3.14. Coastal and marine zones

1. The issue

Coastal zones are considered to be areas where land and sea influence, meet and interact. The coastal band varies depending on the nature of the environment, the interactions of the marine and terrestrial coastal processes and the management needs. Coastal zones occupy less than 15% of the Earth's land surface, yet they accommodate more than 60% of the world's population. If this trend continues, by 2025 there could be up to 75% of humanity residing in coastal areas (UNCED, 1992). Most of the world coastal ecosystems potentially threatened by unsustainable development are located within northern temperate and northern equatorial zones with Europe having 86% of its coasts at either high or moderate risk (Bryant *et al.*, 1995) (Figure 3.14.1).

Coasts are not static. They can change shape rapidly, and coastal erosion, due to human activities or natural causes, is a common phenomenon: in the EU 25% of the coast is subject to erosion, while 50% is stable and 15% aggradating: for the remaining 10%, the evolution is unknown (Corine, 1998). Erosion also varies: 32% of the Portuguese coasts is affected, but 75% of the Spanish Atlantic coasts are considered stable.

Improvements in economic conditions are a priority for coastal regions of Europe. They are among the least economically developed regions of the EU (Table 3.14.1), and in 1996 accounted for 19 of the EU's 25 less favoured areas (compared with 23 in 1983). Coastal regions have received substantial assistance – mainly for infrastructure investment – from the EU Structural and Cohesion funds: nearly 70% of the EU Structural Funds for the period 1994-1999 were allocated to the EU's coastal area (including nearly all EU Mediterranean areas; all areas on the Atlantic coast of Portugal, Spain and France, half of the UK coast, etc.).

For the purpose of this report a strip of 10 km wide is generally considered, in connection with impact of human activities. The EU coastal zones contain irreplaceable ecological, cultural and economic resources; mainte-

GDP statistics per region showing economic disparities between the North West and the other riparian areas in Europe (EU GNP=100)

Table 3.14.1

Area/Region	Index
'Blue Banana' area (Milan to London)	120
North Sea riparian areas	100
Baltic riparian areas	88
Mediterranean riparian areas	82
Atlantic riparian areas	78
Isolated regions	67

Source: Conference of Peripherals Maritime Regions of Europe (CRPM), based on EUROSTAT data

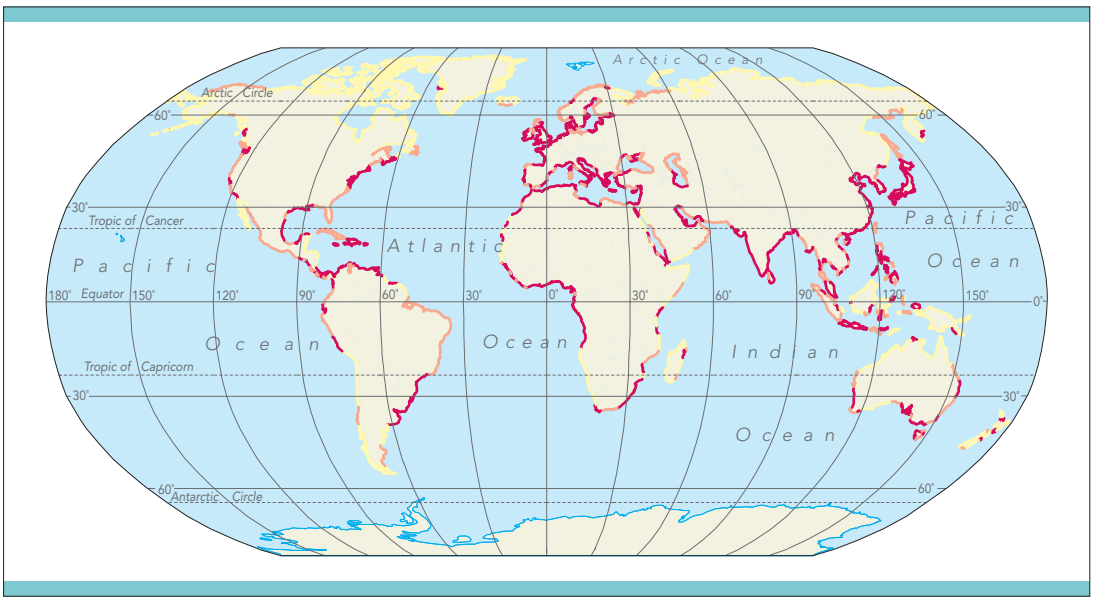


Figure 3.14.1

About 34% of the world's coasts are at high potential risk of all kinds of degradation, and another 17% are at moderate risk.

Source:
World Resources Institute

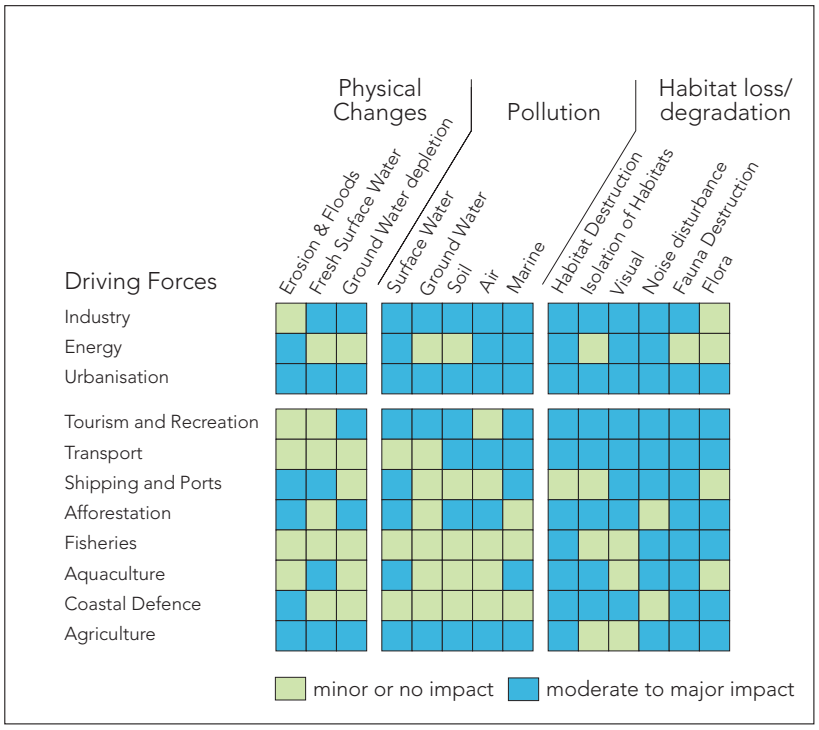
Map 3.14.1

What happens in the coastal zone is important to all Europeans. Much of the influences and pressures on the coastal and marine environments are concentrated in this sensitive area.

Source: EEA

nance of these resources depends on protection of the fragile equilibrium among the dynamic systems (human and natural) of the coastal zones (Map 3.14.1). More importantly, the whole of the EU marine resources depend on the quality of the coastal zones, a relationship recognised in the 5th Environmental Action Programme. Coastal zones also face pressure from development, since they are areas where people want to live and work and where recreational activities also feature in a major way. The EU has recognised the importance of environmental resources in coastal areas and the need for protective measures to ensure that they are not threatened by human activities, in particular urbanisation, transport, tourism, agriculture, industry, energy and fisheries. In 1992, the Council of Ministers called on the Commission to develop an integrated strategy for coastal zone management with a view to providing a coherent environmental framework for sustainable forms of development. The impacts of different human activities on coastal areas are summarised in Figure 3.14.2.

