North-East Atlantic and Baltic Sea Health Check

Assessing the status of wildlife and habitats

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1. Introduction

The marine environment of the North-East Atlantic and the Baltic Sea is in crisis – resources have been overexploited and the seas have been used as a rubbish dump for decades. Since the early 1970s, the contracting parties to the OSPAR and HELCOM Commissions have made some progress towards improving the management of human activities. However, it is clear from the 2000 North-East Atlantic Quality Status Report (QSR) that the habitats, the fish stocks and the marine wildlife are still under threat.

Three years after the publication of the QSR and six years after the last North-East Atlantic and Baltic Sea Ministerial Conferences, WWF's Health Check report for the North-East Atlantic and Baltic Sea shows that many marine species remain in decline; commercial fish stocks are outside of safe biological limits; and habitats are being degraded and destroyed. Even some of the population increases are a result of poor management practices. For example, the fulmar population is thought to have increased due to increased food availability from the wasteful practice of discarding fish and fish offal at sea.

The Health Check report provides a summary of the key threats to the marine environment, the status and management needs of twenty-two habitats and species (or groups of species). The habitats selected represent a typical range of habitats present in the North-East Atlantic and the Baltic Sea, and the species are chosen from a variety of levels in the marine food chain.

The results of the Health Check show considerable consistency in the threats identified and these can be broadly categorised as:

- overexploitation, in particular of fish species;
- pollution from a variety of sources both onshore and offshore;
- development and damaging human activities causing degradation and loss of habitats.

These are the proximate causes of the deterioration in the marine environment of the North-East Atlantic and Baltic Sea. A closer assessment of these threats, however, leads to the conclusion that there are three root causes that have been inadequately addressed for a considerable length of time:

- a lack of or inadequate protection for habitats and/or wildlife;
- a lack of or inadequate management responses to the demands being placed on wildlife, habitats and/or the system as a whole; and
- a lack of knowledge and/or understanding.

Three decades after the Oslo, Paris and Helsinki regional seas conventions came into existence, it is disappointing that these primary root causes of deterioration of the health of the marine environment of the North-East Atlantic and the Baltic Sea remain. The results of WWF's Health Check Report demonstrate that there is a long way to go before it is possible to believe that the ecosystems of the North-East Atlantic Ocean and the Baltic Sea will one day be healthy.

2. The Marine Environment

The oceans cover approximately 71 per cent of the planet and more than one third of all humans live within 100 km of the coast.[1] At the same time, much of the marine environment is still poorly understood and relatively unexplored.

While the vastness of the oceans may at first sight appear to be a uniform and fairly constant environment, marine ecosystems are in fact as diverse and variable as terrestrial ecosystems. Large oceanic currents ensure a constant flux of vast quantities of water, driving the vital exchange of heat and nutrients around the globe. Moreover, there are differences between distinct bodies of water, notably with respect to salinity, water temperature and light penetration, causing variation in productivity and species diversity.

The seabed, like the terrestrial surface, exhibits a multitude of characteristics, including vast plains of soft sediments as well as rocky cliffs and long ridges, and shorelines as complex as a multi-coloured patchwork quilt. Biologically, there are areas of high species diversity, so called 'hotspots', as well as important migratory corridors for marine species such as whales and birds.

Broadly, the marine environment can be divided into three distinct geological regimes:

1. coastal areas, comprising a diverse range of habitats from coastal lagoons, estuaries and inland wetlands, to cliff faces and rocky shores;
2. the continental shelves, which cover the submerged margins of our continents to a depth of approximately 200 metres; and
3. the oceanic basin, or deep sea, reaching depths to approximately 4,000 metres.

It is estimated that coastal waters generate 75 per cent of the ecosystem service benefits for Europe's coastal zones.[2] More specifically, estuaries and the wider waters of the continental shelves, play an important role, for example by supporting in- and offshore fisheries, providing open space for leisure and recreation that contribute to human wellbeing, and acting as a natural filter for sediments, excessive nitrogen and toxic pollutants. Despite this, 86 per cent of Europe's coastal zones are considered to be at high to moderate risk of unsustainable development.[3] This evident conflict between their limited carrying capacity and the excessive human footprint needs to be addressed if Europe's diverse coastal heritage is to be saved. To ensure the sustainable development of Europe's coastal zones, it is therefore vital to strike a sound balance in maximising socio-economic gain from land-based and marine resources without surpassing the natural carrying capacity of the area.

The continental shelf is a relatively flat region of seafloor extending out from the shoreline to a depth of approximately 130-150 metres.[I] This region has the greatest economic potential, harbouring, for example, oil reserves and rich marine fisheries. It commonly corresponds with the so-called Exclusive Economic Zone (EEZ) – the limit of coastal state offshore jurisdiction. The shelf break marks a distinct change in the slope of the sea floor from the flat continental shelf to the steep continental slope, which extends from approximately 130 metres down to a depth of 2,500 to 3,000 metres or more.

The continental shelves, including the coastal zone, are among the most productive and explored areas of the underwater world. This has put them under immense pressure from human use, particularly in areas of high population density and economic development. Pollution, coastal development and overexploitation of fish resources are among the key environmental challenges. In addition to direct impacts on coastal areas, land-based activities in the wider catchment area, notably agriculture and forestry, as well as increased maritime traffic and global climate changes also affect the marine environment. At the same time, many coastal regions are among the least economically developed areas in the EU. They are classified as economically marginalized, often heavily reliant on a limited number of economic activities such as fishing, tourism and port industries, and receive substantial financial assistance from the EU Structural and Cohesion Funds to improve infrastructure, economic development and social cohesion.[45]

Offshore areas do not escape the effects of human activities either, and are indeed physically linked with the coastal waters. Key environmental pressures include:

i) the increase in shipping, notably associated with oil pollution, disturbance (ie noise and movement) and the introduction of alien species (eg through ballast water);

[I] The shelf has been formed by the back and forward movement of shorelines during times of (historic) sea level change, notably as a result of the growth and retreat of continental glaciers, over the past 2 million years.

ii) developments linked to offshore exploitation of oil, gas and mineral resources, to some extent wind and wave energy;
iii) exploitation of fish stocks and the associated impacts on non-target species and benthic habitats;
iv) long-range transboundary air pollution; and
v) global climate change.

With the development of new technology, previously untouched areas of our oceans have become accessible not only to the fishing sector but also to oil and gas industries, mining companies and other economic interests. This trend is perhaps most obvious in the fishing sector; as coastal stocks have faltered under the persistent pressure of commercial fishing, fishermen in search of new catch opportunities have moved further and further offshore. At the same time, many of the habitats of the oceanic basins remain unmapped and unclassified, and there is still a lack of information about many marine species. As scientists often learn of potential problems after initial damage has already been incurred, it is feared that species are being lost at a higher rate than they are discovered.

2.1 National Boundaries and Responsibilities

In the mid-1970s, coastal nations began to declare areas of exclusive access beyond the already established coastal territorial seas (often out to 12 nm).[6] The concept of the so-called Exclusive Economic Zone (EEZ) obtained formal international acceptance in 1982 under the UN Convention on the Law of the Sea (UNCLOS), giving coastal states the right to extend their exclusive access to fish stocks and other resources and the responsibility for regulating pollution to 200 nm offshore. Today, approximately 80 per cent of the oceans remain outside national jurisdiction. While a growing number of international agreements aim to regulate access to ocean space and marine resources on the high seas, assets such as fish stocks in international waters are still suffering from chronic overexploitation – as they are in many waters under national jurisdiction.

2.2 Commitments and Targets Related to the Marine Environment

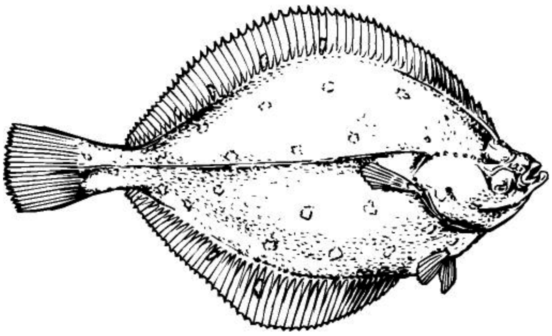
Environmental problems in the oceans have been evident at least since the early 20th century, and have been targeted by a combination of global, regional and national initiatives designed to restore marine health. Within the North-East Atlantic and Baltic Sea regions, key instruments include the Oslo and Paris Convention on the Protection of the North East Atlantic, the Helsinki Convention on the Protection of the Baltic Sea and Declarations adopted at five North Sea Ministerial Conferences (starting in Bremen in 1984). Although initially focused on pollution-related issues, these international instruments have increasingly tackled broader ecosystem problems. They are complemented by a raft of EU and national legislation, covering issues such as waste, water pollution and radioactive substances, biodiversity and conservation.

Despite these considerable efforts, the objective of securing a healthy marine environment remains elusive. In order to inject new political momentum into marine environmental protection, world leaders meeting at the World Summit on Sustainable Development in Johannesburg in September 2002 agreed on a number of priorities for the medium term. Among the suite of objectives agreed at the Summit, the following are directly targeted at the marine environment:

- encourage application by 2010 of the ecosystem approach;
- maintain or restore fish stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible by 2015;

- develop and facilitate the establishment of marine protected areas, including representative networks by 2012; and
- develop national, regional and international programmes for halting the loss of marine biodiversity, including in coral reefs and wetlands.

Read alongside the existing body of international, EU and national commitments, these objectives establish a challenging framework for marine environmental protection over the next decade and beyond.

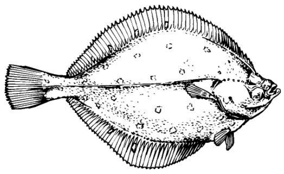


3. A Region Under Threat - The North-East Atlantic and Baltic Seas

In relation to its total landmass, Europe has a comparatively long coastline (89,000 km). Roughly one third of the EU population lives in close proximity (within 10 km) of the sea.[7] The catchment areas of the North Sea and Baltic Sea, in particular, are densely populated. The high population densities and levels of industrialisation significantly increase the environmental pressures exerted on local ecosystems; urbanisation, industrial effluents, sea defence measures, fishing, tourism and leisure, as well as land reclamation and pollution from land-based activities, such as agriculture, are some of the main threats to Europe's coastal habitats.

The total catchment area of the North-East Atlantic and Baltic seas is estimated to 5,140,000 km^2.[8] This effectively means that freshwater from a land area approximately one third of the size of the total surface area of the North-East Atlantic and Baltic seas drains into the marine environment, implying a significant interdependence between terrestrial, freshwater and marine habitats. In addition, the oceans receive airborne pollutants from the atmosphere, and are subject to climate change.

For management purposes and following bio-geographical reasoning, the North-East Atlantic and Baltic seas can be subdivided into six distinct areas (the first five used by OSPAR).



3.1. The North-East Atlantic

3.1.1 Arctic Waters (Region I under OSPAR)

The Arctic Waters are largely governed by a steady inflow of relatively warm Atlantic water and subsequent cooling and outflow of cold water into the North Atlantic. This process, together with the seasonal melting and formation of large ice-shields, influences climate patterns in Europe and beyond. Low temperatures, regional hydrological and atmospheric particularities and the enormous seasonal differences in light exposure are distinct features of the Arctic ecosystems and largely govern their biological processes.

The Arctic region is home to some of the world's largest fish stocks and supports a rich fauna, including some of the top predators in the marine environment, such as polar bears, baleen whales, large toothed whales, gulls and other sea bird species. The slow growth rate and often long life span of many of these cold water species, in addition to the light regime and hydrochemical characteristics mentioned above, make the Arctic ecosystem a fragile environment, at risk from atmospheric pollution, commercial fishing (including some hunting) and global climate change. Mineral extraction and the recent growth of the tourism industry, transport and litter are also beginning to have a noticeable impact.

Persistent pollutants, such as radionuclides, PCBs and heavy metals, have a tendency to bioaccumulate[II] and are often transported over long distances by winds or water. This long-range transport of hazardous substances has extensive impacts on the otherwise relatively unpolluted Arctic seas. Radioactive isotopes originating from the 1986 Chernobyl fallout and British and French nuclear installations, for example, can be found as far afield as the Norwegian coast and the most northern polar waters. Similar observations have been made for DDT, PCBs and several other substances, which find no application in the Arctic region. Other sources of pollution, notably from point sources, include effluents from coastal settlements, nutrient input from Norwegian salmon farming, accidental and operational oil spills from ships and offshore installations, and contaminated freshwater inputs from riverine sources. However, these are currently considered to be of minor importance in relation to the wider Arctic ecosystems.[9]

3.1.2 Greater North Sea (Region II under OSPAR)

The waters of the North Sea consist of a mixture of North Atlantic waters, flowing in from the north and circulating in an anti-clockwise loop through the deeper northern and central parts of the North Sea, and freshwater input from a catchment area including 18 European States. The shallower southern parts of the North Sea also receive waters through the English Channel.

Often considered a characteristic feature of the region, large areas of tidal mud flats, such as the Wadden Sea, are of great importance for migrating birds and provide nursery grounds for many fish stocks. The seabed consists of a rich patchwork of diverse sediment types, with resulting regional habitat characteristics. Sediment deposits, which can be several kilometres thick, include muddy and sandy substrata, areas dominated by sand deposits, and coarse sand and gravel beds. The coastal landscape in the region is also very variable.[10]

Offshore sandbanks and mud flats, as well as gravel beds, are important habitats for many bottom-dwelling organisms, including macroalgae, invertebrates and shellfish, and serve as nursery grounds for many commercially valuable fish species. Other areas of high biological productivity are oceanic fronts[III] – a prominent feature of the North Sea. They occur widely off the eastern coast of Britain, the Dutch, German and Danish coasts, as well as where the less saline waters of the Baltic Sea meet the North Sea. Nutrient rich waters also enter the region with Atlantic currents, notably along the western slopes of the narrow Norwegian Trench[IV]. Overall, the wealth of biomass and habitat diversity supports large numbers of sea birds as well as marine mammals.

The catchment area of the North Sea region is one of the most densely populated areas in the European Union; with on average 194 inhabitants per km^2, it is some 70 per cent above the EU average.[11] As a result, the region faces a considerable human footprint, with significant consequences for its marine life. In addition to more direct and land-use related impacts, high levels of shipping, offshore exploitation and fishing as well as climate change also affect the North Sea. Among the most damaging are the impact of fishing (including industrial and shellfish fisheries) on the seabed and non-target species, the removal and discarding of biomass through fishing, the rise in sea level, artificial nutrient enrichment and associated periodic disturbances due to oxygen depletion, and contamination with certain organic pollutants, such as TBT and the persistent pesticides lindane and DDT.[12]

3.1.3 The Celtic Seas (Region III in OSPAR)

The Celtic seas region comprises i) the Celtic Sea, south of Ireland and west of the English Channel; ii) the Malin Sea, west of the Scottish and Irish coast; and iii) the Irish Sea, dividing England and Ireland.

[II] Bioaccumulation refers to the accumulation of contaminants in an organism through the build-up of toxins taken up by feeding.

[III] Oceanic fronts are areas where two water masses meet, commonly resulting in turbulence and high levels of biological activity. Three types of frontal zones occur in the North Sea: tidal fronts, upwelling fronts and salinity fronts.

[IV] A deep and relatively narrow submarine trench which follows the Norwegian coast and plays an important role in steering large amounts of Atlantic water into the North Sea.

Conditions in the region vary from the more oceanic waters at the continental margin of the north-west coast of the UK and the west coast of Ireland, to the more enclosed Irish Sea. Oceanic water enters the south and west of the region moving northwards away from the wider Atlantic, before exiting into Arctic waters and the North Sea east of Scotland. The Irish Sea and Bristol Channel, in particular, are dominated by strong tidal movements, which allow for a constant and fast exchange of waters. Wind- and wave-driven movements of water are also important in shaping local hydrological conditions.

Overall, the region is dominated by sandy seabeds, as well as more localised gravel and rock covered areas.[13] While the soft bottoms provide important habitats for burrowing species such as Norway lobster (*Nephrops norvegicus*) and flat fish such as plaice, gravel beds play an important role as spawning grounds for species such as herring and sandeel. Moreover, the Celtic Sea and Malin Sea are home to important seal populations (eg grey and common seal) and cetaceans.

The region also contains a number of 'hotspots' of biological activity. These include oceanic fronts, notably the Irish shelf front (south-east of Ireland), the Ushant front (at the entry into the English Channel), and the Celtic sea front (at the entry into the Irish Sea). These are areas generally associated with enhanced biological productivity, and thus important feeding grounds for marine wildlife, in particular numerous fish species, seabirds such as puffins and terns, and marine mammals and sea turtles. Moreover, there are also some occurrences of cold water coral reefs, particularly along the shelf break west of Ireland (see section 6.4).

Fishing has traditionally been of high socio-economic importance in the region. While a lack of data often prevents thorough assessment, it is clear that stocks of cod, hake, saithe, whiting, plaice and sole are now outside safe biological limits due to unsustainable harvesting.[14] Significant impacts of fishing and fishing gear on habitat structure, bottom-dwelling communities, as well as bycatch rates are also a cause for concern.[15] For example, bycatch rates of harbour porpoise in the Celtic bottom-set gillnet fishery are considered unsustainable. In addition, Scottish and Irish mariculture, primarily salmon farming, may cause localised nutrient and chemical pollution.

Other key threats include other types of water pollution (notably endocrine disrupting contaminants and radionuclides), coastal development and global climate change. Lower, and often more confined, pressures arise from activities such as the discharge of domestic and industrial effluents, littering, mariculture, offshore installations and shipping.

The Irish Sea basin in particular receives a fair amount of contaminants both from land-based and airborne sources. A number of large estuaries serve a large total catchment area, which includes some of the most industrialised and heavily populated areas in the UK and Ireland. Major ports and industrial facilities and heavy maritime traffic also take their toll. Discharges from Sellafield into the Irish Sea are decreasing, with the exception of technetium-99, a less radioactive but long-lived isotope. The last shipping incident resulting in a major oil spill in the region was the Sea Empress disaster in 1996.[16] The risk of accidents also applies to nuclear transports.

3.1.4 The Bay of Biscay and Iberian Waters (Region IV in OSPAR)

The Bay of Biscay and Iberian Waters largely comprise the waters of the continental shelf in the southern parts of the North-East Atlantic. Near the Strait of Gibraltar, the Atlantic waters mix with more saline Mediterranean water.[V] Seasonal upwelling of sub-surface water[VI] occurs along the western coasts of Spain and Portugal, resulting in temporarily cooler, more nutrient-rich surface waters. This supports high levels of primary production, and thus important fisheries.

[V] The Mediterranean is characterised by its great depths of 3,000 to 5,000 metres and its very saline waters.

[VI] Upwelling is the transport of subsurface water to the surface. Commonly a consequence of wind patterns, upwelling occurs where surface waters diverge. Upwelling regions develop in response to prevailing winds along coasts and at sea.

While the continental shelf of this region constitutes an area of gentle slopes, the continental slope is marked by steep gradients and associated strong oceanic currents. The continental margin is a diverse underwater landscape of seamounts, banks and submarine canyons.[17]

Due to the naturally favourable conditions, this region is less affected by pollution than the rest of the North-East Atlantic and the Baltic Sea. Instead, unsustainable use of marine resources is a significant threat. Many of the commercially exploited fish stocks, such as sardine, hake, anglerfish, megrim and swordfish, are considered to be outside safe biological limits.[18] Fishing has significant knock-on effects, notably in terms of impacts on habitats and non-target species (see section 4.4). There is, for example, concern for seagrass meadows off the coasts of Portugal and Spain, which are considered to be at risk from trawling. The diverse and often largely unexplored landscape of submarine reefs, ridges and mounts is also thought to be threatened by the physical impacts of fishing gear on the sea floor.

Like the Celtic seas region, the Iberian Waters and the Bay of Biscay have a long history of intensive fishing activity and, while natural fluctuations in oceanic currents and local hydrological regimes (eg upwelling and the Gulf Stream) often lead to seasonal changes in the abundance of many species, it is overfishing that has caused the more long-term decline in fish stocks. Many of the fishing vessels target mixed fisheries, taking several species simultaneously. This makes management of local fisheries more difficult, and often results in high levels of both undersized fish and non-target species in the catch. For example, up to 75 per cent of the hake caught in the region is thought to be juvenile, taken before it has had a chance to reproduce.[19] Bottom trawling is regarded to be the most unsustainable fishing technique, with discard rates of up to 59 per cent of the catch in some areas. The intensification in fishing effort since the 1850s has also severely affected skate and ray populations; both are now ‘virtually extinct’ in the Bay of Biscay.[20]

Like other regions, the Iberian coastal waters and the Bay of Biscay also show raised levels of TBT; a threat to the local ecology and some commercially exploited fisheries.

3.1.5 The Wider Atlantic (Region V in OSPAR)

The wider Atlantic region under OSPAR includes the deep-sea areas of the North-East Atlantic. Characteristic of its waters are strong currents, fronts (eg the North Atlantic polar front), gyres[VII] and eddies[VIII], resulting in the mixing of colder, less saline waters from the Arctic regions with warmer, salty waters from the south. Water turbulence frequently occurs along, for example, the continental shelf, mid-Atlantic ridge, the Faroe-Shetland channel and Azores Archipelago. The Arctic-Atlantic exchange – the large-scale transport of water masses and associated exchange of heat – is a significant determinant of European and global climate patterns. It also makes the waters of the wider Atlantic rich in oxygen and nutrients, as well as maintaining the transport of certain marine species.

In this region, the seafloor exhibits a diverse underwater landscape, ranging from the continental slopes in the east, to the ridges and abyssal plains of the deep sea. The continental margins and Mid-Atlantic Ridge are the sites of numerous offshore banks, reefs[IX], carbonate mounds and seamounts – all areas of high productivity and biodiversity (see sections 6.3, 6.4 and 6.5).[21] A group of active volcanoes, the Azores Archipelago, marks the junction of the three key crustal plate boundaries, another area of intense biological

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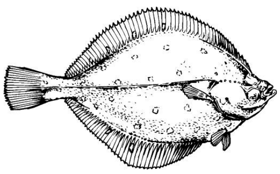
[VII] Gyres are large-scale circulation patterns that develop in surface waters, due to prevailing wind patterns, the Coriolis force and gravity. They drive many of the major ocean currents such as the Gulf Stream.

[VIII] Smaller areas of horizontal turbulence, commonly the circular or whirling flow of water found along the edge of main currents, along continental margins and often in the vicinity of submerged or other structures such as reefs, seamounts or rocky islets. Water circulation induces or sustains vertical water movements and thus leads to the mixing of stratified water masses.

[IX] More than 60 per cent of the reefs described within the 200 nm zones of EU Member States are located in Irish waters, mostly associated to the Celtic Shelf break [reference as end of sentence above] productivity, and constitutes the only coastal margin in the region. The abyssal plains are almost featureless and contain some of the deepest areas in the North-East Atlantic. These soft-bottom areas are home to a largely unexplored diversity of benthic fauna. Overall, the diversity of the physical environment, including topographic and hydrological features, of the wider Atlantic leads to a characteristic distribution of areas of high biological activity, not least in support of many top predators such as whales, sharks, tuna, swordfish, turtles, and many sea birds.

Whereas the wider Atlantic is less directly affected by human pressures, such as coastal developments and eutrophication, deeper areas have not remained untouched by human activities. The main threats in the region are oil exploration and fishing activities, now also targeting highly vulnerable deep-sea species. All dumping of wastes (including radioactive wastes and sludge) at sea is now prohibited,[X] but littering from ships at sea and the remains of oil and tar along busy shipping routes continue to pose a threat to marine wildlife. The debated injection of CO_2 into marine sediments and the deep sea is an emerging issue.[XI]



3.2 Baltic Sea (including Kattegat)

The Baltic Sea is almost completely confined by the landmasses of the European continent. It constitutes the second largest brackish water body in the world and is a comparatively young sea. The product of the melting ice sheets of the last glacial period, it contains an interesting mix of freshwater and marine species.

Its brackish waters are a result of the limited water exchange with the North Sea and the constant freshwater input from a number of large rivers. It has been estimated that it takes on average 25 to 30 years for the Baltic Sea to exchange its full body of water.[22] An area four times the size of the total sea area encompassing 14 countries drains its waters into the Baltic basin.

Despite its rather low species diversity, the Baltic Sea is far from uniform. Coastal habitats range from the extensive archipelagos of the central and northern Baltic to the sandy beaches and lagoons of the south and east. It is characterised by relatively shallow waters, on average 23-50 metres,[XII] soft sediment seabeds (more than 200 metres thick in some areas), and submarine elevations which separate the sea floor into a series of basins (eg the Kattegat, Belt Sea, Baltic Proper, Bothnian Sea, Bothnian Bay and Gulf of Finland). Each basin constitutes a distinct hydrological unit and there is restricted water exchange between them. Sand, sandy silt and gravel sediments dominate the seabed. Below 55 metres, muddy bottoms are most common.

A survey undertaken by HELCOM (1998) identified 146 biotopes and biotope complexes, 83 per cent of which were rated either ‘heavily endangered’ (15 per cent) or ‘endangered’ (68 per cent); none were classified as ‘immediately threatened’.[23] While the Baltic Sea is highly productive, its marine flora and fauna is not very diverse. A mix of freshwater and marine species have adapted to the brackish environment, and the area is an important wintering, resting and feeding ground for many migratory bird species. The deeper parts of the sea floor generally lack higher vegetation, due to insufficient light penetration.

The restricted water circulation and related variance in temperature, oxygen and salt content, high inputs of riverine and land-based run-off and the limited species diversity make the Baltic Sea particularly sensitive to eutrophication, pollution, climate change and the introduction of alien species. Demographic pressures

[X] See for example the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Waste and other Matters, the urban waste water treatment Directive (91/271/EEC), and OSPAR Annex II, HELCOM (Article 11)

[XI] Sediment injection is already taking place in the North Sea. Proposals for experimental releases of CO_2 at the depth of the oceans have so far been averted.

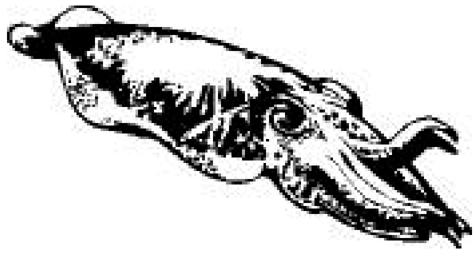
[XII] Maximum depth 459 metres.

have also led to habitat destruction and overexploitation of fish resources, most notably cod. Recent trends show some improvement in terms of emissions to the marine environment, but the flora and fauna still face significant human-induced pressures.

Once oligotrophic[XIII], the Baltic Sea has in less than a century become plagued by high nutrient levels. Only in the last decades, nitrogen and phosphorus levels have increased four and eight times, respectively.[24] This has resulted in the increased occurrence of toxic algal blooms and an excessive growth of plants and algae at the expense of species such as bladderwrack. Eutrophication has also led to lower oxygen levels in the lower parts of the water column, with detrimental effects for many species, particularly cod. While more recent figures show a slight decrease in nutrient input, this has had little positive effect on the ecosystem so far.[25]

Wildlife in the Baltic Sea has also been severely affected by pollutants. Over the last two or three decades, the input of several hazardous substances (eg heavy metals and pesticides) has decreased, however, and the populations of many coastal birds, such as the Baltic white-tailed sea eagle, are recovering. Other marine species (eg seals) continue to be affected by long-lived contaminants that accumulate in their tissue. Unwanted bycatch remains a problem in the fisheries sector, and is still a threat to the harbour porpoise population. With a population currently estimated to less than 600 animals, the Baltic harbour porpoise is under imminent threat of extinction. The introduction of as many as 95 alien species (1998 data)[26] is also a matter of growing concern. Tourism, coastal development, offshore wind parks and marine traffic all are on the increase.

A number of initiatives have been taken to protect the Baltic environment from excessive human pressures. Amongst these are the Baltic Agenda 21, adopted in 1998 by the Seventh Ministerial Session of the Council of the Baltic Sea States[XIV], as well as the WWF Baltic Sea Ecoregion Initiative and its associated Action Plan. There are also projects on sustainable tourism, the designation of marine protected areas, and the ongoing work to establish the Baltic Sea as a Particularly Sensitive Sea Area (PSSA) under UNCLOS.



4. Threats to the Marine Environment and its Biodiversity

4.1 Hazardous Substances

4.1.1 Chemicals

Today we are exposed to an ever-increasing cocktail of contaminants, a result of the widespread use of chemicals, many of them man-made. Many persistent (ie long-lived) pollutants have the capacity to bioaccumulate; their concentrations are greatly magnified in the higher levels of the food web, sometimes resulting in a lower reproductive capacity and/or faltering immune system in top predators. The Baltic Sea is particularly sensitive to persistent toxic substances because of its physical characteristics, the high population density in the region, and the fact that many of the species there are not originally adapted to the brackish water environment but live near the edge of their tolerance range.

Most, if not all, persistent substances will also accumulate in marine sediments, which act as sinks for these pollutants. This may constitute a threat to public health and may impede the use of marine resources for human consumption. Indeed, levels of some toxic substances in fatty fish in the Baltic Sea, such as

[XIII] Poor in nutrients.

[XIV] The Council of the Baltic Sea States (CBSS) includes 12 members (Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia, Sweden and the European Commission) and convenes at the level of Foreign Ministers.

dioxins, are so high that the use of certain species is restricted by the EU. In addition, governments in some of the countries have issued recommendations in order to restrict the food intake of fatty fish.

In the past, discharges of toxic substances by industry were the cause of extreme pollution levels in a number of rivers in Western Europe. This has had profound effects on many coastal areas, notably the North Sea. However, significant improvements have been made between 1990 and 1998, with levels of toxics such as cadmium, mercury, lead, lindane and PCB decreasing in most areas.

One of the outcomes of the 1987 Second International Conference on the Protection of the North Sea was the commitment to reduce the total quantity of hazardous substances reaching the aquatic environment of the North Sea by 50 per cent, between 1985 and 1995. This commitment was subsequently strengthened to 70 per cent by the Hague Declaration (1990) for particularly harmful substances, such as dioxins, mercury, cadmium and lead. Progress in this area has been positive, and the respective targets for mercury, lead and cadmium levels have been met by most if not all North Sea States. Where progress has been slower, or in areas outside the remit of the North Sea Conference, improvements are being sought within the EU framework and/or the OSPAR Strategy on Hazardous Substances agreed in 1998.

