches, sea water fit for bathing and wildlife refuges, can be harmed by the sheer number of visitors, construction, and excessive vehicle and pedestrian traffic.

In the past, bathing water at many coastal sites was contaminated by bacteria and organic material, often as a result of contamination by sewage. As an EC report has shown *(Figure 3.3)*, there has been much improvement recently in bathing water quality primarily through the provision of new or improved wastewater treatment plants. Designated beaches are monitored regularly during the bathing season and the number of beaches complying with the mandatory requirements of the EC Directive (76/160/EEC) is steadily increasing.

Figure 3.3 **Bathing Water Directive compliance in EU countries during 1992 to 1998 (percentage of beaches complying with at least the mandatory values of the Directive). Source: after EC (1999).**



* For 1992 to 1995 insufficient data were available for compliance. This information differs from the EC report where percentages of compliance were presented.

3.5 Fisheries

Fishing has great economic and social importance for most OSPAR countries, and technical developments have led to more efficient exploitation of commercial fish stocks. It is very important that fishing is managed in a sustainable way to avoid overexploitation of the fish stocks and to rebuild those stocks that are believed to be overexploited today. Many target species are now not within their 'Safe Biological Limits' (see footnotes to *Table 5.1*). Fishing also results in the mortality of non-target species and towed fishing gears can impact on benthic communities and cause physical disturbance of the seabed.

3.5.1 Fish

The landings of the main commercial fish species are outlined in *Figure 3.4* and *Table 5.1*.

Norway and Iceland are among the largest fishing nations in the world, with a yearly catch of 2 600 000 and 1 500 000 – 2 000 000 t, respectively. In the Norwegian Sea the catches from the Russian fleet increased from 440 000 t in 1994 to 1 300 000 t in 1998, mainly due to an increase in landings of herring.

In the North Sea at present 30 to 40% of the biomass of commercially exploited fish species is caught each year. The total annual landings in the North Sea (Region II) increased from around 1 million t in 1900 to 2 million t in 1960. During the 1960s the landings increased sharply to about 3.5 million t, followed by a decline to less than 3 million t in recent years; in 1995 landings in the North Sea totalled 2.9 million t, compared to 0.17 million t in the Channel and 0.4 million t in the Kattegat. Over this period, there has been a decrease in the landings of gadoids and an increase in landings of pelagic species and species for industrial processing for fishmeal and oil. Landings from industrial fisheries (mostly sandeels) account for about 55% of the total catch weight in the North Sea. Due to increased beam trawling in the southern and central parts of the area, fishing effort in the North Sea rose between the late 1970s and 1995 when it totalled 2.25 million hours (2 million hours in 1990) (Jennings *et al*., 1999).

In Region III the average yearly landings of fish between 1990 and 1995 were 840 000 t; 75% of which were pelagic species and the remainder demersal. Irish and Scottish fleets account for approximately half the total fish landings in the region.

In Region IV, the major fisheries in economic terms are for tuna, the most noteworthy being the albacore (*Thunnus alalunga*) fishery which extends into Region V ranging from the Bay of Biscay to the Azores (14 000 t), the bluefin (*Thunnus thynnus*) fishery in the Bay of Biscay (yearly 1000 to 4000 t) and the swordfish (*Xiphias gladius*) fishery (6000 t in the entire North-East Atlantic). The

species yielding the highest landings are sardine (*Sardina pilchardus*), horse mackerel (*Trachurus trachurus*) and mackerel (*Scomber scombrus*). The fisheries for sardine and anchovy (*Engraulis encrasicolus*) are important for the survival of coastal communities.

In Region V, fisheries aim at large pelagic tuna and tuna-like fish (mainly in the southern sector), deep-sea species on the continental slopes, and demersal and pelagic stocks (other than tuna and related species) in deep oceanic waters. Artisanal fisheries around the Azores and adjacent seamounts target a great variety of species. An important target species in Region V is Atlantic bluefin tuna with annual catches around 40 000 t. Redfish catches peaked in 1994 and 1995, at 94 000 and 127 000 t, respectively. Catch data are sparse and assessment of the status of the stocks in Region V is severely hampered by insufficient monitoring and reporting. Despite this, assessments have been carried out using total international landings data and the French trawl CPUE (catch per unit effort) data for a range of species. The assessments support the view expressed by ICES in 1998, that most deep-water species are currently harvested outside safe biological limits. Fishing effort in the deeper waters tends to be unpredictable, since it waxes and wanes according to the fluctuations experienced by fishermen as their access to other stocks is limited by regulation or overfishing.

Fleets and gear types

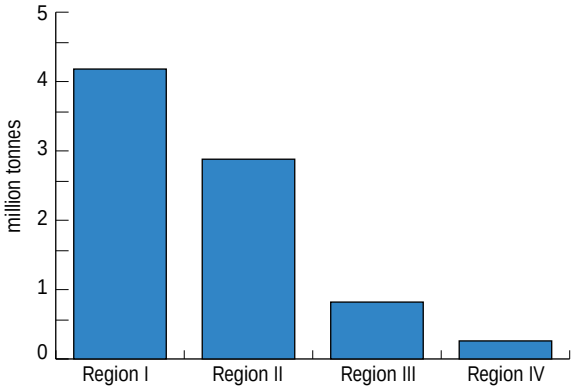
In most Regions the coastal fishing fleets consist mainly of smaller fishing vessels. Additionally, many OSPAR countries have deep sea fishing fleets (e.g. longliners, industrial and factory trawlers). Many nations operate within Region V, including a number of fleets from non-OSPAR countries (e.g. in 1996 282 Japanese longliners operated in the Atlantic Ocean). In the northern part of Region V, the primary fishery is trawling for redfish.

In the North Sea, the capacity of demersal and pelagic fleets was enhanced rapidly after the Second World War. Larger ships with more powerful engines came into operation. Three types of modern fishing vessel are responsible for the majority of the landings: purse seiners for the substantial exploitation of herring (*Clupea harengus*) and mackerel; from the early 1950s otter trawlers started targeting herring, cod (*Gadus morhua*), haddock *(Melanogrammus aeglefinus*), saithe (*Pollachius virens*) and subsequently small demersal and pelagic species, notably sandeel (*Ammodytes* spp.), Norway pout (*Trisopterus esmarki*) and sprat (*Sprattus sprattus*) for the fishmeal and oil industry; the beam trawlers targeting flatfish.

The gear types used are:

- demersal active gear (e.g. otter and beam trawls, demersal seines);
- pelagic active gear (e.g. purse seines, pelagic trawls); and
- passive gear (e.g. nets, traps, lines).

Figure 3.4 **Landings of the commercially important fish species in 1997.**



Some gear types used in North Sea fisheries in relation to target species and by-catch are listed in *Table 3.3*, and the by-catch of some marine mammals owing to fishing activities is shown in *Table 3.4*.

Discards

In Icelandic and Norwegian waters, regulations prohibit the discarding of commercially important fish. Fleets subject to EU regulation are obliged to discard undersized fish. Commercial sized fish may also be discarded when catches are in excess of the quota or to maximise economic returns from the catch (high grading). Many discarded organisms die. Discarding of young fish is considerable on inshore nursery grounds as well as in the mixed roundfish fisheries. The levels of discarding vary largely by species, areas, fleet and season.

In Region II, the estimated average percentage of cod and haddock discarded in North Sea demersal fisheries are 22% and 36% respectively by weight and 51% and 49% by numbers (5NSC, 1997). In the beam trawl fishery, approximately half the numbers of plaice (*Pleuronectes platessa*) caught are discarded, although on inshore grounds this may be as high as 80%.

In 1996, estimates from one of the demersal fleets operating in Region III indicated that about 18%, by weight, of the total catch was discarded. However, this is considered to be a conservative estimate of the extent of discarding. In Nephrops fisheries, just under half a tonne of whiting (*Merlangius merlangus*) is discarded for every tonne of Norway lobster (*Nephrops norvegicus*) landed from the Irish Sea.

Within Regions III and IV, the discarding of pelagic species is generally below 25% of the total weight caught by trawl gears. There is a lack of reliable information on

discards by purse seiners. Occasionally whole catches may be discarded because they are under the marketable size.

Demersal and pelagic fisheries in Region V have been expanding rapidly. Only in a few cases have by-catch and discard rates been studied, indicating that weights of discards often equal the weights of the fish that have landed.

3.5.2 Shellfish (crustaceans and molluscs)

Landings of shellfish are listed in *Table 3.5*.

The most common methods employed in directed fisheries for shellfish are dredges (mechanical for scallops, oysters and blue mussel (*Mytilus edulis*), and suction for cockle (*Cerastoderma edule*)), trawls for Norway lobster and shrimp, and pots for Norway lobster, edible crab (*Cancer pagurus*) and lobster (*Homarus gammarus*).

In all Regions the largest landings by weight originate from the fisheries for shrimp, mussel and cockle *(Table 3.5)*.

Outside the Arctic and Wider Atlantic regions the major commercial crustacean is the Norway lobster, which is caught by trawl and pots on muddy ground in a range of locations in coastal waters, near seas, and along the western shelf. Potting for edible crab has also been increasing in the Channel, Western Approaches and off the Irish–Scottish west coast. Potting for lobsters remains locally important in many coastal areas but fishing is gradually spreading further offshore. Landings from the brown shrimp (*Crangon crangon*) fisheries show substantial natural fluctuations year on year, but landings from the other crustacean fisheries are more stable, although most of the stocks are fairly heavily exploited.

In addition to the large-volume mollusc fisheries for mussel and cockle, fishing effort has been increasing steadily in many great scallop (*Pecten maximus*) and queen scallop (*Chlamys opercularis*) fisheries. New fisheries are also being developed for whelk (*Buccinum undatum*), razor clams (*Ensis directus*) and *Spisula* sp. Most mollusc stocks are heavily exploited, and some scallop and cockle fisheries are giving rise to management concerns. Mollusc stocks invariably show substantial natural variations in recruitment, which contribute to the difficulties in assessment and fishery management.

