The Swedish approach to MPA Network Design & Management

Framework and step-by-step guidance

Report 2021:12

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Abbreviations used in this document

CAB	County Administrative Board
CBD	The Convention on Biological Diversity
CMP	Conservation Measures Partnership
CS	Conservation Standards, i.e. Open Standards for the Practice of Conservation
EEZ	Exclusive Economic Zone
FCS	Favourable Conservation Status
GIS	Geographic Information System
HELCOM	The governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area, also known as the Helsinki Convention
HOLAS II	HELCOM's Second Holistic Assessment of the Baltic Sea
IMM	Integrated Marine Management
MPA	Marine Protected Area
MSFD	The EU Marine Strategy Framework Directive
MSP	Marine Spatial Planning
PO	Protection Objective
OSPAR	The mechanism by which 15 Governments & the EU cooperate to protect the marine environment of the North-East Atlantic as agreed upon in the OSPAR Convention.
OECM	Other Effective Area-Based Conservation Measures
RO	Regulation Objective
TRO	Threat Reduction Objective

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*Ringed seal.
Photo: Jörgen Wiklund.*

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Purpose

This document contains a Framework and step-by-step guidance to support the design and management of Marine Protected Area Networks.

The Framework is designed to support the development of a more ecologically representative, better-connected, and more functional network of effectively managed marine protected areas (MPAs) in Sweden. As such, the Framework also enables the evaluation of this Network. The Framework incorporates principles for how the Swedish Agency for Marine and Water Management, together with relevant coastal Country Administrative Boards (CABs), can work strategically with marine protection using an integrated approach. The Framework helps define clear objectives aimed to achieve ecological representativity, functionality, and effectiveness of the MPA Network. It is accompanied by step-by-step guidance for both designing and managing marine protected areas, and transparently lays out the main assumptions behind this guidance. It can also be of great help to Sweden in meeting the potential future ambition of protecting at least 30% of marine waters by 2030, of which 10% should be strictly protected.

The Framework and the guidance are applied in two Regional Plans, developed by representatives of the relevant CABs. The implementation of the Regional Plans will help Sweden fulfill its national and international commitments to ecologically representative, well-connected, and functional networks of marine protected areas.

The Framework acts as a reference for professionals working with marine protected areas in Sweden on the national level, the regional level, and the county level. It has been primarily developed to support the work of the CABs and the Swedish Agency for Marine and Water Management, but also the


Fotö island.
Photo: Jonas Jacobsson / Unsplash.

Swedish Environmental Protection Agency and other institutes and universities. It also serves as an example of how the Conservation Standards (CS) can be applied to the context of MPA Networks on a national, regional, and local level. Practitioners are encouraged to freely adapt this framework to fit other contexts.

The Framework and the step-by-step guidance can be used for the design and management of a single MPA or a set of MPAs, of a regional or national MPA Network, and potentially even of an international network. In this document, the Framework is described primarily on a regional level, with the aim of creating distinct regional MPA Networks. Some components, however, are the same for all regions in Sweden.

This document only represents a first attempt at a framework with the definitions, guiding principles, and methodology needed to guide MPA Network Design & Management. It will be refined over time, as it is put into practice and as learning is generated about what works and what does not.

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Background

In 2015, the Government of Sweden commissioned the Swedish Agency for Marine and Water Management first to analyse the existing MPA Network, and then develop an action plan that ensures an effectively managed, ecologically representative, well-connected, and functional network of formally protected marine areas, covering at least 10% of Swedish marine waters. This assignment demonstrates the government's recognition that while protecting a percentage of the marine waters is a good first step, further measures are needed for preserving the long-term health and resilience of the Swedish marine ecosystem.

The analysis of the existing MPA Network was completed in early 2016. It revealed, amongst other things, that the distribution and representativity of MPAs were uneven. For example, hard bottoms were deemed protected to a greater extent than soft bottoms, and shallow areas to a greater extent than deep areas. In addition, the proportion of sea area protected by MPAs in the Västerhavet marine region was considerably higher than in the two other marine regions, i.e. Egentliga Östersjön (Baltic Proper) and Bottniska viken (Gulf of Bothnia). The analysis also concluded that it was not possible to evaluate the effectiveness of the MPA Network, and that this would require a framework with clear goals and objectives and a much-improved evidence base.

Based on these conclusions, the National Action Plan for Marine Area Protection was developed during 2016. The National Action Plan contains five overall areas for action:

1. Establishment of additional MPAs
2. Strengthening of current protection, with a particular focus on additional fisheries measures
3. Establishment of a unified national framework with clear processes, definitions, and concepts, to enable planning, implementing, and management of MPAs and MPA Networks
4. Strengthening the evidence base, to provide a more solid basis for decision-making
5. Improvement of follow-up through adaptive management of MPAs.

Since 2016, much progress has been made in all five areas through different initiatives.

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One of these initiatives – set into action by the Swedish Agency for Marine and Water Management in 2017 and carried out in collaboration with the County Administrative Boards (CABs) of the Baltic Proper and Gulf of Bothnia marine regions – focuses on action area 3 as described above, but also contributes to 4 and 5. The key results of this work are (see Figure 1):

- The *National Framework for Design and Adaptive Management of MPA Networks*, hereafter referred to as the Framework. This consists of 1. working definitions of key terminology and the necessary components of the Framework; 2. a Theory of Change that provides an overall structure for the components; 3. guiding principles for developing the Framework; and 4. a step-by-step process for the design and management of an MPA Network. The Framework is national in the sense that it is intended to apply to the entire nation, and can be applied on all levels: nationally, regionally, in a single county, and in a single MPA.
- A prototype *Dashboard*, designed to enable the analysis of data and display key information for management decision-making. The Dashboard is currently accessible only to CAB and Swedish Agency for Marine and Water Management staff, and is situated in the secure IT environment of the CABs.
- *Plans for Marine Protection* for two of the three Swedish marine regions, i.e. for the Baltic Proper and the Gulf of Bothnia. These Regional Plans contain concrete objectives, goals, and priorities for action based on available data. Both these plans will be available in Swedish in 2021 through the respective CABs. Their implementation is also expected to start in 2021.

The focus of this document is the Framework and its components, with the step-by-step guidance as the centrepiece, including recommendations related to the Dashboard and the improvement of the evidence base in order to fulfill the needs of marine protection.

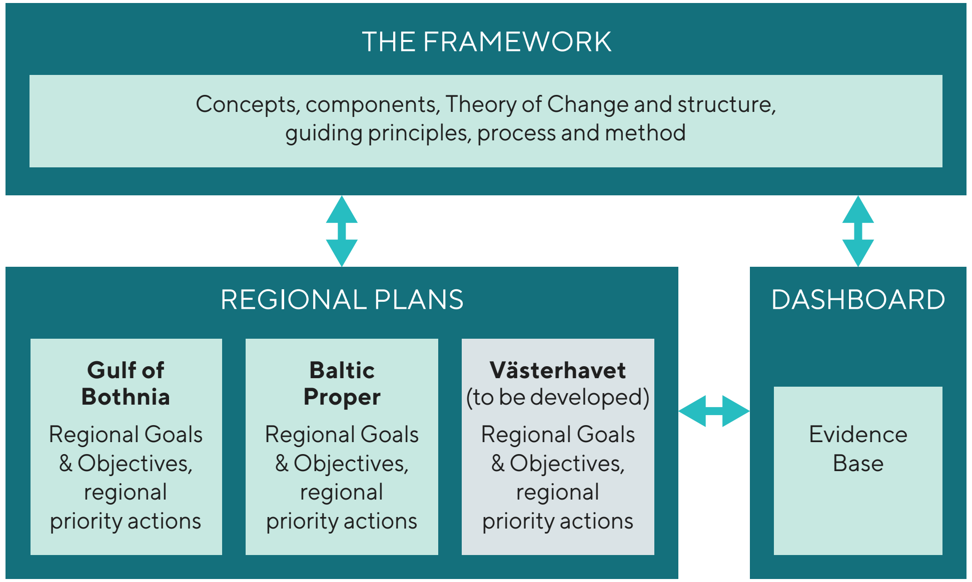

Figure 1. Key results of the work initiated by the Swedish Agency for Marine and Water Management and carried out in collaboration with coastal CABs (2017–2021). The Regional Plans build on the Framework and the evidence base, while they also contribute with feedback to strengthen and refine the Framework and the evidence base.

Note

At the time of publication of this report, there was not yet a Regional Plan for Västerhavet, the third Swedish marine region. The reason for this is that the CABs of this region emerged only in 2020 from extensive planning of an Integrated Marine Strategy for protection and management. Their direct involvement in the work above has, therefore, been limited. However, the intention is that MPA work in Västerhavet will be further aligned to the other regions over the coming years.

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How the Framework was developed

The Framework, the Dashboard, and the Regional Plans were developed in parallel and in an iterative process, so that they were continually developed and adapted based on each other (see Figure 1 on the previous page):

- The *Framework* lays down the structure, the concepts, the components, and the method for MPA Network design and management.
- The two *Regional Plans* make use of the same structure and components as the Framework, as well as of the best available data contained in the Dashboard.
- The *Dashboard*, too, builds on the same structure and components as the Framework. It contains the best available evidence and is designed to support decision-making.

The work took place in a series of co-creation workshops and involved around 60 persons, each a member of one or more of the four teams (see Figure 2):

- The *Core Team* was in charge of the overall coordination and development of the Framework.
- The two *Regional Teams*, of the Baltic Proper and the Gulf of Bothnia, were in charge of testing and using the Framework and the Dashboard in the development of the Regional Plans.
- The *Dashboard Team* was in charge of compiling the evidence base and creating a dashboard.

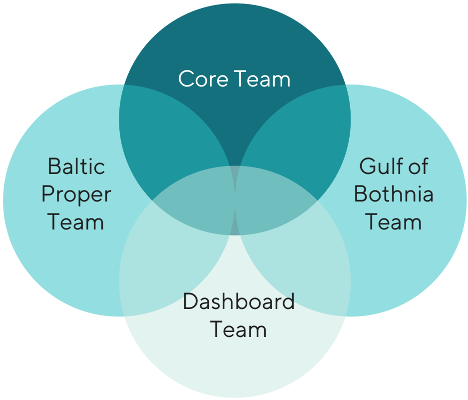

Figure 2. The four teams, working in tandem, comprised around 60 people, of which some were members of more than one team.

The teams consisted of staff from Swedish Agency for Marine and Water Management and relevant CABs, in addition to a methodological expert and overall project leader from FOS Europe and experts in dashboard design and data management (consultants). Other experts relevant to marine conservation provided support throughout the process. For more details on the process and the teams, see Annex 1.

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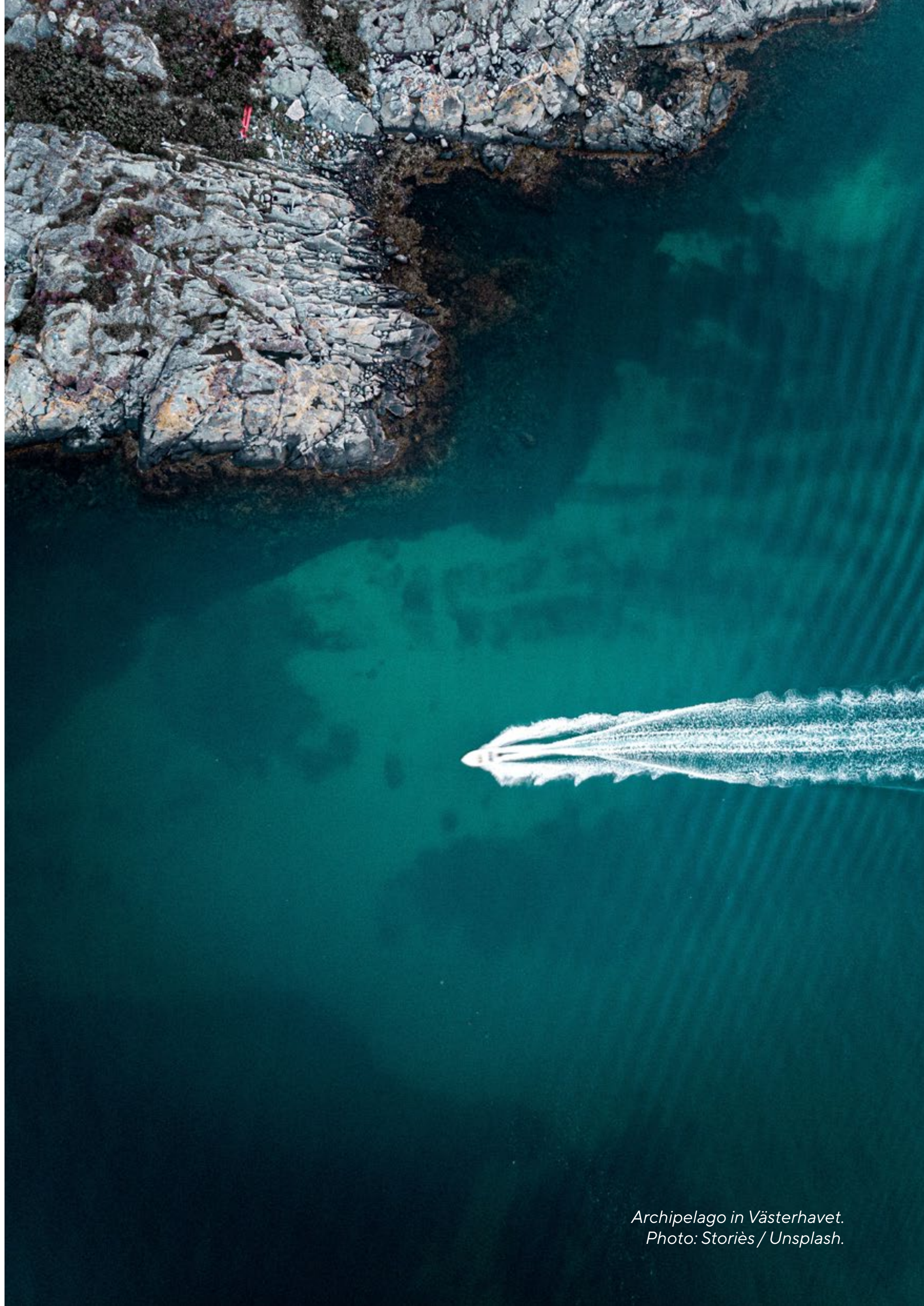
KEY DEFINITION

Conservation Standards (CS) – A common framework and set of best practices that explicitly incorporate principles of collaboration, evidence-based conservation, and adaptive management.

The Framework builds on the Open Standards for the Practice of Conservation, or Conservation Standards (CS) for short, blending its terminology and methods with others from Sweden, Europe, and elsewhere in order to optimise alignment with national and international obligations.

The Framework incorporates some of the latest international insights related to marine conservation. It also builds on the extensive experience gained from applying adaptive management in Kosterhavet National Park (from 2009 onwards), the work related to the development of Collaboration Plans for Valuable Coastal Marine Areas spanning Västernorrland, Östergötland, Blekinge, Stockholm and Norra Bohuslän (2010), and the development of the Västerhavet Integrated Marine Strategy (2014–2020).



Archipelago in Västerhavet. Photo: Storiès / Unsplash.

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How to read this document

This document makes use of the following icons:

Definitions are marked with this icon. Some definitions have been developed specifically for this Framework, whereas others have a single source or are based on several sources and adapted for the Framework. See the Glossary for information on the source of each definition.

Examples that illustrate the concepts and methodological steps are marked with this icon.

Notes, marked with this icon, contain important considerations that are not part of the steps themselves.

Part I introduces the purpose and background of the document, describes how the framework was developed and how to read the document, and lists authors and contributors.

Part II contains an overview of the Framework: definitions of central concepts, components of the Framework, the Theory of Change that underlies the Framework, and guiding principles.

In Part III, the Framework is developed into ten detailed methodology steps, i.e., guidance for how the Framework can be applied in practice. This guidance serves both as a reference during implementation and follow-up of the Swedish MPA Networks and as inspiration for other contexts. It also includes descriptions of how the methodology was applied to the Swedish marine regions during the work to develop the Framework, as well as examples to illustrate what the concepts and steps mean in practice.

This document captures the work done between late 2017 and early 2021. Some elements of the Framework are not yet fully developed. Part IV presents an overview of work in the pipeline.

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Acknowledgements and citation

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This document is also available in Swedish.

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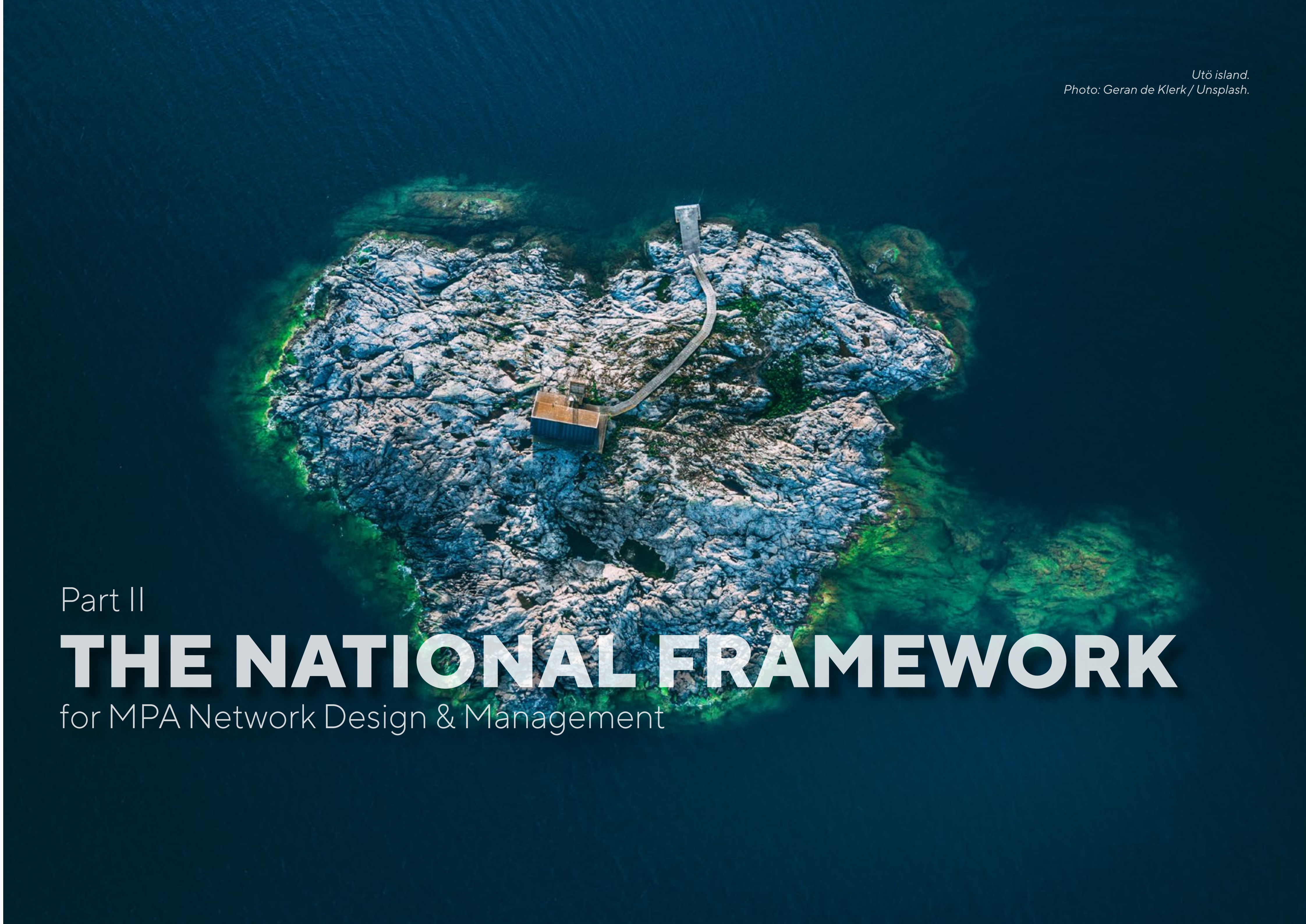

Utö island.
Photo: Geran de Klerk / Unsplash.

Part II

THE NATIONAL FRAMEWORK

for MPA Network Design & Management

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Definitions

The purpose of the Framework is to enable the design and adaptive management of an ecologically representative, well-connected, and functional network of effectively managed MPAs, covering at least 10% of Swedish marine waters.

In order to make this purpose more concrete, some key concepts and assumptions need to be defined. The resulting definitions of key terms and guiding principles described in this section were consistently applied during the development of the Framework, the Regional Plans, and the Dashboard.

The team has interpreted the key terms as presented in the box to the right (definition sources can be found in the Glossary).

Razorbills.
Photo: Lars Gezelius.

