

# APPLICATION OF THE ECOSYSTEM-BASED APPROACH IN MARITIME SPATIAL PLANNING

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## **Maritime spatial planning 2020**

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ISBN 978-952-320-040-1 (PDF)

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# 1 Introduction

Rapid population growth increases the need for renewable energy and the use of commodities. Since land areas are already largely in use, opportunities for business development are being sought from marine and coastal areas. At the same time, this increases the risk of marine overexploitation and conflict situations. Maritime spatial planning can enhance the sustainable use of marine resources by identifying synergies and conflicts between different sectors and reconciling human activities with the boundary conditions of the marine environment. Sustainability in the use of marine resources is ensured by applying the ecosystem approach in maritime spatial planning.

The principles of the ecosystem approach in spatial planning are described in the UN Biodiversity Convention. The first territorial sea agreement to apply the ecosystem approach was the Baltic Sea Action Plan (BSAP) published by the Baltic Marine Environment Protection Commission (Helsinki Commission, HELCOM) in 2007 (HELCOM 2007), while the European Union's Marine Strategy Framework Directive (MSFD 2008) was the first environmental directive to require that the ecosystem approach be applied to regulating and guiding human activities. The approach is already embedded in the 2014 Maritime Spatial Planning Directive (MSPD). The Baltic Sea countries' joint HELCOM-VASAB maritime spatial planning cooperation has produced general guidelines for applying the ecosystem approach, which is also being further developed through cooperation between Baltic coastal states.

The ecosystem approach is defined in the EU Maritime Spatial Planning Directive (preamble, recital 14) by way of its goal. According to the Directive, maritime spatial planning should apply:

*'[...] an ecosystem-based approach [...] with the aim of ensuring that the collective pressure of all activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised, while contributing to the sustainable use of marine goods and services by present and future generations. In addition, an ecosystem-based approach should be applied in a way that is adapted to the specific ecosystems and other specificities of the different marine regions [...].'*

In Finland, maritime spatial planning contributes to the sustainable use of marine and natural resources and the achievement of good marine environmental status in keeping with the Land Use and Building Act (132/1999). The maritime spatial plans drawn up by coastal Regional Councils coordinate the needs of different sectors. In particular, the plans focus on the energy sector, maritime transport, fisheries and aquaculture, tourism, recreation, cultural heritage, and the preservation, protection and improvement of nature and the environment. Attention is also given to national defence needs, the characteristics of the marine area and land-sea interactions. In addition, they also discuss other themes, such as blue biotechnology and extractive and marine industries. Maritime spatial planning is based on application of the ecosystem approach and on knowledge of ecosystem structure and functioning and human activities in marine and coastal areas.

Maritime spatial plans are currently being completed in Finland, in the pan-Baltic region and within the European Union. Following the first plans, the process will advance in tandem with a growing knowledge base on the marine environment, human activities at sea, the impact of maritime spatial planning and the political processes relating to the use of marine resources. At the same time, this also involves formulating and developing practices related to application of the ecosystem approach.

The project entitled Application of the ecosystem approach to drafting maritime spatial plans aimed to provide concrete tools and examples for applying the ecosystem approach to maritime spatial planning in Finland. The work made use of extensive literature relevant to the topic, as well as coastal Regional Councils' maritime spatial planners and experts involved in the maritime spatial planning process.

## 2 The ecosystem approach – concepts and application

### 2.1 Premises of maritime spatial planning

The Maritime Spatial Plan is a general plan covering the whole of Finnish marine waters and designating areas best suited to different activities or those where activities may be restricted. The plan provides background information for other spatial planning and regional development processes as well as for planning sectoral activities. The plan may also be considered a strategic planning tool. Its format of planning is separate from the land use planning system and it does not have a binding effect on the steering of other types of planning. The Maritime Spatial Plan is based on extensive background data on the marine environment and human activities at sea and is drawn up in broad cooperation with various stakeholders.

While the regional land use plans drafted by coastal Regional Councils already contain elements relevant to developing the use of marine areas, these plans only extend to territorial waters. The 2014 regional land use plan of the Regional Council of Kymenlaakso, entitled 'Trade and the marine area', explored aspects of future development of the marine area and experimented with maritime spatial planning by means of regional land use planning. The planning process took account of environmental conditions as well as socio-cultural and economic factors.

Where the Maritime Spatial Plan produces background information and strategic perspectives for the purpose of developing marine areas, regional land use planning creates conditions for their implementation, similar to local master plans and local detailed plans, which are precise and binding in nature.

Maritime spatial planning must apply the ecosystem approach. The general goal is to use ecosystems within their limits so as to preserve them. This goal can be achieved by taking the structure, functioning and characteristics of the marine environment into account as part of the planning process. In practical terms, this can be achieved by ensuring that the spatial planning system takes issues into account at the right planning level. This means that the objectives set by EU legislation on marine environmental status, for example, can be addressed by setting national objectives first and then seeking regional means to achieve these. However, the objectives of water management to achieve good ecological status of coastal waters are defined in the planning areas of river basin districts, which guide regional and spatial planning in much greater detail.

### 2.2 The ecosystem approach and maritime spatial planning

The ecosystem approach is a holistic method of planning use and management, with a core principle of humans as an integral part of nature with an impact on its functions. As a result, it is possible to assess the trade-offs between exploitation of marine ecosystem services and the objectives set in strategic and binding plans (Levin et al. 2009). Making use of the precautionary principle and taking account of the prevailing ecological, social, cultural and economic conditions will also enable sustainable development and growth in marine areas.

The ecosystem approach was first defined at the 1992 Biodiversity Convention (The Convention on Biological Diversity, CBD). A few years later, the key aspects of the ecosystem approach were identified in the Malawi Principles (Table 1). Finland is committed to complying with these principles, not only in areas such as land and maritime spatial planning, but also in other decision-making processes involving the need to manage human–environment interactions (e.g. Baltic Sea Action Plan, HELCOM 2007). A key feature of the Malawi Principles is that they identify the strong interactions between society and the environment. It should be noted, however, that although the ecosystem approach aims to ensure the sustainability of growth, various economic and political processes may still result in solutions that are harmful to the marine environment.

In 2003, the Baltic Marine Environment Protection Commission (HELCOM) and the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic adopted a joint declaration in support of applying the ecosystem approach to marine decision-making, in order to ensure sustainable management of the impact of human activities on the marine environment (OSPAR/HELCOM Statement 2003). The HELCOM Baltic Sea Action Plan (HELCOM 2007) adopted application of the ecosystem approach as the premise for all human activities and specifically mentioned it in the context of maritime spatial planning and fishing.

The EU Marine Strategy Framework Directive (2008/56/EC) requires marine management processes to apply the ecosystem approach to managing the impact of human activities at sea in order to prevent their cumulative effects from compromising the achievement of good marine environmental status. The requirement for the Member States to apply the ecosystem approach to setting up maritime spatial plans is also included in the EU Maritime Spatial Planning Directive (2014/89/EC). On the Baltic Sea, the work carried out by the Joint HELCOM-VASAB Maritime

**Table 1.** Published in 1998 as a result of the Conference of the Parties to the Convention on Biological Diversity (CBD COP), the Malawi Principles identify the key aspects of the ecosystem approach.

1	The objectives of management of land, water and living resources are a matter of societal choices.
2	Management should be decentralised to the lowest appropriate level.
3	Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
4	Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: (I) Reduce those market distortions that adversely affect biological diversity; (II) Align incentives to promote biodiversity conservation and sustainable use; (III) Internalise costs and benefits in the given ecosystem to the extent feasible.
5	Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.
6	Ecosystems must be managed within the limits to their functioning.
7	The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.
8	Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.
9	Management must recognise that change is inevitable.
10	The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
11	The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
12	The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Spatial Planning Working Group has supported international development of maritime spatial planning by means such as clarifying questions of data and principles relating to the process.

The cornerstone of ecosystem-based maritime spatial planning is to support the achievement and maintenance of good marine environmental status. Accordingly, the environmental objectives specified in international agreements and EU and national legislation must be taken into account in preparing such plans (see Chapter 3). In practical terms, it follows that the ecosystem's carrying capacity will be considered when determining the quality and quantity of human activity at sea.

The key is to identify human activities affecting the marine environment, the environmental objectives that can be influenced by means of maritime spatial planning or national land use planning and the ways in which this can be done. Application of the ecosystem approach is particularly important in areas where increased human activity is likely to have significant environmental impacts (Douvere 2008). The Joint HELCOM-VASAB Maritime Spatial Planning Working Group has identified nine principles for ecosystem-

based maritime spatial planning<sup>1</sup> ([https://helcom.fi/media/documents/Guideline-for-the-implementation-of-ecosystem-based-approach-in-MSP-in-the-Baltic-Sea-area\\_June-2016.pdf](https://helcom.fi/media/documents/Guideline-for-the-implementation-of-ecosystem-based-approach-in-MSP-in-the-Baltic-Sea-area_June-2016.pdf)):

1. Compiling the best available knowledge on the sea and its use;
2. Applying the precautionary principle to maritime spatial planning;
3. Alternative development: exploring alternative planning solutions;
4. Identification of ecosystem services;
5. Comprehensive understanding of interactions;
6. Mitigating the effects of maritime spatial plans;
7. Participatory planning and communication;
8. Level of detail and coherence of maritime spatial plans;
9. Adaptation: monitoring, reviewing and evaluation as well as adaptation of the impact of maritime spatial plans.

The theoretical background for these principles and their implementation method in the Finnish maritime spatial planning process are discussed in Chapter 4.

<sup>1</sup> Wording in the HELCOM-VASAB Guideline as follows: (1) Best available Knowledge and Practice; (2) Precaution; (3) Alternative development; (4) Identification of ecosystem services; (5) Relational Understanding; (6) Mitigation; (7) Participation and Communication; (8) Subsidiarity and Coherence; (9) Adaptation.

## 2.3 International application of the ecosystem approach to maritime spatial planning

### *International treaties behind the ecosystem approach*

International treaties require management of human impact on the marine environment and application of the ecosystem approach. Some of the treaties mostly focus on coastal areas, although issues relating to the marine environment have, in recent years, been extended to cover the open seas and international waters as well. The most essential treaties relating to the sustainable use of marine areas include the UN Convention on the Law of the Sea (UNCLOS) and Convention on Biological Diversity (CBD), the UN 2030 Agenda and the Code of Conduct for Responsible Fishing of the UN Food and Agriculture Organisation (FAO).

**The United Nations Convention on the Law of the Sea (UNCLOS)** entered into force in Finland in 1996. The UNCLOS works as the legal framework for all marine activities. The Convention sets standards for the protection and use of seas and their natural resources, shipping and fisheries, etc. It divides seas into zones, defining the rights and obligations of both coastal states and other states for each. It also provides the framework for defining states' exclusive economic zones and their rights and obligations within these.

The **Convention on Biological Diversity (CBD)**, also known as the Biodiversity Convention, creates the foundation for global conservation of biodiversity and sustainable use of natural resources. It requires the Contracting Parties to establish a system of protected areas and plan its management and use. The 2011 Nagoya Biodiversity Summit set new objectives relating to conservation of biodiversity, sustainable use of the components of biodiversity and more fair and equitable sharing of benefits arising out of the utilisation of genetic resources. Achieving the objectives by 2020 requires development of National Biodiversity Strategies, inclusion of biodiversity issues as part of sectoral and cross-sectoral planning and establishment of a monitoring network and extensive conservation programmes. Application of the ecosystem approach is considered a key tool to achieve these objectives. The CBD process is currently developing a 'post-2020' global biodiversity framework, which aims to halt biodiversity loss in future decades as well.

**The United Nations 2030 Agenda for Sustainable Development** follows the UN Agenda 21 Programme of Action for Sustainable Development, which includes 17 goals. Goal 14 aims to 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. One of the identified means is application of the ecosystem approach, while national planning of coastal and marine ar-

reas is considered as a way to promote the implementation of the Agenda. The Agenda's concrete objectives include cross-sectoral coordination in policy and decision-making processes, identification of existing and future forms of sea use and their interactions, and compliance with the precautionary principle in planning.

**The Code of Conduct for Responsible Fisheries of the United Nations Food and Agriculture Organisation (FAO, 1995)** sets out principles and standards for conservation and management of fish stocks. The Code of Conduct also covers fishing operations, handling and trade of catches, the fishing industry, aquaculture, research into fisheries industries and integration of fishing into coastal spatial planning. The Code was supplemented with the FAO Guideline for Precautionary Approach in 1996.

### *Application of the ecosystem approach to maritime spatial planning – from theory to practice*

A specific challenge for applying the ecosystem approach is the lack of concrete examples in practical planning work and on how to balance the values of the marine environment and their sustainable use (Douvere 2008). Some of the principles have been found too broad or complex (Ansong et al. 2017). Nevertheless, the lack of a strict framework has also allowed broad endorsement of the approach (Engler 2015), leaving much room for interpretation in practical implementation.

No detailed descriptions can be found in Europe on how the ecosystem approach has been applied to maritime spatial planning, although HELCOM and OSPAR already expressed their support for applying the ecosystem approach as part of marine decision-making in 2003 (OSPAR/HELCOM Statement 2003). Application of the ecosystem approach was also adopted as the premise of the HELCOM Baltic Sea Action Plan (HELCOM 2007). The Action Plan provides a model for applying the ecosystem approach in practical terms by: (i) assigning goals for all components of the marine ecosystem; (ii) including human wellbeing in the goals; (iii) splitting the goals into objectives and targets; (iv) agreeing on measures to achieve the goals, including restrictions on human activity and restoration of damaged sites; (v) supporting research to fill gaps in knowledge; and (vi) monitoring the achievement and effectiveness of the goals. HELCOM Ministerial Meetings (2010, 2013, 2018) have subsequently supplemented the range of measures and further specified the goals (<https://helcom.fi/helcom-at-work/ministerial-meetings/>).

In the European Union, application of the ecosystem approach started upon entry into force of the 2008 Marine Strategy Framework Directive and the 2014 Maritime Spatial Planning Directive. International cooperation carried out by the Joint HELCOM-VASAB Maritime Spatial Planning

Working Group on the Baltic Sea since 2010 has enabled development of the concept on the Baltic Sea. The Baltic Sea states' joint projects led by the Swedish Agency for Marine and Water Management, Baltic Scope (2015–2017) and Pan Baltic Scope (2018–2019), explored issues involved in applying the concept. In practical terms, HELCOM has strongly promoted compilation of sectoral spatial data from the Baltic Sea and developed a map service and tools for cumulative pressures.

Application of the ecosystem approach has been examined in publications such as the Baltic Scope project report entitled *The Ecosystem Approach in Maritime Spatial Planning – A Checklist Toolbox* (2017). The materials were further specified in the Pan Baltic Scope project (<http://www.panbalticscope.eu/>). However, the projects were carried out on the Baltic Sea at a stage when only some of the states had completed their maritime spatial plans and the reports (Arndt & Schmidtbauer Crona 2019, Langlet & Westholm 2019) show that Sweden was already well advanced in considering the issues relating to application of the ecosystem approach, whereas Estonia has developed tools at a later stage (interview with Triin Lepland in April 2020). Consequently, the reports only provide a limited overview of application of the ecosystem approach to maritime spatial planning.

International cooperation has brought to light the differences between individual countries' planning systems: by way of example, planning is state-driven in Estonia; in Germany, the federal state plans the exclusive economic zone while individual states plan territorial waters; and in Sweden, local authorities are responsible for planning the coastal areas while the rest of the marine area is addressed by the central government. Consequently, application of the ecosystem approach on the Baltic Sea requires development of coherence between national and international planning processes (see Section 2.1).

Application of the ecosystem approach to maritime spatial planning on the Baltic Sea is described in further detail in Chapters 3 and 4. A specific focus is on how the principles have been approached in our neighbouring countries, Estonia and Sweden (for further information, see Appendix 1). Nevertheless, it is already fair to note that, once the maritime spatial plans are completed, the principles and means used in them should be assessed critically and comprehensively, in order to introduce better practices and tools for applying the ecosystem approach in the next maritime planning stage.

# 3 Environmental objectives in ecosystem-based maritime spatial planning

## 3.1 Environmental objectives of maritime spatial planning in EU Directives

The European Union legislation includes a range of directives with environmental objectives applicable to seas: the Marine Strategy Framework Directive (MSFD), the Water Framework Directive (WFD) and the Habitats and Birds Directives (Table 2). The MSFD is the environmental pillar of the EU Integrated Maritime Policy, aiming to achieve good environmental status in European marine environments. The MSFD also imposes an obligation to promote the objectives of the Habitats and Birds Directives and the WFD. In other words, the MSFD plays a key role in determining EU objectives for marine environments and applying the ecosystem approach to maritime spatial planning. The descriptors of the Directives are listed in more detail in Appendix 2.

### *Marine Strategy Framework Directive (MSFD)*

The MSFD aims to achieve good environmental status (GES) in the marine environment. In Finland, the Directive is implemented through the Finnish Marine Strategy, which is a national marine strategy required under the Directive. Marine management covers Finland's entire sea area from the coastline to the outer boundaries of its exclusive economic zone. Pressures and adverse effects from land, air or non-EU waters are regulated by means of other legislation, agreements or negotiations (e.g. MSFD, Art. 6). Marine environmental status is assessed every six years on the basis of eleven descriptors. The status is determined by means of indicators and threshold values provided for each descriptor (Commission Decision (EU) 848/2017).

The scale of the status assessment varies depending on the indicator. In Finland, assessments are either made for the entire sea area or at the level of the six marine areas or coastal water types. Data required for status assessments is collected from the Finnish sea area by means of regular monitoring. The MSFD also requires pressure assessment. If pressure or cumulative effects of multiple pressures prevent good status from being achieved or maintained, quantitative targets are required to reduce such pressures.

The general environmental objectives of the Finnish Marine Strategy are presented in a report entitled 'State of the marine environment in Finland 2018' (Korpinen et al. 2018). These objectives include specific targets for loads of nutrients, organic matter and suspended solids from different sectors (incl. aquaculture, agriculture and shipping), litter loads, loads of harmful and hazardous substances, spread of non-indigenous species, use of natural resources and nature conservation, etc.

### *Water Framework Directive (WFD)*

The WFD aims to achieve good ecological status for surface water and groundwater. The Directive is implemented through river basin management plans. Finland has eight river basin districts, with seven located in Continental Finland and one in the Åland Islands. The sea area has also been assigned coastal water bodies covering internal waters and extending one nautical mile beyond these. Their ecological status is assessed every six years on the basis of biological, hydromorphological and water quality elements. It is important to note that the WFD applies both to bodies of freshwater and to bodies of marine water and that the sea area covered by the WFD overlaps with those falling under the MSFD and the Maritime Spatial Planning Directive (MSPD).

### *Habitats Directive*

The Habitats Directive applies to natural habitats and wild species defined as endangered within the European Union. The Directive's descriptions of marine habitats are based on habitat geomorphology. However, there may be differences in interpretation between marine areas and countries. The Directive's list of species whose conservation requires special attention also includes some found in the Finnish sea area.

The aim of the Habitats Directive is to reach and maintain the favourable conservation status of species and habitats, taking account of economic, social and cultural requirements and regional and local characteristics. A further objective for species is to also maintain the species such that their natural range will not be reduced. In practical terms, the Directive is implemented through the Natura 2000 network of protected sites. In Finland, Natura 2000 protected sites are implemented by the Nature Conservation Act (1096/1996) as well as by the Water Act (587/2011) and Land Use and Building Act (132/1999).

