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Towards a resilient ecosystem of the Baltic Sea

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Towards a resilient ecosystem of the Baltic Sea

Legal frame for monitoring, assessment and reporting on the status of marine biodiversity

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Introduction: biodiversity of the Baltic Sea ecosystem

The Baltic Sea is one of the largest brackish (low salinity) water bodies in the world. The salinity level is determined by a large freshwater inflow from many rivers, as well as weak water exchange with the North Sea. The average salinity of the Baltic Sea is only a fifth of that found in the Atlantic Ocean, being especially low in the northern and eastern parts of the Sea.

On one hand, the low salinity provides unfavourable living conditions for typical salt water species. On the other hand, brackish water provides an environment for a unique mixture of marine and freshwater species. In some parts of the Baltic Sea it is possible to observe typical marine fish species such as European flounder and fresh water species as pike living together.

But it is not only fish that make the Baltic Sea biologically peculiar. Millions of birds fly over the sea during spring and autumn migration time marking the Western Palaearctic flyway connecting Northern Eurasia to Africa. Many bird species come from Northern Eurasia to winter in the Baltic Sea. Even in winter time, the Baltic Sea can provide shelter for visitors from the Scandinavian and Russian tundra.

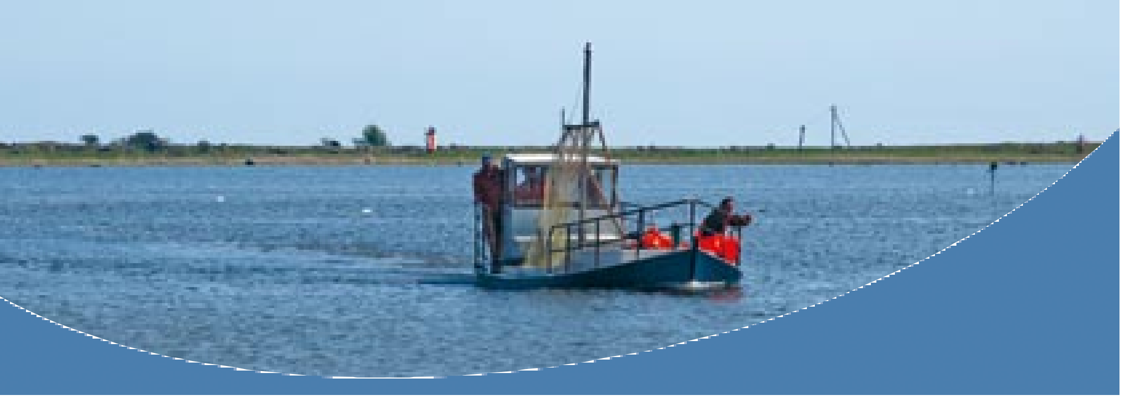
The shallow waters of the Baltic Sea cover a variety of underwater meadows, which host a large variety of plant and invertebrate species. Stony underwater meadows or reefs are an especially important part of the sea ecosystem. Reefs are important for fish reproduction, providing shelter for fish eggs and fry. They also serve as a "restaurant" for sea birds. But the role of mussels goes beyond providing food for birds – they are natural water treatment plants. In one year, the Baltic blue mussels filter water masses equivalent to water in the whole sea!

Unfortunately, there is another side of the story. The fragile Baltic Sea must cope with about 90 million people living in the catchment area of the Sea, including 15 million in the coastal area. The region is economically developed, and various human activities adversely impact the sea. Fishing has traditionally been an important activity in the Baltic Sea. The shipping traffic here is one of the most intense in the world. Nowadays, new economic interests like oil extraction and energy production in wind farms are also under development.

But the biggest danger lies not in the human activities in the sea. The catchment area of the Baltic Sea is four times that of the sea itself. Industries, households and agriculture have generated huge amounts of pollutants that rivers have carried to the Sea. As a result of overfeeding by nitrogen and phosphorus substances, the Baltic Sea is one of most eutrophic sea areas in the world. Eutrophication has affected the sea by changing the balance among species. In addition, the level of toxic pollutants is also among the highest in the world.

Humans try to prevent and combat negative impacts on the marine environment by developing and implementing various political documents. The aim of the brochure is to provide an insight to those most relevant for the Baltic Sea, especially the Marine Strategy Framework Directive (MSFD).

The catchment area (light green on the map) of the Baltic Sea is four times that of the sea itself.
Map: HELCOM



1. The ecosystem approach: a holistic way of thinking

A marine ecosystem is extremely complex, with many components and interactions, it includes animal and plant species and their communities, as well as physical and chemical factors, which influence each other in various ways. If we add the human factor to the ecosystem, the picture becomes even more complicated.

Limiting consideration to single or few components of the system, while ignoring others, will most probably lead to in accurate perceptions of the dynamics of an ecosystem. Ecosystem thinking allows us to look at the ecosystem as a whole and see the relationships among the components. We can better understand why some species are disappearing and/or others are flourishing in certain conditions.