KEY DEFINITIONS

Marine protected area (MPA) – A geographically defined marine area, whose primary and clearly stated purpose is marine conservation and which is regulated and managed through legal or other effective means to achieve this purpose. In the Framework, the following legally binding designation types for MPAs are considered: 1. Marine National Park, 2. Marine Nature Reserve; 3. Marine Biotope Protection Area, and 4. Marine Natura 2000 site. These areas are designated according to the Swedish Environmental Code.

Ecological representativity – A representative MPA Network encompasses geographically well-distributed, relevant proportions of the full range of ecosystems and ecosystem components that occur in a marine region.

Connectivity – A well-connected MPA Network is characterised by the functioning exchange of individuals and genes between different ecosystems and ecosystem components. The opportunity for exchange depends on the occurrence of good quality habitats and ecosystems of relevant size, scattered throughout the seascape.

Functionality – A functional MPA Network maintains and improves the status of ecosystems, habitats, and species that it aims to protect.

Effective management – An MPA Network is effectively managed if its ecological (Nested) Targets are sufficiently protected, the negative effects of human activities are reduced, and favourable Conservation Status is achieved.

Other effective area-based conservation measures (OECMs) – Geographically defined areas other than a protected area, which are governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values.

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Components

The definitions in the previous section dictate the components needed in the Framework.

In order to ensure that an MPA Network is *functional*, it needs to be designed in such a way that its key marine habitats and species reach good health in the long term. This means that the design of the Network requires the following key components:

- a list of the habitats and species to be protected (i.e. Targets and Nested Targets), and
- definitions of what good health means for each of those habitats and species (Goals).

In order to design an *ecologically representative* MPA Network, it needs to protect the entire range of key marine habitats and species. This relies on the following key components:

- the aforementioned list of habitats and species, and
- definitions of the proportion of the occurrence of each habitat and species that should be protected by MPA legislation (Protection Objectives).

Sandemar Nature Reserve. Photo: Chrl Mlln / Pixabay.

For an MPA Network to be *well-connected*, it needs to ensure the exchange of individuals and genes between and within ecosystems. The components above contribute to the connectivity of an MPA Network, e.g. by ensuring a balanced and proportional geographic distribution of protection of habitats and species.

When it comes to the connectivity of MPA Networks, additional analyses and tools are needed for determining how a network should be designed so that exchange of individuals and genes of the target species and within and between the target habitats is fully functional. The issue of connectivity must be addressed in the future, e.g. through the processes in which the placement and size of the protected areas is discussed and decided. See Step 9.1 for preliminary guidance on considerations for connectivity when designating new MPAs, and Part IV for further discussion of future work needed.

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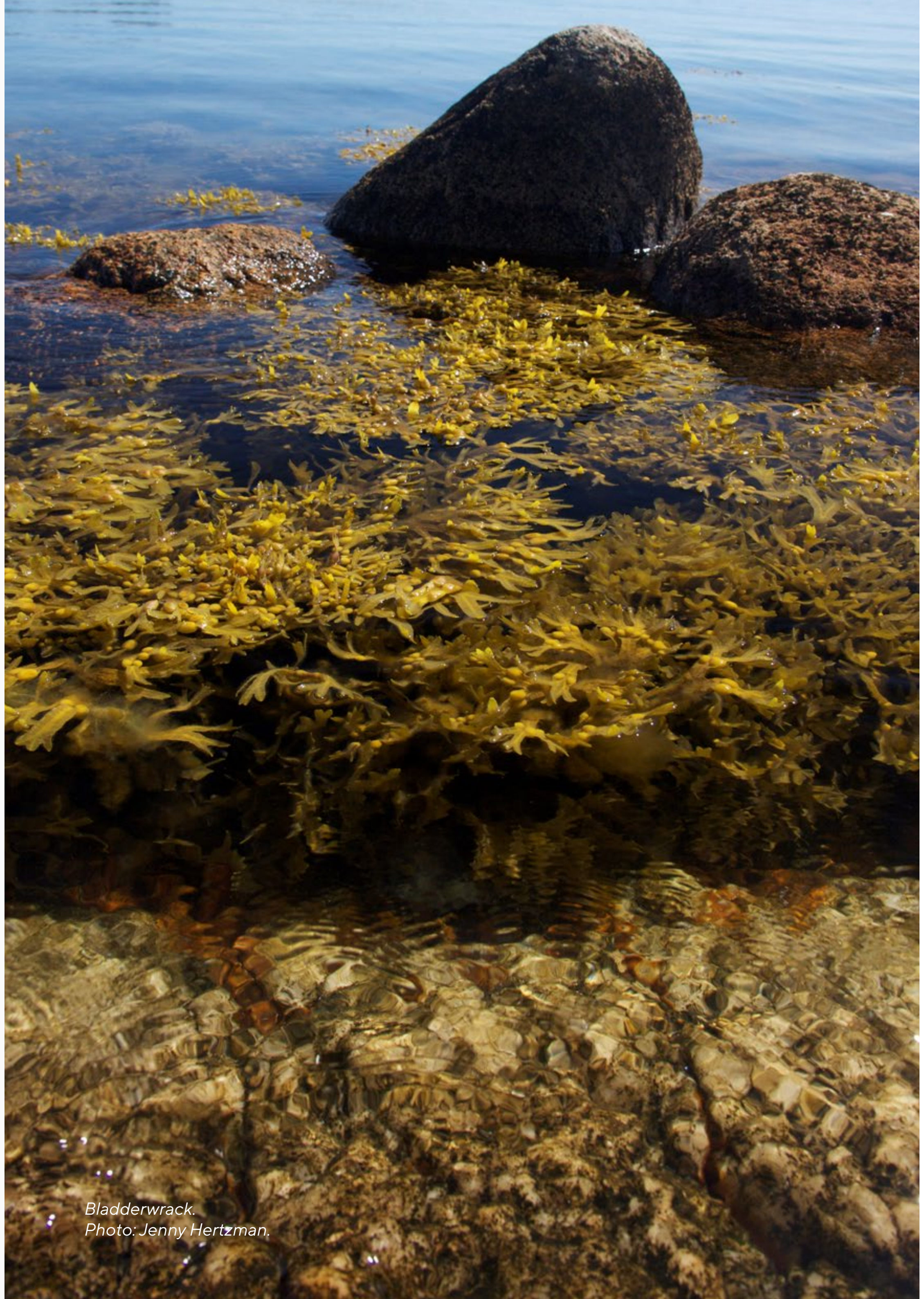

Bladderwrack.
Photo: Jenny Hertzman.

In order for an MPA Network to be *effectively managed*, the Targets need sufficient protection and the negative effects of human activities need to be reduced. Thus, effective management requires the following additional components:

- an understanding of what human activities affect the key habitats and species in a negative way, as well as how and to what degree they do so (a taxonomy of Threats and Stresses and an analysis of the sensitivity of Nested Targets to those Threats and Stresses),
- a description of the extent to which those human activities should be reduced (Threat Reduction Objectives), and
- an analysis of how those human activities should be regulated in order to achieve the desired Threat reduction (Regulation Objectives).

Effective management also entails monitoring the effects of measures taken and adjusting measures accordingly. It therefore relies on the availability of evidence on:

- the occurrence and geographic spread of Targets and Nested Targets in the marine landscape,
- current protection of Targets and Nested Targets, including where they are protected and in what proportion,
- how the Targets and Nested Targets are doing (i.e. on their Conservation Status),
- how and to what degree the (Nested) Targets are impacted by Threats,
- the occurrence of Threats within the protected areas, and
- the current regulation within the protected areas.

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Theory of Change and structure

The Framework relies on a basic Theory of Change, captured in Figure 3: Sufficient protection of enough priority ecosystems and ecosystem components in the right places leads to avoidance or reduction of harmful human activity inside MPAs. This, in turn, leads to maintaining or improving the status of the marine environment.

Please note that this rather simplified Theory of Change ignores the consequences of human activities outside MPAs, and assumes that protection is the only pathway to marine conservation. In practice, however, protection is one of various necessary measures that work in tandem under the umbrella of IMM (see Guiding principles below).

Figure 3. The simple Theory of Change of the proposed National Framework for MPA Network Design and Management.

KEY DEFINITION

Theory of Change – A series of causally linked assumptions about how a team thinks its actions will help it achieve both intermediate results and longer-term conservation and human well-being goals. A Theory of Change can be expressed in the text, diagrammatic (e.g. a results chain), or other forms.

A Theory of Change can be used to map out the resources and activities that need to be deployed in order to achieve the desired results and long-term objectives.

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Each of the key components and data needs outlined in the previous section are connected to a part of this Theory of Change (see Figure 4). For example, Regulation Objectives are a component of the protection that will presumably lead to a reduction in harmful human activity, i.e. contribute to reaching the Threat Reduction Objectives. Data and analyses connected to regulation are, in turn, key to setting and following up on Regulation Objectives.

Later in the process, the Theory of Change will also provide the structure for questions that can be used in management to assess the progress and effectiveness of the MPA Network (see Figure 17 on page 115).

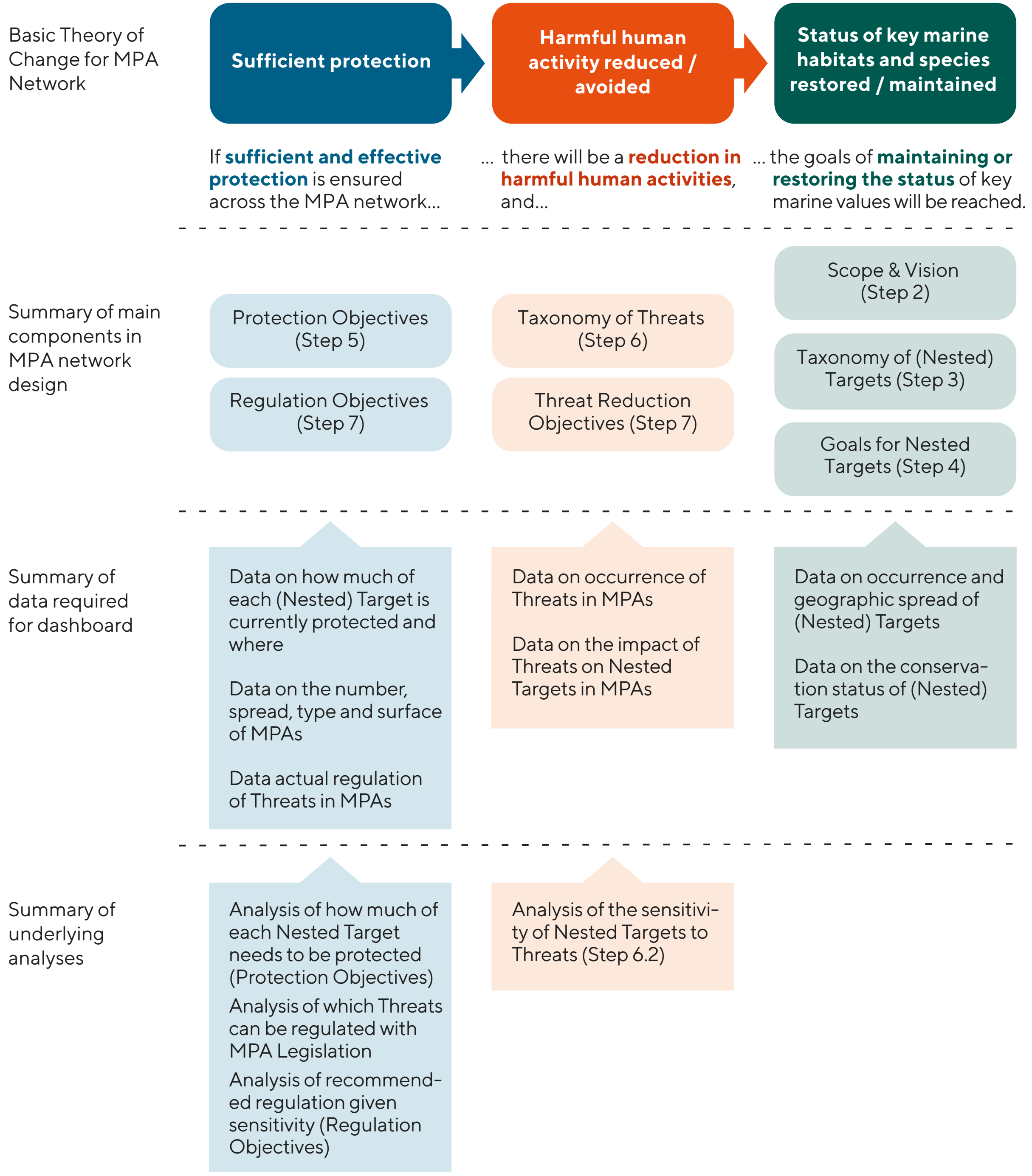

Figure 4. (right) The structure and components of the proposed National Framework for MPA Network Design and Management. The Theory of Change provides a structure for the main components of MPA Network design, the data requirements, and the key analyses. For definitions, see the Glossary or the relevant steps in Part III.

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Guiding principles

The following guiding principles were adopted for the work, and consistently applied during the development of the Framework, the Regional Plans, and the Dashboard:

Common framework facilitates adaptive management across scales: The premise is that Swedish marine area protection comprises three regional MPA Networks, and that each regional MPA Network consists of the MPAs that are geographically located in that region. The Framework and its definitions and constituent components should enable adaptive management of MPAs on all levels: on the level of an individual MPA, on the level of a particular county, on the level of a regional MPA Network, and on the national level. The standardisation of the definitions and components enables roll-up and comparison of information and monitoring of protection across scales, geographies, and jurisdictions (see Figure 5).

Integrated Marine Management (IMM): Integrated Marine Management encompasses the coordination of different (sectoral) management measures with the aim to sustain a healthy and resilient marine ecosystem, providing the basis for a sustainable blue economy. If managed in isolation, MPAs are vulnerable to the impacts of human use occurring outside MPAs, particularly overfishing, alteration and destruction of habitats (including the linkages to freshwater ecosystems), climate change, and marine pollution. It is important to understand the relationship between impact caused upstream and its consequences downstream, from source to sea, because managing the entire chain requires integrated efforts. MPAs are more effective if they are part of the larger toolbox of measures that together form the system of IMM. Alignment with other national and international processes is important to enabling IMM, in particular Marine Spatial Planning (MSP), Green Infrastructure, and work related to the EU Marine Strategy Framework Directive (MSFD) and the EU Habitats and Birds Directives.

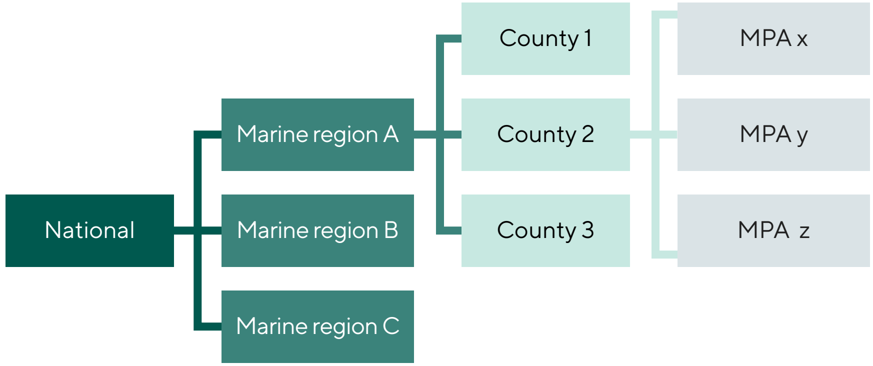

Figure 5. The Framework is applicable on all scales, enabling roll-up and comparison of information across scales.

Focus on protection inside MPAs: The design of the MPA Network focuses on the conservation and protection of a representative selection of ecosystems and ecosystem components inside MPAs. The assumption is that, if effective, the MPA Network contributes to the wider health of the marine environment. Good status of marine ecosystems and ecosystem components outside MPAs needs to be ensured through other measures.

Ecosystem-based management: The Framework is based on an ecosystem-based management approach, which means that the full array of interactions within an ecosystem is recognised, including the role of humans, rather than considering single issues, species, or ecosystem services in isolation.

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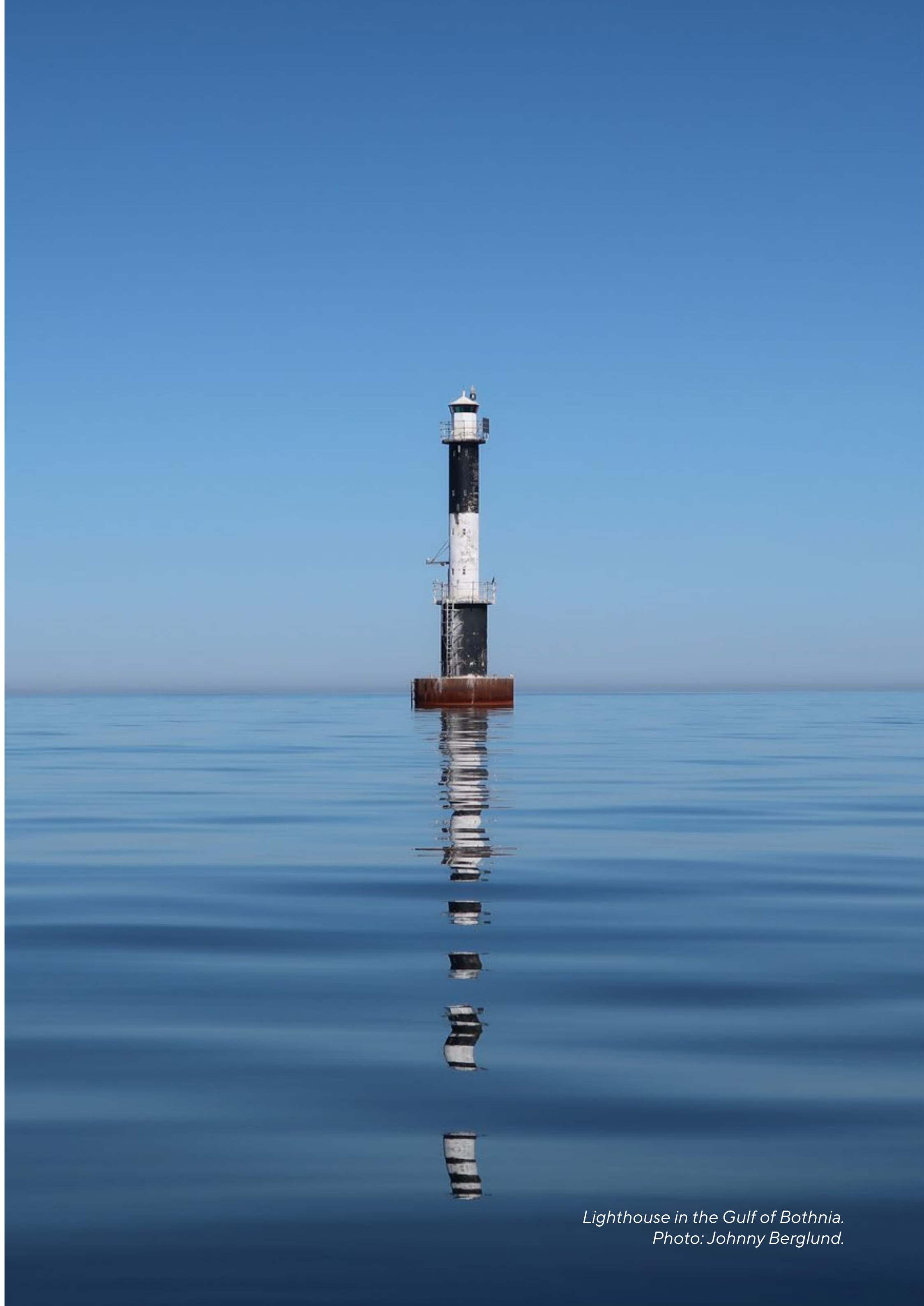
Focus on existing obligations and commitments: The Framework contributes to the possibility of delivery on existing obligations and commitments, in particular those related to the CBD (Aichi Target 11), HELCOM, OSPAR, EU Habitats and Birds Directives, EU MSFD, and the Swedish Environmental Quality Objectives as well as other national priorities. The aim is to operationalise and contribute to those commitments.

Commitment to using and improving the evidence base: Throughout the work process, the best available evidence is used, and gaps in the evidence base are noted, documented, and taken into account. However, it is not possible to wait for a complete evidence base before taking decisions on network design.

Increasing the national ambition from 10% to 30%: It is likely that the current national objective to protect at least 10% of marine waters might soon be increased to 30%, in line with the EU biodiversity strategy (30% by 2030, of which 10% strictly protected). The Framework and its components, definitions, and principles are designed to incorporate such an increase. However, the methodology, and thus the steps laid out in part III of this document, might need to be tweaked to ensure that Other Effective Conservation Measures (OECMs) – measures which are not MPAs – will fully contribute to the effectiveness of the MPA Network and help sustain and improve the health of the marine environment. Not all OECMs are tailored to conserving biodiversity only, so adjustments and interpretations might be needed in order to ensure that the OECMs fit in with the MPA work.