3.5.3 Seaweed

The harvesting of seaweed (algae) for use in alginate and

Table 3.3 Some of the gear types used in North Sea fisheries in 1996 in relation to target species and the by-catch of target and non-target species. Source: 5NSC (1997). Where this type of fishery occurs this table is also representative for the other OSPAR Regions.

	Fisheries	By-catch
Demersal active gear		
otter trawl (human consumption fisheries)	Norway lobster, roundfish and some pelagic species	unwanted sizes of target and non-target species of fish and other vertebrates
otter trawl (industrial fisheries)	small fish species (sandeel, Norway pout, sprat)	human consumption fish species
demersal seines:		
single and pair	human consumption fish species (roundfish and flatfish)	unwanted species and sizes of fish
beam trawl:		
light nets equipped with bobbins	brown shrimp	significant by-catch of flatfish and benthic organisms
heavy gear equipped with chains	flatfish (mostly sole and plaice)	juvenile target species, non-target fish and benthic organisms
dredges	molluscan shellfish	flatfish, damage to target and non-target species
Pelagic active gear		
purse seines, pelagic trawl, single and pair	shoaling pelagic species (herring, mackerel and sprat)	low by-catch of non-target species, unmarketable* fish released dead or damaged
Passive gear		
nets:		
gillnets, demersal set nets	human consumption fish species (cod, turbot, plaice, sole and others)	seabirds, harbour porpoise (for which species gillnets are the main source of by-catch)
drift nets	tuna	dolphins
traps:		
portable baited traps and coastal trap nets	crustacean shellfish and salmonids	undersized and non-target shellfish
lines:		
longlines and handlines†	deep-water demersal fish species	seabirds

* unmarketable non commercial species or undersized commercial species; † little used in the North Sea.

Table 3.4 By-catch numbers of some marine mammals owing to fishing activities on a species and gear type basis for the OSPAR Regions. Source: after ICES (1998).

	Number by-caught per year	Gear type	Comments
Region I			there have been no direct assessments of by-catches of marine mammals in Region I during the 1990s
Region II			
harbour porpoise	average 6785 (range: 8061 in 1994 to 5031 in 1998)	bottom-set nets	Danish observer programme (Vinther, 1999) central North Sea
	113	gillnets	observer programme, Swedish Skagerrak
Region III			
harbour porpoise	2200 (95% confidence limits 900 – 3500)	bottom-set nets	observer programme, estimate does not cover smaller boats
Region IV			
common dolphin	204*	drift nets	
striped dolphin	573*	drift nets	
Region V			
common dolphin	330 – 400	drift nets	observer programme. French fishery
striped dolphin	1135 – 1160	drift nets	observer programme. French fishery

* data from French albacore drift netters during 1992–3 (see also section 5.3.4).

fertiliser production, and occasionally for pharmaceutical use, is a significant industry along parts of the coastlines of Regions I, II and III. The main species harvested are knotted wrack (*Ascophyllum nodosum*) and kelp (*Laminaria hyperboria, L. digitata*). Typical quantities of algae harvested annually in recent years are on average 180 000 t in Norway, 72 000 t in France, 40 000 t in Ireland and 12 500 t in Iceland.

3.5.4 Fisheries management

The overall objective of fisheries management is to ensure sustainable use of fish resources. Management of the fisheries in the OSPAR Convention area is regulated within EU waters under the EU Common Fisheries Policy, and within Faroese, Icelandic and Norwegian waters by national policy and legislation. There is a general overcapacity in most of the fleets fishing in the OSPAR area. The EU and the Icelandic and Norwegian authorities have implemented measures intended to decrease the fishing effort by special programmes. In the EU fleet the reduction has been compensated for by an increase in efficiency, with the result that no reduction in fishing pressure is achieved (5NSC, 1997). The Northeast Atlantic Fisheries Commission (NEAFC) aims at promoting conservation and optimal utilisation of straddling fish stocks in the North-East Atlantic area. For the North Sea, the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues held in 1997 (IMM 1997) recognised problems to achieve agreed goals and requested the development and application of an ecosystem approach to the management and protection of the North Sea. The International Commission on Conservation of Atlantic Tuna (ICCAT) is responsible for the international management of the fisheries of large pelagic tuna and tuna-like fish.

A wide range of national conservation measures have been introduced to protect vulnerable life stages of different stocks, including permanent inshore nursery areas, temporary closures to protect juvenile fish and spawning area closures at peak spawning times of the year. A 12 nautical mile coastal limit to exclude large trawlers is in place in most regions and technical conservation measures such as mesh sizes and sorting grids are widely used to reduce the capture of juvenile fish. Other measures have been aimed at restricting effort through licensing schemes and days at sea limitations.

The main tools at present agreed upon in fisheries (fish and shellfish) management are:

- setting of the Total Allowable Catch;
- technical measures (such as minimum mesh size, minimum landing size);
- fleet reduction programmes; and
- effort restrictions.

The most widely used tool in fisheries management is the yearly setting of TACs. This is done both on national bases, by international fora (e.g. NEAFC, ICCAT) and by the EU based on advice from ICES. The advice from ICES is intended to provide a precautionary approach to fisheries management. As a means to achieve this, ICES has suggested precautionary reference points for spawning stock biomass and fishing mortality. However,

Table 3.5 Landings or catches of the main crustacean and mollusc species.

	Landings/catches (t)	Location
Region I		
crustaceans		
pandalid shrimp	56 000 (1998)	Icelandic waters
	32 000 (1996)	North-east Atlantic
	9 000 (1996)	East Greenland
molluscs		
Iceland scallop	10 000 per year	Iceland
ocean quahog	4300 to 7700 (since 1996)	Iceland
Region II		
crustaceans	catches:	
Norway lobster	12 000 to 20 000 per year	Skagerrak, Kattegat, Moray Firth, Farn Deep, Firth of Forth, Fladen Ground
pandalid shrimp		Norwegian Deep, Fladen Ground
brown shrimp	25 000	in all coastal regions from Denmark to northern France and in some areas of the UK. The main area is near the Wadden Sea
edible crab		
spider crab		
lobster		
molluscs	catches:	
blue mussel	~ 150 000 (mean for 1990 to 1995)	east coast of England, the French Channel coast and the Wadden Sea
cockle	in the Netherlands 50 000 ww	Moray Firth, Wash, Dutch Wadden Sea, Delta area, to a limited extent in Denmark
scallop	~ 2500 per year	Orkney, Shetland, Moray Firth
Spisula spp.		
whelk		
winkle		
Region III		
crustaceans		
Norway lobster, crabs	96 000 (1995)	
lobster, shrimp		
molluscs		
blue mussel, clam, queen scallop,		
scallop, cockle, whelks		
Region IV		
crustaceans		
Norway lobster	3400 (1997)	
total landings of prawns and large	< 2500 (1997)	
crustaceans		
molluscs		
cephalopods	17 600 (1997)	

these precautionary levels are relevant for single stocks and may not be considered as being precautionary with respect to multi-species interactions nor to wider ecosystem effects. In the management of fisheries resources, social and economic considerations also need to be taken into account.

International TACs, and national allocations within the TACs, are agreed for the main commercial fish stocks and also for Norway lobster, northern prawn (*Pandalus borealis*) and other shellfish.

The accuracy of annual stock assessments and TACs depends upon good quality catch data. Illegal landings and unrecorded discards undermine the accuracy of stock assessments and thus the TACs. Programmes to monitor fisheries for discards have been implemented in only some fisheries and usually only in very recent years.

Few data from these programmes have yet been provided for use in assessing stocks.

Technical measures are designed to control aspects of the fishery such as mesh size, net geometry, minimum landing size, by-catch limits, closed seasons and closed areas. Enforcement is a national responsibility and is assisted by, for example, vessel inventories and licences, logbook regulations and satellite monitoring. At European Community level, a revised package of technical measures came into force EU-wide on 1 January 2000. These are designed to improve selectivity and thereby reduce discards, and include the mandatory introduction of square mesh panels into certain nets, limitations on twine and rules on gear construction. In addition, specific controls were introduced to deal with the problem of cetacean by-catch; and as from 1 January 2002 the use of high seas drift nets to catch tuna and other species will be prohibited.

From 1992 to 1996 the EU Multi-Annual Guidance Programme (MAGP III) aimed at reducing the capacity of fleets by reducing tonnage and engine power used catching roundfish by 20% and fleets targeting flatfish by 15%. In a report in 1997 the European Commission noted that the implementation of the MAGP III was successful as regards restructuring the fleets (EC, 1997). Between 1991 and 1996 the EU fleet tonnage and engine power were reduced by more than 10% *(Figure 3.5)*. Although fleets have been reduced, the North Sea IMM 1997 criticised that 'the reduction has been compensated for by an increase in efficiency, with the result that no reduction in fishing pressure has been achieved'. On account of this, the European Commission adopted MAGP IV for the period 1997 to 2001, aiming to reduce the fishing effort by up to 30% on stocks considered to be outside safe biological limits. In 1998, Norway introduced a decommissioning scheme for coastal vessels, similar to that for purse seiners in 1996. Other regulations were aimed at prohibiting access of new trawlers to the shrimp fisheries. Norway has halved the number of vessels from 26 642 (in 1982) to 13 251 (in 1998) while the engine power (1 136 178 KW in 1982 and 1 236 989 KW in 1998) and the gross tonnage (295 925 t in 1982 and 275 524 t in 1998) have remained nearly constant.