The OSPAR Strategy sets out the rather broad 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'. The aim is to achieve 'levels that are not harmful to man or nature' by the year 2000, and to eliminate emissions by 2020. The Strategy also includes a long list of 'chemicals for priority action' to which it applies, such as organotins, PCB, PAHs and certain phthalates and another list of candidate substances (around 400). The priority list is updated by the OSPAR signatories if and when it is appropriate (currently including around 50 substances).

Over the years, several Ministerial Declarations on the protection of the marine environment of the Baltic Sea area have stated a firm determination among the Parties to reduce discharges from point sources of toxic or persistent substances, nutrients, heavy metals and hydrocarbons. Therefore, one of the most important duties of the Helsinki Commission is to make Recommendations on measures to prevent and eliminate pollution from land-based sources in the Baltic Sea area.[27] This should be done by using best environmental practice for all sources and best available technology for point sources. More than fifty recommendations to limit industrial and municipal discharges, as well as discharges from agriculture and transport, has been elaborated by the HELCOM Technological Committee (HELCOM TC). The TC also follows implementation of the different recommendations, which is often patchy. Some Recommendations, notably concerning discharges of DDT and mercury from dentistry, are fully implemented by all Contracting Parties, whereas others such as elimination of the use of PCBs and PCTs, limitation of cadmium discharges and approval of pesticides are fully implemented only by the current EU countries. Contaminant concentrations in Baltic seawater is one of the main parameters in the HELCOM COMBINE monitoring programme, but data on the agreed substances are not available from all of the Baltic States. The Fourth Periodic Assessment carried out in 1994-1998 included a number of heavy metals (eight) and twelve groups of organic contaminants. In general, a decreasing trend for many substances could be seen in seawater, particularly surface waters, while levels of some toxic substances such as cadmium are increasing in fish and other biota.

EU level actions to reduce or eliminate discharges of toxic substances to the marine environment have been limited. These have included the 1976 Dangerous Substances Directive and facility specific controls, such as the Integrated Pollution Prevention and Control

Directive[XV]. An attempt by the Commission to include wider marine obligations in the Water Framework Directive was dismissed by the Council of Ministers (not least due to arguments over whether the Community had competence in this area). Measures can be taken, however, under the Water Framework Directive, notably with regards to coastal waters, and this has led to some initial developments, but also a debate about what the Directive itself commits Member States to achieve.

In 2001, the EU Council adopted a Decision establishing a list of priority substances in the field of water policy. This priority list of 33 substances was put together after an initial survey of other 'lists', including those in the 1976 Dangerous Substance Directive and the OSPAR and HELCOM Conventions. To determine which substances were a priority, a procedure termed COMMPS (Combined Monitoring-based and Modelling-based Priority Setting) was elaborated. Information on environmental contamination in surface waters and sediments was examined across all 15 Member States. In all, over 800,000 data items were used, with the aim of tackling ecotoxicological effects, bioaccumulation and health impacts. The monitoring data also indicated the *in situ* importance of some substances, such as DDT, which are already controlled under existing legislation[XVI]. The final priority list contains four metals (cadmium, lead, mercury and tin) and their compounds, and a number of toxic organic substances (eg certain pesticides, product contaminants). The adoption of this Decision will enable the European Commission to bring forward proposals for specific measures to reduce pollution from the named substances. However, experience shows that finding agreement on a list of substances and agreeing on adequate action to reduce/eliminate discharges of these substances are two very different affairs, and progress on action is expected to take some time.

It is also important to note that the EU is currently reviewing its chemical policies, as has been promoted by OSPAR and HELCOM. New legislation would replace 40 different pieces of current legislation, and is designed, according to the European Commission, to increase the protection of human health and the environment from exposure to chemicals, whilst also maintaining or even enhancing the competitiveness of the EU chemicals industry. The proposals will be consulted upon during summer 2003 and, given current levels of debate, the processes in the EU institutions for adopting legislation are likely to be drawn out and amendments are to be expected. At the heart of the policy is REACH, a single integrated system for the registration, evaluation and authorisation of chemicals. Key elements include:

- the duty of care, which means that the burden of proof of the safety of chemicals will be moved from public authorities to companies that produce, import and use chemicals;
- companies that manufacture or import at least one tonne of a chemical per year will have to provide a minimum of information on the properties, uses and safe management of the substance. Polymers and intermediary chemicals will face reduced requirements, depending on the likelihood of the public's exposure to them or their danger to the environment;
- risk evaluation of chemicals; and
- the authorisation and restriction of chemicals of high concern, such as carcinogens, mutagens, reproductive toxicants and bioaccumulative chemicals.

WWF is concerned that the worst chemicals will not necessarily be phased out even if there are safer alternatives available.

Other emissions of hazardous substances to the marine environment include those from offshore installations, vessels at sea, radioactive discharges from nuclear installations and military sources (see below), as well as atmospheric pollution.

[XV] Directive 76/464 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community

[XVI] These 'historical' substances were not, therefore, included in the list.

4.1.2 Radioactive Contamination

In addition to the hazardous substances mentioned thus far, there are a number of radioactive substances, which originate from or are significantly increased in quantity by human activity. While a certain amount of background radiation occurs naturally, nuclear weapons testing, the dumping of radioactive waste, transport accidents, the foundering of nuclear submarines and emissions from nuclear installations, including liquid discharges into the sea, have all added to increased levels of radionuclides in the marine environment.

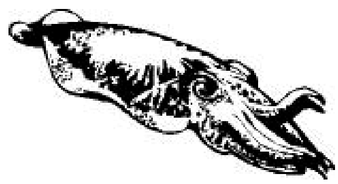
Radioactive contamination of the environment can have long-lasting and wide-ranging effects on ecosystems, and on benthic communities in particular. Radionuclides have been found in seaweed, shellfish and wildlife far from their source. Direct effects on marine species, however, have been difficult to determine, as have the wider effects of the accumulation of radionuclides in the human food chain.

Several sources of radioactive contamination have now been eliminated, successfully reducing the man-made input of radionuclides into the marine environment. All dumping of radioactive waste is prohibited under the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter. While originally applying to the dumping of high-level radioactive waste only, a 1983 agreement on an international moratorium on the dumping at sea of all radioactive waste and subsequent amendments to the Convention made in 1993 have effectively led to a complete phasing out of the dumping of radioactive waste since the early 1980s.

Despite some progress in addressing artificial sources of radioactive pollution, emissions from nuclear installations, and the French and British nuclear reprocessing plants (Cap de la Hague and Sellafield) in particular, are still of great public concern. Liquid discharges and emission to air, particularly from these plants, are now by far the largest contributors to the total radioactive discharges to the North-East Atlantic. Concern over discharges has not been helped by disclosure of unplanned releases, often several years after they occurred. In the Baltic Sea, levels of man-made radionuclides such as cesium-137 derived from the Chernobyl accident in 1986 and atmospheric nuclear weapons testing in the 1960s are still high compared to other water bodies in the world. Radionuclide levels have been decreasing since the Chernobyl accident, due to radioactive decay and the outflow of water into the North Sea. Since 1994, however, the region has started to receive small amounts of technetium-99 from Sellafield.

At the 1998 Ministerial Meeting of the OSPAR Commission in Sintra, Ministers and the European Commission agreed to reduce the discharges, emissions and losses of radioactive substances to 'levels where the additional concentration in the marine environment above historic levels […] are close to zero' by 2020 (Sintra Statement). In 2000, twelve OSPAR states (not including France and the UK) adopted a binding decision to eliminate radioactive discharges.

While authorised discharges of medium to highly active materials from nuclear installations have decreased, changes in the operation of Sellafield has led to increased discharges of certain less radioactive substances, particularly technetium-99. There is also growing concern over the risks associated with the transport of radioactive material by sea, an issue that is to be revisited at a 2006 North Sea ministerial meeting on shipping.



4.2 Nutrient Input

Excessive use of fertilisers and high rates of run-off, as well as urban waste-water discharges all lead to increased levels of nitrate and phosphate in the aquatic environment. This is thought to trigger the occurrence of toxic algal blooms, particularly in the Baltic and Celtic seas and the shallow waters of the Atlantic. Historic toxic blooms include the diatom *Chrysochromulina* sp. bloom in 1988, killing fish and other organisms off Norway and Sweden, and a

Gymnodium bloom in 1968 causing paralytic shellfish poisoning, resulting in the death of 82 per cent of the breeding shags of the Farne Islands in North-East England. In the Baltic Sea, the surface accumulations of blue-green algae in 1997, though not toxic, were denser than any previously recorded. The impact of nutrient enrichment is less evident in the deeper waters of the wider Atlantic, where water circulation is more consistent and constraints such as average surface water temperature limit the occurrence of algal blooms.

Eutrophication and the associated increase in algal abundance reduce the depth to which light penetrates the water column, thus directly influencing benthic communities and the ability of plants and algae to photosynthesise. It also increases the input and decomposition of organic matter, resulting in reduced oxygen levels especially in the lower parts of the water column. This can cause widespread death of fish and other organisms, and also affects the survival of fertilised fish eggs, particularly from cod and herring in the Baltic Sea, further aggravating the situation of overfished stocks.

In 1987, Ministers of the North Sea States, within the framework of the Second International Conference on the Protection of the North Sea, agreed to reduce nutrient input to already affected areas, or areas likely to be affected by eutrophication, by as much as 50 per cent over the period between 1985 and 1995. While most countries subsequently met the target for phosphorous emissions, efforts to reduce nitrogen discharges have been much less successful. This led Ministers to renew their commitment in 2002 (Bergen Declaration), and to call for full implementation of the EU Nitrates Directive, the Urban Waste Water Treatment Directive and the Water Framework Directive. Moreover, OSPAR has set a target to achieve 'a healthy marine environment where eutrophication does not occur' by 2010 (1998 OSPAR Strategy to Combat Eutrophication). The 1998 OSPAR Eutrophication Strategy sets out both a source-oriented and a target-oriented approach to tackling the problem. The latter includes the establishment of quality objectives for waters, reflecting region-specific ecosystems.

In the Baltic Sea region, eutrophication is one of the greatest challenges. Compared to background levels in the 1950s, nutrient levels are still high, though phosphate levels continue to decrease in most areas as a result of targeting point sources in the catchment area.[28] A number of HELCOM Recommendations concerning measures to reduce nutrient inputs have been adopted (eg 9/2, 9/3, 13/9, 13/10 and 16/9), but most have only been partially implemented. In order to reduce the nitrogen load to the Baltic Sea, additional measures are needed in the coming years, in particular regulatory measures to reduce anthropogenic inputs from wastewater treatment plants, agriculture and transport, and shipping.

In recent years, the European Commission has taken increasing action against Member States failing to implement the Nitrates Directive and the Urban Waste Water Treatment Directive, in some cases resulting in judgements by the European Court of Justice (ECJ). A major reason behind the legal actions has been the failure of some Member States to designate Nitrate Vulnerable Zones (NVZ) or Sensitive Areas[XVII], specifically for the protection of coastal waters. Major increases in designation have been required for parts of Belgium, France, Ireland, the UK and Germany. The Commission has recently stated that the UK's latest major increase in NVZ designation is still not sufficient to comply with an earlier ECJ ruling. Arguably, this response is made in anticipation of similarly insufficient lists from other Member States already judged by the ECJ, making a timely and satisfactory resolution to the delays in implementation unlikely.

Taking a more long-term perspective on implementation, it is important to note that a widespread designation of areas is required of the Baltic States and Poland as they join the EU in May 2004, specifically to protect the Baltic Sea. This has been agreed during accession negotiations. However, designation is only the first stage and the necessary responses, such as full installation of nutrient removal from wastewater treatment facilities, will take a further

[XVII] This refers to areas subject to eutrophication or at the risk from eutrophication.

few years to complete, due to the significant investments needed.

The Water Framework Directive also requires Member States to establish and meet objectives for various discharges, including nitrates and phosphate, to coastal waters. Unlike the earlier Directives, which set specific technical obligations, the new framework Directive is driven by the requirement to meet *in situ* ecological objectives. Where coastal waters suffer from eutrophication, or other pollution problems, Member States must take the necessary measures to ensure 'good ecological status', whatever these measures may be. This new approach provides the first real impetus for tackling diffuse pollution of phosphorus from agriculture. Over the next few years, Member States must identify these ecological objectives and the pressures affecting them, and develop plans, including a programme of measures, to meet them. The legal deadline for achieving 'good ecological status' is 2015, unless derogations apply.

The most recent data on nutrient levels in the North-East Atlantic and Baltic, collated and published by the EEA,[29] includes time series for winter nitrogen and phosphorus concentrations across a range of sites in the region:

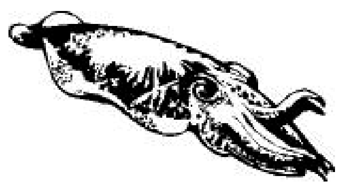
Nitrogen: 45 per cent of the locations surveyed showed a downward trend in nitrate concentrations in coastal waters, but in 25 per cent the concentrations had increased. The decreases seem to be greater than would be expected on the basis of information on reduction in discharges and this may, in part, be due to very low run-off from rivers in the mid-1990s. Increases are found mostly in the Skagerrak, Kattegat and subregions of the Baltic Sea, much of which is due to internal fluxes.

Phosphorus: Half of the coastal waters show little or no change in phosphate concentrations. However, 45 per cent show a substantial decrease and only 5 per cent show an increase. Decreases are seen in coastal areas where nutrient discharges have previously been high, such as the Skagerrak, the Kattegat, the German Bight and the Dutch coastal zone. Between 1985 and 1997, the mean decrease in phosphate concentration was 43 per cent. Places where increases have occurred, for example in the Gulf of Finland, have problems with resuspension from sediments, which is likely to remain an issue for some time.

The greater reduction of phosphorus concentrations is consistent with overall trends in discharges. For example, by 1995 eleven signatories to the final declaration of the Third International Conference on the Protection of the North Sea had achieved the objective of a 50 per cent reduction in phosphorus input, but no signatory state had achieved the objective of a 50 per cent reduction in nitrogen inputs.

These encouraging signs will be strengthened by the full implementation of the EU policy framework for water protection. An examination of major riverine inputs to the North Sea, such as the Rhine, shows dramatic reductions in phosphorus inputs, but less significant reductions in nitrogen inputs, with agriculture remaining a critical area for improvement.

While the direct control of riverine sources or specific local discharges is central to protecting local ecosystems, it is important to stress that the transfer of nutrients throughout the regional seas is also critical, as are atmospheric inputs. An important study of the Scottish east coast by Lyons *et al.* (1993) demonstrated that while riverine inputs accounted for 24 kt N per year, along-shore currents account for 60 kt N per year, and offshore currents for 300 kt N per year.[30] This indicates that a more strategic approach to nutrient reduction is required to resolve eutrophication issues in the Baltic and North seas, including firm commitments to nutrient reductions that are not just driven by the immediate concern for local coastal waters.



4.3 Pollution from Shipping and Man-Made Structures at Sea

4.3.1 Oil Pollution

Oil pollution is a widespread problem in the marine environment. Crude oil is made up of a complex blend of compounds with varying degrees of toxicity and persistence. Commonly, more than 75 per cent of the mixture consists of different types of hydrocarbons,[31] of which many pose environmental and health risks. Some polycyclic aromatic hydrocarbons (PAHs), for instance, are highly persistent, toxic and known to bioaccumulate. Many of them are thought to be carcinogenic. Residues of hydrocarbons have been linked to liver abnormalities and other irregularities in bottom-dwelling fish and other organisms.[32] While more information is becoming available about the effects of hydrocarbons and other oil related substances, the full implications for the environment and human health are still not known.

While oil contamination can occur naturally from oil seeps, oil pollution is generally associated with human activity. Offshore installations are often the source of chronic oil pollution, as well as discharges of contaminated drilling mud and drill cuttings. Moreover, man-made structures, in coastal regions and offshore, may cause environmental problems at their dismantling stage. The disposal of offshore installations is subject to an OSPAR Decision 89/3 which prohibits 'the dumping, and the leaving wholly or partly in place, of disused offshore installations within the maritime area', unless the competent authority of the relevant Contracting Party under specified conditions is satisfied that a relevant assessment shows that there are significant reasons for exemption. Significant disruption of marine habitats also occurs during oil and gas exploration and exploitation.

Numerous instruments address international marine oil pollutionXVIII. In particular, MARPOL (73/78) Annex 1, the OSPAR Offshore Industry Strategy, and HELCOM Annexes IV and VI on the prevention of pollution from ships and offshore activity respectively. According to the Bergen Declaration (2002), considerable progress has been made in preventing operational oil discharges within the OSPAR area. However, further vigilance is required if discharges are to be eliminated altogether. Similar targets have been set for non-accidental oil pollution originating from shipping. The latter concerns operational as well as illegal oil releases from ships at sea.

Given the high rate of traffic in the North Sea region, Ministers responsible for the protection of the environment and the European Commission have agreed to cooperate actively to improve the implementation of existing regional and international agreements related to shipping. In particular, they are committed to 'review, strengthen and introduce, if appropriate, further compensation and liability regimes' under the International Maritime Organisation, and to further develop the International Fund for Compensation for Oil Pollution Damage (IOPC) (Bergen Declaration, 2002). They have also agreed to set up 'a network of investigators and prosecutors' to improve enforcement of relevant rules and regulations in the North Sea area. Similar initiatives have been taken in the Baltic Sea region.

A key concern is the washing out of tanks at sea – an activity that has come under growing scrutiny. MARPOL Annex 1, amongst other measures, prohibits the 'discharge of any oil […] from the cargo spaces of a tanker within 50 miles of the nearest land'. Moreover, the North Sea and seas around Ireland (combined as 'North West European Waters'), as well as the Baltic Sea have been designated 'Special Areas' under Annex I (oil) and Annex V (garbage) to MARPOL 73/78.[33] In these areas, any oil discharges from tankers are prohibited. A number of regional initiatives are also aimed at alleviating the problems of oil pollution from ships. These include action at EU level[XIX], as well as other regional agreements, notably the Bonn,

[XVIII] For further detail see also http://oils.gpa.unep.org/framework/global-action.htm.

[XIX] eg Directive 2000/59 aimed at improving the availability of reception facilities at Community ports for waste and cargo residues, and EU Council Decision (2850/2000) setting up a framework for cooperation in the field of accidental or deliberate marine pollution – including adequate information systems.

Copenhagen and Lisbon agreements (not yet in force), addressing the issue of oil pollution in the North Sea, Baltic Sea and North-East Atlantic respectively. In 1996, the Baltic States adopted a HELCOM Strategy to improve port reception facilities for ship-generated wastes and hopefully limit illegal discharges at sea.[XX]

Under the IMO's International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL 73/78) it is also possible to declare areas vulnerable to damage by international maritime activities and worthy of special protection for ecological, socio-economic or scientific reasons as Particularly Sensitive Sea Areas (PSSAs). Once declared a PSSA, specific measures can be used to control the maritime activities in the area, such as routing measures, strict application of MARPOL discharge and equipment requirements for ships (including oil tankers), as well as installation of Vessel Traffic Systems[XXI]. As one of just five areas in the world, the Wadden Sea was given PSSA status in October 2002, and will consequently be recognised as such in all sea charts.

4.3.2 Accidents at Sea

The North and Baltic seas are heavily frequented by commercial ships – many of which are oil tankers – and the waters are difficult to navigate in certain areas. In particular, the narrow passageway between the Baltic and North seas features a number of important habitats and accommodates a host of charismatic species. It is also the site of important submerged structures, such as offshore banks, featuring some of the last large and intact kelp communities of the region. Fladen and Lilla Middelgrund, for example, are showcases of marine biodiversity, accommodating many benthic species, filter feeders (such as the blue mussel) and a rich algal flora (including maerl). These areas also offer food and shelter for many fish and fish-feeding species, including fulmars, kittiwakes, and grey and common seals. They have been listed as Important Bird Areas (IBAs) and parts have been proposed as Natura 2000 sites under the EU Habitats Directive. Oil spills in general, and larger scale accidents in particular, clearly pose a threat to these valuable habitats.

At EU level, Directive 93/75 provides for a harmonised system for the prevention and mitigation of accidents at sea during transport of dangerous goods by ensuring proper enforcement of international standards. Moreover, in response to the 1999 *Erika* disaster, which resulted in a 10,000 tonnes oil spill off the coast of Brittany, the EU adopted a raft of new measures (Erika I and II measures). These included legislation on ship inspections, pollution prevention and ship safety, the accelerated phasing-in of double hulls or equivalent design for single-hull oil tankers, the establishment of a vessel traffic monitoring and information system, and the European Maritime Safety Agency[XXII]. Similarly, in response to the more recent *Prestige* accident, which involved an ageing single-hulled tanker and resulted in the release of an estimated 22,000 tonnes of oil off the Galician coast in November 2002, the EU reviewed existing measures and the Commission proposed to bring forward timetables for the implementation of several measures[XXIII]. In particular, these new measures included the compilation of a blacklist of sub-standard vessels, the identification of places of refuge where ships in distress can be accommodated, and negotiations with oil companies concerning a voluntary agreement in order to accelerate the timetable for a ban of single-hulled vessels carrying heavy fuel oil. New emergency measures to improve safety have also been suggested.

4.3.3 Tributyl tin (TBT)

The contamination of the marine environment with chemicals used to protect man-made structures and ship hulls from ongrowth of algae and other organisms[XXIV],

[XX] HELCOM Recommendation 17/11, as amended.

[XXI] Vessel Traffic Systems (VTS) are land-based marine vessel surveillance systems usually operated by government authorities or government approved agencies. Their main objective is to enhance safe navigation in restricted shipping areas, such as coastal waters, heavy traffic areas, and areas of dangerous or difficult navigation. Source: http://www.denbridgedigital.com/vts/morevts.html

[XXII] Directives (2001/105) and (2001/106), Regulation (417/2002), Directive (2002/59), and Regulation (1406/2002), respectively.

[XXIII] COM (2003)105

[XXIV] Ships covered with molluscs and similar organisms may be slowed down due to an increase in friction and weight.

is a comparatively recent development. The use of a group of antifouling agents called organotins, including tributyl tin (TBT), was first introduced in the mid-1960, and their undesirable environmental impacts became apparent soon thereafter. Organotins act as endocrine disruptors causing masculinisation in female molluscs, such as dog whelks, and have affected oyster fisheries and farms, as well as other marine organisms, including mammals. Over 100 mollusc species are known to have been adversely affected by TBT,[34] and it has also been shown that organotins bioaccumulate in cetaceans.[35] While most often linked to problems in coastal areas with a lot of boats, such as ports, the effects of organotins have also been documented offshore. Evidence from the North Sea, for instance, has highlighted the risk of contamination along shipping lanes.[36]

The severe effects of TBT and related substances led to a series of national restrictions, which were harmonised in the EU in 1989.[XXV] Targets for the protection of the marine environment from antifouling agents are also set out in an IMO convention,[XXVI] and were affirmed by Ministers meeting at the Fifth North Sea Conference in 2002. These prohibit the (re-)application of organotin compounds which act as biocides in antifouling systems from 2003. By 2008, such compounds should not be on ship hulls or other external parts or surfaces, unless they are prevented from leaching. A corresponding EU regulation (782/2003)[XXVII] adopted early in 2003 applies to ships[XXVIII] registered under the flag of any Member State and translates the 2003 and 2008 commitments into EU law. A HELCOM Recommendation concerning antifouling paints containing organotin compounds was adopted in 1999 (Recommendation 20/4), following earlier commitments to ban the use of them on pleasure crafts and fish net cages in 1992[XXIX]. Among other things, it recommends that the Contracting Parties ban retail sale or use of organotin paints for pleasure boats and fish net cages as a first step, and consider the need for restrictions on other uses. With the exception of Estonia, most of the countries have already forbidden the use of organotin paints on ships less than 25 metres, and monitor imports and sales of these paints. A North Sea Strategy to further reduce the harmful effects of antifoulants is to be developed by 2004.

There is some indication that national restrictions on the use of TBT on boats may have prevented the worst impacts, as some regional mollusc population are showing signs of recovery. However, early predictions that TBT would break down rapidly clearly did not hold true, and the overall trends remain alarming.[37] Even with an international phase-out target in place, the issue of TBT contamination will continue to haunt the marine environment, not least through its persistence in marine sediments and long-lived animals, as well as an additive in number of consumer products.

4.3.4 Alien species

The introduction of non-native invasive species in the marine environment is increasingly recognised as a priority threat to marine ecosystems around the world. Ballast water is one of the prime agents spreading species, notably microscopic organisms, between regions. An International Convention for the Control and Management of Ships' Ballast Water and Sediments is to be expected in 2003, within the framework of the International Maritime Organisation. In addition, the cultivation of non-native species, such as the Pacific oyster and king crab, are a cause for concern.

[XXV] Council Directive 89/677/EEC of 21 December 1989 amending for the eighth time 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.

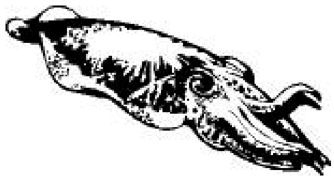
[XXVI] An IMO Convention on the Control of Harmful Antifouling Systems on Ships was agreed in October 2001, but has not yet entered into force.

[XXVII] Regulation (782/2003) on the prohibition of organotin compounds on ships OJ L 115, 9.05.2003.

[XXVIII] The Regulation covers hydrofoil boats, air-cushion vehicles, submersibles, floating crafts, fixed or floating platforms, floating storage units (FSUs) and floating production storage and off-loading units, but excludes any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only in government non-commercial service.

[XXIX] Part 1, Section 2.3 of Annex 1 of the 1992 Helsinki Convention.

At the Fifth North Sea Conference in May 2002, Ministers acknowledged the increasing threat posed not least by genetically modified marine organisms (Bergen Declaration).



4.4 Damage to Marine Habitats and Species due to Fishing Activities

Marine living resources of the North-East Atlantic and Baltic Sea have been targeted by humans for thousands of years, but the 20th century has seen a sharp increase in fishing activities. Interestingly, fishermen and scientists spoke of overfishing in the North Sea as early as 1880. Annual landings in the North Sea increased from approximately 1 million tonnes in 1900 to 2 million tonnes in 1960. During the 1960s, landings again increased sharply. The increased landings reflect the development of more 'efficient' and invasive technology for exploiting marine living resources, including at depths previously unattainable. This has resulted in overexploitation of many commercially important fish stocks, as well as negative impacts on non-target species, physical damage to habitats and long-term changes to ecosystem structure.

4.4.1 Overfishing

Only a small percentage of fish species – about 50 out of the 1,000 or more recorded in the OSPAR area – are commercially exploited. However, commercial species make up a very significant proportion of total fish biomass. It is therefore of particular concern that an estimated two-thirds of EU commercial stocks are below safe biological limits,[38] with an increasing number of stocks having fallen to critically low levels. Long-term overexploitation of fish populations has also been linked to significant changes in ecosystem structure as well as size and age composition of stocks, sometimes causing devastating changes in species viability and population dynamics.

Since the 1970s, almost all roundfish stocks have declined and the current levels of exploitation are not sustainable. Cod, whiting and hake have been heavily exploited in much of the North Atlantic. In the wider Atlantic, sardine, mackerel and anchovy fisheries are economically important. Most of these pelagic stocks show stable and possibly sustainable trends.[39] The Bay of Biscay and the Iberian Coast are important for tuna and swordfish fisheries, as is the wider Atlantic.

In the Baltic Sea, cod, herring, wild salmon and eel fisheries are all currently unsustainable, though the wild salmon stocks have showed signs of improvement in recent years (see sections 7.6 and 7.8). ICES recommended a moratorium on Baltic Sea cod for both 2002 and 2003, something that has also been suggested by the Swedish Government. The European Commission recently decided to take emergency measures to protect the stocks, and closed the fishery for trawling (Regulation 677/2003). The Baltic sturgeon (see section 7.5) is presumed to have disappeared from the Baltic,[40] though efforts to reintroduce it are ongoing.

As commercial stocks decline, fishing pressure is diverted to other areas and stocks, including deep-water fish stocks, many of which are now heavily exploited and some severely depleted.[41] Slow growth and low fecundity rates make these populations less resilient to fishing, and to protect them an immediate substantial reduction in effort, particularly in areas north and west of the British Isles, is needed.

4.4.2 Bycatch

Certain fishing gear and harvesting techniques are associated with higher rates of unintended bycatch of non-target species, including marine mammals and birds that become entangled in nets. While a proportion of the non-target fish bycatch may be landed and sold, most of it will be discarded, including undersized or unwanted commercial species. In some fisheries, such as the whiting fishery west of Scotland, the numbers of fish discarded have often exceeded those landed.[42] In the North Sea beam trawl fishery, approximately half of the numbers of plaice caught are discarded, although the figure can rise to 80 per cent in inshore areas.[43]

Most discarded fish do not survive, thus putting an extra strain on the stock. It also affects ecosystem structure by encouraging certain scavenging species within local community structures.

There is a lack of detailed knowledge on the impact of each fishery or gear type, but unsustainable levels of harbour porpoise bycatch (see section 7.9) have been recorded in the gillnet fisheries targeting cod, turbot and other species in the North Sea, as well as fisheries in the Celtic and Baltic seas. There is also concern about bycatch of dolphins in towed pelagic gear in the English Channel and Bay of Biscay, particularly in the seabass fishery, as well as bycatch of harbour porpoises in the Baltic drift net fishery. Driftnet fishing has been banned in all EU waters, except the Baltic Sea, and for all EU fishing vessels outside these waters. Sharks, rays and skates are also caught in large numbers, commonly in trawls, and many species have shown a dramatic decline over the last decades (see section 7.4).

Large numbers of seabirds are also caught up in nets and lines, including but not limited to driftnets and gillnets in the Baltic Sea. Bycatches of guillemots, long-tailed ducks, velvet scoters, eiders, black scoters and razorbills have also been reported in relation to the set net fisheries for flatfish, cod and salmon. Bycatch of fulmars in longlines is also a particular concern (see section 7.2).