Lighthouse in the Gulf of Bothnia. Photo: Johnny Berglund.

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Pond water-crowfoot in an estuary. Photo: Petra Pohjola.

Part III

STEP-BY-STEP

Guidance for MPA Network Design & Management

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Overview of steps

This chapter presents step-by-step guidance for designing and managing an MPA Network. The guidance describes the method that was designed and tested during the development of the Regional Plans for the Gulf of Bothnia and the Baltic Proper, and formulates it into 10 steps.

For the sake of simplicity, the steps are presented as a linear process. However, each step has consequences both for the previous steps and the steps that follow. In practice, these steps are to be taken iteratively.

It should be noted that the Framework is designed to apply to all MPA Networks in Sweden. Some important notes in light of this:

- Many of the steps result in components that are specific to each MPA Network. Examples include the Scope, the Vision statement, the Goals, and the Protection Objectives. These components are based on the specific characteristics of each particular marine region, and are used for the management of that region's own MPA Network.
- Some of the steps result in taxonomies, such as the Taxonomy of Targets and Nested Targets and the Taxonomy of Threats and Stresses. During the development of the Regional Plans, these taxonomies were developed jointly, with the intention that they be applicable to all marine regions, all counties, and all MPAs in Sweden. In this way, the taxonomies ensure unified building blocks that allow rolling up data across scales and geographies in the whole country.
- Step 10.2 – planning the governance structure – includes considerations of governing both individual MPA Networks and several MPA Networks together.
- The remaining steps – including setting Threat Reduction and Regulation Objectives, compiling the evidence base, and setting priorities for action – are equally applicable to one or several MPA Networks as for individual counties and MPAs.

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The method (see Figure 6) begins with clarifying the purpose of the work and putting together a team to achieve that purpose (Step 1). After that, the Geographic Scope of the MPA Network is defined and a Vision is formulated to describe the desired end result (Step 2). Then, the ecological systems, habitats, and species to protect are defined, i.e. Targets and more detailed Nested Targets (Step 3). For each of the Nested Targets, its current Status is assessed and a Goal for its desired future Status is formulated (Step 4).

Once the basic definitions and aims are in place, various analyses are carried out to determine what proportion of the Targets and Nested Targets should be protected through MPAs (Protection Objectives, Step 5); in what way human activities threaten them and how sensitive they are to these Threats (Step 6); and how to regulate human activities in order to reduce the Threats (Threat Reduction & Regulation Objectives, Step 7).

Throughout these steps, information about the marine environment is needed, and therefore the evidence base should be compiled and its information made available (Step 8) in parallel with the other steps. Finally, once the MPA Network has been designed, priority actions are selected (Step 9). and preparations are made for practicing adaptive management within a suitable governance structure (Step 10).

Figure 6. (right) Step-by-step method for design and management of an MPA Network.

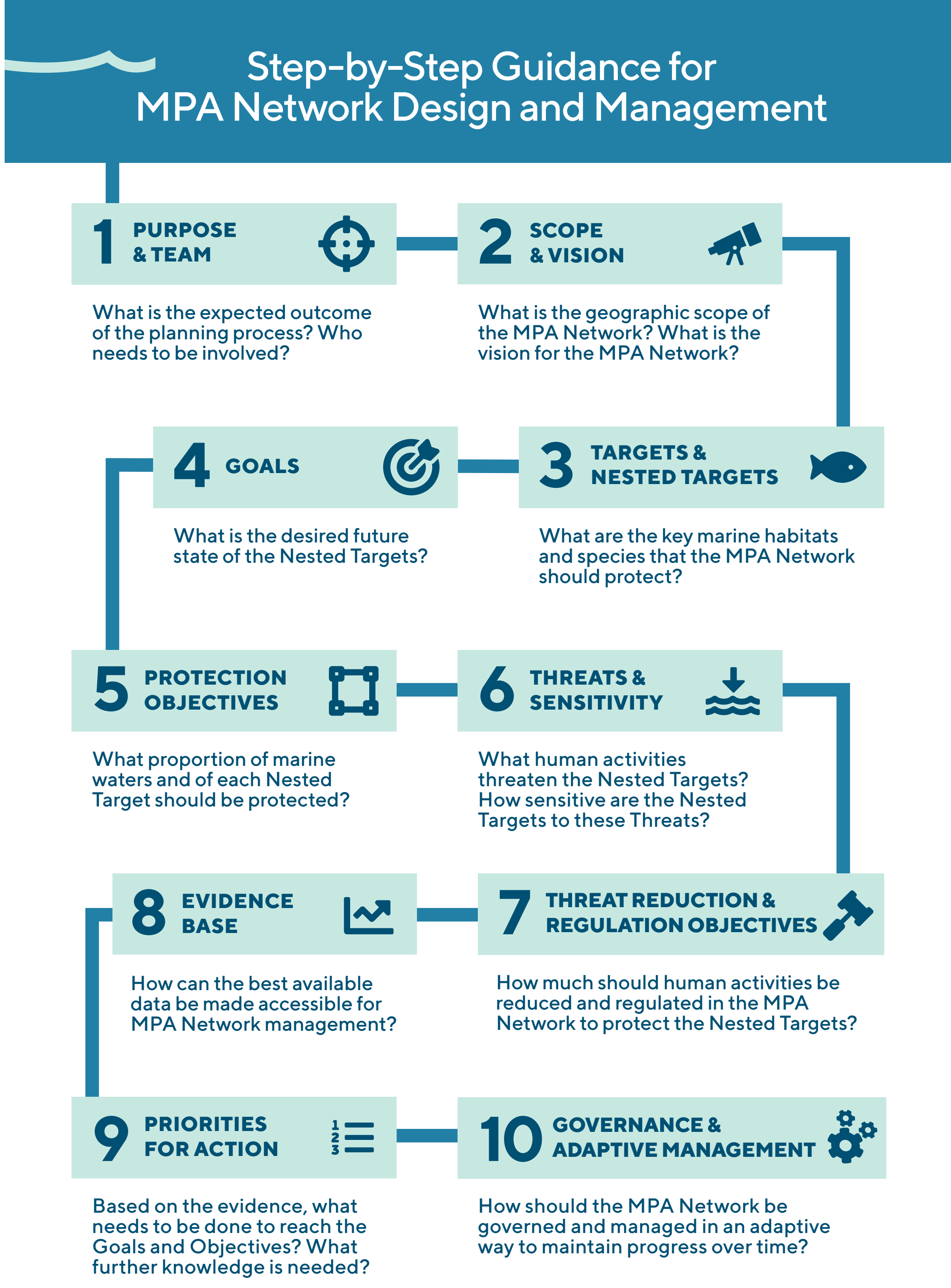

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Photo: Jon Flobrant / Unsplash.

Step 1 Forming the team and planning the process

Before starting the work, the purpose of the planning process is defined. A capable planning team with the right skills is formed, to develop a process plan and ensure continuity and participation throughout the work.

SUB-STEPS

1.1 Clarifying the purpose & forming the team

1.2 Planning the process

CONTENTS

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STEP 1.1 CLARIFYING THE PURPOSE & FORMING THE TEAM

Forming a capable team is an important first step in any planning process. In order to do this, it is worth articulating the exact purpose of the work, as well as the end product and its anticipated use. Understanding the end-use helps discuss who needs to be on the team. Revisiting the purpose during team formation can help further clarify the purpose.

The purpose of the regional planning processes in Sweden was to develop a Regional Plan for each of the MPA Networks, containing Goals, Objectives, and priority actions. Each Regional Plan will be used as a basis for adaptively managing its related MPA Network.

In view of this purpose, some important considerations regarding the team follow:

- It is crucial to ensure that those who are formally responsible for the management and designation of MPAs are represented in the team. Co-creation and shared ownership are critical for reaching the Goals and Objectives of a Regional Plan.
- There should be a clear leader, in charge of coordinating the overall planning process and moving the team forward. Ideally, (s)he has a wide knowledge of the marine region.
- There should be an expert in the Framework methodology, who can help facilitate the more technically complicated steps of the process.
- The members of the team should ideally bring expertise and skills related to
  - regional marine ecology;
  - MPA management, including operational angles;
  - national and international processes;
  - commitments with a legal basis;
  - GIS (Geographic Information Systems);
  - data and marine monitoring;
  - decision-making and governance processes; and
  - stakeholders and socio-political, economic and cultural context.
- It is important to think of experts to whom the team can turn for honest feedback and advice.
- The team composition may change over time, while focusing on the different steps in the methodology.
- It is useful to jointly agree on the role and responsibilities of each team member. It is also important to understand the amount of time that each member is able to commit to the planning process.

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In the Swedish planning process, the two Regional Teams worked in parallel to each other as well as to a Core Team and a Dashboard Team (see How the Framework was developed in Part I). As each MPA Network spans various counties, and as it is mainly the CABs that have formal responsibility for the designation and management of MPAs, it was also crucial to have key staff from coastal CABs participating in the Regional Teams. The teams were complemented by experts from institutions and universities on various topics (e.g. fisheries, connectivity, and legislation).

The parallel work of the four teams provided a mechanism for peer review. In addition, the fact that the regional leaders and process facilitators were also part of the Core Team, and some also of the Dashboard Team, helped ensure alignment and cross-fertilisation of insights between the Teams.

To give an impression of work intensity: members of the Core Team spent on average two days per week on this work over two years. The workload of all other members of the Regional Teams was much lower – around ten days per year.

STEP 1.2 PLANNING THE PROCESS

In order to achieve the purpose and to ensure participation and manage expectations of team members, a plan for the process is needed. One way of making such a plan is to use the 10 steps described in this guidance, and to analyse for each step who needs to be involved and how much time the step is likely to take. It will probably be necessary to adapt the plan to actual progress, as some steps will take more time than anticipated and others less. Also, it is difficult to plan the needed iterations in a linear way. Overall, the 10 steps can probably be done in 12 to 18 months – depending, of course, on the complexity of the MPA Network (including its governance).

The planning process for the Swedish Regional Plans spanned from late 2017 to early 2021. It should be noted that the work started without knowledge of all the steps that would be needed, and without having a tailored methodology to guide us. Some of the more complicated steps, such as finding consensus on Swedish taxonomies and synthesising marine data from different sources and of varying quality, took considerable time. This made it hard to plan and required flexibility and perseverance from all involved.

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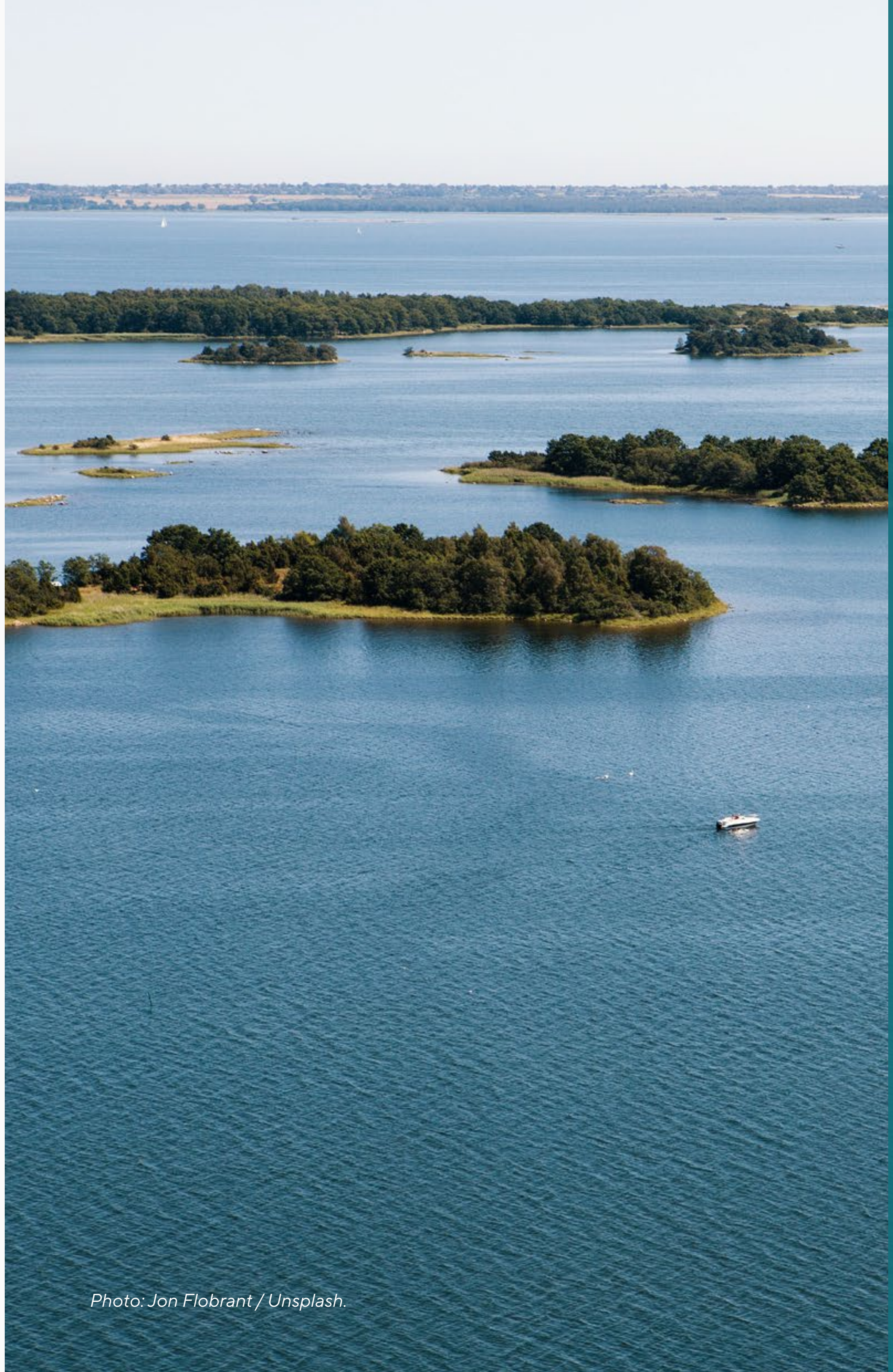

Photo: Jon Flobrant / Unsplash.

Step 2 Defining the Scope and the Vision

In order to delineate the work towards the purpose outlined in Step 1, the geographical boundaries of the MPA Network are made explicit. A vision statement is formulated that outlines the end state that the work strives to achieve.

SUB-STEPS

2.1 Defining the Scope
2.2 Defining the Vision

KEY DEFINITIONS

Geographic Scope – The spatial demarcation of a conservation initiative. It is determined by distinct biological features, ecosystem types and functions, the similarity of occurring Threats, and administrative areas.

Vision Statement – A description of the desired state or ultimate condition that a project is working to achieve. A complete vision can include a description of the biodiversity of the site and/or a map of the project area, as well as a summary vision statement. It should be 1. relatively general, i.e. defined broadly enough to encompass all project activities; 2. inspirational in outlining the desired change in the Targets; and 3. simple and concise so that all participants can remember it.

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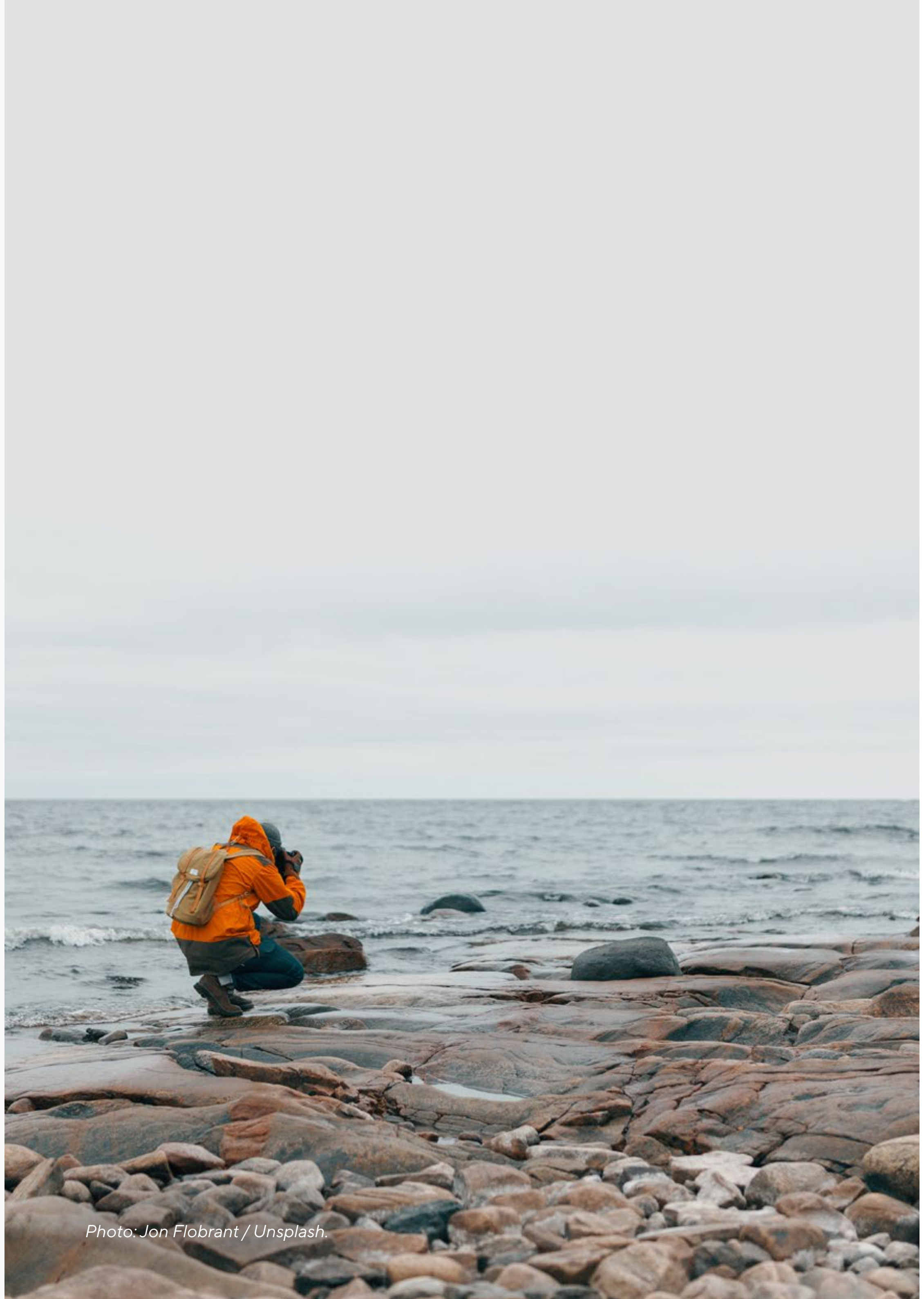

Photo: Jon Flobrant / Unsplash.

STEP 2.1 DEFINING THE SCOPE

To determine the Scope in which each distinct MPA Network functions, the logic used in the Swedish Marine Spatial Planning (MSP) process is applied, dividing Swedish marine waters into three regions and defining their boundaries. Each marine region forms the Scope of its own MPA Network.

The marine regions each cover a distinct proportion of Swedish waters, and they differ somewhat from each other in terms of ecosystem structures and functions (related to differences in, e.g., salinity and climate) and the occurrence of Threats. Each region spans the area from the shoreline, as defined by the Swedish Land Survey, to the outer borders of Sweden's exclusive economic zone (EEZ). The marine regions exclude beaches and terrestrial parts, but include skerries and islets, as they are key areas for nesting marine birds and resting seals.

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The marine regions (see Figure 7):

- *Västerhavet* is located along the western coast of Sweden in the Skagerrak/Kattegat area, which is part of the North Sea. The nearly oceanic conditions make it the most biodiverse of the three regions. The region is home to Sweden's two largest ports, and hence suffers from intense shipping. It is also under pressure from tourism activities. The area is essential for fish and shellfish trade, and is under pressure from commercial fishing. Marine litter is a problem, mainly due to winds and currents.

- *The Baltic Proper* is located along the southern and southeastern coast of Sweden in the Baltic Sea and includes Öresund. The Baltic Proper is less saline compared to Västerhavet. It is under pressure from recreation and tourism, shipping and commercial fishing, coastal exploitation, and eutrophication.

- *The Gulf of Bothnia* is situated along the northeastern coast of Sweden. The low salinity affects the occurrence of species. The seasonal ice is an important factor for the function of the ecosystem. Land uplift alters the near-shore areas, affecting species and biotopes. Furthermore, this reduction in depth encourages dredging. There is commercial fishing in the region. Toxin levels resulting from a long industrial history in the watershed are high. Shipping is mainly connected to mining and forestry.