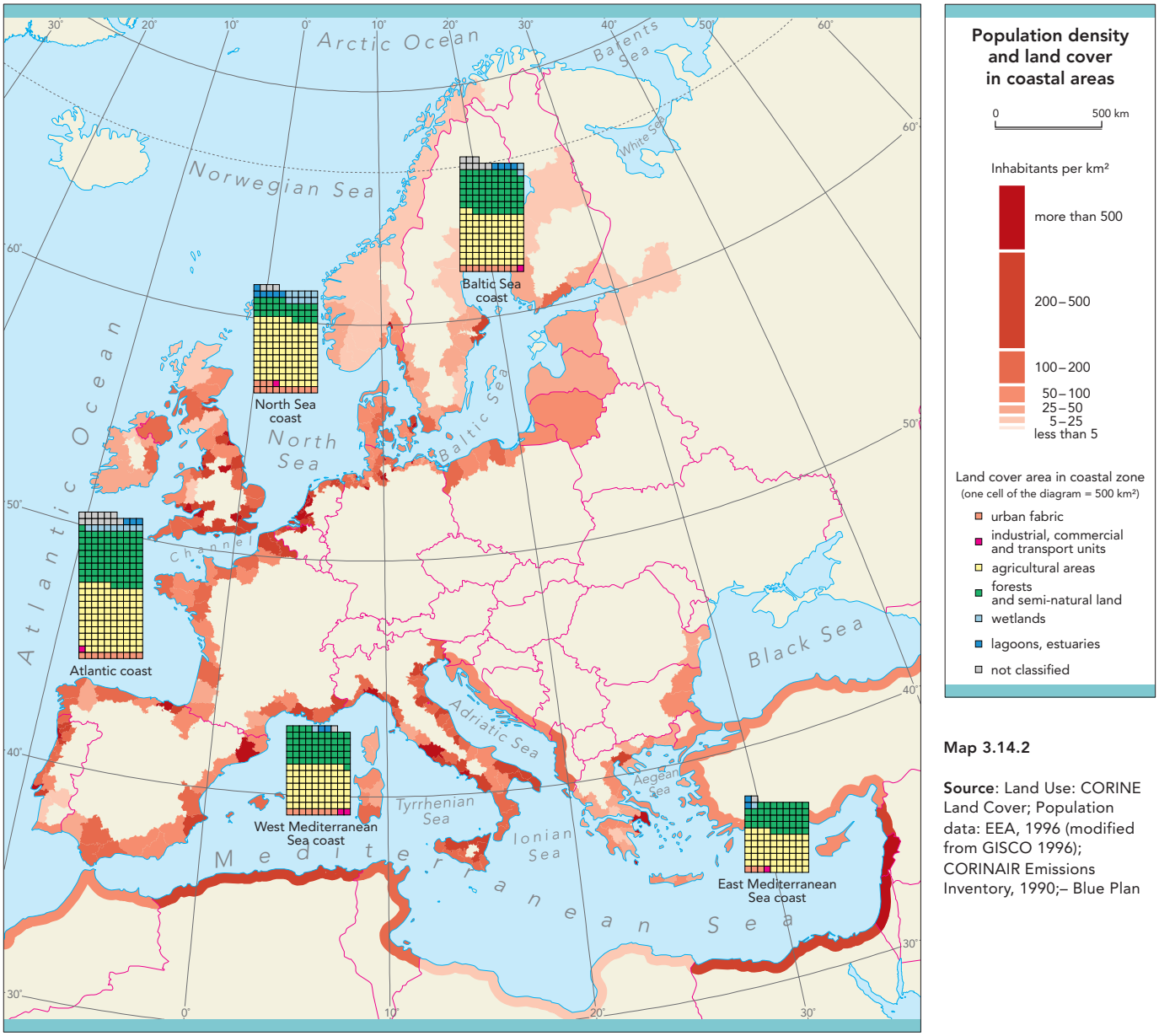
Figure 3.14.2 **General situation of Impacts of the different Driving Forces in coastal areas**



Source: After Rigg *et al.*, 1997; modified

Key areas of action for Integrated Coastal Zone Management (ICZM) are environmental impact assessment, coastal land planning, habitat management and pollution control. The results of the EU 'ICZM Demonstration Programme' and the Water Framework Directive should provide concrete examples of how to tackle coastal zone management issues as they occur. However, although the EU could lead and co-ordinate the approaches to ICZM, decisions on management and implementation should be made at appropriate levels within Member States.

The challenge, then, is to ensure that economic development is sustainable in environ-



Map 3.14.2

Source: Land Use: CORINE Land Cover; Population data: EEA, 1996 (modified from GISCO 1996); CORINAIR Emissions Inventory, 1990;– Blue Plan

mental terms, and does not compromise the quality and viability of the marine environment and its ecosystems. The challenges are being addressed through the development of integrated management strategies in the main coastal areas of the EU: around the Baltic Sea, the North Sea, the Atlantic Ocean and the Mediterranean Sea.

2. The main drivers affecting coastal and marine areas

2.1. Population and urban development

About one-third of the EU population is concentrated near the coasts. Heavy populated areas in the south are usually connected with regions with large cities (e.g. Athens, Rome, Genoa, Marseilles, Barcelona, Lisbon) while a more even, but denser, distribution can be found in the north west of Europe; in the north the population decreases but again the majority of the population is concentrated in the coastal areas (Map 3.14.2). Human activities are often in competition for the use and control of the coastal resources (for example, agriculture and urban areas in the North Sea, agriculture and forests in the Mediterranean and the Baltic Sea; coastal wetlands threatened by other land uses in the Mediterranean, the North Sea and Atlantic).

Urbanisation claims large expanses of coastline, and while stabilising in northern Europe it continues to increase in the southern countries (EEA, 1998) (Figure 3.14.3 and Box 3.14.1). It has major impacts on land, air and water quality (including the surrounding seas) (see Figure 3.14.2), and urban sprawl is

Box 3.14.1 Urbanisation around the Mediterranean Sea

Over the past four decades, urban population rate in the Mediterranean countries grew on average by 44% to 62%. Very fast-growing trends characterise southern Mediterranean countries which show significant annual growth rates, about a doubling of urban population every 30 years.

The number of cities with more than 1 million inhabitants tripled over the same period, from 10 to 29; the number rose from 2 to 17 for the southern Mediterranean countries where Cairo – now the largest city in this area – experiences a density of about 21 000 hab/km2. This striking growth hides the fact that there is also, relatively speaking, a higher growth rate for smaller cities (with over 10 000 inhabitants) which numbered more than 4 000 in 1995, most of them in coastal areas. This urban 'booming' is not comparable to European countries: indeed, while it took one century in Europe to absorb urbanisation, similar phenomena occur only over 20 years in southern Mediterranean countries.

The Mediterranean region in any case faces severe environmental pressures associated with a rapid increase in population, projected to grow from under 400 million in 1990 to around 600 million in 2025, with urban concentrations reaching 75-80% (over 400 million in 2025, up from 220 million in 1985), and the coastal population rising from 140 million in 1990 to over 200 million in 2025. The development pressures are illustrated by projections for an increase in the number of motor vehicles (rising from 60 million in 1980 to 175 million in 2025) while the area of coastal land covered by roads increases to 10 000 sq. kms

Control and management of the social, economic, spatial and environmental consequences of such developments raises serious concerns for the urban quality of life which for hundreds of years has been characteristic of the Mediterranean region, as well as the for the maintenance of high environmental, cultural and economic values of the coastal areas.

Source: Geopolis data base, 1998, quoted and analysed by Blue Plan, 1998; UN population forecast.

a problem in all coastal regions (see Chapter 3.12). In the Mediterranean, MAP/Blue Plan already reported 10 years ago that in 1985 almost 90% of urbanised land in the Mediterranean was located in the coastal zones of Spain, France, Greece, Italy and former Yugoslavia (Grenon & Batisse, 1989). In Southern Mediterranean countries, from Morocco to Syria, 55% of the total population (82% of the urban population in Tunesia) is located in coastal areas which account for 6% of these countries' area.

2.2. Tourism

Coastal-based tourism has been an important part of the economic development of many of the poorer areas of Europe, especially in the South. Over-all, the annual growth rate for tourism in Europe is 3.7% per year, projected to continue through 2000. Nevertheless, tourism in Europe has been losing market share to Eastern Asia and the Pacific, and an additional 10% loss in market share is forecast for 2000, which could lead to a fall in the average growth rate (EUCC, 1997).

In the Baltic sea region tourism may be potentially important to the economies of the Baltic Sea states, especially in places with tourist attractions (such as fishing village, architectural heritage and nature parks) (VASAB, 1994).

The Mediterranean region is the world's leading leisure tourism destination, accounting for 30% of international tourist arrivals and for one fourth of the receipts from international tourism. The French, Spanish and Italian coasts account for 90% of the tourists travelling to the Mediterranean, although the non-EU countries to the south and east are expecting to increase their share in the next decade. The coastal region received some 135 million tourists a year in 1990, and an increase to 200-250 million is projected for 2010 (Blue Plan, 1998). Tourism in coastal regions is estimated at around half of the total tourism to the countries concerned but by far the highest concentrations are found in coastal resorts.

International visits from within Europe (measured as nights) are widely perceived as the dominant form of tourism in Mediterranean coastal regions and the major source of environmental impact. On current estimates (Blue Plan, 1998), however, domestic tourism was already as large in volume in 1990 and this is typically for overnight visits only. The environmental impact of residents' day visits for all purposes is undoubtedly massive in the Region: although there is no adequate data, it is likely that domestic tourism (as defined by the World Tourism Organisation) is at least twice the volume of international tourism, certainly in the more economically developed countries that look South on the Mediterranean.

For international holiday tourism in the Region, package tours are the dominant form in 1999 covering around 84% of visitors to Malta, 78% to Cyprus, 67% for Greece and 48% for Spain (the coastal figures are likely to be even higher). Following a spate of national and international

amalgamations among tour operators in Northern Europe in the last three years, fewer than 10 very large operators now dominate the industry, perhaps accounting for over two-thirds of the market.

Environmental and economic impacts include poor water quality – both salt and freshwater – conversion of nature and agricultural land into tourism facilities, overconsumption of groundwater resources and discharges of untreated wastewater to the sea/catchment area. Analysis of the impacts of tourism on the coastal and marine environments would be assisted by better information to support the framing, monitoring and implementation of sustainable development policies in coastal areas.