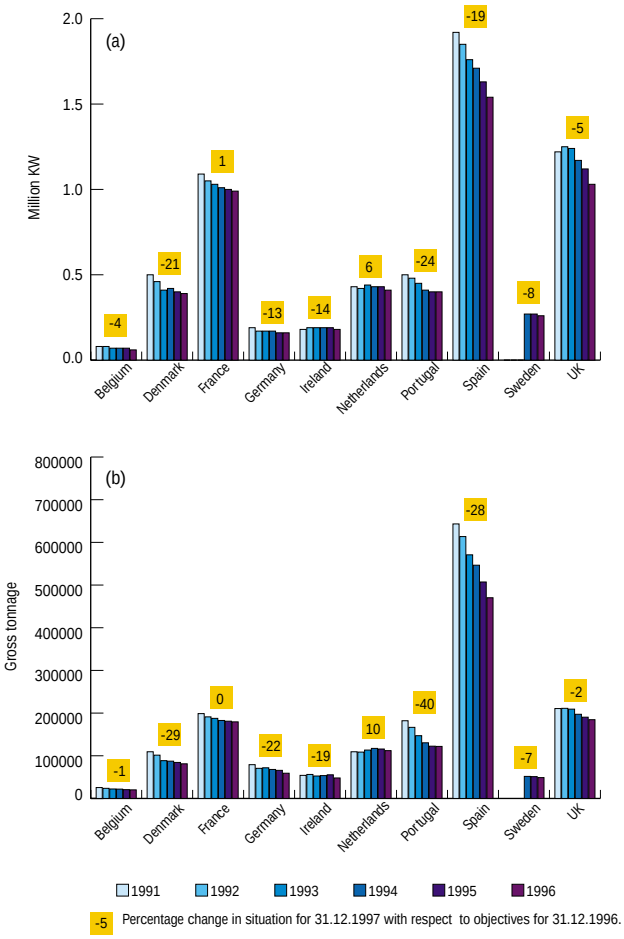
In Iceland, the fisheries management system was introduced with the view to making sure that active fishing capacity does not surpass the carrying capacity of the commercially exploited stocks. This is achieved by the use of Individual Transferable Quotas (ITQs). Every year, based on rigid scientific assessment and prognosis, a TAC is established for nearly all the species that are fished on a commercial basis. To ensure that the TAC is not surpassed, while maximising the economic efficiency of the fishing operations, the Government of Iceland extended in 1990 the ITQs system introduced in 1984, to cover all the commercial species. At the beginning of each fishing year the TAC for individual species is divided between all the fishing vessels which hold a quota share for the species concerned. The quotas are divisible and transferable, which affords the fishing operations the necessary flexibility to maximise their economic return from limited catch. Thanks to the fisheries management system, the active fishing capacity in Iceland has reduced, whether considering the number of fishing vessels, the value of the fishing fleet or the tonnage. For instance there was close to a 38% reduction in demersal fishing efforts in the period from 1984 to 1997.

Shellfish fisheries are under national management in Iceland and Norway; in the EU area these fisheries are not completely EU-regulated because of the localised nature of the stocks. Existing regulations are directed at the restriction of fishing techniques, a reduction in fishing effort (absolute or by temporal or spatial restrictions) as well as minimum landing size or a combination of these practices (OSPAR, 1998a). Norway lobster and northern prawn fisheries are, however, regulated by TACs.

3.5.5 Hunting

Approximately 20% of the population of Greenland is directly or indirectly dependent on hunting activities. The most important resources are ringed seal (*Phoca hispida*) and harp seal (*Pagophilus groenlandicus*), but a wide variety of other mammal species are also taken. In the OSPAR area the whaling activities are managed through two international organisations, the North Atlantic Marine Mammal Commission (NAMMCO) and the International Whaling Commission (IWC), for parties to these organisations. With the exception of minke whales (*Balaenoptera acutorostrata*) and pilot whales, whales are not harvested in the maritime area. The Management Committee of NAMMCO considers that for the Central Stock Area the minke whales are close to their carrying capacity and that catches of 292 animals per year (corresponding to a mean of catches between 1980 and 1984) for the whole central North Atlantic are sustainable. This issue has not yet been considered by the IWC. In the Faroe Islands, the annual traditional whaling for long-fin pilot whale (*Globicephala melaena*) averaged 850 individuals out of a stock of 800 000 individuals. Hunting of small cetaceans like the narwhal (*Monodon monoceros*) and the beluga (*Delphinapterus leucas*) are not under IWC authority, but hunting is regulated bilaterally between Greenland and Canada. Recent assessments by the bilateral commission have concluded that the harvests of narwhal and beluga are sustainable overall, although concerns remain that some sub-components of the greater stock complexes may be over harvested. The areas and species used for hunting and fishing vary by location and season. Polar bear (*Ursus maritimas*) are hunted in

Figure 3.5 **Implementation of EU MAGP III (1992 to the end of 1996): (a) reduction of engine power of fishing fleets, (b) reduction of gross tonnage of fishing fleets.**



These figures should not be interpreted without reference to the explanations given in the text for each Member State.

northern Greenland. Traditionally, seabirds are also caught; the catch is regulated by law as regards species, periods and methods.

3.6 Mariculture (fish and shellfish farming)

During the last decades there was a strong increase in the use of intensive forms of aquaculture such as the mass production of salmon in net cages, and in some countries mariculture production has become comparable in economic value to that of the demersal and pelagic fishing. Concerns about the environmental impacts of mariculture are discussed in Chapter 5 and relate to the following: localised enrichment of sediments; the use of various pharmaceuticals and chemicals; the potential threat to wild fish populations of the transfer of parasites and diseases and genetic interactions with fish escaped from farms.

According to an assessment of data supplied by the UN Food and Agriculture Organization (FAO), aquaculture production in the OSPAR area in 1997 was about 1.1 million t *(Table 3.6, Figure 3.6)*. The largest aquaculture producer was Norway, with a volume (mostly salmon), corresponding to 35% of the total marine production of the OSPAR Contracting Parties, followed by Spain (18%) and France (18%) (mostly shellfish in the latter two countries). Other major producers were the UK and the Netherlands *(Figure 3.6)*.

3.6.1 Fish

Fish farming is undertaken in all OSPAR Regions, with the exception of Region V. Mariculture is now a major industry in Ireland, Norway and Scotland. The main aquaculture species are salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*) (Regions I, II and III). Other species are halibut (*Hippoglossus hippoglossus*), Arctic char (*Salvelinus alpinus*), cod, turbot (*Psetta maxima*) (Regions I, II and III) and eel (*Anguilla anguilla*), as well as seabass (*Dicentrarchus labrax*) and sea bream (*Diplodus* sp.) (Region IV).

3.6.2 Shellfish

Crustacean production is quite low in all OSPAR Regions. In all Regions other than Region I the main mariculture species are blue mussel and oysters (*Ostrea edulis*, *Crassostrea gigas*). There is increasing interest in scallops and queen scallops in Region III.

In Region II, mollusc species including blue mussel are cultured in the Wadden Sea and in the Oosterschelde, along the coast of Brittany, in Norway, Sweden and the UK. Oysters are cultured mainly in the Orkney, Shetland, and other Scottish regions, in the east and south-east of England, in the south-west of the Netherlands, in Norway, and along the coasts of Normandy and Brittany.

In Region III, cultivation of wild stocks of shellfish has been practised for more than a century but in recent times attention has turned to the culture of shellfish hatchery reared stocks. In the UK part of Region III the value of shellfish cultured doubled between 1991 and 1995. In Ireland the tonnage of shellfish produced exceeds production of finfish, due to the rapid expansion of longline culture of blue mussels.

In Region IV, French oyster and mussel cultivation (3500 farms) produces 80 000 t/yr. Spain produced 200 000 t/yr molluscs (90% mussel culture) between 1987 and 1996. Other species are clams and oysters (4000 t/yr for each group). In Portugal clams, oysters and cockles (total 3000 t/yr) are produced.

Table 3.6 Marine aquaculture production in 1997 (tonnes) within the OSPAR area and the Baltic Sea. Source: national data; FAO (1999).

	Salmon	Rainbow trout	Turbot	Blue mussel	Oyster
Denmark*		667			
Faroe Islands*	21 103	1 435			
France	650	232	980	52 350	135 650
Germany		28		22 330	
Iceland	2 513				
Ireland†	15 442	1 020	30	16 371	3 535
Netherlands			25	93 244	1 200
Norway	331 367	33 491		502	
Portugal			196	455	
Spain	851		1 800	188 793	
Sweden		2 166		1 425	
UK	99 422			13 127	400

* national data and reflecting production in the North Sea; † national data from Ireland.

3.7 Coastal engineering and land reclamation

Factors contributing to shore erosion include tidal action, littoral currents and rising sea levels. Apart from these natural phenomena, coastal defence works and infrastructures may locally contribute to significant erosion. Sea surface levels are rising very slowly by natural processes – 50 m over the last 10 000 years, currently 1.5 to 1.9 mm/yr for major parts of the OSPAR area – but there are signs that the rate may be increasing due to global climate warming, especially the thermal expansion of oceanic water.

On parts of the Celtic Seas and Biscay/Iberian coastlines, erosion rates are in the range 0.5 to 1.5 m/yr and, in a few cases, up to 2 m/yr (north of Liverpool). Winds tracking along the shoreline also contribute to coastal erosion. The movement of sand from coastal beaches toward the interior can be significant, ranging from 20 000 to 40 000 m^3/yr (e.g. the coast of Les Landes in France), to extreme values of 200 000 m^3/yr (e.g. Pyla dunes) per kilometre of coastline. Rocky and volcanic coasts (e.g. the Arctic and Azores) are resistant to erosion.