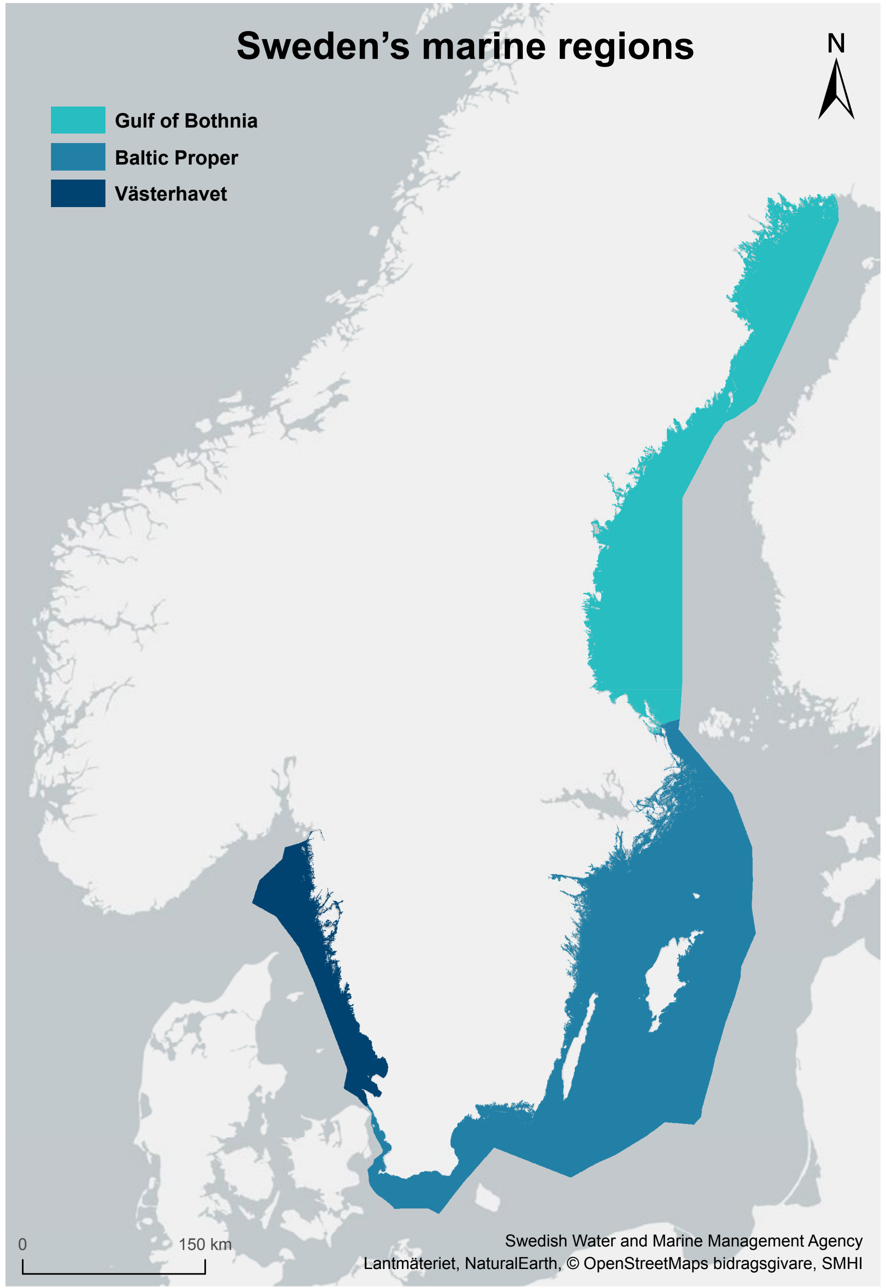

Figure 7. The three marine regions in Sweden.

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STEP 2.2 DEFINING THE VISION

In addition to defining the Scope for each MPA Network, its Vision Statement is formulated. Finding a shared Vision is an important process step that helps unite everyone involved.

In the Swedish planning process, each Regional Team developed its own distinct Vision Statement, to serve as a guiding light for the design of their MPA Network. In this way, the Regional Teams could tailor their specific Vision to express their combined ambition using language that speaks to them and instils ownership and responsibility.

In addition to the regional Vision Statements, a national-level Vision Statement is developed to guide the national ambition for marine protected areas.

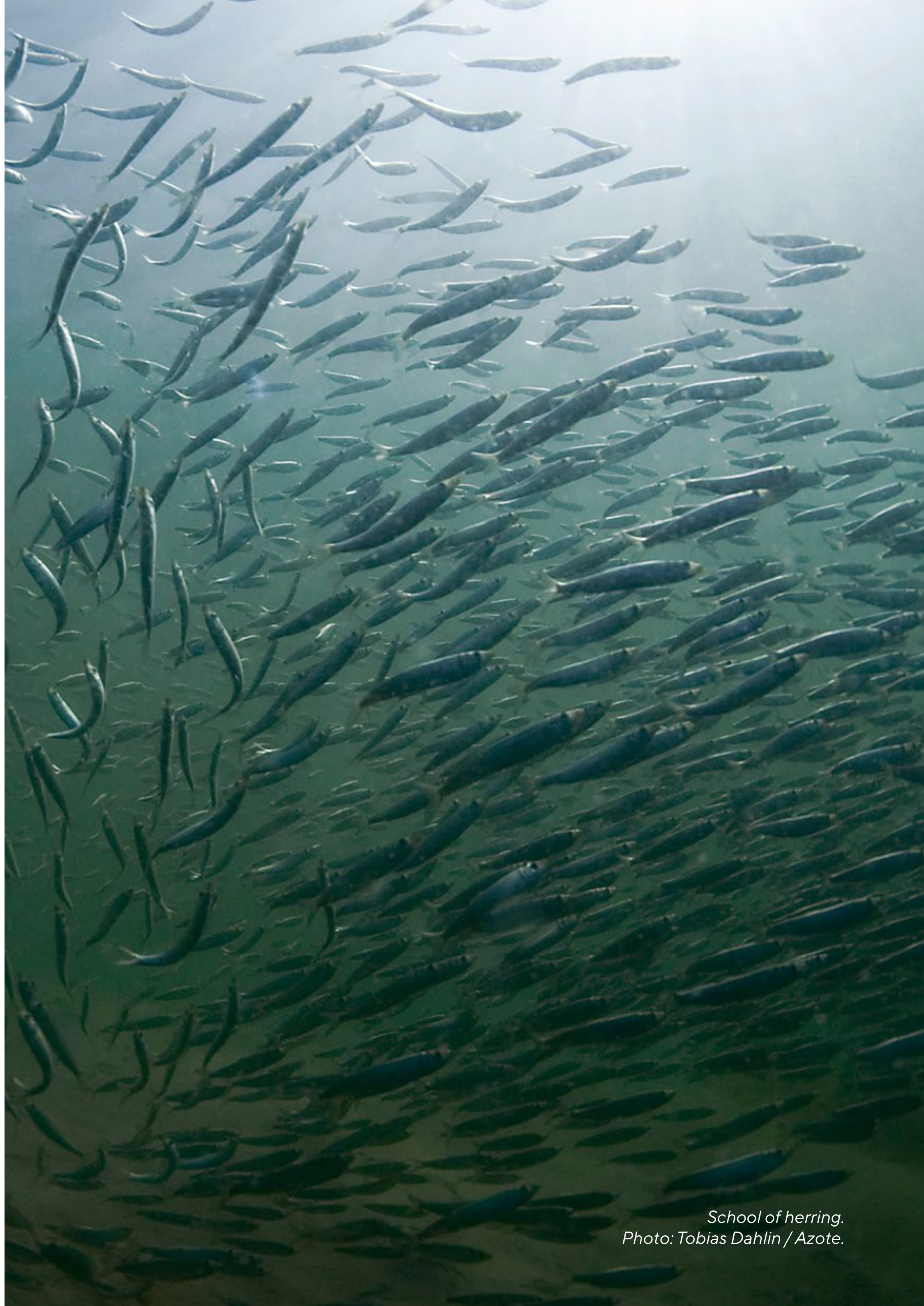
Examples

The Vision Statement for the Gulf of Bothnia:

An ecologically representative, well-connected, and functional network of effectively managed MPAs, covering at least 10% of the Gulf of Bothnia, ensures the preservation of all living creatures and biological features for the enjoyment of current and future generations.

The overall Vision Statement for MPA Networks in Sweden:

Our three ecologically representative, well-connected, and functional networks of effectively managed MPAs, covering at least 10% of the Swedish marine waters, form the keystone of a healthy Swedish sea for current and future generations.



School of herring.
Photo: Tobias Dahlin / Azote.

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Caspian terns on Röskär in Östergötland. One of the five Targets is areas of particular importance to marine mammals and seabirds. Photo: Lars Gezelius.

Step 3 Defining Conservation Targets

To achieve the Vision, ecological systems, habitats, and/or specific species need to be protected within the Scope. In order to select what to protect, a 'coarse filter/fine filter' logic is applied: First, a high-level definition is made of the types of spatial units (Targets) within which particular ecosystems and ecosystem components occur. For each of these, a more detailed selection is then made of the main ecosystems and ecosystem components to protect (Nested Targets).

Reaching agreement on one final taxonomy of Targets and Nested Targets can be a cumbersome process, but it is crucial, because much of the design of the MPA Network is anchored in this list. Notably, concrete Protection Objectives (see Step 5) are set for each Nested Target, and by evaluating the extent to which these Protection Objectives are reached, an assessment can be made of the ecological representativity of the MPA Network and the effectiveness of its management. In addition, the Status of Nested Targets serves as a measure of the functionality of the MPA Network.

SUB-STEPS

3.1 Identifying Targets
3.2 Identifying Nested Targets

KEY DEFINITION

Targets & Nested Targets – Ecological systems/habitats and specific species that were chosen to represent and encompass the full suite of biodiversity in the selected geographic Scope. Conservation of the Targets should, in theory, ensure the conservation of all ecosystems and species within the Scope.

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STEP 3.1 DEFINING TARGETS

First, to create the taxonomy of habitats and species to protect in the Swedish marine waters, the overall Targets are determined, by combining depth (shallow or deep) with substrate (soft or hard bottoms). *Shallow* is defined as the photic zone (to approximately 20 meters depth) and *deep* as the aphotic zone (below approximately 20 meters). Further, *soft bottoms* are defined as areas mainly covered with fine grain sediments, mud, sand, and pebbles, whereas *hard bottoms* are areas covered with boulders, rock, hard clay, or artificial substrate.

Recognising that the substrate can be a mosaic of hard and soft substrates, and therefore difficult to classify, the general rule is that if one type dominates within an area, then it will normally be classified as such. For example, if soft bottom constitutes more than 50% of an area, the entire area will be classified as soft bottom. In practice, it is sometimes difficult to differentiate between soft and hard bottoms, as the distinction depends mainly on the resolution of available data.

In addition to the four Targets connected to depth and substrate, an additional Target is needed for areas of particular importance, e.g. areas that have significance for seabirds and marine mammals.

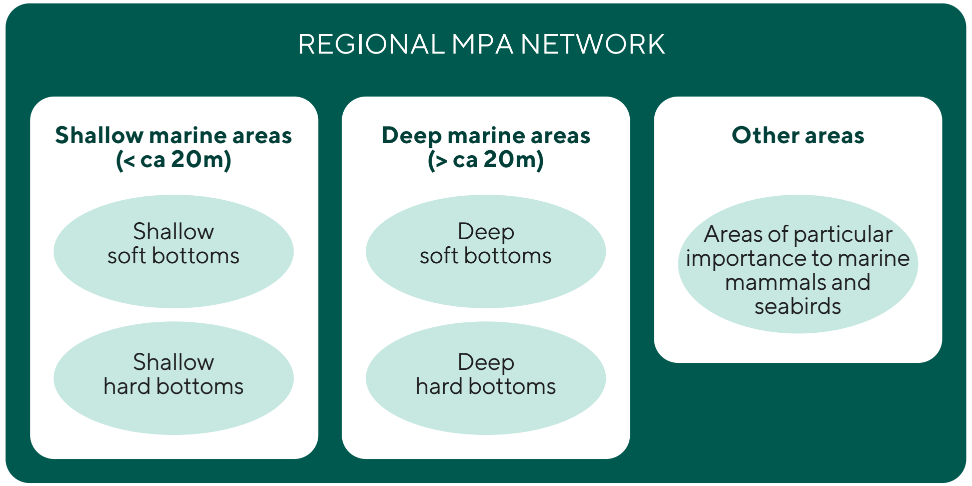

Figure 8. The five high-level Targets of the Swedish MPA Networks.

This set of five Targets (see Figure 8) provides a practical basis for identification of Nested Targets. This is particularly so because:

- the Targets easily correlate with the occurrence of typical ecosystems and ecosystem components, while there is minimal overlap between Targets;
- there is bathymetric data on the occurrence and spread of Targets; and
- the Targets are in line with the logic used in the EU MSFD, the EU Habitats and Birds Directives, and Green Infrastructure, providing as much alignment as possible with existing frameworks and taxonomies.

These Targets are also relevant to all three marine regions in Sweden, ensuring consistency across all three MPA Networks.

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STEP 3.2 DEFINING NESTED TARGETS

Once the Targets are set, the taxonomy is completed by identifying Nested Targets. Jointly agreeing on a limited list of Nested Targets is complicated and takes quite some discussion. There are many different lists of marine ecosystems and ecosystem components relevant to Sweden. Each of these lists follows a distinct logic and terminology, and all are valid.

The following guiding principles have been applied during the selection of Nested Targets, to keep the process manageable and to align with existing legislation and priorities:

Based on existing priorities: The selection is based on European, regional, and national lists of prioritised ecosystems and ecosystem components, in particular, habitats and areas critical to species:

- that Sweden is legally obliged to protect through the EU Birds and Habitats directives);
- that Sweden has committed to protect under the regional seas conventions (i.e. HELCOM and OSPAR);
- that are critical to species that are threatened in the respective marine regions;
- that are endemic or threatened in Sweden;
- that are considered keystone, i.e. critical for ecosystem functioning and ecological representativity.

Fulfill legal commitments to the greatest possible extent: An ecosystem or ecosystem component might appear on different lists under different names. In principle, the names of habitats and species are as listed in the EU Birds and Habitats Directives (linked to Natura 2000 areas). For the names of Nested Targets not covered by the EU Directives, the classifications related to regional conventions (HELCOM for the Baltic Sea and OSPAR for the North Sea) are used. Lastly, for Nested Targets of national importance covered by neither the EU Directives nor the Regional Classifications, the names used in national lists are adhered to. See Figure 9. Note that OSPAR is not yet represented in these principles, as the process of designing the MPA Networks to date has focused only on the two marine regions in the Baltic Sea. The process also includes areas important for those marine birds on the HELCOM Red List whose breeding, foraging, and resting habitats are in the ocean (including islands and skerries).

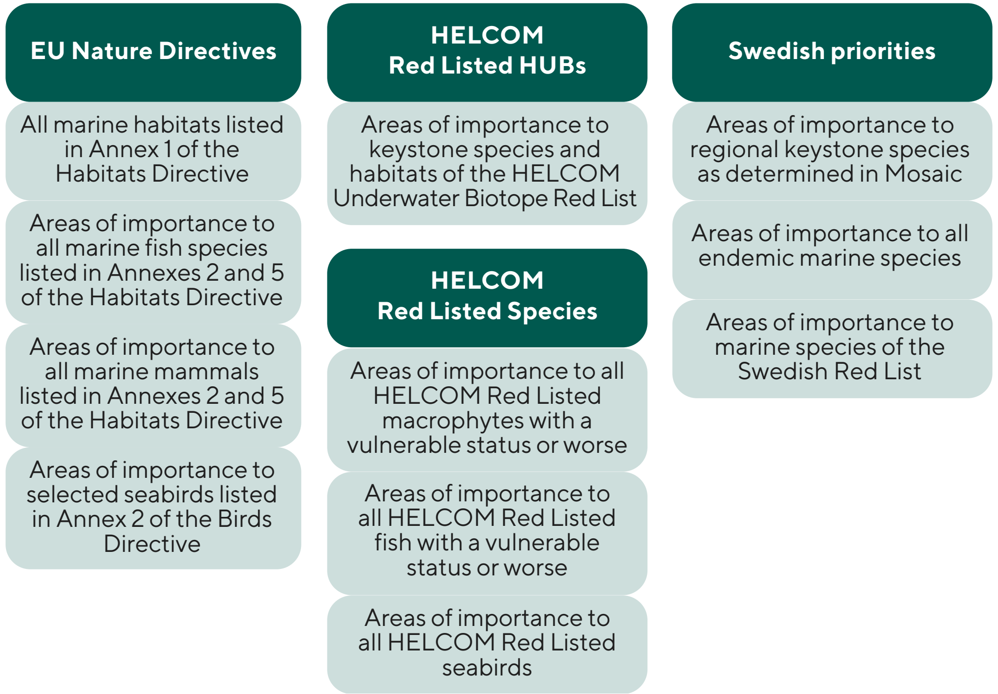

Figure 9. Summary of principles for selecting Nested Targets.

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Limiting to 50: The aim of the Framework is to help practically define, monitor, and manage effective regional MPA Networks. High numbers of Nested Targets can result in overwhelming and unmanageable projects with an unreasonable demand for monitoring and producing management information. In this case, to ensure simplicity and practicality, an arbitrary maximum of 50 Nested Targets has been set.

Species are part of ecosystems: The assumption is that by protecting a habitat or ecosystem, its constituent components are also protected. Therefore, most Nested Targets are habitats or ecosystems. A species is only allowed to become a separate Nested Target if it requires additional attention and protection beyond the protection of the habitat it depends on. If a habitat or ecosystem (a Nested Target) is of high importance to a particular species that occurs on a red list, then this is taken into consideration when setting the Protection Objective for that particular Nested Target (see Step 5.2).

The final list of Nested Targets is envisaged to be applicable to all three MPA Networks and to be relevant on a national level, though not all Nested Targets occur in all three marine regions. For application in the Västerhavet region, the list might need to be completed with habitats and ecosystem components that are relevant to OSPAR.

An illustration of the Targets and some Nested Targets can be found in Figure 10 on the next spread.

More details

- Annex 2: Description of Nested Targets in Sweden
- The taxonomy of Targets and Nested Targets can be found in Annex 3: Generic Goals for Nested Targets.

Eelgrass (Nested Target) on shallow soft bottom (Target). Photo: Kustvattengruppen / Linnaeus University.

Example

One of the identified Nested Targets is eelgrass beds. Eelgrass is an important key species that creates species-rich habitats on shallow soft bottoms (a Target), where it can form vast meadows and provide habitat for many fish and invertebrates, as well as effectively counteract erosion. The meadows also take up nutrients and carbon, helping to reduce the effect of both eutrophication and climate change. They thus have a key role in Swedish marine waters, although they occur in only two out of three marine regions: their distribution area extends to the southern border of the Gulf of Bothnia.

Eelgrass habitats are categorised as Near Threatened in the HELCOM red list and as Vulnerable in the Swedish red list (2020). There is also a national action plan for eelgrass.

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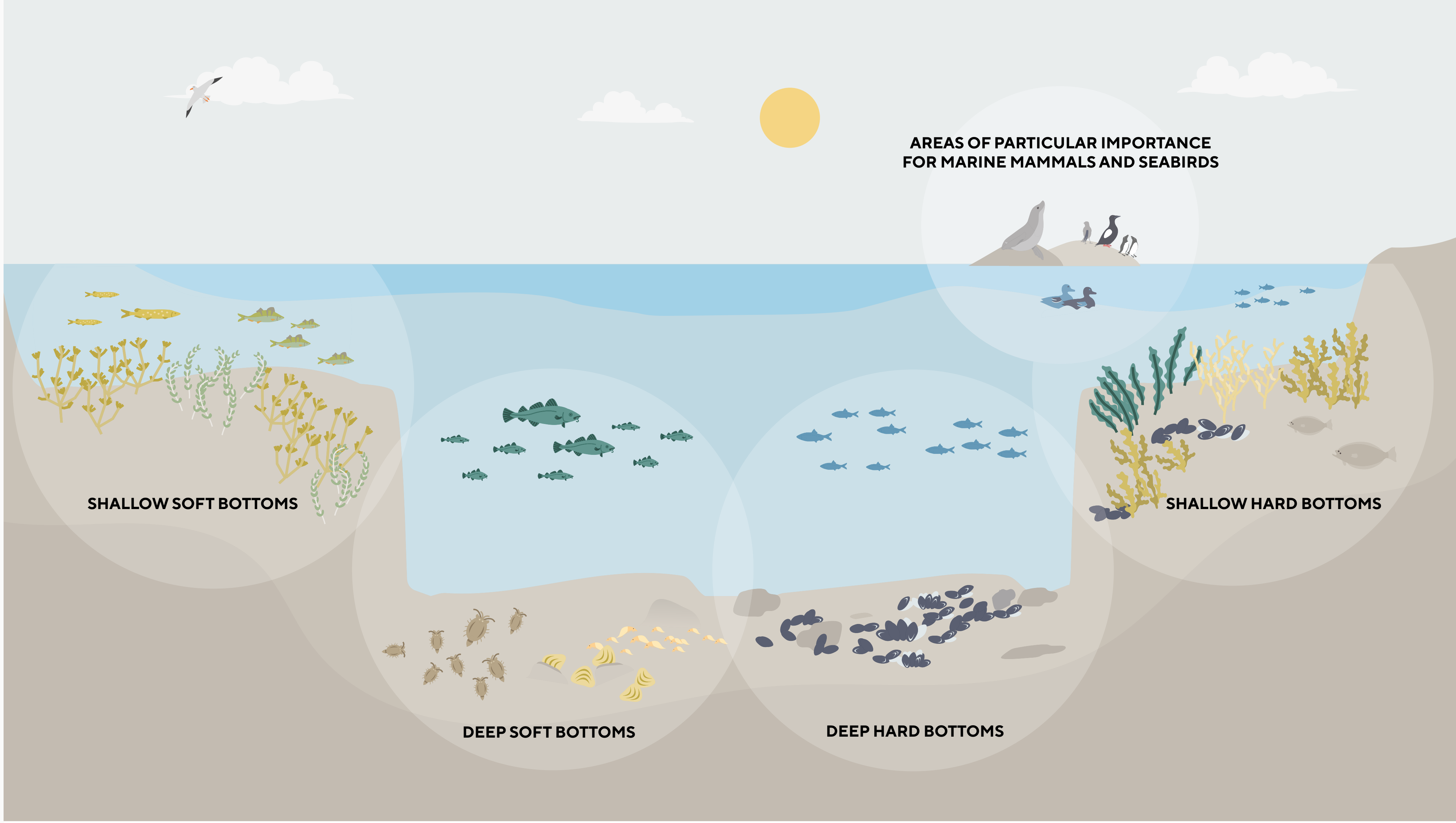
Figure 10. Illustration of the Targets, with examples of Nested Targets within each Target.