Concerns about the world incidental catch of seabirds led to the development of the *International Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries* (IPOA-Seabirds), a voluntary plan endorsed by the Food and Agriculture Organization (FAO) of the United Nations' Committee on Fisheries in February 1999. Targets to reduce the bycatch of sharks have been set in another FAO *International Plan of Action for Conservation and Management of Sharks* (IPOA-SHARKS, 1999). National plans of action are to be endorsed in the context of the FAO. In 2000, under the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), it was agreed that bycatch of harbour porpoise should be reduced to below 1.7 per cent of the best available estimate of abundance, with the intermediary precautionary objective of reducing bycatch to less than 1 per cent of the best available population estimates (Resolution No. 3 Incidental Take of Small Cetaceans). These commitments were reiterated in the 2002 Bergen Declaration on the Protection of the North Sea. Parties to ASCOBANS also committed to agreeing and implementing an action plan to facilitate harbour porpoise recovery in the Baltic Sea.

4.4.3 Physical damage to habitats

In addition to the direct effects on fish stocks, fishing activities can severely disturb or damage marine habitats. Although, according to ICES,[44] the scientific information on the marine environment presently available is 'inadequate to evaluate the impact of fishing practices on sensitive habitats'. Certain fishing gear and harvesting techniques are particularly damaging, notably beam trawls and other gear dragged along the seabed. Damage to benthic communities on both hard and soft bottoms is widespread on the continental shelf and slope, particularly in the North Sea, where beam trawling has occurred over a long period of time. This has resulted in a shift in benthic diversity and species composition from larger, more long-lived species to smaller, more opportunistic ones.[45]

While inshore areas have historically come under severe pressure from trawling and dredging activities, damage to cold-water corals and sponge formations by trawls is also widespread (see sections 6.4 and 6.3, respectively).[46]

4.4.4 Aquaculture

European aquaculture production involves many different species, production zones and farming techniques. European (including freshwater) aquaculture output has grown substantially over the last decade, with the main increase coming from marine salmon farms in north-west Europe.[47] The rapid increase has been driven by market demand and public investment in the sector, and promotion of aquaculture as an alternative to capture fisheries. This is despite the fact that intensive finfish farming depends heavily on fishmeal produced from wild stocks.

Apart from generating demand for fishmeal, intensive finfish production is associated with discharges of organic matter and nutrients, in some areas representing the major anthropogenic source of nutrients.[48] Farms are also a source of parasites and other diseases, affecting local wild stocks but also stocks in other regions, due to the widespread trade in live specimens. Pesticides and other chemicals are used to treat or even pre-empt diseases, but can themselves have major implications for wild fish stocks and the wider marine environment.

Another recent threat linked to fish farming is interbreeding between wild and escaped fish, including genetically modified specimen. Interbreeding and increased competition are regarded as potentially serious risks for wild salmon and sea trout populations.

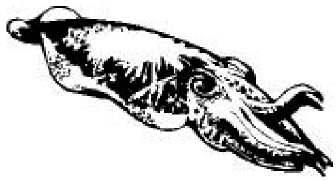
4.4.5 Management Actions

At the 2002 World Summit on Sustainable Development in Johannesburg, Heads of State and Government agreed to maintain or restore fish stocks to levels that can produce maximum sustainable yields, with the aim of achieving these goals for depleted stocks on an urgent basis and where possible by 2015. Application of an ecosystem approach for the sustainable development of the oceans by 2010 is also to be encouraged.

In the EU, the recent reform of the Common Fisheries Policy (CFP) has set a clear aim to gradually apply an ecosystem-based approach to fisheries management, and also made minimising the effects of fishing on non-target species and the wider marine environment a central target. Multi-annual recovery plans are to be developed for depleted stocks, although progress has been slow given the critical state of many. The first post-reform proposal on cod recovery[XXX] was recently published and is expected to be followed by plans for southern hake stocks, sole in the Western Channel and Bay of Biscay, haddock in Rockall and Norway lobster in the Cantabrian Sea and the Western Iberian Peninsula.

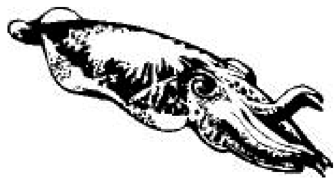
In addition to legislative action and international agreements, eco-labelling schemes such as the one provided by the Marine Stewardship Council may offer an effective market-based tool to promote sustainable fishing practices and to raise awareness of the dangers of overexploitation.

Aquaculture is regulated in major producing countries, including environmental impact assessment of proposed projects. The industry has also taken measures to address waste and other pressures. However, according to the European Environment Agency (2003), assessment, regulation and monitoring has mainly been concerned with micro-impacts or organic matter in the immediate vicinity of farms.[49] The potentially more serious impacts on wild populations and the environment have not been addressed.



4.5 Marine Litter

Increasingly, the marine environment is plagued by industrial and household litter. Plastic waste, in particular, is a problem. Plastic particles are almost indestructible and are often ingested by turtles and surface-feeding seabirds, such as the fulmar. While the implications of eating plastic pellets are not yet fully understood, it is evident that they easily accumulate in the stomach of birds and hence probably reduce the ability to process food. Moreover, plastics leak toxic chemicals such as PCBs and are thought to increase the 'toxic burden' when ingested,[50] leading to a weakening of the animal's immune system. Birds and other marine wildlife may also get entangled in plastic and other remains.



[XXX] (COM(2003)237)

4.6 Climate Change

In their third and most recent Assessment Report, the Intergovernmental Panel on Climate Change (IPCC), state that 'the earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era, with some of these changes attributable to human activities'.[51] The 1990s were the warmest decade in the last 100 years and 1998 the warmest year in the instrumental record (1861-2000). Other evidence for changes in the global climate include an increase in night-time temperatures over many land areas at about twice the rate of daytime temperatures, a decrease in frost days for many land areas and an increase in precipitation (by 5-10 per cent) in many northern hemisphere land areas.

In addition to the observed temperature changes, a range of wider changes in both physical and biological systems have also occurred. In its third and most recent Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) provides numerous examples of observed changes to physical systems:

- Global mean sea level has increased at an average annual rate of 1 to 2 mm during the 20th century and (after adjusting for natural land movements), average sea level around the UK is now about 10 cm higher than it was in 1900.
- Arctic sea-ice extent has decreased by 10-15 per cent since the 1950s and sea-ice has thinned by 40 per cent in recent decades.
- Non-polar glaciers have seen a widespread retreat during the 20th century.
- Snow cover has decreased in area by 10 per cent since the 1960s.
- The number of heavy rainfall events in the mid-latitudes in the Northern Hemisphere has increased in the last 25 years.
- El Niño events have become more frequent, persistent and intense during the last 20 to 30 years compared to the previous 100 years.

The Panel also reports a number of changes in biological systems. For example, in the Northern hemisphere plants are flowering earlier, birds are arriving earlier and insects are emerging earlier, whilst some biota are shifting their ranges upwards both in elevation and towards the pole.

Climate change is perhaps more often discussed in relation to weather patterns and terrestrial habitats, but it will gradually affect the marine environment as well. As on land, climate change may influence patterns of biodiversity. Climate shifts, including temperature changes, more frequent storms and other extreme events, as well as variation in intensity and temporal variance of upwelling events, are likely to have strong impacts at different levels of biological organisation, from genes to ecosystems. Coastal marine ecosystems may experience latitudinal shifts and species redistributions in response to global warming, but it is unlikely that any extinctions will occur, as most of the species can readily relocate themselves and thereby follow latitudinal shifts in water temperature.

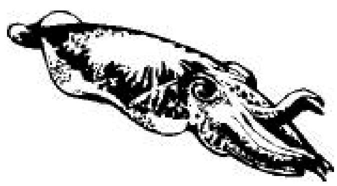
A recent report by the Pew Center in the USA concludes that temperature changes in coastal and marine ecosystems will influence organism metabolism and alter ecological processes such as productivity and species interactions.[52] Since species are adapted to specific ranges of environmental temperature, temperature changes will affect their geographic distributions, thereby bringing together new combinations of species that will interact in unpredictable ways. Just as on land, species that are unable to migrate or compete with other species for resources may face local or global extinction.

Perhaps even more seriously, changes in precipitation and sea-level rise caused by the melting of polar icecaps will have far-reaching consequences for coastal ecosystems. Increases or decreases in precipitation and runoff will increase the risk of coastal flooding or drought, respectively. In addition, sea-level rise will gradually inundate coastal lands changing the coastlines that we know today.

Climate change is also likely to alter patterns of wind and water circulation in the ocean environment. These changes may influence the vertical movement of ocean waters (ie upwelling and downwelling), and consequently increase or decrease the availability of essential nutrients and oxygen to marine organisms. Changes in ocean circulation patterns may also cause substantial changes in regional temperatures and the geographic distributions of marine species.

Critical coastal ecosystems such as wetlands, estuaries, and coral reefs – some of the biologically most productive environments in the world – are particularly vulnerable to climate change. Their existence at the interface between the terrestrial and marine environment exposes them to a wide variety of human and natural stresses. The added burden of climate change may further degrade these valuable ecosystems. Indeed, coral reef bleaching has increased in frequency, especially during El Niño events. It is also thought that fishing activities will be affected by global warming, since species distribution, abundance and spawning periods are likely to be affected.

Scientists have begun to explore the possibility of disposing larger quantities of the greenhouse gas CO_2 into marine sediments and the deep sea in an effort to address emissions. Sediment injection is already taking place in the North Sea, where Statoil – the Norwegian oil firm – is injecting one million tonnes per year into an offshore oilfield. Plans by an international coalition led by the Norwegian Institute for water research to inject 5.4 tonnes of liquid CO_2 at 800 metres water depth off the Norwegian coast were stopped late in 2002, after the Norwegian Environment Ministry rejected authorisation.[53] These new methods of CO_2 ocean sequestration could potentially cause considerable damage to marine ecosystems by reducing the ocean pH levels and thus rates of calcification of calcareous micro-organisms such as reef-building corals, although knowledge of impacts is still very limited. The injection of CO_2 arguably violates the 1972 London Dumping Convention and the 1992 OSPAR Convention (Annex II). In 2002, OSPAR agreed to establish a position on the matter as soon as possible.[54]

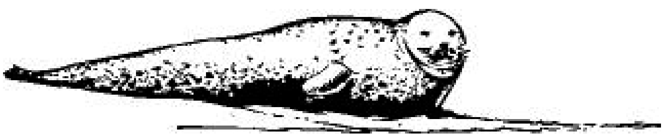


4.7 Seafloor Dredging and Aggregate Extraction

The practices of seafloor dredging and aggregate extraction are likely to have a major local impact as well as some wider consequences for habitats and marine wildlife. Dredging and aggregate extraction leads to physical scarring of the seafloor and related damage to marine habitats and species. Moreover, where marine sediments are removed so are benthic organisms. Consequently, it may take some time for devastated areas to recover and for the benthic community to recolonize. Indirect impacts on the marine environment include the creation of sediment plumes, which may smother surrounding benthic organisms and reduce water transparency. Resuspension of hazardous substances into the water column and habitat damage associated with the dumping of sediments in sensitive areas place an additional burden on marine ecosystems. In the Baltic Sea, for example, 87.1 million tonnes of dredged material were dumped in the marine environment between 1994 and 1998, most of which derived from maintenance dredging.[55] Knock-on effects resulting from changes in seabed topography and sediment stability are also likely.

The term marine aggregate includes sand and gravel (see section 6.5) extracted for the construction industry, land reclamation and beach replenishment, as well as maerl (see section 6.8), which is used as a calcium-rich soil enhancer, in water filtration and as an additive in animal feed, pharmaceuticals and cosmetics. Maintenance dredging takes place near ports and harbours and along busy shipping routes to maintain access and navigation channels for ships. It is particularly common in areas where strong coastal erosion results in frequent filling of navigation channels with eroded materials. Due to the natural land up-lift in the Baltic Sea region, particularly in the north, dredging is widespread along the coast of the Gulf of Bothnia.[56] In addition, certain coastal areas, notably lagoons, shallow bays and islands, may suffer disproportionately from seafloor scarring by recreational boats.

Since 1985, the EU Directive on the Environmental Impact Assessment for certain public and private projects (85/337/EEC)[XXXI] also regulates 'extraction of minerals by marine or fluvial dredging'. To decide whether a project should be subject to assessment or not, EU Member States have to carry out case-by-case examinations and/or refer to thresholds or criteria. In addition, the Baltic States are obliged to exercise control over their dredging operations since 1992.[57] HELCOM adopted specific guidelines for marine sediment extraction in 1998, and recommends that an Environmental Impact Assessment (EIA) and environmental monitoring should be essential components of any sediment extraction (Recommendation 19/1). Similar guidelines have been suggested by ICES' Advisory Committee on the Marine Environment (ACME) and initiatives have also been taken at the Ministerial level within the framework of the North Sea Conferences.



5. Conserving Marine Habitats and Species

Against this background, the 1990s saw a proliferation of international commitments in support of strengthened marine biodiversity conservation. From the global 1992 UN Convention on Biological Diversity, to developments under the OSPAR and Helsinki Conventions, and the EU Habitats Directive, the legal framework for marine biodiversity conservation has been progressively refined and strengthened. Furthermore, a broad consensus has emerged regarding the basic objectives for marine biodiversity conservation: to conserve, restore and protect diversity within species, between species and in ecosystems. The diverse strategies for attaining this objective include a combination of networks of protected areas and more general measures to tackle biodiversity damage resulting from economic activities.

5.1 International Efforts in Marine Biodiversity Conservation

The global framework for marine conservation is clearly established in the UN Convention on Biological Diversity (CBD), with a specific focus on marine biodiversity provided by the 1995 Jakarta Mandate and a programme of work on integrated management of marine and coastal areas, the sustainable use of marine living resources and protected areas. The CBD is complemented by other global conservation regimes, notably those concerned with marine exploitation (UN Convention on the Law of the Sea or UNCLOS), wildlife trade (the Convention on International Trade in Endangered Species of Wild Fauna and Flora or CITES), whaling (the International Whaling Commission or IWC), migratory species (the Convention on the Conservation of Migratory Species of Wild Animals or the Bonn Convention) and wetlands (the RAMSAR Convention).

As in many other parts of the world, more specific regional seas agreements have been elaborated for the North-East Atlantic and the Baltic Sea, involving the Oslo/Paris Convention (OSPAR) and the Helsinki Convention (HELCOM), respectively. More unusually, these regional conventions operate alongside the 'softer' North Sea Conference Declarations, as well as activities of the Nordic Council and the Baltic Agenda 21 process. Although initially preoccupied with pollution-related issues, each of these initiatives or regimes has placed increasing emphasis on marine biodiversity conservation throughout the 1990s, resulting in a rich, dynamic and challenging set of commitments.

[XXXI] As amended by Directive 97/11/EC

Marine Biodiversity Conservation under the Regional Seas Conventions

Valuable work to conserve and restore marine biodiversity is being undertaken within the North-East Atlantic and the Baltic Sea. While there are many similarities in the approach taken, there are differences in focus and in actual progress towards implementation. Selected commitments under the two regional seas conventions are as follows.

OSPAR Convention – Annex V

The Convention on the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention) entered into force in 1998. The Convention covers the area of the North-East Atlantic, excluding the Baltic Sea. It has been ratified by all relevant coastal States, plus Luxembourg and Switzerland.

A new Annex V to the Convention was agreed at Sintra in 1998, covering the protection of ecosystems and biodiversity. It entered into force in 2000, although France, Belgium, Portugal and Ireland have not yet deposited their ratification instruments. Annex V requires parties to take measures to protect and conserve the ecosystems and biodiversity of the region, and to restore areas adversely affected. It also provides for the adoption of programmes and measures to assist management of human activities that can have an adverse impact on the marine environment. The 1998 OSPAR Biodiversity Strategy contains guidelines on implementation of Annex V.

In support of Annex V, Ecological Quality Objectives (EQOs) are being developed for the region. The development of EQOs has been given added impetus by the 2002 North Sea Conference, which committed to establishing an ecosystem approach to management of the North Sea, based on a coherent and integrated set of EQOs. Existing EQOs are to be used as a pilot project for the North Sea; a complete set of EQOs is to be developed by 2004.

Apart from work on establishing a network of marine protected areas (see below), work has proceeded on the assessment and prioritisation of species and habitats, including the development of criteria for selecting species, habitats and ecological processes in need of protection (so-called 'Texel-Faial criteria'). The process of classifying and mapping of habitats is also ongoing. An initial list of threatened or declining species and habitats has been prepared for submission to the 2003 OSPAR Commission meeting. In parallel to these activities, a list of human activities that can potentially have adverse effects on biodiversity still has to be drawn up, and may be followed by programmes and measures to control activities, as necessary.

Helsinki Convention

The 1992 Helsinki Convention on the Protection of the Baltic Sea entered into force in 2000, replacing an earlier 1974 Convention. The new Convention covers the Baltic Sea as a whole, including the Kattegat and inshore waters. To reduce land-based pollution, measures are also taken in the whole catchment area of the Baltic Sea.

Article 15 of the Convention requires parties to conserve natural habitats and biodiversity, and to protect ecological processes. Nature conservation and coastal zone management are taken forward by the HELCOM HABITAT working group. A red list of marine and coastal biotope complexes in the Baltic Sea has been produced. In addition, parties have agreed to establish a system of coastal and marine Baltic Sea Protected Areas (BSPAs). A first set of 62 marine and coastal areas has been identified. In addition, guidelines for managing these areas have been produced, as well as criteria for assessing threats to certain biotopes or biotope types. In 1998, an expert report proposed a further 24 offshore areas to be included in the BSPA network. According to the Council of Europe, progress in designating and protecting sites is limited, however.[58]

The regional initiatives are complemented by more specific, species or habitat related agreements, notably the Trilateral Agreement on the Protection of the Wadden Sea, and the Agreement on Small Cetaceans of the Baltic and North Seas (ASCOBANS) under the Bonn Convention. The latter calls for a reduction in the fishing bycatch of small cetaceans (dolphins, porpoises and some whales) to no more than 1.7 per cent of the best available abundance estimates.

Importantly, work under each of these initiatives is supported, to varying degrees, by scientific bodies, notably including classification of species by the World Conservation Union (IUCN), scientific assessment and advice by the International Council for the Exploration of the Seas, and scientific reports of the European Environment Agency.

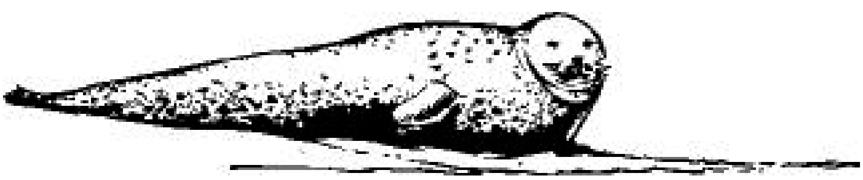
5.2 EU Marine Biodiversity Policy

EU marine biodiversity commitments have a clear bearing throughout the North-East Atlantic and the Baltic Sea regions. Their further elaboration and implementation is pursued through national legislation and policies, but importantly, also through the substantial body of EU law.

Although not specifically conceived for this purpose, the EU Habitats and Birds Directives contain important opportunities for EU marine biodiversity conservation. By establishing the Natura 2000 ecological network of sites (see box), and by introducing more general species-related protection measures, the Directives provide the cornerstone of EU biodiversity policy. They are expected to make a major contribution to achieving the EU's overall objective of halting the loss in biodiversity by 2010. Despite the important commitments under the Directives, however, their application to the marine environment is far from complete and many years behind schedule. It is also recognised that, apart from applying the Directives as they stand, certain changes would benefit marine conservation, such as developing and refining the list of protected habitats and species.

The importance of these and other measures, such as the Water Framework Directive, are outlined in the 1998 EC Biodiversity Strategy and associated action plans. Specific marine-related targets and measures are being elaborated within an EU marine thematic strategy, to be in place by 2005 at the latest. The aim, according to the Sixth Environment Action Programme, is to promote the 'sustainable use of the seas and conserve marine ecosystems' (Decision 1600/2002).

The EU dimension of regional marine biodiversity conservation is significant, given the ability to introduce legally binding measures that can be directly enforced in the Member States. Of those States bordering the North-East Atlantic and Baltic Sea, most are already members of the EU. The importance of the EU is set to increase further with the accession of three Baltic States in May 2004, whereupon all Baltic States, apart from Russia, will be part of the Union.



Ecological Networks of MPAs in the North-East Atlantic and Baltic Sea

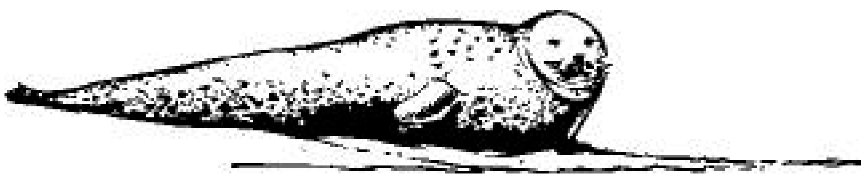
In line with the UN Convention on Biological Diversity and the Jakarta Mandate, parties to the OSPAR and Helsinki conventions, as well as the EU, are committed to establishing international ecological networks of Marine Protected Areas (MPAs), as follows.

- North-East Atlantic – under OSPAR Annex V, an inventory of existing marine protected areas has been produced, and guidelines have been developed for the identification and selection of marine protected areas, as well as their management. The aim is to achieve, by 2010, an ecologically coherent network of marine protected areas across the OSPAR region.

- Baltic Sea – according to a Helsinki Convention Recommendation (15/5), appropriate measures are to be taken by parties to establish a system of coastal and marine Baltic Sea Protected Areas (BSPAs). The recommendation also states that 'the system of BSPAs shall be gradually developed as new knowledge and information becomes available and that special attention shall be paid to include marine areas outside territorial waters'. Within EU Member States, many of the identified BSPAs overlap with the Natura 2000 network.

- Waters under the jurisdiction of EU Member States – the Natura 2000 ecological network of sites is designed to protect important habitats and habitats of listed species across the EU, including marine areas. Natura 2000 is to be made up of Special Protection Areas (SPAs) designated under the Birds Directive (79/409) and Special Areas of Conservation (SACs) designated under the Habitats Directive (92/43). Progress in establishing the Natura 2000 network in the marine environment has been slow, hampered by disagreement over whether it applies out to 200 nautical miles, a lack of clear definitions for identifying marine sites, as well as difficulties associated with the management of sites affected by fishing activities.

The 2002 Bergen Declaration also commits parties to designating relevant areas of the North Sea as MPAs by 2010. Each of these initiatives has the potential to make an important contribution to marine biodiversity conservation in the North-East Atlantic and the Baltic Sea. However, efforts are needed to ensure their effective implementation, as well as coordination between the various networks to improve their overall coherence. To this end, a comprehensive approach to MPAs, covering both the North-East Atlantic and the Baltic Sea, is being prepared by the OSPAR and the Helsinki Commissions for the joint Ministerial Meeting in June 2003. The European Commission has also committed to developing, by 2005, a programme to enhance marine conservation in European waters, together with the regional seas conventions.

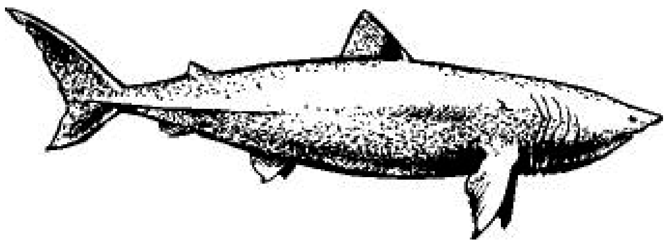


5.3 Integrating Biodiversity Objectives within Sectoral Policies

Together, these global, regional and EU instruments provide an indisputable legal mandate for governments and others to act, wherever possible, to conserve marine and coastal biodiversity. Delivering on these commitments will, however, depend on coordinated and accelerated efforts by national, regional and EU bodies.

Importantly, progress will be limited unless pressures on the marine environment are adequately reduced. The root causes of biodiversity loss, be it pollution from agriculture, industrial installations or shipping, or impacts from fishing, need to be addressed rapidly and effectively. This requires greater cooperation between environment and sectoral organisations, such as the North-East Atlantic and Baltic Sea Fisheries commissions, the International Maritime Organisation, as well as sectoral ministries, departments and agencies.

Already, some progress has been made in reducing the harmful effects of economic activities, for example, by securing agreement on the phase-out of single-hulled oil tankers, or to ban the use of certain fishing gear. Further initiatives to fully integrate biodiversity considerations within sectoral activities are essential, as reflected in the CBD and related regional, EU and national biodiversity strategies. Success on this front will be key to securing ecosystem health in the North-East Atlantic and the Baltic Sea.



Diversity at Risk

So have the commitments made and management actions taken over the last few decades provided protection for marine wildlife and habitats in the North-East Atlantic and Baltic Sea? In this report, a range of typical habitats and a number of species from different levels on the marine food chain have been selected for brief assessments of their status. The report also covers the management measures in place or needed to ensure their protection.

6. Habitats

6.1 Soft Sediments and Offshore Mud Bottom Areas

A thick layer of soft sediments covers the lower end of the continental slope, depressions on the shelf (eg most of the northern North Sea), sea lochs, marine inlets, deep fjords near the coast and the deep-sea plains[XXXII].

These soft sediments are commonly sheltered from direct wave action and tidal movements, and form the habitat for a diverse burrowing macro- and megafauna and for seapen populations, typically *Virgularia mirabilis* and *Pennatula phosphorea*.[59] These communities also occur extensively in the more sheltered basins of sea lochs, and in deeper offshore waters of the North and Irish seas, where habitat conditions are similar. Large mounds formed by the echiuran *Maxmuelleria lankesteri* are present at some sealoch sites.[60] Scavengers such as *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* are present in low numbers; brittlestars may be present in large numbers. The sediment fauna may also contain significant populations of different polychaetes, bivalves and echinoderms.

Our knowledge about offshore areas and, in particular, deep-sea areas below 600 metres is still notoriously limited. There is little information on individual species and habitat sensitivity, and in particular ecosystem functioning, as well as on the impact of human activities. What is known, however, is that the deep-sea floor has a lower faunal density, a higher species diversity, and that individuals of species have a smaller body size than on the continental shelf. More research and taxonomic identification work would greatly improve present knowledge.

While seapens and burrowing megafauna may share the same habitat, ie muddy seafloor areas, they fulfil very different ecological roles. The term 'burrowing megafauna' refers to a group of crustaceans, worms and fish, which construct often large and long-lasting burrows in the fine sediments of the sea floor at depths greater than 15 metres. The burrowing activity of macro- and megafauna makes the habitat more architecturally complex. These mud bottoms are

[XXXII] Deep-sea plains, or abyssal plains, form the flattest regions on this planet and cover much of the ocean basins. At a depth of 4,000 to 6,500 metres, they are made up of a thin blanket of muddy sediments that covers the rugged volcanic rocks of the ocean crust.

therefore generally better ventilated and oxygenated to a much greater depth than would be the case in undisturbed sediments. Higher levels of oxygen, in turn, are thought to provide suitable habitat for richer sub-seafloor communities, which may contribute considerable amounts of biomass.

The burrowing crustaceans include Norway lobster (*Nephrops norvegicus*), which is frequently found in shallow burrows below the lower tidal mark on soft sediments.[61] It commonly occurs at depths of 40-250 metres, but occasionally on bottoms as shallow as 20 metres. Norway lobster is common around most Atlantic coasts, from Norway and Iceland down to North Africa. It is an important food source for a variety of bottom-feeding fish including haddock, cod, skate and dogfish, as well as a target species for economically important fisheries. Norway lobster is predominantly caught in bottom trawls on the continental shelf and is often described as one of the most valuable shellfish resources in the North-East Atlantic[XXXIII].

Seapens on the other hand are colonial animals, closely related to corals. They are suspension-feeders, living on plankton and organic particles trapped by their polyp tentacles. Very little is known about their population dynamics and longevity in the North-East Atlantic. However, it has been estimated that some species may live for up to 15 years, and it is thought that they can take up to five years or more to reach sexual maturity.[62] Their distribution may be patchy in space and highly episodic in time, with recruitment failing in some years.

6.1.1 Status and threats

Soft sediments on the continental slope and in the deep sea and their specific fauna demonstrate the shortcomings in our understanding of human impacts on the marine environment. Fishing activities, and in particular bottom trawling for species such as Norway lobster, is perhaps the main threat to these unique bottom communities. The deeper waters of the continental slope are also commercially exploited, targeting species such as anglerfish, hake, blue ling, blue whiting, roundnose grenadier, black scabbardfish and orange roughy.[63]

Studies show that deep-sea trawling has severe and long-lasting effects on seafloor communities of mud bottom areas. Detectable trawler marks have been recorded from various areas in the North-East Atlantic, particularly the Rockall Trough region north-west of Scotland, where considerable physical impact on the seabed has been reported. In all but the shallowest regions, where marks are likely to be less long-lived due to water currents, linear scars covered the seabed, often down to depths of 1,000 metres or more.[64]

Bottom trawling affects benthic fauna, notably seapens and other fragile benthic organisms, by destroying, removing or scattering animals in the immediate vicinity of the trawl. Certain megafauna may be reduced by as much as 60 per cent and will only partially recover within three years of the disturbance.[65] Only a minor part of the damaged biomass is hauled up with the catch. Despite this, it is not unusual for 50 to 90 per cent of the catch to consist of unwanted species that are then discarded.[66] Filter feeders occurring in the wider surroundings may be indirectly affected by smothering due to the resuspension of sediments. Moreover, bottom trawling reduces the overall surface roughness of the seabed and, by affecting burrowing megafauna, changes the complexity and oxygenation of the sediment. This is likely to have further impacts on soft-bottom communities.

In addition to fishing, soft-sediment habitats on the continental shelf are also likely to be affected by nutrient enrichment, particularly if located close to shore and/or in inlets. Sewage outputs, agricultural run-off and fish farms are of particular concern. Both may have a very localised impact, but can result in the loss of certain species, for example smothering of benthic species by excessive algal growth. A critical determinant in this case is the rate at which water is

[XXXIII] The Norway lobster fishery in Scottish waters has increased from a few tonnes in the early 1960s to approximately 20,000 tonnes in 2000. In some areas, particularly the Fladen Ground, Norway lobster is also caught as bycatch by whitefish trawlers. Source: Marine Laboratory, 2003 at http://www.marlab.ac.uk.

exchanged between these locations and the wider marine environment, especially if a nutrient discharge occurs directly into the inlet.