3.7.1 Coastal defence

Coastal defences are necessary on exposed, soft and low-lying shores of Regions II and III and on parts of the French and Portuguese coasts in Region IV. According to the local situation sea defence works have been undertaken for decades using rock armouring, construction of breakwaters, piers and jetties or beach replenishment. Coastal land reclamation and diking change the physical environment and in some cases may reduce spawning areas, biological diversity and sanctuaries for wildlife.

Around the North Sea coastal defences are common, particularly on the shallow south and east coasts, the Wadden Sea and on islands vulnerable to storm surges and sea level changes. Beach protection is partly accomplished by offshore breakwaters. Dunes are occasionally protected by hard structures – although this may prevent natural beach nourishment by sediment transport and cause enhanced erosion elsewhere. The present tendency is to use artificial nourishment. In 1996 the Netherlands replenished 7.7 million m^3 of sand and may need to double this quantity to keep ahead of the predicted rise in sea level. In other parts of the North Sea there are plans to improve coastal defences through the restoration of natural coastal dynamics.

On coasts of the Celtic Sea there are large areas of land bordering estuaries, or close to centres of population or industry, that have been protected by sea walls. In the upper reaches of the Bristol Channel and the Severn Estuary much of the shoreline is protected from flood damage by embankments. Shoreline management plans are being drawn up for the whole of the English and Welsh coastlines.

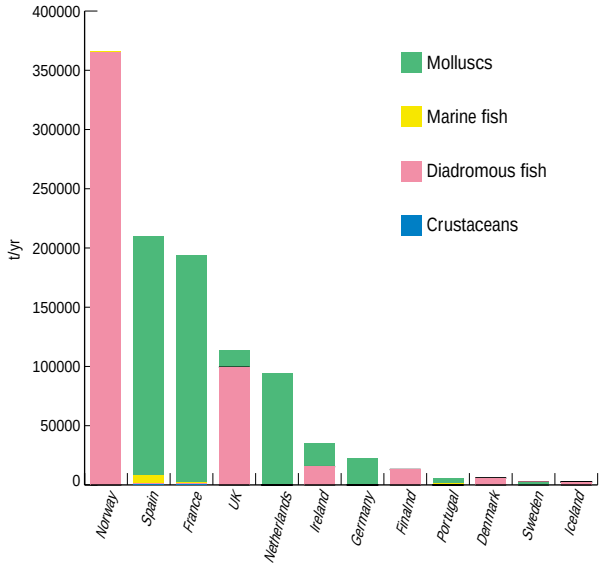
In Region IV, the French coast between Biarritz and Adour is most prone to erosion due to a powerful swell (reaching a wave height of 15 m) and a continuing deficit of replenishing sediments. Nearly 1000 transversal structures such as jetties, and 500 longitudinal structures such as sea walls and breakwaters, have been constructed.

Coastal erosion also affects the Portuguese coast. Large spurs and rock walls have been constructed in several sectors, thereby significantly modifying local sediment transport and, in some cases, resulting in the destruction of once sandy beaches.

3.7.2 Land reclamation

Coastal land reclamation was most common around the North Sea, particularly on the shallow south and east

Figure 3.6 **Aquaculture production in the Atlantic area. Source: FAO.**



For Germany, Denmark and Sweden production in the Baltic Sea area is included

coasts. New plans exist to expand the port of Rotterdam seawards.

3.7.3 Power generation

Power generation at sea is not practised on any significant scale at present but there is growing interest in offshore wind-power installations and experiments are underway with wave-power generators. The only tidal power station (240 MW) in the OSPAR area is located on the Rance estuary (Region II), near St Malo in Brittany; it commenced operation in 1967.

As wind is a source of renewable energy there are intensive efforts to find convenient sites with sufficient wind energy and low population. Wind-power generation is cost-effective when average wind speeds exceed 5 – 6 m/s. The problems with this technology are the space required as well as visual and noise impacts which can be especially detrimental to birds (Kruckenberg and Jaene, 1999). In many countries wind energy is generated from coastal wind power stations (e.g. 23 MW in Region III; between 5.1 and 8.8% of the power demand of the Azores).

In several countries there are plans to construct wind parks offshore. In Denmark four to five offshore wind parks (with up to 400 turbines) are planned to be built within the next five years. The effects of noise and electro-magnetic impact on fish and marine mammals are under consideration. Several other OSPAR countries also have plans for an offshore wind park; the UK has plans for five.

3.8 Sand and gravel extraction

Sand and gravel are essential materials for private and industrial construction work, for coastal protection and beach replenishment. In many OSPAR countries land-based sand and gravel deposits are in short supply and in some countries up to 15% of the national requirement is taken from the sea (ICES, 1992). The amount of sand and gravel extraction is listed in *Table 3.7*.

The main targets for exploitation are siliceous sand and gravel deposits. Calcareous deposits such as banks of mussel shells and of the algae *Lithothamnion* (maërl) are also subject to exploitation in some of the OSPAR countries. These lime deposits are used for the production of cement or as a soil fertiliser and conditioner.

The exploitation of marine aggregates may have negative effects on the marine environment. The removal of shallow banks close to shore increases the potential for coastal erosion by enhancing wave and current activity. Depressions produced by excavation act as traps for fine-grained sediments. In areas where aggregates underlie spawning or fishing grounds, their extraction may compete with fisheries.

Various measures have been introduced at national and international levels to minimise the environmental impact of marine aggregate extraction (e.g. the ICES Code of Practice on Commercial Extraction of Marine Sediments (ICES, 1992)). Nevertheless, extraction continues at high rates and there is limited control on quantities removed. Although some countries are developing more stringent licensing systems, in many cases national approaches to the regulation of this practice appear somewhat ambivalent.

By far the highest demands for marine sand and gravel exist in the North Sea area (Region II). Production increased from 34 million m^3 in 1989 to 40 million m^3 in 1996. Most of the material is needed for coastal protection, construction work and for beach replenishment.

In the Irish/Celtic Sea area marine aggregates are used mainly for beach replenishment and as infill for harbour development and for building and road construction purposes. The extraction of aggregates at offshore sites in Region III is presently confined to the Bristol Channel (seven sites, in 1997 more than 2 million t) and the north-eastern Irish Sea (two sites, in 1997 about 300 000 t).

Sand and gravel are extracted in larger amounts along the Atlantic coast (Region IV) for construction and beach replenishment. In France annual extractions amount to around 2.2 million m^3. Maërl and shell sands are excavated mainly along the Brittany coast.

Around the Azores (Region V), licences have been approved for the annual extraction of 140 000 m^3 of sand.

3.9 Dredging, dumping and sea-based discharges

Dumping of waste or other matter is prohibited by the OSPAR Convention except dredged material, waste from fish processing, inert material of natural origin and vessels or aircraft (until 2004). A wider range of material, including sewage sludge and industrial waste has been disposed of in the past.

3.9.1 Dredged material

Dredged material dumped at sea consists primarily of material removed to keep navigation channels clear (maintenance dredging) or removed during the construction of coastal engineering projects, like harbours (capital dredging). Amounts of dredged material are listed in *Table 3.8*. For Belgium, France, Germany and Spain, the bulk of the dredging came from estuaries and sea channels. In some other countries most of the dredgings came from harbours. Trends in the amounts dumped are difficult to establish, as the dredging requirements are strongly influenced by natural conditions as well as dumping strategy. Regular reporting takes place within the OSPAR framework.

A licence for the disposal of waste at sea is issued only where it can be shown that the material is not seriously contaminated and will not harm the marine environment. Dumping of dredged materials can, nevertheless, introduce contaminants to the marine environment. The size and location of dumpsites are designated by the national licensing authorities and the sites are subject to periodic monitoring to ensure that impacts are within approved limits.

The disposal of dredged material at sea affects the environment both through the contaminants it contains and also physically. According to the OSPAR Guidelines for the Management of Dredged Material (OSPAR ref. no. 1998-20) measures to keep the volume of dredged material to a minimum are regarded Best Environmental Practice (BEP) for minimising the effects on the environment.

3.9.2 Sewage sludge

The disposal of sewage sludge at sea, which ceased at the end of 1998 by agreement of the OSPAR Contracting Parties, was practised only in Regions II and III. Germany ceased the practice in 1981, Ireland early in 1999 and the UK in 1998 (see *Table 3.8*).

3.9.3 Industrial waste

The dumping of industrial wastes was phased out in 1993 when the last few licences for disposal at sea of liquid industrial waste and fly ash from the UK expired.

Table 3.7 Sand and gavel extraction 1992 to 1997. Source: national data; OSPAR (1998b,c).

	Total (m^3)	Average (m^3/yr)
Belgium	11 000 000*	1 833 333*
Denmark	30 500 000	5 083 333
France	13 200 000	2 200 000
Germany	17 000 000	2 833 333
Iceland	ni	ni
Ireland	ne	ne
Netherlands	104 200 000*	17 366 666*
Norway	710 000	118 333
Portugal	ni	ni
Spain	ni	ni
Sweden	ne	ne
UK	81 600 000	13 600 000

* mainly sand; ni no information; ne no extraction.

Incineration of liquid industrial waste on special incinerator vessels in the North Sea was terminated in 1991. The dumping of waste from the titanium dioxide (TiO_2) industry was terminated in the North Sea in 1989 and by Spain in 1993. Discharges from the TiO_2 industry are permitted under OSPAR and EU regulation and are mainly confined to French and UK estuarine waters (Seine, Humber and Tees).

3.9.4 Radioactive waste

Since 1983, there has been a global moratorium on radioactive waste disposal within the framework of the London Convention. The OSPAR Convention 1992 contains a legally binding ban for such dumpings, which is now accepted by all Contracting Parties.

Before 1967, sea-disposal of radioactive wastes was uncoordinated and a number of shallow sites were used for the disposal of relatively small amounts of wastes. After 1967, its disposal was done in deeper waters and co-ordinated by the Nuclear Energy Agency (NEA).