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Long-tailed ducks.
Photo: Tomas Järnetun / N.

Step 4 Assessing the Status and setting Goals

In order to focus efforts and track the progress on protecting the Targets and Nested Targets, an assessment of the current situation and a clear definition of the long-term aim are needed. Thus, for each Nested Target an assessment of its current Status is made, and its desired future Status, i.e. the Goal, is defined in a form that applies to the entire MPA Network. On a more local level (i.e. on the level of a county or individual MPA), more concrete Goals are useful.

Understanding the Status of Nested Targets is crucial for assessing the functionality of the MPA Network. Goals, on the other hand, are important tools for assessing the effectiveness of protection. If the Goal for a particular Nested Target is not met for the MPA Network, analyses of Goals on the level of county and MPA can help prioritise specific local actions (see Step 9 Defining Priority Actions).

SUB-STEPS

4.1 Assessing the Status of Nested Targets
4.2 Setting Goals for Nested Targets

KEY DEFINITIONS

Goal – A formal statement detailing a project's desired impact, such as the desired future Status of a (Nested) Target. A good Goal meets the criteria of being *specific*, *measurable*, *achievable*, *results-oriented* and *time-limited* (SMART).

Conservation Status (or Status) – The overall health of a Nested Target. Ideally, the Conservation Status also expresses the development of the Status over time, in order to convey the trend.

Key Attribute – An aspect of a (Nested) Target's biology or ecology that, if present, defines a healthy (Nested) Target and, if missing or altered, would lead to the outright loss or extreme degradation of that Target over time.

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STEP 4.1 ASSESSING THE STATUS OF NESTED TARGETS

To set Goals, good knowledge of the current Conservation Status of each Nested Target in the MPA Network would ideally be available. At the most basic level, this would involve using available evidence to develop an overall assessment of the Status of the Nested Targets. More detailed Status assessments would involve specifying key attributes of each Nested Target, determining indicators for each attribute, and outlining the acceptable range of variation for each indicator. Finally, the current Status (i.e. baseline value or trend) of the attribute would be determined in reference to this range of variation.

Attributes related to range, structure, and function are often used when assessing the Conservation Status of a Nested Target. If these are optimal (i.e. judged to be within the natural range of variation), a species or habitat is said to have Favourable Conservation Status (FCS). Many protection conventions and agreements make use of this concept, or a similar one, to assess the status of habitats and species. Therefore, applying the same concept in this Framework makes it possible to compile status information from existing assessments and reports (e.g. IUCN and HELCOM status reports). Most importantly, achieving FCS is the explicit aim of the EU Habitats Directive, and hence the term has legal implications for all species and habitats in that Directive. Using the term thus helps focus marine protection on existing obligations. The term has no legal basis for the Nested Targets not listed in the Habitats Directive.

According to the European Commission, a *habitat* is considered to have FCS if

- its natural range and the areas it covers within that range are stable or increasing;
- the quality of the habitat is stable, i.e. the species structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- the Conservation Status of its typical species is favourable.

Similarly, a *species* is considered to have FCS if

- population dynamics data for the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- the natural range of the species is not being reduced in the foreseeable future; and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

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Hippuris tetraphylla *(Nested Target) on shallow soft bottom (Target). Photo: Johnny Berglund.*

To date, no list of standardised indicators for each Nested Target has been developed and agreed on. Such standardised indicators and related data would be crucial for enabling the flow of information across scales and geographies. Standardising indicators and Status data requires substantial work, which is expected to take place over the course of the coming years. Even when an agreed monitoring framework is in place, it could take several more years before enough data will have emerged.

Instead, regional experts chose from a range of existing rating scales during the various workshops (2017–2021), and opted for a four-category rating of Conservation Status (Very Good, Good, Fair, or Poor). Further harmonisation with EU rating scales might support reporting in the future. The regional experts used the categories for expressing the status of the Nested Targets, basing their judgement on the best available evidence combined with their own knowledge.

It is essential to realise that the quality and availability of existing data for the marine environment is poor. Often, the scope of status reports does not fully match the Scope of the relevant MPA Network or the identified Nested Targets. Also, status reports often show the general status of a Nested Target in a larger area – e.g. in the reporting for article 17 of the Habitats directive, the assessment is made per biogeographical area (marine Baltic and marine Atlantic region). In addition, most reports do not distinguish between status in protected areas and status in unprotected areas. Ideally, Conservation Status is rated at a local scale, distinguishes between protected and unprotected areas, and is based on data sourced from counties and relevant MPAs.

More details
For information on the compilation of existing data related to the occurrence and Conservation Status of Targets and Nested Targets, please refer to Step 8 Compiling the Evidence Base.

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STEP 4.2 SETTING GOALS FOR NESTED TARGETS

Ideally, once an estimation of the Conservation Status of the Nested Targets has been made, a SMART Goal would be formulated for each of them. A SMART Goal is:

- *Specific* – clearly defined so that all people involved in the work have the same understanding of what the terms in the goal or objective mean;
- *Measurable* – definable in relation to some standard scale (numbers, percentage, fractions, or all/nothing states);
- *Achievable* – practical and appropriate within the context of the marine region, and in light of the political, social, and financial context;
- *Results-oriented* – represents necessary changes in Target condition, Threat reduction, or other key expected results; and
- *Time-limited* – achievable within a specific period of time.

In the absence of precise indicators and solid data, the Goal formulation must be more generic, and applicable to all Nested Targets: '*The Conservation Status of [Nested Target] within MPAs is stable, and a growing proportion has Favourable Conservation Status (FCS).*' In addition to applying to each MPA Network, this generic Goal is in principle functional on all other levels (national and county level as well as the level of individual MPAs; see Figure 11).

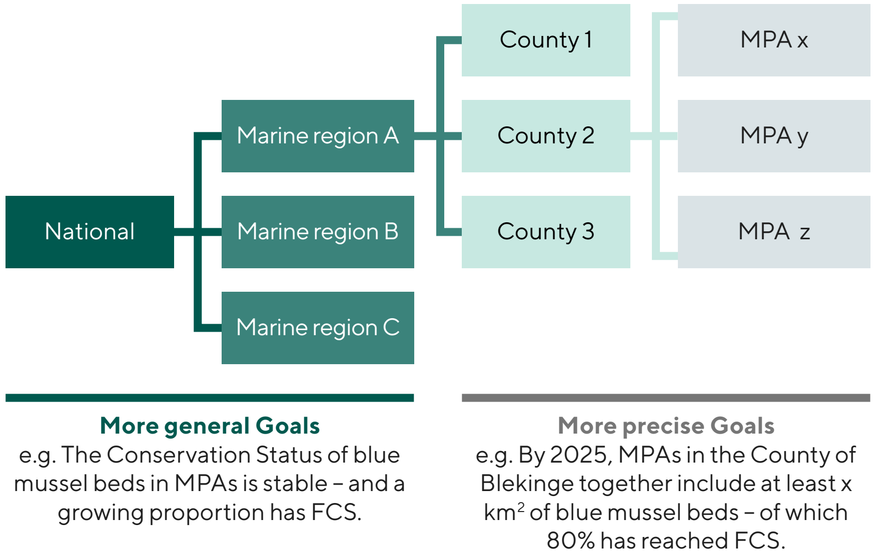

Figure 11. Goals on different levels require different levels of precision. Goals for an individual MPA are more detailed than for an MPA Network. A similar logic can be seen to apply to how international Goals link to national ones.

This Goal formulation means that the ultimate measure of success for the MPA Network is the Conservation Status of the Nested Targets. In particular, the Goal entails that their range, structure, and function do not show a negative trend and that the proportion of the Nested Targets that is doing well (expressed, for example, in the number of MPAs or square kilometres) is increasing.

For adaptive management, it is crucial to be as specific as possible, and it is highly recommended to formulate more precise Goals whenever feasible (see Figure 11). This will likely be easier

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on the level of counties and even for individual MPAs. These more precise Goals can be seen as milestones towards the overall MPA Network Goals.

More details

- For information on the compilation of existing data related to the occurrence and Conservation Status of Targets and Nested Targets, please refer to Step 8 Compiling the Evidence Base.
- Annex 3: Generic Goals for Nested Targets

Example

The following overall Goal is defined for eelgrass beds in shallow soft bottoms: 'The Conservation Status of eelgrass beds in MPAs is stable and a growing proportion has Favourable Conservation Status.'

Eelgrass beds are currently classified as Near Threatened by HELCOM and as Vulnerable by the Swedish Red List. Using this information and adding their own knowledge of the Conservation Status of eelgrass in the regions, experts rate it at Fair Status in the Baltic Proper. Eelgrass does not occur in the Gulf of Bothnia.

Common guillemot. One of the five Targets is areas of particular importance to marine mammals and seabirds. Photo: Ingrid Nordemar.

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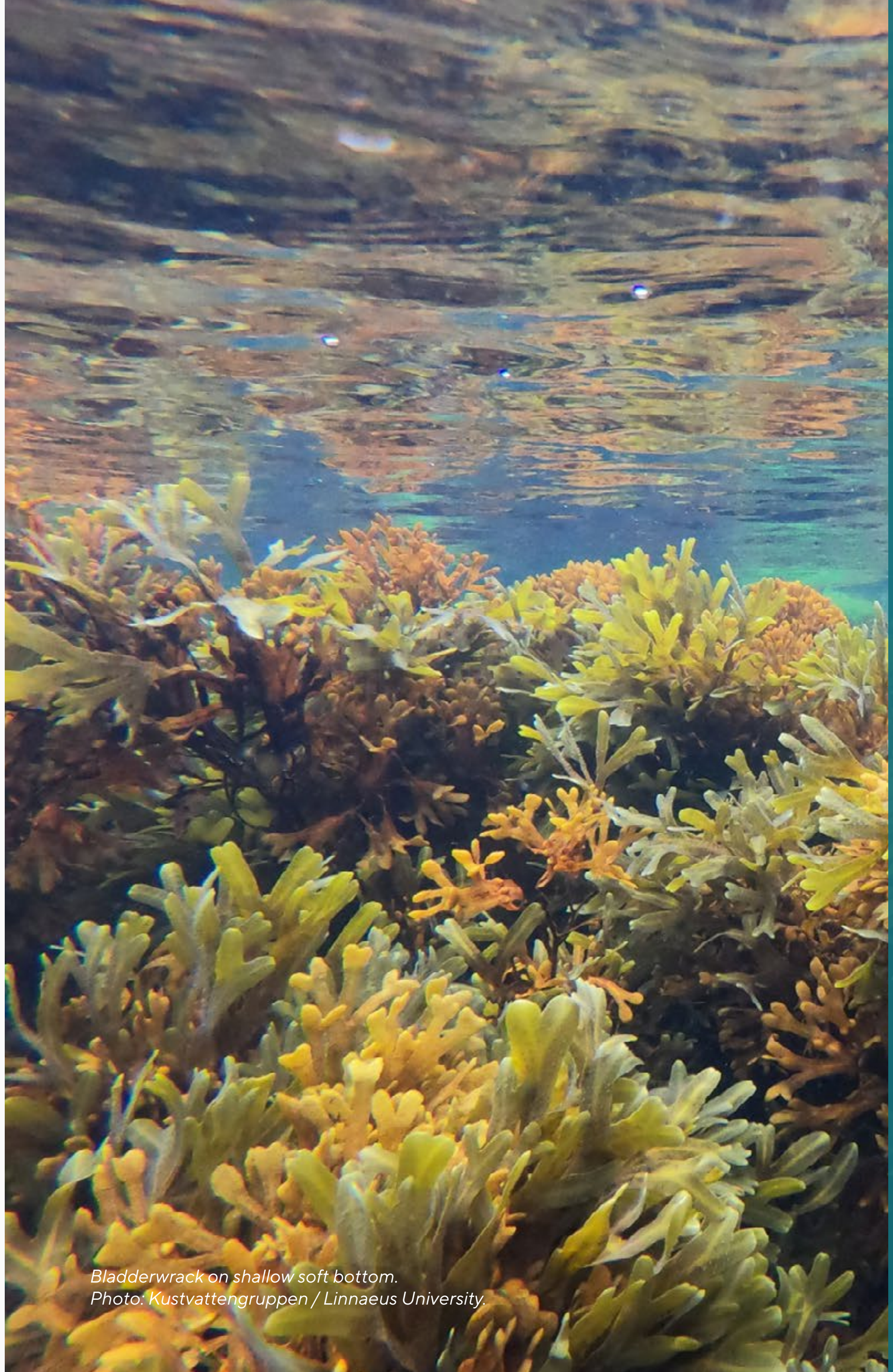

Bladderwrack on shallow soft bottom.
Photo: Kustvattengruppen / Linnaeus University.

Step 5 Formulating Protection Objectives

Now that it is clear what to protect (Nested Targets) and what the Goal is of that protection, it is possible to determine how much of marine waters in general, and how much of each Nested Target in particular, should be protected.

Two complementary types of Protection Objective are used: The general 10% PO for national- and regional-level marine waters, and specific POs for each of the Nested Targets. Each specific Protection Objective for each Nested Target is also adjusted for climate change. Agreeing on specific Protection Objectives can take much effort, but it is crucial for ensuring ecological representativity of the MPA Network.

The extent to which Protection Objectives are met is an important measure for assessing ecological representativity. In addition, POs – together with Goals and the Objectives for Regulation and Threat Reduction – are all tools for assessing the effectiveness of the MPA Network.

SUB-STEPS

5.1 Formulating general Protection Objectives for marine waters

5.2 Formulating specific Protection Objectives for Nested Targets and correcting for climate change

KEY DEFINITIONS

Protection Objective (PO) – A formal statement detailing the desired proportion of a (Nested) Target that is protected by MPA legislation, i.e that is part of the MPA Network.

Ecological representativity – A representative MPA Network encompasses geographically well-distributed, relevant proportions of the full range of ecosystems and ecosystem components that occur in a marine region.

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Pondweed.
Photo: Joakim Hansen.

STEP 5.1 FORMULATING GENERAL PROTECTION OBJECTIVES FOR MARINE WATERS

As Sweden is committed to protecting 10% of national marine waters, this same percentage is applied to the marine waters of its constituent marine regions, to increase the possibility of ensuring ecological representativity on a national level. The assumption is that the protection of 10% of the Swedish marine waters can be achieved by protecting 10% of each marine region (including the adjacent EEZ). This means that each MPA Network should cover at least 10% of the marine waters within its Scope. See Figure 12.

On a more local level, the same 10% can act as a guideline for the protection of each county's marine waters. This percentage should really be treated as guidance rather than an absolute minimum. The occurrence of Nested Targets in the various counties of a marine region should determine how the region's 10% Protection Objective is distributed among the counties.

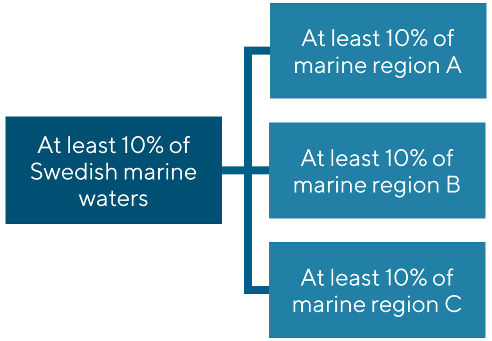

Figure 12. General Protection Objectives. The Objective of protecting 10% of marine waters trickles down from national to regional level.

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STEP 5.2 FORMULATING SPECIFIC PROTECTION OBJECTIVES FOR NESTED TARGETS AND CORRECTING FOR CLIMATE CHANGE

It is important to realise that the CBD Aichi Target of 10% protection of Marine and Coastal Areas by 2020 is based on an agreement following international discussions, and not necessarily on ecological data only, in spite of the fact that scientific counsel was heard in the decision-making process. For this reason, a different approach is used when setting Protection Objectives for the Nested Targets in each MPA Network, expressed as a proportion of the area in which the Nested Target occurs. This approach is inspired by (among others) the criteria adopted by the CBD for the identification of Ecologically or Biologically Significant Marine Areas.

The assumption is that different Nested Targets require different levels of protection. Thus, a specific Protection Objective is set for each Nested Target, based on three criteria: *current occurrence, Conservation Status,* and *biological value*. This means that the Protection Objective for a specific Nested Target can be much higher than the generic 10% for marine waters (see Figure 13). Areas classified as estuaries, for example, require as much as 50% protection in both the Gulf of Bothnia and the Baltic Proper.

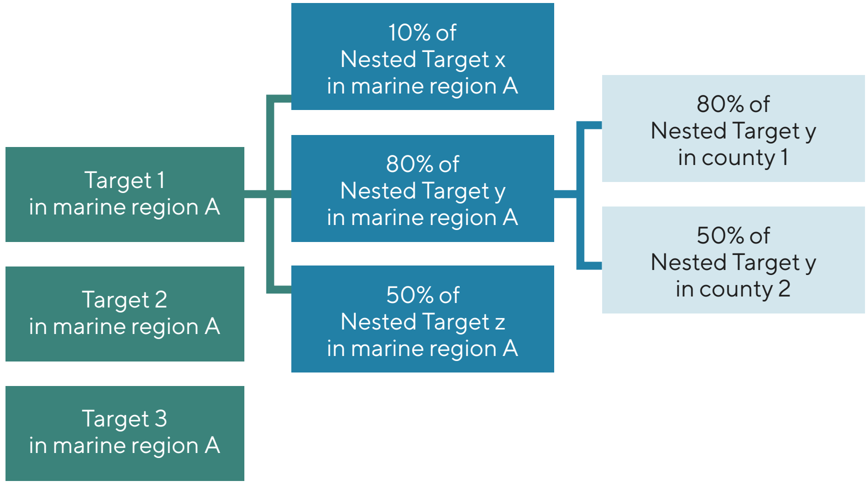

Figure 13. For Nested Targets, specific POs are set by looking at its occurrence, Status, and biological value. On a local level, the PO for a Nested Target might vary somewhat from county to county.

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To operationalise these criteria, a tool was developed in the form of a matrix, presented in Table 1). The criteria are applied using three simple rules of thumb that complement each other:

1. The more the Nested Target occurs in a particular region, the smaller the proportion that needs to be protected. See column A: *Current Occurrence*.
2. The better the Conservation Status of the Nested Target, and the better the trend, the smaller the proportion that needs to be protected. See column B: *Conservation Status*.
3. The higher the biodiversity of the Nested Target (e.g. the more species that live in or depend on the Nested Target), the more important it is to ecosystem functioning, and thus the bigger the proportion that needs to be protected. Similarly, the more important the Nested Target is for species of special concern (e.g. a critical habitat for a part of the life cycle of a red-listed species), the bigger the proportion of the Nested Target that needs to be protected. See column C: *Biological Value*.

These rules of thumb are not necessarily all of equal importance to each Nested Target. Because of that, it is possible to apply a different weighting, shown in the row Criterion Weight in Table 1.