In the 1980s, ecosystem thinking grew from a scientific theory into the concept of the ecosystem approach, which means the inclusion of its principles into practical management of ecosystems for human needs. In 1995, the ecosystem approach was accepted as the primary framework for action under the Convention on Biological Diversity (CBD).

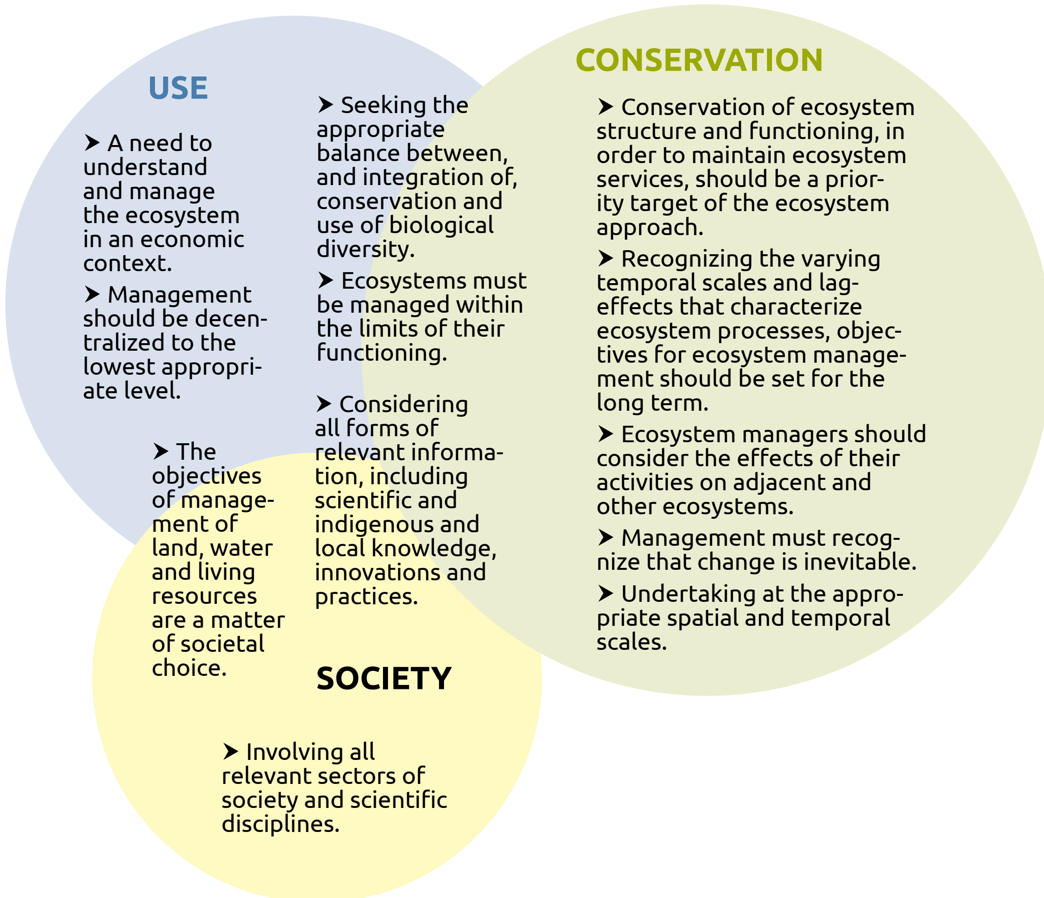
According to the CBD, **the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.** The approach aims at balancing the three objectives of the CBD: the conservation of biodiversity, sustainable use of its components (ecosystems, species or genetic resources), and fair and equitable sharing of the benefits of the utilisation of genetic resources.

The ecosystem approach also goes beyond the CBD, appearing in the Baltic Sea Action Plan and the EU Strategy for the Baltic Sea Region.

The ecosystem approach is also the flagship concept in the most influential EU document on the marine environment - the Marine Strategy Framework Directive, which clearly states that the approach should be applied to the management of human activities while enabling sustainable use of marine goods and services and helping to reach the objective of a good environmental status of the sea.

Although, at first glance, the ecosystem approach may seem to focus on nature conservation objectives, it actually recognizes humans as an integral component of ecosystems and helps society to sustainably manage ecosystem services.

Figure 1: The twelve principles of the ecosystem approach by the Convention on Biological Diversity



2. Diversity of the international legal framework

International environmental policy documents are among the most important drivers, pushing countries to take action. There are a number of such initiatives which influence activities related to marine biodiversity in general or the Baltic Sea in particular. They have not been developed in isolation; each has roots in other documents, and thus they form a common framework for the protection of marine biodiversity.

In 1979, the Council Directive 79/409/EEC on the conservation of wild birds (the **Birds Directive**) was adopted by the European Community. It was updated in 2009 (Council Directive 2009/147/EC) and provides a framework for the conservation and management of wild birds in Europe. A most important component of the Directive aims at the maintenance of the favourable conservation status of all wild bird species across their distributional range, as well as the identification of Special Protection Areas for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory (including marine) species.