The wastes consisted mostly of low-level materials mostly from nuclear plant operations, fuel fabrication and reprocessing, radionuclide use in medicine, research and industry, and decontamination of redundant plant and equipment. A report on the main dumpsite (OECD, 1985) concluded that it posed negligible human radiological risk. However, in the absence of baseline data on the benthic biology, it is difficult to draw firm conclusions about the environmental impacts. In 1995, the OECD/NEA finalised its Co-ordinated Research and Environmental Surveillance Programme related to Sea Disposal of Radioactive Waste (CRESP), and summarised the results in the CRESP Final Report 1981 – 1995 (OECD, 1996). While this programme collected new biological information for a radiological assessment of

dumping, none of these new data radically changed the conclusions of the last main site suitability review (OECD, 1985). Several OSPAR Contracting Parties expressed concern that the surveillance of the former radioactive dumpsite was terminated.

3.9.5 Inert materials of natural origin

Dumping of inert material of natural origin (such as mine stone) has been carried out only in Ireland. Some inert material is deposited onto the foreshore in the UK and Norway, but such deposits from land do not constitute dumping under the OSPAR Convention.

3.9.6 Other waste

The dumping of ships in the OSPAR maritime area will be prohibited from 2005. In 1996 Norway dumped eighteen mostly wooden fishing vessels. Dumping of iron/steel hulled vessels is now forbidden in Norway.

During the First and Second World Wars, numerous vessels were sunk in the Atlantic and in some Regions, in the post-war periods, large quantities of redundant munitions were dumped at sea.

3.9.7 Discharges from offshore installations

Offshore installations are significant sources for the input of oil to the maritime area, especially in Region II. Variations in oil discharges are shown in *Figure 3.7* (not taking into account synthetic muds, which fall into a different category). Overall, inputs of oil have decreased from a maximum of about 28 300 t in 1985 to about 9500 t in 1997 (-66%). This reduction was mainly achieved by decreasing the amount of oil discharged via cuttings from about 25 800 t to about 6000 t in 1996 after which only synthetic fluid muds have been used (discharge via cuttings in 1997: 7200 t). During the period 1985 to 1997, the discharge of oil with production water increased from about 2500 t to about 8500 t. This rise is due to the increased number of installations and increasing amounts of production water associated with progressive exploitation of the oil fields.

Heavy metals, polycyclic aromatic hydrocarbons (PAHs) and production chemicals are, together with oil, discharged via produced water. These inputs increase with increasing age of the field. The amount of discharged produced water can be reduced by for example re-injection into the reservoir or by downhole separation, which is largely experimental at present. Operational discharges of water-based and synthetic drilling muds are strictly regulated.

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 control of chemicals intended for use on offshore installations. 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.

Water-based muds, oil-based muds (OBMs) and, more recently, synthetic fluid muds have been, and in some cases still are being, used when drilling wells. With the exception of geological or safety reasons, the use of oil-based muds is prohibited in the upper part of the well. Cleaned cuttings contaminated with drilling fluid may be discharged to the sea. Since the end of 1996 they must comply with the target standard for oil on cuttings of 10 g/kg dry cuttings (previously 100 g/kg). Ministers at the Fourth International Conference on the Protection of the North Sea invited OSPAR to ban (with certain exceptions) the discharge of oil contaminated cuttings by 1997. Since then only cuttings contaminated with water-based and synthetic fluids have been discharged. As some synthetic fluids were found to possess properties that could result in adverse impacts on benthic communities, the UK industry undertook a voluntary agreement to phase them out by 2000. Following a review within OSPAR of measures relating to cuttings contaminated with organic-phase drilling fluids, a new comprehensive Decision was adopted in June 2000 (OSPAR Decision 2000/3 (contaminated cuttings)), which rules out discharges of such cuttings except, in exceptional circumstances, those contaminated with synthetic fluids.

Table 3.8 Summary of amounts of wastes dumped at sea in 1996 (tonnes dry weight). Source: national data; OSPAR (1999b).

	Dredged material	Sewage sludge*
Belgium	29 264 498	0
Denmark	562 784	0
France	24 273 000†	0
Germany	19 123 000	0
Iceland	220 698	0
Ireland	1 372 734	11 758
Netherlands	8 016 381	0
Norway	399 716	0
Spain	2 055 148	0
Sweden	3 308 608	0
UK	24 105 334	276 609
TOTAL	112 701 901	288 367

* all dumping of sewage sludge ceased early in 1999; † national data from France.

3.9.8 Litter

Despite pertinent laws and regulations, litter is still a

considerable problem for the marine environment and the coastal communities around the whole OSPAR area. Potential sources of litter are mainly related to waste generated by shipping (fishing and commercial) and tourist and recreational activities.

The use of plastics and other synthetic materials has increased exponentially. Non-degradable plastic constitutes 95% of the total amount of litter in many parts of the OSPAR area. Marine sources include shipping, fishing and mariculture operations, and land-based sources include coastal landfill sites, sewage discharges and beach recreation. On many beaches discarded drink containers (bottles and cans) are a growing component of the litter problem. Whereas the recreation and commercial fishing sectors are likely to be most affected economically by litter, it is also a hazard to wildlife. Drifting fishing nets and ropes may foul ship propellers, lead to entanglement and drowning of mammals and seabirds, and carry epiphytic organisms beyond their normal ranges. The feeding of seabirds, particularly fulmars (*Fulmarus* sp.) (NSTF, 1993), can be harmed through ingestion of small plastic particles. Litter also reduces the value of fishing products since catches containing hazardous objects (e.g. glass) may have to be discarded.

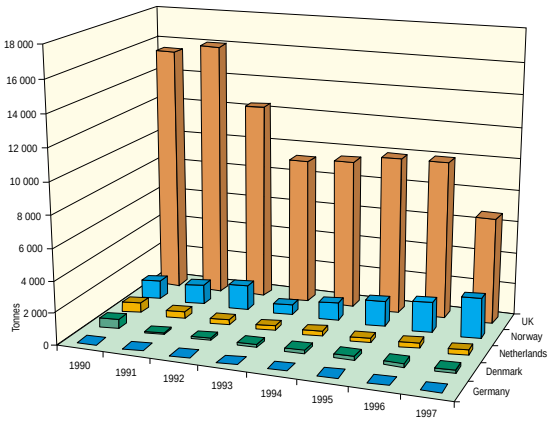
In Region II it was roughly estimated that annually at least 70 000 m^3 of litter were thrown overboard in the North Sea (OSPAR, 1997). Estimates of litter resting on the seabed are at least 600 000 m^3, based on a Dutch investigation. In Region III, one study to quantify the scale of the litter problem was undertaken in the Minch off the Scottish west coast. The results suggest that quantities of litter on beaches have increased over the last ten years and that the main sources were fishing, shipping, aquaculture and tipping. The North Sea (1991) and the Baltic Sea (1988) have been designated as MARPOL Special Areas (Annex V) to prohibit dumping of garbage and litter from ships. However, the situation with regard to litter seems not to have improved (OSPAR, 1997).

In Region IV, significant quantities of floating litter have been observed by air far to the west of the coastal Bay of Biscay, several hundred kilometres from the shore. In the Bay of Biscay, fieldwork carried out since 1992 shows that between the surface and 200 m, there are at least 50 million individual items of litter, for areas of greater depth (1800 m, canyons off Cap Breton and Cap Ferret), debris concentrations are around 15 items/ha.

3.10 Oil and gas industry

Refineries within the Convention area are located mainly in coastal areas or on large rivers. Their effluents are a source of oil and other substances. There have been many rationalisations and environmental improvements in this sector. This is reflected in the large reduction in the quantities of oil discharged.

Figure 3.7 **Total discharges of oil (tonnes) from offshore installations to the OSPAR area. Source: OSPAR (1999a).**



There are substantial offshore oil and gas activities in the OSPAR area *(Table 3.9)*. *Figure 3.8* gives the number of installations in the OSPAR area. There is believed to be considerable scope for expansion in the future. In Region V offshore exploration is at an early stage of development. Environmental problems associated with discharges of oil *(Figure 3.7)*, heavy metals and PAHs are dealt with under Section 3.9.7 and in Chapter 4. Generally, improvements in environmental performance relating to the offshore oil and gas sector will be addressed through the OSPAR Strategy on Environmental Goals and Management Mechanisms for Offshore Activities agreed in 1999.

In Region I oil and gas production takes place at several fields along the Norwegian coast. Oil exploration occurs both in the Russian and the Norwegian sectors of the Barents Sea. Some of the worlds biggest offshore gas reserves have been found at the Shockmanov and Murmansk fields but production is difficult and expensive because of seasonal ice cover. Very big oil reserves have been discovered close to the shore in the Pechora area. In the Norwegian part of the Barents Sea some larger gas reserves are found.

In Region II the major developments of offshore oil industry have been in the northern North Sea, in the UK and Norwegian sectors. Gas fields are exploited mainly in the shallower southern regions in the UK, Dutch and Danish sectors, as well as in Norwegian waters. Between 1990/2 and 1996 the number of offshore platforms and oil production have almost doubled, primarily reflecting increased activity in the Norwegian and UK sectors.

In Region III offshore gas production started in 1985.

The Kinsale Head Gas Field and Ballycotton Field reserves are expected to last no more than about ten years. Exploration drilling continues in the Irish Sea, Celtic Sea and Bristol Channel. Oil was found in 1990 in the UK Douglas Field in Liverpool Bay. Following discoveries of oil west of Shetland and the development of the technology required to exploit such deep water areas there has been renewed interest in exploration off Scotland, west of the Hebrides. Oil exploration and production activities continue to expand into previously unexploited areas (Rockall, west of the Shetland Islands etc.).

