10 messages for 2010
Coastal ecosystems

European Environment Agency

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This document is the 9th in a series of assessments under the title '10 messages for 2010'. Each message provides a short assessment focusing on a specific ecosystem or issue related to biodiversity in Europe. The final message will be published before the end of 2010. More detailed information on the published and forthcoming messages can be found at www.eea.europa.eu/publications/10-messages-for-2010.

European Environment Agency

Coastal ecosystems

Key messages

- As an interface between land and sea, European coastlines provide vital resources for wildlife, but also for the economy and human health and well-being.
- Multiple pressures, including habitat loss and degradation, pollution, climate change and overexploitation of fish stocks, affect coastal ecosystems.
- Coastal habitat types and species of Community interest are at risk in Europe; two thirds of coastal habitat types and more than half of coastal species have an unfavourable conservation status.
- Integrated and ecosystem-based approaches provide the foundation for sustainable coastal management and development, supporting socio-economic development, biodiversity and ecosystem services. Coordinated action at the global, regional and local levels will be key to sustainable management of coastal ecosystems.

1 As an interface between land and sea, European coastlines provide vital resources

Europe's coastline ([1]) is estimated to stretch almost 185 000 km. The terrestrial part of the coastal zones totals some 560 000 km^2 in 24 European countries (22 coastal EU Member States plus Iceland and Norway) according to Corine Land Cover data — equivalent to 13 % of their total land area (EEA, 2006a). Coastal regions host almost half of the human population of EU countries with a sea border. The highest population density is found in the coastal regions of Malta, Belgium, the Netherlands, the United Kingdom, Portugal, Italy, and Spain, whereas the lowest population densities are in Estonia, Sweden, and Finland (Eurostat, 2009).

European coasts provide a vivid juxtaposition of natural and artificial environments. They are very rich ecosystems, providing vital and highly dynamic resources for nature, but are often also the most urbanised areas of countries.

The evolution of coastal habitats depends on changes on land and on the inherently dynamic nature of the marine environment ([2]). Their varied habitats, including salt-adapted scrub and grasslands, sheer cliffs and rocky shores, sandy beaches and tidal areas, estuaries and lagoons, provide breeding grounds and habitats for marine organisms, as well as for waterfowl, shorebirds and other wildlife.

Coastal areas are very important habitats. They provide key feeding areas for some species of migratory birds, namely wetlands. They are also essential for populations of birds in EU overseas territories (e.g. blue-footed boobies, frigate birds) where conservation efforts are under way under the Convention on Biological Diversity (CBD) to protect unique wildlife. About 50 coastal habitat types and 150 species that prefer coastal ecosystems (other than birds) are listed in the annexes of the EU Habitats Directive (ETC/BD, 2008).

Coasts are shaped by basic geology, the constant movement of the tides and currents, sediment deposition and erosion, extremes of weather and, crucially, millennia of human activity. Indeed, they underpin the health, economy and well-being of a significant segment of the European population.

([1]) In this report, coastlines are determined from the Corine land cover data base (CLC). The terrestrial portion of the coastal zone is defined by an area extending 10 km landwards from the coastline.
([2]) For further information see 'Message 4 — Marine Ecosystems' of the EEA's '10 messages for 2010'.

They are places where people live and work, providing ports and harbours, locations for industry and business, holiday destinations, and areas for recreation and enjoyment. Their rich biodiversity, particularly fish and shellfish, is a major source of Europe's food and economic prosperity.

Table 1 presents examples of the goods and services provided by coastal ecosystems. For instance, there are about 100 coastal lagoons and wetlands in the Mediterranean, which provide an important resource for regional economies via fisheries and tourism. They are refuges for many species and function as nursery areas and feeding grounds for marine fauna, while storing important genetic diversity and supporting different benthic assemblages within each lagoon (Pérez-Ruzafa *et al.*, 2010).

2 Multiple pressures affect coastal ecosystems

Europe's coastal zones are under multiple pressures and face a large number of economic, social and environmental problems (EEA, 2006a).

Table 1 Examples of ecosystem services provided by different coastal habitats

Ecosystem services provided	Estuaries and marshes	Lagoon and salt ponds	Intertidal zone	Kelp (Laminariales) brown algae	Rock and shell reefs	Sea-grass	Coral reefs	Inner shelf
Provisioning services								
Food	X	X	X	X	X	X	X	
Fibre, timber, fuel	X	X						X
Medicines, other resources	X	X		X			X	X
Regulating services								
Biological regulation	X	X	X		X		X	
Freshwater storage and retention	X	X						
Hydrological balance	X	X						
Atmospheric and climate regulation	X	X	X		X	X	X	X
Human disease control	X	X	X		X	X	X	
Waste processing	X	X				X	X	
Flood/storm protection	X	X	X	X	X	X	X	
Erosion control	X	X				X	X	
Cultural services								
Cultural and amenity	X	X	X	X	X	X	X	X
Recreational	X	X	X	X			X	
Aesthetics	X	X	X				X	
Education and research	X	X	X	X	X	X	X	X

Note: X indicates the habitat provides a significant amount of the service.

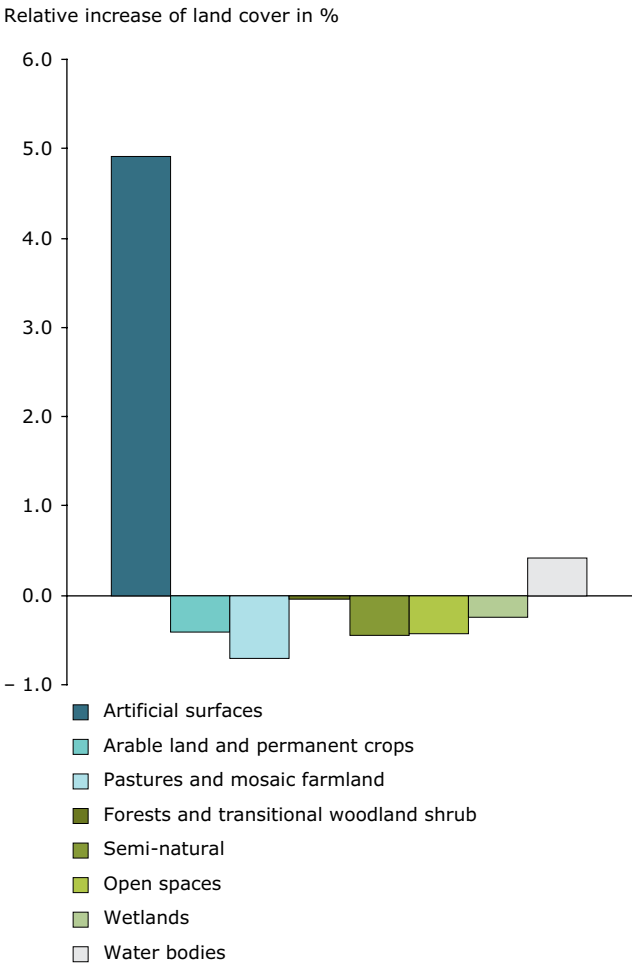
Source: Adapted from Brown *et al.*, 2006.