In 1992, the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the **Habitats Directive**) was endorsed. The Directive helps to maintain biodiversity in the EU Member States by defining a common framework for the conservation of wild plants and animals and habitats of Community interest, including marine ones. It defines habitats and species of European importance and requires the Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status.

The Habitats Directive together with the Birds Directive are the tools that established the European network of protected areas - Natura 2000.

In 1993, one of the most important documents for the protection of global biodiversity - the **Convention on Biological Diversity** (CBD) - entered into force. Two of its seven thematic programmes are relevant in relation to marine bio-

diversity: **Island Biodiversity** and **Marine and Coastal Biodiversity**. The work programme on Island Biodiversity was adopted in 2006. Its aim is to significantly reduce the rate of island biodiversity loss by 2010 and beyond.

Adopted in 1998, and reviewed and updated in 2004, the programme of the work on marine and coastal biodiversity focuses on integrated marine and coastal area management, marine and coastal living resources, marine and coastal protected areas, mariculture, and invasive alien species.

Supporting the implementation of the CBD, the United Nations declared 2011-2020 as the Decade on Biodiversity.

In 2000, the EU **Water Framework Directive** (WFD) was adopted and entered into force. Overall, the WFD aims at achieving good (non-polluted) water status (including good ecological status) for all waters by 2015; ecological quality is one part of the objective. The WFD is important also from marine perspective, because it covers coastal (up to 1 nautical mile seawards from the coast baseline) and transitional (in the vicinity of river mouths) waters aiming at improvement of the aquatic environment through specific measures.

In 2007, the **HELCOM Baltic Sea Action Plan** (BSAP) was adopted. It aims at restoring the good ecological/environmental status of the Baltic marine environment by 2021. The HELCOM BSAP aims to address all the major environmental problems of the Baltic Sea through the four segments, expressed as goals, including favourable conservation status of biodiversity: biodiversity is restored and maintained and all elements of the marine food-webs occur at normal abundance.

In 2009, the **European Union Strategy for the Baltic Sea Region** was adopted. The Strategy is based on “four pillars”, one of them being “To make the Baltic Sea Region an environmentally sustainable place”. Among the five priority areas of the pillar, one is directly related to nature conservation and biodiversity, “To preserve natural zones and biodiversity, including fisheries”.

In 2011, the European Commission adopted an ambitious new **EU Biodiversity Strategy to 2020** to halt the loss of biodiversity and ecosystem services in the EU by 2020. The Strategy sets six targets: 1) full implementation of EU nature legislation to protect biodiversity; 2) better protection for ecosystems, and more use of green infrastructure; 3) more sustainable agriculture and forestry; 4) better management of fish stocks; 5) tighter controls on invasive alien species; 6) a bigger EU contribution to averting global biodiversity loss. The Strategy is the direct successor of the EU Biodiversity Action Plan adopted in 2006.

But, of all the policy documents, the one likely to be most influential for the European marine environment is the EU **Marine Strategy Framework Directive**, adopted in 2008.

Figure 2: Adoption of marine biodiversity-related legal and policy documents and corresponding objectives