In Region IV on the Spanish Atlantic coast, oil rigs and production wells are found off the Basque coast and used for storing gas; gas production wells are situated in the Gulf of Cadiz.

Considering 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 Offshore Installations prohibiting the dumping and the leaving wholly or partly in place of disused offshore installation within the marine 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.

3.11 Shipping

Commercial shipping, its navigational requirements and land-based facilities, have various impacts on the marine environment. These include large-scale coastal development for port facilities, the dredging and disposal of sediments, the transfer of non-indigenous species through ships' ballast water and hull fouling, and the operational, accidental, and occasionally illegal, release of oil. In addition, shipping causes inputs of hazardous substances through the cleaning of tanks, the burning of fuel containing waste products, losses of antifoulants containing biocides, releases of wastewater and garbage, and the loss of cargo and dumping of litter. Along the old Atlantic shipping routes, the seabed is littered with large amounts of clinker from coal-fired vessels. Plastic litter and tar balls commonly occur at the surface, particularly in shipping lanes, and these may affect coastal resources and seabirds. Additional environmental effects of shipping include air pollution through the release of for example sulphuric (SO_x) and nitrous (NO_x) oxides. The increasing use of so-called High Speed Craft increases fuel consumption and thus the release of greenhouse gases such as carbon dioxide (CO_2).

In the whole OSPAR maritime area, discharges of oil from bilges and engine room spaces of ships should, in accordance with the rules, not give rise to visible oil at the sea surface. Under the name North West European Waters, the North Sea, and the seas around Ireland and their approaches have received the status of a Special Area under MARPOL Annex I (oil) as from 1 August 1999; that means that the discharge of oily cargo residues into the sea from any oil tanker is prohibited. Limits for bilge water from machinery space remain 15 ppm, although a Special Area demands modern oily water separation equipment. Slicks do occur when ships fail to observe the rules concerning discharge rates.

Within the IMO, a mechanism for a general ban on the use of organotin compounds in antifouling paints has been decided. The target is to prohibit their application from 2003 and to require the removal of tributyltin (TBT) from ships' hulls by the year 2008. Given the serious effects of TBT on snail and bivalve populations, effective implementation of this measure is required. Within the EC, the control on other TBT applications has been increased with the revision of Council Directive 76/769/EEC. Also within the IMO framework, traffic separation schemes have been introduced to reduce the risk of accidents and activities are ongoing to reduce air pollution by emissions from ships.

3.11.1 Traffic and cargo

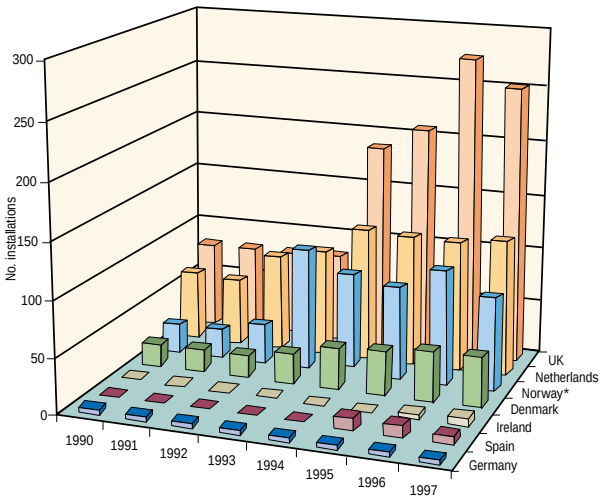
Ocean transportation grows as world trade expands.

Table 3.9 Oil and gas production in the OSPAR area in 1998. Source: regional QSRs; national data; BP and AMOCO (via www.bpamoco.com).

	Natural gas		Oil	
	production (billion m^3/yr)	proved reserves (trillion m^3)	production (million t /yr)	proved reserves (thousand million t)
Denmark	7.6	0.11	11.7	0.1
Germany	0.3*		0.5*	
Ireland	2.46	0.00685		
Netherlands	27.4*		1.8*	
Norway (whole)	47.8	1.17	150	1.4
Norway (> 62° N)†	0.7		26	
UK	90.3	0.77	132.6	0.7

* data from the QSR for Region II and reflecting 1996; † data from the QSR for Region I.

Figure 3.8 **Total number of offshore installations in the OSPAR area.**



* The Norwegian count of the number of installations is done in a more aggregated manner, and therefore results in a lower number of installations compared to the counting method used by other Contracting Parties.

Large bulk carriers convey increasing quantities of raw materials. In the decade to 1995, the worldwide transportation of crude oil increased by 61% in tonnage and 86% in tonne-miles. Of the 1415 million t of crude oil transported by sea worldwide about 26% (374 million t) were either destined for, or came from north-western Europe *(Figure 3.9)*. Sea-borne trade in iron ore, coal, grain, bauxite and alumina, and phosphates also increased by an average of 2.6% per annum during the same decade. Of the 402 million t of iron ore carried by ships, about 31% (125 million t) passed through the OSPAR area *(Figure 3.9)*. There was an increase of 59% in coal shipments.

Container traffic is also increasing. As an example, by 2020 the port of Rotterdam is expected to handle 20 million containers each year. The maximum size of container vessels continues to grow (now up to 7000 containers). Losses of containers in bad weather are quite frequent and recovery of hazardous cargoes from deep water is often impossible.

In the main ports of Regions II, III and IV there is an estimated 500 000 vessel movements annually. Most of Europe's largest ports are on North Sea coasts and rivers, the largest being Rotterdam/Europoort. The North Sea contains some of the busiest shipping routes in the world.

In some areas shipping activity consists to a large extent of regional and local traffic such as ferries, and roll-on/roll-off vessels on fixed routes. There is little cargo traffic in the Arctic.

3.11.2 Accidents

Depending on the location and the types and amounts of substances released, maritime accidents may result in harmful effects to marine life and occasionally to humans. Accident probability depends strongly on shipping density – so in the open ocean accidents are less frequent and tend to have less impact than those nearer shore. Unintentional pollution at sea has a number of causes: explosions, collisions, groundings, ship damage and breakdowns. One source (Quell and Klimsa, 1997) recorded eighteen accidents in 1994, and a further thirteen in 1995, involving pollution of sea water in the OSPAR area, more than half in the North Sea. Some of the more notable accidents in the last decade are listed in *Table 3.10*.

3.12 Coastal industries

Industries tend to be grouped together in places that combine a series of facilities: transport, communication, energy and water supplies etc. Thus, many of the major industrial centres in coastal states of the North-East Atlantic are located along estuaries and close to the main cities and ports. Some of the larger industries to be found at such locations include: metal and metal-processing; smelters; chemical, petrochemical and paper-making plants; oil refineries; gas terminals; vehicle factories; shipbuilding; power stations; and fish processing *(Figure 3.10)*.

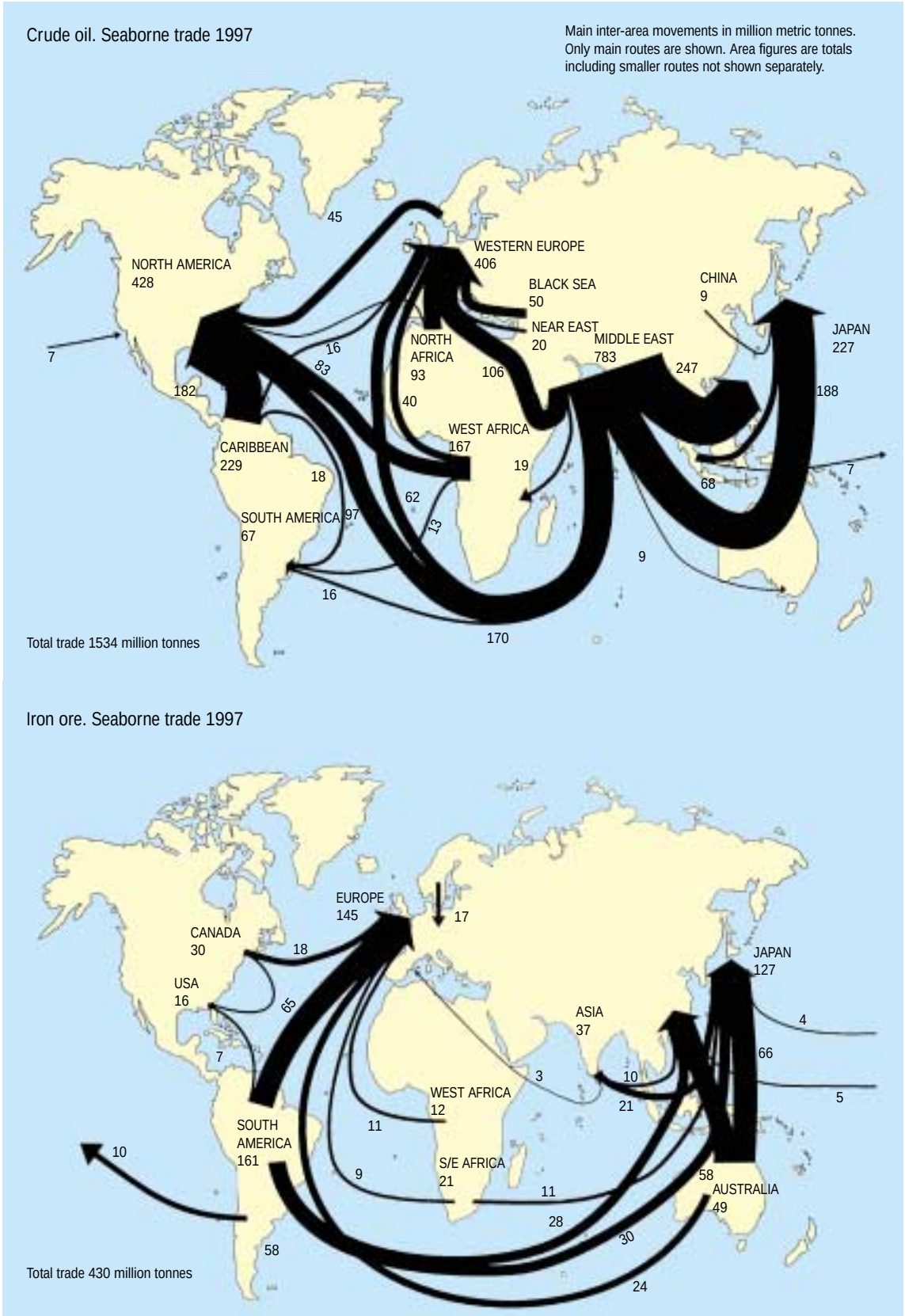
Coastal habitats have been, and continue to be, altered, disturbed or destroyed by industrial development. Other environmental impacts arise as a result of discharges, emissions and losses to land, air and water. Several estuaries are under considerable pressure from industrial pollution as a result of paper-milling, petroleum refining, production of chlorine, titanium dioxide and surface coatings, iron and steel working, metal fabrication and other heavy industries. Many of these industries use water in large quantities for cooling, rinsing and cleaning.