The *weighted average* (WA, column D) that results from the three ratings combined with their weight translates into a suggested Protection Objective (column E). Inspired by different directives and studies, four options for Protection Objective are defined:

1. *10% protection or less*. In principle, at least 10% protection of each Nested Target is required for establishing a representative MPA Network. In some cases where the Nested Target is widely spread, is in very good health, and has lower biological value, it might need less than 10%.
2. *30% protection*. In cases where the Nested Target is less widely spread and in fair condition, it might be necessary to protect at least 30%, in particular if it has higher biological value. Note that most Nested Targets will require a protection of 30% rather than 10%.
3. *50% protection*. Protecting 50% can be required for endangered Nested Targets that have high biological value.
4. *80% protection or more*. A protection level of 80% or more can be required in the case of highly endangered Nested Targets that have particularly high biological value.

Table 1. The essence of the tool used for setting draft Protection Objectives per Nested Target, with the example of coastal lagoons in the shallow soft bottom areas of the Baltic Proper.

	A: Current Occurrence	**B: Conservation Status**	**C: Biological value**	**D: Weighted Average (WA)**		**E: Protection Objective**	
	1: Very High (very common)	**1: Very Good** (doing very well)	**1: Low**			WA <2	10 % or less
	2: High (common)	**2: Good** (within natural range of variation)	**2: Medium**			WA 2–2.8	30 %
	3: Medium (rare)	**3: Fair** (needs urgent action)	**3: High**			WA 2.9–3.4	50 %
	4: Low (very rare)	**4: Poor** (risk of regional extinction)	**4: Very High**			WA > 3.4	80 % or more
Shallow soft bottoms: Coastal lagoons (1150)	2	3	4	**3.3**	→	**50 %**	
Criterion Weight for Nested Target	1	1	2				

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The tool produces a suggested Protection Objective, which is interpreted and adjusted depending on the specifics of a Nested Target, if expert insight suggests that this is necessary. For example, the weighted average for estuaries in the Gulf of Bothnia suggests a Protection Objective of 80%. However, the experts chose to put the final Protection Objective at 50% based on knowledge of the local situation: many estuaries accommodate so much infrastructure, such as harbours and factories, that it would not be practically feasible to protect 80% of them.

These rules of thumb are useful for setting Protection Objectives for Nested Targets in a marine region. On a smaller scale, i.e. for each county, there are several other factors that could play into the decision. These factors are best determined by regional experts, who know the situation in the area and the stakeholders within the individual counties. Therefore, while the general Protection Objective for a given Nested Target on the MPA Network level is straightforward, it might vary more on the county level, with some counties protecting bigger proportions of the Nested Target than others within that region.

When setting Protection Objectives, one of the things to consider is Conservation Status, which is closely linked to the Threats impacting the Nested Targets. In Step 6 and Step 7, an analysis is made of which Threats the Nested Targets are most sensitive to. That information is then used to decide what to protect the Nested Targets from and how to do so (Threat Reduction and Regulation Objectives). There is one exception to this, and that is the Threat of climate change, as detailed below.

Red algae.
Photo: Lotta Nygård

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Summary of climate change impacts on marine ecosystems in the Baltic Sea

The Regional Teams identified potential impacts on marine ecosystems in the most likely climate change scenario for the entire Baltic Sea.

Climate change scenario:

- Sea-level rise
- Seawater temperature increase
- Precipitation increase (particularly in winter)
- 50-80% loss of winter sea ice
- Reduced salinity
- Sea acidification

The potential impacts of the above scenario on marine ecosystems include:

- Serious changes in the typical composition of the Baltic Sea ecosystem
- Shifts in the ranges of key species (e.g. eelgrass, blue mussels, cod, key crustacean species)
- Decrease in the populations of blue mussels, seagrass, ringed seal etc.
- Further decrease in oxygen levels
- More and larger oxygen-depleted areas (dead zones)
- Disappearance of some of the present-day marine species (e.g. cod)
- Exotic and potentially invasive species gradually colonising Swedish waters (e.g. American comb jellyfish)
- Increasing toxic algal blooms
- Altered seasonal succession and species composition of the phytoplankton community
- Altered metabolism, growth, survival, and productivity of many individual organisms and populations

The potential human responses to the climate change scenario in the marine context include:

- Increased shipping in northern areas that are no longer covered by ice during winter
- Changes in patterns and techniques of fishing, due to replacement of fish species adapted to cold and salty water with species adapted to warm and brackish water
- Construction of new ports due to sea-level rise and coastal erosion
- Construction of dikes (i.e. walls) as a measure against coastal erosion
- Potential water abstraction for use in agriculture
- Increased use of fertilisers and new pesticides in agriculture as more pests and weeds emerge, leading to increased run-off into the sea

Dredging.
Photo: Eva Andersson.

Correcting Protection Objectives for climate change

Knowledge about climate change and its impact on the Swedish marine environment is developing. Much, however, is still unknown, and the available predictions generally have huge disclaimers attached to them. Despite this, there is consensus that climate change is rapidly changing key characteristics of the Swedish marine environment. Incorporating the current understanding of climate change is a crucial step in the design of an effective and resilient MPA Network.

The following step-by-step approach is suggested for incorporating climate change considerations into Protection Objectives:

i: Develop scenarios and list potential impacts
Based on the best available knowledge, the most likely climate change scenario is developed (see the box, left).

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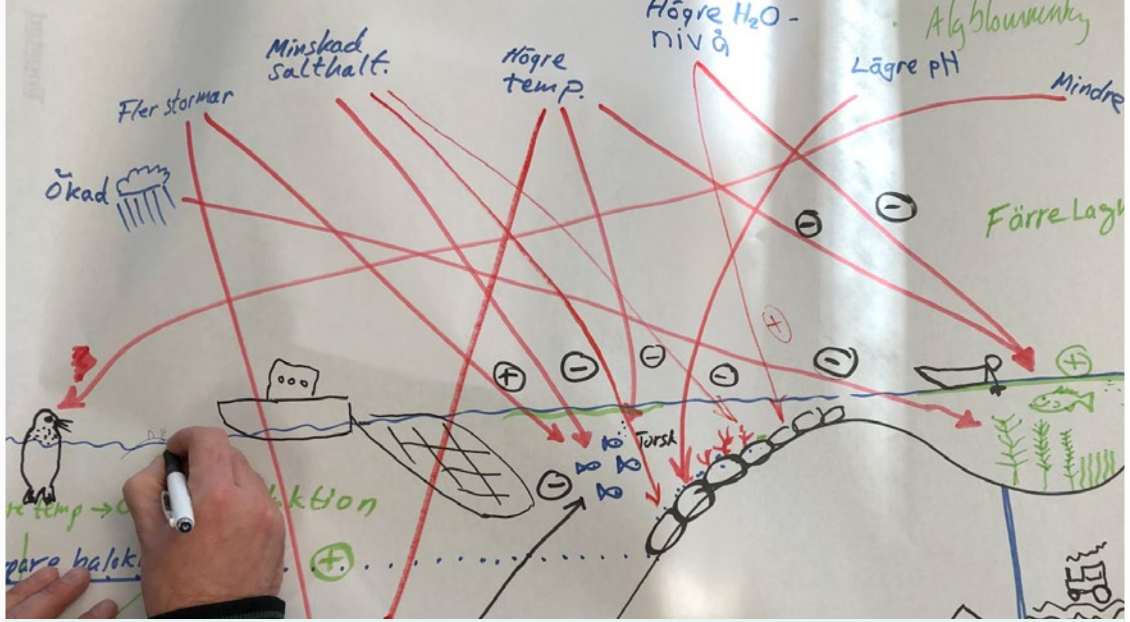

Example

Correcting the Protection Objective for eelgrass in shallow soft bottoms for climate change.

Target: Shallow soft bottoms
Nested Target: Eelgrass

Exposure		Sensitivity	Changes in PO + other recommendations after correction for Climate Change
Climate Impact	**(Potential) Human Response**	**Hypothesis of Ecological Change**	
Increase in sea temperatures	Increased recreational (seaside) activities	Higher seawater temperature negatively impacts eelgrass health (growth, nitrogen metabolism, protein and enzyme synthesis). Southern distribution is affected more. Increased Threats from tourism (anchoring damage, suspension of sand).	Keep at 50% but prioritise climate refuge areas in the southern range

Figure 14. (left) Ecological drawing under development.

II. Visualise impacts

Each Regional Team makes an ecological drawing, i.e. a visualisation of the (Nested) Targets in their region, the current and expected human use, and the projected impacts of climate change on particular parts of the system (see Figure 14).

III. Adapt the Protection Objective

The Regional Team uses the scenario and the ecological drawing to go through a set of guiding questions that helps them to correct each Protection Objective for the anticipated impacts of climate change:

- What is the *exposure* of the Nested Target to climate change, in terms of climate impact and human response?
- What is the *sensitivity* of the Nested Target to climate change, in terms of a hypothesis of ecological change?
- Based on the exposure and sensitivity considerations, how should the Protection Objective be adjusted for the Nested Target, and what other recommendations can be made?

Most often, a Protection Objective will be corrected up (e.g. from 50% to 80%) when taking anticipated climate change impacts into consideration. However, it could also be adjusted down, for example if climate impacts would lead to less dredging and thus to decreased impact on the Nested Target.

More details

- Annex 4: Regional Protection Objectives for the Gulf of Bothnia and the Baltic Proper. All Protection Objectives in the Annex are corrected for the impacts of climate change.
- For information on the compilation of existing data related to the occurrence and Conservation Status of Targets and Nested Targets, please refer to Step 8 Compiling the Evidence Base.

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Algal blooms outside Gotland 2015.
Photo: Willem Tims / Shutterstock.

Step 6 Defining Threats, Stresses, and Sensitivity

In the definitions in part II, an MPA Network was defined as effectively managed if 1. its ecological Targets are sufficiently protected, 2. the negative effects of human activities reduced, and 3. Favourable Conservation Status is achieved. This means that in the design of an MPA Network, it must be ensured that (potential) Threats do not negatively affect the Nested Targets – otherwise none of those three criteria will be fulfilled.

In order to do this, an understanding of the impact of human activities on Nested Targets is needed.

SUB-STEPS

6.1 Defining a taxonomy of Threats and Stresses
6.2 Assessing the Sensitivity of Nested Targets to Threats

KEY DEFINITIONS

Threat – (short for Direct Threat) Primarily a human activity that immediately degrades one or more (Nested) Targets (e.g. dredging or unsustainable fishing). Threats can also be natural phenomena altered by human activities (e.g. sea-level rise due to climate change). Typically a Threat is tied to one or more stakeholders.

Stress – An impaired aspect of a conservation target that results directly or indirectly from human activities. For example, low population size due to habitat loss, reduced river flows due to dams, and increased sedimentation due to dredging.

Sensitivity – An expression of severity and irreversibility of the impact of a particular (potential) Threat to a Nested Target. It is based on an assessment of Stresses caused by that Threat.

Important note: In this Framework, the terms 'Threats' and 'Stresses' are used strictly as defined above, following the Conservation Standards. The terms 'Threats', 'Stresses', and 'Pressures' are sometimes used differently in other frameworks.

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The analysis of Threats, Stresses, and Sensitivity is heavily informed by the sensitivity scoring in HELCOM's Second Holistic Assessment of the Baltic Sea (HOLAS II), with a few adjustments:

- The ecosystem components used in HOLAS II have been translated into the Nested Targets used in the Framework.
- The IUCN-CMP list of Threats has been used to make the list more exhaustive.
- The sensitivity assessment has been extended to those Threats and Nested Targets not represented in HOLAS II.
- For ease of use later, the numerical sensitivity scores used in HOLAS II have been translated to categorical scores, differentiating between Very High (red), High (yellow), Medium (light green), and Low (dark green).

The aim has been to develop a taxonomy and sensitivity analysis that is applicable to every marine region in Sweden, in order to facilitate roll-up and comparison between and across geographies as well as from local to regional and national level. Agreement on clear names and descriptions of Threats and Stresses is important, as they will be used during implementation and follow-up of the framework.

Picking up trash that has washed ashore along the Swedish West Coast. Photo: Maja Kristin Nylander.

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STEP 6.1 DEFINING A TAXONOMY OF THREATS AND STRESSES

To create the taxonomy of Threats and their associated Stresses, the first step is to define the Threats that impact the Nested Targets, and then of all the Stresses each of them causes. When identifying Threats and Stresses, a comparison was made between (in order of importance for the Framework):

- HELCOM's Human Activities and Pressures Analysis (HOLAS II)
- The IUCN-CMP taxonomy of Threats
- The list of Threats and Pressures in the EU Habitats Directive
- The EU's MSFD list of Pressures and Impacts
- The Swedish Agency for Marine and Water Management list of Pressures and Human Activities from Symphony – used for Marine Spatial Planning in Sweden
- OSPAR Pressures and Impacts framework

The end result is a taxonomy that adheres to the following criteria:

- It differentiates between Threats and Stresses, to enable setting pertinent regulation of human activities.
- It stays close to the existing and most commonly used taxonomies, to facilitate uptake.
- It is specific enough to be useful for defining specific regulations (e.g. by differentiating between bottom trawling and recreational angling).
- It includes all Threats that are either currently occurring or likely to occur in the foreseeable future.

The taxonomy, applicable to all marine regions in Sweden, now includes 25 distinct Threats and 13 distinct main Stresses (see Table 2 on the following page). Each Threat can cause one or several Stresses. For example, the Threat *marine litter* is associated with two Stresses: *disturbance of species/food webs* and *inputs of hazardous substances*. Some of the Threats are illustrated in Figure 15 on page 100.

More details

- Annex 5: The Swedish taxonomy of Threats and associated Stresses (includes description of Threats)
- Annex 6: Description of Stresses

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Table 2. The taxonomy of Threats and Stresses.

Threat \ **Stress**	Physical loss	Physical disturbance	Changes to hydrographical conditions	Disturbance of species/ food webs	Inputs of impulsive sound	Inputs of continuous sound	Inputs of nutrients	Inputs of hazardous substances	Oil slicks and spills	Passive introduction of invasive alien species	Inputs of electromagnetic and seismic waves	Decreased populations due to extractions of species	Input of heat
Physical development/restructuring													
Structures in water	●	●	●	●	●	●							
Dumping	●	●	●	●			●	●					
Cables and pipelines	●	●			●						●		
Energy and material recovery													
Establishment of wind turbines	●	●	●	●	●								
Production of wind energy			●	●		●							
Extraction of sand and stone	●	●	●		●								
Transport and shipping													
Maritime shipping	●	●	●	●		●	●	●	●	●			
Dredging and widening for waterways	●	●	●	●	●	●							
Human activities – recreation, military activities etc.													
Recreational boating, recreational life		●	●	●		●		●	●				
Dredging and dumping (leisure boats)	●	●	●	●		●							
Research and exploration		●		●	●								
Military activities	●	●		●	●	●		●			●		
Hunting and fishing													
Bird hunting				●	●							●	
Seal hunting				●	●							●	
Pelagic trawling				●		●						●	
Bottom trawling	●	●		●		●						●	
Quantitative catching gear		●		●								●	
Recreational angling				●		●						●	
Discharge and pollution													
Industrial discharge			●				●	●	●				●
Discharge from household and municipal sewage treatment plants			●				●	●					
Discharge from agriculture			●				●	●					
Discharge from forestry			●				●	●					
Discharge from aquaculture			●				●	●					
Marine litter				●				●					
Active introduction of alien species													
Active introduction of (invasive) alien species				●									

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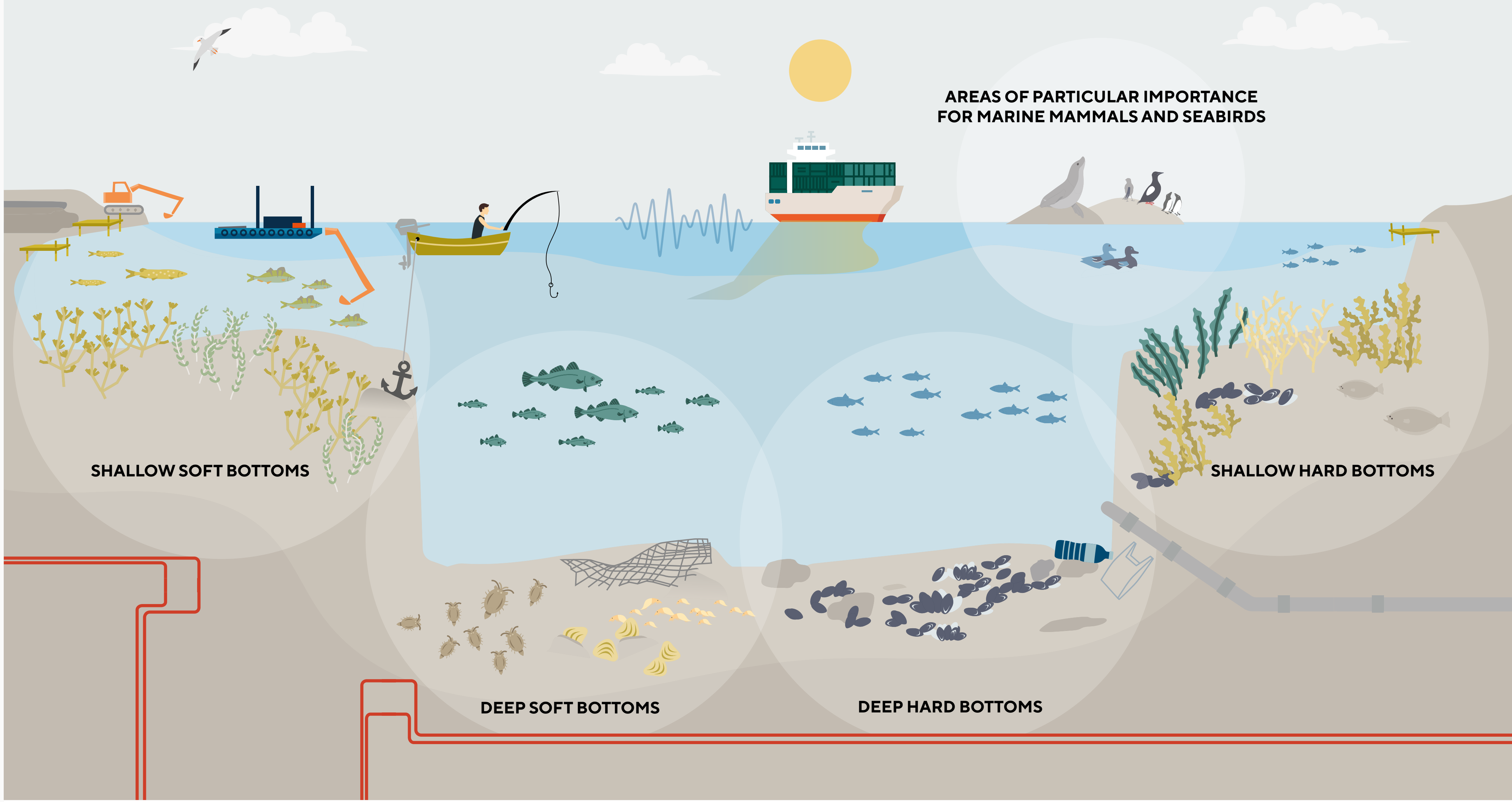
Figure 15. Illustration with examples of Threats in the marine environment.



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STEP 6.2 ANALYSE THE SENSITIVITY OF EACH (NESTED) TARGET TO EACH THREAT

Through a systematic examination of the taxonomy, the Sensitivity of each Nested Target to each Stress is rated using categorical scores: Very High, High, Medium, or Low. These Sensitivity scores are then cross-tabulated with each Threat through its associated Stresses. Thus an overall assessment of the Sensitivity of each Nested Target to each Threat is made. The overall Sensitivity is determined by the highest score of the individual Stresses.

For an overview of the Sensitivity of each Nested Target to the various Threats, see Annex 7: Sensitivity analysis.

Notes on Threats, Stresses, and Sensitivity

It has taken plenty of going back-and-forth to agree on the taxonomy of Threats and Stresses as well as the Sensitivity Analysis to the point where they can be used to determine Threat Reduction Objectives and Regulation Objectives (see Step 7). The result is a large and colourful table, with considerably more red and orange than yellow and green, meaning that many of the Nested Targets are deemed to have Very High or High Sensitivity to many of the Threats.

It is important to realise that the HOLAS II scores are currently based on expert judgement and incorporate the best available knowledge. The combination of best available evidence on the Conservation Status of the Nested Targets (see Step 4.1) and on their Sensitivity to particular Threats provides a rational justification for recommending Regulation Objectives in Step 7.

Example

Imagine that the goal is to understand how (potential) extraction of sand and stone (Threat) is likely to impact eelgrass beds (Nested Target) in shallow soft bottoms (Target). In the taxonomy of Threats and Stresses, extraction of sand and stone is associated with the following (potential) Stresses: physical loss and physical disturbance, changes in hydrographical conditions, and input of sound. Thus, the Sensitivity of eelgrass to all these Stresses is rated: Very High for physical loss and physical disturbance, Very High for changes in hydrographical conditions, and Low for the input of sound. The highest Sensitivity of eelgrass to any Stress related to extraction of sand and stone is Very High, so the overall Sensitivity score of eelgrass to extraction of sand and stone is also Very High.