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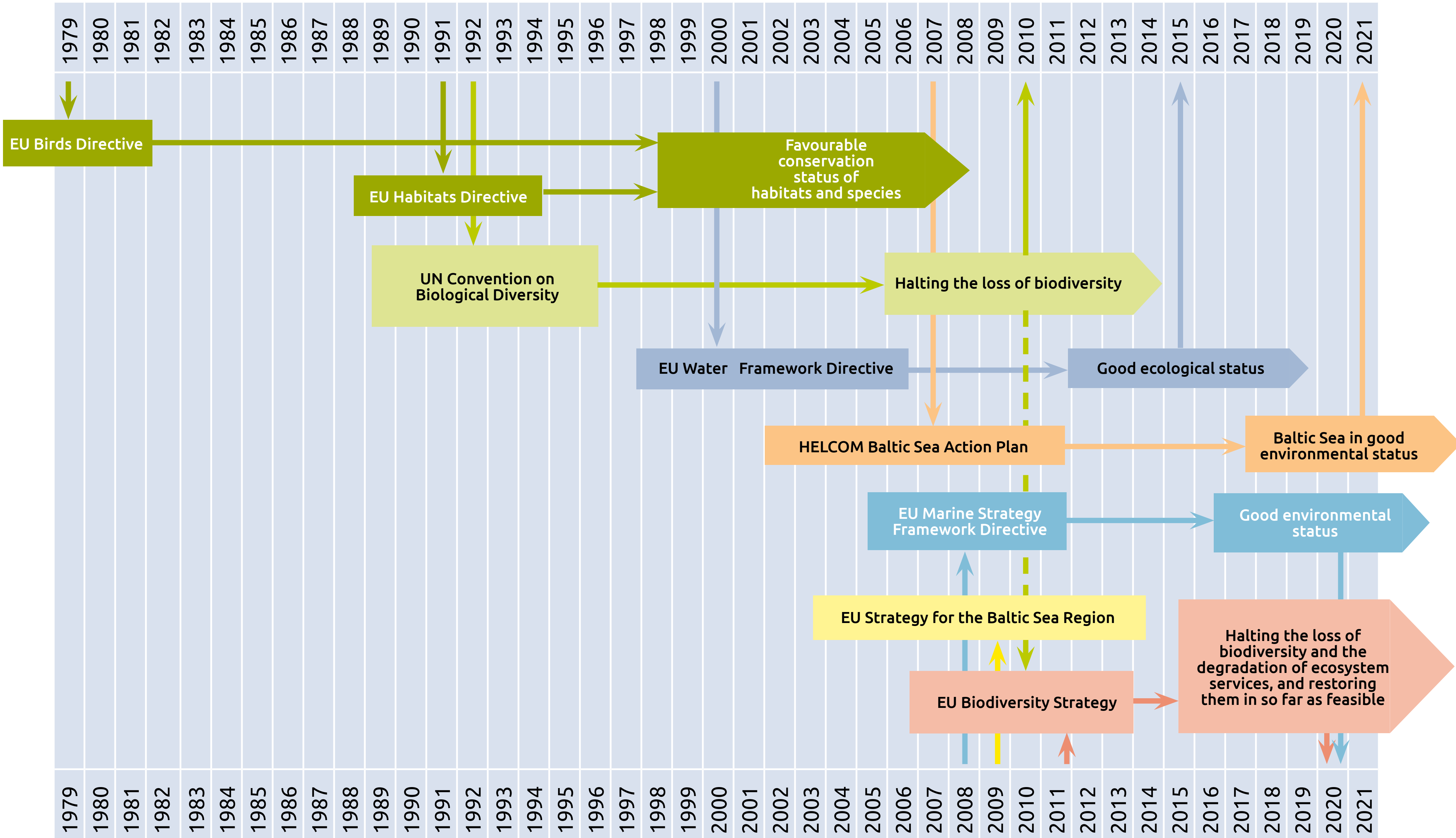
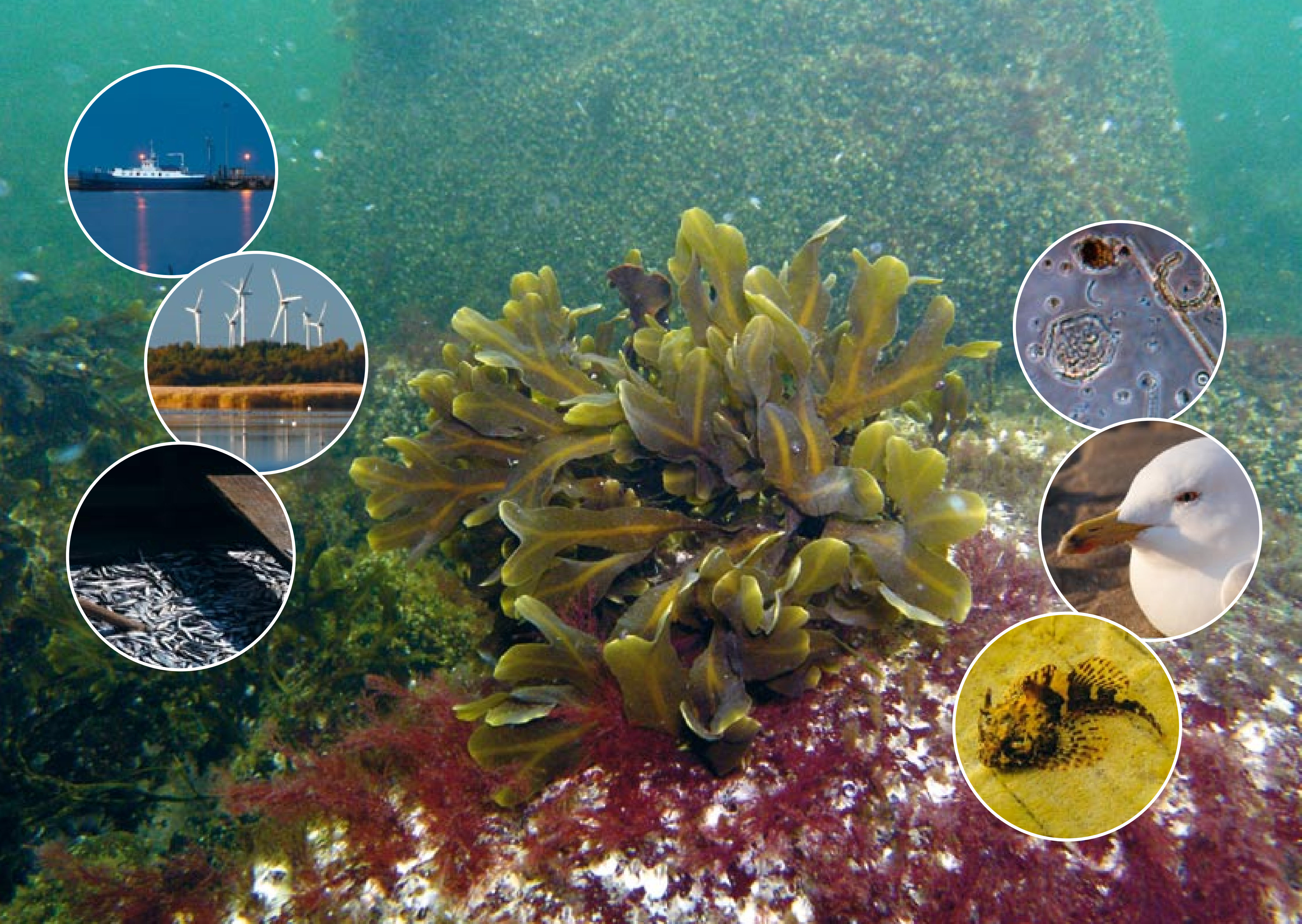