2.3. Agriculture

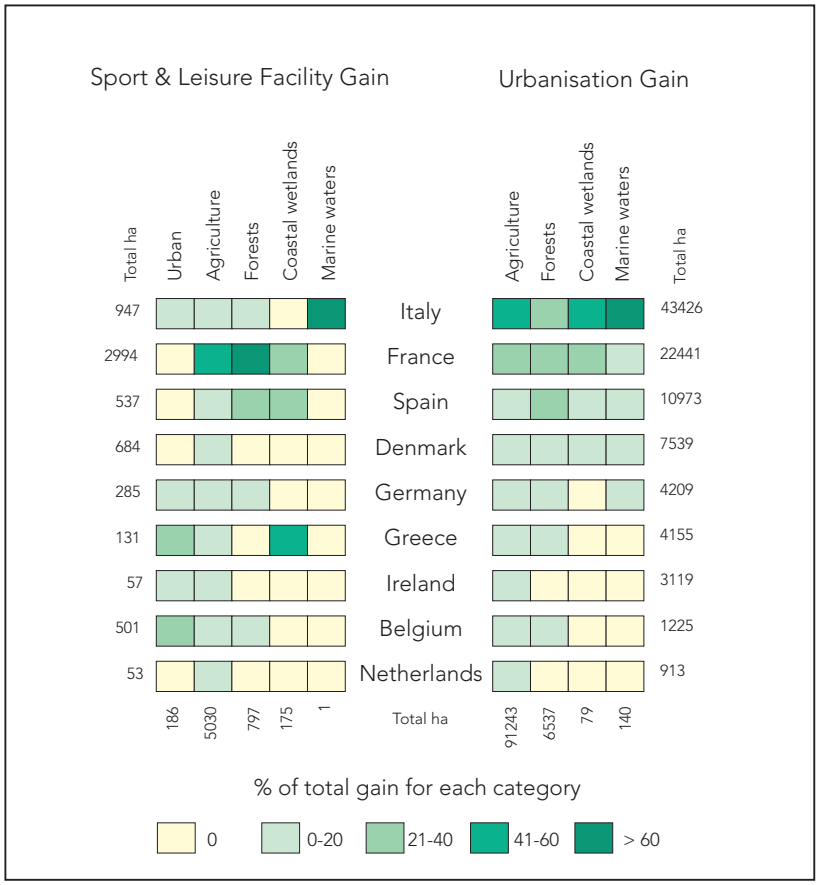
Agriculture is a significant, albeit declining, source of employment in EU coastal zones (the proportion of the workforce in agriculture (9%) is almost twice the EU average of 5.5%).

Along the coasts of the North Sea, a general decline of the area of arable land under cultivation by at least 10-11% as a result of set-aside is expected in agriculture by the end of the century, while a further 4 to 5% of arable land will be farmed less intensively, chiefly because of stricter environmental controls (European Commission, 1994). In the Mediterranean basin, intensive agriculture and farming is limited by the topography of the terrain, being concentrated in the few alluvial plains (Ebro, Rhone, Po and Nile); countries on the northern and western Euro-Mediterranean coasts are specialised in monocultures and achieve good yields while in the south and east, demographic pressure constantly increases and cultivated surfaces continue to expand at the expense of forests and grazing land (EEA/UNEP-MAP, in press).

It is interesting to note that in northern EU countries the loss of agricultural land is connected with the increase of urbanisation, while in the south EU countries agriculture and urbanisation grow simultaneously at the expense of semi-natural and natural areas.

Agri-environment schemes (see Chapter 3.13) can help maintain farm employment and income, while promoting farm diversification and sustainable land management. In coastal regions these schemes can make use of land taken out of production for development of wildife habitats, such as coastal grazing marsh and reed beds behind low lying seawalls, or create new saltmarsh as part of managed realignment of sea walls for conservation and flood defence objectives.

Urbanisation and sport and leisure facilities gains in EU coastal zones (1970s-1990s) Figure 3.14.3



Urbanisation, connected mainly with agricultural and forest loses, continues to grow in the southern European countries but this process is slowing down in the North.

Source: LACOAST Project, JRC, European Commission

2.4. Fisheries and aquaculture, both in transition

2.4.1. Fisheries

A decline of fisheries has been reported in almost all regional seas (EEA, 1998). In April 1997, following an expert group recommendation for a 40% reduction in fleet capacity to match the available fish resources, the EU decided on a reduction of 30% for those vessels targeting those stocks at risk of depletion and 20% for those pursuing stocks which are over fished. Fleet technology in the industrialised EU countries is very high and there has been a shift from labour-intensive to more capital-intensive vessels. In recent years pelagic fishing and processing has increased (EEA, 1998).

Gear such as bottom trawls, pelagic trawls and drift nets, although highly productive, is indiscriminate, and EU drift net fisheries for tuna and a number of other species will be prohibited from 1 January 2002.

The main objective of the EU's Common Fisheries Policy (CFP) is to control fishing pressure so that the fish stocks are exploited sustainably and are able to replenish themselves in the medium and long term.

A 1994 Council Regulation (No 1626/94) (amended in 1996 – No 1075/96 – and 1998) for conservation of Mediterranean fishery resources enhanced the protection of resources and the environment by harmonising different national rules of the four involved EU countries, in accordance with available scientific studies. Mediterranean fisheries are operated by both EU and non-EU countries, and cooperation is essential to ensure conservation and management of shared resources, since management of fisheries focuses mainly on control of licences and subsidies to the sector, rather than quota control. In 1997 the European Community became a member of the General Fisheries Council for the Mediterranean (GFCM).

2.4.2. Aquaculture

Intensive aquaculture results in the production of waste which can stimulate and distort productivity and alter the abiotic and biotic characteristics of the water body (see Chapter 3.5). Aquaculture can result in genetic disturbance of the natural ecosystem, the transfer of diseases and parasites and contamination by chemicals. The effects vary according to a closed, or semi-closed, or open area (see Figure 3.14.2).

In the Baltic region fish produced in hatcheries account for more than 90% of the salmon population. In the North Sea aquaculture is expected, generally, to stabilise rather than grow, primarily due to environmental restrictions and increased production costs. Cultivation of mussels and oysters in the Channel and Wadden Sea, salmon in Norway and Scotland, along with oysters, scallops and mussels are the aquaculture products of the North Sea region. Aquaculture is significant on some Atlantic coasts particularly for local communities in Ireland, Spain and France. The regional aquaculture production in the Mediterranean show a sharp increased by about 185% in a decade (39 575 tonnes in 1984 to 113 103 tonnes in 1994) (EEA/UNEP-MAP, in press).

2.5. Industry and energy, very present in coastal zones

The dominant fuel used in EU countries is oil, almost all of which is transported across the sea to be processed within the coastal zones. The North Sea area is still the primary source of energy in the EU, but the extraction of oil most probably will decline in the years to come (European Commission, 1994). The Mediterranean basin endowment of oil and natural gas is leading to the establishment of many refineries in the region. The environmental consequences of oil (extraction, transport, refinement, and use) are well documented.

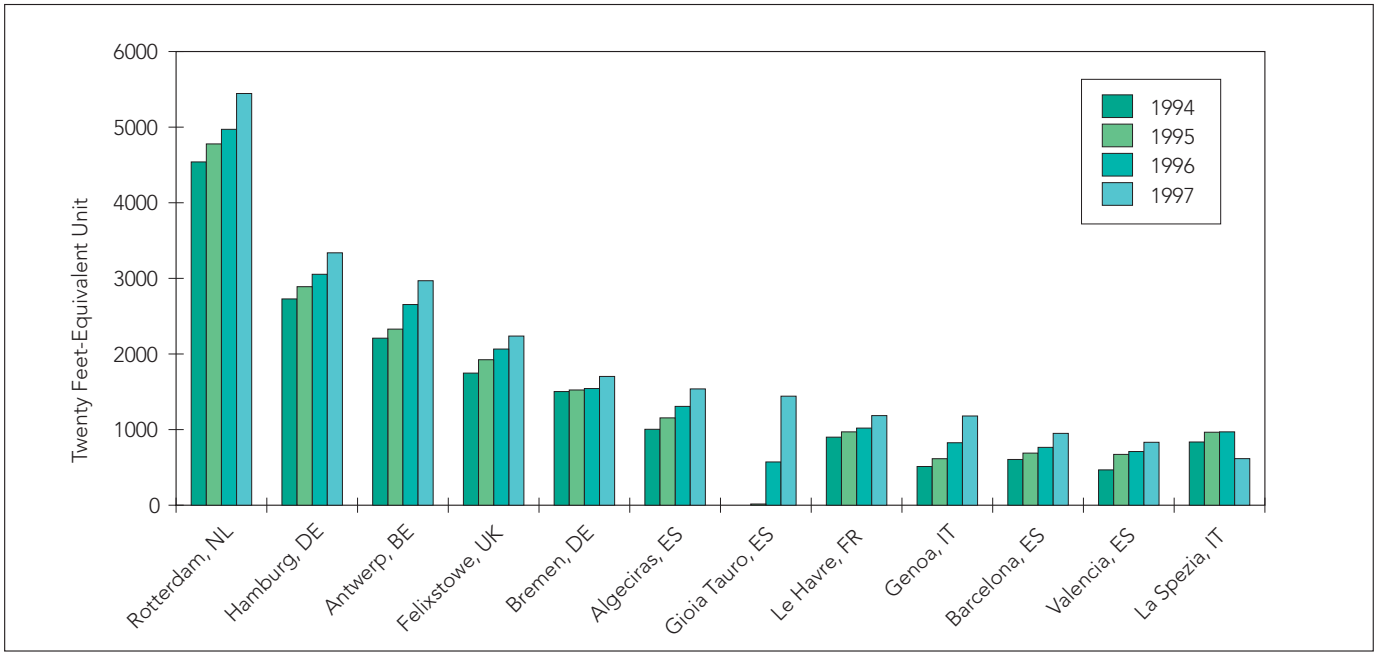
There are around 200 nuclear power plants operating throughout Europe, many of which are located in coastal regions or along important rivers due to the large volume of cooling water needed. The nuclear industry poses a special set of threats to coastal and marine ecosystems mainly due to the sheer scale of damage that could result from a major nuclear accident, however unlikely that may be. In the absence of major accidents, coastal and marine ecosystems are still subject to operational discharges of radioactive waste.