Target:
Shallow soft bottoms
Nested Target:
Eelgrass

Threat	Stress	Sensitivity of Nested Target to Stress	Sensitivity of Nested Target to Threat
Extraction of sand and stone	Physical loss	VH	VH
	Physical disturbance	VH	
	Changes to hydrographical conditions	VH	
	Inputs of impulsive sound	L	

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Marine litter on a shore in Halland. Photo: Natalie Greppi.

Step 7 Setting Threat Reduction and Regulation Objectives

Based on the Sensitivity score and the Conservation Status of the Nested Targets, it is determined to what extent harmful human activities should be reduced in the marine protected areas, and, consequently, how strictly harmful human activities should be regulated, so that the status of the marine environment is maintained or improved. Threat Reduction and Regulation Objectives – together with Goals and Protection Objectives – are all measures for assessing the management effectiveness of the MPA Network.

This part of the Framework and the Guidelines is still under development, and will evolve and gain strength as it is tested in practice and as better evidence is collected.

SUB-STEPS

7.1 Setting detailed Threat Reduction and Regulation Objectives
7.2 Generalising Threat Reduction and Regulation Objectives to MPA Network level

KEY DEFINITIONS

Effective Management – An MPA Network is effectively managed if its ecological (Nested) Targets are sufficiently protected, the negative effects of human activities are reduced, and favourable Conservation Status is achieved.

Threat Reduction Objective (TRO) – A formal statement detailing the desired reduction of a harmful human activity (Threat).

Regulation Objective (RO) – A formal statement detailing the recommended regulation of a harmful human activity (Threat).

A good objective meets the criteria of being *specific, measurable, achievable, results-oriented,* and *time-limited* (SMART). If the project is well-conceptualised and well-designed, the realization of a project's Objectives should lead to the fulfillment of the project's Goals and ultimately its Vision.

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STEP 7.1 SETTING DETAILED THREAT REDUCTION OBJECTIVES AND REGULATION OBJECTIVES

To set objectives for threat reduction and regulation, the Sensitivity score of Nested Targets to Threats, obtained in step Step 6.2, is combined with the Conservation Status of the Nested Targets in the MPA Network, obtained in Step 4.1. Then, the precautionary approach is applied (i.e. if it is uncertain whether an activity will lead to harm, measures should be taken to prevent harm). This procedure creates a solid basis for the extent to which each Threat can co-occur with each Nested Target. This Threat Reduction Objective, in turn, informs the Regulation Objective. See Figure 16 for a visual explanation of how all these elements fit together.

Three general categories of Threat Reduction Objective are defined:

- The human activity does not occur at all
- The human activity occurs to a limited degree, but with no negative impact
- The human activity can occur

The higher the Sensitivity, and the worse the Conservation Status of the Nested Target, the more stringent the Threat Reduction Objective will be. If, for example, eelgrass beds in a marine area are not doing very well, and eelgrass beds are deemed to be very sensitive to the effects of dredging, then it is a logical Objective that no dredging should be happening where there is eelgrass. However, if eelgrass beds are not that sensitive to the effects of people swimming, then it is no problem if swimming occurs.

The Threat Reduction Objective informs the Regulation Objective: the more stringent the TRO, the more rigid the RO. See Table 3.

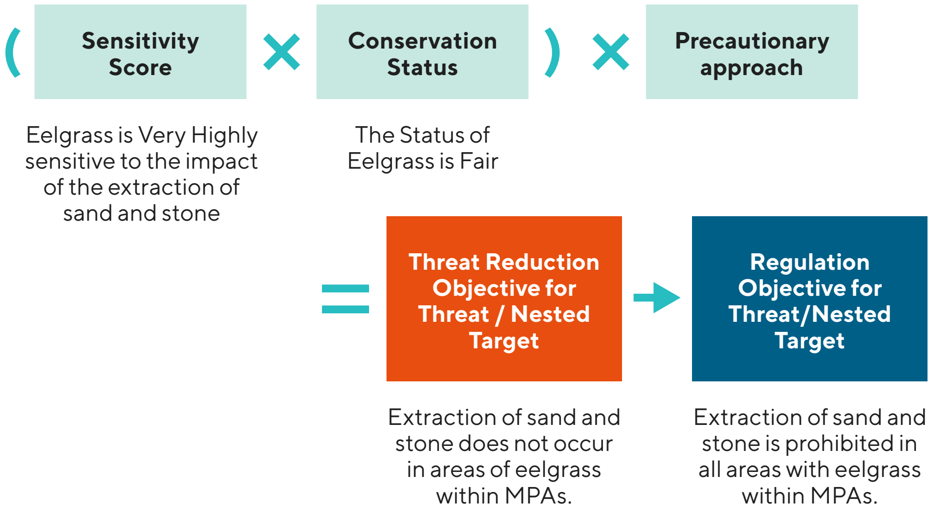

Figure 16. Overview of steps to define Threat Reduction Objectives and Regulation Objectives, using extraction of sand and stone and eelgrass as examples.

Table 3. Categories of Threat Reduction Objectives and Regulation Objectives. Regulation Objectives will be achieved through regulation within the MPA or through other legislation.

TRO category	Related RO category
The human activity does not occur	The human activity is prohibited
The human activity occurs to a limited degree, but with no negative impact	The human activity is restricted (limitations on e.g. time, place, speed)
The human activity can occur	The human activity is allowed

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STEP 7.2 GENERALISING THREAT REDUCTION AND REGULATION OBJECTIVES TO MPA NETWORK LEVEL

In total, the taxonomies from Step 3 and Step 6 comprise 25 Threats and about 50 Nested Targets, respectively. This means that each MPA Network encompasses almost 1 250 detailed Threat Reduction Objectives and another 1 250 detailed Regulation Objectives. These detailed Objectives are very useful for formulating or reviewing the specific regulations for any particular MPA, because each MPA usually encompasses a smaller subset of Nested Targets and Threats. However, on the MPA Network level, they are too detailed, and therefore the Objectives for each Threat are generalised across Nested Targets for each Threat.

First, each Threat is examined, and all its Threat Reduction Objectives are summarised across all Nested Targets, in such a way that the crucial details are retained. This is repeated with the Regulation Objectives of each Threat. Finally, those summarised Objectives are generalised into Threat-specific Objectives that apply in general to the entire MPA Network. See the example at right.

More details

- For a list of general TROs and ROs applicable to all MPAs in Sweden, please see Annex 8: Threat Reduction Objectives & Regulation Objectives.
- For information on the compilation of existing data related to the occurrence of Targets and Nested Targets, please refer to Step 8 Compiling the Evidence Base.

Example

Threat Reduction Objectives and Regulation Objectives for extraction of sand and stone, on different levels of specificity. The detailed TROs justify the more general TROs.

	Threat Reduction Objectives	Regulation Objectives
Detailed for particular Nested Targets	Extraction of sand and stone does not occur in areas with eelgrass in MPAs. Extraction of sand and stone does not occur in estuaries in MPAs. Extraction of sand and stone occurs to a limited degree, but with no negative impact, in areas with seasonal ice in MPAs. (etc.)	Extraction of sand and stone is prohibited in all areas with eelgrass in MPAs. Extraction of sand and stone is prohibited in all estuaries in MPAs. Special exceptions* for extraction of sand and stone can be made in areas with seasonal ice in MPAs. (etc.)
Summary across all Nested Targets	Extraction of sand and stone does not occur in Nested Targets in MPAs, except for the following, where it can occur to a limited degree but with no negative impact: Areas with seasonal ice; Areas of oxygenated water below the halocline; Spring resting areas for eider; Wintering and resting areas for greater scaup, red-breasted merganser and smew; Wintering areas for black- and red-throated diver.	Extraction of sand and stone is prohibited in all Nested Targets in MPAs, but special exceptions* can be made in the following Nested Targets: Areas with seasonal ice; Areas of oxygenated water below the halocline; Spring resting areas for eider; Wintering and resting areas for greater scaup, red-breasted merganser and smew; Wintering areas for black- and red-throated diver.
General for all MPAs in the network	Extraction of sand and stone does not occur in MPAs.	Extraction of sand and stone is prohibited in all MPAs.

*A special exception requires an environmental impact assessment.

Grey seals in Bråviken. Photo: Lars Gezelius.

Notes on Threat Reduction and Regulation Objectives

The Regulation Objectives are meant as recommended regulation of a particular Threat in the entire MPA Network overall, and as such are meant to help harmonise regulation across the MPAs in the Network. They are, however, not meant to prescribe the use of any specific kind of legislation. The government and other agencies can use different kinds of legislative tools to achieve a specific Threat Reduction Objective (e.g. national legislation or regulation on protected areas, fisheries, maritime traffic, or EU regulation on fisheries). Also, the legislation used can differ between MPAs.

It should be kept in mind that not all Threats can be regulated through MPA legislation, and thus additional measures are often necessary (e.g. to tackle the impact of eutrophication, pollution from plastic, or hazardous substances). Additionally, in the Regional Plan, TROs and ROs apply within MPAs, so additional protection might be needed outside of MPAs. Hence, MPAs are most effective when they form a part of Integrated Marine Management (see Guiding principles in Part II).

The logic behind the recommended TROs and ROs is based on best available evidence about the impacts of Threats on Nested Targets, and will need to be reviewed as new evidence emerges that helps us better understand these impacts. This is true for all the components of the Regional Plans, and it is why practising adaptive management is recommended (see Step 10.1 Setting up the adaptive management process).

The guidance on Threat Reduction and Regulation Objectives reflects the current thinking about how this part of the Framework works. It is likely to evolve over time, as it is put into practice through the developing Regional Plans.

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Research with an aquascope.
Photo: Peter Lilja

Step 8 Compiling the evidence base

In Steps 1–7, the bulk of the design of the MPA Network has been completed. A solid evidence base is key for the implementation of many of these steps, and forms the foundation for sound management decision-making. The generation and use of evidence should, therefore, be an integral part of the adaptive management process.

Building the evidence base starts with articulating management questions, the answers to which are needed to inform decision-making and priority-setting, and continues with identifying related indicators and required data. Then, data is located, its quality is assessed, and it is optimised so that it has a clear structure and adheres to the taxonomies of Targets and Nested Targets and of Threats and Stresses. Finally, the best way to visualise the information is identified.

SUB-STEPS

8.1 Identifying management questions, indicators, and information needs
8.2 Assessing the quality of available data
8.3 Displaying suitable evidence

KEY DEFINITION

Evidence Base – The body of all data, studies, syntheses/systems, and theory being used as evidence for a particular set of hypotheses. It is composed of the optimal combination of available data of sufficient quality, expert opinions, and studies.

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STEP 8.1 IDENTIFYING MANAGEMENT QUESTIONS, INDICATORS, AND INFORMATION NEEDS

The structure of the Framework presented in Part II) is used to identify and articulate management questions, i.e. questions that, when answered, support adaptive management of the MPA Network. There are several important management questions for each part of the Theory of Change (see lower part of Figure 17).

For each management question, the indicator used to answer the question is identified and described. Table 4 (next spread) outlines the main management questions and associated indicators defined for the Theory of Change. The choice of some of the indicators is quite straightforward, while in other cases, it is less obvious and might require rethinking. For some indicators, there is reasonable data available, whereas for others, there is currently no data at all. The data gaps will inform priorities for research, mapping and monitoring (see Step 9.3 Defining priority data requirements).

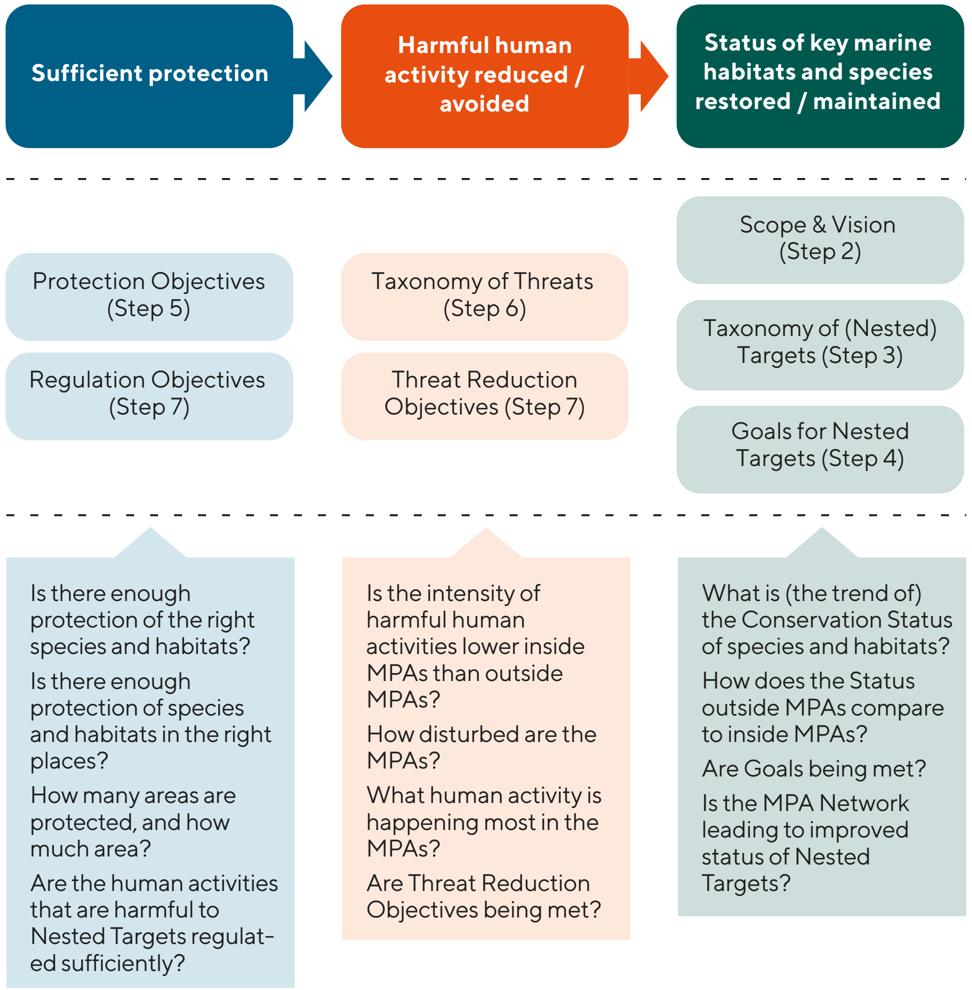

Figure 17. The Theory of Change provides the structure for management questions that can be used to assess the progress and effectiveness of the MPA Network.

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Table 4. Indicators for the main management questions in line with the Theory of Change. Indicators marked with an asterisk (*) are ones for which there is not yet sufficient data, or for which there are large gaps in the data sets.

	Management Question	Indicator
Sufficient protection	Is there enough protection of the right species and habitats?	Proportion of marine region protected
		Proportion of each Nested Target protected
		Number and type of MPAs
		Size of MPAs
	Is there enough protection of the right species and habitats in the right places?	Occurrence of Nested Targets*
		Proportion of actual vs Protection Objective of each Nested Target
	Are human activities (Threats) that are harmful to Nested Targets regulated sufficiently?	Proportion of MPAs meeting Regulation Objective of each Threat (to be developed further)*
Harmful human activity reduced/ avoided	Are Threat Reduction Objectives being met?	Actual vs desired occurrence of each Threat*
	Is the intensity of harmful human activities lower inside than outside MPAs?	Actual vs desired occurrence of each Threat inside vs outside MPAs*
	What human activity is happening most in the MPAs?	
	How disturbed are the MPAs?	Aggregated occurrence of Threats per MPA*
Status of key marine habitats and species restored/ maintained	What is (the trend of) the Conservation Status of species and habitats?	Conservation Status per Nested Target over time
	Are Goals being met?	Proportion of Nested Target in Favorable Conservation Status inside MPAs
	How does the Conservation Status of species and habitats outside MPAs compare to those located inside MPAs?	Conservation Status per Nested Target over time outside MPAs vs inside MPAs*
	Is the MPA Network leading to improved Conservation Status of Nested Targets?	Correlated data on Conservation Status, protection, Threat reduction (to be developed further)*

Sometimes the description of an indicator is kept vague deliberately, in order to make use of various data sets tied to other, more specific, indicators. For example, for understanding how species and habitats are doing, the indicator 'Conservation Status per Nested Target over time' is used. By keeping this indicator rather vague, it is possible to use many different reports on status, each using slightly different exact indicators. Such an exact indicator can be, for example, the specific density of vegetation cover or the occurrence of a typical species (i.e. a species that occurs regularly in the habitat type and indicates favourable habitat quality). The expectation is that over time, more precise indicators for each management question can be formulated, through which specific monitoring investments can be influenced.

Finally, the data needed to express each indicator is located.

Example

When thinking about how to ensure sufficient and effective protection, the first question is 'Is there enough protection of the right species and habitats?' To answer this question, the indicator is defined as 'Proportion of actual versus desired protection'. Then, data is located related to the area size of each Nested Target and its current protection, and benchmarked against the Protection Objectives formulated for each Nested Target per county and for the whole region.

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STEP 8.2 ASSESSING THE QUALITY OF AVAILABLE DATA

In order to use the identified data appropriately, it is crucial to understand its quality, and hence to understand the limitations to its use. For each data set, therefore, a quality assessment is conducted by calculating a quality score based on six criteria: *validity*, *reliability*, *integrity*, *precision*, *timeliness* and *efficiency* (see example in Table 5).

Each quality criterion is rated using a set of questions. The better each criterion is met, the higher the score for that criterion. The total score for all criteria combined is turned into a percentage using an algorithm, and rated on a rating scale from Very Good to Poor – the same scale used for Conservation Status (see Step 4.1 Assessing the Status of Nested Targets). The quality categories are matched to the reporting methods listed in Article 17 of the EU Habitats Directive (see Table 6).

The example in Table 5 represents the indicator 'Proportion of actual versus desired protection', whose data comes from six different sources of varying quality, most ranking Good or Very Good. The total score for all criteria equals 56%, which gives a data quality rating of Good.

If two data sets cover the same species or habitat, the one with the best quality is chosen. When designing the Swedish MPA Networks, unfortunately, there were large data gaps for most components in the Framework, so did not have much to choose from.

Table 5. Example quality assessment summary. The data sets for the indicator 'Proportion of actual versus desired protection' have been scored using the different criteria. The total score for all criteria equals 56%, which gives a quality rating of Good.

Indicator: Proportion of actual versus desired protection

Criterion	Score	Quality assessment
Validity: Data should accurately and adequately measure the intended result.	5	
Reliability: Data should reflect consistent collection processes and analysis methods over time.	9	
Integrity: Data should have safeguards to minimize risk of error or data corruption.	8	
Precision: Data should have a sufficient level of detail to permit management decision making.	6	
Timeliness: Data should be available at a useful frequency and be current enough to influence management decision making.	4	
Efficiency: Data collection and analysis should be performed at a cost (financial and time) commensurate with the value of the related indicator and result.	6	
Total score	**56 %**	**Good**

Table 6. Data quality rating categories adapted to reporting methods in Article 17 of the EU Habitats Directive.

Quality rating	**Associated reporting method in Article 17**
Very Good (76–100%)	Complete survey or a statistically robust estimate (e.g. a dedicated mapping or survey or a robust predictive model with a representative sample of occurrence data, calibration and satisfactory evaluation of its predictive performance using good data on environmental conditions across entire species range)
Good (51–75%)	Based mainly on extrapolation from a limited amount of data (e.g. other predictive models or extrapolation using a less complete sample of occurrence and environmental data)
Fair (26–50%)	Based mainly on expert opinion with very limited data
Poor (1–25%)	Insufficient or almost no data available

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Notes on data quality and gaps

The work to date on designing a framework for Sweden's MPA Networks has revealed multiple problems in the evidence base, including incomplete data sets, limited access to data sets, and even data being fully out of reach due to security restrictions. It has only been possible to identify suitable data for half of the Nested Targets and two-thirds of the Threats. Of particular worry is the low quality of data on the Status of Nested Targets. The existing data is meagre and does not differentiate between the Status inside and outside MPAs. This is likely also true for many other countries in the world.

It is clear that these gaps form hurdles to achieving the Goals and Protection and Regulation Objectives of the MPA Networks. Without the missing information, management decision-making happens largely blindfolded.

On the basis of the identified gaps, however, it is possible to identify priorities for inventories and monitoring. The data gaps that are most urgent to solve are, of course, related to those ecosystems and ecosystem components that are in decline and in a Fair or Poor state. Investing in a solid evidence base is important for managing the risk of losing these ecosystems and ecosystem components.

With more time and effort, it might be possible to identify better data sets for some indicators. However, it was deemed important to compile a first version of the evidence base, and allow it to improve over time. Using the current selection of data with its limitations will also help us to clearly identify the gaps and prioritise the needed improvements.