3. What is the Marine Strategy Framework Directive?

What makes the MSFD so unique among the many other international initiatives? The MSFD is the first European Community framework instrument aimed expressly at protecting and preserving the marine environment as a whole. Furthermore, it is the first attempt of the European Union (EU) to implement the ecosystem-based management of human activities in the marine environment to ensure balanced protection and use of the European seas.

The MSFD is set as the environmental pillar of the European Integrated Maritime Policy, which is aimed at developing the sustainable use of the seas.

The Directive introduces the concept of 'marine regions', the Baltic Sea among them.

Although the implementation of the MSFD is the responsibility of each EU Member State, the Member States must cooperate and coordinate the implementation of the Directive within each marine region. Obligations within regional sea conventions, such as the Helsinki Convention in the Baltic Sea Region, must be taken into account.

The MSFD is an ambitious political initiative. It aims to achieve a good ecological status of the European seas already by 2020.

The implementation of the MSFD is organised in several logical steps:

15 July 2012 is the first milestone for the EU Member States. To have a comprehensive overview of the situation in the marine region, each country is preparing an **initial assessment** of the current environmental status of the marine waters, as well as pressures and impacts of human activities.

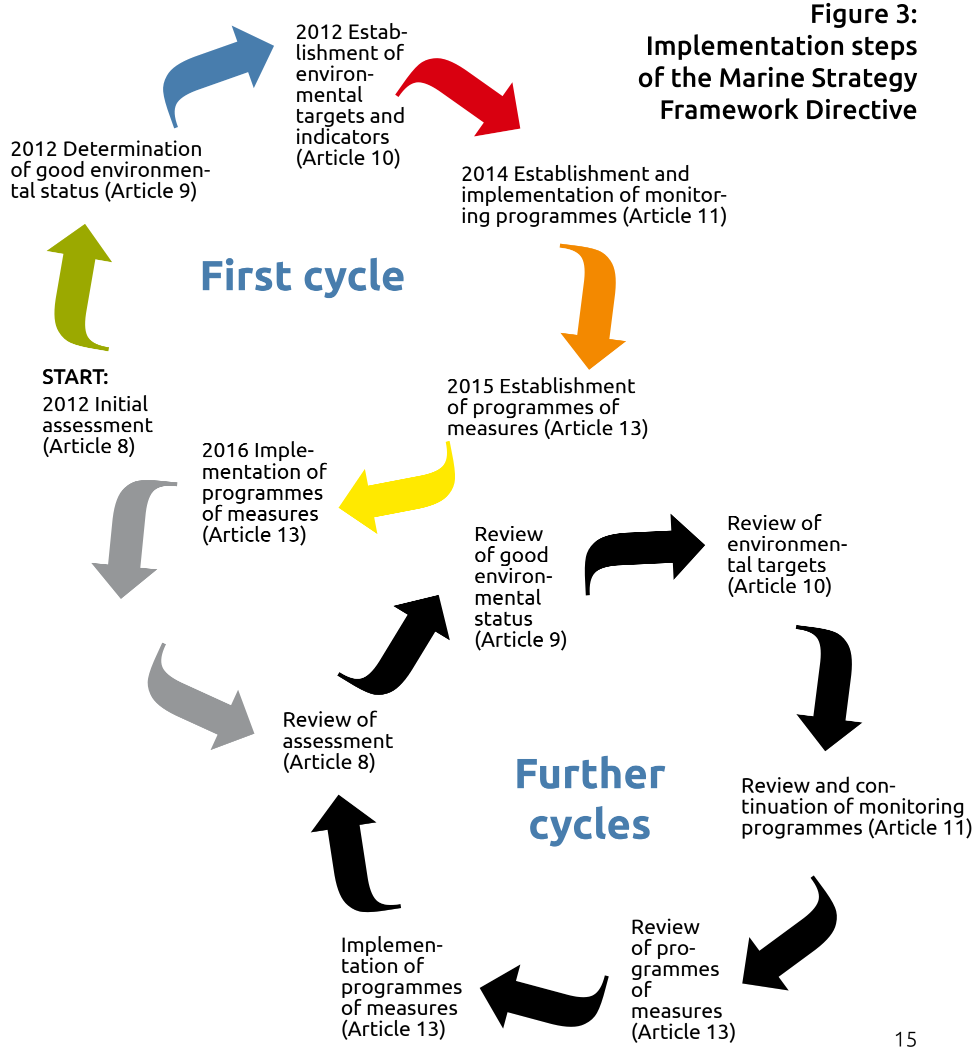
Precise ecological objectives determined in the form of a **good environmental status** (GES) shall set the conditions in which the societies of the EU Member States would like to see their marine waters in the future. A series of measurable **environmental targets** and **associated indicators** shall help to follow the progress in achieving the GES.