Industrial inputs to the Baltic Sea mainly come from pulp and paper processing (this area is responsible for 25% of the world's pulp production), iron and steel industry, mining and fertiliser production (HELCOM, 1998). In the Atlantic coast many manufacturing industries are in decline but a number of traditional industries maintain their importance (European Commission, 1994). The development of renewable energy sources (especially wind and, solar sources) is preferable to continued investment in conventional energy supplies since there is a lower contribution to global warming and air pollution. The use of renewable energy sources in the North Sea area is expected to increase especially in coastal areas (European Commission, 1995). Renewable energy sources have impacts on the landscape, particularly at the local level, although fields of modern wind turbines or solar panels may be less undesirable than large power plants with cooling towers and huge steam clouds.

2.6. Transport growth

Maritime transport of goods increased in the EU by 35% between 1975 and 1985, but has since levelled off (EUCC, 1997). It is considered to be one of the most environmentally friendly modes of transport, if all measures and legislation are enforced. However, it has environmental impacts in the European coastal and marine environ-

Maritime freight in container traffic for main EU ports 1994-97 Figure 3.14.4



Source: Port of Rotterdam – web site

ment from spills of hazardous materials (oil spills being the best well known), and can cause significant environmental damage with implications for economy (e.g. tourism, fisheries, agriculture), ecology and health (see Figure 3.14.2). Ports have a key role as interconnection points between seaborne and land-based transport modes. Freight passing through European ports has increased in the past five years and this trend is probably going to continue as the enlargement of the EU generates new transport flows (Figure 3.14.4). Large ports such as Rotterdam – the world's largest – Hamburg, London, Le Havre connect to some of the busiest shipping routes in the world. In the Mediterranean basin the major transportation mode of commerce between countries is through the sea, mostly by ferries. It is estimated that about 220 000 vessels of more than 100 tonnes cross the Mediterranean each year, which is estimated as 30% of the total merchant shipping in the world and 20% of oil shipping mainly coming from the Middle-East (MAP/REMPEC, 1996).

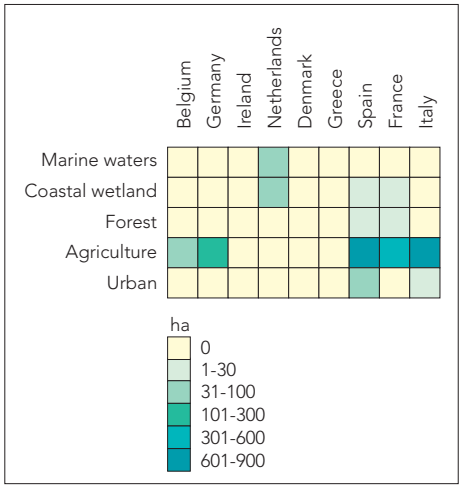
In the Baltic Sea the transport of goods, including oil, via the Baltic ports has grown significantly since 1990. The threats to marine and coastal environment degradation are increasing but the political will of the countries in the Baltic region to fight oil pollution is strong; they have agreed to implement an integrated, no-special fee system, for oil and wastes in their harbours and making it mandatory to deliver oil at a reception facility before departure.
Ports, in conjunction with water-borne transport, can make an important contribution to environmentally sustainable transport, but this depends on measures to limit adverse environmental impacts, and in particular a full assessment of the environmental impacts of all port-related developments.

Railways, motorways and roads occupy long stretches of land and form barriers which lead to the fragmentation and/or isolation of habitats. If located near the coast, they can inhibit the natural processes of shore formation and development, they can have an impact through airborne pollutants on the surface water, and they can also cause significant coastal erosion; one of the feedback effects of erosion could be the destruction of the infrastructure itself (example can be found in the Black Sea coastline). In addition road runoff in the coastal zone and in catchment draining to estuaries cause chronic pollution from contaminants such as polyaromatic hydrocarbons. Road traffic in coastal zones is well developed but very dense, while railway use is in decline (EUCC, 1997). In some countries the geomorphology dictates the expansion of the road and rail network in the coastal zones (for example Italy has a long coastline with mountains in the middle; in the Netherlands creation of dams, are maintained for coastal protection) (Figure 3.14.5).

Figure 3.14.5 **Changes in road and rail networks surface for some EU coastal zones (1970s - 1990s)**

Note that geomorphology dictates the expansion of the road and rail network in the coastal zones (e.g. Italy, Netherlands)

Source: LACOAST Project, JRC, European Commission

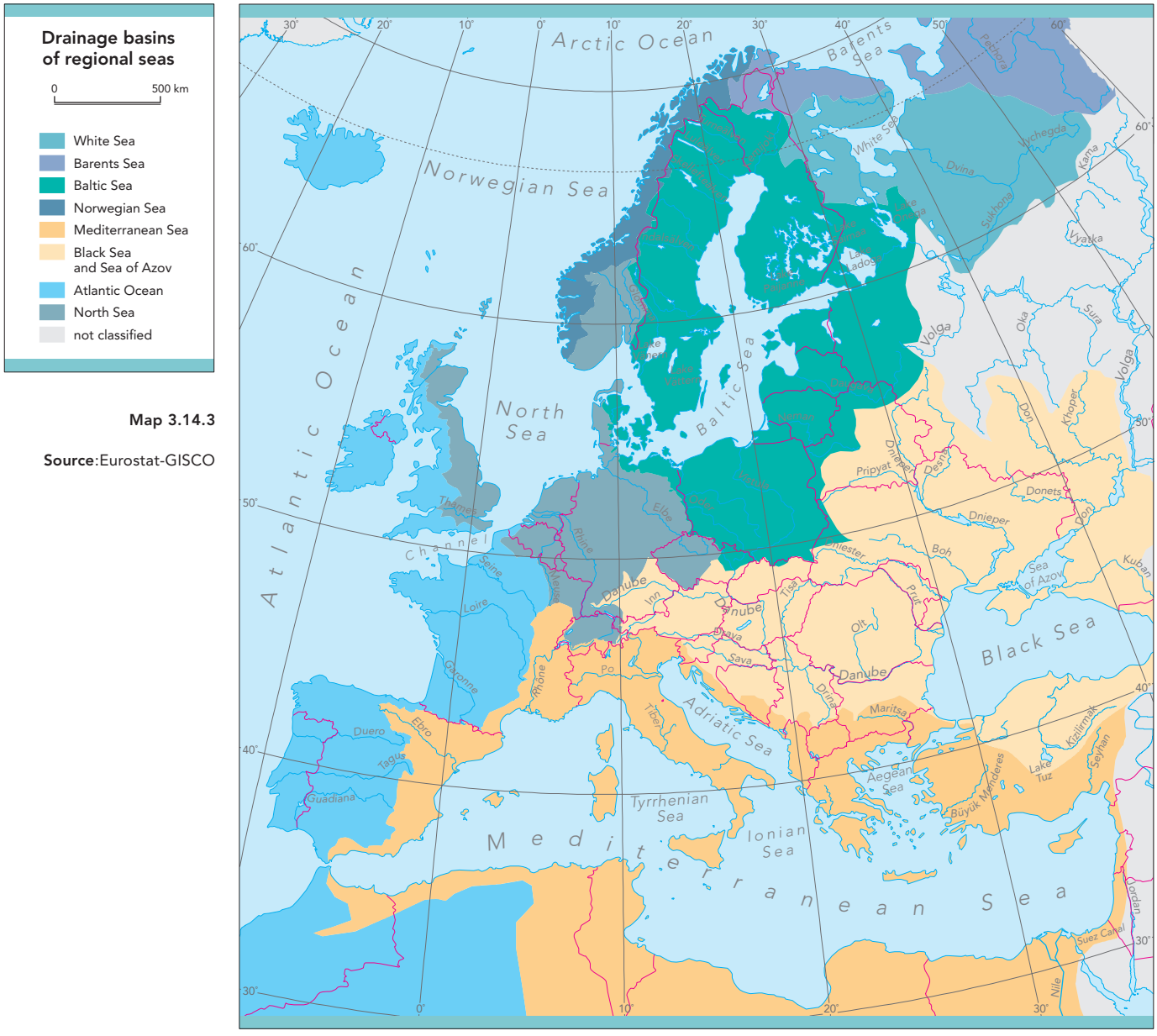


3. Environmental conditions in regional seas

The environmental problems faced by maritime areas in the EU are summarized in Table 3.14.2. This summary has been formulated through an analysis of the INTERREG.II.C programmes of the EU. The information presented represents the 'perception' which, those in charge of the maritime areas, have of their environment, as discussed and agreed upon through the policy process.

Important research has been made in all European regional seas through the MAST Programme from DGXII. During the MAST-III programme (1994-98) the regional seas were covered by the following projects:

- the Canary Islands Azores Gibraltar Observation (CANIGO) project with the



Map 3.14.3

Source:Eurostat-GISCO

Challenges and problems in the different EU maritime regions Table 3.14.2

Atlantic	North Sea	Baltic	Western Mediterranean
Dichotomy of under-exploitation of abandoned areas and over-exploitation and rising population of areas under development. Risks linked to natural conditions (insufficient amount of drinking water, erosion, fires, flooding). Maintain coastal ecosystems threatened by coastal erosion, regression of beaches and scarcity of water resources in humid sourthern zones. Seasonal pressure of tourism, especially in southern Brittany. Qualitative degradation of river and sea water (industrial dumping and abandoned mining sites). Apparition of extreme situations in agriculture: over-exploitation of certain zones, abandonment of other zones. Growing urban pressure, especially around 'capitals' and coastal cities, and diffuse and uncontrolled urbanisation in interior zones.	Strong consensus for integrated management of coastal areas. Improve quality and availability of operational information for spatial planning. Encourage renewable forms of energy. Coastal erosion. Reduce level of marine pollution. Concern to protect natural areas still untouched by economic development.	Increase in eutrophication leading to the proliferation of algae. Origin of major problems: nitrogen due to combustion of fossil fuels, agriculture and landfills; added phosphorus (agriculture and landfills). Numerous of hot-spots (direct industrial discharges). Global vulnerability of the Baltic Sea due to less saline water and its nature as a closed sea (narrow exchange corridors with the North Sea).	Conscious of rich natural heritage which is threatened and is at risk (natural risks, agriculture, tourism, transport, urbanisation in coastal areas). Prospects for fragile or low-density areas in all aspects. Control of tourism development. Manage and protect inland and marine waters; specific problems in semi-arid zones; regulating debit and quality of water, provision of water and risks linked to natural conditions (erosion, desertification, saline intrusions in groundwater).