Conservation status is assessed every six years using a four-step scale (favourable, unfavourable-inadequate, unfavourable-bad, unknown). The assessment criteria for natural habitats are distribution, natural range, structure and function as well as foreseeable development of conservation status. The assessment criteria for species are distribution, population status, habitat status as well as foreseeable development of conservation status. Any pressures on and threats to species and habitats will also be reported. Conservation status is determined on the basis of the factor assessed to be worst.

**Table 2.** Objectives of Directives relevant to marine environmental status, means to achieve the objectives, assessment of environmental status and status classification.

	Marine Strategy Framework Directive	Water Framework Directive	Habitats Directive	Birds Directive
<b>Objectives</b>	Achieving good marine environmental status	Halting deterioration of the status of water bodies and achieving good ecological status in them	Achieving favourable conservation status of natural habitats and species and halting their quantitative and regional decline	Maintaining bird populations at a level which corresponds to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements
<b>Means</b>	Measures in the programme of measures for the marine strategy	Measures in the programmes of measures for river basin management plans	Natura 2000 network of protected sites Other conservation and restoration measures	Natura 2000 special protection areas (SPAs) Other measures
<b>Assessment</b>	Qualitative descriptors and related criteria	Quality elements (biological, hydromorphological and water quality)	Factors of favourable conservation status	Species-specific data, similar to those under the Habitats Directive
<b>Classification</b>	Good/Not achieved	High/good/moderate/poor/bad	Favourable/unfavourable-inadequate/unfavourable-bad/unknown	No specific classification; application as for the species under the Habitats Directive

## Birds Directive

The objective of the EU Birds Directive is to maintain bird populations at a level which corresponds to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level. The primary measure is to identify sites that are important to birds and establish Natura special protection areas (SPAs) on these sites. Other measures include upkeep and management of habitats, re-establishment of destroyed biotopes and creation of new ones, as well as promotion of research and protection of bird populations. In Finland, the Directive is primarily implemented by the Nature Conservation Act.

Reports on implementation of the Directive are submitted every six years. Such reports include an assessment of the status of bird populations nesting naturally in Finland and the most important migratory and wintering populations. The assessment is based on data on the levels of and changes in populations, areas of and changes in distribution, as well as potential conservation plans and pressures on and threats to populations.

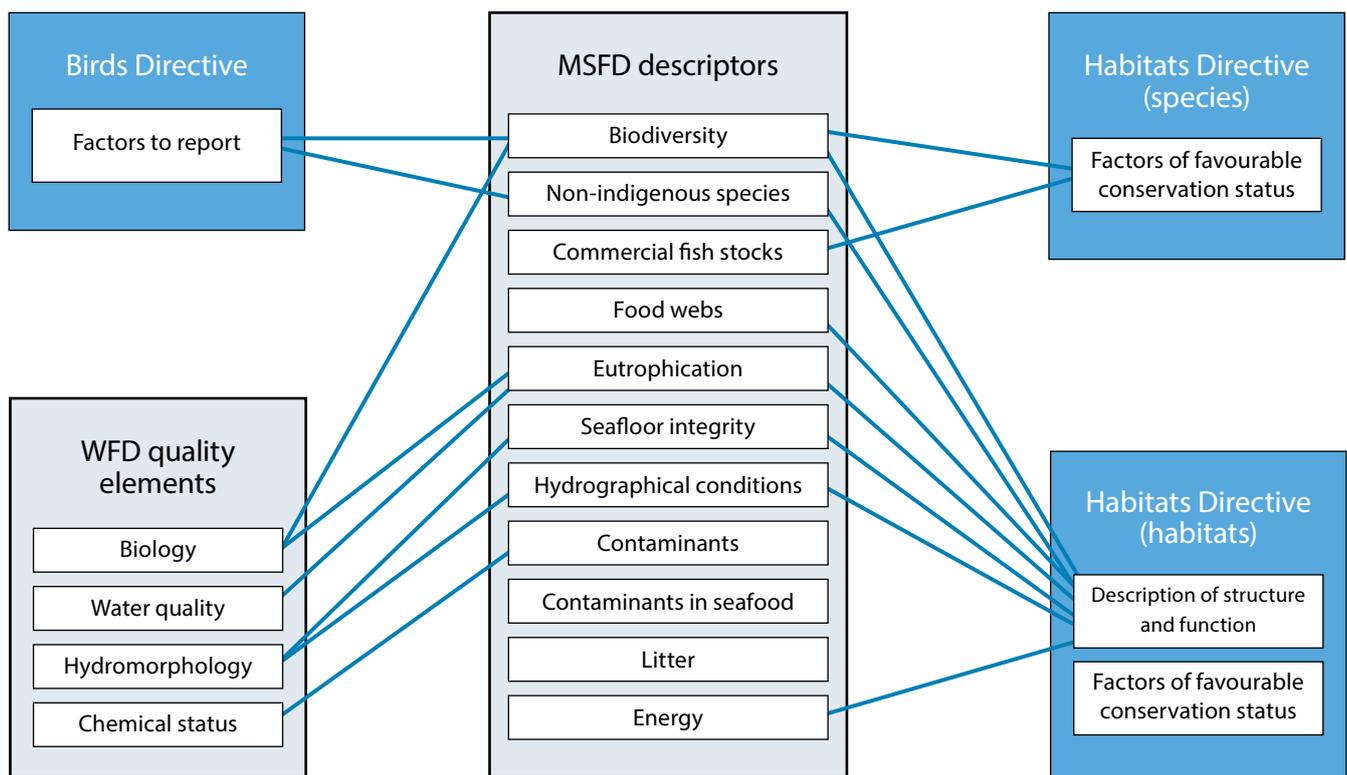
## Commonalities between the Directives

The relationship between the assessment elements used in the Directives and the descriptors of the Marine Strategy Framework Directive is shown in Figure 1 and the commonalities between the Directives are presented in Appendix 2. While all four Directives examine the marine environment and its good status, the MSFD is the broadest and creates

the framework for the other Directives. The Water Framework Directive mainly focuses on inland waters and groundwater, which is reflected in the smaller number of quality elements specified for coastal waters when compared with inland waters. The WFD and the MSFD apply a holistic ecosystem approach, whereas the Habitats and Birds Directives focus on ensuring the preservation of the endangered or vulnerable species or habitats listed in their Annexes by means of targeted conservation measures.

MSFD implementation makes use of the WFD quality elements to assess the good status of coastal waters where the two Directives overlap. All of the biological and water quality parameters and half of the hydromorphological parameters used for coastal waters are also MSFD descriptors or indicators (Table 2, Figure 1). MSFD implementation has drawn on indicators developed by HELCOM, for example. There are some commonalities between the conservation status of species considered in the Habitats and Birds Directives and the MSFD. Some assessment elements of the Habitats Directive and the status of populations of certain species within its scope are directly applied as indicators in the MSFD.

MSFD implementation equates the favourable conservation status of habitats with good status, while descriptions of habitat functions and structures are linked to most MSFD descriptors. However, these definitions are not quantitative and the status of habitats is not thus far monitored in the same way as the development of MSFD and WFD indicators.



**Figure 1.** Commonalities between the assessment elements used in the Directives and the descriptors of the Marine Strategy Framework Directive. Source: Finnish Environment Institute (SYKE)/Samuli Korpinen 2020.

### 3.2 Environmental objectives of maritime spatial planning in Finland, Estonia and Sweden

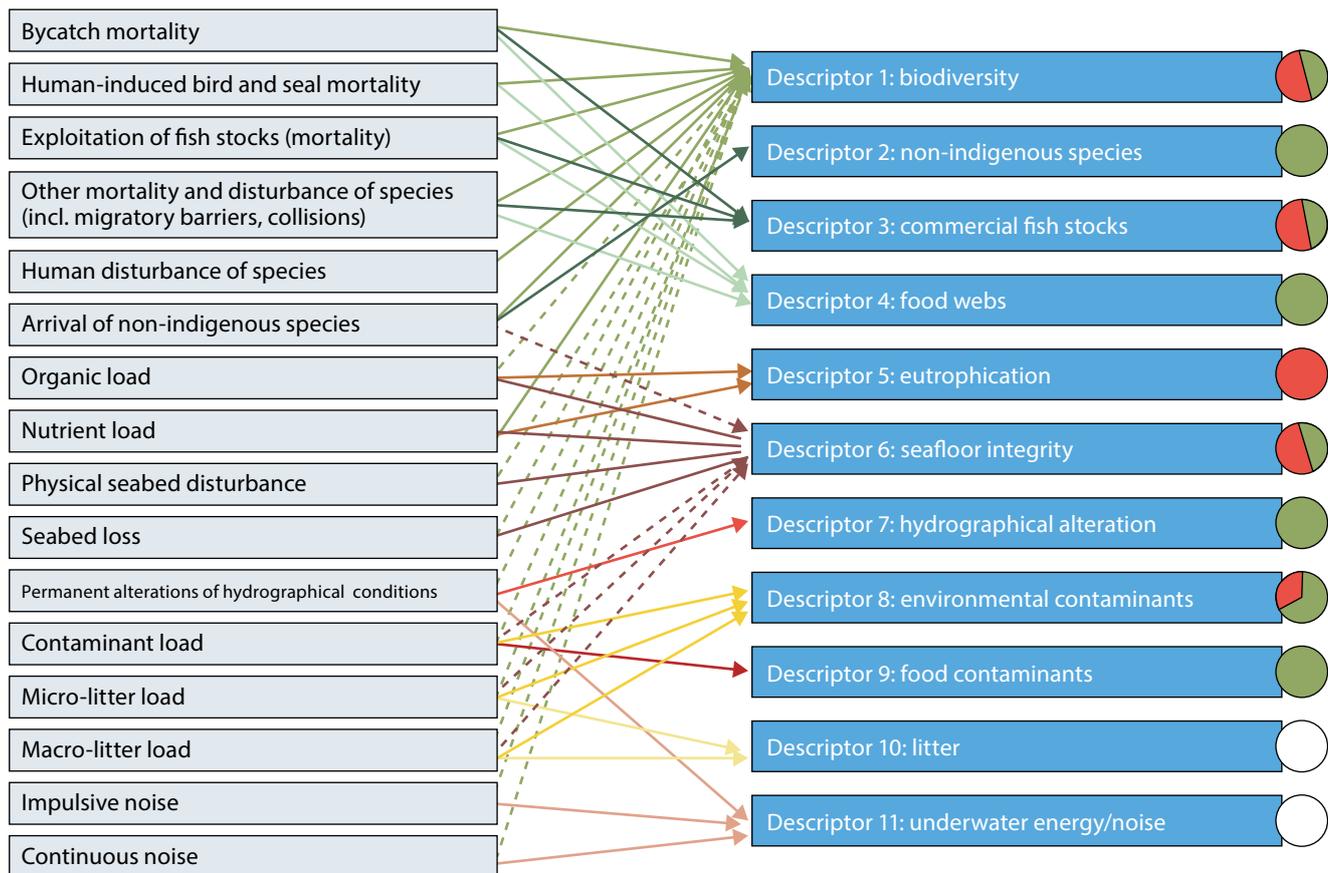
The environmental objectives of the MSFD and the other Directives are taken into account in ecosystem-based maritime spatial planning (cf. Table 2). The goal is that implementation of maritime spatial plans supports the achievement of good marine environmental status. Human pressures on the marine environment are assessed in implementation of the Directives (Figure 2). In general terms, individual objectives (and status descriptors) are affected by multiple pressures; by way of example, biodiversity and seafloor integrity are compromised by a wide range of pressures produced by human activities in Finnish marine areas (Appendix 3).

Sweden has set achievement (and maintenance) of good marine environmental status under the Marine Strategy Framework Directive as an objective for maritime spatial planning. The criteria and indicators used to determine good marine environmental status have been utilised in environmental impact assessments under the SEA law governing the environmental impact assessment of plans and programmes by the authorities. The effects of planning solutions on the marine environment are assessed in Sweden using the Symphony tool developed in support of maritime spatial planning.

Estonia's law governing maritime spatial planning states that one of the key tasks of maritime spatial planning is to achieve good marine environmental status in keeping with the Marine Strategy Framework Directive and to determine the measures required to protect the marine environment. Planning must take account of protected areas and the premises for their use. In Estonia, maritime spatial planning is carried out at the national level and activities in marine areas are then developed on a project basis. Environmental impacts are analysed from a national perspective at different scales as part of the environmental impact assessment (EIA) process relating to project implementation.

Maritime spatial planning and national spatial planning can contribute to several descriptors of good marine environmental status. Examples include biodiversity loss, status of commercial fish stocks, changes in marine food webs, seabed destruction and disturbance, changes in hydrographical seabed characteristics, levels of contaminants in the marine environment, increase in marine litter, and amounts of energy and noise carried into the sea.

A specific challenge is to take account of processes that cannot be influenced solely by measures taken at sea. The 2019 assessment under the Habitats Directive, for example, found that nutrient loads from land had an adverse effect on the status of several underwater habitats. Nevertheless, maritime spatial planning can also highlight horizontal environmental problems and explore solutions to these in order to achieve environmental objectives.



**Figure 2.** Human pressures and their effects degrade the status of the marine environment. The Figure examines the effects of human activity on the descriptors of the Marine Strategy Framework Directive. The pie chart adjacent to each descriptor shows its status in Finnish marine areas based on the 2018 assessment; green indicates a good and red indicates a poor status, while white means that the status is unknown. Source: Finnish Environment Institute (SYKE)/Samuli Korpinen 2020.

### 3.3 Means to achieve environmental objectives

The strategic role that maritime spatial planning plays in protecting the marine environment creates a framework for spatial planning at sea, which is further specified and implemented through other types of planning. The notations of regional land use plans and local master and detailed plans can be taken into account in permit processes, which in turn contributes to achievement of the environmental objectives of maritime spatial planning. The Land Use and Building Act also applies to territorial waters, ensuring that the surveys and impact assessments required for planning are carried out at the level of detail required by law. Regional land use plans have played a major role when the Centres for Economic Development, Transport and the Environment (ELY Centres), for example, have issued statements on land extraction and water permit applications and joint permit applications falling under both the Environmental Protection Act (527/2014) and the Land Extraction Act (555/1981). Such statements recall the notations of regional land use plans concerning nature, landscape, cultural heritage sites and groundwater areas ([https://mrluudistus.fi/wp-content/uploads/2020/01/MRL\\_-Alueidenkäytön-pykäläluonnosten-kommentointi\\_Valtion-viranomaiset\\_julk.pdf](https://mrluudistus.fi/wp-content/uploads/2020/01/MRL_-Alueidenkäytön-pykäläluonnosten-kommentointi_Valtion-viranomaiset_julk.pdf), in Finnish).

*A key question in ecosystem-based maritime spatial planning is what types of environmental problems can be*

*solved through planning solutions implemented in marine areas. Some factors affecting marine environmental status, such as eutrophication, cannot be resolved solely by measures taken at sea but will also require action in catchment areas.*

Taking land–sea interactions seamlessly into account in maritime spatial planning as well as regional land use planning and local master and detailed planning processes will make it possible to improve marine environmental status by means of spatial planning. Likewise, pressures from international merchant shipping or fishing cannot be restricted by local – or even national – measures; instead, their management will require global or regional agreement.

Table 3 presents some proposals for applying the ecosystem approach to maritime spatial planning in Finland. The marine status descriptors selected for analysis include elements compromising the status that can be influenced by means of spatial planning. The table then lists practical measures relating to each descriptor that could reduce human activities affecting the descriptor's status.

In practical terms, examination of marine status descriptors is part of the maritime spatial planning process and the process of assessing the impact of plans. The planning process aims to

**Table 3.** Maritime spatial planning and spatial planning in general can contribute to achieving marine status targets. The data was collected at a workshop organised for maritime spatial planners in the spring of 2020 as part of the project focusing on the application of the ecosystem approach to drafting maritime spatial plans. Source: Finnish Environment Institute (SYKE) 2020.

Descriptor	Examples of planning solutions and other measures
<b>Biodiversity</b>	<p>Key areas for marine biodiversity and their links to land–sea interactions should be presented as part of the package of background data for maritime spatial planning and the maritime spatial plan. Planning solutions should support the objectives of protecting species and habitats in Finland (status assessments include the most significant pressures threatening the status). Key areas maintaining marine biodiversity should be included as part of planning solutions. Where necessary, planning principles should refer to the need to ensure compatibility with nature values.</p> <p>Temporal use of space should be developed as part of planning principles for special nature values, such as spawning and brooding seasons or nesting and moulting seasons.</p> <p>Activities involving significant adverse environmental effects should not be located in the vicinity of protected areas or other key areas of biodiversity importance.</p>
<b>Non-indigenous species</b>	<p>Planning solutions should take ensuring hunting opportunities in coastal and marine areas into account as part of recreational activities, which in turn contributes to removal of non-indigenous species such as small predators. Removal of small predators has a significant effect on safeguarding successful nesting of seabirds.</p>
<b>Commercial fish stocks</b>	<p>Commercial fish stocks (Baltic herring, sprat, salmon, cod and plaice) should mainly be regulated through fishing quotas complemented by specifying permitted catch sizes and temporal and local closed seasons. Planning solutions should take account of the use and management plans for fisheries regions, which help ensure sustainable fishing.</p>
<b>Marine food webs</b>	<p>Key functions for marine food webs and their locations in Finnish marine areas should be identified. Such key functions include breeding, brooding, feeding and resting areas for birds, seals and fish. Planning solutions can identify key fish spawning and brooding grounds while also taking the potential of other marine activities into account when designating areas identified as being important for birds and seals. Planning solutions can steer the development of tourism and recreation such that the pressure will be directed to sites that involve as little harm as possible to bird feeding areas or seal resting areas during moulting seasons, for example.</p>
<b>Eutrophication</b>	<p>Most nutrient loads come from agricultural and forestry catchments or from wastewaters from coastal residential and industrial areas. At sea, nutrient loads come from activities such as fish farming, boating and shipping. Planning should weigh the role of land–sea interactions in total eutrophication, highlighting their importance. Planning solutions can identify sites for fish farming with the greatest potential with regard to minimising eutrophication effects. Nitrogen emission control areas (NECAs) should be identified for maritime transport.</p>
<b>Seafloor integrity</b>	<p>Any seafloor use altering its structure, such as offshore wind, dredging and dumping of dredged material, should be located and concentrated in areas with no specific seafloor nature values. See Biodiversity above.</p>
<b>Hydrographical characteristics</b>	<p>Planning solutions should not significantly alter the hydrographical characteristics of marine areas. These could include bridges, harbours, merchant shipping lanes or causeways, which decrease or increase current velocities, raise temperatures or reduce salinity.</p>
<b>Contaminants</b>	<p>The seabed areas with significant concentrations of contaminants should be identified in planning. The processes to regulate the release of contaminants should also be identified, such as sulphur emission control areas (SECAs) for maritime transport. Planning solutions should not increase the discharge of contaminants into marine ecosystems or contribute to release of substances stored in the seabed.</p>
<b>Marine litter</b>	<p>When locating any activities that may increase littering (e.g. tourism and recreation), the requirement of sustainability in development of activities should be included in the reference card.</p>
<b>Energy and noise</b>	<p>Any noise-emitting activities, such as maritime transport, should be identified in planning. It is possible to use zones in planning solutions to i) restrict the amount of human-induced noise (quiet areas); and ii) concentrate human activities (noisy areas). These areas should be located taking account of underwater sound conductivity within each specific area.</p>

find solutions that will not compromise achievement and maintenance of good marine environmental status, while the plan assessment process involves assessing how the plans meet the requirement of achieving the environmental objectives set out in the Directives. A similar assessment should also be carried out as part of other maritime spatial planning processes at regional and local levels.