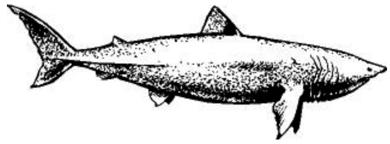
6.1.2 Management

The protection of soft sediment communities has been insufficient, though some management tools are available. While soft sediment habitats characterised by sea pens and burrowing megafauna do not directly match any category listed in Annex I of the EU Habitats Directive, they may be interpreted to correspond with the respective categories of 'sandbanks covered by sea waters at all times' and 'large shallow inlets and bays'.[67] The habitat has also been included on OSPAR's List of Threatened and/or Declining Species and Habitats as being of special concern. The decline and sensitivity of seapen and burrowing megafauna communities were cited as key criteria in support of their protection, notably with regards to their distribution in the Celtic Seas and Greater North Sea. Hence, future measures agreed at OSPAR could supplement the EU provisions under the Habitats Directive. No other international protection mechanisms currently apply to mud bottom habitats.

6.1.3 Conclusions

A lot still needs to be learned about this relatively unexplored habitat type. While muddy sediments may appear, at first glance, to be dreary, uniform and unworthy of closer inspection, reality proofs quite the opposite. Species are vanishing faster than they are discovered. More comprehensive research on the ecology of this habitat and its species is needed, as well as a deeper understanding of the impact of human activities on these fragile communities.

More management actions are also needed, especially to protect sites from fishing activities and offshore exploitation of oil and minerals. Among the known sites, the most valuable need to be mapped and protected with urgency. A review of Annex I under the EU Habitats Directive will address shortcomings in habitat classification and should consider this habitat for listing. Impacts on this habitat will also need to be assessed in determining good ecological status under the Water Framework Directive and, potentially, action taken to reduce discharges as programmes of measures are developed.



6.2 Seamounts

Seamounts are mountains that rise from the seabed without breaking the water's surface. They can be significant structures, both in terms of height and the area they cover (some are more than 100 km across their base), frequently forming chains or clusters of cone shaped peaks. They constitute a distinct deep-sea feature. Their often-steep slopes and characteristic hard-rock composition, originating from ancient volcanic activity, represent a pronounced feature compared to the characteristically flat and sediment covered seabed. Their existence also affects ocean currents and provides a diverse habitat for many distinct species. Known seamounts in the North-East Atlantic include Josefine, Gorringe Bank and Rockall Bank.

Seamounts vary significantly in species richness and diversity. Common inhabitants are corals, sponges, and commercially valuable shellfish and fish, such as black scabbardfish and orange roughy. It is still unclear how much exchange occurs between geographically isolated seamount populations, but benthic fauna is believed to include a large percentage of endemic species. It is, however, likely that seamounts also act as 'stepping stones' for the dispersal of continental shelf and oceanic species, and may constitute important centres of speciation. Compared to other deep-sea habitats, their productivity is high and they support commercially important fisheries as well as providing a feeding ground for many marine predators. It is also thought that they serve as hotspots for mating and spawning, notably for marine mammals such as dolphins and whales, as well as sharks.

6.2.1 Status and threats

There are more than of 800 seamounts in the North Atlantic,[68] the majority of which are situated close to the mid-Atlantic Ridge and the Rockall Trough. Their unique constitution makes them excellent case studies for investigating patterns of marine biodiversity – much of which still needs to be discovered. Seamount ecosystems are fragile habitats, which need to be managed carefully and with the best scientific information available. Yet their biological resources are increasingly being targeted by fishing fleets, affecting their ecological integrity both directly through the use of destructive fishing practices and indirectly through over-exploitation of local fish stocks. Of particular concern is the use of towed fishing gear that is dragged over the surface of seamounts, smashing coral communities and other structures in their path. The abundance and species richness of the benthic fauna is markedly reduced on heavily fished seamounts.

The disruption of the community structure by fishing is a primary concern from a conservation perspective. The patchy distribution and relative isolation of seamounts, means that any damage inflicted will take long to mend, if at all. Regeneration is slowed by the complex life-history traits of key seamount species. The orange roughy, for example, is slow-growing and has an estimated life span of 100 years. Intense harvesting of local stocks of this species is likely to cause irreversible damage.

Recent developments suggest that seamounts may also become the target of deep-sea mining companies, which are exploring the possibility of mining metallic compounds from these habitats.[69]

6.2.2 Management

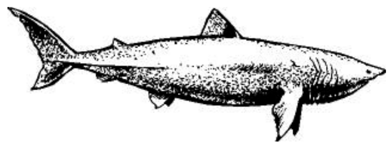
Seamounts are not internationally recognised as a habitat type worthy of protection. However, since many if not all seamounts are colonised by deep-sea corals, measures taken to protect this habitat (see section 6.4) may be used to protect seamount structures as well. OSPAR has included seamounts, particularly in the wider Atlantic region, in their draft List of Threatened and/or Declining Species and Habitats on the basis of decline, sensitivity and ecological significance.

To address shortcomings in the protection of the marine environment, and in particular of less explored ecosystems in the high seas, including seamounts, the IUCN, WWF, and WCPA Marine have launched a joint High Seas Ecosystem Protection Project. Seamounts are also considered by WWF and IUCN as priority habitats/ecosystems to benefit from high seas Marine Protected Areas.

Stronger protection of seamounts is clearly justified by the high species diversity on or around seamounts, the highly localised species distribution of many seamount species, the critical role of seamounts for species congregating in their vicinity for spawning and mating, and the sensitivity of seamount flora and fauna to largely unregulated fishing activities.

6.2.3 Conclusions

Any representative system of Marine Protection Areas (MPAs) would need to include some seamount habitats. But so far, the lack of scientific knowledge of seamount ecosystems and the impacts of human activities has prevented a site selection process. Swift protection of seamounts in the North-East Atlantic, as well as restrictions on the use of damaging fishing gear is paramount to the protection of associated biodiversity, and would be consistent with the protection of reefs under the EU Habitats Directive (see section 6.4).



6.3 Deep-water sponge fields

Though plant-like in appearance, sponges are among the most primitive animals in the sea. Numerous species are found in the North-East Atlantic, mostly in shallow waters although some are found up to depths of 2,500 metres.[70] The diversity in colour and shape of sponges is considerable.

Many sponges have an internally fused skeleton, which provides structural support and contributes to the formation of reefs. The average life span of deep-water sponges is believed to be comparatively short, often not more than four years. Their larvae are also comparatively short-lived, suggesting a limited ability for long distance dispersal. Sponges are dependent on certain hydrographic conditions; for example, they favour areas with ocean currents where the water contains organic particles.

Deep-water sponge fields occur widely throughout the OSPAR area, typically at water temperatures ranging between 5-10°C, although their distribution is often patchy and limited to restricted areas. In *ostur* areas ('cheese bottoms') – sponge dominated areas on the shelf and slope off the Faeroes – around 50 different species can be found, some with body weights up to 80 kg.[71] *Ostur* areas are also thought to be important for the recruitment of certain fish stocks.

Sponge fields play an important ecological role in maintaining a balanced, structurally and biological diverse marine environment. They have an impact on water circulation and sediment deposition, and provide a microhabitat for other species. For example, the abundance of spiny lobsters has been directly linked to the abundance of sponges, which are used as refuges. In addition, a very rich fauna (more than 242 species) has been shown to be associated with sponge-dominated areas (Klitgaard, 1995). Some of the highest diversity areas coincide with *Lophelia* reefs, notably off the Norwegian coast and along the continental shelf around the Faeroe Islands.[72] These areas match tropical reefs in terms of their biodiversity.[73]

6.3.1 Status and threats

Because of a lack of data, it is difficult to assess the conservation status of sponge fields or to evaluate the impact of human activities on them. Sponge fields are sensitive to physical disturbance, notably mechanical damage by fishing gear such as bottom trawls. As filter feeders, sponges are also particularly vulnerable to persistent activities, for example construction work or repeated trawling of the sea floor, that increase the amount of sediment suspended in the water column. Little is known about the influence of chemical pollutants on sponge species, although there is evidence to suggest that toxins may lead to deformation and abnormalities in their physical structure.

6.3.2 Management

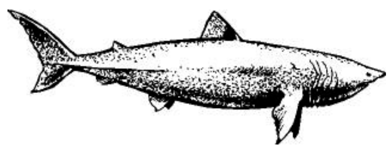
Deep-water sponge fields are not formally recognised as a habitat type worthy of global protection. They have, however, been proposed as a habitat of special concern within the OSPAR framework of Lists of Threatened and/or Declining Species and Habitats, based on rarity, decline and sensitivity, notably with regards to distribution in the wider Atlantic.

Deep-water sponge fields are not covered by the 'reef' category of the EU Habitats Directive. However, where they occur together with reef structures, such as *Lophelia* reefs, they will be protected by measures relating to these habitats/species. Key gaps exist for the protection of deep-water sponges on medium to fine substratum.

The conservation of sponge fields may also yield significant benefits in terms of pharmaceutically substances found in their tissue.

6.3.3 Conclusions

Greater efforts are needed to improve our understanding of deep-water sponge communities – their requirements and distribution, as well as their ecological and socio-economic significance. Nevertheless, it is already evident that deep-water sponges constitute a key group in the marine environment and should be part of a comprehensive system of protected marine areas.



6.4 Cold-water coral reefs

Contrary to popular belief, coral reefs also occur in cold-water environments. The most common cold-water coral is *Lophelia pertusa,* which has a global distribution but is most commonly found in the North-East Atlantic where water temperatures range between 4ºC and 12ºC. It forms a hard, branched external skeleton, which protects individual polyps and forms the basis of solid reef structures. Rough estimates of the growth rate of cold-water corals suggest that colonies grow approximately 5.5 millimetres per year. Living *Lophelia* banks have existed on the Norwegian continental shelf for at least 8,000 years.[74]

Cold-water corals frequently colonise areas up to a depth of around 2,000 metres where water currents are accelerated by topographic characteristics. The world's largest known deep-water reef, Røst reef, can be found off Lofoten in Norway. Other significant reefs occur in Norwegian fjords, at depths from 40 metres, and along the continental shelf and shelf break of Norway, as well as off the north-west coast of Sweden, the UK, Ireland, France, and Spain.

There are also offshore reefs on seamounts and banks. By and large, however, a patchy distribution of *L. pertusa* is more common than large reefs. Patches of coral often include more than one species.[75] For example, *Madrepora oculata* and *Solenosmilia variabilis* often coincide with *L. pertusa*. Well-known locations with cold-water coral include the Trondheim Fjord, Kosterfjorden in Skagerrak, Sula Ridge, Hurtside Wreck, Darwin Mounds, Rockall Bank and Trough, and the Porcupine areas. The Darwin Mounds were discovered only in 1998, to the north-west of Scotland in UK waters.

The structures formed by the growing and decaying coral represent an important habitat for many marine species, which find food, shelter and/or a foothold amongst the reef's cavities and outcrops. Cold-water reefs display a species diversity rivalling that of tropical reefs and exceeding that of surrounding mud plains by a factor of three.[76] As many as 800 or more different organisms live in or on *Lophelia* reefs in the North-East Atlantic, including deep-sea sponges, starfish, brittlestars, sea pens, and sea urchins, and fish such as redfish, saithe, cod and ling. In addition, numerous larger species rely on reefs as feeding grounds. Like their tropical counterparts, cold-water reefs are also important spawning and nursery grounds for many fish species. They should therefore be recognised as true 'hotspots' of biodiversity.

6.4.1 Status and threats

Given their fragility and slow growth rate, cold-water coral reefs are susceptible to a number of activities. These include damage caused by bottom trawling and pollution, notably resulting from oil exploration. They are also sensitive to changes in the marine environment attributable to climate change, though arguably to a much lesser extent than tropical reefs.

The extension of commercial fishing activity to deep-sea environments has progressively increased pressures. Damage predominantly takes the form of mechanical damage, with towed fishing gear such as bottom trawls directly impacting on the reef structure. This type of damage is now widespread throughout the OSPAR area[77], with an estimated 30-50 per cent of *Lophelia* reefs in Norwegian waters scarred by trawling.[78] Recent high frequency sonar imagery reveals deep scars on the Darwin Mounds, and photographs show smashed and fragmented coral. Fishermen usually avoid known coral areas. There are reports, however, of deliberate crushing of corals taking place prior to trawling – an attempt by fishermen to save their gear from damage while maximising the catch.[79] On occasions, whole reefs have thus been flattened, leaving areas of total devastation.

In addition to direct impacts of trawling, indirect effects associated with the disturbance of the seabed have also been identified as a significant threat to coral communities. Trawling and other activities disturbing the seabed result in increased suspension of sediment in the water column, which has the potential to smother new coral growth. These indirect effects are felt more widely, beyond the area of direct impact, and are difficult to document due to the time scales involved in coral growth.

Much is unknown about the effects of chemical pollutants on corals and other reef species. Oil exploration and exploitation causes discharges of oil-polluted drilling mud and drill cuttings, which may result in silting and/or breakage of coral structures. In addition, chemical pollution, including dissolved and dispersed oil, may have lethal or sub-lethal effects on the coral and associated communities.

6.4.2 Management

Given the slow growth rate of corals, any loss will take years to regenerate, if it does at all. Effective means of safeguarding known coral reefs include the protection of defined areas, the introduction of regional water quality and sedimentation standards, as well as restrictions on the use of harmful fishing gear.

In order to close susceptible areas to certain types of fishing and other destructive activities, more extensive reef mapping is required. The Atlantic Coral Ecosystem Study (ACES)[XXXIV] is undertaking an environmental baseline assessment of deep-water coral reefs in Europe, trying to ascertain the sensitivities of cold-water coral reef systems with regards to various impacts.

Reefs within the area of national jurisdiction (ie 200 nm) are covered by the EU Habitats Directive. Consequently, EU Member States are obliged to designate Special Areas of Conservation (SACs) to protect cold-water coral reefs. *Lophelia* reefs have also been proposed for inclusion on the OSPAR List of Threatened and/or Declining Species and Habitats for the entire OSPAR area, based on their global or regional importance, decline and sensitivity. The proposal is awarded high priority.

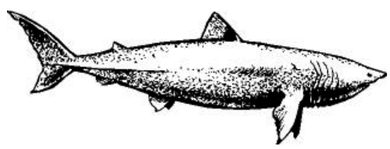
One of the first examples of effective site designation aimed at cold-water coral reef protection in the North-East Atlantic is the Sula Ridge Protection Area. In March 1999, the Norwegian government formally designated this area, following a joint initiative involving scientists and WWF. The Ridge is believed to be one of the best developed reefs in the North-East Atlantic, comprising heights of up to 35 metres and stretching over 13 km in length.[80] The largest reef in the Sula complex is some 100 km from land, and is one of the first protected areas in European waters outside territorial waters.

Koster-Väderöfjorden off the Swedish west-coast has been declared a Natura 2000 area, and the coral reefs in Kosterfjorden are protected against trawling. Measures have been developed to reduce the effects of shrimp trawling on the sensitive marine organisms in the area. Certain gear restrictions have been introduced and trawling is forbidden in a number of smaller areas identified as key coral sites. The County Administration in Västra Götaland is currently working on a management plan for the entire area.

The Darwin Mounds are also vulnerable to fishing activities, and a recent WWF status report (October 2002) reveals new damage over about a half of the Darwin Mounds. This is despite a year-old UK government commitment to protect them.[81]

6.4.3 Conclusions

The establishment and implementation of a comprehensive, global network of ecologically representative and well-managed Marine Protected Areas (MPAs) is paramount to the protection coral reefs. Within the EU, site designation should be taken forward as a matter of urgency, as part of the EU Natura 2000 network. Sidescan and sonar imaging can help to map the distribution of reefs and reveal the extent of damage already incurred. Furthermore, EU regulation directly prohibiting the use of gear dragged along the bottom in the vicinity of coral areas would greatly improve the chances for conservation of remaining coral formations.



6.5 Offshore Sand and Gravel Beds

Sand and gravel beds are a common but varied sediment type in the North-East Atlantic and Baltic Sea. Submerged sand and gravel habitats, extending from immediately below the low tide mark to a depth of approximately 200 metres, occur in a wide variety of environments, from sheltered to highly exposed locations. In this report, 'offshore sand and gravel beds' refer to the more exposed habitats of the open coast, excluding the relatively sheltered areas in sea lochs, enclosed bays and estuaries.

[XXXIV] research project supported by the European Commission under the 5th Framework Programme

The particle composition of these habitats can vary from mainly sand, through various combinations of sand and gravel, to mainly gravel. There are also some characteristic regional variations with regards to the origin of particles. Sand and gravel beds found to the west of the UK, in the English Channel and the Irish Sea, for example, are largely shell derived, whereas those in the North Sea are predominantly formed by rock material. Much of the deposits are thin, covering the underlying bedrock, glacial drift or mud, and the strength of tidal currents and exposure to wave action are important local determinants of the stability and constitution of the habitat.

The diversity and composition of plant and animal communities on offshore sand and gravel beds are largely determined by the underlying substrate mix, as well as exposure to the elements (eg wave action, salinity, currents, light intensity). Coarse gravel beds, exposed to strong tidal currents or wave action, generally support a low to medium biodiversity and are inhabited by robust and well-adapted species, such as small polychaetes (segmented worms), small or rapidly burrowing shells and mussels, as well as other small crustaceans and mobile predatory species (eg crabs, hermit crabs, whelks and sand eels). More diverse communities often include sea cucumbers (*Neopentadactyla mixta*) and sea urchins (*Psammechinus miliaris* and *Spatangus purpureus*) as well, notably around Shetland, the Irish Sea and English Channel.

Offshore sand and gravel beds provide important spawning grounds for herring, particularly off the Scottish and Shetland coasts, along the eastern English coast and in the English Channel, as well as parts in of the Central North Sea, the Celtic Seas and the Baltic Sea. Herrings deposit their sticky eggs on coarse sand, gravel, small stones or rock, commonly gathering in large shoals with females releasing eggs in a single batch. The resulting egg carpet may be several layers thick and may cover a large area of the seabed. Depending on the sea temperature, eggs take about three weeks to hatch.

6.5.1 Status and threats

As habitats, sand and gravel beds are subject to a range of human pressures, including poor water quality and physical disturbances due to the use of destructive fishing gear, construction, and extraction of sand and gravel (collectively termed ‘marine aggregates’). They clearly have an impact on the marine organisms inhabiting these environments. In particular flatfish fisheries and the associated use of beam trawlers in areas of sandy seabed in the southern North Sea, English Channel and Baltic Sea, and scallop dredging in gravel areas, particularly in the English Channel and northern Irish Sea.

Marine aggregates have become an important mineral resource for the construction industry, land reclamation and beach replenishment in a number of European countries, particularly the Netherlands, the UK, Denmark, and to a lesser extent Germany, France, Belgium and Ireland. Marine aggregate extraction has in recent years increasingly replaced the mining of sand and gravel in terrestrial environments. This change in resource use to some extend reflects the higher transport cost, stricter statutory control and stronger public opposition to onshore mining. Sand and gravel is usually extracted from the seabed at a depth of 10 to 40 metres or more. It can be dredged over large areas using thin/surface resources (eg by suction dredging) or mined in ‘pits’, commonly to sediment depths of approximately 10 to 30 metres below the seabed and 10 to 50 metres in diameter. Annual volumes extracted range from approximately 2-3 Mm^3 of a sand and gravel mix by France and Belgium, to 25 Mm^3 of sand in the Netherlands (North Sea).[82] In many countries the trends appear to be stable or increasing.[XXXV]

The impacts of aggregate extraction are usually restricted to defined areas. However, as both the substrata and fauna are removed, the impact on the seabed per unit area will often be greater than impacts from fishing. In particular, recovery periods may be longer as organisms struggle to recolonise devastated

[XXXV] Extraction in German, Danish, Finnish and Russian waters have a significant impact on Baltic sand and gravel habitats.

areas.[83] Natural refilling of extraction pits can take ten years or more, depending on local water currents, wave action and sediment inputs.[84] Some studies have recorded a 70 per cent reduction in species abundance, 80 per cent in biomass and 30 per cent in species numbers. Under certain circumstances biological communities may also take a decade to recover.[85] Areas dredged for marine aggregates are often only visited once and then left to recover, however, while heavily fished areas may be harvested relentlessly, never giving the community a chance to recover.

While many species characteristic of highly perturbed and mobile sediments are relatively resilient to fishing activities or other anthropogenic physical disturbances, some larger and slow-growing organisms (eg certain shells and mussels) are not. In addition, the loss of suitable spawning grounds for fish species such as herring is added to the effects of fishing pressure and other stress affecting stock health, and may prove detrimental. These types of physical disturbance may also have more far-reaching effects on local and regional bottom topography. Factors which need careful consideration include: i) changes in seabed elevation, which may alter water currents and wave activity, as well as near-shore sediment systems; ii) enhanced coastal erosion; iii) increases in the amounts of suspended fine-grained sediments during extraction and/or as a consequence of the removal of stabilising substrata; and iv) the creation of large depressions on the seabed where anoxic conditions may develop due to a lack of water circulation.[86]

Besides direct exploitation of aggregate resources, other physical disturbances also affect offshore sand and gravel beds. These include construction of offshore wind parks and other marine structures, the widening and dredging of channels, pipe and cable laying and the construction of sea defences. Importantly, all construction activities can alter tidal flow regimes and wave exposure, or result in deposition of sediments that influence the structure of sedimentary habitats and thus may interfere with the natural functioning of sand and gravel bed communities.
There are plans to build large offshore wind parks in offshore areas in many states bordering the northeast Atlantic and the Baltic Sea (eg Germany, Sweden and Denmark). These plans pose a threat to many offshore banks (sand and gravel beds) such as those off the Swedish and German coasts.

6.5.2 Management

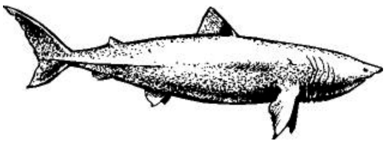
While licenses for marine extraction of sand and gravel are required in most if not all European countries, there is some variation in the use and implementation of Environmental Impact Assessments (EIAs) or corresponding ecological impact studies. The EU EIA Directive (85/337/EEC, as amended by 97/11/EC) regulates (amongst others) the extraction of minerals by marine or fluvial dredging. Member States have to decide on a case by case examination, and/or by reference to thresholds or criteria whether a project should be subject to assessment or not. In Germany, for instance, EIA is obligatory for all extraction projects exceeding 10 hectares or an extraction rate of 3,000 tonnes per day.[87] The same provisions of the EIA Directive also apply to wind farms.

Since 1993, ICES' Advisory Committee on the Marine Environment (ACME) has published a number of guidelines and recommendations for EIA of marine aggregate dredging and on monitoring the environmental effects of extraction. Similarly, HELCOM adopted a recommendation (19/1) in 1998, which includes a list of guidelines on sediment extractions, including advice on EIA, extraction practices, sensitive and no-take areas, environmental monitoring and progress reporting.

The impacts of aggregate extraction on the marine ecosystem can be reduced by limiting the size and/or volume of extraction allowed in a given area, by retaining and replacing the top layer of the sediment and by protecting particularly sensitive areas from mining.

6.5.3 Conclusions

While a basic legal framework appears to be in place to ensure prior environmental assessment of marine extraction, as well as international guidance, there is a need to ensure full and effective implementation of these provisions. Assessment of other activities, such as the construction of offshore wind farms, should also be brought within the regulatory framework. There is clearly a need for more coherent spatial planning and routine strategic environmental assessments (SEA) of plans and programmes affecting the marine environment. These include coastal management schemes as well as offshore policies, notably those with an impact on water quality, coastal integrity and marine resource exploitation. The existing EU Strategic Assessment Directive (2001/42) is applicable in EU Member States, but only where plans or programmes, eg for gravel extraction, are being prepared. Impacts on this habitat will also need to be assessed in determining good ecological status under the Water Framework Directive and, potentially, action taken to reduce damaging activities as programmes of measures are developed.



6.6 Intertidal mudflats

Intertidal mudflats occur in coastal areas of low tidal turbulence, in particular in estuaries and other sheltered places. Nonetheless, they are usually characterised by highly dynamic systems of continuous deposition of sediments, notably silts and clays, and form a rich habitat of high biological productivity. Their biodiversity is generally low, with few rare species to be found amongst the mostly invertebrate fauna. Species composition is dependent on the interplay of complex, site-specific environmental variables.

Coastal mudflats represent an important feeding ground for many aquatic bird species, in particular waders and wildfowl, which feast upon the plentiful supply of easily accessible invertebrates. Similarly, many fish species (eg flounder and juvenile plaice) depend upon the high biological productivity of this habitat for food, and use the shallow banks as refuge. Large scale damage to intertidal habitats is thus likely to impact significantly on population levels of coastal bird and fish species, especially if migratory, as decreases in food availability raise mortality rates directly, and indirectly through increases in stress levels.

Intertidal mudflats occur throughout the OSPAR area, with the largest continuous expanse stretching along the coasts of Denmark, Germany and the Netherlands in the Wadden Sea. Local hydrophysical characteristics strongly influence the community structure, and physical and biological integrity of the habitat. Exposure regimes and wave action, for instance, affect the topography and temperature exposure of local intertidal mudflats, and hence determine for example microbial activity, species richness and productivity.

6.6.1 Status and threats

ICES notes there is 'good' evidence for significant declines in intertidal mudflats throughout the OSPAR area. A key historic threat to intertidal habitats has been land claim, especially associated with the reclamation of shallow coastal areas for agricultural purposes (eg grazing). According to the UK's Habitat Action Plan for mudflats, land claim has removed as much as one quarter of Great Britain's estuarine intertidal flats, and up to 80 per cent in some estuaries. While this continues to be of concern, habitat loss is increasingly being driven by relative rises in sea level. This may involve the (natural) sinking of land masses such as in southern England and/or the consequences of global climate change, leading to increases in storm frequency as well as actual rises in sea level. Sea defence structures limit the ability of intertidal habitats to 'migrate' inshore as sea levels rise. This effectively leaves mudflats with their 'back against the wall' when faced with the increasing pressure of global climate change.

Coastal construction in intertidal zones, notably estuaries, is posing a significant disruption to mudflats. Sea defence structures, harbour infrastructure and industrial installations may all cause significant direct harm through the physical removal of all or part of the habitat, or may have an indirect impact due to disturbances caused by effluent discharges, traffic, recreational use, bait digging and/or fishing activity. The disruption of the seabed and local community structure often has knock-on effects, with implications for the wider marine environment. This notably concerns predator populations such as shellfish and coastal birds, which rely on intertidal mudflat habitats as a feeding ground.

Pollutants such as hydrocarbons, radionuclides and/or heavy metals have been shown to deposit and accumulate in soft sediments. Oil spills may cause large-scale deterioration of intertidal mudflats, reducing oxygen penetration in affected areas and resulting in accumulation of toxic agents in the food chain. Poor water quality and the impact of toxins, particularly those linked with a reduction in the reproductive ability of certain species, are inflicting damage to mudflat communities.

The effects of organic enrichment on intertidal mudflats is well-documented and shows a consistent sequence of response[XXXVI]. Organic particulates or dissolved organic matter from sewage, aquaculture, effluent inputs from the pulp and paper-mill industry, or degrading oil, coupled with poor oxygenation, may lead to anaerobic chemical conditions in the sediments. In turn, this increases microbial activity and ultimately promotes the production of toxins such as hydrogen sulphide and methane. Overall diversity declines and the community becomes increasingly dominated by a few pollution-tolerant, opportunistic species. Organic enrichment further leads to excessive algal blooms, which manifest themselves in the formation of 'green tides', and excessive growth of certain macroalgae, which can smother other species.

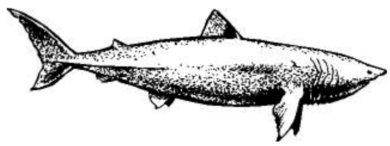
6.6.2 Management

Intertidal mudflats are listed in Annex I of the EU Habitats Directive, and consequently require the designation of Special Areas of Conservation (SACs) within the Union. Most if not all Member States seem to have fulfilled their obligations in proposing sufficient sites[XXXVII]. The habitat has further been proposed as a priority habitat within the framework of the OSPAR List of Threatened and/or Declining Species and Habitats. Mudflats were nominated for the entire OSPAR area, with the exception of the wider Atlantic, citing decline, sensitivity and ecological significance as key criteria in support of their protection.

While intertidal mudflats represent a comparatively well-studied habitat, gaps persist in our understanding of the precise interactions between natural fluctuations and processes in the intertidal system and their overall conservation status. In particular, management of Natura 2000 sites requires the definition of the 'favourable conservation status' of this habitat type – an obligation which should drive further research in this field.

6.6.3 Conclusions

In addition to ongoing management efforts, the protection of intertidal mudflats from human influences requires the management of marine-based as well as terrestrial activities. Coastal development planning and water quality improvements should be part of an integrated coastal zone management system. Management measures need to be sensitive to the natural dynamics of coastal systems. Intertidal mudflats need to be able to adjust to natural and some extend human-induced changes in local hydrology and climatology. Impacts on this habitat will also need to be assessed in determining good ecological status under the Water Framework Directive and, potentially, action taken to reduce discharges as programmes of measures are developed. Full implementation of the Urban Waste Water Treatment, Nitrates and Dangerous Substances Directives is also necessary to reduce the impacts currently being observed.



6.7 Eelgrass meadows

Eelgrass communities can be found in the intertidal and shallow subtidal zones of many coastal areas of the North-East Atlantic and Baltic Sea. They are

[XXXVI] Also known as the Pearson-Rosenberg model (Pearson, T.H. & Rosenberg, R. (1978) Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. *Oceanogr. Mar. Biol. Ann. Rev.*, 16, 229-311.).
[XXXVII] see outcomes of the respective biogeographic seminars

commonly found in sheltered waters on sandy and/or fine gravel substrates. Eelgrasses belong to the flowering plants, and the most common species include *Zostera marina*, *Z. angustifolia* and *Z. noltii. Z. marina* essentially inhabits the sublittoral zones to a depth of several metres. *Z. noltii* is frequently associated with salt marshes immediately along the shore.