Source: INTERREG-II

objective to understand the functioning of the marine system in that region of the Northeast Atlantic Ocean and its links with the Alboran Sea;

- the Ocean Margin EXchange (OMEX) project in the north east Atlantic, to gain a better understanding of the physical, chemical and biological processes occurring at the ocean margins in order to quantify fluxes of energy and matter across this boundary;
- the Baltic Sea System Study (BASYS) in the Baltic Sea with the aim to further the understanding of the susceptibility of the Baltic Sea to external forcing and to improve the quantification of past and present fluxes;
- the Mediterranean Targeted Project II-Mass Transfer and Ecosystem Response (MTP II -MATER) with the aim to study and to quantify the triggering and controlling mechanisms of mass and energy transfer in contrasting trophic environments (from eutrophic to oligotrophic) of the Mediterranean Sea and to investigate the ecosystem response to such a transfer.

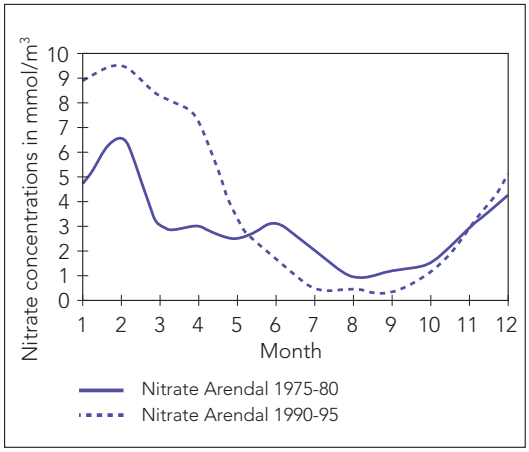
3.1. North Sea

The North Sea catchment area (850 000 km^2) with about 165 million inhabitants has a high population density (194 persons per km^2, some 70% above the EU average). Around a quarter of the coastal areas of the North Sea are at risk from erosion (Corine, 1998). Nutrient levels seem to be high in some areas of the North Sea (Fig 3.14.6).

Large areas of the North Sea have contaminants (mainly coming from the rivers Elbe, Weser, Rhine, Meuse, Sheldt, Seine, Thames and Humber) in concentrations that are clearly above the North Atlantic background level (EEA, 1998). Synthetic organic compounds such as PCBs, DDT, PAHs, and TBT, are widespread, although higher concentrations are clearly identifiable in certain areas (EEA, 1998). Higher concentrations of PCBs are found in the southern part of the North Sea and close to harbour and city areas, and TBT concentrations are higher in some estuaries, harbours, and shipping lanes. Despite actions to restrict or, in some cases, ban the use of PCBs, unacceptably high concentrations are still found, which sug-

Figure 3.14.6 **Nitrate concentrations in the coastal water mass at Arendal on the Norwegian Skagerrak coast (monthly mean values for the periods 1975-80 and 1990-95)**

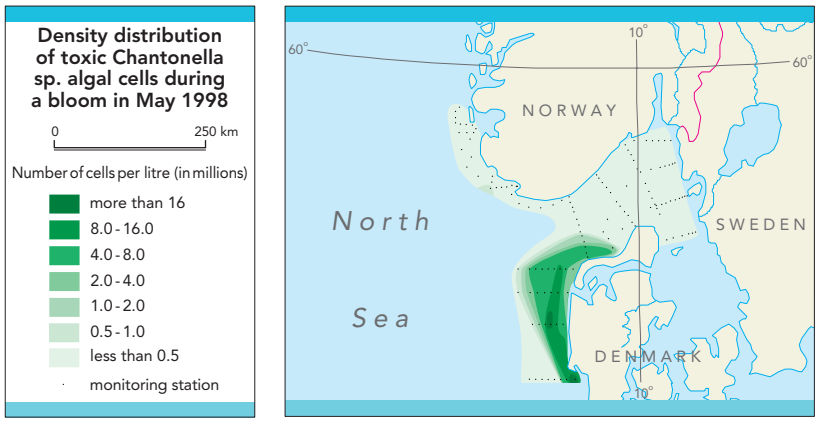
Source: ANON, 1997a



gests that existing measures are only partially effective. There is little evidence on the environmental effects of synthetic organic compounds.

In recent years, algal blooms (for example *Chrysochromulina polylepsis*, in 1988) have occurred in the North Sea (particularly in south eastern parts such as the Jutland coastal watermass) due to the elevated nutrient concentration. A new toxic species, *Chatonella sp.*, formed blooms the major of which occurred in May 1998 (Figure 3.14.7) and caused fish kills in Norwegian salmon farms. In such conditions oxygen depletion, caused by degration of algae, can damage marine life.

Figure 3.14.7 **Distribution of the densities of algal cells during a bloom in May 1998 of the toxic species *Chatonella sp.***



Chatonella species were first seen in 1990 and probably introduced from ballast water.

Source: Data from Institute of Marine Research, Norway

3.2. European Arctic Seas: Norwegian, Iceland, Greenland Barents and White Seas

Areas surrounding the European Arctic seas are sparsely populated (about 2.2 million inhabitants) and not very industrialised: some mining and metal industry in Northern Norway and Russia, offshore petroleum industry in expansion in the Norwegian and Barents Seas, and fisheries of major importance for population in Iceland, Faroe Islands and Northern Norway.

The northern seas is the home area for some of the largest fish stocks in the world which in turn support large stokes of seals, cetaceans and birds. However, most of the major commercial fish stocks in the area are below safe biological limits. A further issue of concern is the damage by bottom trawling on cold-water reef colonies in shelf and slope waters in the Norwegian Sea (ANON, 1997b).

The major source of pollutants and radionuclides in the Arctic is atmospheric long range transport, Russian rivers, ice-drift and ocean currents (AMAP, 1997). High levels of persistent organic contaminants, with possible effects on the reproduction and on the immune system, are detected in some top predators such as polar bears, glaucous gull and harbour porpoise probably coming from atmospheric deposition (AMAP, 1997). In spite of the presence of nuclear power plants in Russia and of the considerable amount of nuclear waste (ANON, 1997b; Layton *et al.*, 1997) the concentration of radionuclides in the marine environment in the Arctic is generally very low. The most immediate and potentially largest threats relate to nuclear wastes from past Russian military activities.

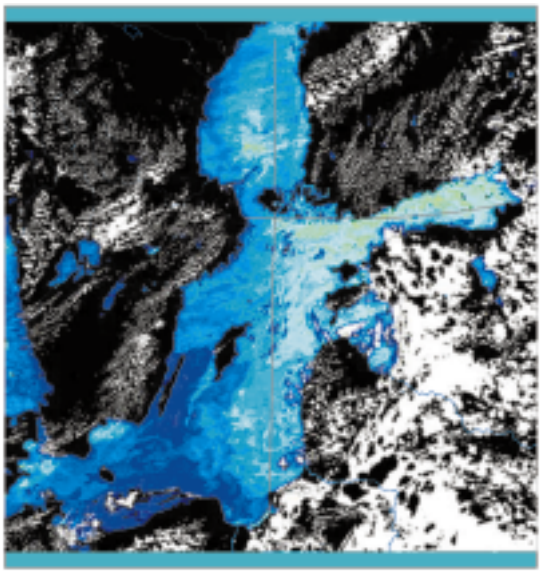
3.3. North-East Atlantic

The North-East Atlantic region includes some densely populated coastal areas such as South Wales, the Basque country, and major cities (Lisbon, Porto, Bilbao, Dublin, Glasgow, Nantes and Bordeaux). Many river catchments such as the Mersey and the Oria, are heavily industrialised, while others such as Loire and Shannon are largely rural and agricultural.

The NE Atlantic is not heavily affected by eutrophication, although sporadic toxic seaweed blooms can be observed (EEA, 1998). Contaminants of both heavy metals and organo-chlorines are not found in concentrations dangerous either for the environment or for human health (EEA, 1998).

The NE Atlantic (and particularly the North Sea) is also contaminated to varying degrees by radionuclides discharged in particular from nuclear fuel reprocessing plants in the UK (Sellafield) and France (The Hague) (Brown, *et al.,* 1998). However, even in the periods of peak discharges, doses of the most exposed members of the public have remained well within the statutory limits and there has never been any evidence of ecological damage. Moreover, taken collectively, annual discharges of the most significant nuclides from the point of view of public exposure have been substantially reduced by up to two orders of magnitude since the peaks of the mid-1970s in the case of Sellafield and by one order of magnitude since the mid-1980s for Cap de la Hague. Packages of nuclear waste have not been dumped on the bed of the North-East Atlantic since the early 1980s and various surveys carried out since then have not revealed any evidence of significant leakage from the packages (EEA, 1998, p.214).