2.1 *Destruction and degradation of coastal habitats*

Coastal habitats are fragile and are being destroyed to make way for housing, industry, agricultural land, and infrastructure for tourism and transport.

The human population density of European coastal regions is on average 10 % higher than inland but in some countries this figure is as high as 50 % (EEA, 2006b). Habitat changes occur specifically as a consequence of expanding human activities that convert natural areas to artificial surfaces such as residential and tourism development. In addition, demands from agriculture, aquaculture, transport, industry, flood defence, waste storage and port development compete with natural coastal habitats.

Figure 1 Relative change in land cover within 10 km of the coast in 27 European countries * 2000–2006



Note: * including 20 EU Member States, data not available for Greece and the United Kingdom.

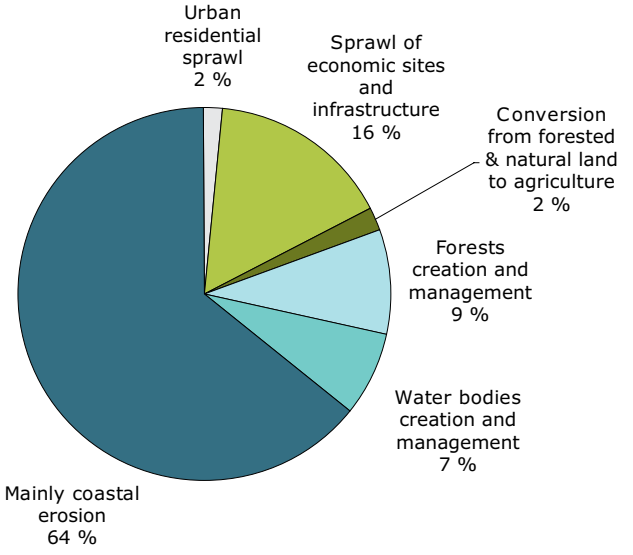
Source: CLC, 2006.

In 2006 the total area of coastal ecosystems was 21 030 km^2, 26 % made up of dunes, salt marshes and salt pans and the remaining 74 % comprising intertidal flats, lagoons and estuaries. Europe's coastal zones have experienced rapid rates of development, however, with an increase in artificial surfaces between 1990 and 2000 of 7.5 %. In the period 2000–2006, this trend continued, with a 4.9 % expansion in artificial surfaces implying a slight acceleration in the annualised growth rate from 0.75 % to 0.82 % (Figure 1).

Figure 2 illustrates the main causes of coastal ecosystem loss between 2000 and 2006. The largest contributors to that loss were coastal erosion, which accounted for 65 % of the total, and sprawl of economic sites and infrastructure such as airports, which accounted for 16 %.

Other coastal ecosystems (intertidal flats, lagoons and estuaries) were gained through the creation and management of water bodies during the same period (Figure 2). Often, however, human-made structures in coastal marine waters, such as breakwaters, jetties and seawalls in intertidal and shallow subtidal coastal waters can cause fragmentation of populations and loss of natural habitats (Bulleri and Chapman, 2010). For instance, the Mediterranean monk seal (*Monachus monachus*) population has declined and its range drastically shrunk due, in part, to habitat destruction. Shorebirds are also

Figure 2 Causes of changes to coastal ecosystems



Note: Geographical coverage: EU except Greece and the United Kingdom.

Source: CLC, 2006.

declining due to the loss of breeding, foraging and resting areas throughout the European coastal strip.

In a recent survey, the EEA (2010) shows how Mediterranean coastal wetlands have been under constant pressure from urbanisation between 1990 and 2000, particularly in Spain and southern Italy (Map 1).

2.2 Pollution

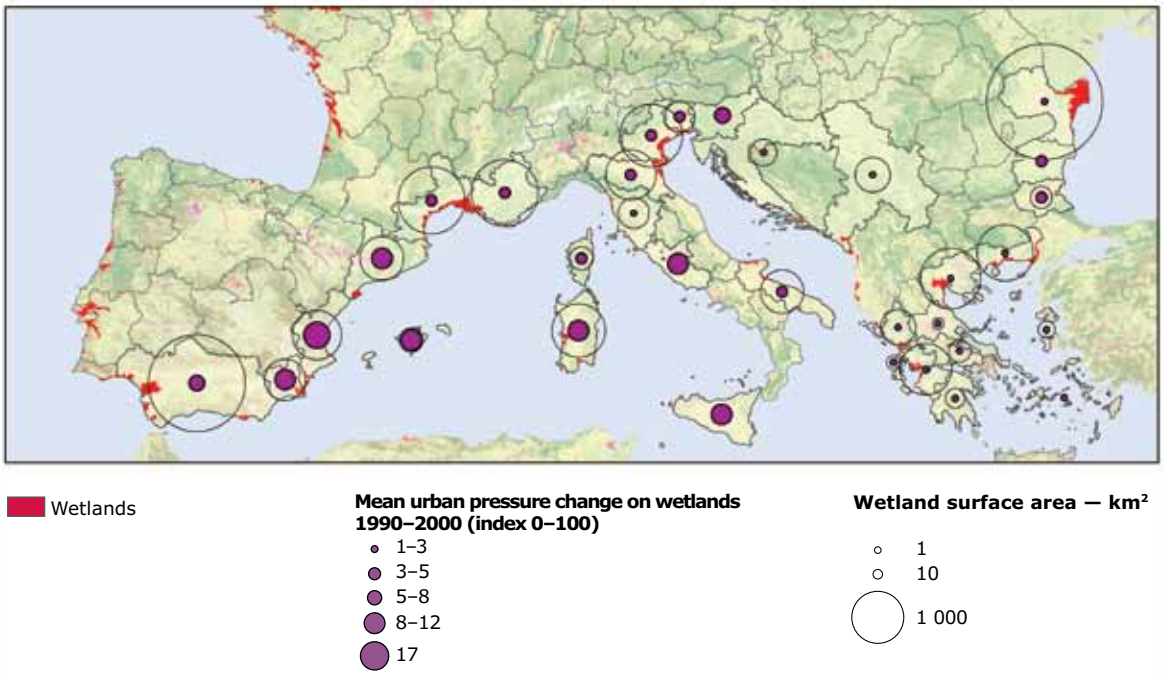
As transition zones between terrestrial and marine environments, coasts are affected by a wide range of pollution sources. Pollution from land-based activities reaches the coast through rivers, which can accumulate significant loads of agro-pesticides, nutrients, heavy metals and industrial chemical compounds. In general, nitrogen and phosphorus loads in coastal waters have been decreasing since the 1980s due to improved waste water treatment. In some countries, however, waste water is still released directly into the sea without any prior treatment (EEA, 2006c).