Eelgrasses form a dense sward of dark green, long and narrow, ribbon-shaped leaves about 20-50 cm long, and are characterised by high productivity and large biomass. Eelgrass meadows support diverse animal and plant communities and act as nursery areas for fish and shellfish. Perennial, fully submerged eelgrass meadows generally support the highest number of species. Their vigorous growth provides a rich feeding ground for wildfowl such as Brent goose, widgeon, and mute and whooper swan. They also play an important role in reducing the impact of tidal activity. Dead plants are thought to be a significant source of organic matter in the marine environment.

6.7.1 Status and threats

Significant historic declines took place in the 1920s and 1930s owing to naturally occurring disease. In the period between 1970 and 1982, on the other hand, approximately half of the global loss of eelgrass was attributable to human causes, and this figure increased to 75 per cent for the following decade.[88]

Extreme weather events, such as storms, and grazing animals both take their toll on eelgrass meadows. Grazing wildfowl, for instance, can reduce biomass by as much as 90 per cent.[89] These effects, however, are usually not long-term. But eelgrass communities are sensitive to many activities typical of developed coastal zones. In particular, they are likely to be damaged by large-scale land reclamation, water pollution, bottom trawling, channel dredging, construction and flood prevention measures, as well as boating and other recreational uses. Physical factors such as substrate loss, smothering, increased turbidity and wave exposure present the greatest threats, while other chemical and biological changes play a less immediate role.

Prolonged increases in turbidity and the resulting decrease in light penetration and hence photosynthesis have been linked to die-backs in *Zostera*, notably in the North Sea, where as much as 58 per cent overall, and up to 82 per cent in certain areas, of eelgrass meadows were lost in the ten to fifteen years between surveys undertaken in the 1980s and in 2000.[90] A decrease in light penetration is also thought to prevent eelgrass regeneration in the Wadden Sea, where recovery from losses suffered during the disease-related declines in the 1930s is slow. Currently approximately 4.8 per cent of all intertidal mudflats in the Wadden Sea are covered by eelgrass meadows, with as little as 1 per cent of the pre-1930s area coverage remaining in some areas (eg the Dutch Wadden Sea).[91] Oxygen depletion and associated sulphite releases, often associated with nutrient enrichment and increases in turbidity, have also been linked to reductions in productivity and ensuing losses.[92]

Sensitivity to chemical pressures, such as contamination by synthetic compounds, hydrocarbons and changes in nutrient level, are thought to be intermediate to strong. More indirect effects of chemicals may also disrupt the structure of eelgrass communities, for example by killing key primary consumers or leading to excessive algal growth smothering the eelgrass. While increasing nutrient levels may to some extent encourage productivity of *Zostera*, excessive eutrophication, particularly in the Baltic and Wadden Sea, is associated with algal blooms, which may smother eelgrass.

Biological factors such as the introduction of microbial pathogens/parasites, grazers or natural competitors may also lead to changes in leaf cover. The spreading of exotic species remains a potent problem, despite the introduction of mitigation measures to prevent new introductions.

Overall, eelgrass meadows are likely to suffer from the combined effects of multiple threats and a slow species recovery rate. Links between changes in benthic community structure and eelgrass declines have been shown for some areas. Systematic scientific research, however, is still required to establish broader trends.[93]

6.7.2 Management

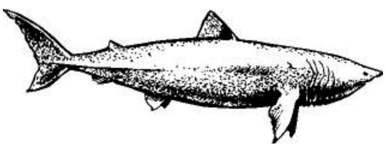
While the EU Habitats Directive does not identify *Zostera* meadows as a habitat worthy of protection, eelgrass communities are likely to occur in other habitats listed under Annex I, namely coastal lagoons, estuaries, large shallow inlets and bays, mudflats and sandflats not covered by seawater at low tide, and sandbanks which are slightly covered by sea water at all times. Consequently, some eelgrass meadows will be protected by the designation of areas for the Natura 2000 network.

The HELCOM Red List Marine and Coastal Biotopes and Biotope Complexes refers amongst others to lagoons/fladas (Heavily Endangered), fjords/fjord like bays (Endangered), which are relevant biotopes for eelgrass-meadows.

In addition, eelgrass meadows are proposed for inclusion on the OSPAR List of Threatened and/or Declining Species and Habitats, notably with regards to their distribution the in Greater North Sea Region. While ICES disputes the OSPAR assessment that 'all the *Zostera* areas are dramatically declining', it agrees that there is good evidence for a decline, particularly in UK waters and the Wadden Sea.

6.7.3 Conclusions

In order to minimise pressures on eelgrass meadows, there is a need to provide for the protection of sufficient representative areas as part of the Natura 2000 network, as well as to establish measures within an integrated framework of coastal zone management. The latter requires sound watershed management, notably under the EU Water Framework Directive, and sustainable coastal planning. Awareness-raising of the ecological importance and sensitivity of eelgrass communities is an important means to minimise trampling and the effects of, for example, water sports. Restoration of eelgrass beds may also be an effective management tool in heavily damaged areas, such as the Wadden Sea.



6.8 Maerl beds

'Maerl' is a collective term for several species of calcified red seaweed. Despite their slow growth-rate, maerl beds can cover extensive areas if left to grow, and may reach several thousand years of age. Like corals, maerl can grow to form hard structures by accumulating its skeletal remains as a substratum. In its live form, it can be found in coastal areas to depths of up to 40 metres.

Unlike eelgrass, which prefers sheltered habitats, maerl favours moderately wave exposed coastal stretches, where faster water currents prevent it from being smothered with sediments. Hence, it predominantly occurs along more exposed stretches of the Atlantic and western Baltic coasts. Maerl also occurs on the soft sandy bottoms of the offshore banks in the Kattegat, in narrow inlets, sea lochs and the sounds between islands where there are faster tidal currents. The best known examples of maerl beds are found along the coasts of Brittany, Norway and Ireland.

Like coral reefs and sponge fields, maerl beds serve as nursery areas for several commercially harvested marine fish species, and offer shelter for a wide range of coastal species, including crabs and anemones. They also support high levels of biodiversity, with several species thought to be entirely or predominantly confined to maerl habitats. Moreover, maerl constitutes a significant source of oceanic calcium carbonate, an essential resource for other marine species and a source of grains for sand dunes and beaches.

During the past four decades, scientists have made some progress in establishing the ecological requirements of, and common threats to maerl communities. However, much remains to be learned about their community structures and associated biota.

6.8.1 Status and threats

The distribution of maerl beds is scarce and patchy, and their decline is thought to be exacerbated by a combination of human-induced stresses. First and foremost, maerl beds are still commercially harvested despite their sensitivity to direct extraction and smothering with sediment. In addition to dumping sediments on any plants which escape dredging, extraction also removes the productive surface layer of maerl beds. This is likely to inhibit fast recovery. Extraction is taking place mostly in France and Ireland, and to a lesser extent in UK coastal waters. While historically maerl was used as a calcium-rich soil enhancer, commercial interests are now focusing on its use in water filtration and as an additive in animal feed, pharmaceuticals and cosmetics.

In the 1970s, France extracted approximately 600,000 tonnes of maerl per year. In the UK, licences have been granted for extraction from the Fal Estuary, resulting in an annual extraction of between 20,000 and 30,000 tonnes of maerl between the 1970s and 1990s.[94] Today, European maerl extraction is commonly regulated by licenses, but there has been evidence of illegal extraction in, for example, the UK. Commercial mining in the UK, is now limited to less than one per cent of inshore waters.[95]

In addition to commercial extraction, maerl beds are being damaged by offshore developments, such as wind farms, certain recreational uses, benthic fisheries, especially dredging for mollusc species, fish farming and poor water quality. Eutrophication is considered a key factor in maerl decline, by causing excessive growth of other, more competitive algae. Pressures on maerl beds associated with climate change may manifest themselves in sea level changes and increased storm frequency and intensity. Both are likely to affect these slow-growing algae significantly.

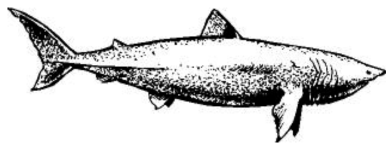
6.8.2 Management

Two of the more common maerl-forming species are listed in Annex V of the EU Habitats Directive, specifying species whose taking in the wild and exploitation may be subject to management measures. Their exploitation must be compatible with their being maintained at a favourable conservation status. In addition, maerl beds may benefit from their association with the Annex I habitat category: 'sand banks which are slightly covered by seawater at all times'.[96] This would give them protection under the Natura 2000 scheme.

Maerl beds were not considered to be threatened enough to be included on the top priority OSPAR list. The ICES reviewers of the list, however, disagreed and concluded that significant maerl bed declines are evident, for example, in the Celtic Seas.

6.8.3 Conclusions

Aside from benefiting from protection afforded to sandbanks under the Habitats Directive, global or regional protection of maerl beds appears to be rather limited. Given suggestions of significant declines in maerl beds, it is appropriate to re-examine their status within EU and regional agreements. Attention will need to be given to reviewing extraction licences, whilst ensuring the proper enforcement of existing licences. In issuing permits or licences for other activities, such as fish farming and offshore developments, proper consideration should be given to impacts on maerl beds.



6.9 Kelp banks

Kelp banks are a complex and diverse habitat dominated by large, brown seaweeds, commonly known as kelp (Laminariales). Kelp plants can grow up to tens of metres in height, but generally reach a size of several metres in European waters (the North-East Atlantic and the south-western Baltic Sea, including Kattegat). The size, complexity and characteristically high biodiversity of kelp banks have earned them the title 'underwater jungle of the sea'. Indeed, kelp forests match the terrestrial rainforest in their ecological significance for marine life, their high productivity and importance as a natural resource, not least for human use. Their influence extends far beyond the immediate habitat and species value.

In the North-East Atlantic, the dominant kelp species is *Laminaria hyperborea*, which occurs in combination with for example *Laminaria saccharina, Laminaria digitata, Alaria esculenta* and *Saccorhiza polyschides*. Important habitats occur along the coast of Norway, where kelp forests cover thousands of acres. Light intensity permitting, kelp grows below the mean low water mark at 2 to 35 metres. Plants usually require bedrock or other hard substrata such as big boulders that they can attach to, and hardier species tolerate comparatively strong wave exposure. Kelp does not tolerate wide temperature fluctuations, and its distribution is thought to be limited by temperature and salinity. Depending on the species, individual plants can live for up to twenty years.

Extensive areas of the offshore banks in Kattegat (Fladen and Lilla Middelgrund) are dominated by kelp, *Laminaria hyperborea*, which plays an important role for habitat diversity. Kelp beds provide a three-dimensional structure of different habitat types, supporting a diverse flora and fauna. For example, beds provide an ideal habitat for filamentous algae, bottom fauna, epi-fauna and fish. Off the Swedish west-coast, kelp only occurs sporadically. This is due to the lower salinity of the Baltic waters, effectively limiting *Laminaria hyperborea* to the northern parts of the Kattegat.

Despite a long history of human exploitation for food and fertiliser, relatively little is known about the wider ecological contribution of individual kelp species to the marine environment and the role of kelp forests at large. Kelp forests serve as an important habitat and food source for many other commercially exploited species, including lobsters and crabs. They display complex patterns of constantly changing assemblages of local plant and animal communities. Sometimes, large areas are subject to extensive grazing by, for example, sea urchins and limpets. While kelp plants themselves are not particularly sensitive to temporary fluctuations in their natural environment, certain species in their community, so called keystone species, may be affected by short-term events, causing subsequent disruption of the ecological balance of kelp banks.

6.9.1 Status and threats

Kelp beds have traditionally been harvested as a local resource, but the intensification of harvesting to an industrial scale poses an increasing threat in the North-East Atlantic. Surveys have shown that while kelp beds may recover to harvestable levels within three to four years, full recovery is likely to take much longer. Other known threats include local nutrient enrichment and changes to water quality, notably affecting light penetration and competition between species, chemical and oil pollution, the introduction of alien species, as well as changes in the global climate regime and depletion of the ozone layer. Mariculture constitutes an added local pressure, in so far as it may increase nutrient and chemical input, detritus and disease.

Given the ecological significance of kelp forests, especially their role as protection and habitat of growing fish and crustaceans, any decline can be directly translated into economic losses.

6.9.2 Management

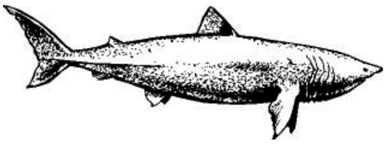
The lack of knowledge about the environmental and physical attributes of kelp forests, and temporal variation in their species composition complicates surveillance and management decisions.

Requirements under the EU Habitats Directive oblige EU Member States to introduce a system of designated areas (Natura 2000) for certain kelp-relevant marine habitats, and to ensure the maintenance or restoration of their favourable conservation status.

The offshore areas, Lilla Middelgrund and Fladen, in the Kattegat have been proposed as HELCOM Baltic Sea Protected Areas (BSPAs). They have further been proposed as Natura 2000 sites by the local County Administration and the Swedish Environmental Protection Agency. As yet, notification has not been confirmed by the Swedish Government. In the meantime, both areas have been proposed as suitable sites for the development of offshore wind farms.

6.9.3 Conclusions

Despite some efforts to protect kelp banks under the EU Habitats Directive, they have so far received inadequate attention and protection. The lack of knowledge about the dynamics of the habitat further exacerbates the problem. It is clear, however, that the basis for kelp protection is the avoidance of habitat deterioration, notably by improving overall water quality and addressing the issue of global climate change. Impacts on kelp beds will also need to be assessed in determining good ecological status under the Water Framework Directive and, potentially, action taken to reduce discharges as programmes of measures are developed, as will further implementation of the Urban Waste Water Treatment and Nitrates Directives. In addition, the identification and management of certain keystone species affecting the conservation status of kelp banks may be necessary to maintain and restore the natural balance of kelp communities.



6.10 Mussel Banks (*Mytilus edulis*)

The Common or Blue mussel, *Mytilus edulis*, colonises rocky shores of tide-swept coasts, or rocks and piers in sheltered harbours and estuaries down to a depth of approximately 20 metres and more. It often forms dense beds, sometimes called reefs, in the moderately exposed high intertidal to shallow subtidal coastal zones. Where the salinity is high enough, the species is widespread and still comparatively common along the coasts of Europe.

The blue mussel is a typical suspension feeder, feeding on bacteria, phytoplankton, detritus, and dissolved organic matter. Growth rates are highly variable, depending on factors such as salinity, temperature, food availability and wave exposure. It reaches sexual maturity in its first year, but recruitment is also highly variable.

Mussels provide numerous niches for other organisms, such as crabs, and form a rare hard substrate in some soft-bottom environments. Moreover, by depositing silt, mussel banks promote the development of unique biotopes, often associated with eelgrass communities. As filter feeders, mussels also help ‘clean’ water from excessive detritus, algae, organic matter and other contaminants. Intertidal and subtidal mussel banks can differ considerably in their structure and in the organisms they attract.

Predation can play an extremely important part in determining abundance. While invertebrates, such as sea urchins, whelks, starfish and fish, feed on small mussels, larger ones are often targeted by coastal birds, especially common eiders (*Somateria mollissima*) and oystercatchers (*Haematopus ostralegus*). Populations of these birds are highly dependent on the availability of mussels. Since the 1950s, Blue mussels have also been cultivated for commercial purposes.

6.10.1 Status and threats

Blue mussel communities have undergone considerable fluctuations in recent decades. The biomass of *M. edulis* in certain areas of the Baltic, for instance, almost doubled in the years between 1970 and 1993, only to go through an episode of mass extinction, following an unusually hot summer in 1994.[97] Predation is a very important natural source of mortality; others include disease, storm damage, wave action, desiccation and siltation. In general, Blue mussels are only moderately sensitive to minor physical impacts and recover fairly quickly. Major physical impacts, however, whether natural or caused by human activities such as fishing, may result in widespread losses and may even lead to long-term disappearance of mature mussel beds.

In the UK, where large commercial beds exist in the Wash, Morecambe Bay, Conway Bay and the estuaries of south-west England, North Wales and West Scotland, the species is considered to be overexploited in places but not in decline.[98] Intense harvesting is blamed for major losses in natural mussel banks in the Wadden Sea, including German, Dutch and Danish waters. In the Wadden Sea, many mature intertidal mussel banks have been destroyed by overfishing while large areas with short-lived subtidal mussel banks have been created for cultivation purposes. In the south-western part of the Wadden Sea, where the mussel fishery is particularly intense, these rather large-scale ecosystem changes have been linked to mass mortality of common eiders during three winters (1999/2000 to 2001/2002). Mass mortality of oystercatchers has also occurred in this part of the Wadden Sea. While there is some controversy over the exact causes of mortality, evidence suggests that shortages in mussels, the preferred food source of both eiders and oystercatchers, forced animals to feed on lower quality foods.[99]

6.10.2 Management

In the EU, reefs within national jurisdictions (ie out to 200 nm) are covered by Annex I of the Habitats Directive. Mussel banks are included under the 'reef' habitat category and, consequently, EU Member States are to identify representative sites for inclusion in the Natura 2000 network. Non-raised aggregations formed on hard substrata, however, may not always be interpreted as reefs and are therefore likely to fall outside current EU habitat protection.[100]

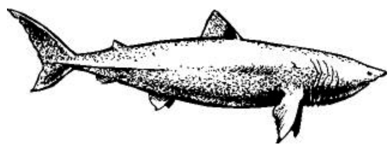
Mussel beds have also been proposed for the OSPAR List of Threatened and/or Declining Species and Habitats, and ICES in its advice to SPAR confirmed sufficient evidence of threat and decline.

The HELCOM Red List Marine and Coastal Biotopes and Biotope Complexes refers amongst others to sublittoral mussel beds with little or no macrophyte vegetation of the photic zone, sublittoral mussel beds covered with macrophyte vegetation, hydrolittoral mussel beds with little or no macrophyte vegetation of the photic zone, as well as hydrolittoral mussel beds covered with macrophyte vegetation, all of which are classed as endangered and relevant to the Common (Blue) mussel.

In the Wadden Sea, the responsible States (the Netherlands, Germany and Denmark) have all taken some steps to protect wild mussel populations and to reduce the impacts of local fisheries on the wider coastal ecosystem.[101] Trilateral policies and regional management plans regulate the harvesting of mussels by license and have led to the establishment of small no-take zones for mussels. However, considering that the Wadden Sea is a Marine Protected Area based on a trilateral agreement setting out common goals and a clear priority on allowing natural processes in the area, and the recent mortality of birds, the overall intensity of mussel fishing in the Wadden Sea is still to high. This is particularly true for The Netherlands. Also the size of no take zones is too low. The protection of intertidal mussel banks has been of particular concern, given their role in supporting mussel-feeding sea bird populations. Evidence suggests, however, that management focusing only on the protection of intertidal mussel banks may be overlooking important ecological differences between intertidal and subtidal communities.[102] For successful protection of mussel banks, a representative sample of mature mussel banks in submerged zones needs to be ensured.

6.10.3 Conclusions

Given the fact that *M. edulis* still remains a common species in most of the region, even abundant in areas with mature mussel banks, the importance of its conservation, notably as a reef-forming species, may not be apparent to many coastal users (eg those involved in fishing). A wider promotion of the need for protection of mussel banks, underlining the broader aims and objectives, in educational and awareness raising campaigns would be beneficial. In addition, better management of mussel fisheries is necessary, particularly in the Wadden Sea, and any management decisions need to be as open and transparent as possible.



6.11 *Chara* sp. Meadows

Chara meadows occur in waters with low salinity throughout the Baltic Sea region, where more than twenty species have been identified, including *Chara aspera*, *C. baltica*, *C. canescens, C. connivens* and *C. tomentosa*. Many species also occur outside the Baltic region, but find a stronghold in the Baltic Sea.

Chara species comprise of a group of stoneworts, which grow to a height of 30 to 90 centimetres, forming regular whorls of slender cylindrical branches. Species can be annual or perennial. *Chara* meadows commonly colonise areas to a depth of 2.5 metres and are characteristic of clear brackish waters. They are especially abundant in the shallow and sheltered, soft-bottom areas of the Danish fjords and the Swedish, Finnish and Estonian archipelagos, in coastal lagoons, lakes and pools. Some species colonise freshwater environments.

Relatively little is known about their life-cycles or natural fluctuations in population size. In comparison to other aquatic plants, *Chara* species are poor competitors and thus typical pioneer plants, taking advantage of transient, sparsely colonised substrates. Consequently, they rely, at least to some extent, on the natural dynamics of coastal zones.

6.11.1 Status and threats

Declines in *Chara* meadows have occurred along the coasts of most, if not all, countries bordering the Baltic Sea, and local extinctions have been recorded for some heavily polluted and exploited locations. Along the western Baltic coast of Germany, for example, coastal engineering, intense maritime recreation and pollution have eliminated most *Chara* meadows. This contrasts with the relatively undisturbed east coast of Germany, where the habitat is still widespread.[103] In other areas, such as certain parts of the Estonian shoreline, some species have increased their range while others have declined, leading to a change in community structure within *Chara* meadows.

Chara species are largely restricted to nutrient-poor environments and are therefore highly sensitive to eutrophication. They suffer from the resulting decreases in water transparency and are simply outgrown by other marine plants and algae. Competition from other vegetation may also prevent recolonisation of otherwise suitable habitat. Change in substrate quality due to eutrophication is also a common threat. A further threat is posed by sulphate-rich effluents, for example from Swedish pulp mills, which are believed to cause localised extinctions.

Chara meadows are also directly affected by habitat loss and disruption, notably due to coastal protection structures, sand dredging, boating, the deepening of channels and other harbour-related activities. Dredging is a particular issue in the northern parts of the Baltic Sea were the land-uplift is large. These may lead to increases in turbidity, changes in water salinity and/or changes in seafloor characteristics.

6.11.2 Management

While most *Chara* species have no specific legal protection, they are listed as key species for many of the coastal habitats protected under the Habitats Directive, and will therefore benefit from the efforts to create the Natura 2000 network of protected areas. In particular, they colonise many coastal lagoons, shallow inlets, estuaries and sandbanks. Suitable surveillance schemes will have to be established to assess the conservation status of these sites[XXXVIII].

Like many coastal habitats, *Chara* meadows will also benefit from improvements in water quality and better coastal zone management. In particular, a decrease in nutrient input from point and diffused sources and coastal planning sensitive to the need for naturally dynamic coastlines, which continue to provide a diverse mix of soft sediments and shallow lagoons, is essential for the safeguarding of *Chara* meadows in the Baltic and elsewhere.

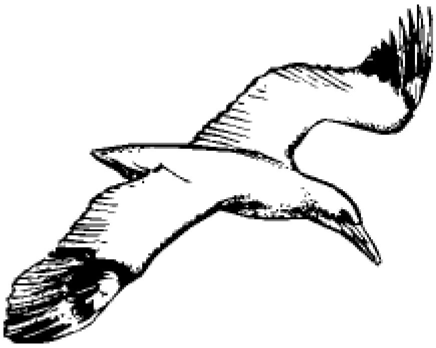
The HELCOM Red List Marine and Coastal Biotopes and Biotope Complexes refers amongst others to lagoons/fladas (Heavily Endangered), fjords/fjord like bays (Endangered), which are relevant biotopes for *Chara* meadows.

6.11.3 Conclusions

The dynamics of *Chara* meadows are still poorly known, and so is the distribution of the different species. New sites are still being discovered along the Baltic coasts. More surveys and research are therefore needed to truly assess the status of different species and the habitats that they form, and their role in the wider ecosystem. In addition, it is clear that while site protection, as required under the EU Habitats Directive, is one way of achieving conservation, it must be complemented by efforts to improve water quality and the health of the marine environment as a whole.

[XXXVIII] Article 11 states that 'Member States shall undertake surveillance of the conservation status of the natural habitats and species […]'

Impacts on this habitat will, for instance, need to be assessed in determining good ecological status under the Water Framework Directive.



7. Species Descriptions

7.1 Long-tailed duck (*Clangula hyemalis*)

The long-tailed duck can be found throughout much of northern Eurasia and North America. In western Eurasia, the breeding distribution of the species extends from the core range in western Russia, through northern Finland and the mountain ranges of Sweden and Norway, and as far as Iceland.[104] Long-tailed ducks commonly breed on tundra pools and marshes or along seacoasts and still-standing mountain waters, primarily in the Arctic region. The birds winter at sea, often in large, dense flocks offshore. They feed mainly on mussels, cockles, clams, crabs and small fish.

In Europe two regional sub-populations may be distinguished:[105] i) the Iceland/Greenland breeding population, comprising some 150,000 birds which winter in Iceland, north-western Britain and Ireland, and ii) the western Siberia/north-west European population, numbering approximately 4,600,000 individuals and wintering primarily in the Baltic. Non-breeding ranges are thought to overlap to some extent.

As much as 90 per cent of the long-tailed ducks in Europe winter in the Baltic Sea, notably the Gulf of Riga, Irbe Strait, the Hoburg Bank and Pomeranian Bay. The spring migration through the Baltic in late May is spectacular, with over 100,000 birds flying towards the north-eastern tundras on peak days.

7.1.1 Status and threats

The total north-western European population of long-tailed duck has been estimated at 4.7 million individuals. Of these, 4.3 million were estimated to winter in the Baltic.[106] This almost doubled previous bird counts, which were clearly under-estimates. During winter counts in the North Sea, close to 11,600 birds were recorded.[107] This is thought to be an underestimate given the species preference for offshore locations during the winter season and numbers may be closer to 20,000. Information on their conservation status and population trends are still sparse, particularly due to difficulties created by their extensive and often fairly inaccessible breeding range, but numbers seem to be fairly stable.

Many sea birds are relatively long-lived and able to forage and migrate over long distances. Generally, this makes them somewhat more resilient in terms of coping with environmental change. Nonetheless, seabirds have and are being affected by changes in their habitat, food resources, disturbance, and perhaps most importantly impacts on their physical integrity notably caused by chemical and other pollution.

Long-tailed ducks are often affected by oil pollution in their winter grounds. Even smaller, 'routine' oil spills from ships cleaning out their tanks can have severe localised effects, since the birds are so aggregated in the winter. In the Baltic, the wintering area overlaps with a busy shipping route, with traffic from Finland, St Petersburg and the Baltic States. The fact that 90 per cent of the north-western European population winters in the region makes it vulnerable. The risk of a shipping accident, causing a major oil spill, is therefore often seen as the key threat to the population. Long-tailed ducks also get entangled in fishing gear, but this does not seem to have any significant effects on the population.

7.1.2 Management

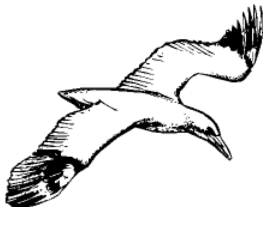
The Birds Directive (79/409/EEC) provides a general system of protection for all species of wild birds in Europe, as well as requiring the designation and management of sites for *inter alia* regularly occurring migratory species. The long-tailed duck is also listed in

Annex II as a species that may be hunted. The risks associated with oil spills in the Baltic has lead both conservation groups and HELCOM to look at possibilities of restricting shipping in this area. One option being investigated is the nomination of parts or the entire Baltic Sea as a Particularly Sensitive Sea Area (PSSA). Under HELCOM, the Baltic States have also agreed on a plan to minimise oil spills in the entire region. This consists of a combination of measures, such as free cleaning facilities in shipping harbours, and increased surveillance and prosecution of illegal discharges at sea.

Implementation has so far been uneven; some countries have progressed more than others. It also remains difficult to prosecute vessels for illegal oil spills. Unless caught in the act, vessels might have left the area, making it difficult for authorities to link vessels to spills. In addition, few courts and lawyers have sufficient experience to effectively prosecute this type of environmental crime.

7.1.3 Conclusions

Trends indicate that long-tailed ducks are in no immediate danger. The population is large and viable and shows no clear signs of decline. The huge aggregation of birds in the Baltic during the winter does, however, make the population particularly vulnerable to events in that area. A shipping accident leading to a major oil spill in the wrong place at the wrong time could wipe out most of the north-western European population. Minimising this risk can therefore be seen as the primary goal, to ensure the long-term survival of this species. There is also a need to continue population surveys and to estimate effects of smaller spills, as well as bycatch in fishing gear to ensure that sudden changes in the population do not go unnoticed.



7.2 Fulmar (*Fulmarus glacialis*)

The fulmar is a common pelagic bird in seas of north-western Europe. It breeds in colonies along the North Atlantic shores, from north-west France and northwards. It is common on the British Isles, Iceland, and locally in Norway. A fulmar resembles a compact herring gull, but is somewhat chubbier with the tube-like nose typical of the petrel family. Adult birds are 43-52 cm in length, with a wingspan of over one metre. They commonly nest on ledges on steep coastal cliffs or in burrows on inaccessible slopes, but will not reject ledges on buildings in areas of dense human habitation. Breeding colonies frequently include other bird species, such as kittiwakes, murres, and cormorants.

Also known as ‘shearwaters’, fulmars spend most of their time at sea, hunting for food. Fulmars are versatile foragers, taking crustaceans, fish and squid, and fish offal and whale flesh. Large gatherings of birds may be seen offshore, far from their colonies. They often follow ships. Thousands of birds can be seen trailing fishing vessels near the breeding colonies. Fulmars can dive in flight or while swimming on the water surface. They obtain their food by dipping, surface seizing, surface- plunging, pursuit-diving, and scavenging.

Fulmars migrate south from their largely Arctic feeding grounds to breed along the European coasts during September and October. They unusually form large colonies, and breeding pairs commonly produce a single egg per season, which is incubated for about eight weeks. Young leave the nest about seven weeks after hatching. The fulmar first breeds at the mature age of 8-10 years, and immature birds probably spend the first 3 years at sea. The fulmar is a comparatively long lived bird, with some individuals breeding until 40 years and older.[108]

7.2.1 Status and threats

Populations in the North Sea increased considerably in the last two centuries but seemed to stabilise in the 1990s. An estimated 571,000 pairs are thought to breed around the coasts of Britain and Ireland[109], and counts in the North Sea have estimated approximately 307,600 breeding pairs, or 3,744,000 wintering individuals.[110]

The reasons for recorded increases are still debated, but one likely explanation is the dramatic increase in easily available food in the form of fisheries discards.