Abundant bleu-green algae (cyano bacteria) in the Baltic Sea Figure 3.14.8



Source: Finnish Institue of Maritime Research, 1997

3.4. Baltic Sea

The Baltic Sea is the second largest brackish water area in the world. The population in the catchment area is about 85 million, nearly 15 million of which living within 10 km from the coast (Sweitzer *et al.,* 1996). The 'Red List of Marine and Coastal Biotopes and Biotope Complexes of the Baltic Sea, Belt Sea and the Kattegat' presents the status of the marine and coastal biotopes with severe cause for concern, as 83% of all biotopes of the Baltic Sea Area are rated as heavily endangered (15%) or endangered (68%) (HELCOM Environment Committee, 1998). Agriculture is well developed, except in the northern parts, and is responsible together with natural leaching for most of the total nutrient load entering the Baltic Sea (Elofsson, 1997). Excessive nutrients, the physical and chemical nature of the Baltic Sea and its topography are responsible for the eutrophication observed in this catchment area. The Baltic Sea states decided in 1988 to reduce nutrients, heavy metals and POPs by 50% by 1995 compared with the mid 1980s, to decrease the pressure of eutrophication effects in the coastal zones. Eutrophication affects almost all areas of the Baltic Sea and represents one of the main issues of concern for the marine environment (Fig 3.14.8). The frequency and spatial coverage of phyto-plankton blooms, especially cyano-bacteria, has increased due to the increase in nutrient concentrations, but also to changes in the seasonal availability and relative proportions of nutrients (HELCOM, 1996).

The blooms of harmful algae have resulted in losses to the fish farming industry, death of fishes and sea birds from poisoning, and also some damage to human health. Periods of oxygen depletion have increased, especially in the south-western parts (HELCOM, 1996). Contradictory trends of heavy metals concentration in sea water and biota have been observed (HELCOM, 1998), possibly due to inadequacies in the load data.

Discharges of organo-halogen compounds from pulp industry are reported to have been reduced by nearly 90% since 1987. A clear long-term decrease in concentrations of PCBs, DDT's, HCH and HCB has been observed from the early 1970s to the early 1990s, nevertheless, they are still several times higher than in the open North Sea and the Atlantic Ocean (HELCOM, 1996 and 1998). Although organo-chlorine levels are still very high in Baltic seals, measures taken by the Baltic Sea States have arrested a decline in seal populations and the total number of grey seals has increased considerably in the northern parts of the Baltic Sea since the mid 1980s (HELCOM, 1998).

3.5. Mediterranean Sea

The population in the Mediterranean catchment area is currently 129 million inhabitants, with an increasing trend (UNEP-MAP/Blue Plan, 1998). The increasing pressure due to the resident population is exacerbated by the seasonal variation due to tourism (Map 3.14.4). These pressures

Box 3.14.2 The changing marine environment of the Mediterranean: The Mediterranean Targeted project (MTP).

During the past five years 70 Institutions and 250 scientists from 14 countries have cooperated to produce important scientific results illustrating the change in the functioning of the Mediterranean ecosystems:

- The temperature of deep waters in the Western Mediterranean had increased by 0.13°C over the past 40 years ($3.2 \cdot 10^{-3}$ °C/y).
- Evidence for climatic changes were also detected in the deep-water masses of the eastern Mediterranean basin.
- Increases in nutrient discharges (phosphate and nitrate) were documented from deep water measurements.
- MTP results supports strongly the hypothesis of phosphorus limitation for phytoplankton growth in the northwestern Mediterranean.
- Lead concentrations in surface waters decreased in the early 1990s following the application of European regulations relating to leaded gasoline.
- The southern Aegean Sea is one of the most oligotrophic areas of the world. Important changes were also observed (nutrient enrichment connected water masses movement from the Cretan Sea), having a direct effect on the biology of the region.

Source:
Interdisciplinary Research in the Mediterranean Sea, 1997

give rise to deterioration in the geomorphological patterns of the coastal strip leading to changes in natural processes, such as movement of dunes. Consequently, around one-fifth of the Mediterranean coast is estimated to be subject to coastal erosion (Corine Coastal Erosion Atlas, 1998).

The overall environmental task and the need to address tourism specifically is huge. It is estimated that the tideless Mediterranean, the principal natural resource for leisure tourism, was being treated as a sink in the mid-1990s for some (Blue Plan, 1998):

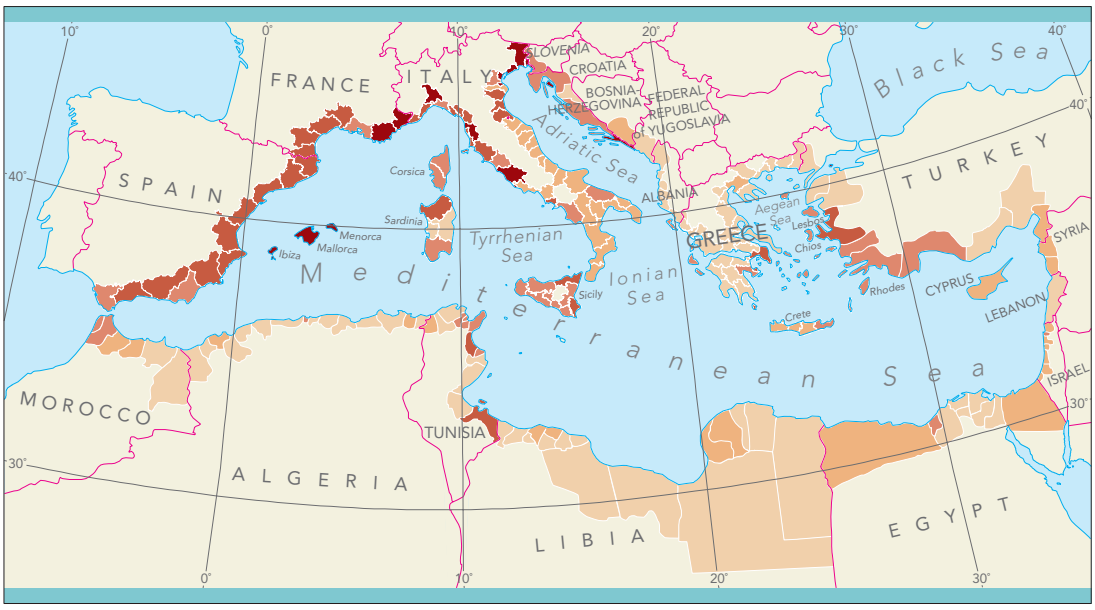
- 10 billion tonnes of industrial and urban waste (including sewage) dumped annually – of which only a very small proportion receives even primary treatment before discharge (90% of municipal wastes in the whole basin is still untreated).
- Over 70 rivers which drain into the Mediterranean and, at the end of this century, many are still virtually open pipelines for industrial, agricultural and human effluent.
- 1 million tonnes of crude oil dumped by all activities, and a major risk factor in the Sea of Marmara for tankers entering and leaving the Black Sea oil terminals.
- 60 000 tonnes of detergents, 100 tonnes of mercury.
- 3 600 tonnes of phosphates.
- Sewage and agricultural run off leading to eutrophication which routinely creates red tides and algal blooms that disrupt the ecosystems of the area.

Concentrations of hydrocarbons in water and on beaches have increased in recent years. Values of 0-5 µg/l of hydrocarbons have been measured in open waters and over 10 µg/l near the shore, the latter caused mainly by point sources in the shore line and illegal discharges.

The presence of heavy metals does not appear to be a major environmental problem for the Mediterranean Sea (EEA/UNEP-MAP, in press). The contribution from industry is small compared with other industrialised regions; other main sources of heavy metals are natural geo-chemical occurrences, agriculture, and urban pollution. The same conclusion is valid for PCBs – with the exception of 'hot spot' sediments – with the difference that most of these substances are no longer used in the Mediterranean industry and agriculture.

Eutrophication, resulting in phytoplankton blooms, mainly occurs locally and in places in the Adriatic, the Gulf of Lion and the northern Aegean (EEA, 1998, p. 214). Microbial contamination is mainly related to urban waste water and represents a potential risk for human health especially through the consumption of uncontrolled shellfish food. The situation has been mitigated by the installation of urban waste-water treatment plants along EU Mediterranean countries and the demand for good water quality from the tourism industry has pushed also other countries to pay an increasing attention to this problem; nevertheless, about 60% of municipal sewage is still untreated (EEA/UNEP-MAP, in press).

Energy comes mainly from conventional oil and gas and, as this area exhibits high seismic activity (EEA/UNEP-MAP, in press), construction of nuclear plants in the Mediterranean basin should be generally avoided.