Eutrophication is an adverse change in ecosystems, which affects many coastal areas (Map 2). It is caused by increased inflows of nutrients both from rivers and direct discharges, including precipitation. High nitrate and phosphate loads lead to flourishing of blue-green algae, which can choke all other aquatic life through its high oxygen consumption (Eisenreich, 2005). Blue-green algae can directly threaten human health (Eisenreich, 2005), for instance in bathing areas. As long-lived components of coastal ecosystems, seagrasses can serve as useful indicators of nutrient concentrations and water quality (Duarte, 2009).

Aquaculture can have a positive impact on biodiversity by reducing pressure on wild fish stocks. However, aquaculture still creates demand for fishmeal and impacts coastal ecosystems through the nutrients and antibiotics released to the environment. Farmed fish can also be a source of disease infecting wild coastal fish populations. Artificial feed supply can alter the natural food web structure and significantly impact the local environment.

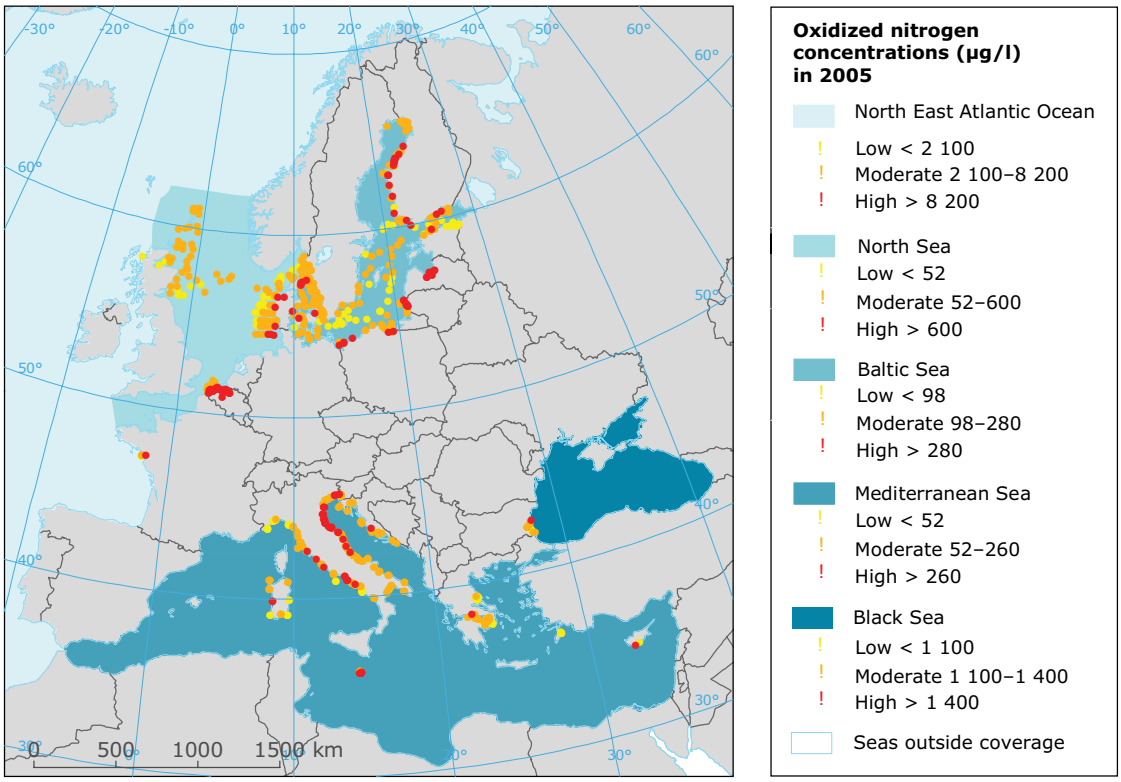
Intensive aquaculture can be the cause of localised pollution and eutrophication that can significantly alter species community composition (EEA, 2006a). For instance, a typical Norwegian salmon farm yielding 1 000 tonnes of fish of annually produces nutrient waste comparable to that of 7 500–10 000 people. The highest nutrient waste emission rates are expected in summer (Olsen and Olsen, 2008). Accidental escape of farmed species

Map 1 Pressure changes on wetlands from urban proximity (1990–2000) summarised at NUTS 2 level in parts of the Mediterranean and Black Sea regions



Source: EEA, 2010.

Map 2 **Winter oxidised nitrogen concentrations observed in European coastal areas and estuaries, 2005**



Note: The highest oxidized nitrogen and orthophosphate concentrations can be found in coastal areas and estuaries that are subject to nutrient inputs from major rivers.

Source: EEA, 2009.

can cause the introduction of alien species, which may turn invasive, or the hybridisation of native species with introduced non-native species (Cook *et al.*, 2008).