The fortunes of seabirds are more tied up with fishing than any other human activity. There are direct effects of fishing practices on birds – such as entanglement in different types of fishing gear – but fisheries also have more subtle indirect effects on seabird populations, destabilising their community structure by manipulating the food chain. Fishing has reduced stocks of large fish (such as cod and mackerel) which eat smaller fish (such as sprats and sandeels), allowing the latter to multiply. This potentially increases the food supply for seabirds living on small pelagics.

The practice of discarding fish at sea is thought to have an even greater influence on seabird populations. As much as half of the fish caught by fishing vessels is routinely thrown overboard. Together with other fish waste thrown overboard, this has led to an increase in numbers of scavenging birds over the last century, notably fulmars, gannets and gulls which find rich pickings behind trawlers.[111] Attempts to reduce discarding are likely to affect breeding populations of the species affected, as well as of other seabirds on which they may prey. Effects will be most pronounced amongst the smaller scavenging species that prefer small discards, such as great skua and most gull species. Northern fulmar, which is more dependent on offal than discards, is likely to be affected. Though recent declines in haddock and whiting catches have already reduced offal availability.

Relatively large numbers of dead birds are found along European shores each year. The reasons for this are not entirely clear, but starvation and exhaustion during migration appear to be the main causes. This is natural selection at work, and ensures a strong breeding population. Breeding birds, however, are very sensitive to disturbance, notably approaching ships or aircraft. Nesting birds become agitated and may leave their nests in a rush, knocking eggs or chicks off cliff ledges.

Since much of their time is spent sitting on and feeding from the water surface, fulmars are sensitive to pollution from oil, and industrial and household litter, notably plastic wastes. Fulmars have been shown to ingest plastic pellets and accumulate them in their stomachs. While the consequences of this are not yet fully understood, it is thought that pellets reduce their ability to process food, and may increase the toxic burden on individual animals,[112] leading to a weakening of the immune system. Birds may also become entangled in plastic remains.

In addition, the introduction of certain species to offshore nesting places has been shown to have an adverse affect on breeding populations. Animals such as the brown rat, feral cats, foxes and mink pose a problem in the North Sea area, and may affect fulmar populations over time.

7.2.2 Management

The Birds Directive (79/409/EEC) provides a general system of protection for all species of wild birds in Europe, as well as requiring the designation and management of sites for *inter alia* regularly occurring migratory species. Efforts to minimise the impact of fishing on the wider marine ecosystem, making fishing practices more selective, and possibly banning discarding at sea, may well cause a decline in fulmar numbers. This does not mean that actions to make fishing practices more sustainable should be halted.

Fulmars would benefit from actions to reduce seabird bycatch, particularly in the long-line fisheries. Likewise, other actions to decrease problems related to pollution and littering would be beneficial, not just for the fulmar but a whole range of species and their habitats.

Disturbances are often regulated on a regional/local level. Many bird breeding sites are surrounded by areas closed to both shipping activities and leisure boats. This is normally regulated at national level and will be marked in maps and on sea charts. To minimise disturbance, ships should maintain a distance of 3 km from seabird colonies. Speed should be reduced and other measures taken to reduce noise.

7.2.3 Conclusions

The fulmar is one of the most numerous seabirds of the Northern Hemisphere, and only one example of the many seabird species that have actually increased over the last century. It is a good example of a species that may well decline in number once fishing practices become more sustainable. There are a number of other threats that need to be minimised, though they seem to have only localised effects on the species.

7.3 Alfonsinos (*Beryx* sp.)

There are two main species of alfonsinos in the OSPAR Maritime Area: *Beryx splendens* and *B. decadactylus*. These are relatively long-lived deep-sea fish species, with an average longevity between 11 and 13 years. They are reported to have low resilience, taking between 4.5 and 14 years for the population to double. Their maximum size is 70 cm (*B. splendens)* and 1 metre (*B. decadactylus*).

Beryx sp. mainly feed on fish, crustaceans and cephalopods. They inhabit the outer shelf and slope to at least 1,300 metres depth, and are often found over seamounts and underwater ridges, although young fish are pelagic. *B. decadactylus* is found around Iceland and Norway, down to the South Atlantic. There is evidence to suggest that the Azores region is close to the northern limit of distribution of *B. splendens* in the Mid-Atlantic Ridge.

The population structure of alfonsinos is not clear. Some investigations suggest that *B. splendens* occurs in relatively isolated populations on each of the many oceanic seamounts. Other studies suggest that significant genetic differentiation may occur between populations of *B. splendens* within the North Atlantic.

Total reported landings of alfonsinos rose from 225 tonnes in 1988, to a peak of 1,507 tonnes in 1994, falling back to an average of 492 tonnes between 1999 and 2001. Since 1995, catches of *Beryx sp.* have been reported from the wider Atlantic. The majority of catches used to be taken from around the Azores, but other areas to the north and east are now equally important.

7.3.1 Status and threats

The state of the stocks in the various ICES subareas where these species occur is unknown. Landings from the Azorean EEZ and outside the EEZ on the Mid-Atlantic Ridge once dominated. There are some indications that the stocks on various seamounts in the area were intensely exploited during the last decade. Certainly, reported catches in this region fell from a peak of 1,500 tonnes in 1994 to 199 tonnes in 2001.

Alfonsinos are usually a bycatch of demersal handline and longline fisheries and to a lesser extent, trawl fisheries. The main fishery around the Azores has consistently involved Portuguese vessels, although increased catches in 1994 and 1997 were associated with Russian activities. Spanish demersal vessels, mainly longliners, are active in other areas.[113]

7.3.2 Management

Alfonsinos is not known to be classified internationally as threatened or endangered, and is not listed under the EU Habitats Directive. Nevertheless, interactions of fishing activities on the Mid-Atlantic Ridge outside the Azores EEZ, and landings of alfonsinos from the traditional fishery within the EEZ, continues to be uncertain.

Given the likely isolated populations and their aggregating behaviour, management of these species needs to take their limited spatial scale of distribution on seamounts and the fishing activities in international waters into account.

Management of deep-sea fisheries in waters outside national jurisdiction falls under the competence of the North East Atlantic Fisheries Commission (NEAFC). Within national jurisdictions, management falls to the EU, Norway and Iceland. At its November 2002 meeting, NEAFC agreed, as an interim measure, to cap fishing effort levels on deep-sea stocks.

Within the EU, while total allowable catch limits were set for several deep-sea stocks in 2002, alfonsinos is not among them. EU vessels fishing for alfonsinos, eg in and around the Azores fishing zone, would need a deep-sea fishing permit under EU law (Regulation 2347/2002). The EU measures represent a step forward, but they fail to set a timetable for addressing fishing effort on deep-sea stocks, and do not provide for specific measures such as fishery closures that are or would be justified in the future to protect stocks.

7.3.3 Conclusions

It is clear that knowledge of *Beryx* sp. is limited and that additional research and data collection is necessary to ascertain the status of stocks, followed by suitable measures to manage fishing pressure effectively. To this end, ICES has issued a general recommendation that fisheries on deep-sea species be permitted only when they are accompanied by programmes to collect data, and expand very slowly until reliable assessments indicate that increased harvests are sustainable.

7.4 Common Skate (*Dipturus batis*, formerly *Raja batis*)

The common skate belongs to the cartilaginous elasmobranch family, along with rays and sharks. It is the largest of the European skates, with individuals growing to two metres or more in length and weighing as much as 100 kg. Common skates are scarce but widely distributed, found from Iceland and Norway down to Morocco.

Common skates feed predominantly on benthic species such as crabs and scallops, but have also been observed to prey on mackerel, herring, whiting, hake and dogfish. They are a bottom-dwelling species, inhabiting areas of soft-sediment seabed and are widely distributed along the shelf edge and in deeper waters. They have been taken from as deep as 1,000 metres.

The Greater North Sea/Celtic Sea area is thought to have been the common skate's primary habitat range, with up to 75 per cent of its population once present in these waters.[114] Population declines have, however, affected their distribution throughout the North-East Atlantic, and the species is no longer abundant in the North and Irish Sea.

Like most shark-like fish, the common skate is relatively long-lived – not uncommonly living beyond 50 years. It has a low reproductive rate, owing to low female fecundity and late age of maturity, making it extremely vulnerable to additional pressures. In addition, much is still unknown about the common skate's life cycle and ecological needs.

7.4.1 Status and threats

The common skate was once an abundant member of the demersal fish community in the North-East Atlantic. Fisheries data indicate that populations have been severely depleted in the central part of its range around the British Isles since the early 20th century. It is now considered rare and very sensitive, with strong evidence of significant declines in the North Sea and Irish Sea. There is uncertainty as to the status of offshore populations and the proportion of the overall species range that has been affected. The limited numbers of individuals means that research into its ecology has effectively become impossible.

While scientific knowledge about the common skate remains very limited, fishing has been identified as the main factor in bringing it to the brink of extinction. A slow growth rate and late maturity means juveniles have little or no chance of surviving to maturity in heavily fished areas. Fishermen are no longer targeting the species for commercial purposes – its rarity has made this unprofitable – but it remains vulnerable to bycatch in other fisheries, especially those using static and towed gear.

Further expansion of fishing activities into deep-water areas is likely to affect previously unaffected populations. French fisheries caught 400 tonnes of common skate in deeper waters (ICES areas VI and VII) in 2000.[115] An ICES study group has noted that fisheries operating on the edge of the continental shelf and continental slope have similar impacts as those recorded in the North Sea and Irish Sea.[116]

In addition to fishing pressure, bioaccumulation of pollutants through the food chain may also pose a considerable threat. This however remains speculative.

The species is considered 'endangered' by the IUCN, facing a very high risk of extinction in the wild in the near future.[117]

7.4.2 Management

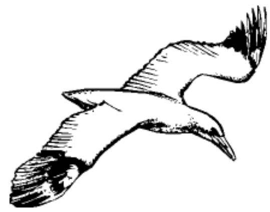
Skates and rays are included in the scope of the voluntary FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-SHARKS). States are to adopt a plan of action for the conservation and management of shark stocks (*Shark-plan*) if their vessels conduct directed fisheries for sharks or if their vessels regularly catch sharks in non-directed fisheries. States were to 'strive' to have a *Shark-plan* in place by 2001.

The EU has not adopted a shark action plan under the FAO initiative. At present, a single total allowable catch is set for all rays and skates in the North Sea/Artic region (ICES areas IIa and IV). This does not distinguish between species, and is not based on any analytical stock assessments. For 2003, the total catch that can be taken is 4,122 tonnes, of which 2,665 tonnes has been allocated to the UK (EU Regulation 2341/2002). No further measures have been introduced at EU level to limit (by)catches of rays and skates. According to the Bergen Declaration, however, competent authorities are urged to establish target reference points for skates and rays by 2004, and to determine the action to be taken if they are not met.

The common skate is not covered by the EU Habitats Directive. The species has, however, been proposed as being of special concern to OSPAR as part of their List of Threatened and/or Declining Species and Habitats. The UK Biodiversity Action Plan also commits to designating at least five refuge areas within which common skates are given legal protection from commercial fishing and deliberate killing or retention by anglers. Steps have also been taken in the UK and Ireland to discourage recreational anglers from catching and/or landing skates.

7.4.3 Conclusions

Research and monitoring programmes are needed to provide the basis for stock assessment and subsequent management measures. These should focus on monitoring life-cycles, growth, reproductive capacity and population dynamics (including migration). Centres of distribution of relict populations also need to be identified, followed by the establishment of refuge areas to protect common skates from commercial or recreational killing.



7.5 Baltic Sturgeon (*Acipenser sturio*)

The sturgeon was once common in European waters, inhabiting the open sea and rivers suitable for spawning. Like the salmon, the sturgeon migrates between its freshwater spawning grounds and its marine habitats. In the case of the Baltic sturgeon this includes the North Sea, Atlantic, and the brackish waters of the Baltic Sea. Long-distance migration of more than 3,000 km is not uncommon, particularly between different feeding areas. Their main food consists of worms, molluscs, crustaceans and small fish.

Sturgeons can reach up to 6 metres in length and 600 kg in weight, though the average catch size and weight is closer to 2 metres and 90 kg, respectively. Individuals have been shown to reach an age of 60 years or older. Female fish reach sexual maturity at between 11 and 18 years; males mature slightly earlier, between 9-13 years. Intervals between spawning differ depending on the species' range, and may vary from 1-3 years according to sex. The spawning season usually falls between April and July, with eggs placed on sand or gravel, hatching after 11-14 days.

Juvenile sturgeons stay in the freshwater environment for 1-2 years and then migrate into the brackish waters of the estuary. Regular migrations between the estuary and the sea occur during the first years. After spawning in rivers, adults spend much of their time in marine environments, particularly those areas with sandy and muddy substrates.

7.5.1 Status and threats

Evidence of a decline in sturgeon populations dates as far back as the early and mid-19th century, when most pressures were attributable to fishing. While little information exists in terms of past and current trends, it is evident that population declines have been drastic and terminal. Today, the Baltic sturgeon is almost invariably described as near extinct, and rare sightings usually concern animals trapped in fishing gear. The remaining Atlantic population is centred around the Gironde-Dordogne-Garonne catchment in France, in what is perhaps the world's last breeding area of this species.[118]

Its survival and reproduction depends on a wide range of habitats. Key threats affecting sturgeon populations include the obstruction of migration routes, water pollution, notably in their freshwater environments, fishing and damage to riverine spawning grounds.

7.5.2 Management

The species is considered 'critically endangered' by the IUCN (IUCN, 2002). It is further listed in Annex II and IV of the EU Habitats Directive as a species in need of strict protection, and whose conservation requires the designation of Special Areas of Conservation (SACs) [XXXIX]. It is also listed under Appendix I of CITES. The latter lists species under threat of extinction, which are or may be affected by trade. Trade in these species will thus only be permitted in very limited circumstances. In 1997, the Conference of the Parties to CITES further resolved to curtail illegal fishing and exports, and to promote regional agreements between range States to bring about proper management and sustainable utilisation of sturgeons[XL]. The Baltic species has been proposed for inclusion on the OSPAR List of Threatened and/or Declining Species and Habitats.

HELCOM has made efforts to re-establish the sturgeon in the Baltic region (1997-2001). Further national measures for the reintroduction of the species have been taken by other European states, including France[119], Germany[120] and Poland[121].

7.5.3 Conclusions

Given the poor conservation status of the once common sturgeon, reintroduction measures are perhaps the last option in its survival in the wild. However, such measures can only bear fruit if pressures that led to the species decline, notably fishing/bycatch and habitat degradation, are addressed and significantly reduced. Impacts on this species will need to be assessed in determining good ecological status under the Water Framework Directive and, potentially, action taken to address hydromorphological issues (ensuring migration, etc) as programmes of measures are developed. Moreover, reintroduction and habitat rehabilitation initiatives need to be complimented by adequate awareness-raising campaigns, giving a voice to the plight of the sturgeon and avoiding further killings by uninformed fishermen.

7.6 Atlantic Cod (*Gadus morhua*)

Cod is one of the commercially most important fish species in north-western Europe. It has a maximum life

[XXXIX] Article 4 of the same Directive, however, specifies that 'for aquatic species which range over wide areas, such sites will be proposed only where there is a clear identifiable areas representing the physical and biological factors essential to their life and reproduction.'

[XL] CITES Resolution 10.12, as amended by the 11th COP, on the Conservation of Sturgeons.

span of 25 years, and has the potential to reach a size of 2 metres and more than 90 kg, if left to mature. Such superior specimens are now rare due to overfishing of most (if not all) stocks.

This is a cold water species, with Atlantic cod distributed around Greenland, Iceland and along European coasts from the Barents Sea to the Bay of Biscay. There are several distinct stocks, including two in the Baltic Sea. There are also many distinct populations, involving the more stationary coastal stocks, and migratory stocks, such as those around Newfoundland, Norway and Iceland.

Cod feeds on a wide range of marine fish and invertebrates including haddock, whiting, shrimp and squid, and even young cod. Key breeding grounds within the North-East Atlantic include the mid- and southern North Sea and the Bristol Channel, where breeding commonly takes place between January and March. In the Baltic Sea, the Bornholmian deep is recognised as the important spawning area for cod and is accordingly protected during the summer. The other two, Gdansk and Gotland deep, have similar features, but are not protected. Breeding periods vary between different stocks. An average female produces between half a million and nine million eggs. Like many fish species, female cod produce more eggs the larger they are, making the decreasing average size in the populations an issue that affects reproduction.

7.6.1 Status and threats

It is now widely recognised that Atlantic cod populations in the North-East Atlantic and the Baltic Sea have suffered severe declines in recent decades. In November 2000, the International Council for the Exploration of the Seas (ICES) indicated that cod stocks in the North Sea were 'at serious risk of collapse'. Stocks in the North Sea, English Channel, areas west of Scotland, the Celtic Seas, the Irish Sea and the Baltic Sea are considered to be 'outside safe biological limits'. This situation follows the now infamous crisis off the northeast coast of Newfoundland, where, according to the Committee on the Status of Endangered Wildlife in Canada, stocks have declined 97 per cent in the past 30 years due mainly to fishing. Globally, IUCN (2002) lists cod as 'vulnerable' given the observed and/or estimated reduction of at least 80 per cent of the population over the last 10 years.

The population declines have significantly affected the spawning stock (ie the proportion of a cod population capable of reproducing), and therefore also recruitment and ultimately the sustainability of the fisheries. While the number of mature cod in certain areas has recently begun to rise, following strict restrictions on fishing activity, recruitment remains low.

Without question, over-fishing in directed fisheries and as by-catch in mixed fisheries is the primary threat to the Atlantic cod. In the North Sea, for instance, more than 70 per cent of the cod reaching maturity each year is removed by the commercial fishing sector.[122] Persistent fishing pressure has also selected against fast-growing and late-maturing fish, leaving fish that mature when younger and smaller. This has been shown to result in a significant reduction in the mean spawning age of intensely exploited stocks.[123]

The impact of large-scale fishing for prey species for cod, such as sandeels, is not known but may have an impact the potential of cod to recover. Recent studies have raised concern about the combined impact of certain pollutants, notably increased UV radiation due to ozone depletion, impacting negatively on cod larvae. Stocks are also sensitive to changes in climate, water temperature and oceanic currents. These factors compound problems caused by over-fishing, which remains the most critical issue.

7.6.2 Management

Poor management and the current over-capacity of commercial fishing fleets are blamed for bringing many Atlantic cod stocks to the brink of collapse. The most critical stocks fall totally or partially under EU management, and a series of emergency EU measures have been introduced to stem the decline in stocks, including short-term measures to regulate fishing effort on several stocks. In October 2002, on the basis of all time low stock levels and continued fishing effort, ICES recommended a closure of all fisheries for cod stocks in the North Sea, Skagerrak, Irish Sea and waters west of Scotland, including fisheries taking cod as bycatch. A long-term recovery plan has now been proposed (COM(2003)237) covering four stocks. The recovery plan seeks to combine fishing limits, effort reductions and increased control and enforcement. Agreement on the plan is expected before the end of 2003.

In the Baltic Sea, the International Baltic Sea Fisheries Commission (IBSFC) has agreed a long-term management plan for cod, although the European Commission has come forward more stringent emergency measures. This proposal followed a proposal from Sweden to introduce a unilateral ban on cod fishing, which was rejected by the IBSFC and the European Commission.

Atlantic cod is being put forward by OSPAR as a species of special concern, as part of their List of Threatened and/or Declining Species and Habitats.

7.6.3 Conclusions

Atlantic cod stocks are in a critical condition, the primary threat posed by over-fishing. After years of inadequate fisheries management, there is a possibility that problems may now be addressed, at least partially. Meanwhile, the Newfoundland and Labrador Atlantic cod populations which crashed a decade ago have recently been designated as threatened and endangered, following assessments by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). They provide a sobering example of what may lie ahead for the North-East Atlantic and the Baltic Sea should management turn out to be ‘too little and too late’.

7.7 Sharks

Sharks belong to an ancient group of fishes with skeletons of cartilage and teeth of modified scales. Atlantic species are diverse in terms of size, range, feeding strategies and habitat requirements. Despite our long fascination with sharks, we know relatively little about their remarkable adaptation to the underwater world. The largest known species, the whale shark (*Rhincodon typus*), can grow to 20 metres in length and weighs up to 34 tonnes; smaller species, including dogfish, usually grow to no more than one or two metres in length. Sharks are commonly slow growing and have a low reproductive rate. Many species, including deep-sea species, appear to be highly migratory.

The basking shark (*Cetorhinus maximus*) is the second largest fish species. It has a wide distribution within the temperate regions of the world’s oceans, including the Atlantic. Individuals migrate, showing seasonal movements between the open ocean and certain coastal feeding grounds. Little is known about their life history traits and evidence of suggested decline relies heavily on anecdotes.

Several deep-water catsharks (Scyliorhinidae) and squalid sharks (Squalidae) are found in the North-East Atlantic, the latter including Portuguese dogfish (*Centroscymnus coelolepis*), leaf scale gulper shark (*Centrophorus squamosus*) and gulper sharks (*Centrophorus granulosus*). Catsharks lay relatively small numbers of large eggs, while the squalid sharks produce live young. The deep-water sharks are often segregated by sex and size, and sometimes, apparently, also by size and depth.

The whale shark and the basking shark are plankton feeders, which filter large amounts of water through their specially adapted gills, thus sifting out small shrimps and other marine organisms. Many of the smaller sharks, including the white shark (*Carcharodon carcharias)* and the blue shark (*Prionace glauca*) are voracious predators. Their position in the marine food chain as top predators and scavengers suggests that sharks play an important ecological function in maintaining a careful balance within marine communities, their structure and diversity.

7.7.1 Status and threats

Estimates of global or regional populations are not readily available for shark species. IUCN however assesses the global status of the great shark, the gulper shark, and the basking shark as 'vulnerable' in its 2000 Red List. Some local or regional populations in the North-East Atlantic are considered as being endangered.[124]

Given their unique life history traits, sharks are comparatively sensitive to increased rates of mortality. The main threat is thought to be overfishing, whether in targeted fisheries or as bycatch. The intense exploitation of the basking shark, for instance, has had devastating effects on local populations in Norwegian, Irish and Scottish waters, as well as in certain areas of Region V (the wider Atlantic). Catch estimates for the same species in the North-East Atlantic show a 90 per cent drop between 1960 and 1990.[125] There is uncertainty as to whether the decline in catches reflects a decline in population.

While fishermen have prosecuted sharks for their liver oil, the Leaf scale gulper shark and the Portuguese dogfish are now routinely also landed for their fins. These sharks are caught in trawl fisheries to the west of the British Isles or in longline fisheries mostly along the continental slopes of Spain and Portugal. Significant shark numbers are also caught incidentally as bycatch. Of 51,205 fish landed by the Spanish swordfish fleet in the south of the wider Atlantic and beyond, 9990 were sharks.[126] Portuguese dogfish is an important bycatch of the longline fisheries for black scabbardfish. The birdbeak dogfish (*Deania calceus*) tends to be discarded because it is difficult to skin. Markets are being developed for a few other species. There are some landings of basking shark outside the EU (ICES area IIa). For larger species such as the basking shark, collision with sea traffic is also considered to contribute to increased mortality.

The removal of top predators from an ecosystem is known to have profound effects on the structure of littoral and terrestrial communities. In the absence of controls by top predators, the populations of the herbivores and detritivores become unstable, fluctuate and the overall diversity decreases. Discarding bycatch and offal will also upset competitive balances within communities by favouring scavenging species.

7.7.2 Management

The lack of knowledge surrounding shark species creates significant problems in terms of protecting them from fishing impacts or from habitat degradation and/or destruction. Various precautionary measures can however be applied to restrict targeted fisheries and reduce incidental bycatch. The most important are gear restrictions, seasonal and area closures to protect pupping/egg laying females and nursery grounds, and trade prohibitions. Minimum and maximum landing sizes may also be valid for targeted shark fisheries, depending on the life history of the target species. Limiting net or long-line soak time may reduce bycatch mortality. It may also be possible to vary baits and fishing methods to reduce bycatch.

In order to address knowledge and management deficiencies, an International Plan of Action (IPOA) - SHARKS has been elaborated within the framework of the FAO Code of Conduct for Responsible Fisheries. This calls on States to adopt a national plan of action for the conservation and management of shark stocks (*Shark-plan*) if their vessels conduct directed fisheries for sharks or if their vessels regularly catch sharks in non-directed fisheries. States are asked to have a *Shark-plan* by the COFI Session in 2001. In addition, the basking and whale Sharks that are now listed in Appendix II of the CITES Convention.

The EU has yet to develop a 'national plan of action' under the FAO initiative. EU proposals to address shark finning are before the Council, however. At the national level, the basking shark is protected in UK waters and the Isle of Man. To support national and EU initiatives, scientific assessment work is being taken forward by ICES. The aim is to establish target reference points by 2004, as agreed at the 2002 North Sea Conference.

7.7.3 Conclusions

To ensure effective implementation of the IPOA-SHARKS in the North-East Atlantic, a detailed monitoring and reporting system is required, covering catches, releases, landings, imports and exports by species and location. In the meantime, given the limited scientific data presently available on/for (many) shark species, and their limited capacity to recover from significant population declines, a precautionary approach should be taken to their management, as advocated by ICES.

7.8 Atlantic salmon (*Salmo salar*)

The Atlantic salmon is found throughout the Atlantic region and the Baltic Sea. Like most salmonids, it returns to the riverine spawning grounds to breed, migrating up-stream during the autumn months and spawning. Some die without returning to sea; others survive and get a second chance. Young salmon stay in the freshwater environment for up to three years before they migrate out to the open sea.

At sea, salmon prey on other fish and crustaceans. Key feeding grounds in the Atlantic are believed to be the sub-arctic waters off the coasts of Norway, Greenland and the Faeroes. During the marine part of their life cycle, Atlantic salmon can grow to a considerable size, weighing up to 20 or 45 kg for females and males respectively. Their preferred water temperature lies between 4º and 10ºC.

7.8.1 Status and threats

Many salmon populations are in serious and long-term decline due to a number of pressures that take their toll at various stages of their complex life-cycle, including damming, habitat destruction and fishing. The destruction of migration routes and spawning grounds by water power stations, dams and other artificial impediments, has been a major issue, especially after the 1940s when hydroelectric power production rapidly expanded. Salmon has also been affected by pollution, something thought to play a role in the mysterious immune deficiency disease, M74, that salmon in the Baltic Sea has suffered from over the last few decades. From 1992 to 1996, more than 50 per cent of all young salmon died from the disease.

Salmon is still targeted by some fisheries in the UK, Ireland and Norway, as well as in the Baltic. This has potentially significant impacts, particularly when large numbers of returning adults are caught in the river before spawning. In the Baltic, wild salmon are largely threatened by offshore driftnet and longline fisheries, which are aimed at released salmon but coincidentally also catch wild salmon.[127] Approximately 5.5 million smolt are released each year into rivers affected by hydroelectric dams, generating a strong salmon fishery in the Baltic. Overall, however, scientists are more concerned about the levels of bycatch of young salmon in mackerel and herring fisheries.

Salmon populations are thought also to suffer the effects of climate change. In particular, reductions in population density have been linked to changes in water temperature. In addition, climate change is likely to have indirect effects on salmon through impacts on their habitats and food resources.

The enormous expansion of salmon farming, notably in Scotland and Norway, presents a comparatively new threat to wild salmon populations. Intensive fish farming increases the risk of transmission of disease and parasites from farmed fish to wild salmon, an issue linked to the devastating outbreaks of, for example, salmon lice and the near collapse of some local populations (eg Infectious Salmon Anaemia virus and Furunculosis). The use of chemicals to treat or prevent diseases can also have major implications for wild stocks.

Interbreeding between wild and escaped farmed salmon, including genetically modified fish, is of growing concern. Norway, the largest producer of farmed salmon, recorded 276,000 escapes in 2000. This should be seen against wild stocks that number approximately 1 million. In Scotland, 420,000 escapes were recorded, compared to 60,000 local wild salmon.[128] Wild salmon stocks in individual rivers bear unique genetic traits, which reflect their close adaptation to their respective environments. The mixing of their gene pool with introduced traits may lower the long-term chances of survival in the population.

7.8.2 Management

Atlantic salmon has been proposed as being of special concern to OSPAR, and to be part of their List of Threatened and/or Declining Species and Habitats. In the meantime, Atlantic salmon, whilst in freshwater, is covered by Annex V of the EU Habitats Directive. This allows for the management of takings in the wild, to ensure favourable conservation status of the species.

In order to manage the large Baltic fishery, the International Baltic Sea Fisheries Commission (IBSFC) in 1989 decided to adapt catch levels to facilitate an increase in wild populations; in 1991, catch levels were at least partially adapted to the needs of wild salmon. Following the outbreak of the M74 disease, a Salmon Action Plan was agreed by the IBSFC in 1997. The main goal is to restore wild salmon populations to at least 50 per cent of the potential capacity of each river by 2010, and to encourage the establishment of wild salmon in potential salmon rivers. The Salmon Action Plan has prompted management measures in the Baltic region, and also resulted in increased efforts to compile existing knowledge of the state of salmon.

The North Atlantic Salmon Conservation Organisation (NASCO) is responsible for managing most Atlantic salmon in the OSPAR area. Individual countries, such as Norway and Iceland, are supporting efforts to protect threatened populations. Both countries have closed large areas to salmonid aquaculture. Norway has also designated rivers as "National salmon rivers" where salmon is given particular protection from damming, aquaculture and road-building.

7.8.3 Conclusions

As noted by NASCO (1999), many salmon populations are threatened, despite management measures implemented over the last decade. Salmon are still not responding in the way that gives cause for optimism.[129]

There is an increased understanding of the plight of salmon and the need to restore or reshape migration routes in their spawning rivers. Impacts will need to be considered in determining good ecological status under the Water Framework Directive and, potentially, action taken to ensure migration routes, as programmes of measures are developed. Additional measures are needed to support tighter restrictions on fish farming, together with no-go areas to protect the wild salmon. Bycatch in other fisheries needs to be tackled through appropriate gear development and take-up. ICES has emphasised the importance of managing salmon stocks on a river-by-river basis, recommending that salmon stocks in the whole of the Atlantic be based on local assessments of the status of river and sub-river stocks.[130]

7.9 Harbour porpoise (*Phocoena phocoena*)

The harbour porpoise is the smallest cetacean in the North-East Atlantic and Baltic Sea. The species is widely distributed in shelf waters but usually occurs at low densities. It tends to travel in small groups of one to three individuals, although larger groups may be found in rich feeding grounds. Individuals live up to 12 –15 years, reaching sexual maturity at three to four years. Female porpoises on average give birth to a single calf every one to two years; the gestation period is 10 to 11 months. Their common prey species are herring and sandeels, or other small schooling fish species.