Frequency of tourism in the Mediterranean region during summer season

0 500 km

Estimated number of tourist (thousands) for 1990's

- 900 – 1100
- 600 – 900
- 300 – 600
- 150 – 300
- less than 150

Map 3.14.4

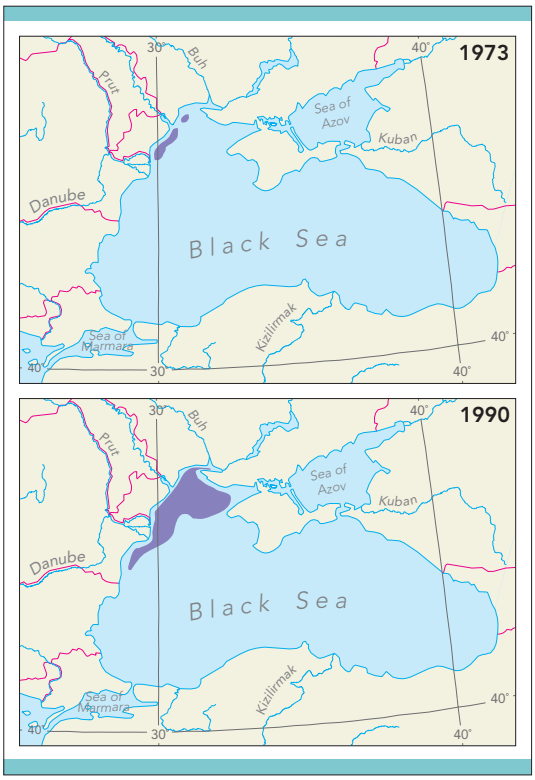
Source: Blue Plan

3.6. Black Sea

The catchment area of the Black Sea, which is over 2 million km^2 – that is five times the size of the actual sea – covers (wholly or in part) 22 countries in Europe and Asia Minor with 175 million inhabitants. The largest volume of river flow entering the Black Sea comes from the north-western part of the basin (important rivers being the Danube, Dneper, Dnester) and from the Caucasus, Turkey and the Bulgarian and Romanian coasts. In the last 30 years the Black Sea has increasingly attracted the attention of scientists, governments and the public at large as a region suffering ecological deterioration. As the result of past geological events, its morphometry and specific water balance, nearly 87% of the Black Sea water volume is anoxic and contains high levels of hydrogen sulphide (Fig 3.14.9). Between 1973 and 1990, as mineral and nutrient concentrations increased in flows from rivers including the Danube, Dneper, Dnester, 60 million tons of bottom living animals (including 5 000 tons of fish), were found dead in the Black Sea (GEF/BSEP, 1997). The recent eutrophication caused by a heavy anthropogenic nutrient load has resulted in severe stress, even in the oxygenated area (13% of the Black Sea's volume) which consists mostly of shallow surface water. Future projections indicate that the Black Sea will remain the worst affected area for eutrophication in Europe in 2010 (European Commission, 1999).

Little is known about heavy metals in the Black Sea (GEF/BSEP, 1997). Information on pesticides is also scarce, although levels up to 200-300ng/l total organo-chlorine pesticides have been reported in the river Don and 5ng/l in the open Black Sea. 'Hot spots' of phenol in the water have been reported in the Odessa area and in other northern coastal areas (GEF/BSEP, 1997).

Due to its connection with the Mediterranean, the Black Sea consists of two general categories of flora and fauna: Mediterranean immigrants and Caspian relics. Thirteen Mediterranean and other exotic species have penetrated either through ballast waters and as fouling organisms on ship hulls (Tiganus, 1997). Another 13 species have been intentionally introduced. The most urgent and



Expansion of seasonal hypoxic and anoxic zones on the north--western shelf

0 250 km

hypoxis and anoxis zones

Figure 3.14.9

Source: from Zaitsev, 1992

most prominent example of the impact of exotic species in the Black Sea environment is that of *Mnemiopsis leidyi* (GESAMP, 1997).

4. What is the policy response for coastal and marine zones?

4.1. Marine – still a fragmented approach but with progress

Many of the policy developments in recent decades have been focused on the quality of the marine environment rather than on the factors influencing coastal zones. The transboundary characteristics of most of the environmental problems and the need for regional strategies and international cooperation have fostered the establishment of Regional Conventions, which now cover all the seas that are of direct concern to EU countries. The purpose of these Conventions is to assess the quality of the marine environment and its trend, and to define strategies for its protection, using appropriate scientific and management tools (Table 3.14.3).

At the EU level, environmental legislation related to the marine and coastal environment deals primarily with marine water quality and inputs of contaminants, and to a lesser degree with the protection of marine and coastal habitats. The objectives and results of implementation of EU Legislation are summarised in Table 3.14.4. The implementation of EU Directives varies between Member States.

The assessment approach for most of the EU Directives, based on monitoring the chemical determinants of water quality, requires the monitoring of a large and growing number of contaminants. This has placed an overwhelming and unnecessary (and expensive) burden on the regulatory authorities, who have to monitor a large and growing number of contaminants. At the same time effects of new contaminants are being missed, until they have a significant impact in the environment.

The Bathing Water Directive is arguably the most successfully implemented of all EU environmental legislation related to water

Table 3.14.3 **Regional Conventions for European waters**

	Signatories states	Area covered	Objective	Programmes	Main problems
OSPARCOM 1992 (Oslo ,1972 and Paris ,1974)	Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Norway, the Netherlands, Portugal, Spain, Sweden, UK, Luxembourg and Switzerland.	North-East Atlantic	Prevention and elimination of pollution of the marine environment in the North-East Atlantic, from land-based sources and by dumping from ships and aircraft.	JAMP (Joint Asessment and Monitoring Programme) Nutrient Monitoring Programme	No obligatory reporting
HELCOM Helsinki Convention 1974-1992	Czech Republic, Denmark, Estonia, the European Union, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia and Sweden.	Baltic Sea and Baltic catchment area	Protection of the marine Environment	COMBINE (Joint Comprehensive Environmental Action Programme of the Baltic Sea)	No obligatory reporting
Barcelona, 1975-1995	Albania, Algeria, Bosnia and Hergegovina, Croatia, Cyprus, Egypt, the European Union, France, Greece, Italy, Israel, Lebanon, Libya, Malta Morocco, Slovenia, Spain, Syria, Tunisia, Turkey	Mediterranean Sea	Protection of the Marine Environment and the Coastal Region	MAP, (Mediterranean Action Plan)	Different pace of the EU and non-EU countries
Bucharest Convention 1992	Bulgaria, Georgia, Romania, Russia, Turkey, Ukraine	Black Sea	Protection of Black Sea against pollution	BSEP (Black Sea Environment Programme)	Lack of resources

EU Environmental Directives related to coastal zones and marine waters, and their objective Table 3.14.4

Directive	Objective	Main results of implementation
76/160/EEC, Bathing Water	Achieving/maintaining good bathing water quality as defined by a set of parametric values. Monitoring bathing water quality. Publication of monitoring results.	Due to increasing number of urban waste-water treatment plants, encouraging results. Certain problems still remain with inland waters.
*76/464/EEC, Dangerous Substances	Dangerous substances to be eliminated and the groups of dangerous substances to be reduced from community waters.	
* 78/659/EEC Fish water, amended by 90/656/ECC and 91/692/EEC	Water Quality for fish.	Proper implementation; however, scope of waters covered is rather limited.
* 79/923/EEC, Shellfish Waters	Quality of shellfish waters.	Proper implementation; however, scope of waters covered is rather limited.
* 80/68/EEC – Groundwater amended by 90/656/ECC and 91/692/EEC	Prevention of groundwater pollution caused by certain dangerous substances.	Proper implementation; however, scope of waters covered is rather limited.
82/176/EEC, The Mercury Discharges		Based on values Europe-wide.

* will be incorporated in the proposed Water Quality Framework Directive (COM (97)49)

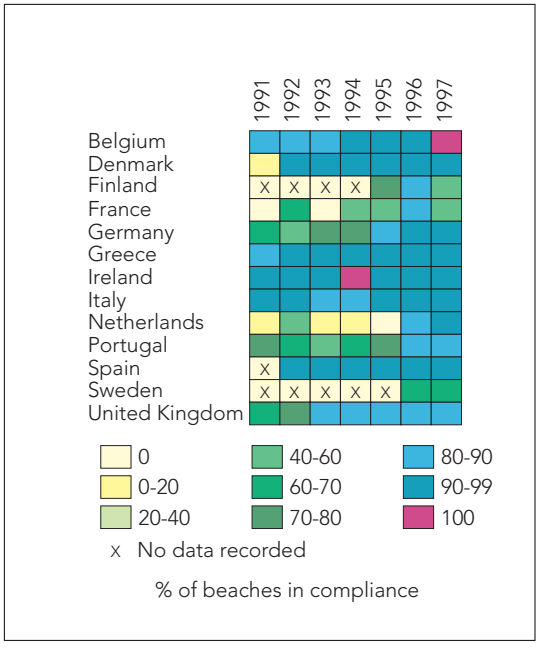
(see Figure 3.14.10). In 1997, more than 90% of EU bathing waters complied with the Directive's minimum quality requirements, leading to substantial environmental improvements for bathers and other recreational users in coastal areas. Measures to improve the bathing water quality have included increasing and improving advanced sewage treatment and the application of cleaner technology in industry, as well as a major control of deliberate and accidental disposal of waste and discharge of pollutants.

The proposed Water Framework Directive (see Chapter 3.5) is in line with the concept of integrated coastal zone management (ICZM) as it considers the entire river basin as the unit for the management of water and is designed to protect and enhance the quality of aquatic ecosystems. More EU Directives should follow this line of integration in the future.