2.3 *Climate change and invasive species*

Recent global climate change has imposed additional pressure on coastal ecosystems by accelerating sea level rise, increased water temperatures, storms, erosion and flooding (EEA, 2006a; Robinson *et al.*, 2005). Coastal seas experiencing rapid surface warming are often surrounded by major industrial/population agglomerations, with likely direct anthropogenic influence. Freshwater inflows play a particular role in modulating and exacerbating the global warming effects (Belkin, 2009). The European countries most vulnerable to sea level rise are the Netherlands and Belgium with more than 85 % of the coastal zone below an elevation of 5 m, followed by Germany and Romania (50 %), Poland (30 %), and Denmark (20 %) (EEA, 2006a).

Alien species are a major cause of biodiversity loss and the highest numbers are found in the Mediterranean Sea. They can affect marine and coastal ecosystems through predation, competition, habitat modification and introducing pathogens. Warming of marine and coastal waters and direct human destruction of habitats can assist the introduction of new (alien) species.

Increasing water temperatures significantly affect the species composition and turnover of coastal ecosystems, as shown in benthic and rock-dwelling species communities on the Swedish coast (Hillebrand *et al.*, 2010). Alien species become competitive with natives in changed environmental conditions when unintentionally (e.g. in ship ballast water) or intentionally transported into coastal waters (e.g. the Pacific oyster (*Crassostrea gigas*) in the northern Wadden Sea) in Europe (Reise and van Beusekom, 2008). There is growing evidence that alien species tend to prosper in disturbed habitats and new ecological niches in both terrestrial marine coastal areas becoming invasive (Bulleri and Chapman, 2010; EEA, 2006a).

2.4 Overexploitation

Overexploitation of key fish stocks in European seas alters the biological capacity of coastal ecosystems (EEA, 2006a). In 2006, 75 % of the fishing sector's annual catch of nearly 5 billion tonnes was caught in the north-east Atlantic, while 11 % came from the Mediterranean and Black Seas (Eurostat, 2009). In the Mediterranean, in particular, unsustainable fishing practices such as trawling have impacted sensitive habitats such as seagrass (*Posidonia*) beds and deep corals (EEA, 2006c). Increasing exploitation of sand and gravel for construction and beach nourishment deteriorates natural coastal habitats (EEA, 2006a). This together with the artificialisation of rivers and development of road transport infrastructure affects the shoreline and coastal dynamics.

For example, about 23–28 million tonnes of sand and gravel are taken from offshore sediments around England and Wales, which significantly impacts the abundance of various macrofaunal species and species community composition. These effects are apparent in, for example, the Shoreham Box in the Eastern English Channel (Birchenough *et al.*, 2010).

Some nuclear power stations are located in coastal areas, such as in France, which has five power stations at coastal sites. Apart from potentially contaminating coastal and marine waters, their extraction and release of heated up cooling water disrupts ecosystem integrity, especially during increasing summer temperatures. In 2003, for example, rising water temperatures became lethal for many estuarine species in the Gironde estuary (Dauvin, 2008).

Coastal development of tidal barrages and enclosures for energy may result in increased biological productivity, such as at the Severn barrage in the United Kingdom, where new habitats for birds and fish are expected to be created (SDS, 2007). However the effect of removing energy from the system may have significant effects on sessile organisms that inhabit the coastal strip.

Local fisheries' access to intertidal habitats and the impacts of tourism, camping and transport (e.g. cars, trail-bikes, boating) can have a significant additional destructive impact on coastal habitats such as sand dunes and rocky habitats if it reaches an unsustainable level of intensity (Tyler-Walters and Arnold, 2008). Excessive groundwater extraction to meet the demands of irrigation, growing population and tourism can make marine saltwater intrusion a serious problem. More than 100 areas in ten European countries are affected by marine saltwater intrusion (EEA, 2006a).

2.5 Erosion and siltation

Coastal erosion is largely caused by sediment starvation of the coast as a consequence of river dams, although intensive development and sand mining can also contribute to coastal habitat destruction. If currents are disturbed by coastal infrastructure, the dynamic equilibrium between erosion and accretion may be lost and unwanted changes in the coast morphology and functions can result.

The World Heritage Site Curonian Spit, shared between Lithuania and the Russian Federation, is an example of natural processes of coastal erosion and accretion that have created a unique, varied and dynamic coastal landscape. Drifting dunes there have attracted tourists and artists for more than a century (Armaitienė *et al.*, 2007). About 10 % of European coastlines are protected by sea defences (EEA, 2006a).