It is possible to distinguish between a series of regional subpopulations, at least two of which occur in the Baltic region - the Skaggerak/Kattegat population and the Baltic proper population. Baltic populations are markedly different from those in other areas of the North-East Atlantic.

7.9.1 Status and threats

European waters have witnessed a drastic decline in harbour porpoise populations, now rarely seen in the British Channel, as well as being absent from many parts of the Baltic Sea.[131] Studies off the coast of Cornwall, have recorded a 90 per cent reduction in sightings over the last 50 years.[132] Of the populations in the OSPAR area, the Baltic Sea population is the worst affected. Their occurrence has become much less common compared to the 1960s - and their range decreased significantly, to as few as 599 animals.[133] With numbers as low as this, there are concerns as to the lack of intermixing between regionally distinct subpopulations, and hence a lack of vital genetic exchange. Inbreeding and the associated reduction of genetic diversity are linked to significant increases in the vulnerability of populations, notably to pressures exerted by humans.

The IUCN classes the harbour porpoise globally as 'vulnerable' throughout its range, meaning that it is considered at high risk of extinction in the wild in the medium-term future.[134] Populations in the Baltic and Black Sea are listed as endangered which means that there is a risk of extinction within three generations. According to HELCOM, the present population may be classed as vulnerable or endangered. The species is further listed as a 'priority' species under the EU Habitats Directive, and has been proposed as a priority species on the OSPAR List of Threatened and/or Declining Species and Habitats.

Entanglement in fishing nets and subsequent drowning has been identified as the most serious threat to Harbour porpoise populations, with as much as six percent of individuals of some local populations affected annually.[135] Surveys in the North Sea have shown bycatch rates of approximately two per cent of the total population per annum.[136] In extreme cases, bycatch related mortality might lead to localised extinction. While harbour porpoise deaths resulting from bycatch are associated with different types of fisheries, the gear type which has been identified as the most problematic is bottom set gill nets. In the Baltic, in addition to bottom set nets, there is also concern about bycatch of harbour porpoises in the Baltic drift nets. Driftnet fishing has been banned in all EU waters, except the Baltic Sea, and for all EU fishing vessels outside these waters.

Pollution is another serious threat to harbour porpoise populations globally, and populations in the North-East Atlantic and Baltic seas in particular. As a top predator, harbour porpoises accumulate and magnify toxins in their environment, notably by accumulation through the food chain. Of particular concern are high levels of heavy metals, such as lead and mercury, polychlorinated biphenyls (PCBs), which have their source in paints, hydraulic liquids etc, chemicals such as the pesticides DDT and Dieldrin, as well as other organic and radioactive pollution. High pollution levels tend to have their greatest impact on the health of individuals by suppressing the immune system and making animals vulnerable to infections.

7.9.2 Management

In 1996, HELCOM recommended that 'highest priority' be given to the mitigation of porpoise bycatch and that, amongst others, the establishment of protected marine areas for harbour porpoise be considered, within the framework of the Baltic Sea Protected Areas (BSPAs) (Recommendation 17/2).

Special Areas of Conservation (SACs) are also to be designated for harbour porpoises under the EU Habitats Directive, as long as areas can be identified that are essential to their life and reproduction. At present however few if any Natura 2000 sites have been proposed specifically for the harbour porpoise. The Directive also requires EU Member States to establish a system to monitor the incidental capture and killing of all cetaceans, and in the light of the information gathered to introduce conservation measures to ensure that incidental capture and killing does not have a significant negative impact on the species concerned. There have been very few independent observer schemes in EU waters,[137] making it difficult to identify the scale of the problem and the necessary management measures although it is now accepted that bottom set gill nets pose a significant risk where they are set in areas frequented by porpoises. Denmark has taken steps to address bycatch by making 'pingers' mandatory since 2000 for the wreck fisheries in the period August-October.

In 2000, the Parties to ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas) agreed to reduce harbour porpoise bycatch to less than 1.7 per cent of the best population estimate. They further underlined an intermediate precautionary objective to reduce bycatch to less than 1 per cent of the best available population estimate.

A Recovery Plan for the Baltic harbour porpoise was agreed under ASCOBANS in 2002, with an interim goal of restoring population levels to at least 80 per cent of its carrying-capacity levels (Jastarnia Plan, 2002). The Recovery Plan focuses on the reduction of fishing effort, notably in the most damaging fisheries (driftnet and bottom-set gillnet fisheries), the changing of fishing methods away from particularly harmful gear in the longer term, and the use of 'pingers' as a mandatory but strictly short-term mitigation measure, as well as the development of alternative gear. Ministers at the Fifth North Sea Conference in March 2002 have committed to developing and adopting a species recovery plan for the North Sea 'as soon as possible' (Bergen Declaration).

7.9.3 Conclusions

Given the dispersed and migratory nature of the species, a site based approach to harbour porpoise conservation is clearly not a substitute for reducing pressure on populations, notably resulting from fishing and marine pollution. The threat posed by fishing gear is not adequately addressed through the deployment of pingers, which are helpful in the short term only. There remains a need to develop alternative approaches that combine substantial fishing effort reductions with the introduction of alternative fishing gear, particularly in the high risk bottom-set gillnet fisheries. Countries need to meet their obligations to monitor bycatch of harbour porpoise but given the clear identification of certain fisheries which pose the greatest threat (ie. bottom set gill nets), failure to monitor bycatch of harbour porpoise, should not stand in the way of taking action to reduce porpoise bycatch.

7.10 Blue whale (*Balaenoptera musculus*)

The blue whale is the largest living animal on the planet. It is found in all of the world's oceans, with animals frequently migrating long distances between their northern feeding and calving areas, to equatorial wintering and breeding grounds.

The North Atlantic population is thought to divide into two separate stocks: the Western North Atlantic stock and the Eastern North Atlantic stock that is present in the OSPAR Maritime Area. In both northern hemisphere stocks, individuals reach approximately 25 metres in length and can weigh 90,000 kg. Average life expectancy is between 30 and 90 years. Their migration patterns are still not fully understood, although some blue whales are known to winter near the Azores and feed around Iceland, the Barents Sea and Spitzbergen during the summer.

The blue whale belongs to a group of non-toothed 'baleen' whales. The blue whale has the most limited diet of all the great whales, feeding almost exclusively on small planktonic, shrimp-like krill. The animals gulp large quantities of water into their mouths and then force it across the baleen plates back into the sea. The krill are caught in the filter created by the overlapping fibrous edges of the plates, and are swallowed by the whale. A blue whale is thought to consume between two and four tonnes of krill each day, in order to meet its energy requirements.

Blue whales have a very low reproductive rate and late age of maturity. Females are thought to reach maturity at 5 to 10 years, then bearing a single calf every two to three years. The gestation period is 10-11 months and calves are nursed for about seven months. The only known natural predator of blue whales, other than humans, is the Orca whale (*Orcinus orca*).

7.10.1 Status and threats

Due to their speed and size, blue whales were not hunted until the late 19th and early 20th centuries. However, the advent of steam-powered vessels, factory ships and more powerful harpoon guns by the 1930s led to thousands of animals being taken around the world, peaking at nearly 30,000 animals in 1930-1931. The vast majority is thought to have been taken in Antarctic waters.

The International Whaling Commission (IWC) banned hunting of blue whales in 1964. Killing continued up to 1980, but none have been reported in recent years. Given their low reproductive rate and specific life history traits, populations have been slow to recover from historic overexploitation. Changes in available food resources, for example, due to global climate change, and chemical poisoning could be putting additional strain on population recovery. Collisions with marine traffic also pose a threat to whales during migrations.

Today, the blue whale is severely depleted throughout its range and is classified as endangered by IUCN, with the North Atlantic stock classified as vulnerable. While the North Atlantic stock is believed to consist of around 13,500 animals, some estimates suggest there to be only a few hundred to a thousand individuals.[138] There is currently no agreement on either numbers or trends for North Atlantic stocks.

Baleen whales are also vulnerable to acoustic disturbance, due to their use of low frequency sound to navigate and communicate. Noise from oil and gas exploration, the raising and dismantling of oil rigs, naval sonar use and explosives testing, acoustic devices to deter marine mammals from fishing nets, and engine noise from ships, may all have far-reaching and long-term effects on the social and foraging behaviour of blue whales, as well as their migration. Of particular concern in this respect is the extension of oil exploration into the Atlantic Frontier – an important migratory route for the blue whale.

7.10.2 Management

Given the poor recovery of blue whales, despite the 1964 moratorium, the IWC Scientific Committee held two workshops in the mid-1990s to consider the effects of chemical pollutants, climate change and ozone depletion. A 1998 IWC Resolution urged further research into the impacts of environmental change on whales. IWC scientists are to give greater priority to research on environmental threats and to collect and share this information with other scientific bodies.[139]

The blue whale is listed among species to be covered by a system of strict protection under the EU Habitats Directive, prohibiting the deterioration or destruction of breeding sites or resting places. There is also a requirement to monitor incidental killing and, in light of information gathered, Member States are to undertake further research or conservation measures to ensure this does not have a significant negative impact on the species concerned.

The blue whale is also listed under Appendix I of the CITES Convention and has been proposed as being of special concern to OSPAR as part of their List of Threatened and/or Declining Species and Habitats.

7.10.3 Conclusions

The low population densities of blue whales renders research on their behaviour, ecological requirements and population trends difficult. Much of the natural population variability in the past will have been masked by the sizeable impact of whaling, while the resulting low population densities are now likely to magnify problems relating to natural variability.

It is clear that a ban on commercial whaling is not sufficient to ensure species recovery. Further measures addressing other threats and stresses, particularly acoustic noise, as well as marine pollution and collisions with maritime traffic, may have to be taken to ensure recovery.

7.11 Bladderwrack (*Fucus vesiculosus*)

Bladderwrack is a brown macroalgae, which occurs along the northern Atlantic and Pacific coasts. It is easily recognised by the tough, air-filled pods or bladders situated along its stem to help it float. Bladderwrack colonises hard bottoms of moderately exposed to exposed shores, down to a depth of approximately six to ten metres. It is widely associated with tidal areas. Its geographic distribution is strongly dependent on salinity, levels of light intensity and the occurrence of suitable substrata. Other important factors influencing distribution include biological interaction with other organisms, for example, grazing animals such as crustaceans and gastropods, ice scouring, and nutrient levels in ambient water.

In the Baltic Sea, bladderwrack is the dominant macroalgae. It does, however, prefer the more marine conditions of the Atlantic, and frequently coexists with saw wrack (*Fucus serratus*) in the south of the Baltic Sea. Bladderwrack areas are among the most species rich habitats in the region, providing shelter, feeding and spawning ground for some thirty animal and algal species, amongst them many filter feeders such as barnacles or the common (blue) mussel.

7.11.1 Status and threats

Bladderwrack experienced dramatic declines in the late 1970s in many locations in the Baltic Sea, notably along the Finnish and Estonian coasts.[140] The most severe effects have been associated with a decrease in the maximum growth depths. The depth limit of bladderwrack along the Swedish coast, for instance, decreased from eleven to approximately seven metres below sea level between the 1940s and 1980s.[141] While some recovery has taken place since, this is not evident for the lower sections of the shore. This change is most likely caused by decreasing light penetration.

As with eelgrass communities (*Zostera marina*) and to some extent maerl, increased nutrient input and the associated increase in algal abundance in the water column reduces the depth to which light penetrates, thus inhibiting photosynthesis at lower levels. In addition, more competitive opportunistic annual filamentous algal species may smother bladderwrack plants. The inflow of oxygen-rich saltwater from the North Sea in 1993-1994 temporarily improved the situation in the Baltic Proper and the western waters of the Gulf of Finland. Overall, however, the problem has persisted, and surface accumulations of blue-green algae were particularly extensive during the warm summer of 1997.

In addition to eutrophication, changes in the community structure of local bladderwrack communities can have a severe impact on species distribution. In particular, it has been suggested that decreases in certain fish populations may lower the predation pressure on some benthic communities and thus lead to overgrazing of bladderwrack.[142]

7.11.2 Management

While considerable declines of bladderwrack are evident in the Baltic region, it is still comparatively common in the areas where salinity is high enough. In order to reduce pressures on the species, it is necessary to urgently and permanently curb the nutrient load to the Baltic Sea, in particular by: i) reducing inputs from municipal wastewater treatment plants, ii) tackling diffuse sources such as agriculture and transport, and iii) decreasing pollution from shipping – one of the largest sources of nitrogen deposition. Sea transport contributes 12-20 per cent of the total nitrogen input.[143]

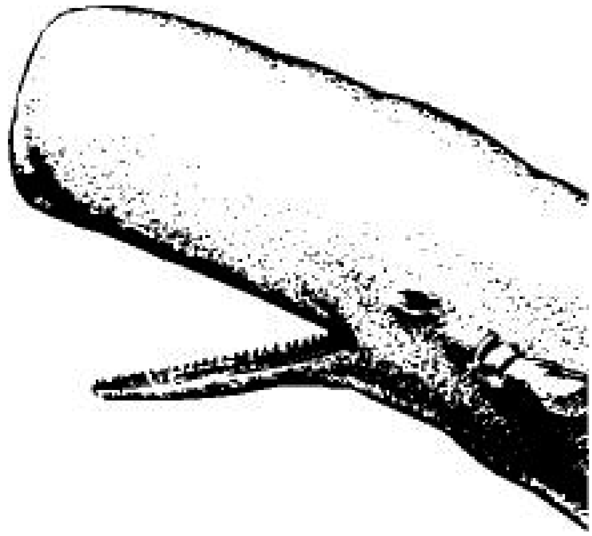
As early as 1988, Ministers meeting at the 9th Ministerial Conference under HELCOM agreed to 'reducing discharges from point sources, such as industrial installations and urban wastewater treatment plants […] in the order of 50 per cent […] as soon as possible but not later than 1995'. Since then, a raft of HELCOM recommendations has addressed the issue of nutrient input, and some progress has been made in implementing mitigation measures and in introducing new legislation, particularly within the EU (see section

4.2). After a substantial review of progress ten years later, Ministers reaffirmed their commitment to achieve the 1988 goal, notably by defining a series of more specific targets to be realised before 2005.[144] Overall, however, regional trends still give reason for concern.

Projects like the Baltic Eutrophication Regional Network (BERNET) in 1999-2001, involving co-operation between seven regions around the Baltic Sea and aimed at improving nutrient management by identifying the key sources and analysing the environmental, economic and political aspects of the problem, can help to consolidate a more strategic approach.

7.11.3 Conclusions

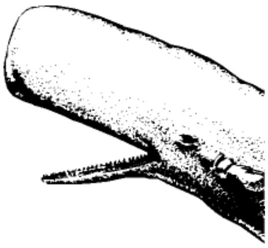
Eutrophication and its wider effects on the marine environment is clearly the main threat to one of the more valuable habitats in the Baltic Sea region - bladderwrack belts. A number of efforts have been made over the last 15-20 years to deal with both the issue of eutrophication and more specifically the decreasing occurrence of this macroalgal species. This has lead to some improvements, locally of great importance, but euthrophication issues remain one of the main challenges for marine conservation in the Baltic region. With its densely populated catchment area, small water volume and limited water exchange with the Atlantic, nutrient inputs in the Baltic Sea remains a hard nut to crack. The regional co-operation under HELCOM, the Baltic Agenda 21 process and, within the EU, the EU water policy, are important in this respect. In order to reverse trends, however, efforts at the national level will need to be stepped up, as well as tracking broader drivers, including EU agricultural policies.



8. Summary and Conclusions

After a rather slow start, marine environmental protection has made tremendous strides since the 1970s, reflected in and spurred on by developments in international environmental conventions and initiatives, with the OSPAR and HELCOM regional seas Conventions, and the series of North Sea Conferences making substantial contributions. These efforts have been supported and reinforced by a mounting body of EU environmental law, as well as national policies, essentially seeking to tackle the negative effects of economic development.

While international and EU commitments have been reinforced, most recently at the Johannesburg Summit in 2002, there have been growing concerns that the actual state of the marine environment may in fact be worsening. Against this background, and ahead of the OSPAR/HELCOM Joint Ministerial Conference, the WWF Marine Health Check report has set out to assess the status of marine conservation in the North-East Atlantic, from the Arctic waters in the north to the Bay of Biscay in the south, and the Baltic Sea. The aim has been to ascertain not only whether conservation efforts have been effective in conserving habitats and species, but also to identify key obstacles to progress.



8.1 Assessing the Status of the North-East Atlantic and Baltic Sea

The North-East Atlantic and Baltic Sea exhibit an enormous diversity in terms of their physical characteristics – from the Norwegian fjords, the vast mountains and plains of the open Atlantic, to the shallow brackish waters of the Baltic – as well as their biological features, and their exposure to human intervention. While the region has progressively evolved over ages and centuries, an increase dominance in human activities has led to more rapid changes. The most persistent and pressing threats facing the marine environment consist of:

- damage to habitats and species resulting from the use of certain fishing gears and overexploitation of fish stocks;
- pollution by hazardous substances, including chemicals, heavy metals, radioactive substances and oil;
- increased nutrient load leading to eutrophication, particularly in coastal waters and the Baltic Sea;
- coastal development and flood defence construction, leading to a loss of intertidal habitats; and
- climate change.

In addition, littering, dredging and aggregate extraction and the development of offshore windfarms may have severe effects, but generally on a more local level. The report also points to a number of other issues, including the introduction of alien species. Together, these activities threaten the entire ecosystem, and not only specific habitats and species.

In order to ascertain how far the above threats to the marine environment have in fact been realised, or averted, this report examines the status of twenty-two habitats and species (or groups of species) in the North-East Atlantic and Baltic Sea. The eleven habitats – soft sediments and offshore mud bottom areas, seamounts, deep-water sponge fields, cold-water coral reefs, offshore sand and gravel beds, intertidal mudflats, eelgrass meadows, maerl beds, kelp banks, mussel banks, and *Chara* meadows – were chosen because they represent a typical range of habitats found in the North-East Atlantic and the Baltic Sea. The eleven species – long-tailed ducks, fulmars, alfonsinos, common skate, Baltic sturgeon, Atlantic cod, sharks, Atlantic salmon, harbour porpoise, blue whale and bladderwrack – represent different levels in the marine food chain.

8.1.1 Selected Habitats

It is clear that a lack of information and knowledge makes even an assessment of the status of key marine habitats difficult. While a great majority of the habitats examined is thought to be declining in area and/or quality, some of them rapidly. The real extent of the damage is simply not known, due to insufficient mapping and monitoring. Furthermore, habitats such as soft sediments, sand and gravel beds, kelp banks and *Chara* meadows have not been given the protection they deserve, despite their biological importance. In general, more information is available for coastal habitats and, together with more 'charismatic' offshore habitats such as corals, they have also received more attention.

Having said that, all of the habitats assessed are affected by human activities and appear to be in decline. Overall, the seriousness of the situation depends on the importance of the habitat and its ability to recover from disturbance. Complex habitats formed over long periods of time, such as seamounts and cold-water coral reefs, are particularly vulnerable.

A distinction between coastal and offshore habitats can be made in terms of the threats that have to be dealt with in order to ensure their protection. Coastal habitats are often threatened by a much wider range of activities, such as coastal development, pollution, eutrophication, disturbance and fishing activities, reflecting the fact that the coastal zone is under more pressure, as well as the first recipient of pollutants and nutrients from land-based activities. Intertidal habitats, such as intertidal wetlands, are important breeding and nursery grounds for many fish species; despite this, a substantial proportion has been lost due to coastal development and the construction of flood defences. Many of the key species in coastal habitats are particularly sensitive to eutrophication, which affects both light availability and competition between species with different strategies, and can have far-ranging effects even in the short term.

As a consequence, a wider range of instruments needs to be used to achieve protection in coastal areas. Area protection alone will often not be effective; it needs to be complemented with effective wastewater treatment, firmer regulation of coastal development activities, for example within the framework of Integrated Coastal Zone Management (ICZM), and efforts to restrict pollution from diffuse sources such as agriculture and traffic. When protection under the Habitats and Birds Directives, restricting fishing and extraction activities, is combined the implementation of the Water Framework Directive and other legal instruments, under the 'umbrella' of ICZM some real progress might be achieved in coastal areas.

Offshore habitats occur in a more stable environment. They are not directly targeted by a range of activities in the same way as the coastal zone, and the natural characteristics are less variable – no tidal movements, dramatic changes in light availability or temperature occur in deeper waters. In general, the deeper you go, the more stable the environment becomes. The primary threats to the offshore habitats are therefore more limited, but nevertheless serious. Many of the species living here are unable to adjust to rapid changes. The primary threats that need to be tackled are fishing activities, particularly towed gear, oil and mineral extraction, and pollution. Protection of offshore habitats may, therefore, to a greater extent be achieved through site protection, simply restricting the activities that directly affect them.

Some of the habitats covered in this report are directly targeted by commercial exploitation, notably offshore sand and gravel, maerl beds, kelp banks and mussel banks. In these cases, further restrictions of the extracting activities would be an important first step towards effective conservation.

8.1.2 Selected Species

In many cases, monitoring of marine species is better than it is for habitats, notably for the species covered in this report. For the absolute majority of species, however, the available information is still very limited. Current trends for the marine species are even more alarming than for habitats, with most either being exposed to unsustainable pressures, or not being able to recover from earlier depletions despite ongoing management efforts, such as the blue whale, sturgeon and wild salmon. Many of the species have declined dramatically in the past 50 years and are now vulnerable to or even threatened with extinction, for example, the common skate and Baltic harbour porpoise. The exceptions concern a number of bird populations that have benefited from a reduction in pollutant loads, and the increasing food availability that the wasteful practice of discarding provides.

For many species, habitat conservation is absolutely crucial. As long as the habitat or habitats that they depend on are protected, they will be able to survive. There are exceptions, however, where site protection will not be sufficient. Migratory species that do not depend on particular areas, such as harbour porpoise, sharks, whales and many fish species, will not be effectively protected through site conservation. Many of these migratory species are primarily threatened by fishing activities, either as target species or through bycatch. Better fisheries management is therefore essential for their recovery. In many cases, this would involve a combination of area restrictions, so called no-take-zones, and technical measures to reduce bycatch. In some cases, complete closures of fisheries might be needed. Once this has been achieved, other factors affecting their recovery might become more visible.

The development of many bird populations is also very closely linked to fishing activities. They may benefit from discards increasing food availability in the short term, but they will also suffer from changes in fish abundance caused by fishing. In addition, diving birds are often decimated through entanglement in fishing gear. All seabirds that spend time on the surface are also vulnerable to oil spills, both deliberate smaller spills and large-scale accidents. This is an issue that can be tackled through restrictions in maritime activities and greater safety precautions, but legislative progress has so far been slow, particularly internationally.

Long-lived, slow-reproducing species are particularly sensitive to exploitation or bycatch, such as some seabirds, most deep-sea fish stocks, sharks and rays, and marine mammals. In addition to the measures mentioned above, they need closer monitoring to ensure that population changes do not go unnoticed. Because of their longevity and their position in the food web, they are also likely to be more affected by other threats, such as pollutants that accumulate in body tissue.

Conservation of salmon and sturgeon, species that spend parts of their life cycle in different environments (ie they move from freshwater to the sea and back), demand a different management approach. Widespread habitat destruction in their freshwater environment may have been the primary culprit in their decline, and this has then been exacerbated by targeted fishing activities. Both species are also vulnerable to pollution. To ensure their recovery, a wide range of measures is required, involving habitat reconstruction as well as protection of their spawning rivers and restrictions in their exploitation. A combination of these measures has indeed enabled wild salmon to recover in some areas, while sturgeon is threatened with extinction and most likely has to be reintroduced if it is to recolonize the Baltic Sea, for example.

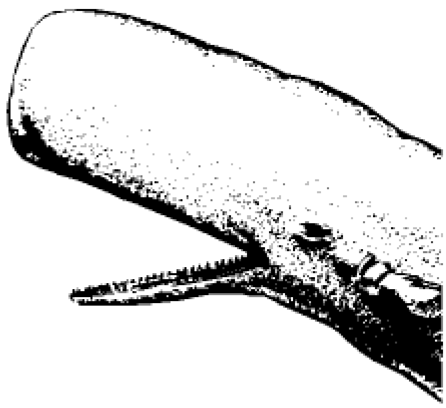


Table 1. Threats and status of the assessed habitats and species

Habitat	**Threats**	**Status**
Soft sediments and offshore mud bottom areas	Fishing activities (towed gear) and oil exploration	Likely to be declining, but not properly monitored
Seamounts	Fishing activities and possible target of mining activities	Declining; lack of knowledge prevents site selection for protection
Deep-water sponge fields	Fishing activities and possibly hazardous substances	Thought to be declining, but not properly monitored
Cold-water coral reefs	Fishing activities, seabed disturbance (ie siltation) and pollution	Declining, though some areas are now protected
Offshore sand and gravel beds	Extraction and dredging activities, fishing and construction (ie windfarms)	Thought to be declining, but not properly monitored
Intertidal mudflats	Land reclamation, sea level rise (ie climate), coastal construction & development, pollution, eutrophication and disturbance	Declining, though some protection and management measures are in place
Eelgrass meadows	Coastal development, pollution, eutrophication, fishing activities and dredging	Declining.
Maerl beds	Commercial exploitation, eutrophication, fishing activities and offshore developments	Thought to be declining, but knowledge is poor and they are not properly monitored
Kelp banks	Commercial exploitation, eutrophication, pollution, deteriorating water quality and climate change	Declining, but not properly monitored
Mussel banks	Commercial exploitation, pollution, eutrophication and natural factors	Common in most of the region, but in need of better monitoring and restrictions in fishing
Chara meadows	Eutrophication, pollution and coastal development	Thought to be declining; locally extinct, but knowledge is poor.
Species		
Long-tailed duck	Oil spills, bycatch, habitat destruction at breeding sites	Stable to increasing; aggregation makes entire population vulnerable to oil spills in the winter
Fulmar	Fishing activities, disturbance and species introduction at breeding sites, oil pollution, littering	Increasing; may decline as a result of better fisheries management in the future
Alfonsinos	Targeted by deep-sea fishing activities	Thought to be declining, but data availability is poor
Common skate	Fishing activities, possibly affected by pollution	Dramatic decline, many populations on the brink of extinction, poor monitoring
Baltic sturgeon	Habitat destruction, pollution and overexploitation	Dramatic decline, now critically endangered, possibly extinct in the Baltic Sea
Atlantic cod	Overexploitation, possibly affected by climate change	Dramatic decline, most stocks outside safe biological levels, facing commercial extinction
Sharks	Targeted fishing activities and bycatch	Dramatic decline of many species, poor knowledge and monitoring complicates the situation
Atlantic salmon	Habitat destruction, overexploitation, climate change, pollution and fish farming	Earlier dramatic decline has slowed down and some populations are recovering, but still a cause of concern
Harbour porpoise	Bycatch in fisheries, pollution, disturbances	Declining, threatened with extinction in the Baltic Sea
Blue whale	Hunting before ban in 1964, changes in food availability, climate change, pollution, collisions with ships and noise	Declined dramatically due to whale hunting; slow recovery thought to depend on other factors. Still depleted and classified as endangered.
Bladderwrack	Eutrophication, habitat destruction and changes in species interactions	Declined dramatically in the Baltic Sea in the 1970s, mainly due to eutrophication. Some regional improvements.

8.2 Current Management Efforts

While some improvements in the health of the marine environment are noted, many species and habitats remain under threat and in decline despite management efforts. Current frameworks and measures in place for marine protection are clearly insufficient. The overall prognosis is therefore poor.

Essentially, there are two ways to tackle the deteriorating health of the marine environment in the North-East Atlantic and the Baltic Sea: addressing the threats and building up a protection regime for specific areas of the sea. For effective conservation of marine wildlife and habitats, a combination of both is necessary.

8.2.1 Targeting the threats

A range of measures have been put in place to reduce the effects of fishing on the marine environment, such as catch quotas, and technical measures to reduce bycatch and physical damage. So far, however, they have largely been insufficient in addressing the problems. The commercially harvested stocks have almost without exception continued to decline, many sensitive species are still depleted because of bycatch and valuable bottom habitats destroyed by towed fishing gear. The recent reform of the CFP, together with some measures to improve the management of sharks and deep-sea fish stocks, are all steps in the right direction. But further measures will have to be put in place before any substantial improvements can be seen.

In many countries, the levels of a number of hazardous substances being released into the environment have decreased. The positive effects can be seen in several species that were previously affected, such as the white-tailed eagle in the Baltic region, which declined very rapidly in the mid-1900s because pesticides such as DDT and PCBs made their eggs shells thinner and reduced reproductive success. Levels of some of these pollutants have also been decreasing in the body tissues of marine mammals and fatty fish. However, new chemicals affecting marine species and habitats continue to appear, eg dioxins, flame-retardants, endocrine disruptors and the like.

Substantial progress has also been made in the area of nutrient input into the marine environment, especially tackling point sources of phosphorus. Measures to combat nitrogen input have been less effective, and several areas have in fact seen an increase. A greater proportion of the nutrients now come from so called diffuse sources, such as agriculture run-off and traffic, making further progress more difficult to achieve.

Exploitation of offshore mineral resources continues to be a threat, despite the fact that technology is constantly improving, and discharges of contaminated drilling mud, drill cuttings and oil is a chronic problem around offshore installations. Dumping or just leaving installations no longer in use has been the focus of new regulations, however. So has shipping-related oil pollution, particularly deliberate spills connected to cleaning tanks and safety measures to prevent major oil spills in association with accidents at sea.