### 3.4 The ecosystem approach and impact assessments of maritime spatial plans

The Act on the Environmental Impact Assessment of Plans and Programmes by the Authorities (the 'SEA Act' 200/2005) imposes a general obligation to assess the environmental impacts of plans and programmes (section 3) and defines the plans and programmes requiring specific environmental assessment (section 4), which are governed by further provisions issued by the Government Decree on the Environmental Impact Assessment of Plans and Programmes by the Authorities (the 'SEA Decree' 347/2005). The general assessment obligation under SEA Act section 3 also applies to maritime spatial plans.

Impact assessment forms an integral part of the ecosystem approach. Impact assessment aims to reduce the adverse environmental effects of human activity at sea and produce planning solutions that contribute to achievement and maintenance of good marine environmental status. Assessments may also examine the long-term effects of implementing strategic planning objectives on the sustainable use of marine areas (do Rosário Partidário 2012). Furthermore, they can examine the ways in which the ecosystem approach is applied in maritime spatial planning and the extent to which plans achieve the environmental objectives set for them (Altwater & Passarello 2018, European MSP Platform 2018).

*The environmental impacts of maritime spatial plans can be assessed at all planning stages by taking account of: (1) whether plans were drafted making use of an adequate knowledge base and (2) understanding of the interactions between ecosystems and human activities; (3) whether the sustainability of plans was verified where the knowledge base was inadequate; (4) whether potential changes in sectors and human activities were taken into account in alternative planning options; (5) whether the effects of different planning solutions on ecosystem services were assessed; and (6) whether the environmental impacts of plans can be mitigated by means such as using the zoning approach, taking account of the cumulative effects of pressures and (7) making full use of stakeholders' knowledge. Assessment must take account of (8) environmental effects at different levels of planning, while ensuring that (9) the environmental impacts of plans can be monitored and adjusted on the basis of the assessment.*

In practical terms, such assessments are carried out by coastal Regional Councils responsible for drafting regional maritime spatial plans. The impact assessment of the national Mari-

time Spatial Plan has now been carried out and documented in a separate report, which also assesses the plan's social, economic and cultural impacts in addition to its environmental impacts. The assessment also takes account of the maritime spatial planning process and the background data and analyses produced during the process on the marine environment and human activities at sea.

The Pan Baltic Scope project's report compares the implementation of the principles of the ecosystem approach as part of assessing the environmental impacts of the maritime spatial plans in Germany, Poland, Sweden and Denmark (Arndt & Schmidtbauer Crona 2019). As there were differences between countries in implementation of both maritime spatial plans and strategic environmental assessments (SEAs), the results partly describe these differences rather than the suitability of applying the ecosystem approach for assessment as such. Appendix 5 provides a summary of the differences observed in the report. In summary, it can be noted that:

- All countries used extensive background data on the sea and its uses in support of the planning process;
- Germany, Poland and Sweden applied the precautionary principle in their planning processes;
- Germany and Denmark drafted alternative planning options and assessed their effects; Poland and Sweden aimed to produce the least environmentally damaging planning solutions in the course of the planning process;
- Poland, Sweden and Denmark examined ecosystem services in the context of the SEA process;
- Germany, Poland and Sweden took account of cross-sectoral interactions in their planning processes;
- the planning processes assessed measures to mitigate environmental impacts superficially, if at all;
- all countries engaged stakeholders in different ways during the planning process;
- the planning processes assessed national coherence of the maritime spatial plans to some extent, whereas international coherence was assessed superficially, if at all;
- adjustment of maritime spatial plans was assessed superficially, if at all.

#### Environmental objectives in ecosystem-based maritime spatial planning

In Finland, maritime spatial planning is based on the marine environment's carrying capacity and planning solutions aim to promote the sustainable use of the marine environment and the achievement of good marine environmental status. The special characteristics and water status of Finnish marine areas must be taken into account in development of planning principles and solutions. At the same time, the environmental objectives specified in international agreements and EU and national legislation are supported by available means of planning. The environmental objectives of maritime spatial planning are also cascaded into regional and local spatial planning.

## 4 Implementation of ecosystem-based maritime spatial planning

In Finland, maritime spatial planning applies the ecosystem approach, which focuses on taking account of the objectives of marine environmental status and ensuring that planning solutions promote sustainable use of the marine environment. In the Baltic Sea region, the projects carried out in cooperation between the HELCOM-VASAB Maritime Spatial Planning Working Group and the Baltic Sea countries have produced a range of recommendations and principles drawn up for the Baltic Sea's conditions (Schmidtbauer Crona 2017, Arndt & Schmidtbauer Crona 2019, Langlet & Westholm 2019). There may be differences between countries in application of the ecosystem approach, because each state's planning process always needs to take account of the special characteristics of its sea area and marine environment as well as socio-cultural and economic circumstances.

Application of the ecosystem approach to maritime spatial planning may mean that the marine ecosystem's carrying capacity restricts the location or intensity of human activities in Finnish marine areas. Preserving nature's carrying capacity ensures that the ecosystem services that nature provides for humans, such as fish catches and recreational opportunities, will also endure into the future.

*Successful planning entails that coordination of sectors and activities will promote good marine environmental status and development of marine livelihoods in Finnish marine areas.*

Applying the ecosystem approach to maritime spatial planning requires compliance with its nine key principles as follows: after setting environmental objectives, (i) the best possible knowledge on the planning area will be used to (ii) reach comprehensive understanding of the environmental impact of human activity and interactions between sectors. The process (iii) assesses the environmental effects of alternative planning solutions and (iv) aims to mitigate these (v) in keeping with the precautionary principle, while also (vi) including ecosystem services in planning. Active (vii) engagement of stakeholders will increase the knowledge base and contribute to the legitimacy of the plans. Finally, (viii) it is necessary to ensure that the plans are compatible at national and international levels. The efficiency and effects of the plans are assessed at regular intervals and, where necessary, (ix) adjusted to changing circumstances. These planning principles are discussed in more detail below.

### 4.1 Compiling the best available knowledge on the sea and its use

Ecosystem-based maritime spatial planning requires constant collection of data on both marine ecosystem structure and functioning and human activity and its effects on the marine environment. This knowledge base should include information produced as part of national mapping programmes and research projects, complete with knowledge held by stakeholders on issues relating to the sea and its uses.

*An extensive knowledge base will allow production of planning solutions that are sustainable in terms of the marine environment and marine sectors. The data will provide a basis for assessing the current marine environmental status and its change, location of human pressures, implementation of plans and achievement of the underlying environmental objectives.*

#### International examples

In Sweden, environmental conditions and pressures are fairly similar to those found in Finland. Significant volatility in environmental factors, such as salinity variations and eutrophication, requires that the characteristics of the marine environment and ecosystem are taken into account in planning. Sweden has made use of statistical modelling based on spatial data sets to describe marine biodiversity. The country has implemented the Marine Strategy Framework Directive in parallel with maritime spatial planning. Important coordination themes have included data management and assessment of human pressures. Key steps in developing knowledge and practices have included identification of marine green infrastructure and areas of ecological importance as well as development of the network of protected areas (Nyström Sandman et al. 2020).

Estonia has also surveyed underwater biodiversity and, based on comprehensive inventory data, produced statistical models on the distribution of species and habitats, building on spatial data sets. Separate field studies have also been carried out for planning purposes on fishing and fish breeding grounds as well as on birdlife and migration patterns. In addition, the country has stepped up cooperation between parties responsible for marine activities and marine environmental protection.

## Knowledge base for maritime spatial planning in Finland

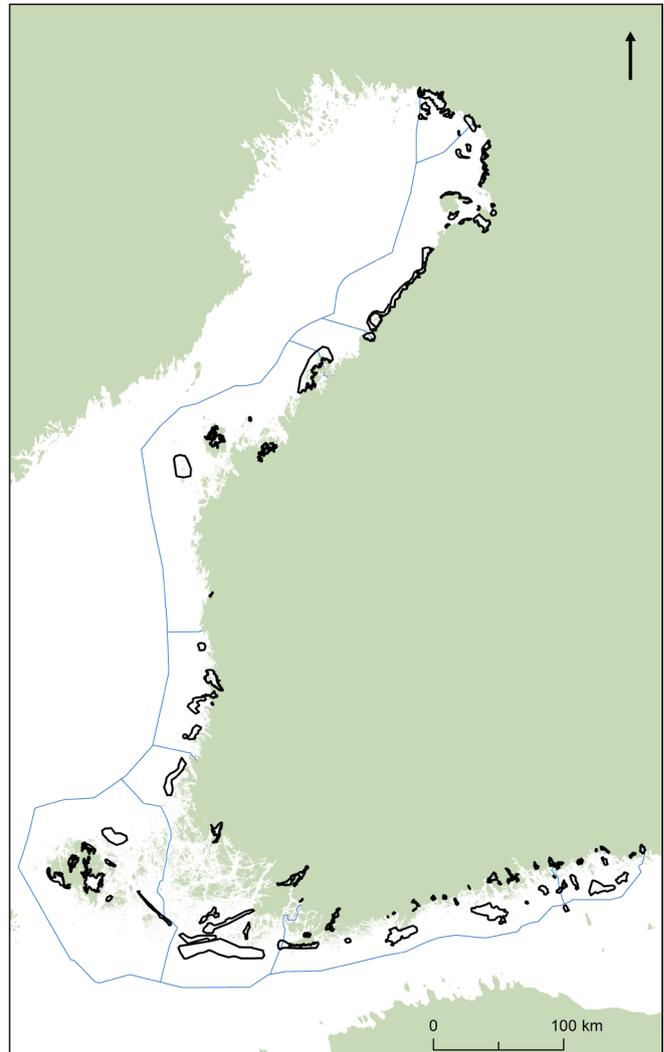
### Marine ecosystem structure and functioning

Plenty of data sets on the marine ecosystem structure and functioning are available in Finland. Marine biodiversity has been surveyed since 2004 as part of the Finnish Inventory Programme for the Underwater Marine Environment (VELMU). Similar to Sweden and Estonia, Finland has also produced statistical models on the distribution of underwater species and habitats across the Finnish sea area, building on survey data. At present, underwater survey data is, to some extent, even more comprehensive than land-based species and habitats data. This is particularly true for the archipelago: data on the coastal environment is incomplete, while bird counts, for example, are not carried out systematically.

The ample knowledge base makes it possible to understand the marine ecosystem's structure and functioning. The challenge for maritime spatial planning is to combine the extensive data sets on species and habitats and describe the most valuable sites on a single map. While common spatial data methods can be used to combine data, more advanced spatial prioritisation methods, such as Marxan and Zonation, can supplement the data on the occurrence of species by also taking account of aspects such as the relative rarity (endangerment) of species or habitats and their functional or commercial value. It is also possible to include in analyses some data on the effects of human activity, costs arising from the use of areas, the value of ecosystem services and the environmental effects of alternative planning solutions.

In Finland, areas important for the marine ecosystem were first described in an analysis where all types of VELMU inventory data were combined with data on human and environmental pressures using Zonation software (Virtanen et al. 2018). This data set provided a basis for describing the Finnish ecologically significant marine underwater areas, also known as 'EMMA areas' (Lappalainen et al. 2020; Figure 3). Similar analyses of valuable and sensitive marine ecosystem areas have been carried out in Norway, for example (Olsen & von Quillfeldt 2003, Olsen & Auran 2008, Institute of Marine Research and Norwegian Environment Agency 2012).

In addition to the Zonation analysis, EMMA descriptions also made use of literature and expert assessments on marine life. Valuable areas were selected on the basis of the criteria relating to the descriptions of ecologically or biologically significant marine areas (EBSAs) under the Convention on Biological Diversity (CBD) ([www.cbd.int/EBSA](http://www.cbd.int/EBSA)). The EMMA project provides a good foundation for taking



**Figure 3.** A total of 87 ecologically significant marine underwater areas (EMMA areas) were identified in Finland's sea area on the basis of spatial data analysis, expert assessments and literature. Source: Lappalainen et al. 2020.

nature values into account in maritime spatial planning. It should be noted, however, that only areas with plenty of direct observations available were eligible as EMMA areas. Nevertheless, this does not mean that no high nature values exist outside the EMMA areas, which should be borne in mind in planning. Furthermore, it should be noted that EMMA analyses only made use of data sets on underwater ecosystems. As data on coastal ecosystems and birdlife is currently fragmented, it could not be used to delineate the areas. Adding this data to the analyses based on underwater data would provide an opportunity to analyse the marine environment as a whole.

Analysis of land–sea interactions makes it possible to gain a better understanding of the processes that maintain nature's carrying capacity. The maritime spatial planning process has taken account of ecological connections, such as

important rivers for migratory fish, migratory routes for birds and bats, as well as international green connections. Analyses were also conducted for the Kymenlaakso regional land use plan by 2040, for example, which designates needs for blue–green connections between core natural areas (sea–rivers–lakes–land areas). A thorough consideration of land–sea interactions provides additional information for both maritime and local spatial planning.

Application of the ecosystem approach requires plans to be adjusted as circumstances change. Updating the maps of values describing marine biodiversity on the basis of climate forecasts, for example, would make it possible to develop proactive planning solutions. The effects of climate change on the location of valuable marine sites and maritime spatial planning decisions are currently being studied in both Finland and Sweden in several research projects (SmartSea, Econnect, ClimeMarine and FutureMARES). The results of these research projects will be available in the next planning round.

### *Human activities at sea*

Data on human activities at sea is collected in research projects, as part of official duties and within the HELCOM framework. The Finnish Environment Institute (SYKE) and Metsähallitus Parks & Wildlife Finland have compiled extensive data on human activities from Finnish marine areas in national and international databases. Data sets are also created as part of environmental impact assessments (EIAs).

The amount and level of detail of data on human activities vary by region and sector and it is not always available in a spatial data format. Point-based spatial data sets on emissions and loads can be downloaded from the environmental administration's VAHTI data system. Since 2016, data has been collected in the YLVA environmental permit and control data system used by operators with environmental permit and registration obligations to upload their data. Spatial data sets on measures and structures in water bodies are also available in the VESTY waterworks data system included in the environmental administration's HERTTA system. Furthermore, the HELCOM Map and Data Service (<https://maps.helcom.fi>) collects spatial data sets on human activities.

Maritime spatial planning also requires data on cross-sectoral interactions. It can be used to assess what types of activities will result in significant effects on other sectors. The most extensive analysis to date on interactions between sectors, pressures and status is being carried out in the HELCOM ACTION project (<https://helcom.fi/helcom-at-work/projects/action/>), which assesses trends in each sector, the resulting pressures, the effects of pressures on marine status and the effectiveness of measures on pres-

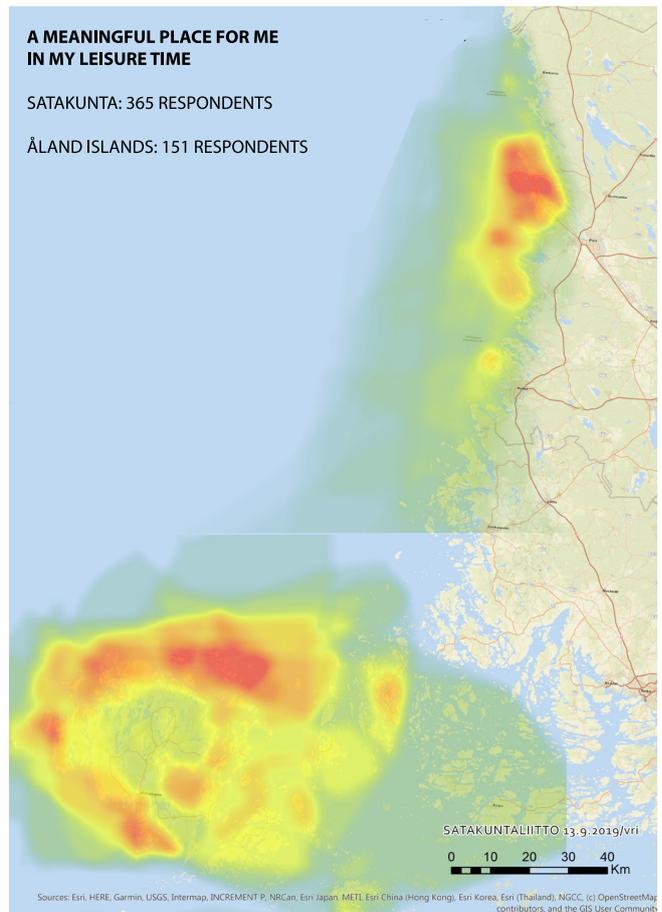
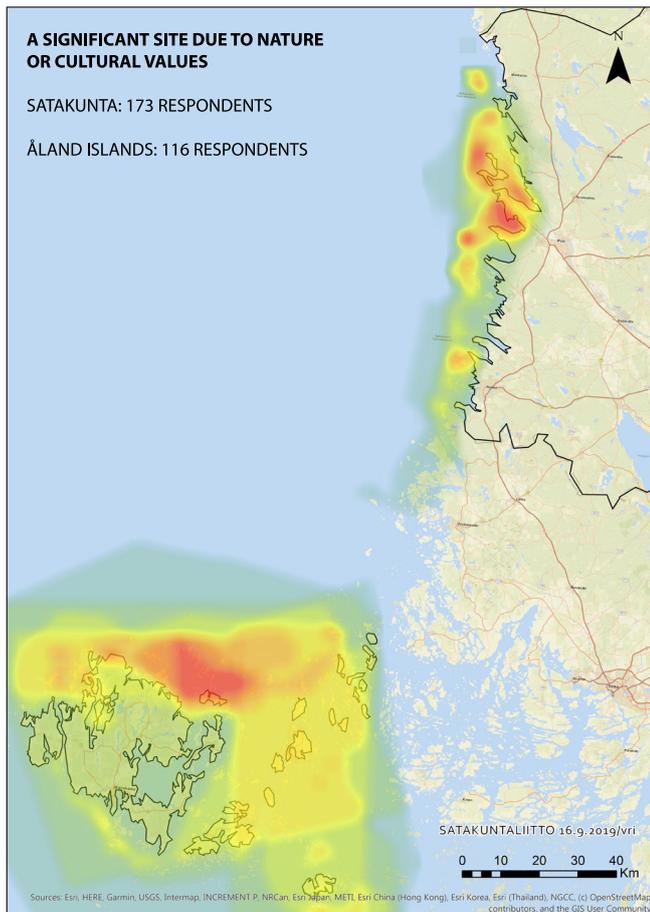
sure reduction. In Finnish marine management, sectors and pressures were analysed as part of the 2018 status report (Korpinen et al. 2018).

Maritime spatial planning aims to identify areas with multiple cumulative pressures and/or pressures cascading through the ecosystem. It is necessary to decide whether to restore these areas or allow them to remain in heavy use. Restoration is recommended in areas with significant nature values, whereas concentration of activities may help secure more valuable sites. The HELCOM HOLAS II project (2017–2018) produced an index of cumulative human pressures for the Baltic Sea, known as the Baltic Sea Impact Index (BSII). The tool has already been tested as part of cross-border maritime spatial planning to assess the cumulative effects of increasing offshore wind generation (Bergström et al. 2019). The BSII resolution is 1 km<sup>2</sup>, but pressure assessments have also been carried out in Finland using a more detailed scale as part of the VELMU and SEAmBOTH projects, for example (Virtanen et al. 2018; Bergdahl et al. 2020; Virtanen et al. manuscript).