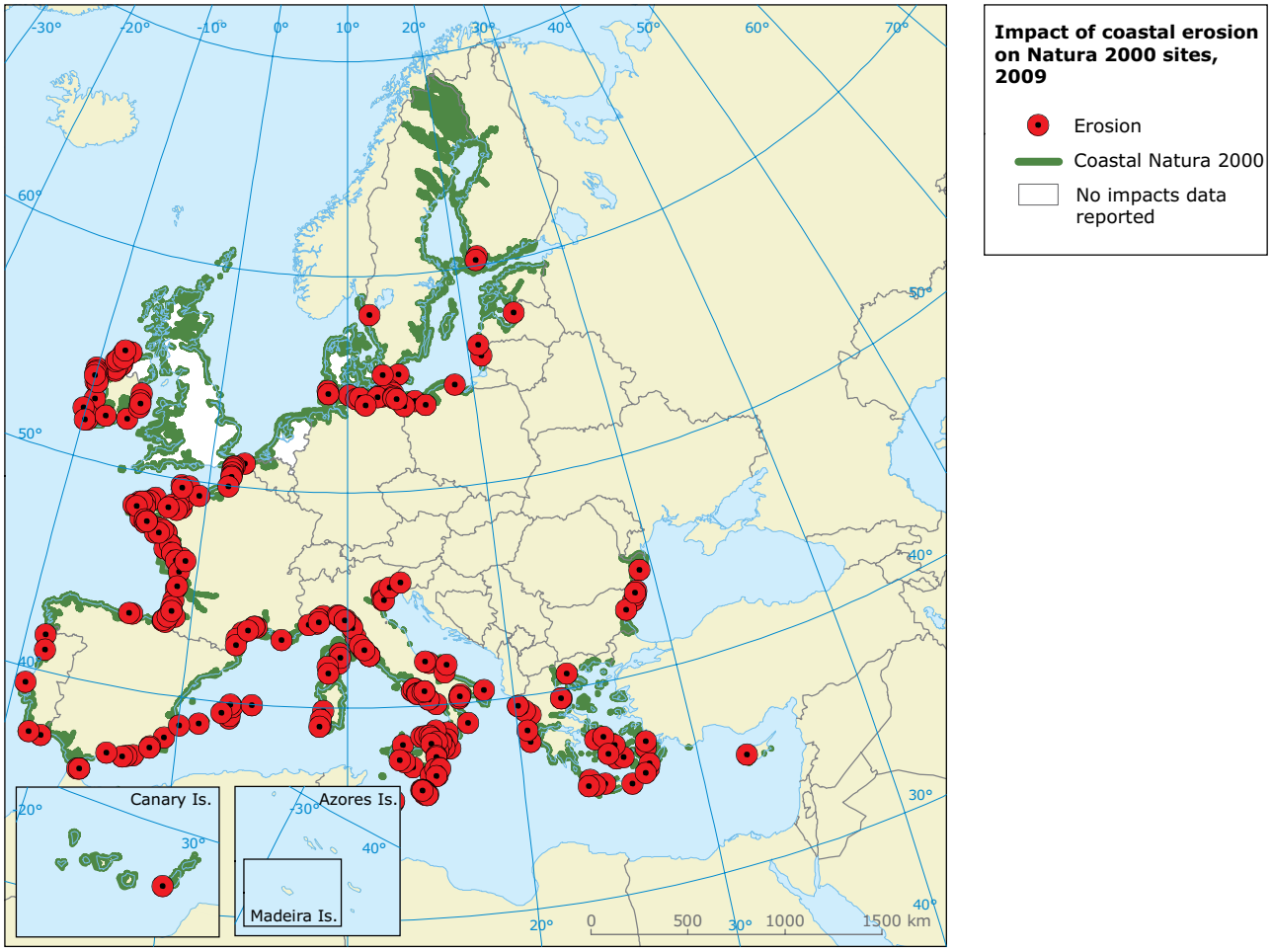
Important changes in river discharges (as a result of climate change, increased irrigation and canalisation) also impact upon coastal processes. Land-based activities that alter the flow and sediment load of rivers (e.g. inland dam construction) can also have profound effects on the dynamics of coastal ecosystems, in particular coastal wetlands and intertidal habitats situated in estuaries and deltas (EEA, 2006a). It is anticipated that this situation will be aggravated by climate change and that considerable areas of coastal dunes and wetlands will disappear and with them natural vegetation and species (Map 3). The social, economic and ecological functions fulfilled by these areas will also disappear. Destruction of dunes is expected to pose threats to freshwater aquifers as salt water intrudes in coastal plains (EC, 2004).

According to studies for the United Nations International Panel for Climate Change (IPCC), approximately 158 000 people in Europe will be victims of coastal erosion or flooding in 2020, with half of Europe's coastal wetlands expected to disappear as a result of sea level rise (Doody *et al.*, 2004).

3 Coastal habitat types and species are at risk in Europe

As a result of the multiple pressures described above, coastal habitats have suffered significant losses over recent decades (Table 3.1).

Map 3 Impact of coastal erosion on Natura 2000 sites, 2009



Source: Natura 2000, 2009.

The first reporting by EU-25 Member States (EU-27 minus Bulgaria and Romania) on the conservation status of species and habitat types targeted by the EU Habitats Directive shows that more than two-thirds of coastal habitat types of Community have an 'unfavourable' status, with no 'favourable' assessments in the Atlantic biogeographic region or in the Marine Atlantic, Marine Baltic and Marine Mediterranean regions (Figure 3).

Concerning the species of Community interest that are typical of coastal ecosystems, more than 50 % of the assessments are 'unfavourable', while only 11 % are 'favourable' with a large proportion 'unknown' (Figure 4).

Within the taxonomic groups of species of Community interest typical of coastal ecosystems, invertebrate species are faring worst, with more than 60 % having an 'unfavourable' conservation status. Nearly 20 % of assessments for reptiles have 'favourable' conservation status, compared to the very few assessments of fish species (2 %) and invertebrates (6 %). The status of many species is 'unknown', especially in the case of fish species (Figure 5).

The LIFE programme has been the most visible EU financial instrument dedicated to nature conservation since 1992. The link between LIFE projects and improved conservation status of coastal habitats and species has been shown in several cases, such as in Mediterranean dune habitats (EU, 2010). However, most studies have focused on terrestrial habitats and species.

4 Integrated and ecosystem-based approaches provide the foundation for sustainable coastal management and development

In 2002, the EU recognised that the 'coastal zone is of great environmental, economic, social, cultural and recreational importance to Europe' and that 'coastal zones possess a unique biodiversity in terms of flora and fauna' in its recommendation for the implementation of Integrated Coastal Zone Management (ICZM) in Europe (EC, 2002).

In its evaluation of ICZM in 2007, the European Commission emphasised that the EU's ICZM Recommendation in 2002 had called for a strategic approach to coastal zone planning and management in order to achieve sustainable development. The Commission further noted that adaptation to climate change and risk, and management of the land-sea interface and marine areas are priority themes of the further promotion of ICZM (EC, 2007).