Climate change mitigation policies clearly need to be developed, in compliance with the Kyoto Protocol and subsequent commitments. In so doing, care must be taken to ensure that any potential climate change mitigation measures, eg the development of offshore wind turbines or ocean sequestration of carbon dioxide, are fully assessed to avoid negative impacts on marine health. For other activities, such as aggregate extraction, the policy framework remains patchy. The report also underlines a number of emerging issues, including the introduction of alien species, which will need to be tackled.

8.2.1 Site-based Marine Protection

For adequate protection of marine wildlife and habitats, a comprehensive network of protected areas needs to be established. Efforts have been made under the two regional conventions to address this issue, notably under Annex V of OSPAR and the identification of Baltic Sea Protected Areas (BSPAs) in the Baltic. Within the EU, the Habitats & Birds Directives in principle provide protection for many important habitats and species, but implementation is very much behind schedule and a review is needed to address shortcomings in marine habitat classification. Implementation of the other instruments has also been slow, and overall the current declarations of protected areas are insufficient to ensure good conservation status. A further problem is the lack of information about many species and habitats, which makes it difficult to select appropriate sites or networks of sites for their protection.

8.2.3 Recent Developments

While the major shortcomings – in policies, implementation and science – are noted, it would be unfair to deny some of the significant improvements that have recently been made, closing important gaps in the management jigsaw. For example:

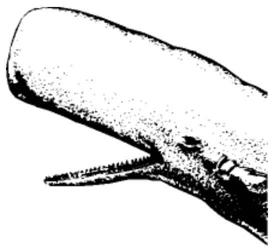
- Chemicals – the EU is on the road to revising its overall chemical policy, which should strengthen restrictions on the use and release of chemicals. Already, an EU list of priority substances in the field of water policy has been adopted, building on earlier EU policy and OSPAR and HELCOM commitments.

- Eutrophication – over the next decade, work is to proceed on implementing the ambitious EU Water Framework Directive, which aims to enhance the status of coastal and estuarine aquatic ecosystems. Although it only applies to one nautical mile offshore, the Directive could, over time, make an enormous contribution to reducing discharges resulting from land based or coastal activities.

- Fisheries – the global, regional and EU framework for fisheries management has received attention on an unprecedented scale over the last decade. Following the 2002 CFP reform, management should now proceed on a precautionary basis and seek to progressively implement an ecosystem-based approach. To have any effect on the marine environment, however, EU Ministers still need to take tough decisions to secure the recovery of critical stocks.

- Maritime transport – the legal framework for controlling maritime transport pollution is continually being strengthened, in response to a series of major oil pollution incidents, most recently the *Prestige* disaster off the Spanish/Portuguese coast. Despite the adoption of new legal standards, some will not become effective for years to come. Perhaps more significantly, difficulties in prosecuting offences and limited liability provisions mean that our seas, habitats and species remain at high risk from future incidents.

At a more strategic level, the EU is now working towards a Thematic Strategy on the marine environment – the first comprehensive EU marine strategy - which is to assess the problems facing European marine areas, and address shortcomings in current policy. A wholesale review such as this is long overdue but hopefully reflects a new political awareness of, and commitment to, marine protection. But while the Thematic Strategy is being elaborated, opportunities must be taken, indeed created, to put a halt to some the most critical activities, in particular those affecting fragile and little known deep-sea areas.

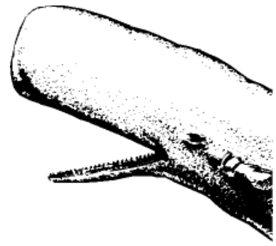


8.3 Towards More Effective Management?

Limitations in the basic scope and coverage of the international and EU legal and policy framework, weaknesses in the implementation of existing policies, and poor scientific knowledge are together conspiring to undermine the marine environment. Although the science is improving, there are still enormous gaps in our knowledge, making effective policy development more difficult. A priority must therefore be to reinforce the science needed to underpin management, but in the meantime, also to strengthen the effectiveness of existing policies and measures – covering both environmental policy and environmental integration within sectoral policies. True to the precautionary principle, action should be taken as soon as there is sufficient evidence of serious and irreversible damage. As noted above, a number of new policy frameworks, particularly within the EU, are currently being elaborated. But it is not at all clear to what extent they will deliver any concrete results within the necessary timeframe.

One persistent obstacle to marine protection is the complex issue of jurisdiction in offshore areas. Individual countries have a clear remit to act in their coastal waters, which makes it easier to implement conservation efforts. In offshore waters, however, it gets more difficult, even within the 200 nm zones which give maritime states control of the extraction of resources. This applies to oil and gas exploration, as well as to aggregate extraction, but within the EU a different regime applies to fisheries. Since fishing is regulated under the Common Fisheries Policy (CFP), in principle all waters, except coastal territorial waters (up to 12 nm), are open to fishing vessels from all EU Member States. An initiative to protect an offshore area can therefore be contested by another Member State on the grounds that it restricts the right to fish. Though some moves have been made to resolve these difficulties within the EU, it remains unclear where priorities lie and conservation efforts are likely to be met with resistance. In international waters, the barriers to conservation are greater, since no particular state has jurisdiction. Greater efforts are needed to resolve these issues and clarify the legal basis for international and EU marine protection.

Even where progress is being made, it will be some time before the impact of new or emerging policies and initiatives are likely to be felt, if at all. Meanwhile, the EU is embarking on its biggest ever enlargement in 2004. This historic development will bring all but one Baltic coastal State into the EU and, in doing so, could make a major contribution to furthering marine conservation in the North-East Atlantic and Baltic Sea. However, the test of all of these developments must be whether habitats and species, including those assessed in this report, are in fact on the road to recovery.



8.4 WWF Call for Action

It is clear that three decades after the Oslo, Paris and Helsinki regional seas conventions came into existence, the primary root causes of deterioration of the health of the marine environment of the North-East Atlantic and the Baltic Sea remain and current management efforts are insufficient to ensure conservation of valuable habitats and species. WWF therefore calls on the Environment Ministers of the HELCOM and OSPAR maritime areas to introduce an ecosystem approach, by:

- developing a shared vision and objectives for the future of the North-East Atlantic and Baltic Sea;
- undertaking strategic assessments of the biodiversity and socio-economic needs affecting the maritime areas;
- implementing networks of marine protected areas representative of the full range of habitats and biodiversity;
- introducing spatial planning for the myriad activities and developments taking place in the marine environment, and particularly in the coastal zone;
- improving and strengthening regulation, management actions and enforcement;
- ensuring strong research programmes which inform the delivery of ecosystem management; and
- implementing already existing instruments, strategies and targets to eliminate hazardous and radioactive substances, reduce oil pollution and nutrient load, and protect species, habitats and ecosystems.

[1] UNEP (1999) *Global Environment Outlook 2000.* Earthscan Publications Ltd, London
[2] Firn Crichton Roberts Ltd, University of Strathclyde (2000) *An assessment of the socio-economic costs and benefits of integrated coastal zone management.* Final report to the European Commission (B4-3040/99/134414/MAR/D2), November 2000 [http://europa.eu.int/comm/environment/iczm/socec_en.pdf]
[3] EEA (1999) *Environment in the European Union at the turn of the century: Coastal and marine zones*. Environmental Assessment Report No 2; EEA, Copenhagen
[4] EEA (1999) *Environment in the European Union at the turn of the century: Coastal and marine zones*. Environmental Assessment Report No 2; EEA, Copenhagen
[5]
[6] FAO (2002) *The State of the World Fisheries and Aquaculture*. FAO Fisheries Department, Rome
[7] EEA (1999) *Environment in the European Union at the turn of the century: Coastal and marine zones*. Environmental Assessment Report No 2; EEA, Copenhagen
[8] OSPAR Commission (2000) *Quality Status Report 2000*. OSPAR Commission, London
[9] OSPAR Commission (2000) *Quality Status Report 2000*. Region I (Arctic Waters) OSPAR Commission, London
[10] OSPAR Commission (2000) *Quality Status Report 2000*. Region II (Greater North Sea) OSPAR Commission, London
[11] EEA (1999) *Environment in the European Union at the turn of the century: Coastal and marine zones*. Environmental Assessment Report No 2; EEA, Copenhagen
[12] OSPAR Commission (2000) *Quality Status Report 2000*. Region II (Greater North Sea) OSPAR Commission, London
[13] OSPAR Commission (2000) *Quality Status Report 2000*. Region III (The Celtic Seas) OSPAR Commission, London
[14] OSPAR Commission (2000) *Quality Status Report 2000*. Region III (The Celtic Seas) OSPAR Commission, London
[15] OSPAR Commission (2000) *Quality Status Report 2000*. Region III (The Celtic Seas) OSPAR Commission, London
[16] OSPAR Commission (2000) *Quality Status Report 2000*. Region III (The Celtic Seas) OSPAR Commission, London
[17] OSPAR Commission (2000) *Quality Status Report 2000*. Region IV (Bay of Biscay/Iberian Coast) OSPAR Commission, London
[18] OSPAR Commission (2000) *Quality Status Report 2000*. Region IV (Bay of Biscay/Iberian Coast) OSPAR Commission, London
[19] OSPAR Commission (2000) *Quality Status Report 2000*. Region IV (Bay of Biscay/Iberian Coast) OSPAR Commission, London
[20] OSPAR Commission (2000) *Quality Status Report 2000*. Region IV (Bay of Biscay/Iberian Coast) OSPAR Commission, London
[21] WWF (2001) *Implementation of the EU Habitats Directive Offshore: Natura 2000 sites for reefs and submerged sandbanks*. Volume I and II; June 2001
[22] WWF (in print) *Baltic Sea Ecoregion Action Plan*.
[23] HELCOM (1998) *The Red List of Marine and Coastal Biotopes and biotope Complexes of the Baltic Sea, Belt Sea and Kattegat*; Helsinki Commission, Baltic Marine Environment Protection Commission, Helsinki [http://www.helcom.fi/a/proceedings/bsep75.pdf] (accessed May 2003)
[24] WWF (in print) *Baltic Sea Ecoregion Action Plan*.
[25] WWF (in print) *Baltic Sea Ecoregion Action Plan*.
[26] WWF (in print) *Baltic Sea Ecoregion Action Plan*.
[27] HELCOM (2000) *Summary Report on Implementation of HELCOM Recommendations under HELCOM TC.* Helsinki Commission, 21st Meeting, Helsinki, 20-21 March 2000.
[28] Helsinki Commission (2002) *Environment of the Baltic Sea areas 1994-1998.* Baltic Sea Environment Proceedings No. 82B.
[29] EEA (2003) *Testing of indicators for the marine and coastal environment in Europe – Part 1: eutrophication and integrated coastal zone management*. European Environment Agency, Copenhagen.
[30] Lyons, M.G., Balls, P.W. & Turrell, W.R. (1993). A preliminary study of the relative importance of riverine nutrient inputs to the Scottish North Sea Coastal Zone. *Marine Pollution Bulletin*, 26: 620-8.
[31] OSPAR Commission (2000) *Quality Status Report 2000*. OSPAR Commission, London
[32] OSPAR Commission (2000) *Quality Status Report 2000*. Region III (The Celtic Seas) OSPAR Commission, London
[33] OSPAR Commission (2000) *Quality Status Report 2000*. OSPAR Commission, London AND http://oils.gpa.unep.org/framework/region-2.htm
[34] The Royal Society (2000) *Endocrine disrupting chemicals (EDCs)*. Document 06/00 RSC, London
[35] Santillo, D; Johnston, P; Langston, W. (2001) Tributyltin (TBT) antifoulants: a tale of ships snails and imposex; in *Late lessons from early warnings: the precautionary principle 1896–2000*, Environmental issue report No 22, pp 135-142, EEA, Copenhagen

[36] Santillo, D; Johnston, P; Langston, W. (2001) Tributyltin (TBT) antifoulants: a tale of ships snails and imposex; in *Late lessons from early warnings: the precautionary principle 1896–2000*, Environmental issue report No 22, pp 135-142, EEA, Copenhagen
[37] Santillo, D; Johnston, P; Langston, W. (2001) Tributyltin (TBT) antifoulants: a tale of ships snails and imposex; in *Late lessons from early warnings: the precautionary principle 1896–2000*, Environmental issue report No 22, pp 135-142, EEA, Copenhagen
[38] OSPAR Commission (2000) *Quality Status Report 2000*. OSPAR Commission, London
[39] CEC (2001) *Green Paper: The future of the common fisheries policy*. European Commission, COM(2001)135 final
[40] CEC (2002) *Towards a Strategy to protect and conserve the marine environment.* (COM (2002) 539)
[41] ICES (2000) *Report of the study group on the biology and assessment of deep-sea fisheries resources.* ICES CM 2000/ACFM:8, 205 pp. Copenhagen
[42] CEC (2002) *On a Community Action Plan to reduce discards of fish.* (COM(2002)656 final
[43] OSPAR Commission (2000) *Quality Status Report 2000*. Region II (Greater North Sea) OSPAR Commission, London
[44] ICEC (2002) *Report of the ICES Advisory Committee on Ecosystems*. ICES Cooperative Research Report No. 254, Copenhagen, June 2002
[45] ICEC (2002) *Report of the ICES Advisory Committee on Ecosystems*. ICES Cooperative Research Report No. 254, Copenhagen, June 2002
[46] CEC (2002) *Towards a Strategy to protect and conserve the marine environment*. European Commission, COM (2002) 539
[47] EEA (2003) *Europe's environment: the third assessment.* Environmental assessment report, No 10, EEA; Copenhagen
[48] EEA (2003) *Europe's environment: the third assessment.* Environmental assessment report, No 10, EEA; Copenhagen
[49] EEA (2003) *Europe's environment: the third assessment.* Environmental assessment report, No 10, EEA; Copenhagen
[50] ICES (2001) *Report of the Working Group on Sea Bird Ecology*. Oceanopgrapgy Committee; ICES CM2001/C:05, Copenhagen
[51] IPCC (2001) *Third Assessment Report*. Intergovernmental Panel on Climate Change, Cambridge University Press
[52] V.S. Kennedy, R.R. Twilley, J.A. Kleypas, J.H. Cowan, Jr. & S.R. Hare (2002) Coastal and Marine Ecosystems and Global Climate Change: Potential Effects on U.S. Resources. Pew Center Report, USA
[53] Norwegian Environment Ministry (2002) *Release of CO2 in the Norwegian Sea May be in Conflict with International Environmental Conventions*. Press Release 22/08/02 [http://odin.dep.no/md/engelsk/aktuelt/pressem/022051-070061/index-dok000-b-n-a.html]
[54] OSPAR (2002) *Disposal of CO2 at Sea*. OSPAR meeting document
[55] HELCOM (2002) *Environment of the Baltic 1994-98*. Baltic Sea Environment Proceedings No. 82B, Helsinki
[56] HELCOM (2002) *Environment of the Baltic 1994-98*. Baltic Sea Environment Proceedings No. 82B, Helsinki
[57] HELCOM (2002) *Environment of the Baltic 1994-98*. Baltic Sea Environment Proceedings No. 82B, Helsinki
[58] Council of Europe (2002) *International Programmes on conservation of marine and coastal biodiversity in the European part of the Atlantic Ocean and the Baltic Sea – Status, evaluation and future priorities.* T-PVS/Inf(2002)32
[59] Picton, B.E. and Costello M. J. (1998) *The BioMar biotope viewer: a guide to marine habitats, fauna and flora in Britain and Ireland.* Environmental Sciences Unit, Trinity College, Dublin
[60] BioMar (2003) *Marine Biotopes and Species of Britain and Ireland* [http://www.itsligo.ie/biomar/INDEX.HTM] (accessed May 2003)
[61] (see Dyer et al., 1982 and 1983
[62] Birkeland, C. (1974) Interactions between a sea pen and seven of its predators. *Ecological Monographs,* **44**: 211-232
[63] Gordon, J.D.M. (2001) *Deep Water Demersal Fisheries*. [http://www.jncc.gov.uk/marine/fisheries/Reports/rpt_deepwater.htm] (accessed May 2003)
[64] Ball, B.J.; Fox, G.; Munday, B.W. (2000) Long- and short-term consequences of a Nephrops trawl fishery on the benthos and environment of the Irish Sea. *ICES Journal of Marine Science*, **57** (5), pp. 1315-1320; AND; Lindegartha, M.; Valentinssona, D.; Hanssona, M.; Ulmestranda, M. (2000) Effects of trawling disturbances on temporal and spatial structure of benthic soft-sediment assemblages in Gullmarsfjorden, Sweden. ICES Journal of Marine Science, **57** (5), pp. 1369-1376
[65] Roberts, J.M.; Harvey, S.M.; Lamont, P.A., Gage, J.D.; Humphery, J.D. (2000) Seabed photography, environmental assessment and evidence for deep-water trawling on the continental margin west of the Hebrides. *Hydrobiologia*, **441**, pp. 173-183
[66] WWF (2002) *La Grande Vasière – A Potential Marine Protected Area*. WWF briefing [http://www.ngo.grida.no/wwfneap/Publication/briefings/briefing.htm]
[67] Hughes, D.J. (1998) *Sea Pens and Burrowing Megafauna: An overview of dynamics and sensitivity characteristics for conservation management of marine SACs*. Scottish Association for Marine Science (SAMS)
[68] Epp, D. & Smoot, N.C. (1989) Distribution of seamounts in the North Atlantic. Nature 337:254-7

[69] Anonymous (2003) *Initial draft list of threatened and/or declining species and habitats in the OSPAR Marine Area – Habitats.* BDC 03/03/02h-E*, OSPAR submission
[70] Gubbay, S.; Baker, M.; Bett, B.; Konnecker, G. (2002) *The Offshore Directory – Review of a Selection of Habitats, Communities and Species of the North-East Atlantic*. WWF
[71] Klitgaard & Tendal (2001) *Marine biological investigations and assemblages of benthic invertebrates from the Faroe Islands.* In Bruntse, G. and O.S. Tendal (eds) Report from Kaldback Marine Biological Laboratory, Faroe Islands.
[72] ICES (2003) *Section 6 and Annex I of the 2002 ACE Report: Draft OSPAR list of threatened and declining species and habitats*. BDC 03/03/03-E*, OSPAR submission
[73] Klitgaard, A.B. (1995) The fauna associated with outer shelf and upper slope sponges (Porifera, Demospongiae) at the Faroe Islands, North-eastern Atlantic. *Sarsia,* **80**, pp 1-22.
[74] Hovland, M.; Thomsen, E. (1997) Cold Water corals – are they hydrocarbon seep related?. *Sarsia*, **74**, pp 29-42
[75] Rogers, A.D. (1999) The biology of Lophelia pertusa and other deep-water reef-forming corals and impacts from human activities. International Review of Hydrobiology, 84; pp. 315-406; AND; Long et al., (1999) Occurrences of Lophelia pertusa on the Atlantic Margin. British Geol. Survey Report WB/99/24, Edinburgh, 23 pp and appendices
[76] ICES (2003) *Section 6 and Annex I of the 2002 ACE Report: Draft OSPAR list of threatened and declining species and habitats*. BDC 03/03/03-E*, OSPAR submission
[77] ICES (2003) *Section 6 and Annex I of the 2002 ACE Report: Draft OSPAR list of threatened and declining species and habitats*. BDC 03/03/03-E*, OSPAR submission
[78] ICES (2003) *Coral Reefs in the North Atlantic?* [http://www.ices.dk/marineworld/deepseacoral.asp] (accessed May 2003).
[79] Gubbay, S.; Baker, M.; Bett, B.; Konnecker, G. (2002) *The Offshore Directory – Review of a Selection of Habitats, Communities and Species of the North-East Atlantic*. WWF
[80] WWF (1999) *The Sula Ridge – A Potential Marine Protected Area*. WWF Briefing
[81] WWF(2002) *The Darwin Mounds – Out of sight and still under threat.* WWF UK
[82] ICES (2001) *Effects of the Extraction of Marine and Gravel on Ecosystems.* Section 13 of the ACME Report 2001; BDC 01/5/11-E, OSPAR, London
[83] JNCC (2003) *UK Biodiversity Action Plan: Sublittoral sands and gravels* [http://www.ukbap.org.uk/asp/UKPlans.asp?UKListID=44#1] (accessed May 2003)
[84] HELCOM (1999) *Marine Sediment Extraction in the Baltic Sea.* Baltic Sea Environment Proceedings No.76, Helsinki
[85] HELCOM (1999) *Marine Sediment Extraction in the Baltic Sea.* Baltic Sea Environment Proceedings No.76, Helsinki
[86] HELCOM (1999) *Marine Sediment Extraction in the Baltic Sea.* Baltic Sea Environment Proceedings No.76, Helsinki; as well as [http://www.azti.es/eumarsand/background.htm] (accessed May 2003)
[87] HELCOM (1999) *Marine Sediment Extraction in the Baltic Sea.* Baltic Sea Environment Proceedings No.76, Helsinki
[88] Baden, S.; Gullström, M.; Lundén, B.; Pihl, L.; Rosenberg, R. (in print) Vanishing Seagrass (Zostera marina, L.) in Swedish Coastal Waters. *Ambio*, **32** (5)
[89] Davison, D.M.; Hughes, D.J. (1998) *Zostera Biotopes (Volume I): An overview of dynamics and sensitivity characteristics for conservation management of marine SACs*. Scottish Association for Marine Science (UK Marine SACs Project)
[90] Baden, S.; Gullström, M.; Lundén, B.; Pihl, L.; Rosenberg, R. (in print) Vanishing Seagrass (Zostera marina, L.) in Swedish Coastal Waters. *Ambio*, **32** (5)
[91] CWSS (2001) *Wadden Sea Specific Eutrophication Criteria*. Wadden Sea Ecosystem Report No. 14, Wilhelmshaven, Germany
[92] Baden, S.; Gullström, M.; Lundén, B.; Pihl, L.; Rosenberg, R. (in print) Vanishing Seagrass (Zostera marina, L.) in Swedish Coastal Waters. *Ambio*, **32** (5)
[93] CWSS (2001) *Wadden Sea Specific Eutrophication Criteria*. Wadden Sea Ecosystem Report No. 14, Wilhelmshaven, Germany
[94] Birkett, D.A.; Maggs C.; Dring, M.J. (1998) *Maerl (Volume V): An overview of dynamics and sensitivity characteristics for conservation management of marine SACs*. Scottish Association for Marine Science (UK Marine SACs Project)
[95] Berry, C. (2000) *Marine health check – A report to gauge the health of the UK's sea-life*. WWF UK
[96] Birkett, D.A.; Maggs C.; Dring, M.J. (1998) Maerl (V*): An overview of dynamics and sensitivity characteristics for conservation management of marine SACs*. Scottish Association for Marine Science (UK Marine SACs Project)
[97] HELCOM (2002) *Environment of the Baltic 1994-98*. Baltic Sea Environment Proceedings No. 82B, Helsinki
[98] English Nature (2003) *UK Marine Special Areas of Conservation* [http://www.ukmarinesac.org.uk/communities/biogenic-reefs/br8.htm] (accessed May 2003)
[99] Dekker, R. (2001) Food Situation for Common Eiders in the Western Wadden Sea in 1999-2000 Estimated on Long-term Macrobenthos Monitoring Data. *Wadden Sea Newsletter*, **1**, pp. 32-34

[100] Holt, T.J.; Rees, E.I.; Hawkins, S.J.; Seed, R. (1998) *Biogenic Reefs (Volume IX): An overview of dynamic and sensitivity characteristics for conservation management of marine SACs*. Scottish Association for Marine Science (UK Marine SACs Project)
[101] Common Wadden Sea Secretariate (2002) *An overview of policies for shellfish fishing in the Wadden Sea*. TWG 02/2-3.3. Shellfish fisheries. Final Draft
[102] Saier, B. (2002) Subtidal Mussel Beds in the Wadden Sea: Threatened Oases of Biodiversity. *Wadden Sea Newsletter*, **1**, pp.12-14
[103] Anonymous [in press] *Proposal of a Red Data Book for charaphytes in the Baltic Sea; final proposal for chapter 5*
[104] JNCC (2003) *UK SPA species account* [http://www.jncc.gov.uk/ukspa/Species/accounts/A6-38.pdf] (accessed May 2003).
[105] JNCC (2003) *UK SPA species account* [http://www.jncc.gov.uk/ukspa/Species/accounts/A6-38.pdf] (accessed May 2003).
[106] Durinck, J *et al.* (1994) *Important Marine Areas for Wintering Birds in the Baltic Sea.* Ornis Consult Ltd, Copenhagen
[107] ICES (2001) *Report of the Working Group on Sea Bird Ecology*. Oceanopgrapgy Committee; ICES CM2001/C:05, Copenhagen
[108] *Northern Fulmar* [http://www.neseabirds.com/fulmar.htm] (accessed May 2003)
[109] JNCC (2003) *Species Account – Fulmar*. quoting Lloyd (1991 data) [http://www.jncc.gov.uk/ukspa/Species/sptoc.htm] (accessed May 2003)
[110] ICES (2001) *Report of the Working Group on Sea Bird Ecology*. Oceanopgrapgy Committee; ICES CM2001/C:05, Copenhagen
[111] Birdlife International (2003) *Net loss - seabirds gain? Implications of fisheries management for seabirds scavenging discards in the northern North Sea.* BDC 03/04/Info.03-E* OSPAR submission
[112] ICES (2001) *Report of the Working Group on Sea Bird Ecology*. Oceanopgrapgy Committee; ICES CM2001/C:05, Copenhagen
[113] ICES (2002) *Report of the Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources.* ICES CM 2002/ACFM:16
[114] Anonymous (2003) *Initial draft list of threatened and/or declining species and habitats in the OSPAR Marine Area – Fish (A-G).* BDC 03/03/02c-E*, OSPAR submission
[115] ICES (2002) Report to the Working Group on Elasmobranch Fishes. ICES CM 2002/G:8 ACFM
[116] ICES (2002) Report to the Working Group on Elasmobranch Fishes. ICES CM 2002/G:8 ACFM
[117] IUCN (2002) *Red List of Species Database*. [http://www.redlist.org/] (accessed May 2003)
[118] EUROPA Life Web page (2003) *Conservation and restoration of the European sturgeon* [http://europa.eu.int/comm/environment/life/project/Projects/index.cfm?fuseaction=SEARCH.CREATEPAGE&s_ref=LIFE98%20NAT/F/005212&area=1&yr=1998&n_proj_id=540&CFID=1640710&CFTOKEN=82033949#Species] (accessed May 2003)
[119] Anonymous (2003) *Initial draft list of threatened and/or declining species and habitats in the OSPAR Marine Area – Fish (A-G).* BDC 03/03/02c-E*, OSPAR submission
[120] BMU (2001) Mitteilungen der Regierung der Bundesrepublic Deutschland an die Kommission der Europäischen Gemeinschaft gem. Artikel 17 der Richtlinie 92/43/EWG
[121] Anonymous (2001) *The 2001 Polish national report to the CBD* [http://www.biodiv.org/doc/world/pl/pl-nr-02-en.pdf] (accessed May 2003)
[122] Berry, C. (2000) *Marine health check – A report to gauge the health of the UK's sea-life*. WWF UK
[123] Berry, C. (2000) *Marine health check – A report to gauge the health of the UK's sea-life*. WWF UK
[124] IUCN (2002) *Red List of Species Database*. [http://www.redlist.org/] (accessed May 2003)
[125] ICES (2003) *Section 6 and Annex I of the 2002 ACE Report: Draft OSPAR list of threatened and declining species and habitats*. BDC 03/03/03-E*, OSPAR submission
[126] OSPAR Commission (2000) *Quality Status Report 2000*. Region V (Wider Atlantic) OSPAR Commission, London
[127] WWF (2001) *The Status of Wild Atlantic Salmon: A River by River Assessment*. WWF European Freshwater Programme, Copenhagen
[128] EEA (2003) *Europe's environment: the third assessment, Environmental assessment report*. No 10, EEA: Copenhagen
[129] NASCO (1999) *Report on the Activities of the North Atlantic Salmon Conservation Organization in 1998 – 1999*. North Atlantic Salmon Conservation Organization, Edinburgh
[130] NASCO (2000) *Report of the annual meeting of the council*. Seventeenth annual Meeting. Miramichi, Canada, CNL (00)57, North Atlantic Salmon Conservation Organization, Edinburgh
[131] ASCOBANS (2002) *Recovery Plan for Baltic Harbour Porpoises: Jastarnia Plan*. ASCOBANS, July 2002, Bonn
[132] Berry, C. (2000) *Marine health check – A report to gauge the health of the UK's sea-life*. WWF UK
[133] HELCOM (2003) [http://www.helcom.fi/environment/marinemammals/harbourporpoises.html] (accessed April 2003)
[134] IUCN (2002) *Red List of Species Database*. [http://www.redlist.org/] (accessed May 2003)

[135] Simmonds, M.; Irish, R.; Moscrop, A. (1997) *The Dolphin Agenda.* The Whale and Dolphin Conservation Society. As in Berry, C. (2000) Marine health check – A report to gauge the health of the UK's sea-life. WWF UK
[136] OSPAR Commission (2000) *Quality Status Report 2000*. Region II (Greater North Sea) OSPAR Commission, London
[137] ICES (2002) *Report to the ICES Advisory Committee on Ecosystems*. ICES Cooperative Research Report No. 254, Section 2, Copenhagen
[138] Anonymous (2003) *Initial draft list of threatened and/or declining species and habitats in the OSPAR Marine Area – Mammals.* BDC 03/03/02f-E*, OSPAR submission
[139] U.S. Delegation to the IWC (1998) United States calls for more research on environmental change that impacts whale stocks [http://www.publicaffairs.noaa.gov/pr98/may98/iws2.html] (accessed May 2003)
[140] Bäck, S.; Ruuskanen (2000) Distribution and maximum growth depth of *Fucus vesiculosus* along the Gulf of Finland; *Marine Biology*, **136**, pp. 303-307
[141] HELCOM (2002) *Environment of the Baltic Sea area 1994-1998*. Baltic Sea Environment Proceedings No 82B; Helsinki
[142] *Coastal Ecosystems of the Baltic* [http://www.bom.hik.se/research/foomrade/aquatic.html] (accessed May 2003)
[143] HELCOM (2003) *Nutrients* [http://www.helcom.fi/pollution/nutrients.html] (accessed May 2003)
[144] HELCOM (1998) *Communiqué of the Ministerial Session.* 26 March 1998

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