The second milestone is 15 July 2014, by which time each EU Member State shall develop and implement a **monitoring programme** that will allow it to follow important trends in the marine ecosystems.

By the end of 2015, the countries shall prepare the **programmes of measures** that are needed to achieve or maintain the GES. A year later, the programme must be operational.

The Member States shall use adaptive management through a review of the initial assessment, description of GES, environmental targets, monitoring programme and programme of measures every six years after their initial establishment.

Figure 3: Implementation steps of the Marine Strategy Framework Directive



4. Towards integrated policy objectives

Many political documents set biodiversity-related policy objectives that should be attained in general or within a given time frame (see Figure 2).

The Habitats Directive introduces the concept of the **favourable conservation status** as the objective for habitats and species.

A natural habitat is in a favourable conservation status when

➤ its natural range and areas it covers within that range are stable or increasing,

➤ the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future,

➤ the conservation status of its typical species is favourable.

A species is in a favourable conservation status when it is maintaining itself on a long-term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

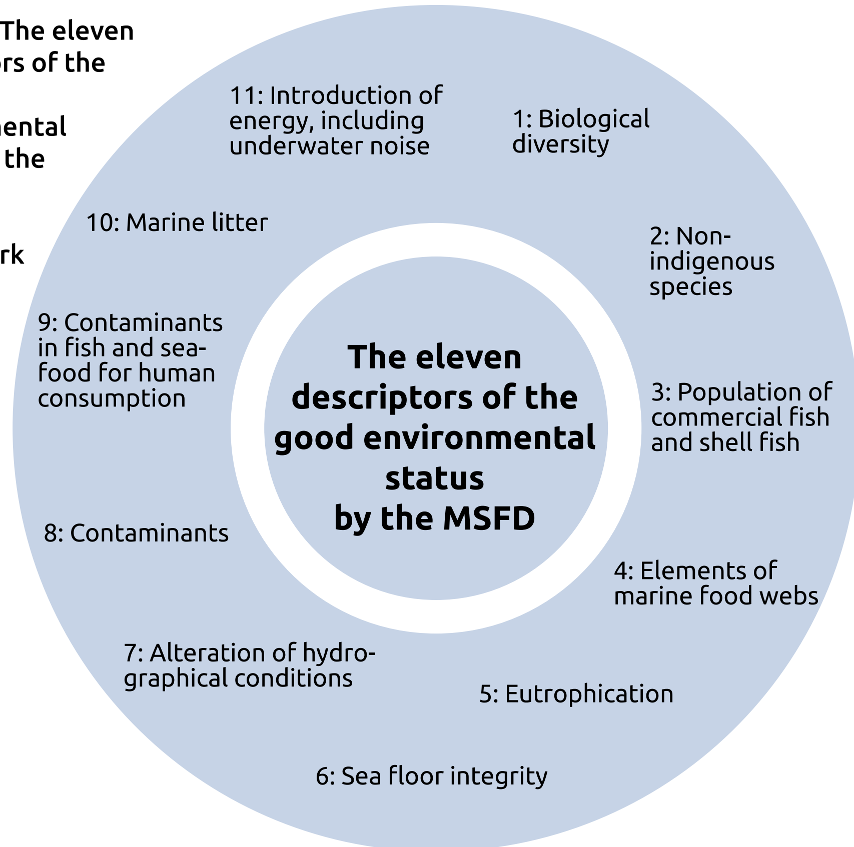
An equivalent approach (not specifically named) is used for bird species in the Birds Directive.

Although the Water Framework Directive (WFD) is mainly targeted at protecting waters from chemical pollution, it also includes the objective of a **good ecological status**, which expands the consideration of the ecosystems of waterbodies as compared to the single habitat or species approach in the Habitats Directive. Together with the good chemical status, it is a component of good water status for surface water bodies that should be achieved overall Europe by 2015.