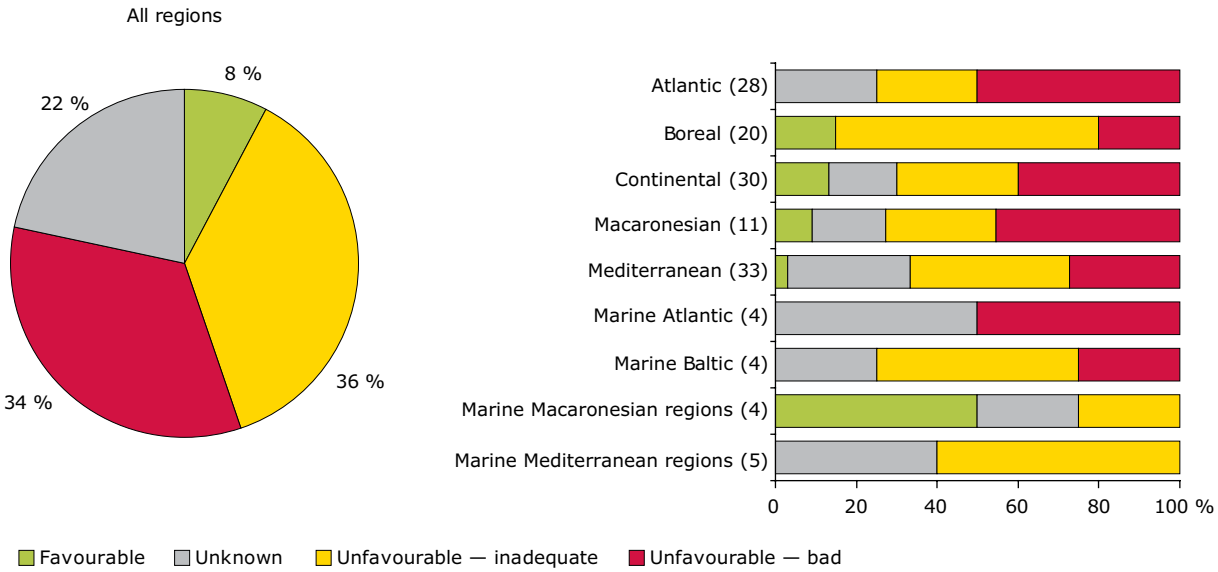
For the Mediterranean, fourteen Contracting Parties to the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention) signed a new Protocol on Integrated Coastal Zone Management in the Mediterranean in Madrid in 2008. Among a wide range of provisions, the Protocol calls for using the ecosystem approach to ensure sustainable development of coastal zones (EC, 2010a).

Table 2 Selected losses of coastal habitat types along the European coastline

Coastal habitat type	Present status	Historical loss	Main reference
Coastal wetlands	51 910 km²	> 65 % since 1900	Nivet and Frazier, 2004
Seagrasses	7 290 km²	> 65 %	Duarte, 2002; Green and Short, 2003
Wild native oyster reefs	Scarce	> 90 %	Mackenzie *et al.*, 1997
Macroalgal beds	Unknown	More than 2 m in mean depth distribution	Vogt and Schramm, 1991; Eriksson, 2002

Source: Adapted from Airoldi and Beck, 2007.

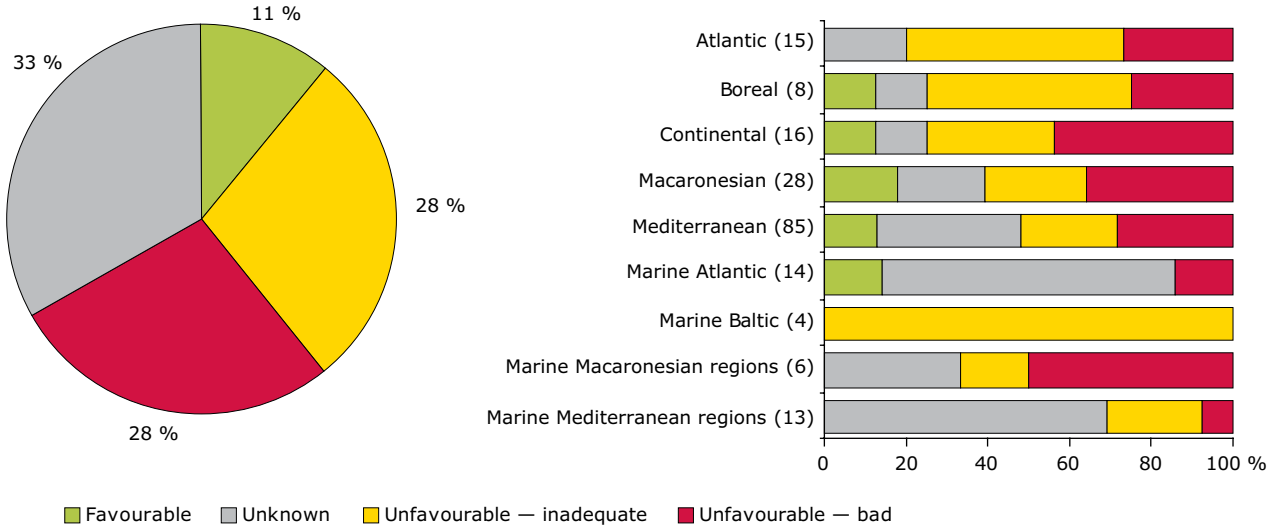
Figure 3 Conservation status of coastal habitat types of Community interest in the EU-25



Note: The number of assessments is indicated in brackets.

Source: ETC/BD, 2008.

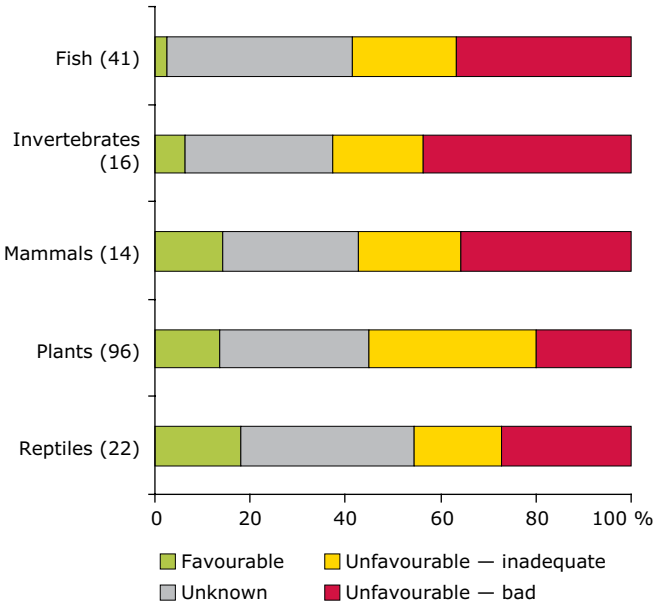
Figure 4 Conservation status of species of Community interest typical of coastal ecosystems in the EU-25



Note: The number of assessments is indicated in brackets.