Sweden has developed the Symphony tool for maritime spatial planning, which can be used to assess the effects of human activity on the marine environment. The tool has been used to understand the current and future pressures in the SEA process, for example. Spatial data on human activities at sea and their effects on marine ecosystems has been collected to provide background for assessment. The analyses have also taken account of uncertainties and emphasised the precautionary principle where the cascading effects of human activities were severe.

Modelling and applications developed for pressure assessments can be used to analyse the effects of various future scenarios (Hammar et al. 2020). By assessing future sea use, it is possible to assess the development of human activity in relation to the current situation and sectoral policy processes. However, planning should also take account of the impact of land-based activities on the sea. Analyses across the land–sea interface relating to aspects such as nutrient emissions, maritime transport, the blue bio-economy or recreational use may allow both promotion of marine economic activity and achievement of environmental objectives.

Human activity data sets should be standardised and quality-controlled and the data should be readily accessible. Launched in April 2020, the MarineFinland.fi (Itämeri.fi, Östersjön.fi) web portal will serve as a system providing access interfaces to both human activity and environmental data sets. The river basin and marine management data system for experts will also include environmental data compiled on different pressures.



**Figure 4.** The Pan Baltic Scope project used the Maptionnaire tool to collect information about places that were meaningful for survey respondents. The figure shows sites identified as significant in terms of nature and cultural values in the Åland Islands and Satakunta regions. Source: Pan Baltic Project/Regional Council of Satakunta.

### *Knowledge collected from stakeholders on the marine environment and sea use*

Maritime spatial planning should draw on stakeholders' knowledge of the marine environment and sea use. In order to compile local, experience-based data, methods have been developed in recent years to collect place- and time-dependent information (public participation geographic information system, PPGIS). The PPGIS method can be used to explore stakeholders' activities, views and values, which helps form a full picture of human–marine interactions (Figure 4). The data can be used to identify connections between activities and areas and to verify and supplement expert information.

Compiling experience-based data promotes stakeholder participation in planning and increases commitment to planning outcomes (Boström et al. 2016). The survey conducted on meaningful places in Satakunta (Figure 4) also gauged respondents' social trust in maritime spatial plan-

ners and other environmental authorities at different levels, as well as their motivation to participate in the maritime spatial planning process. Increasing trust and motivation among stakeholders will support the legitimacy of plans.

### **Compiling the best available knowledge on the sea and its use**

The background data used for maritime spatial planning must be up to date and cover relevant data on marine ecosystem structure and functioning as well as on human activity and its impact at sea. Data must be collected on marine ecosystem characteristics and biodiversity as well as locations of human activities at sea. The aim is to understand the effects of individual and cumulative human pressures and take these into account in maritime spatial planning.

Data should be collected from both national data resources and stakeholders and data sets should be compiled into a comprehensive collection that is easily accessible by planners.

## 4.2 Applying the precautionary principle to maritime spatial planning

Application of the precautionary principle aims to take the unpredictability created by the uncertainty of data into account in the environmental impacts of maritime spatial plans and interactions between different economic sectors. The precautionary principle means that activities should not be located in an area where doing so could run the risk of endangering its species or ecosystem function.

*Drawing on the precautionary principle will reduce the risk of causing significant adverse effects to the marine environment where the impact of activities is not adequately known and it is possible that the impact might lead to significant marine environmental degradation.*

Few practical examples are available of the effects of using the precautionary principle on maritime spatial planning decision-making processes (Domíniguez-Tejo et al. 2016). There have also been variations in the ways in which different countries have used and defined the precautionary principle in their maritime spatial planning processes (WWF 2017). Discretion and risk assessments should be required for human activities that may, based on current scientific knowledge, lead to significant damage to the marine ecosystem and whose impacts may not be assessed in full or in part (Schmidtbauer Crona 2017). At the same time, the UNEP introductory guide for marine and coastal ecosystem-based management points out that, under the precautionary approach, the proponent of a new activity must show the activity is safe before the permit decision is made, shifting the burden of proof from the public sector to the private sector (UNEP 2011). Consequently, the choice of approach will also have a bearing on how the precautionary principle is applied to planning.

### International examples

Uncertainty about marine ecosystem responses is one of the key issues in maritime spatial planning (Murawski 2007). The ecosystem approach to planning requires a reflective planning process – that the effects of solutions on both the marine ecosystem and human beings are assessed on a continuous basis (Boström et al. 2016). However, responses

cannot always be anticipated reliably, such as when human activity creates cumulative effects (Udovyk & Gilek 2013). The policy processes and social factors that have a bearing on decision-making should also be identified and analysed as part of planning (Boström et al. 2016, Linke et al. 2014). Uncertainties can be managed by means such as engaging stakeholders (Udovyk & Gilek 2013). Uncertainties may allow stakeholders to interpret background data sets and conclusions based on their own interests, which may lead to conflicts between them (Linke et al. 2014). Being transparent and describing uncertainties openly will help reach shared interpretations.

Estonia used the PlanWise4Blue tool to assess the impact of its draft maritime spatial plan, which takes account of cumulative human pressures, nature values, ecosystem services, etc. Since maritime spatial planning is carried out in Estonia at the national level, some decisions were left for subsequent stages involved in marine area use, such as permit procedures. This means that maritime spatial planning sets the criteria in Estonia and determines the types of research required in the future to make decisions on use after adoption of the maritime spatial plans. Detailed analyses of the environmental impacts of the projects to be implemented are carried out in the context of assessing environmental impacts.

### The precautionary principle in Finnish maritime spatial planning

Finland is exceptionally well positioned for ecosystem-based maritime spatial planning. The very extensive observation data on the underwater marine environment collected within the VELMU Inventory Programme makes it possible to identify and map valuable marine sites across the Finnish sea area (Virtanen et al. 2018). Indeed, VELMU data provided a basis for creating the 'EMMA areas', i.e. ecologically significant marine underwater areas, in support of the maritime spatial plans (Lappalainen et al. 2020). The EMMA areas reflect the occurrence of biodiversity in Finnish marine areas, based on observations and statistical models on species and habitats, as well as on interviews and involvement of local experts. Only areas with a sufficient number of direct observations were selected as EMMA areas, eliminating a considerable share of uncertainties. In decision-making situations, this means that it is easy to identify the endangered or valuable species and habitats found in a certain area and what the use of such areas would mean in each specific situation.

The precautionary principle should especially be applied to areas where (i) the long-term combined effects of human pressures cannot be assessed reliably, and (ii) data is still inadequate but the likelihood of valuable marine ecosystems is high. By way of example, many areas that are

likely to be valuable were excluded from the EMMA areas because no direct observations were available at the time. In cases where uses are being planned for areas with no direct observations, it is advisable to make use of models. The key is to combine data from all available sources and carry out a risk analysis of the effects of area use. This will prevent degradation of the status of valuable sites due to lack of information and provide extra time to focus additional studies on the area.

Any data used as background material for planning should always indicate which baseline data sets were used to produce the data, how this was done and whether there are any known gaps in the baseline data. This will help identify areas and cases where the available information is not sufficient to make a decision in keeping with the principle of sustainable use, which would therefore require application of the precautionary principle.

### Applying the precautionary principle to maritime spatial planning

Applying the precautionary principle ensures sustainable sea use while avoiding damage to habitats and loss of endangered species and habitats due to lack of information. The precautionary principle must be applied whenever the effects of human activity cannot be assessed reliably, or there is a risk that the activity may lead to significant environmental impacts, especially in areas with strong cumulative or cascading pressures on the ecosystem.

## 4.3 Exploring alternative planning solutions

The challenge for maritime spatial planning is to balance the needs relating to the marine environment and socio-cultural and economic development (Gilek et al. 2018). In accordance with the ecosystem approach, the impact of human activity on ecosystems should not exceed the limits of their carrying capacity (Grumbine 1994, OSPAR/HELCOM 2003, MSFD 2008). However, planning must accept that any choices made are always societal and strongly linked to policy processes (Malawi Principle 1).

The key is that planning solutions and their rationale are transparent. Planning should also address and involve sectors or stakeholders at risk of facing significant disadvantages as a result of implementing a planning solution (Langlet & Westholm 2019), aiming to seek solutions to reduce these. Participatory planning may produce several different planning solutions, which have taken the interests of dif-

ferent stakeholders and sectors into account with different weightings. Should further efforts fail to reconcile different solutions, policy-makers will ultimately decide which of the solutions will be implemented.

Production of alternative planning options will allow societal choices to be made on the principles of using marine areas and protecting the marine environment. Combining comprehensive ecological background data with information collected from stakeholders will make it possible to produce socially legitimate planning solutions sensitive to the marine environment.

### International examples

The Swedish Agency for Marine and Water Management submitted a three-part proposal for a maritime spatial plan to the Swedish Government in 2019. Prior to the officially submitted proposal, the Agency had prepared several alternative planning solutions. The aim was to propose alternative planning solutions for each plan and marine area as required.

In Estonia, the Pärnu and Hiiu pilot plans explored various sea use scenarios to identify the most balanced solution for the marine environment. A similar approach was also used in other Estonian marine areas. In addition to different scenarios, the plan also suggested some future research needs which should be met before some of the planning solutions could be implemented.

### Implementation of maritime spatial planning options in Finland

Finland did not develop alternative planning solutions during the first planning round. Options were instead produced and examined by means of future scenarios in collaboration with stakeholders as part of the planning process itself. The scenarios explored potential changes in the marine operating environment as well as the needs and views of interested parties concerning the development of the Finnish sea area by 2050, covering the periods from 2019 to 2025, from 2025 to 2035, and from 2035 to 2050. The completed future scenarios were entitled as follows: (1) 'Dancing with big businesses', (2) 'Profitability under the environment's terms', and (3) 'Baltic Sea of restrictions and tensions'. The alternative future scenarios were especially analysed from societal and policy perspectives, in the context of the environment and marine status and in terms of the following marine sectors: energy, maritime transport, fisheries and aquaculture, cultural heritage, tourism and recreation,

defence, maritime industry, biotechnology and extractive sectors.

The work carried out with stakeholders was put to use to develop planning solutions. At the workshops organised during the planning process, planners and stakeholders worked together to develop mind maps to ensure that stakeholders' values and views were taken into account. The regional workshops produced the mind maps by planning area and discussed issues of regional importance.

The scenarios were used to assess potential developments in different sectors and their spread into the marine areas under the alternative future scenarios. Each scenario was also provided with an impact assessment, taking account of the effects of sectoral developments and planning solutions on environmental status, blue growth and people's wellbeing and social inclusion. The scenario exercise made it possible to prepare a contingency plan for maritime spatial planning, i.e. the perspectives and measures that should be taken into account under different future scenarios.

The first planning round and the assessment of the plans' implementation, effects and effectiveness create a basis for updating the plans. In the next round, it will be possible to put forward new alternative solutions based on new knowledge on the marine environment and sectoral developments, as well as any potential change in society and sea use needs.

### Exploring alternative planning solutions

The interests and views of stakeholders and sectors on how sustainable sea use could and should be developed will be clarified by presenting alternative planning solutions and scenarios. Alternative future scenarios will be developed to provide a basis for planning, while assessing the effects of the different planning solutions on the marine environment and human activities.

## 4.4 Identification of ecosystem services

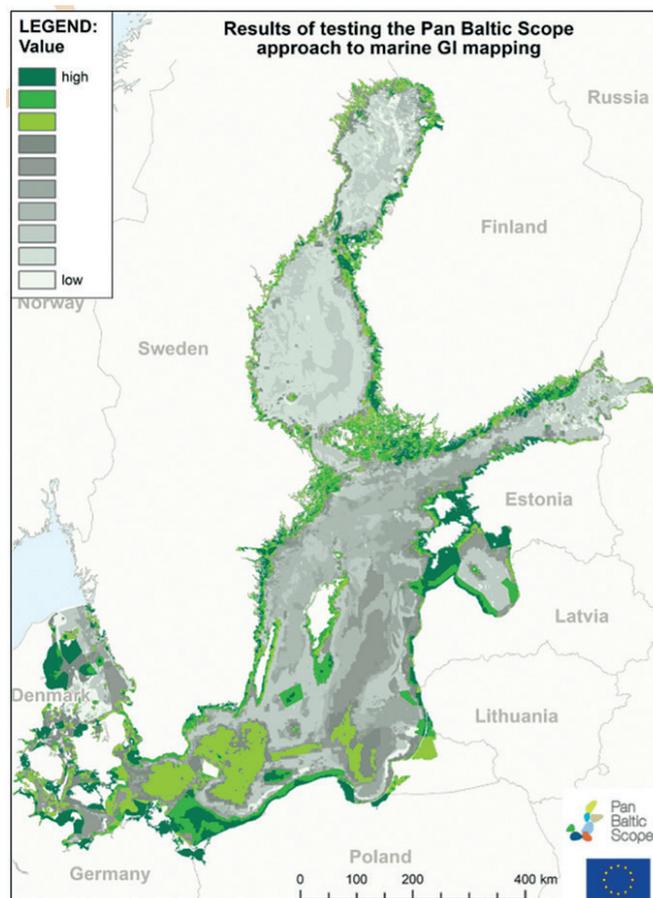
Ecosystem services are the benefits and services of nature for humans that may include water quality, fishing, energy production, recreation and cultural values. The identification and management of ecosystem services is considered a key part of maritime spatial planning that uses the ecosystem approach (Arkema et al. 2006). This approach is human-centred, so if only ecosystem services are emphasised in maritime spatial planning, important natural values will unavoidably be ignored. In addition, the value of ecosystem services to different stakeholders may differ, which must be

taken into account in determining their value. Ecosystem services should therefore be seen as a means of linking nature to human activities, as part of maritime spatial planning that uses ecosystem sources (Waylen et al. 2014).

*Describing and valuing the benefits of the marine environment to people enables links to be established between the environment and economic activities. Understanding the benefits and commodities provided by marine waters with a good environmental status increases stakeholders' interest in achieving goals related to the status of the marine environment.*

## International examples

In order to determine the ecosystem services provided by the Baltic Sea, materials were collected in the Pan Baltic Scope project on the distribution of pelagic habitats, seabed habitats and species, underwater landscapes, key species, areas of importance for mammals, fish and birds, and Natura 2000 habitats in the Baltic Sea (Ruskule et al. 2019). Both the ecological value of and the ecosystem services provided by the marine environment were evaluated. The maps



**Figure 5.** The assessment of the location of green infrastructure in the Baltic Sea was based on extensive data provided by coastal states. The work has combined estimates of the location of ecological values and ecosystem services. Source Ruskule et al. 2019.

**Table 4.** Determining the number, location and value of ecosystem services provided by the marine ecosystem in Finland is progressing in cooperation between several research projects.

Phase	Measures	Situation in Finland
Defining ecosystem services	Identification of ecosystem services provided by different ecosystem components (habitats, species)	An estimate will be completed in 2020
Location of ecosystem services	Description of the distribution of components providing ecosystem services in the marine area	The pilot will be ready for the Western Gulf of Finland in 2020. The work describes the distribution of ecosystem services produced by marine habitats.
Production capacity of ecosystem services	Describes the service provision capacity in the current status of the sea and as the sea reaches a good status	The example will be completed in 2020
Demand for ecosystem services	Estimation of the demand in the marine area now and in the future	Ecosystem service-specific examples from the pilot area in 2020
Valuation of ecosystem services	Providing a value estimate of ecosystem services provided by the marine ecosystem	Ecosystem service-specific examples from the pilot area in 2020

resulting from the work on the location of ecological values and ecosystem service capacity in the Baltic Sea were combined into a map describing the green infrastructure of the Baltic Sea (Figure 5).

In Sweden, ecosystem services were identified as part of the impact assessment of maritime spatial plans, based on environmental and multiple-criteria analyses. A qualitative approach was adopted.

In Estonia, sensitivity analyses and cumulative pressure assessments carried out in connection with the draft plan used existing information on ecosystem services. The data used included catches of different fish species and shellfish biomasses and the water filtering services provided by them (Planwise4Blue website). Methodological development will continue in the MAREA project carried out by Estonia, Finland and Latvia, which aims to describe ecosystem services provided by the marine environment and develop tools for the valuation of these services.

### **Identifying marine ecosystem services and their valuation in Finland**

The first example of identifying ecosystem services, assessing their distribution and their valuation will be completed in 2020 in the Western Gulf of Finland, in collaboration with several different research projects. Practical steps towards identifying ecosystem services and determining their volume and value are presented in Table 4.

Ecosystem services provided by marine habitats (including pelagic and sea ice habitats) in the Finnish sea area have been reviewed on the basis of the Common International Classification of Ecosystem Services (CICES), literature and

expert assessments (Jernberg et al. manuscript). Important commercial fish species as well as the grey seal and the Baltic ringed seal have also been included in the analysis. Habitats types were used to link ecosystem services directly to species data. This enables generalisation of the information, unlike in surveys carried out at the Baltic Sea level on the basis of broader units such as the seabed habitats or the natural habitats of the Habitats Directive.

The location of ecosystem services in the Finnish marine area can be assessed on the basis of modelling based on spatial data. The models based on field observations and environmental data describe the regional distribution of the species or habitats providing ecosystem services. The accuracy of the models and their baseline data influence their use at different scales.

The capacity to provide ecosystem services can be assessed both in the present state and on the basis of future scenarios. The assessment requires information on the distribution of the ecosystem service-providing component, such as the habitat, in the planning area. The capacity of the component to provide ecosystem services can then be assessed, taking into account, for example, the effects of the marine status on species and habitats.

The production of regulatory and production services can be assessed on the basis of statistical analyses. The assessment of recreational and cultural services' capacity requires interviews and surveys to gather information on recreational and cultural services that are appreciated and used by stakeholders. There is a need to further develop methods to evaluate how these values are linked to the marine status and to the marine ecosystem.

### **Taking ecosystem services into account in maritime spatial planning in Finland**

During the first maritime spatial planning round in Finland, the ecosystem services provided by the marine environment were examined from the point of view of the different sectors in the Visio phase workshops organised by the coordination group for maritime spatial planning. In the workshops, the representatives of the sectors examined the consultant's material on ecosystem services provided by the marine environment, after which the significance of ecosystem services for different sectors was assessed as part of the work. As a result, the activities of the economic sectors could be linked to the ecosystem services offered by the marine environment. In practice, questions related to the demand for ecosystem services were identified by sector, which together with the description of the provision of ecosystem services enables the valuation of services at least with respect to the most important ecosystem services.

#### **Identification of ecosystem services**

Knowledge of marine ecosystem services is essential to avoid short-sighted overexploitation of marine resources. Information must be collected on the quantity, quality, location and value to humans of marine ecosystem services to support planning. In order to take ecosystem services into account in maritime spatial planning, mapping, scenario and valuation methods must be developed. This allows ecosystem services' economic and long-term benefits to humans to be taken into account and the value of ecosystem services to be transferred to national accounting alongside other marine commodities.

### **4.5 Comprehensive understanding of interactions**

For the ecosystem approach, it is essential that the impacts of human activities on the marine environment and cultural heritage, and the economic and social impacts of various sectors on each other are assessed in planning. In addition to these, the role of land-sea interactions should also be assessed. It is essential, however, that the functioning of the marine ecosystem is not endangered by the human activities. As part of the planning work, it should be possible to identify direct and indirect, cumulative, short- and long-term, permanent and temporary, and positive and negative impacts. The description of various interactions may provide information on how design solutions change the impacts of human activity at sea.