Ecological status describes the degree to which human uses of the water environment have altered the structure and functioning of aquatic plant and animal communities. A Good Ecological Status means that pollution from human activities has had only slight impacts on the ecological characteristics of aquatic plants and animal communities.

The general objective of the Marine Strategy Framework Directive goes even further. While the WFD concentrates on water quality, the **good environmental status** takes into account a far larger variety of environmental parameters. The GES is defined for 11 descriptions. Descriptor 1 is directly related to biological diversity calling for its maintenance, as well as for ensuring the quality and occurrence of habitats and the distribution and abundance of species in line with prevailing physiographic, geographic and climatic conditions. Other GES descriptors such as non-indigenous species, populations of commercial fish/shell fish and elements of marine food webs, are also closely linked to biodiversity. The other descriptors describe either pressures from human activities or certain components of marine ecosystems (see Figure 4).

Figure 4: The eleven descriptors of the good environmental status by the Marine Strategy Framework Directive



5. Biodiversity indicators – tools to follow the changes

Nature itself is very complex and difficult to understand. The whole set of natural sciences deals with explaining the mechanisms behind the functioning of ecosystems and different elements in them.

Biodiversity as a term describes all variety of the structure and organization of living matter and the environment around it. From the perspective of human beings, biodiversity forms the basis for providing valuable ecosystem services. That is why, from a purely pragmatic perspective, people should be concerned about the loss and degradation of biodiversity caused by various human induced pressures, as well as by natural processes of global character (e.g. climate change).

The first step in managing the pressures causing degradation of biodiversity is the ability to evaluate the current state of biodiversity on different levels. This is a difficult task because the complexity of ecosystems makes it impossible to measure everything. Therefore, parameters are needed which respond to the processes and changes we are interested in, but they should also be easy to measure, understand and interpret. These parameters are called **"indicators"**.

Biodiversity indicators are tools that enable following the changes in biological components of marine ecosystems, to link those changes with pressures as well as to assess the effectiveness of measures taken to reduce the pressures on different geographical scales, providing thereby a basis for informed decision making and adaptive management.

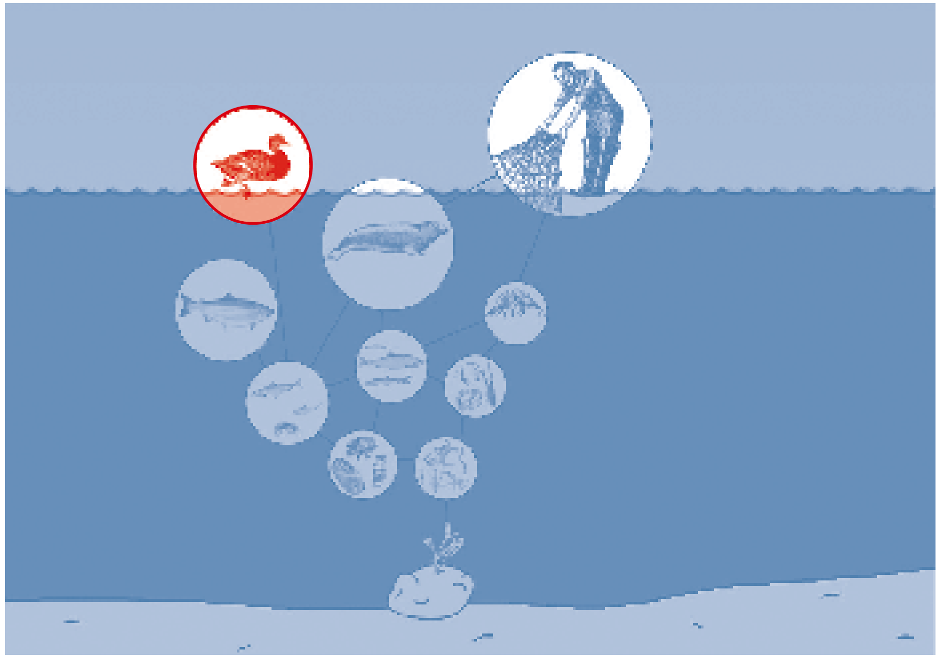
A biodiversity indicator can be either a single measurable parameter (e.g. concentration of chlorophyll a, number of species in one sample, depth distribution of vegetation, etc.), aggregation of a parameter over time or space (e.g. mean summer chlorophyll a concentration in sea water, average number of species in samples within a certain area, share of biomass of certain species in the area, etc.) or a complex index calculated by using many different parameters or measurements.

The long-tailed duck, for example, can serve as an indicator species for marine biodiversity, because it is dependent on various water animals and reflects the quality of the underlying marine habitats.

Until now, marine monitoring programmes have concentrated mainly on measuring different parameters reflecting water quality. There is no programme in place in the Northern Baltic Sea for evaluating the status of marine biodiversity, although some components of biodiversity are monitored as indicators of water quality or chemical status.