Source: ETC/BD, 2008.

Figure 5 Conservation status of species of Community interest that are typical of coastal ecosystems, EU-25



Note: The number of assessments is indicated in brackets.

Source: ETC/BD, 2008.

The EU adopted its Marine Strategy Framework Directive in 2008. It complements the ICZM and sets quality standards in line with the objectives of the EU Water Framework Directive (WFD), adopted in 2000 for freshwater ecosystems, which requires surface water bodies (e.g. lakes, streams, rivers, estuaries, and coastal waters) to be ecologically sound by 2015. Both directives can be expected to have a significant influence on the future of coastal ecosystems in the EU. The EU Marine Strategy Framework Directive urges the creation of a network of marine protected areas by 2012 and applies an ecosystem-based approach, requiring sustainable use of marine goods and services by ensuring that marine ecosystems have good environmental status by 2020 (EC, 2010b).

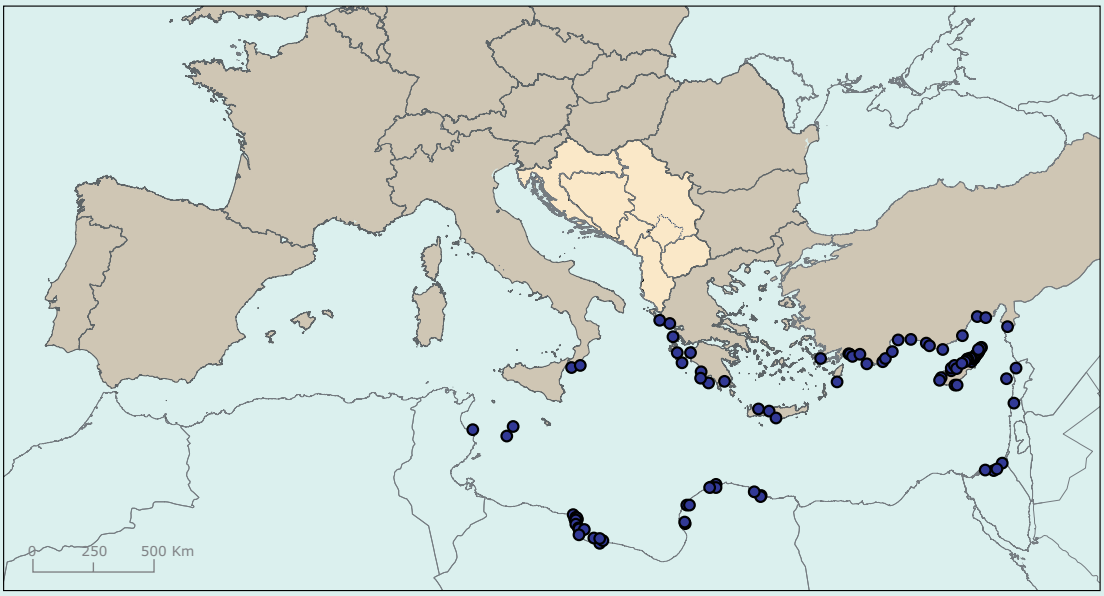
In 2009, the European Commission adopted a Green Paper on Reform of the Common Fisheries Policy presenting a vision for restoring Europe's fish stocks and achieving maximum sustainable yields, which would have a strong positive impact on coastal economies (EC, 2009).

A number of European agreements address water quality and fisheries, including the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), the North Sea Conference Declarations, the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention), the Trilateral Cooperation on the Protection of the Wadden Sea, the UNEP Mediterranean Action Plan, and the Black Sea Environmental Programme (Airoldi and Beck, 2007).

The Loggerhead Sea Turtle (*Caretta caretta*), a species vulnerable to coastal disturbance and degradation

The Loggerhead Sea Turtle is one of seven sea turtle species inhabiting the world's oceans. In Europe, it is present in the Macaronesian and Mediterranean Marine biogeographical regions. The species' largest nesting concentrations in the Mediterranean Sea occur along the Cypriot, Greek, Libyan and Turkish coasts. Estimated annual nesting rates are 3 050, 1 365 and 571 nests per year respectively for Greece, Turkey, and Cyprus (Margaritoulis *et al.*, 2003). Smaller nesting events occur along the Italian, Tunisian, Egyptian, Israelian, Siryan, and Lebanese coasts (Margaritoulis *et al.,* 2003; Mast *et al.*, 2007) (Map 4).

Map 4 Nesting distribution of the Loggerhead Sea Turtle (*Caretta caretta*) in the Mediterranean Sea



Source: UNEP/MAP–RAC/SPA, 2009; Mast *et al.*, 2007; Mingozzi *et al.*, 2007; Canbolat, 2004; Kasparek, 2004; Balletto *et al.*, 2003; Margaritoulis *et al.*, 2003; Demirayak *et al.,* 2002; Clarke *et al.*, 2000; Broderick and Godley, 1996.

The Loggerhead Sea Turtle is exposed to a wide array of threats throughout its lifecycle, both when using beach areas and while at sea. In particular, nesting ground degradation due to human beach use and coastal zone mismanagement practices (for example physical installations and constructions, tourism, traffic, light pollution and debris, sand extraction and beach erosion) severely decrease nest development and success.

Accidental capture of loggerhead turtles in various fishing gears causes high mortality across age groups. The annual total accidental capture of marine turtle species in the Mediterranean Sea has been estimated at 40 000 individuals for bottom trawl nets, 50 000 for pelagic longlines, 35 000 for demersal longlines and 30 000 for stationary nets (Casale, 2008). Pollution by plastic ingestion and boat strikes are also threats to marine turtles. The latter occur especially during summer months and in areas close to nesting grounds (Margaritoulis *et al.*, 2003).