### **Direct, indirect and cumulative effects**

The direct effects of human activity are easier to detect than indirect effects: for example, the construction of a port on reclaimed land causes the devastation of benthic species and habitats in the area, while substances harmful to the marine environment may be released from the seabed or from the material used to fill the site, which will, in the long term, have an impact on benthic and pelagic biota. Assessing indirect impacts requires strong expertise on the functioning of the marine ecosystem and the impact of human activities.

In order to determine the cumulative effects of human activities, the combined effects of different sectors on the marine environment should be studied (Bergström et al. 2019). According to meta-analysis of research on the marine environment, many pressures reinforce each other's impacts and may also partially offset each other's impacts (Crain et al. 2008). HELCOM's Baltic Sea Pressure Index and Baltic Sea Impact Index can be used to assess the cumulative effects of pressures. HELCOM and Sweden use a methodology that evaluates the sensitivity of ecosystem components to different pressures through a sensitivity matrix and produces a map that illustrates the combined intensity of anthropogenic pressures on different areas.

A lot of information on the characteristics of the marine environment and human activities at sea is available in Finland (e.g. Virtanen et al. 2018, Virtanen et al. manuscript), which can also be used in assessing pressure impacts. For maritime spatial planning, it is important to create a national information pool on the location of human activities at sea. Using data from the marine environment and human activities at sea produced in Finland, the methods and tools mentioned in the report could also be used to build cumulative impact assessments in maritime spatial planning.

### **Short- and long-term impacts**

The short- and long-term impact of the implementation of the plans will be assessed in the maritime spatial planning process. The timeline for the updating of maritime spatial plans is sufficient for a short-term impact assessment, but in the long term, the impact of the implementation of maritime spatial plans on both the marine environment and human activities at sea and on the land-sea interface should be considered. The development of the marine environment can be monitored through river basin and marine management tools, linking the maritime spatial planning process with marine environment status targets.

The permanence of the impact of maritime spatial plans should also be assessed. For example, the construction of a port will permanently alter the structure of the marine

environment, while the impact of fish farming will mainly disappear as farming units are removed. Placing activities that cause permanent and significant harm to the marine environment requires careful consideration in the planning of land use and in the EIA processes. Also, the placement of activities that have a temporary impact also requires consideration and extensive background studies. In addition to the duration and intensity of temporary impacts, the capacity of the marine environment to recover from the harmful effects and the extent of the harm caused to other businesses must also be assessed.

### **Synergistic impacts**

Maritime spatial planning can also provide synergy benefits between different sectors and operators. In addition to questions related to location, a time perspective should also be taken into account: the correct timing of operations may allow additional synergy to be achieved between operators. On the other hand, different activities may be placed in the same area, provided that they are separated over time to reduce adverse effects. It is essential that impacts are described in a transparent way so that stakeholders and decision-makers can assess their significance as part of the process.

*Knowing the interactions within the ecosystem and between sectors is essential in order to identify synergies and conflicts. Identification of interactions can significantly reduce adverse impacts on the marine environment and contribute to the achievement of the objectives set for the status of the marine environment.*

### **International examples**

In Sweden, the Symphony tool was created to support the planning process in order to assess the direct and indirect impacts of cumulative pressures in the marine environment. The strategic environmental assessment (SEA) looked at the long-term effects of the plans, although significant short-term impacts such as impulsive underwater noise were also taken into account. The criteria and indicators for assessing significant impacts include both negative and positive impact scales. In Estonia, the interaction between the different sectors was examined as part of the impact assessment process.

### **Descriptions of interactions in Finland**

In Finnish maritime spatial planning, the impact of human activities on the marine environment and the interactions between the different sectors have been studied on the

basis of information on the location of marine activities in relation to each other and the marine environment. This information was collected in so-called reference cards where each entry in the maritime spatial plan was described from the perspective of land–sea interaction or its significance in each planning area (<https://meriskenaariot.info/merial-uesuunnitelma/vm0/>). The material has also been refined in stakeholder workshops organised by the MSP coordination group. Land–sea interactions became one of the key issues in the discussion of sectoral needs, values and forecasts in relation to the future outlook for each sector. The discussion increased understanding of synergies and potential conflicts between sectors .

The design solutions of the first round take into account the interaction between the different sectors based on the best available information and extensive and participatory planning. It can be assumed, however, that with the knowledge base becoming more precise in the future, interaction between sectors and their significance can be assessed even more accurately.

### **Comprehensive understanding of interactions**

The cornerstone of ecosystem-based maritime spatial planning is that the structure and functioning of the ecosystem are known and the impacts of land and marine human activity on the marine environment are understood. In addition to research data, it is essential to develop and use a range of indicator-based tools to assess the impact of human activities in Finnish marine areas.

## 4.6 Mitigating the impact of maritime spatial plans

The objective of maritime spatial planning is to align activities that take place at sea with each other and the environment in order to support the achievement of a good status of marine waters. If, however, solutions remain in maritime spatial plans that have an adverse effect on the environment, it is necessary to mitigate the impact. Identification of environmental impacts requiring mitigation measures may be challenging, however, especially in the case of cumulative effects arising from human activity or recurring effects in the ecosystem at different levels of the food network (Langlet & Westholm 2019; Cleasby et al. 2015).

*Identifying the impact and impact chains of human activities helps to mitigate the impact of maritime spatial plans so that the use of marine areas will not impede the achievement of a good status of marine waters.*

### International examples

In order to target mitigation, it is necessary to identify the situations in which the environmental impacts of human activities are significant enough that measures should be taken. The information in the scientific literature on the environmental impacts of human activities and the associated risk and impact models enable an assessment of the impacts of human activities, but so far there is little experience in using these models in practical planning (Rodriguez 2017). The uncertainties and various value choices arising from data and its analyses should be brought to light when discussing the impact of maritime spatial plans (Olsen et al. 2016).

Halpern et al. (2008) have developed a methodology to systematically assess activities that are harmful to the marine ecosystem. The method has been developed for application in the Baltic Sea (Korpinen et al. 2012; Bergström et al. 2019) and HELCOM has used the Baltic Sea Impact Index method in two holistic assessments (HELCOM 2010, 2018). The HELCOM SPICE project (<https://helcom.fi/helcom-at-work/projects/spice/>) assesses the link between the status of marine waters and the Baltic Sea Impact Index, and the results indicate that it is possible to estimate how strong synergies must be to lead to a degraded status.

The Symphony tool created in Sweden can be used to describe the environmental impacts of planning solutions. The tool has been used to identify significant adverse impacts of operations, and it has been possible to modify the planning solutions when necessary.

In Estonia, the need for mitigation measures was assessed both through sensitivity analyses and through the impact assessment process. Planning solutions were updated, for example, by avoiding the placement of planned offshore wind farms on important pathways used by migratory birds.

### Mitigating the impact of maritime spatial plans in Finland

In Finland, a goal in the first planning round was to mitigate the impact of maritime spatial plans by identifying the environmental impact of offshore activities (Airaksinen et al. 2020). Practical measures to mitigate the environmental impact of maritime spatial plans include:

- Avoiding activities with environmental impacts in areas identified as particularly sensitive or valuable for the functioning and structure of the marine ecosystem, such as areas identified as important in the national EMMA review.
- Identifying ecological entities that transcend the land–sea interface and that are significant for the environment at national and regional level, with the aim of preserving the structure and functioning of the ecosystem through planning and zoning solutions, for example.
- Leaving sufficient distance between human activities and Natura 2000 sites and other protected areas to avoid endangering the grounds for protecting these areas.
- Planning areas located at sea in which a low level of human noise is maintained.
- Restricting human activity at times when biota becomes particularly vulnerable, such as the nesting and moulting seasons of seabirds, the spawning time of fish or the moulting and breeding seasons of seals.
- Promoting energy and material efficiency related to the marine sector at regional and national level and the progress of technology and economic activities in Finland that reduce environmental impacts.

One of the most important ways to mitigate the environmental impact of maritime spatial planning is to divide the marine area into zones and to take account of the characteristics of the zones in planning solutions. The planning areas are divided into three zones: the inner archipelago and inner coastal waters, the outer archipelago and outer coastal waters, and the open sea (Figure 6). The zones are defined by surface water classification and also reflect the ratio of coastal land and sea surface areas. Zone use planning takes into consideration, among other things, the marine and water protection objectives that are typical of the areas, cultural values, development needs for tourism and recreational use, securing the operating conditions of maritime transport, and international infrastructure and transport connections. In addition, the aim is to preserve

open seascape and landscape values in the planning and development of all zones.

In ecosystem-based maritime spatial planning, the aim is to adapt the development and positioning of operations to the carrying capacity of the marine environment. In practice, the adaptation is carried out so that the description of the zones and the “reference cards” of maritime spatial plans contain principles on the basis of which functions can be reconciled in such a way as to minimise harm to the marine environment.

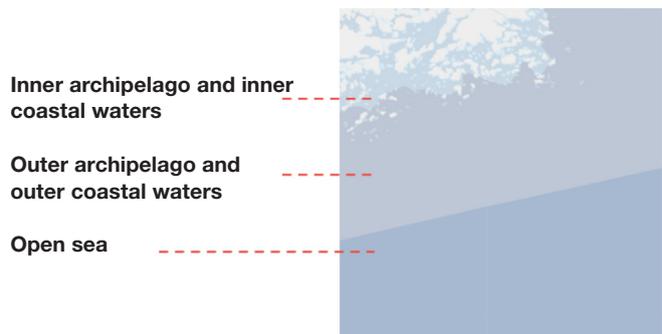
The descriptions of the zones describe the characteristics of the marine environment that must be taken into account in planning and designate functions that are appropriate for each zone. This enables planning areas to develop on the basis of their own strengths, ensuring the compatibility of operations while reducing their environmental impacts and achieving a good marine environmental status.

### Mitigating the impact of maritime spatial plans

Comprehensive maritime spatial planning can effectively mitigate the adverse effects of human activities on the status of the marine environment and support the achievement of good status of maritime waters. It is essential to identify areas that are important for the functioning of the marine ecosystem, to know the human environmental impacts on them, and to secure them either by including them in the network of protected areas or by otherwise taking them into account in the maritime spatial plans. In mitigating these impacts, attention must also be paid to those maritime activities that may have a wider impact on the marine ecosystem beyond their immediate vicinity, and to the impact of the land-sea interaction on the structure and functioning of the ecosystem.

## 4.7 Participatory planning and communication

Engaging stakeholders is a key part of maritime spatial planning that is ecosystem-based. UNESCO's (2009) definition of maritime spatial planning stakeholders includes individuals, groups or organisations that engage in maritime spatial planning to which they are exposed and in which they have an interest (positive or negative). These include parties (I) that rely on resources located in the planning area; (ii) that have or may have legal claims or obligations concerning areas or resources located in the planning



**Figure 6.** In Finland, the zoning of the maritime spatial plans is based in on the surface water classification of coastal waters covering the entire Finnish coast. In addition to planning principles applied to all zones, principles were developed in the planning process that allow the characteristics of the different parts of the planning areas to be taken into account.

area; (III) that have specific temporal (seasonal) or regional interests in the planning area; and (iv) that have specific interests in the planning area (e.g. cultural history, nature conservation).

In practice, stakeholders include those who feel it is necessary to participate in the process or who have an external obligation to participate in planning, decision-making or implementation. The significance of stakeholders in the planning process can be reviewed on the basis of four factors (Mitchell et al. 1997, Driscoll & Starik 2004):

- 1) power – genuine opportunity to influence planning (e.g. Defence Forces, decision-makers);
- 2) legitimacy – issued or assumed by society (the authorities and communities which the plan concerns, including the majority of maritime actors);
- (3) urgency – time-bound and knock-on effects (maritime actors); and
- 4) spatial proximity – sharing of everyday living space (local residents, some maritime actors).

Engagement requires that stakeholders are made aware of how and at what stages they can participate in planning. The development of an interaction plan supports appropriate and timely engagement. For instance, Susskind and Cruishank (1987) describe different methods and technical solutions for developing planning and decision-making processes in conditions characterised by the overlapping nature of sectors, the possibility of conflicts of interest and great uncertainty. Inclusion can provide an opportunity to reconcile interests and enhance common understanding.

*Inclusive planning raises issues and needs that are important to stakeholders in the coordination between sectors. In this way, conflicts between the development of stakeholders' activities and the protection of the marine environment can be addressed already in the planning stage and the participants can be committed to the outcome of the planning.*

### **Inclusive planning in the Finnish maritime spatial planning process**

Participation and cooperation in maritime spatial planning are prescribed on in the Land Use and Building Act 132/1999 (482/2016). According to the law, regional councils must prepare maritime spatial plans in cooperation and coordinate them. Authorities and entities whose sector is addressed in planning must be allowed to participate in the planning and consulted on maritime spatial planning. Other parties must also be given access to preparatory material and the opportunity to express their opinion. The regional councils must provide information on the maritime spatial plan and its rationale, and the completed plan must be accessible online.

### **International examples**

The Swedish Agency for Marine and Water Management (Havs och vattenmyndigheten), responsible for the Swedish national maritime spatial planning process, mainly included trade associations and provincial level administration in the process. County administrations were responsible for contacts with coastal municipalities. Other stakeholders have had the opportunity to participate in the planning process at different stages. Meetings related to the process have been held with NGOs, municipalities and universities, for example.

In Estonia, the Planning Act sets minimum requirements for the involvement of research institutes, municipalities, civil and lobbying organisations, citizens and other stakeholders. In addition to the rules laid down in the planning legislation, various working groups were set up in Estonia for the maritime spatial planning process in order to include stakeholders. In addition, an annual event was arranged in connection with the Tallinn Sea Festival, to which speakers from different maritime sectors were invited. These proved to be a good way of reaching people who would not necessarily take part in consultations and working groups. The 2019 event was also shown live on the website of the Postimees newspaper.

Led by the Ministry of the Environment, the implementation of the Maritime Spatial Planning Directive was prepared in a working group consisting of the relevant ministries, the Finnish Association of Local and Regional Authorities, the Regional Councils and the Centres for Economic Development, Transport and the Environment (ELY Centres). The working group prepared its legislative proposals on the basis of extensive stakeholder work. Already during the drafting of the directive, the content and process of Finnish maritime spatial planning were prepared in cooperation with stakeholders in the Ministry of the Environment's development projects concerning maritime spatial planning.

Following the entry into force of the provisions on maritime spatial planning, a coordination group for maritime spatial planning was set up from the bodies responsible for drafting the plan, i.e. representatives of regional councils and the Ministry of the Environment. The planning process was built to be very participatory. It involved ministries, regional environmental authorities (ELY Centres), municipalities, national agencies, institutes and research centres, maritime and coastal livelihoods, and lobbying organisations, unions

**Table 8.** The first round of Finnish maritime spatial planning made extensive use of inclusive planning throughout the process.

Stakeholders defined the future stages of the planning process in the period 2016–2017	They created future scenarios based on the preparatory work of a consultant and planners.	The stakeholders created a vision for the future for 2050 and maritime sector goals and roadmaps for 2030 based on the preparatory work of a consultant and planners.	The vision videos for maritime spatial planning for 2030 were prepared with stakeholders' views on sustainable use of Finnish marine areas.
One hundred and twenty people participated in sectoral national and regional thematic meetings and over 500 people participated in national stakeholder information and discussion events.			
Some 120 people participated in the preparatory stage workshops, some 390 in scenario workshops and about 400 in vision workshops.			
The network for cooperation in maritime spatial planning is open to all and involves about 400 people from local residents to ministerial officials.			

and associations, private expert and research institutes, ports, museums, universities and other institutions of higher education. Cooperation and communication took place through a web-based network for maritime spatial planning cooperation. It was the most important channel for maritime spatial planning communication. Anyone interested in maritime spatial planning could participate in the network on the [merialuesuunnittelu.fi](http://merialuesuunnittelu.fi) website. The network of stakeholders engaged in maritime spatial planning was extensive and played an active role in drafting the plan (Table 8).

At the startup, data collection and planning stages of maritime spatial planning, stakeholders considered themes related to maritime spatial planning, the content and presentation of the plan and the planning process itself. This led to a consensus on how to plan and what to include in the plan. On the basis of the workshops, an interaction plan was drawn up giving an overview of maritime spatial planning and stakeholders' and citizens' opportunities to influence the planning.

In 2016–2020, during the maritime spatial planning process, the Ministry of the Environment organised several national events on current topics and national workshops in cooperation with the coordination group. Regional Councils organised dozens of regional workshops and regularly informed regional council boards and assemblies about the progress of maritime spatial planning.

Information on the planning stages and completion was provided on the [merialuesuunnittelu.fi](http://merialuesuunnittelu.fi) website and on social media channels. The planning materials were available on the [www.merialuesuunnittelu.fi](http://www.merialuesuunnittelu.fi) website and the approved plan in digital form on the [www.merialuesuunnitelma.fi](http://www.merialuesuunnitelma.fi) website. Information on maritime spatial planning was also published on the websites of the Regional Councils and the Ministry of the Environment. The network was also regularly informed by newsletters.

Future scenarios, visions, target scenarios and roadmaps were prepared together with experts and stakeholders. During the scenario stage, the cooperation network met in national and regional workshops. In autumn 2019, a vision for sustainable use of the marine area and regional target scenarios and sector-specific road maps were created. Thematic regional and national discussions were also organised. Stakeholders had the opportunity to participate in scenario and vision work also on a digital platform, and they had the opportunity to present their opinions on draft plans both anonymously and face-to-face. A consultation took place in spring 2019 on target scenarios and scenario work, while a consultation on vision work, the draft plan and impact assessment took place in spring 2020.

There was close cooperation with other Baltic Sea countries during the planning process to coordinate maritime spatial

plans. Separate consultation meetings were held twice during the planning period, in 2018 and 2020. The various projects in which the Regional Councils have participated have also involved cooperation. Finland's maritimespatial planning has been presented in several international events and an international consultation of the draft took place in spring 2020.

### Participatory planning and communication

In order to ensure the admissibility of maritime spatial plans, stakeholders must be identified and reached during the planning process. Stakeholders must be able to influence the maritime spatial planning process in such a way that their values and views concerning both the marine environment and socio-cultural and economic issues are taken into account in planning solutions. This can be ensured by developing electronic and other feedback systems and taking into account stakeholders' information and opinions in planning, and by actively communicating on the work stages and the related knowledge base and any uncertainties. This creates strong trust between maritime spatial planners and the maritime sectors and other stakeholders affected by planning.

### 4.8 Level of detail and coherence of maritime spatial plans

A maritime spatial plan is a national vision of the direction in which the sustainable use of the sea should be steered, taking into account the carrying capacity of the sea and the status objectives of the marine environment. The national and international coherence of maritime spatial planning is essential for the management of the extensive environmental impacts on the ecosystem. The aim is that the national maritime spatial plans of the Baltic Sea countries are coherent in terms of each other so that the planning principles and data processing methods used are sufficiently convergent and that any cross-border effects are taken into account between neighbouring countries. At national level, maritime spatial plans must be coherent, both among themselves and with other forms of national planning, to bring added value to regional and municipal planning.

*At their best, national maritime spatial plans form a planning system that coheres with the plans of the other Baltic Sea countries and local and regional plans and in which plans at different levels support each other and the opportunities for development of human maritime activities are reviewed at the appropriate planning level for each activity.*

## **Coherence of Finnish maritime spatial planning with other Baltic States**

The Baltic Sea is one biogeochemical and ecological entity in which a wide range of human environmental impacts can cross national boundaries. Reservations of space for marine transport, fishing and offshore wind power, for example, can impact neighbouring countries, and it is therefore important that the Baltic Sea countries are aware of each other's plans. Awareness enables them to steer national planning so that the use of the sea as a whole does not exceed the carrying capacity of the ecosystem and the environmental goals jointly set for the Baltic Sea can be achieved.