4.2. Coastal zone management – sustainability still some way off

The lack of an effective integrated catchment and coastal zone management (CZM) has been recognised to be responsible of the degradation of coastal and marine environment. This lack of co-ordination not only concerns the horizontal relations between sectors of activity, but also the intermeshing of the policies and actions carried out at various levels of territorial Authority (local, regional, national or European). The integrated approach to CZM is still missing from most of the legislation at National level where a sectoral approach still dominates. Key areas of action for ICZM are environmental impact assessment, coastal land planning, habitat management and pollution control. Public awareness and participation are crosscutting themes in every coastal management effort and need special empha-

Bathing Water Directive compliance in EU countries during 1991-97 (percentage of beaches complying with at least the mandatory values of the Directive Figure 3.14.10



The situation after the long implementation period is still improving, although results do not show consistency within the Member States.

Source: European Commission, DG XI

sis. Examples of good ICZM in the Netherlands, Poland and the United States, are shown in Box 3.14.3.

The need for better management of coastal zones has stimulated a growth of interest in ICZM at the EU level, especially in the last decade, and has led to political commitments and numerous measures, even though the tentative to launch an EU framework directive on ICZM was unsuccessful.

The current EU 'Integrated Coastal Zone Management Demonstration Programme' is a response to Council's request in 1992 for the overall Community strategy on integrated coastal zone management. It is a joint initiative of DG XI, DGXIV and DGXVI consisting in 35 projects, which, for the geographical distribution and range of problems encountered, represent the diversity of the ecological, economic and social situations of the European coastal zones. The Programme aims to:

- provide concrete technical information about the factors and mechanisms, which either encourage or discourage sustainable management of coastal zones and,
- stimulate a broad debate and exchange of information among the various actors involved in the planning and implementation of coastal zone management, including those at the local, regional, national and European levels.

The results of the 'The Integrated Coastal Zone Management Demonstration Programme' and the initiative of the Framework Directive for Water should provide concrete examples on how to tackle the coastal zone management issues as they occur in the Member States. However, although the EU might have a role in leading and co-ordinating the approaches to ICZM, decisions on management and implementation should be made locally, regionally or nationally (see Box 3.14.4 & 3.14.5). Only by maximising experiences and expertise at the local level and allocating budgets to projects which promote environmentally, economically and socially sustainable management can ICZM achieve the desired results.

Box 3.14.3 Marine and coastal environment in Cyprus: reasons for concern

The coastline of Cyprus is 784 km long. Sensitive coastal areas include sand-dune systems, banks of shingle, cliffs, and coastal wetlands, all of which are subject to intense pressure. Coastal ecosystems provide habitats for flora and fauna such as the seagrass *Posidonia oceanica* beds and sea turtle nesting areas. Sea turtles have been protected by Cyprus law since 1972. A turtle hatchery at Lara (beach area on the Akamas Peninsula), the only one of its kind in the Mediterranean managed under detailed regulations, has been in operation since 1978. This project was set up by the Government, partly financed by the EC´s MEDSPA project. The hatchery is a success and the Department of Fisheries releases into the sea approximately 6.000 hatchlings a year. The Lara beach area is protected by various specific measures for the period June to September. Regular sightings of the rare Mediterranean monk seal *(Monachus monachus)* have been reported in past years, but no breeding has taken place and it is uncertain whether monk seals have disappeared entirely from the Cyprus coastline.

As is the case with the rest of the East Mediterranean, the coastal areas of Cyprus are not rich in marine life. The lack of marine life is mainly due to the relative isolation of the Mediterranean Sea and its oligotrophic nature, rendering it more vulnerable to small inputs of nutrients and pollution.

Monitoring for tar on beaches and dissolved hydrocarbons in the sea water is carried out through the MEDPOL Programme. No port reception facilities for bilge or ballast waters exist in Cyprus, although regulations on their establishment and operation have been recently prepared. An oil-pollution combating unit is in place, a national oil spill Contingency Plan has been implemented and sub-regional oil combating arrangements have been established with Egypt and Israel, with EU support.

Under the Fisheries Regulations, standards have been adopted for substances in effluent and the environmental quality of recipient sea waters. There are also prohibitions on the disposal of lubricating and other oils and in the use of organotin-based anti-fouling paints in the marine environment. It should be mentioned that the greatest part of the marine waters of Cyprus is of very high quality and sea pollution problems are highly localised.

Tourism industry represents 18% of the Cyprus GDP. Up to 80% of foreign tourists visit the coast of Cyprus. Hence the pressure in coastal areas of Cyprus is growing and the fragile ecosystems are subjected to increasing misuse and over-exploitation. Tourist infrastructure development, urban expansion, industrial and port development, and road infrastructure development add to the pressures. Direct threats to the systems include localised domestic pollution, agricultural inputs, and, to a lesser degree, industrial and oil pollution. Excessive strip development along coastal areas has raised concerns that the carrying capacity of several coastal areas may already have been exceeded.

In addition, several other specific problems are also impinging on the well-being of species and ecosystems. These are: petroleum pollution and development of artificial beaches (breakwaters); aquaculture. In order to minimise local effects, aquaculture is now carried out 'offshore'.

Box 3.14.4 Examples of Coastal Zone Management

In the Netherlands the concept of restoring resilience of the coastal zone was launched in 1996 during public forums of major actors/stakeholders from the governmental, business, academic and nature conservation communities. Increasing natural resilience by restoring the strength of the buffer capabilities of the coastal areas is seen as a response to the increasing pressure of urbanised population and as an anticipation to the impacts of climate change, such as accelerated sea-level rise. The essence of this concept is to provide more space for dynamic coastal development in the different coastal compartments (dunes, coastal sea, urban waterland etc.) through drastically revising the water and sediment regimes and integrating the different functional uses of the coastal zone, land in water and water in land.

In Poland, by the 1991 Coastal Act, a coastal belt was established, consisting of a technical belt and a protective belt. Since 1996 effective mechanisms and co-ordinating activities were functioning. Especially in Poland, with its rapidly increasing economic development, the key issue in ICZM plans is the balance between natural dynamics and the pressure from economic and urban development. Finding this balance requires strong vertical and horizontal integration: co-operation between all responsible actors at different levels of government and different sectors of the economy and non governmental organisations (NGOs). Since March 1997 three Regional ICZM consultative bodies have been installed in which representatives of all levels of government, science, industry, NGOs and landowners participate. They stimulate co-ordination of activities in the coastal zone by initiating preparation of ICZM plans within the coastal 'voivodships' ('provinces').

The United States recognised the desirability of diversity. The US Coastal Zone Management Act 1972 sets out the basic objectives of ICZM, and requires American States to draw up coastal management programmes that will meet those objectives. However, it leaves each State free to choose its own methods, and consequently each has devised its own system. There is no necessity for each coastal State to have an identical system of ICZM, provided that the methods they adopt work and are capable of operating in harmony for the benefit of the coastal zone as a whole.

Box 3.14.5 Management plan for the Wadden Sea: how to preserve a unique environment without excluding people from the area

The natural environment
The Wadden Sea is an area very special and rich in wildlife shared between the Netherlands, Germany and Denmark. The landscape is characterised by a shifting pattern of submerged and exposed tidal flats, sandy beaches and dunes, low-lying salt marshes, sand and sediment, fresh and salt water, nutrient-poor saline soils in the islands, but also woods and grassland area. These varied conditions make the Wadden Sea an ideal habitat for flora and fauna: it is the most important area for waterfowl in North West Europe and the habitat for the largest population of common seals in the North Sea.

Human intervention ...
Many features of the landscape have been created over time by human intervention: for centuries people living along the coasts have practised small-scale land reclamation; a fair amount of land around the Wadden Sea has been recovered in the past with consequent reduction of salt marshes; the construction of dikes and embankments has created sharp divisions between areas of salt and fresh waters. These fixed constructions hamper the natural adaptability of the system to sea level rise and bottom subsidence and have reduced natural salt-fresh transitions.

... and activities
Fishery has always been an important activity: blue mussels are fished from the channels and the tidal flats, and used mainly as 'seed material' for mussel culture. Mainly in the Netherlands cockles are dredged from the flats. The deeper channels are trawled for shrimps. In years with low shellfish stocks food shortage for birds has occurred. There are strong indications that shellfish fisheries have been an important factor in the decline of mature mussel beds.

Beneath the bed of the Wadden Sea natural gas and oil are extracted and exploration licences for new gas fields are being negotiated. Due to the unique natural environment, hundreds of thousands of tourists visit the area, representing the major economic resource, but also a potential disturbance to wildlife and environment. In addition to maritime and air traffic, military activities take place in the area. Finally, the Wadden Sea receives the pollutants loads of several major rivers, including the Elbe and the Rhine.

'Management plan for the Wadden Sea'
The Dutch, Danish and German governments are keen to preserve the natural environment of the Wadden Sea, but unwilling to exclude people from the area. Already since 1978 a political cooperation framework between the three states is in operation. This has resulted in 1997 in the adoption of the Wadden Sea Plan (WSP) in which the accumulated agreements of the previous two decades have been integrated according to a catalogue of common Targets. The Targets aim at the conservation, restoration and development of all the out standing ecological features, through active intervention and through the regulation of those activities which can represent threats to the environment. Two examples: The Target 'to increase the area of wild mussel beds' has guided blue mussel fisheries in such a way that in principle no fisheries will take place on the tidal flats, providing chances for wild mussel beds to recover and guaranteeing food supply for birds. Also areas have been designated where mussel fishery is excluded. The Target 'to increase the naturalness of salt marshes' stimulates the reduction of artificial drainage and intensive grazing.

The Wadden Sea Plan invites all stakeholders to participate in discussing the way in which the Targets can be implemented. The open-end nature of the Targets leave sufficient room for such a dialogue. The results will be used in the process of evaluating the Plan in the period up till 2001, the year in which the next intergovernmental conference is due.

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