To be able to assess the status of biodiversity in our marine areas as required by the Marine Strategy Framework Directive, new measures and monitoring programmes need to be introduced. In this process, development of suitable indicators reflecting the status and trends of different components and levels of biodiversity is a very important step.

Figure 5: A bird species may serve as an integral indicator for the whole marine habitat



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6. Interaction with other sectors

Responsibility for the protection of marine biodiversity is not limited to the environmental sector, and, in fact, goes far beyond it. Most changes in the marine biodiversity arise from impacts created by various human activities. Many actors have interests in the Baltic Sea. Traditionally, the sea has been a source of food, mainly fish, and the state of the fish stocks is directly linked to the quality of the environment and the sustainable use of resources. A healthy Baltic Sea is a precondition for sea-related tourism and recreation. The sea also serves as space for maritime transport, energy production, aquaculture, military operations and as a source of different living and non-living resources. Since we depend on marine goods and services for our economic and social wellbeing, we have many good reasons to be interested in a healthy marine environment.

The **programme of measures** to be developed within the MSFD is the connecting point of the environmental and other sectors. It stresses that all aspects of sustainable development shall be considered and the social and economic impacts of the measures envisaged, when drawing up the programme for achieving the good environmental status of our seas. Such a programme may include a variety of measures, e.g. control of human activities and mitigation impacts, restoration of marine ecosystems, introduction of various management tools (e.g., spatial and temporal planning, economic valuation of ecosystem services), as well as communication, stakeholder involvement and raising public awareness.

The question of restrictions – are they necessary or not? – should always be carefully considered when making determinations for efficient environmental protection. Often good results can be achieved by introduction of more environmentally friendly practices in economic activities. E.g., regular medium speed shipping in an important bird area would not harm birds, and might even benefit the birds by opening the water during colder winters. On the other side, fast and noisy motorboats can significantly disturb birds and should therefore be regulated. The best results can be achieved in co-operation of all sectors related to the sea. Each economic sector can contribute to the implementation of the MSFD by planning the activities in a sustainable way and considering the needs of the environment (see Table 1).

Table 1: Various human activities related to the sea and possible impacts

	Activity	Possible impacts	Examples of possible measures
Extraction of living resources	Fisheries	Depletion of fish stocks, by-catch of marine mammals, birds and non-targeted fish, habitat damage (e.g. by trawling)	Introduction of Maximum Sustainable Yield principles Introduction of by-catch safe nets
	Seaweed and other sea-based food harvesting	Habitat damage and destruction, depletion of resources	Development of sustainable harvesting plans
	Aquaculture	Worsening water quality of habitats Habitat damage and destruction Spreading of diseases	Introduction of best aquaculture practices
Man-madestructures (incl. construction phase)	Coastal structures	Habitat damage Coastal erosion Disturbance of migratory birds Disturbance of underwater animals during construction	Careful planning of locations (marine spatial plans/local spatial plans) and construction works
	Submarine cables and pipelines	Habitat damage and destruction Potential impacts on marine animals (magnetic fields)	Careful planning of locations (marine spatial plans)
Extraction of non-living resources	Marine mining (sand and gravel, rock)	Habitat damage and destruction	Careful planning of locations (marine spatial plans) and time
	Dredging and dumping	Habitat damage and destruction	Careful planning of dumpsite location and dredging time
Transport	Boat traffic	Disturbance of birds and seals Pollution/worsening water quality (oil spills) Introducing alien species (ballast water)	Planning routes and speed (marine spatial plans) Clean fuel and combustion technologies Receiving ballast waters in ports

Table 1: Various human activities related to the sea and possible impacts
(continued)

	Activity	Possible impacts	Examples of possible measures
Tourism and recreation	Tourism and recreation incl. yachting, bathing, diving	Disturbance of birds and seals Pollution from boats Littering	Planning of tourism areas (marine spatial plans/local spatial plans) and improvement of infrastructure Educating tourists on nature-friendly behaviour Installing waste bins
Energy production	Marine-based renewable energy generation (wind, wave and tidal power)	Disturbance of birds, marine mammals and other biota Habitat damage and destruction	Careful planning of power plant locations (marine spatial plans)
	Marine hydrocarbon (oil and gas) extraction	Habitat damage and destruction Pollution spills	Careful planning of drill locations (marine spatial plans) Use of best available technologies
Land-based activities/industries	Industrial discharges and emissions	Worsening water quality by toxic pollution	Introduction of best available technologies
	Agricultural and forestry run-off and emissions	Worsening water quality by toxic pollution and nutrients	Introduction of best agricultural and forestry practices Restoration of natural wetlands and creation of artificial wetlands
	Municipal waste water discharge	Worsening water quality by toxic pollution and nutrients	Better cleaning of waste water
Military	Defence operations	Disturbance of birds and seals	Adoption of operational time to species' seasonal peculiarities
	Liquidation of dumped ammunition, shooting training	Habitat damage and destruction, disturbance of birds and seals and other biota	Adoption of operational time to species' seasonal peculiarities

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