There has been close cooperation with other Baltic Sea countries during the planning process to coordinate maritime spatial plans. Finland has actively participated in a HELCOM-VASAB Baltic Sea working group on maritime spatial planning and in its sub-working group on data which develops data management. In addition, cooperation has been carried out through various projects in which designers and scientists have developed different aspects of maritime spatial planning. Finland's draft maritime spatial plan has been the subject of two international consultations, and maritime spatial planning has also been presented at international conferences and meetings.

### **Level of detail and coherence of maritime spatial plans in Finland**

A hierarchical planning system enables interaction in the socio-ecological system to be taken into account at different planning and plan levels (Gilliland & Laffoley 2008). In the Finnish system, in addition to strategic maritime spatial plans, the use of marine areas is controlled with regional and local planning, which offers an opportunity to implement sustainable land use solutions. When developing connections between different planning levels, it is essential to consider how the broad maritime spatial planning data base of can be used in planning and what types of input from other planning can be used in maritime spatial planning. Achieving coherence between maritime spatial planning and land use planning will in practice take place when coastal regions are responsible for both planning processes at national levels. Maritime spatial planning can create new opportunities for regions and municipalities to plan the use of the sea by utilising more comprehensive and better data, forecasts and analyses of the marine environment and the use of the sea.

Coherence between maritime spatial plans and other planning levels also requires consideration of the issues to be solved at different planning levels. Maritime spatial plans are comprehensive strategic plans that allocate the best potential areas for each purpose in the long-term. The

use of marine areas and the coast can be considered in more detail in regional planning but the solutions remain strategic and reflect the regions' objectives, the principles established in the Land Use and Building Act and the national land use objectives. Local planning can, in turn, be used to steer the actual location of activities at sea and on the coast. In practice, the planning of the use of Finnish marine areas is likely to progress more coherently after the completion of the maritime spatial plans when the planning process has harmonised the data used in planning and the planning practices, for example.

### **International examples**

In Sweden, maritime spatial planning can be implemented both at national and municipal levels in approximately 60 coastal municipalities. There are 11 nautical miles of overlap between the planning areas of national and local maritime spatial planning. Local maritime spatial plans include coastal and municipal land. The national plan extends from the baseline of one nautical mile to the external border of the exclusive economic zone. In national plans the focus is on activities of national importance. The coherence of planning between different scales is ensured by exchanging information between the planning levels.

In Estonia, maritime spatial planning is implemented at national level, partly because the state owns all maritime areas. Established forms of the use of the sea, such as fishing and maritime transport, are governed by their own legislation and are not addressed by maritime spatial planning, but planning provides a foundation for other instruments such as the permit process which enables the implementation of future plans. Maritime spatial planning sets legal criteria and proposes necessary additional research for the implementation of individual projects, which must be taken into account in permit processes. Municipalities do not have planning rights at sea but they have to ensure, through their plans at the local level, that the national maritime spatial plan can be implemented (e.g. port planning, infrastructure).

### **Level of detail and coherence of maritime spatial plans**

Successful maritime spatial planning brings added value to the national and international planning system. The aim is that Finland's maritime spatial plans are coherent with each other and with the Åland Islands' maritime spatial plan. The aim is also to ensure the compatibility of maritime spatial plans with other Baltic States. It is therefore necessary to ensure that the principles and data used at different planning levels are consis-

tent and that the functioning and compatibility of maritime spatial plans are continuously assessed in relation to other land use planning. This enables the various sectors to grow sustainably in the Baltic Sea area and maritime spatial planning to support the attainment of jointly agreed environmental objectives.

#### 4.9 Monitoring, evaluation and adapting the impact of maritime spatial plans

Data on the marine environment and human activities accumulated in the maritime spatial planning process and observations on the environmental impacts of the implementation of the plans can be used in subsequent planning rounds (Katsanevakis et al. 2011, Gilek et al. 2018). Central to the ecosystem approach to maritime spatial planning is to adapt management and planning solutions to the changing operating environment (Grumbine 1994). Marine management goals and assessments of the status of the marine environment are revised every six years.

Adaptive planning requires that maritime spatial plans are reviewed at regular intervals (i) with respect to new knowledge of the marine environment and human activities at sea, (ii) new marine management objectives, (iii) changes in the status of maritime waters, (iv) policy changes and social decision-making, and (v) experiences on the functioning of planning solutions.

*Taking changes in the marine environment and in human activities into account as part of the maritime spatial planning process will enable the creation of new solutions for the development of maritime sectors and the attainment of status targets of the marine environment.*

##### International examples

Based on literature, the normal review period for maritime spatial plans is estimated at 5–7 years (Gilliland & Laffoley 2008). However, such a short review period cannot be used to assess long-term adverse impacts on the marine environment or the success of ecosystem restoration (Phillips & João 2017). In fact, in addition to short-term reviews, regular reviews should also be conducted to establish whether the implementation of maritime spatial plans can be demonstrated to have significant long-term impacts on the marine environment or society. The review can be linked to marine and river basin management status assessments, but new tools are needed to develop the assessment of the long-term impact of maritime spatial plans.

The Swedish marine spatial planning ordinance states that the Swedish Agency for Marine and Water Management (Havs och vattenmyndigheten) must monitor the development of marine areas following the Government's decision on the plans. The planning authority must update the plan when necessary or at least every eight years in order to keep the maritime spatial plans up-to-date and relevant. In Estonia, maritime spatial plans are updated every five years in accordance with the Planning Act. When a plan enters into force, an action plan will be implemented, which will define the obligations and responsibilities of the maritime spatial plan.

##### Adaptive maritime spatial planning in Finland

In Finland, maritime spatial plans are reviewed no later than ten years after the completion of the previous plan to assess whether they are up-to-date. Reviews take into account changes in the maritime environment, in society and in human activities at sea, as well as marine management goals and policy processes related to the sea. The implementation of maritime spatial plans and the environmental impacts of their implementation are also assessed. The ten-year review period allows for relatively short-term changes to be taken into account in all of the above-mentioned factors, but does not yet allow reviews of long-term changes in the plans or the environment. However, analysis of indicators and estimates of changes in the environment and society may allow long-term trends to be predicted. Both short- and long-term reviews also provide more information for the national regional planning system. As maritime spatial plans' environmental objectives come from the Marine Strategy Framework Directive, a timely update of the maritime spatial plans can support the achievement of marine and river basin management objectives.

##### Monitoring, evaluating and adapting the impact of maritime spatial plans

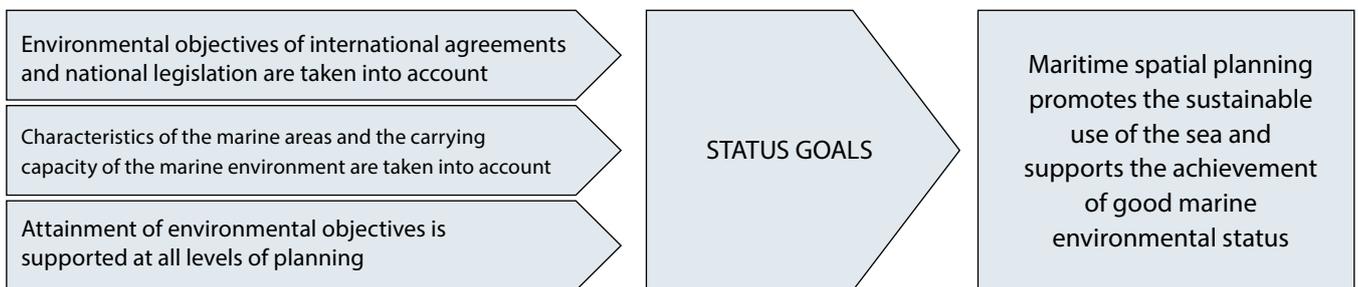
As the operating environment and society change, the appropriateness of maritime spatial plans is ensured by monitoring the plans' impacts and effectiveness and by making periodic assessments. It is essential that changes in the marine environment, marine management and the use of the sea, as well as socio-cultural and economic development are taken into account in maritime spatial planning. To this end, the knowledge base for maritime spatial planning needs to be constantly updated and monitoring and evaluation tools developed.

# 5 National recommendations on the application of the ecosystem approach

The following presents a summary of the principles related to the application of the ecosystem approach and recommendations on how to apply the ecosystem approach in Finnish maritime spatial planning.

## Marine environmental status goals as the starting point

The aim is that maritime spatial planning is based on the carrying capacity of the marine environment and that planning solutions support the growth of the marine economy while at the same time steer the use of the marine environment in a sustainable direction. In practice, planning must take into account the objectives of marine and river basin management and the nature and Bird Directives for good status and protection of the marine environment and for reducing the harmful effects of human activities. Central to maritime spatial planning is to identify which environmental objectives can be influenced by means of maritime spatial planning or national land use planning and the ways in which this can be achieved.

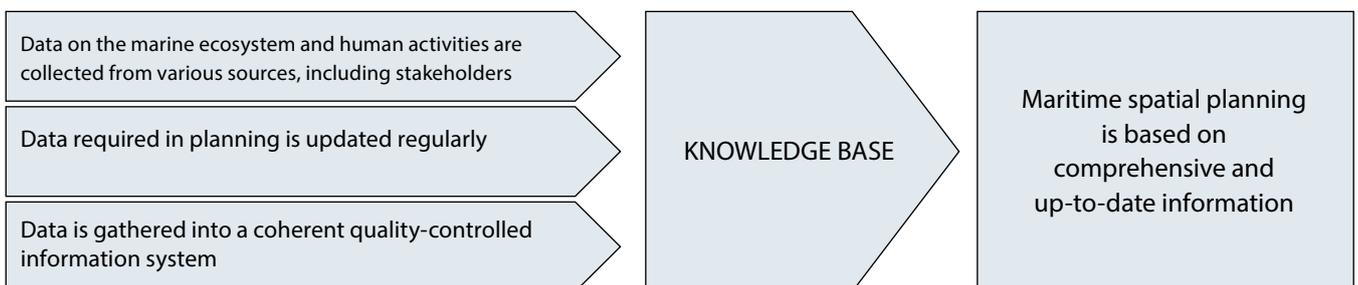


### Recommendations

- Actively use maritime spatial planning to attain the environmental objectives of EU and national legislation and international agreements through the means available to planning.
- Take into account the special characteristics and water status of Finnish marine areas in the development of planning principles and solutions.
- Set attaining and maintaining environmental objectives as goals also in regional and local planning.

## Compiling the best available knowledge on the sea and its use

The data used for planning must be up to date and include relevant information on marine ecosystem structure and functioning as well as on human activity and its impact at sea.

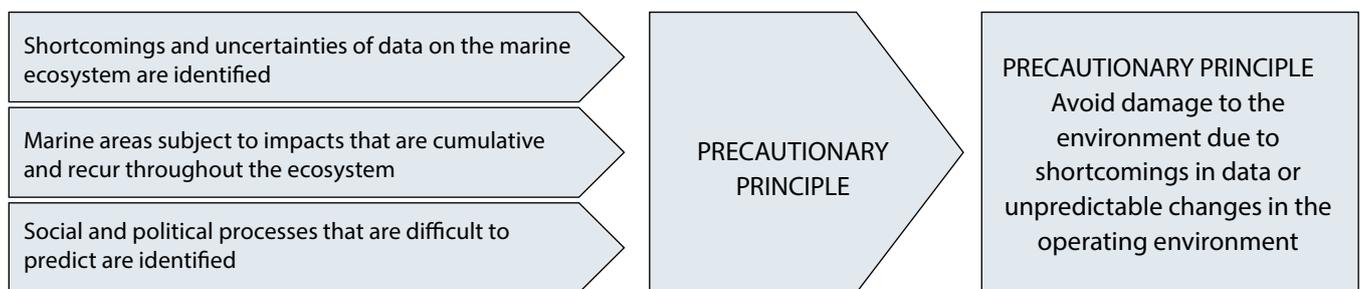


### Recommendations

- Compile all marine environment and human activity data needed for planning, and develop new data based on the needs of the maritime spatial planning process. Communicating data needs in advance to data providers, and compiling a knowledge base together with data producers.
- Identifying areas with vulnerable or endangered habitats or species and pressures that are cumulative and/or recurring in an ecosystem .
- Collect, through methods that engage stakeholders, empirical data describing relevant marine locations and processes.
- Regularly update this data and is publishing it through the interfaces of the itämeri.fi website, for example.
- Toolbox: A comprehensive set of data containing spatial data and a national information system on human activities at sea.

## Applying the precautionary principle to maritime spatial planning

The precautionary principle should be observed if the effects of human activities cannot be reliably assessed and there is a risk that the activities will result in significant environmental impacts. This often means areas where data is lacking or where cumulative human pressures occur. This will prevent damage to habitats and loss of endangered species and habitats due to lack of or uncertain information.

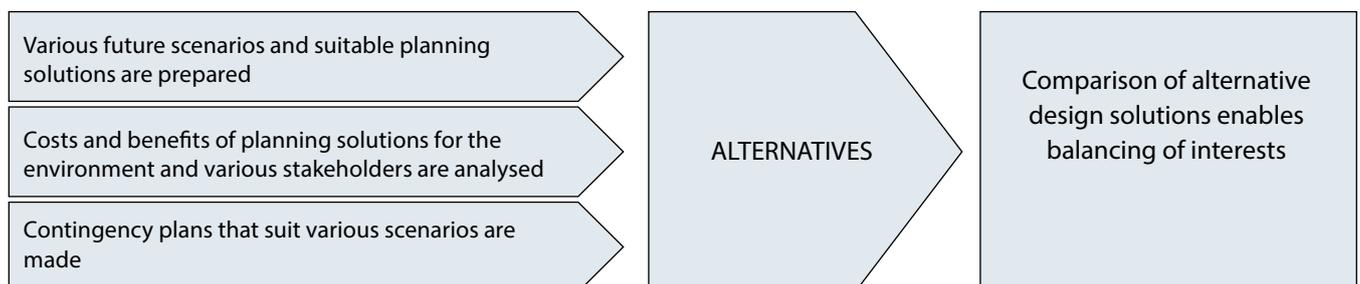


### Recommendations

- Apply the precautionary principle especially in areas where there is insufficient information or where there are severe cumulative or recurring human pressures.
- Analyse the lack of data on the impact of pressures from human activities on the marine environment.
- Draw up a plan in accordance with the full precautionary principle and comparing its costs and benefits with other alternatives.
- Add a description of any uncertainty factors to background data used in planning and notifying stakeholders of these factors.
- Toolbox: Tool for assessing the uncertainty of the stages of the planning process.

## Exploring alternative planning solutions

Alternative planning solutions and/or scenarios for assessing environmental impacts will be developed in the planning process to clarify the interests and views of different stakeholders and sectors on how sustainable marine use can and should be developed. The aim is to prevent the impacts of human activity from exceeding the carrying capacity of the marine ecosystem and to ensure that planning will produce maximum benefits for both marine sectors and the environment.

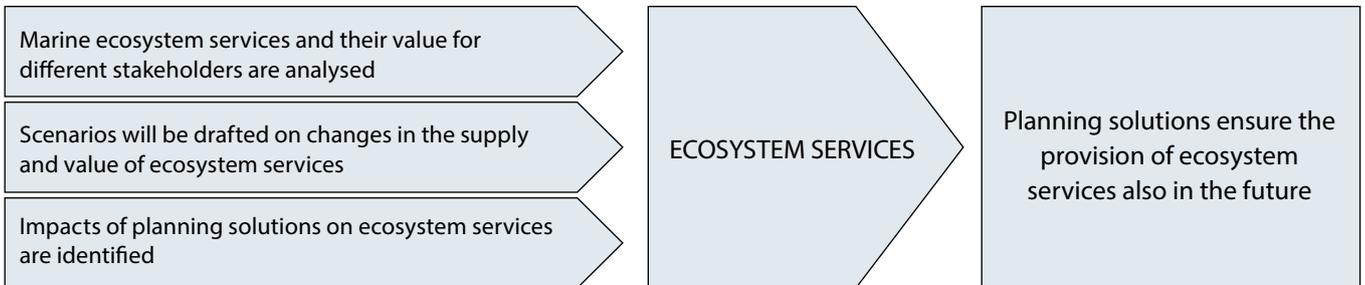


### Recommendations

- Create environmentally, socio-culturally and economically focused scenarios and planning solutions based on them as background for planning and assess their costs and benefits as well as their impact on the marine environment and human activities.
- Take into account the special characteristics of planning areas and the effects of environmental changes, including climate change, when developing planning solutions.
- Collect feedback from stakeholders during the planning process and take it into account when formulating and developing planning alternatives.
- Toolbox: Cost-benefit model for different design solutions.

## Identification of ecosystem services

Data on the quantity, quality and location of marine ecosystem services and their value to people must be used in planning. The data is taken into account in the development of planning solutions.

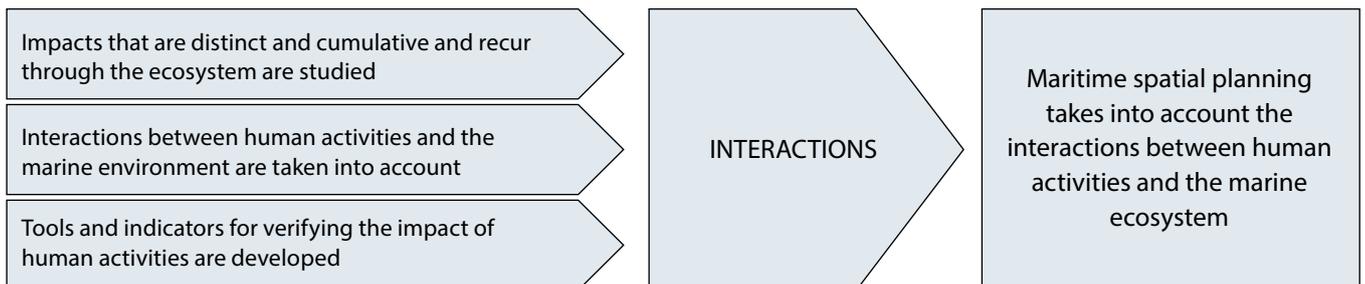


### Recommendations

- Provide information on marine ecosystem services and their regional occurrence in the Finnish marine area.
- Produce environmental economic review of the human value of marine ecosystem services by marine area.
- Provide scenarios on different future trends related to the provision and use of ecosystem services in Finnish marine areas.
- Develop methods and practices for the inclusion of the value of ecosystem services provided by the marine environment in national accounts.
- Toolbox: Estimates of the number, quality, location and value of ecosystem services in the Finnish marine area.

## Comprehensive understanding of interactions

The impacts of terrestrial and marine human activity on the marine environment and different interaction chains are understood and taken into account in the maritime spatial plans.