Some nuclear power plants and the French and UK reprocessing plants can be considered as coastal industries discharging heat and radioactive substances into the marine environment. OSPAR reports show that the discharges of most facilities are much lower than those permitted. In their Sintra Statement, OSPAR Ministers agreed 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'.

3.13 Military activities

In peacetime, military operations constitute only a small part of sea-borne and coastal activity. They include port

Figure 3.9 **Shipments of crude oil and iron ore through the OSPAR area in 1997. Source: Fearnleys (1998).**



activities, construction and upkeep of the fleet, underwater disposal of weapons and munitions, and manoeuvres and firing exercises. Firing exercises are held within clearly identified zones. Military activities can lead to disturbance of wildlife and interfere with other uses of the areas involved.

At the end of the First and Second World Wars in most of the Regions considerable quantities of arms and munitions were dumped at sea including considerable quantities of chemical warfare materials (mustard gas, tear gas, nerve gas, tabun, chloroacetophenone, different arsenic-containing compounds (and other agents)). Usually the material was disposed at sites with some distance from land. An exception was the use of the deep trough in the North Channel between Northern Ireland and Scotland. From time to time items (mainly phosphorus incendiary devices) are washed up and present a hazard to beach users.

In the wider Atlantic during the Second World War some 20 million t of shipping were sunk. The seabed along the western European continental margin is littered with items ranging from sunken vessels, some nuclear or armed with nuclear devices, to munitions and pyrotechnics used in exercises, to hydrophone arrays (still operational).

3.14 Land-based activities

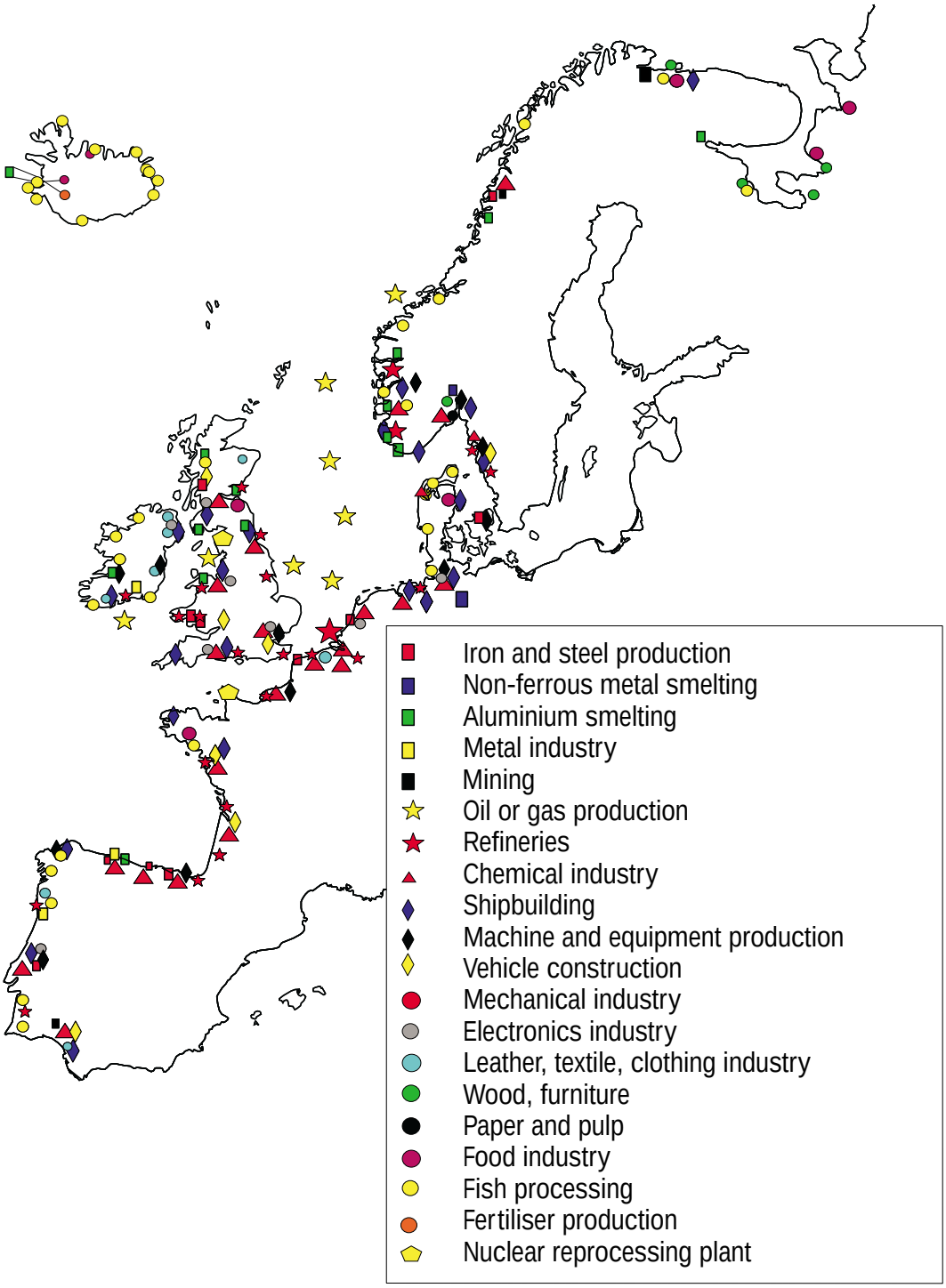
Land-based activities such as agriculture, industry and households have enormous impact on the marine ecosystem via riverine or atmospheric inputs of nutrients and contaminants; their quantification is often incomplete and tentative. Environmental policy has resulted in measures to reduce inputs of nutrients and contaminants. For example, the reductions in nutrient inputs were mainly achieved by improvements at point sources such as sewage plants for phosphorus and farm waste discharges for nitrogen compounds. However, little success is reported in reducing inputs from diffuse sources where the main problems occur from flushing of fertilisers from arable land, volatilisation, and leakage of industrial and municipal waste deposits.

The ban on certain persistent organochlorine compounds in OSPAR countries such as PCBs, hexachlorobenzene (HCB), lindane and DDT has been beneficial to the marine environment. Anthropogenic sources of some contaminants are listed in *Table 4.1*. In the chlor-alkali industry, reduction in mercury discharges has been achieved by applying Best Available Techniques (BAT) and BEP measures. In certain products mercury was replaced by less hazardous substances. The discharges of mercury from dentistry were also reduced. The (non)-ferrous metals and fertiliser industry minimised cadmium discharges and further reductions have been achieved through the substitution of cadmium by less harmful elements. Efficient flue gas treatment has reduced atmospheric emissions of cadmium, mercury and dioxins. The enhanced use of unleaded fuel caused a significant

Table 3.10 Major shipping accidents since 1992.

	Ship	Location	Accident
Oil accidents			
1992	tanker	Spanish coast, Galicia	the Aegean Sea ran aground and burned; 80 000 t crude oil were spilled
1993	tanker	UK, Shetlands	the Braer ran aground; 84 000 t crude oil were spilled
1996	tanker	UK, Milford Haven	the Sea Empress ran aground causing major oil pollution; 74 000 t were spilled
1998	cargo	Germany, Amrum	the Pallas ran aground with a fire on board and spilled 250 m^3 oil in the Wadden Sea; 16 000 dead seabirds
1999	tanker	France, south-western Brittany	the Erika was wrecked and sank to 120 m. 14 000 t of bunker oil were released and stranded on 400 km of French Atlantic coasts. 11 200 t of oil were removed from the wreck during summer 2000
Chemical accidents			
1993/94	unknown	Region V	the Sao Miguel was dumped in Region V, during dumping the ship exploded. Several thousand detonators from the ship were found on the beaches of Region IV
1994	unknown	Netherlands	containers lost five times with various types of cargo; in one instance packages of the pesticide *Apron plus*; in another instance the coast of a Dutch Wadden Sea island was polluted by phosphorus
1997	bulk carrier	France, south-west of Ouessant Island	the Albion II was lost with all hands. Cargo included 110 t of calcium carbide, a substance which reacts with water to form the flammable gas, acetylene
1997	container ship	Atlantic	the Carla released three (sealed) containers with radioactive caesium-137

Figure 3.10 **Simplified overview of industry located near the coast of the OSPAR area.**



decline in lead release to the environment. Less progress has been made with respect to some other substances (e.g. PAHs and dioxins) identified by the OSPAR Commission for priority action (Annex 2 of the Strategy with Regard to Hazardous Substances).