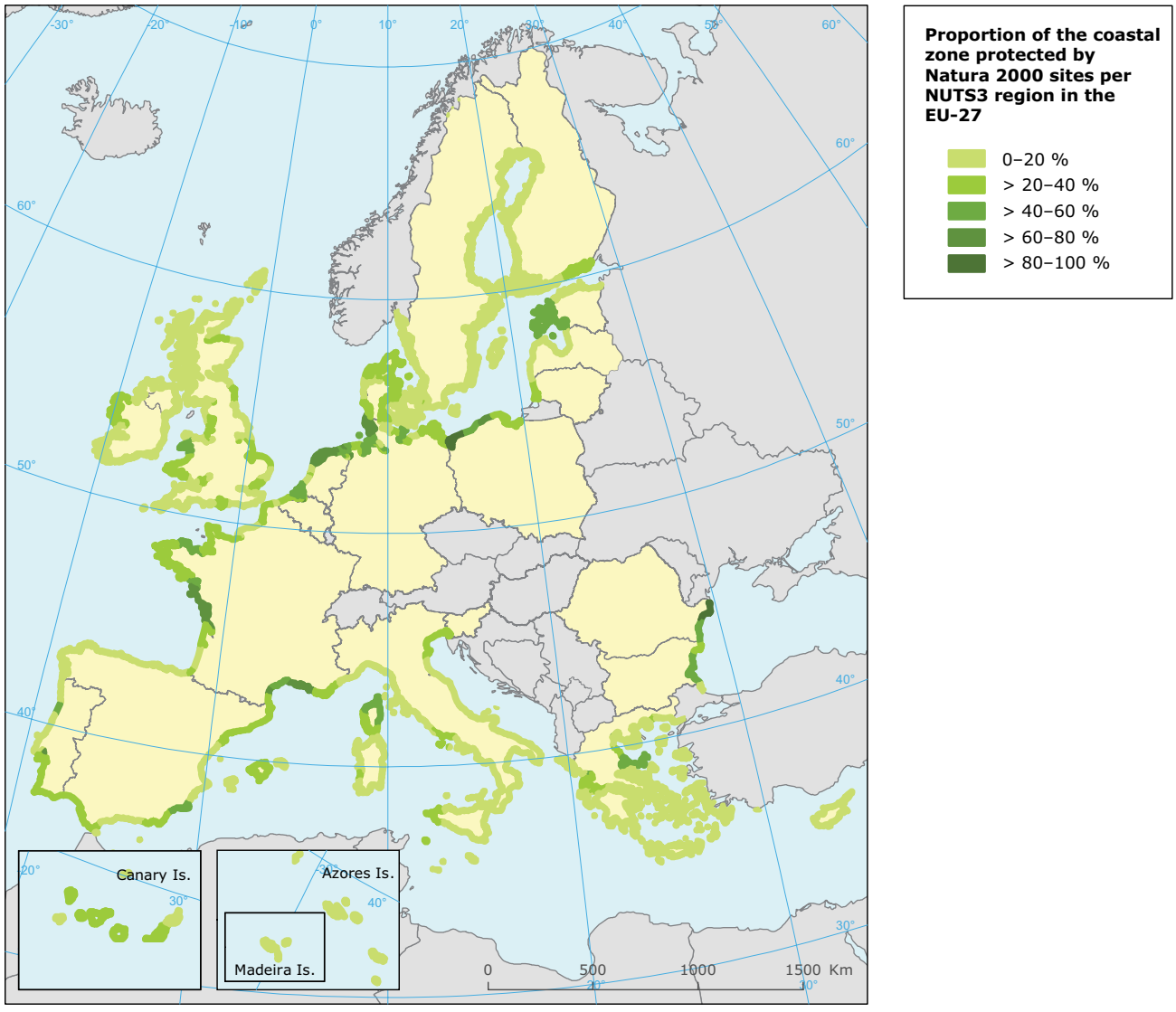
The Loggerhead Sea Turtle is considered as 'endangered' in the IUCN Red List of threatened species (IUCN, 1996). The Loggerhead Sea Turtle is one of the priority marine species listed under Annexes II and IV of the EU Habitats Directive. As such, EU Member States must designate a coherent network of Natura 2000 sites for its protection (EC, 1992).

An ecologically coherent network of Marine Protected Areas, including the EU Natura 2000 network, is necessary for European coasts and seas. Such a network should be completed in the North-East Atlantic and the Baltic Sea by 2010, as agreed by the joint Ministerial Meeting of the Helsinki and OSPAR Commissions in 2003 (Boedeker *et al.*, 2010; OSPAR Commission, 2007). In the Mediterranean Sea, the Barcelona Convention and its Protocols aim to develop Marine Protected Areas (MPAs) to support the Mediterranean countries in achieving the Convention on Biological Diversity (CBD) target of establishing a representative network of MPAs by 2012 (UNEP, 2009).

Against the background of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), the total area of marine and coastal protected areas in the Black Sea amounts to more than 1.1 million ha (2.4 % of the marine area) within this frame. The country with the largest area designated as MPA is Ukraine. Romania has the greatest length of shoreline designated as MPA (ECBSEA, 2009).

The Natura 2000 network of the EU Habitats and Birds Directives protects a significant portion of the coastline in the EU (Map 5).

Map 5 **Percentage of the coastal zone within 10 km of the shoreline protected by Natura 2000 sites per NUTS3 region in the EU-27**



Source: Natura 2000, 2009.

Coastal Natura 2000 sites comprise approximately 3 000 km^2 of primarily coastal and salt-tolerant habitat types of Community interest. Of that, some 250 km^2 comprise dunes, 600 km^2 are natural grasslands and 400 km^2 are forests. Among coastal and halophytic habitats, nine main habitat types make up about 85 % of the total area.

Together, the different policy instruments with their approaches and efforts to protect habitat types and species of Community interest can significantly contribute to safeguarding the prosperity and ecological status of our coastal ecosystems in Europe. This is particularly so when supported by other policy instruments that aim to ensure good status of ecosystems, for example the EU Marine Strategy Framework Directive and the EU Water Framework Directive. Indeed, the principle of 'working with natural processes and respecting the carrying capacity of ecosystems, which will make human activities more environmentally friendly, socially responsible and economically sound in the long run', which is set out in the EU ICZM Recommendation (EC, 2002), should be used to guide the management of coastal areas and could arguably be used as the general principle for managing other ecosystems.

Many policy and legal instruments aim to improve management of coastal areas but they must be better streamlined in order to safeguard Europe's coastal biodiversity. Coordinated action at the global, regional and local levels will be key to sustainable management of coastal ecosystems.

Further reading

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