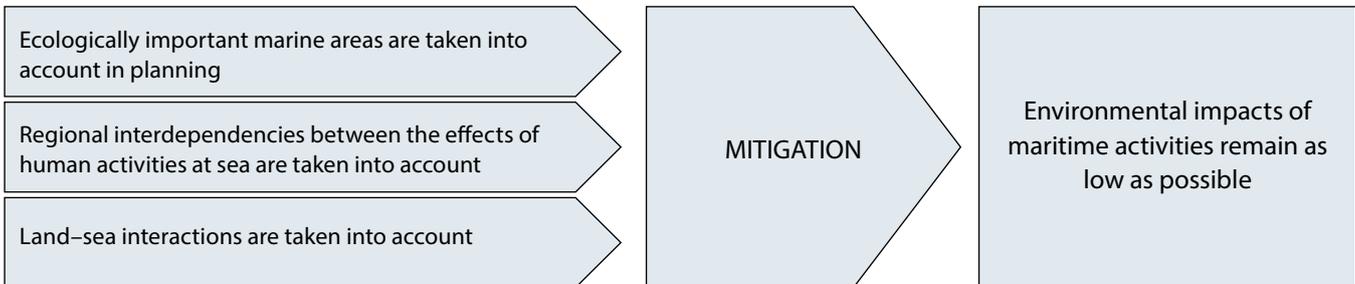


### Recommendations

- Assess the impact of human activity with up-to-date information on the structure, functioning and state of the marine environment, both before and after planned activity.
- Develop methods in international cooperation to assess the cumulative impact of human activity that recur across the ecosystem in the Baltic Sea.
- Apply and develop tools and indicators to assess the impact of human activity in Finnish marine areas and take their results into account when drafting maritime spatial plans.
- Toolbox: An tool to evaluate cumulative human pressures that recur across the ecosystem and their impacts and regional interconnectedness.

## Mitigating the impact of maritime spatial plans

Comprehensive maritime spatial planning can mitigate the adverse impacts of human activities on the status of the marine environment and support the achievement of a good status of marine waters.

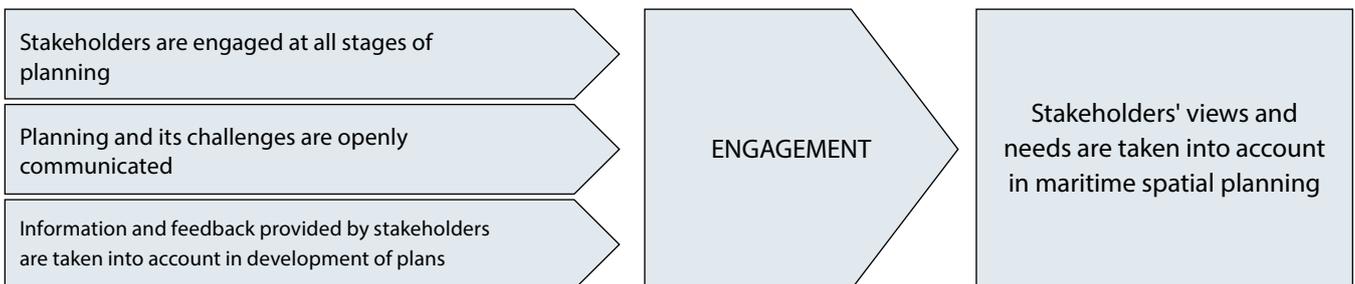


### Recommendations

- Safeguard the structure and functioning of the marine ecosystem through planning solutions by taking into account both the network of protected areas and areas identified as important for the functioning of the marine ecosystem.
- In planning solutions, take into account the marine activities that may have a wider impact on the marine ecosystem than in the immediate vicinity of the activities.
- Also take into account land-sea interactions with the structure and functioning of the ecosystem.
- Develop the environmental impact assessment and monitoring of maritime spatial plans.
- Toolbox: Indicator-based monitoring tool for assessing the environmental impact of maritime spatial planning.

## Participatory planning and communication

It is essential for the acceptability of maritime spatial plans that the values and opinions of stakeholders concerning the marine environment and socio-cultural and economic issues are taken into account in planning solutions. The aim is that stakeholders are identified and reached during the planning process and that, as a result of the process, there is strong trust between maritime planner and the representatives of maritime sectors and other stakeholders.

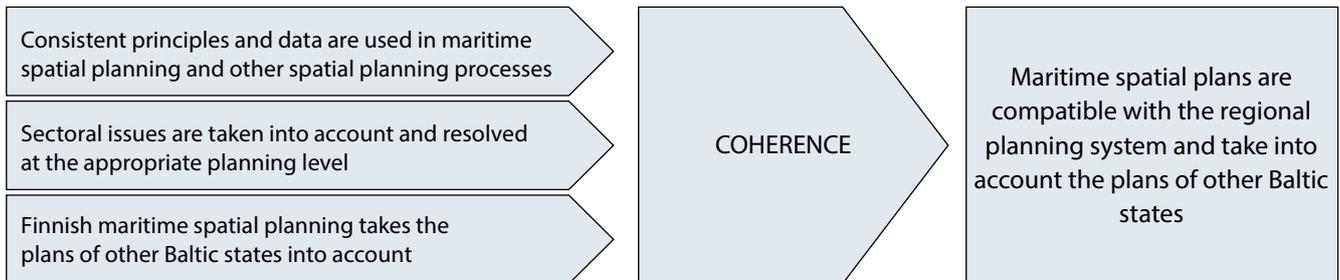


### Recommendations

- Collect information on stakeholders' values and views related to the marine environment and the use of marine areas.
- Developed tools for engaging stakeholders in planning work, compiling information received from stakeholders and providing feedback.
- Openly inform stakeholders about the progress of the planning process, challenges and the quality and uncertainties of the information.
- Enhance trust in the planning process by providing genuine feedback and ensuring that stakeholders recognise that feedback has made a difference in developing planning solutions.
- Toolbox: Tool for collecting information from stakeholders and participating in planning work, and a feedback system for collecting information on stakeholders' experiences related to the planning process.

## Level of detail and coherence of maritime spatial plans

The aim is that maritime spatial planning will bring added value to the national planning system and that maritime spatial planning and the planning processes at different scales form a coherent whole. The aim is to achieve coherence with other Baltic States.

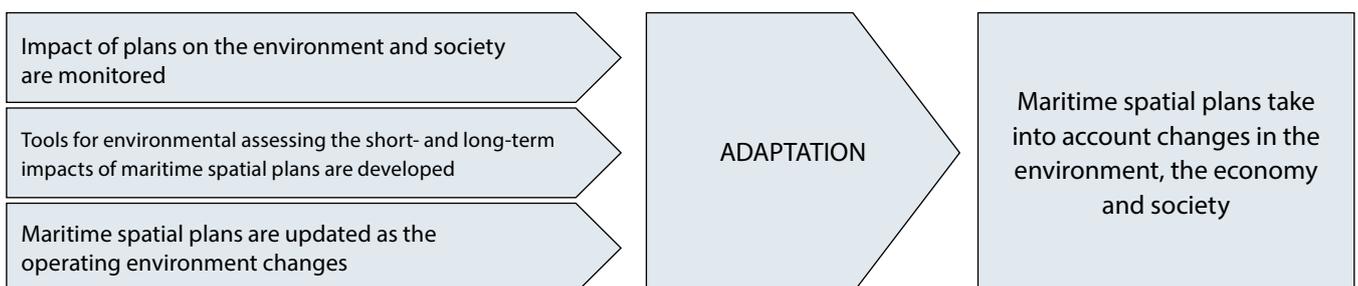


### Recommendations

- Ensure that Finland's maritime spatial plans are coherent with each other and with the Åland Islands' maritime spatial plan.
- Use integrated planning principles and consistent background data in maritime spatial planning and other spatial planning.
- Process matters that are essential to different sectors at the right spatial, local or regional planning level.
- Assess the functioning and compatibility of maritime spatial plans with other land-use planning and regional development.
- Develop methods and indicators for the assessment of the coherence of maritime spatial planning, national and international maritime spatial planning, and national maritime spatial planning and land-use planning.
- Toolbox: Indicator-based evaluation tool for assessing both national and international coherence.

## Monitoring, evaluation and adapting the impact of maritime spatial plans

It is essential that changes in the marine environment and in socio-cultural and economic development are taken into account to ensure the continuous development of maritime spatial planning.



### Recommendations

- Develop tools for short- and long-term impact assessment maritime in cooperation with data providers.
- Monitor and evaluate the process of maritime spatial planning and the impact of maritime spatial plans during an appropriate time span.
- Monitor the implementation and impact of maritime spatial plans in neighbouring countries and adopt best international practices.
- Review maritime spatial plans to assess whether they are up-to-date and update them on the basis of estimates of their impacts and changes in the operating environment (incl. status of maritime waters, marine management objectives, use of the sea, society).
- Harmonise the update cycle of maritime spatial plans with the marine and river basin management update cycle.
- Toolbox: The operational process for updating maritime spatial plans, in which new information is taken into account and included in the new planning cycle.

## 6 Summary

When applying the ecosystem approach, maritime spatial planning must be based on objectives related to the status of the marine environment. They define the limits of growth for maritime activities while ensuring their sustainability. Planning must be implemented at the appropriate planning level, proceeding step-by-step and ensuring that the ecosystem is taken into account throughout the process.

In order to mitigate environmental impacts, interactions between sectors and the environment, and between the sectors themselves must be assessed. This requires a comprehensive understanding of the functioning of the socio-ecological system and its application at all stages of the planning process. To this end, the best possible knowledge base on both the marine environment and the related pressures must be used. Engaging stakeholders in the is important in order to gather a sufficient knowledge base, ensure transparency, communicate uncertainties and mitigate conflicts between sectors. Determining the value of ecosystem services that are guaranteed by planning helps to justify solutions.

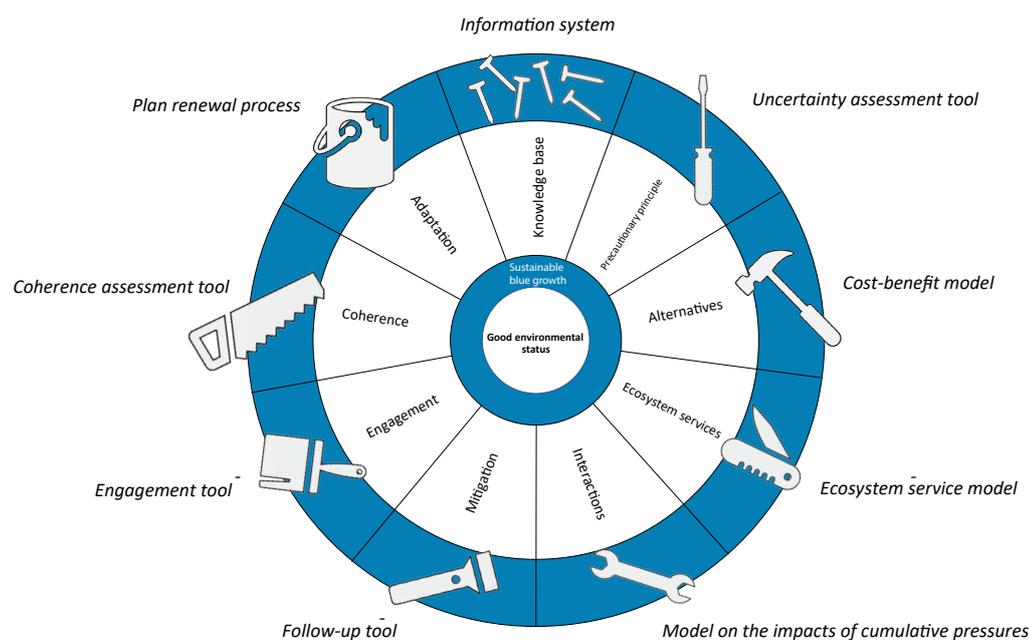
In order to identify environmental impacts, a comparison must be made of the effects of different planning options on the attainment of marine status objectives. When information is uncertain or incomplete, and when the cumulative impacts of pressures are unknown or the response of the ecosystem cannot be predicted, the precautionary principle must be applied. The compatibility of the plans with

the must be ensured both nationally and internationally. As circumstances change and knowledge accumulates or when environmental policy indicators indicate the need for new measures, the plans must be adjusted to the limits set by the sustainability.

### Future guidelines

A monitoring and evaluation programme will be established in maritime spatial planning, and the need to update maritime spatial plans will be reviewed at least every ten years. So far, there are no experiences or practical examples of the process as a whole, or of drawing up targets for impact monitoring. Hence, application should be based on overall recommendations and comparisons based on maritime spatial planning or cooperation specific to marine areas.

The next planning rounds may already explore how the different principles of the approach have been taken into account in planning work and in assessing the environmental impacts of the plans and what effects the plans have had. If necessary, the theoretical framework for the application of the ecosystem approach and the range of tools available to planners in relation to each concept principle can be updated. At the same time, shortcomings in data can be identified and plans can be adapted to new situations.



**Figure 7.** Toolbox for ecosystem-based maritime spatial planning. The planning principles as sectors and the tools proposed in the report on the outer ring.

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# Appendices

## Appendix 1

Appendix 1. Review of the application of the ecosystem approach in a maritime spatial planning process carried out in Sweden and Estonia. Source: The Ecosystem Approach in Maritime Spatial Planning – a Checklist Toolbox ([http://www.balticscope.eu/content/uploads/2015/07/BalticScope\\_Ecosystem\\_Checklist\\_WWW.pdf](http://www.balticscope.eu/content/uploads/2015/07/BalticScope_Ecosystem_Checklist_WWW.pdf)).

### Environmental objective: Good environmental status of marine waters (GES)

*Does maritime spatial planning support the objective and/or contribute to maintaining a good status?*

Sweden	Yes	Partially	No
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Achieving a good status of marine waters is part of the Swedish environmental objective 'A balanced marine environment, flourishing coastal areas and archipelago', which forms the basis for its maritime spatial plan. Maritime spatial planning regulations also separately state that plans should help to achieve and maintain a good status. The criteria and indicators used to assess the impact plans have regarding a good status have been used in the environmental impact assessments (SEA) of the initial draft plans and will be further developed to link maritime spatial planning to the Marine Strategy Framework Directive.

Estonia	Yes	Partially	No
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According to the Estonian Planning Act one of the tasks of maritime spatial planning is to define the measures necessary to protect the marine environment. This means not just a network of protected areas, but protecting the good status of the marine environment as a whole. The Act also states that maritime spatial planning must use methods of land-use planning to take into account protected areas and the conditions of their use. Prior to maritime spatial planning, the methods used for taking good-status criteria and indicators into account in assessing the impacts of maritime spatial plans were still under development.

### Best available information and practices

*Are best information and practice applied in planning?*

Sweden	Yes	Partially	No
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Sweden co-ordinates national Marine Strategy Framework Directive practices concurrently with maritime spatial planning process. Important themes in coordination include the development of protected marine areas, data management and assessment of human pressures. Key steps in developing the knowledge base and practices include surveying marine green infrastructure and identifying areas of ecological importance.

Estonia	Yes	Partially	No
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Prior to the launch of maritime spatial planning, field surveys and material analyses were carried out, including the collection of data on fishing and fish spawning areas, as well as on birds and their migration. In addition, cooperation between the different bodies responsible for activities associated with the sea and the protection of the marine environment was intensified.

## Precautionary principle

*Will the precautionary principle be taken into account in planning?*

Sweden	Yes	Partially	No
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Sweden developed a tool called Symphony to assess cumulative pressures for maritime spatial planning. The tool was used to understand current and future pressures in the SEA process, for example. The assessment was based on spatial data on human activities at sea and included assessments of the impacts of pressures on selected ecosystem components. The analyses produced by the assessment tool also took into account uncertainties and emphasised the precautionary principle where the cumulative impacts of human activities were severe. Alternative ways of using marine areas were considered in order to reduce cumulative pressures that were at a significant level.

Estonia	Yes	Partially	No
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Since maritime spatial planning is carried out in Estonia at the national level, some decisions were left for subsequent stages concerning the use of marine areas, such as the permit process. This means that maritime spatial planning sets the criteria in Estonia and determines the types of research needed in the future to make decisions on use following the adoption of the maritime spatial plans.

## Alternative development

*Are alternatives used in planning?*

Sweden	Yes	Partially	No
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In Sweden, the Agency for Marine and Water Management (SwAM), which manages the planning process, submitted a three-part proposal for a maritime spatial plan to the Swedish Government in 2019. Prior to the officially submitted proposal, the Agency had prepared several alternative planning solutions. The aim was to propose alternative planning solutions for each plan and marine area as required.

Estonia	Yes	Partially	No
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In Estonia, the Pärnu and Hiiu pilot plans explored various sea use scenarios to identify the most balanced solution for the marine environment. A similar approach was also used in other Estonian marine areas. In addition to different scenarios, the plans also suggested some future research needs which should be met before some of the planning solutions can be implemented.

## Identification of ecosystem services

*Is assessment of ecosystem services included in planning?*

Sweden	Yes	Partially	No
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In Sweden, ecosystem services were identified as part of the impact assessment (environmental and multiple-criteria analyses). Initially, a qualitative approach was used.

Estonia	Yes	Partially	No
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At the moment, no precise method has been developed in Estonia to take ecosystem services into consideration. A number of individual projects have been carried out to develop methods for the evaluation of ecosystem services. Methodological development will continue in cooperation with Finland.

## Mitigation of impacts

*Is impact mitigation applied in planning?*

Sweden	Yes	Partially	No
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The Symphony tool was used to evaluate the location of cumulative pressures in order to identify significant adverse impacts and to adjust planning solutions when necessary. Other mitigation measures were specified on the basis of the content of the plan proposals.

Estonia	Yes	Partially	No
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The need for mitigation measures was assessed through the SEA process. The planning solutions were updated with mitigation measures, as required.

## Understanding relationships/dependencies

*Is a holistic approach taken in planning?*

Sweden	Yes	Partially	No
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In Sweden, the Symphony tool was created to support the planning process in order to assess the direct and indirect impacts of cumulative pressures on the marine environment. The strategic environmental assessment (SEA) looked at the long-term effects of the plans, although significant short-term impacts such as impulsive underwater noise were also taken into account. The criteria and indicators for assessing significant impacts include both negative and positive impact scales.

Estonia	Yes	Partially	No
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The review was carried out as part of the SEA process.

## Participation and influence

*Have participation and communications been ensured in planning and the SEA?*

Sweden	Yes	Partially	No
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Maritime spatial planning is a cross-sectoral and multi-level process. It is therefore critical that all marine sectors and stakeholders are involved. SwAM was responsible for the Swedish national maritime spatial planning process and prepared the maritime spatial plans for the Swedish Government. Swam was involved mainly in industry organisations and regional government. County administrations were responsible for contacts with coastal municipalities. Other stakeholders have also had the opportunity to participate in the planning process at different stages. Meetings related to the process have been held with civil organisations, municipalities and universities, for example. The process took several years and offered stakeholders the opportunity to raise questions and comment on the progress of the process.

Estonia	Yes	Partially	No
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The maritime spatial planning process in Estonia includes both design solutions and the SEA process. The Planning Act sets minimum requirements for the involvement of research institutes, municipalities, civil society organisations, the public and other stakeholders. In addition to the rules laid down in planning legislation, various working groups were set up in Estonia for the maritime spatial planning process in order to engage stakeholders to take active part.

## Planning level and coherence

*Have the principle of subsidiarity and coherence between planning levels been taken into account in planning?*

Sweden	Yes	Partially	No
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In Sweden, maritime spatial planning can be implemented both at national and municipal levels in approximately 60 coastal municipalities. There are 11 nautical miles of overlap between the planning areas of national and local maritime spatial planning. Local maritime spatial plans include coastal and municipal land. National plans extend from the baseline of one nautical mile to the external border of the exclusive economic zone. The aim of the national plans was to focus on a broad-based planning of activities of national significance. The coherence of planning between different scales is ensured by exchanging information between the planning levels. SwAM has provided funding to municipalities to promote their commencement of local planning.