Efforts have been made toward the collection of urban and industrial wastewater and the application of appropriate levels of treatment. Nevertheless, even if households and industries are served by tertiary treatment, exceptional rainfall or tourism during the summer could reduce the efficiency of these systems. Measures were adopted by the Paris Commission in relation to the reduction in nutrient inputs (PARCOM Recommendations 88/2 and 89/4). The EC Directive on Urban WasteWater Treatment (91/271/EEC) provides for the required level of treatment for wastewater. The deadlines for this application are from 31 December 1998 to 31 December 2005, depending on the size of the population, its agglomeration and the sensitivity of the surface waters. The proportion of the population connected to sewage treatment ranges approximately from 80 – 98%.

3.15 Agriculture

There are extensive areas of agricultural land in Regions II, III and IV. Farmland accounts for more than 42% of the total land in Europe, although the proportion varies from less than 10% to over 70% between countries. In Region I – with only 1 % to 3% cultivated land – forest-based industries dominate; by far the largest resources of wood in the European Arctic are in Russia.

Agriculture results in inputs and emissions of nutrients (phosphorus and nitrogen compounds) and pesticides (e.g. atrazine, carbofuran, triphenyltin (TPT), lindane, DDT, aldrin and dieldrin). There are considerable environmental impacts in certain areas; the main types of pollution are from nitrates, phosphates, ammonia, methane, pesticides *(Figure 3.11)*, and run-off of silage and slurry. Losses of nitrogen and phosphorus contribute to eutrophication of coastal waters. Atmospheric emissions from agriculture are a source of contaminants (e.g. ammonia and pesticides) in the deep ocean and atmosphere (e.g. methane). The EC Directive on the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) provides for the establishment of codes of good agricultural practice, for the designation of vulnerable zones and for action programmes to reduce pollution by nitrates.

The highly productive agricultural systems in Western Europe fall into two broad categories. Firstly, there are areas of intensive field-crop farming, dominated by large holdings; secondly, there are areas of very intensive agriculture specialising in animal production and/or fruit and vegetable farming. The OSPAR Strategy to Combat Eutrophication includes a commitment to source-oriented approaches, including the promotion of good agricultural practice and ecological agriculture.

3.16 Regulatory measures and future developments

The environmental policy framework for the OSPAR area is developed through the International Conferences on the Protection of the North Sea, under the OSPAR Convention, within the framework of the European Union, by the Trilateral Governmental Wadden Sea Conferences, under the Bonn Agreement and, more generally for the marine environment, under the London Convention and within the framework of the IMO. It takes into account the Rio Declaration and policies developed under the Convention on the Protection of the Marine Environment of the Baltic Sea Area (the Helsinki Convention 1997/1992). Additionally there is co-operation within the framework of international river conventions, such as for the Elbe, Rhine, Scheldt and Meuse. So not all of the measures and regulations apply to all OSPAR Contracting Parties. This is particularly the case with regard to EC regulations.

The OSPAR Convention, which was opened for signature in 1992 and came into force in March 1998, served to merge and modernise its predecessors the Oslo Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft, and the Paris Convention for the Prevention of Marine Pollution from Land-based Sources. It has the general objective of preventing and eliminating pollution of the maritime area of the Convention, to ensure that the ecosystems are in a sound and healthy condition, used in a sustainable way, and that human health is protected. The 1998 Ministerial Meeting of the OSPAR Commission expanded the Convention by a further Annex which allows for the protection and conservation of the ecosystems and biological diversity of the maritime area. In 1998/1999, the OSPAR Commission adopted five strategies that established objectives and requirements for action relating to hazardous substances, radioactive substances, the combating of eutrophication, the protection and conservation of the ecosystems and biological diversity of the maritime area and environmental goals and management mechanisms for offshore activities. Amongst other measures, the OSPAR Convention provides for the adoption of legally binding ‘Decisions’, the first five of which were adopted in 1998

The OSPAR Strategy to Combat Eutrophication takes up agreements made within the North Sea Conference framework, followed through by the Oslo and Paris Commissions and which have been partly fulfilled to date,

regarding the reduction of nutrient inputs by about 50%. An important element of the OSPAR strategy is the Common Procedure for the Identification of the Eutrophication Status of the Maritime Area.

OSPAR has agreed on measures for a number of substances (e.g. mercury, hexachloroethane, short chained chlorinated paraffins, PAHs and PCBs) and industrial sectors (e.g. iron and steel, aluminium, PVC, pulp and paper), and has defined BAT or BEP for a number of industrial sectors (e.g. the pulp and paper industry, the aluminium and the non-ferrous metal industry, combustion plants, use of toxic chemicals and pesticides in agriculture and aquaculture).

The OSPAR Strategy with regard to Hazardous Substances takes up agreements made within the North Sea Conference framework. This strategy contains provisions for the development of a dynamic selection and prioritisation mechanism to identify hazardous substances and assist the Commission in selecting those for which priority action will be taken to continuously reduce discharges, emissions and losses of hazardous substances with the ultimate aim of achieving concentrations in the environment near background values for naturally occurring substances and close to zero for man-made synthetic substances. Every endeavour will be made to move towards the target of cessation of discharges, emissions and losses of hazardous substances by the year 2020. OSPAR 1998 also adopted Decisions relating to the disposal of disused offshore installations (see Section 3.10) and radioactive dumping (see Section 3.12).

Specific OSPAR guidelines for the identification, selection and implementation of measures for Marine Protected Areas (MPAs) are under consideration. However, several other national and international initiatives have led to the establishment of a number of MPAs within the OSPAR maritime area. Most MPAs are located at or near the coast.

The OSPAR Convention prohibits incineration at sea. It also prohibits the dumping of all wastes or other matter except for dredged material, inert materials of natural origin, fish waste and, until the end of 2004, of vessels and aircraft. On a worldwide level, the London Convention regulates dumping of waste and its 1996 Protocol, yet to enter into force, places particular emphasis on the need to identify and control sources of contamination for dredged materials.

Environmental policy objectives of the EU are contained in the Amsterdam Treaty of the EU (1997). While fisheries management is directly governed by EC Regulations, the EC has no legislation specifically addressing the protection of the marine environment with regard to land-based activities. However, implementation of EC legislation on air and water quality, nature protection, chemicals, nutrients and industrial processes would lead to a reduction in pressures on and improvement in quality of the marine environment.

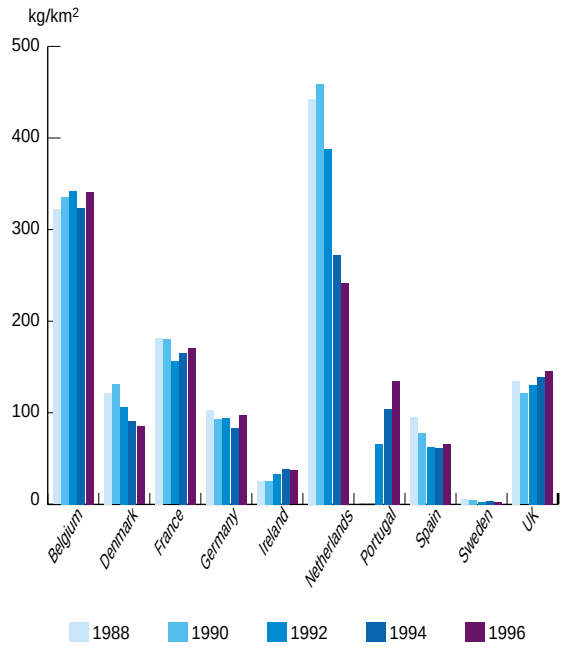
The four ministerial North Sea Conferences held since 1984 have resulted in political commitments to implement certain measures at a national or OSPAR level, or within the EU. Important agreements were to adopt the precautionary principle and to reduce inputs of nutrients and hazardous substances, the latter with the target of their cessation by 2020.

Eight governmental conferences about the protection of the Wadden Sea have been held since 1978 and have resulted, *inter alia*, in the agreement of a trilateral monitoring and assessment programme as well as common targets for nature conservation.

The Bonn Agreement, which first came into force in 1969, was a reaction to major oil spills and aimed to encourage North Sea states to jointly improve their capacity for combating oil pollution. The current Bonn Agreement (1983) is a commitment by North Sea states and the EU to combat pollution by offering mutual assistance and co-operation and to execute surveillance and to prevent violations of anti-pollution regulations.

The UN Conference on Environment and Development (UNCED 1992, Rio de Janeiro) has made 'sustainable development' an underlying principle in the development of environmental policy. The 'precautionary principle', and the 'polluter pays' principle were introduced on a global level. The Agenda 21 was agreed to implement this key idea and to express the general policy direction for the Twenty-First Century. The Rio Declaration emphasised that

Figure 3.11 **Total pesticides used in agriculture. Source: Eurostat (1998).**



States have the sovereign right to exploit their own resources pursuant to their own policies, but also the responsibility of ensuring that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction. At UNCED the Convention on Biological Diversity (CBD) was signed, aiming at the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the utilisation of genetic resources. In adopting the Jakarta Mandate (1997) parties to CBD have provided concrete provisions that are specifically suited to the conservation of marine and coastal biodiversity. Annex V implements this CBD on the regional OSPAR convention level.

In 1994, after several years' efforts, the UN Convention on the Law of the Sea entered into force, setting out the overall legal framework for the Governance of the Oceans, also including environmental issues. An agreement for the implementation of the provisions of UNCLOS relating to the conservation and management of straddling fish stocks and highly migratory fish was adopted in 1995.

The International Maritime Organization deals with the safety of shipping and the protection of the marine environment against risks related to shipping. The IMO Marine Environmental Protection Committee (MEPC) deals with issues relating to the prevention and control of pollution from ships. As well as conventions relating to ship safety, the IMO has agreed on the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) which relates to operational discharges from ships.