Estonia	Yes	Partially	No
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In Estonia, maritime spatial planning is implemented at national level. This means that maritime spatial planning does not in itself permit the use of the sea, but provides a basis for other instruments such as the permit process, which enables the implementation of plans. Maritime spatial planning sets certain criteria for the implementation of individual projects, which must be taken into account in the permit process. As the local authorities do not manage marine areas, the municipalities do not have planning rights at sea. However, they have to ensure, through their plans at the local level, that the national maritime spatial plan can be implemented (e.g. port planning, infrastructure).

## Adaptive management and use planning

*Is adaptation taken into account in planning?*

Sweden	Yes	Partially	No
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The Swedish marine spatial planning ordinance states that the Swedish Agency for Marine and Water Management (SwAM) must monitor the development of marine areas following the Government's decision on the plans. The planning authority must update the plan when necessary or at least every eight years in order to keep the maritime spatial plans up-to-date and appropriate.

Estonia	Yes	Partially	No
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Maritime spatial plans must be reviewed every five years and, when needed, a new plan must be developed.

# Appendix 2

## Definition of the good status of the marine environment and its descriptors in EU directives

Regional dimension	Marine Strategy Framework Directive (MSFD)	Water Framework Directive (WFD)	Habitats Directive	Birds Directive
Implementation period	Measures defined by the marine management plan and programme of measures Goal of attaining a good status by 2020 Two categories (good/target not reached)	Water management plans and action plans (by river basin management area) define measures Good status by 2015 (extension to 2027) Five categories (high, good, moderate, poor, bad) Qualitative factors: <b>Biological</b> Phytoplankton Macroalgae Benthic flora <b>Hydro-morphological</b> Proportion of the total length of the modified/built shoreline Modified surface area (%) Surface area of bridge and embankment impact area Intrinsic connection to the sea/in-pounded bays <b>Water quality</b> Intrinsic elements Transparency	Entire sea area Nature areas for which management and use plans define measures (*) Continuous Four categories (favourable, unfavourable, inadequate, unfavourable-bad, unknown) Elements of a favourable conservation status: Distribution Natural range (habitats) Population (species) Habitat of species (species) Future outlook The general trend in the conservation status is also assessed. (Improving / deteriorating / stable / unknown)	Natura SPA areas for which management and use plans define measures (*) Continuous Factors to be reported: Population size Short- and long-term population trends Extent and trend of the natural range and distribution Progress on protection and action plans SPAs, management and use plans and protection measures Research carried out (Bird atlas, monitoring reports, red lists and other publications) Non-native bird species
Indicators, metrics and other reporting factors	1 Diversity 2 Non-indigenous species 3 Commercial fish stocks 4 Food webs 5 Eutrophication 6 Seafloor integrity 7 Hydrographic conditions 8 Contaminants in fish 9 Contaminants in fish 10 Litter 11 Energy (including underwater noise)	Stressors and threats In the WFD, limit values for categories/quality elements are specific to water bodies. Some WFD quality elements are direct indicators in MSFD descriptors, but there are differences in limit values. WFD requires that biological quality elements are assessed by each water body. MSFD allows discretion in regional monitoring. Connection with descriptors 1, 5, 6, 7 and 8. No or no direct contact with descriptors 2, 3, 4, 9, 10 or 11. (**)	Stressors and threats Connection to most descriptors through definitions of good status of natural habitats. There are no corresponding unambiguous descriptors in the Habitats Directive for the good status of habitat types, but the country-specific habitat definitions typically use quality criteria corresponding to MSFD descriptors when describing the structure and functioning of a habitat type. Connection to descriptors also through threats and stressors to habitats and species (with the exception of descriptor 3) Species: the status of the grey seal, Baltic ringed seal and the harbour porpoise as indicators in descriptor 1. Habitats: links to bird, fish and algal indicators, etc. Habitats: links to non-indigenous species indicators	Stressors and threats Direct link to descriptor 1: diversity and descriptor 2: non-indigenous species. Indirect link to descriptor 4, food webs.
Connection to MSFD descriptors				
MSFD descriptor	1 Diversity 2 Non-indigenous species 3 Commercial fish stocks 4 Food webs 5 Eutrophication 6 Seafloor integrity 7 Hydrographic conditions 8 Contaminants 9 Contaminants in fish 10 Litter 11 Energy (including underwater noise)			
Evaluation	Qualitative, summary A report is issued every six years on the implementation of the Birds Directive. Such reports include an assessment of the status of bird populations nesting naturally in Finland and the most important migratory and wintering populations. For each species, the report shall include information on the population size and its short- and long-term outlook, the range of distribution and its changes as well as any conservation plans and stressor and threats to the population. In addition, the total population of Natura species from sites selected for the Natura network, under the Birds Directive and the protection measures taken for these species were reported.			
Reporting				

\* = the Directive also requires research and types can be subject to different levels of action and management plans (Species Action Plans, Management Plans and Bird Management Statements).

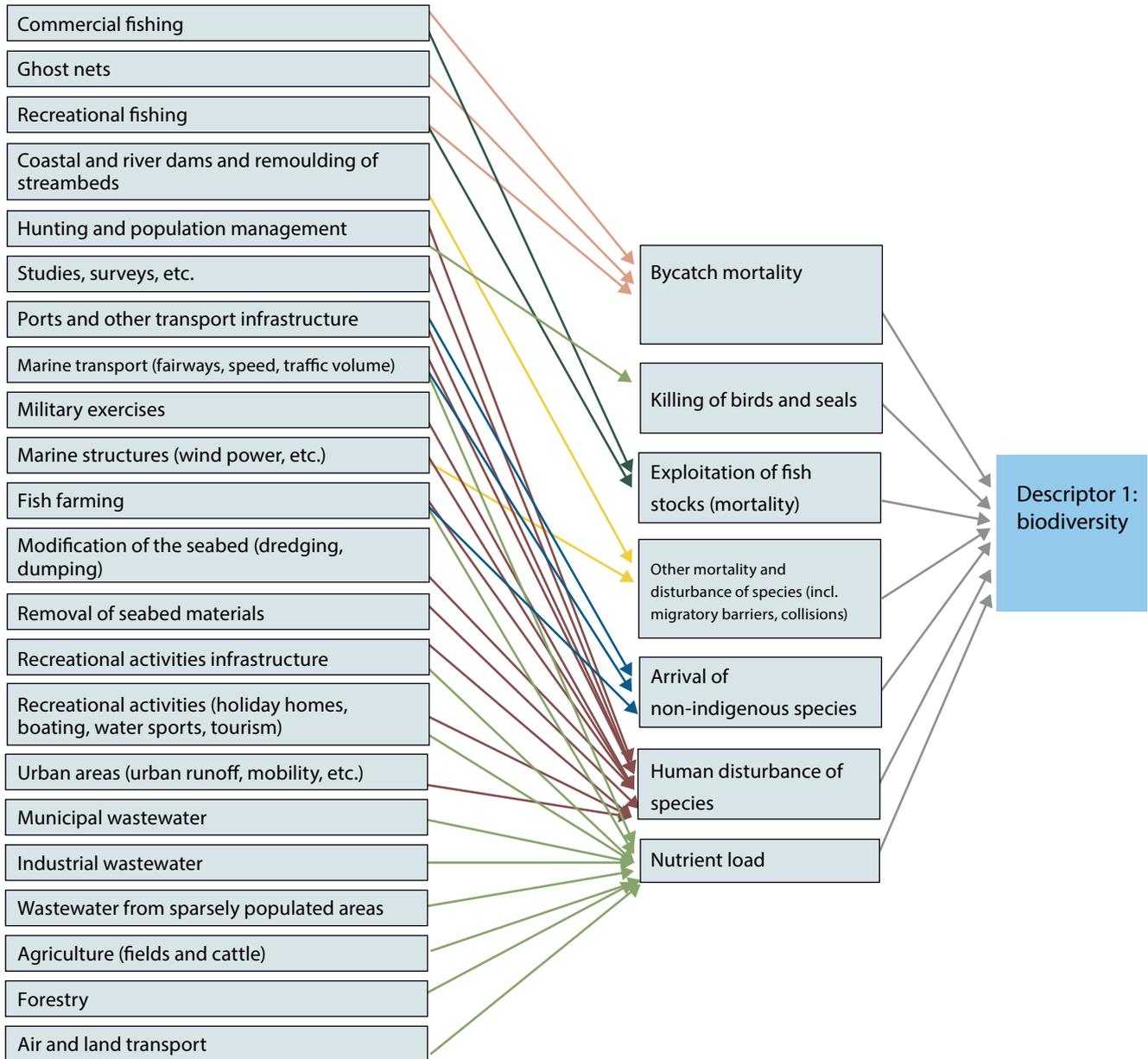
\*\* = the protection measures carried out shall also be reported for the species of Appendix 2. These can be defined, for example, in a species conservation plan that can be made for species protected in the Nature Conservation Decree.

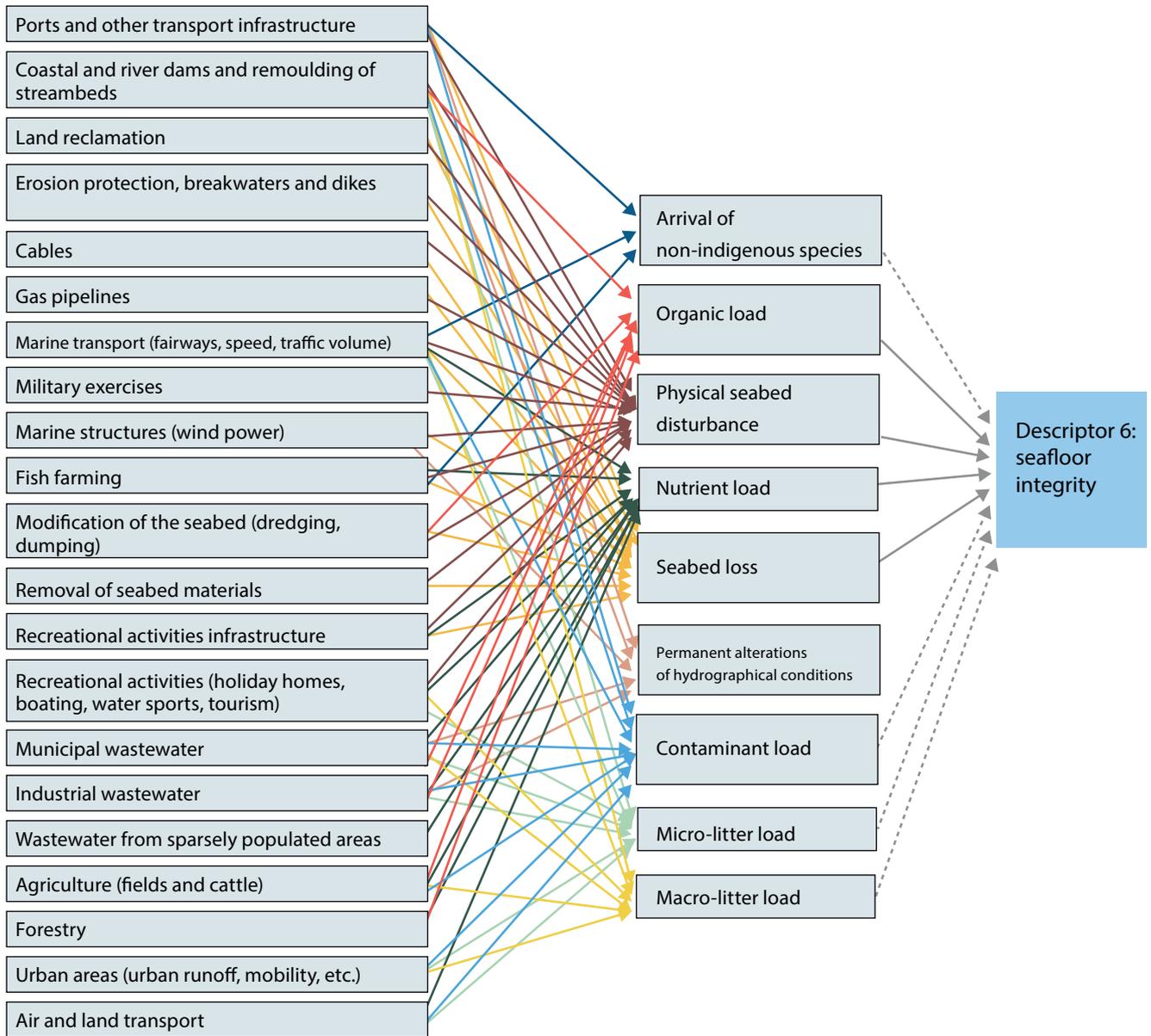
\*\*\* = Additional biological, hydro-morphological and water quality elements are used in assessing the status of inland waters and groundwater that would have links with the descriptors of the Marine Strategy Framework Directive but are not used for coastal waters. For instance, the fish stock of biological elements and salt content of water quality elements are linked to the Marine Strategy Framework Directive.

\*\*\*\* = The MSFD, but may be implicitly included for instance, commercial fish stocks are not taken into account in WFD as such, but are part of environmental

### Appendix 3

Impact of human activities on biodiversity in descriptors 1 (diversity) and 6 (seafloor integrity). Source: Samuli Korpinen, SYKE





## Appendix 4

Impacts of human activity on the state of Finnish sea areas. Source: Samuli Korpinen, SYKE

Human activity	SPECIAL IMPACT ON THE STATE OF FINNISH SEA AREAS
Commercial fishing	Status of salmon, whitefish and pikeperch; Bycatch mortality of mammals and sea trout; Ghost nets
Recreational fishing	Status of salmon, whitefish and pikeperch; Bycatch mortality of mammals and sea trout; Ghost nets
Hunting and population management	Endangered waterbirds; Disruption of other species
Coastal and river dams and remoulding of streambeds	Sea trout, migrating whitefish, salmon and eel; Flow changes in flads and bays (dredging of thresholds)
Ports and other transport infrastructure	Local seabed destruction and pollution; Underwater noise; Non-indigenous species
Marine transport (fairways, speed, traffic volume)	Erosion and siltation along fairways and shallow waters; Underwater noise
Marine structures (wind power, etc.)	Interference with the seabed (construction stage); Loss of the seabed; Changing flows and erosion; Collisions
Fish farming	Loss of seabed (local); Nutrient load; Organic load
Modification of the seabed (dredging, dumping)	Loss of seabed (local); Interference with seabed (siltation)
Removal of seabed materials	Loss of seabed (local); Interference with seabed (siltation)
Recreational infrastructure (incl. leisure residences)	Human-induced disturbance to species; Changes caused by shoreline structures; Loss of the seabed (small-scale dredges); Interference with the seabed (siltation effect of small-scale dredging); Flow changes in flads and bays (dredging of thresholds)
Recreational activities (holiday homes, boating, water sports, tourism)	Human-induced disturbance to species; Underwater noise
Urban areas (urban runoff, mobility, etc.)	Human-induced disturbance to species; Underwater noise; Litter, Pollutants in urban runoff
Land reclamation	Loss of seabed (local); Interference with seabed (siltation)
Erosion protection, breakwaters and dikes	Loss of seabed (local); Flow changes in flads and bays
Cables	Loss of seabed (local); Siltation during construction and underwater noise
Gas pipelines	Loss of seabed (local); Siltation during construction and underwater noise

## Appendix 5

Implementation of the principles of the ecosystem approach in the environmental impact assessments of the maritime spatial plan of Germany, Poland, Sweden and Denmark. Source: Arndt & Schmidtbauer Crona 2019

Principle	Germany	Poland	Sweden	Denmark
<b>Compiling a continuously updated knowledge base on the sea and its use</b>	SEA is based on extensive marine ecological and physical data compiled from national and international monitoring programmes and projects and EIA reviews.	SEA was based on the existing knowledge base and expert assessments.	A national status assessment (Current Status 2014) was compiled as the basis for maritime spatial planning, which includes extensive data on maritime sectors and the marine environment at present and in the future.	The existing knowledge base was used and new analyses were produced. No new data was collected.
<b>Precautionary principle</b>	The application of the ecosystem approach and the precautionary principle form a part of the maritime spatial planning process and the assessment of the environmental impacts of plans.	The material derived from the environmental impact assessment does not describe how the precautionary principle was applied, but a number of decisions based on the precautionary principle have been made in maritime spatial plans.	According to SwAM, the authority responsible for maritime spatial plans, plans should identify which marine areas are best suited to the placement of different sectors' activities. The precautionary principle should be applied and the continuity of ecosystem operations ensured in this context.	Not assessed
<b>Alternatives</b>	The maritime spatial plan presented three planning alternatives with different focuses; a proposal will follow.	The aim of the impact assessment has been to assess the future impacts of the plans and to find a planning solution that is least harmful to the marine environment.	The Symphony tool was used to assess the cumulative environmental impacts that arise in the planning area between the current zero level and the situation forecast for 2030.	Different planning options were assessed, but only one final planning solution was proposed. During the process, solutions related to some sectors, such as marine transport between Denmark and Germany, were assessed on a cross-border basis.
<b>Identification of ecosystem services</b>	Not processed	Previously produced materials were used, but no new material was produced.	In the SEA, ecosystem services were identified in relation to the sustainability assessment that was carried out. The sustainability assessment was produced at the same time as the SEA review, based on economic, ecological and social factors. The economic and social aspects of the sustainability assessment were included in the SEA review.	Ecosystem services were included in the SEA review.

*Jatkuu seuraavalla sivulla*

Principle	Germany	Poland	Sweden	Denmark
<b>Comprehensive understanding of interactions</b>	The SEA examines the interaction between sectors and the marine environment, with the aim of identifying conflicts and reconciling sectors' needs.	The SEA examines the interaction between sectors and the marine environment, with the aim of identifying conflicts and reconciling sectors' needs	The plan and the associated background material have focused on assessing cross-sectoral impacts. This was taken into account especially in the 2014 status review that provided data for maritime spatial planning.	Not assessed
<b>Mitigation of impacts</b>	As mitigation measures, the SEA review identified using the best environmental practices (BEP), the non-placement of wind power in Natura 2000 protected areas and restricting construction in periods during which the marine environment is especially sensitive.	The SEA identifies mitigation measures at a general level. The proposals in the SEA report were used in the finalisation of the maritime spatial plan. Detailed mitigation measures will be addressed in project-specific EIA reviews.	The Symphony tool was used to assess cumulative environmental impacts and to develop planning solutions	Not assessed
<b>Participatory planning</b>	The SEA is an integral part of the maritime spatial plan. The SEA report is evaluated concurrently with the maritime spatial plan.	The SEA was carried out at the same time as the maritime spatial planning process; the process included a number of national and international consultations and meetings.	During the maritime spatial planning and impact assessment process, comments received from stakeholders were taken into account in the drafting of the plans.	Formal and informal workshops were organised for stakeholders
<b>Planning level and coherence</b>	Maritime spatial plans were completed at such an early stage that coherence was not assessed. The internal coherence German plans and their coherence with those of other countries will be assessed when the plans are updated.	Coherence was examined separately in coastal waters and the exclusive economic zone through WFD and MSP frameworks.	The maritime spatial plan was drawn up in three parts in order to take regional characteristics into account. At the same time, the SEA assessed five Baltic Sea sections located in Swedish territory.	Not assessed
<b>Planning of adaptive management and use</b>	The SEA does not examine adaptive management or use.	The SEA does not describe the adaptation process. The key objective of the maritime spatial plan is to increase the production of renewable energy so that Poland will attain the objectives set by the EU in preventing climate change.	The SEA does not specify how the planning of adaptive management and use have been examined	Since the plans are legally binding, their amendment requires a legal process. The knowledge base of the digital plan can be updated with new data.