For a full list of questions for each quality criterion, see Annex 9: Data Quality Assessment Questions.

STEP 8.3 DISPLAYING MANAGEMENT INFORMATION

After the data has been collected and rated, the next step is to develop a way to display it, so that it can be used for management decision-making. For this purpose, a (prototype) MPA Network Dashboard was created, i.e. an interactive tool that supports data analysis and decision-making for effective adaptive management of MPA Networks. The intention is to update the dashboard with new data as it becomes available.

Below is an overview of the main steps in the development of the Dashboard:

I. Choose software

The first task is to decide what software to use for visualising the information. In this case, the software chosen was Power BI from Microsoft, a business analytics tool that provides interactive visualisations through dashboards. This tool fits the needs of the Framework, and experienced design experts were engaged to deliver the required dashboard functionalities.

II. Clean up the data sets

Data often comes from various sources in different formats, and might need to be cleaned, standardised, sorted, and organised so that they can be imported into the software. Some spatial analysis might also be needed to create the requested visualisations. Thus, the various data sets are restructured into standardised sheets that are easily readable by the software. In addition, the taxonomies of all the data are aligned with the standard taxonomies used in the Framework. It is advisable to get to know the needed data structure upfront, to make it easier to organise all used data sets.

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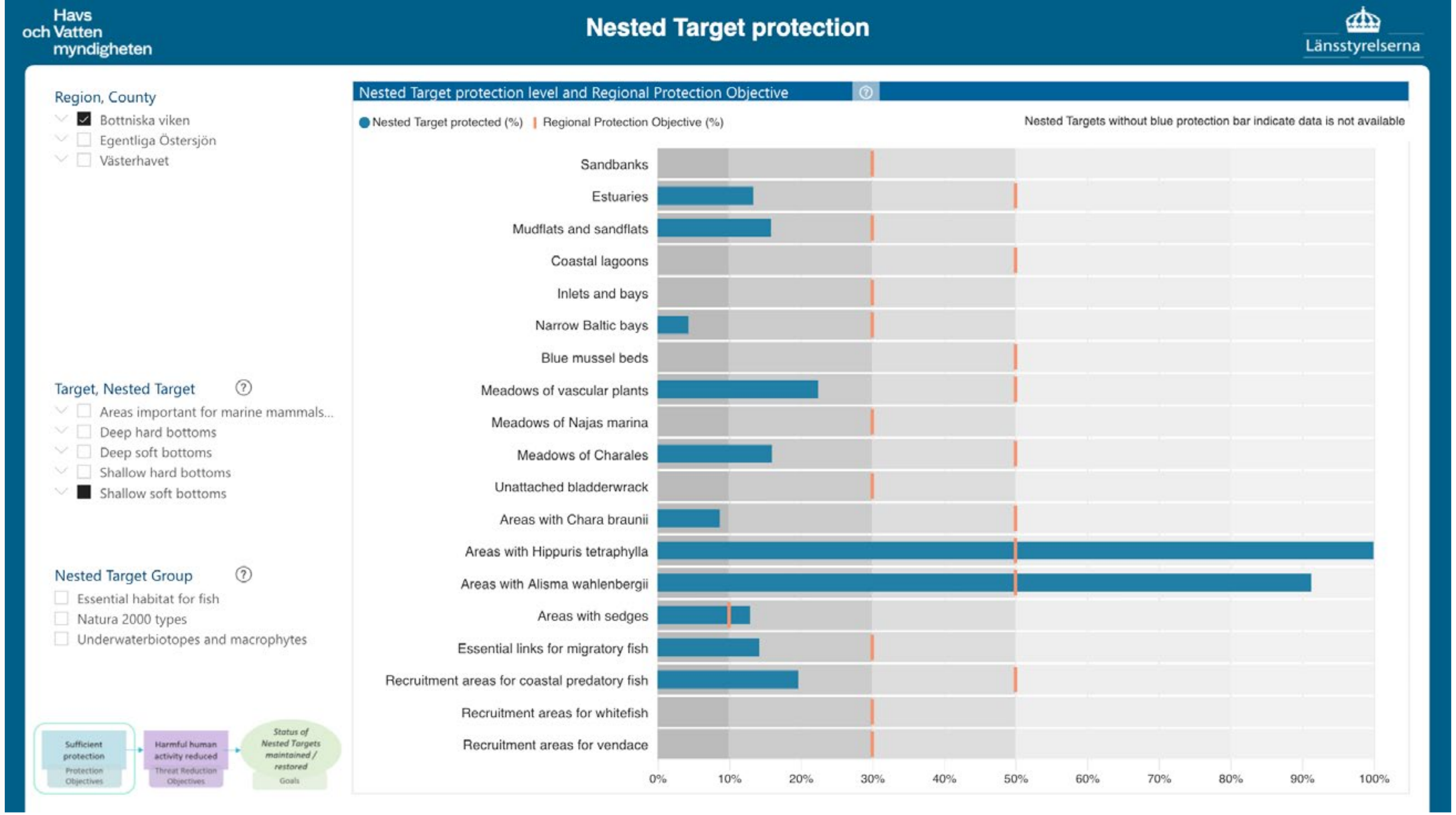

Figure 18. Example of an interactive dashboard page containing information about the protection of Nested Targets. On the left panel, the Gulf of Bothnia (region) and shallow soft bottoms (Target) have been selected. On the right, there is a graph showing the Nested Targets in that region and that Target (see step 3). The regional Protection Objectives (see step 5) are shown as orange lines, and the current level of protection as blue bars. When a Nested Target does not have a blue bar, it means there is no suitable data available for calculating the protected proportion of the Nested Target.

III. Determine visualisation
Using the management questions (see Step 8.1) and the availability of data, the most suitable way of visualising the data is then determined. The visualisations can take many forms, e.g. charts, maps, or tables. The Framework dashboard has been organised into different pages, each displaying information related to a particular part of the Theory of Change and optimised for answering the specific related management question. An example of a dashboard page is shown in Figure 18.

In addition to the dashboard itself, a user guide – both as a written document and as a video – was developed, to help users learn how to navigate the different pages and use the various tools.

More details
For further examples of dashboard pages, see Annex 10: Examples of Dashboard Pages.

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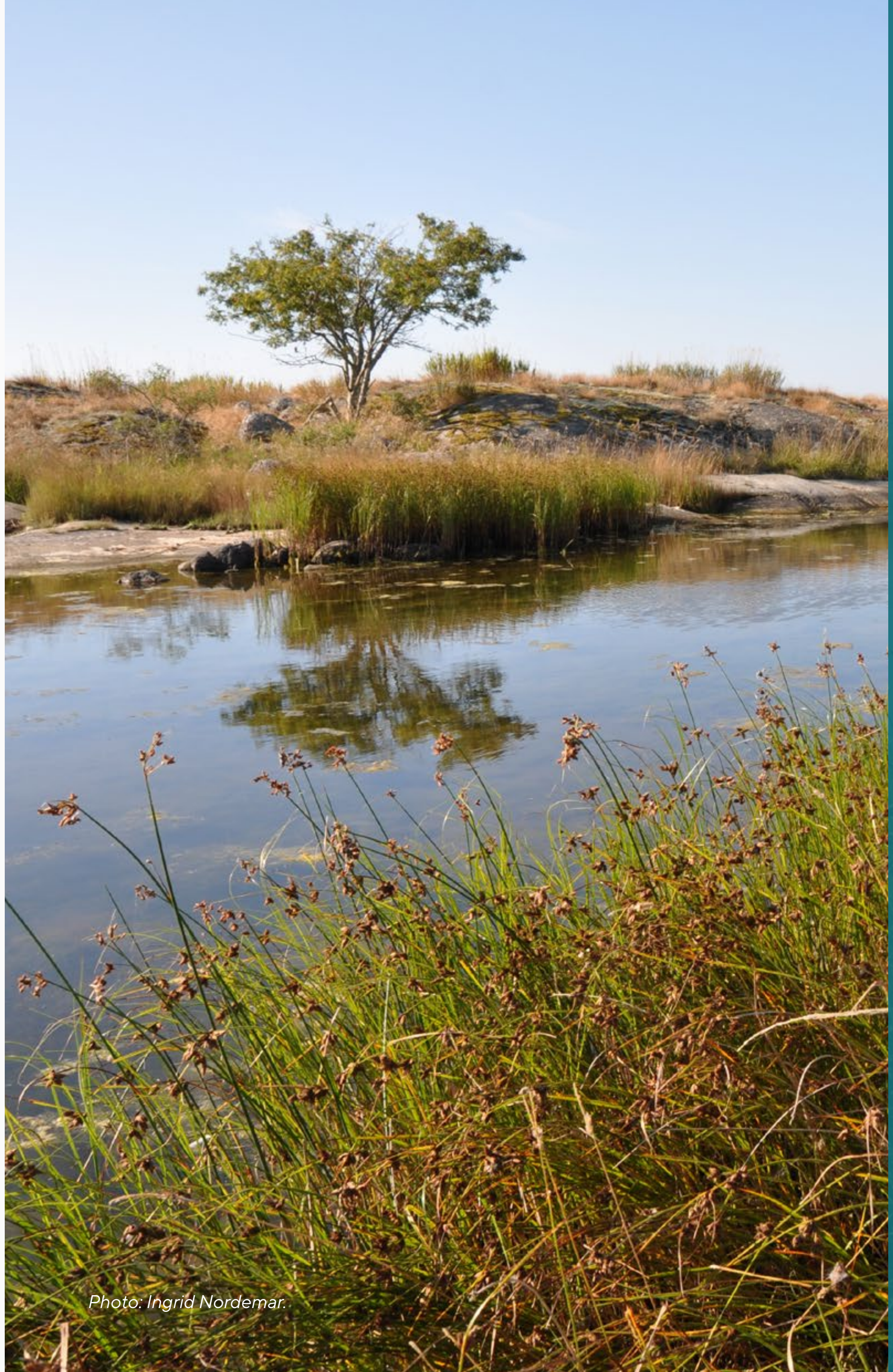

Photo: Ingrid Nordemar.

Step 9 Setting priorities for action

The information provided in the dashboard set up in Step 8.3) helps analyse to what extent the MPA Network is representative, well-connected, functional, and effectively managed. The detailed diagnoses provided in each of the dashboard pages gives insight into what evidence exists and what does not, how complete the protection is, and whether the regulation is sufficient. This understanding helps determine priorities for action.

SUB-STEPS

9.1 Defining protection priorities
9.2 Defining regulation priorities
9.3 Defining priority data requirements

KEY DEFINITION

Connectivity – A well-connected MPA Network is characterised by the functioning exchange of individuals and genes between different ecosystems and ecosystem components. The opportunity for exchange depends on the occurrence of good quality habitats and ecosystems of relevant size, scattered throughout the seascape.

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STEP 9.1 DEFINING PROTECTION PRIORITIES

Assessing and improving ecological representativity

By comparing actual protection to the Protection Objectives set in Step 5, and by zooming in from MPA Network level to county-level details, a sound basis for setting priorities is found:

- For Nested Targets, the priority is those Nested Targets whose protected proportion falls short of their specific Protection Objectives (see Step 5.2).
- Those Nested Targets whose protection is further from the Protection Objectives are prioritised. This means that the larger the gap is, the higher it scores on the list of priorities for additional protection.

Assessing and improving functionality

On a finer level, the focus is on those Nested Targets that have the worst status and for which additional protection could make a real difference with respect to their long-term chances for survival. Additional protection is prioritised for the Nested Targets which are in Fair or Poor condition or have a negative status trend.

For some Nested Targets, however, there is not sufficient data to understand whether they require additional protection. That lack of data should be selected as a priority data requirement for the region (see Step 9.3).

Regional priorities inform county-level action

Priorities for the MPA Network are translated to priorities for the individual Counties. CABs might fulfill their Protection Objectives by expanding their existing MPAs, or by establishing new MPAs. During this process, CABs should take on board considerations that improve not only ecological representativity and functionality, but also connectivity.

In Part II of this document, it is highlighted that more knowledge is needed on connectivity in order to operationalise the concept. In general, the recommendation is that the size of the protected area and its proximity to other protected areas must be adapted for the different Nested Targets, depending on their properties (spreading distance and occurrence). For example, blue mussels are widely distributed in the Baltic Sea,

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Chara braunii, *a Nested Target. Photo: Petra Pohjola.*

and therefore there is connectivity even with areas outside protected areas. For other species with a more isolated occurrence and shorter spreading distance, such as certain vascular plants, connectivity within protected areas may be of more importance. Long-term survival for such species might require protecting a few large areas rather than many small ones. For species that spread far, it might be more efficient to protect many smaller, interconnected areas. This, however, requires that the specific ecological requirements of each Nested Target be taken into account.

The broad recommendations below can be used to inspect options for expanding existing MPAs or for deciding between different candidate areas for new MPAs.

When it comes to expansion, the alternatives include the following:

- Extending the protection by also including currently undesignated Nested Targets within existing MPAs.
- Extending the boundaries of existing (or potentially new) MPAs to include specific Nested Targets.

When looking beyond existing MPAs and at candidate areas for new MPAs, priority should probably be given to (in no particular order):

- Geographic distribution: Areas that contribute significantly to the geographical spread and connectivity of one or more Nested Targets in the context of the MPA Network;
- Size: Areas that are big enough to encompass the full range of habitats that priority species need throughout their lifecycle;
- Quality: High-quality areas that serve as 'source area' for priority species and habitats;
- Refugia: Areas that can serve as e.g. climate refugia for priority species and habitats;
- Status: Areas in which priority habitats and species are in the best Conservation Status;
- Multiple Targets: Areas in which multiple Nested Targets occur;
- High-pressure areas: Areas under such pressure that, if the area is not protected, the Nested Target could be lost or become extinct.

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STEP 9.2 DEFINING REGULATION PRIORITIES

The sensitivity analysis (see Step 6.2) has helped set Threat Reduction Objectives and Regulation Objectives (see Step 7). Aligning existing regulation within and across all MPAs in the Network to these Regulation Objectives seems like the logical next step. Standardised regulatory text can help ensure consistency within the MPA Network and efficiency in the work.

Harmonising regulation is not just a bureaucratic matter, and sometimes creates push-back. This is logical, considering that more stringent regulation can decrease the access rights of certain stakeholder groups, such as fisheries and shipping. The need for stakeholder consultations and public hearings must be taken into account in the phasing of priorities over time.

It is therefore important to understand which Threats are more urgent to deal with than others. By comparing the occurrence of Threats inside protected areas with the Threat Reduction Objectives, clues can be found as to which Threats require the most (urgent) action:

- The bigger the gap between the Threat Reduction Objective and the current occurrence of Threats, the higher the priority.
- The more sensitive the Nested Targets are known to be to that particular Threat, the higher the priority.

A finer examination is performed of the Threats occurring in those MPAs that contain Nested Targets at risk of disappearing. The regulation of the Threats impacting these Nested Targets is prioritised.

For many Threats, however, there is not sufficient data to understand whether more enforcement is needed or whether regulation needs to be tightened. That lack of data might require urgent action (see Step 9.3).

If a Threat known to impact the Nested Targets within an MPA occurs but is not dealt with effectively, that MPA is considered ineffective. To solve this, responsible authorities can improve enforcement, revise existing regulation, or both. They can also consider compensating for ineffective areas by designating additional MPAs. If, for example, a particular MPA contains one or more Nested Targets that are very sensitive to trawling, but the MPA cannot be closed to trawling, then the MPA is considered ineffective and might be compensated by protecting an area with similar conservation values – and closing that area to trawling.

Some Threats, unfortunately, cannot be effectively addressed through protection measures and require additional action. Using the information in the dashboard and the sensitivity analysis underpinning the Threat Reduction Objectives will greatly help make the case. For example, some Nested Targets are seriously impacted by the effects of eutrophication. Some of the main sources of eutrophication, i.e. the use of fertilisers in agriculture, are hard to regulate effectively with MPA legislation. This is why Integrated Marine Management – and hence the collaboration between different sectors – is a crucial precondition for the ultimate success of an MPA Network. Without additional measures, the MPA Network cannot be fully effective.

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STEP 9.3 DEFINING PRIORITY DATA REQUIREMENTS

The usability of the Framework and its components depends to a large extent on having an evidence base that can be used for decision-making. In Sweden – and probably in most other parts of the world – the evidence base is far from ideal. There are two arguments that can help decision-makers move forward despite a meagre evidence base:

1. Not taking action is a decision in itself and might have consequences for the long-term survival of certain species and habitats.
2. It is sometimes possible to make decisions without having a full understanding of the situation, if the risk of adverse impact is likely to be negligible. These are called no-regret actions.

The work to synthesise the existing evidence base (Step 8) has unveiled problems with the quality of existing data, as well as gaps in data on the occurrence and Conservation Status of many of the Nested Targets, on actual regulation in MPAs, on the occurrence of Threats, etc.

Within this context, some priorities for data related to protection (Step 9.1) and for data related to Threats and Regulations (Step 9.2). have already been defined. The priorities are as follows:

- Data requirements related to the protection of Nested Targets with worse Conservation Status. These requirements are prioritised because the associated risks of losing these Nested Targets is high. In practice, this means prioritising the gathering of base-line data for Nested Targets with a Poor or Fair (suspected) Conservation Status.
- Monitoring over time of the status of Nested Targets in Poor or Fair (suspected) Conservation Status. This is prioritised because insight in the status trend can help us understand the effectiveness of protection measures.
- Data requirements for Threats and Stresses that impact Nested Targets in worse Conservation Status. These requirements are prioritised because the associated risk of those Nested Targets disappearing in that region is higher.
- Data requirements related to actual regulation of priority Threats in MPAs. These requirements are prioritised because it is important to understand if there is a regulatory problem inside MPAs or if the problem needs to be tackled outside MPAs.

However, the list of data requirements remains very long. Over time, further prioritisation is needed taking into account a wide range of issues, including the newest developments in data gathering methods, their cost-effectiveness, security issues, the use of data from other sectors (e.g. the maritime sector or surveillance data), and public debate.

For the latest regional priorities, please refer to the Regional Plans for the Baltic Proper and the Gulf of Bothnia (publication expected in 2021).

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Razorbills.
Photo: Ingrid Nordemar.

Step 10 Designing the governance structure and adaptive management process

In the previous steps, the MPA Network has been designed, an evidence base to inform decision-making has been built, and priority actions have been based on existing evidence. In order to ensure that the priorities remain relevant as things change over time, a final step is needed: designing and implementing a process and structure for the management of MPA Networks.

SUB-STEPS

10.1 Designing the adaptive management process
10.2 Planning the governance structure

KEY DEFINITIONS

Adaptive Management – The incorporation of deliberate learning into professional practice to reduce uncertainty in decision making. Specifically, it is the integration of design, management, and monitoring to enable practitioners to systematically and efficiently test key assumptions, evaluate the results, adjust management decisions, and generate learning. The Conservation Standards explicitly bring adaptive management principles into conservation practice.

Effective Management – An MPA Network is effectively managed if its ecological (Nested) Targets are sufficiently protected, the negative effects of human activities are reduced, and favourable Conservation Status is achieved.

Theory of Change – A series of causally linked assumptions about how a team thinks its actions will help it achieve both intermediate results and longer-term conservation and human well-being goals. A Theory of Change can be expressed in the text, diagrammatic (e.g. a results chain), or other forms.

Assumption – An explicit statement of what a team assumes is true. Assumptions are the logical sequences linking project strategies to one or more Targets as reflected in a Theory of Change. Assumptions may also include a team's expression of how they anticipate external variables to influence the achievement of results.

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STEP 10.1 SETTING UP THE ADAPTIVE MANAGEMENT PROCESS

By continuously reviewing progress, adjusting actions, and revisiting decisions, it is possible to gradually improve the effectiveness of the MPA Network. The suggested adaptive management process for MPA Networks is based on the cycle described in the Conservation Standards (see Figure 19). In Figure 20, the different components of the National Framework for MPA Network Design and Management have been mapped onto the steps of this cycle.

The adaptive management cycle does not necessarily entail that all the steps in Figure 20 are iterated in order. Rather, adjustments can be made in any step, as relevant. Some components are suitable for yearly reviews and adjustments, whereas other components only need to be reviewed over longer periods in time.

Firstly, a routine assessment of the progress made towards reaching Goals and Objectives and an evaluation of the effectiveness of the MPA Network are needed, in order to ad-

Figure 20. The adaptive management cycle as described in the Conservation Standards.

ASSESS
Team, Purpose
Scope, Vision
Targets, Nested Targets
Threats, Sensitivity
Conservation Status (baseline in dashboard)

PLAN
Goals
Protection Objectives
Regulation Objectives
Priorities for action (monitoring, regulation, protection)

IMPLEMENT
Work plan for CABs
Budget for CABs
Implement work plan

ANALYSE & ADAPT
Prepare data (update dashboard)
Analyse results
Adapt plans

SHARE
Document learning
Share learning
Foster learning

Figure 19. The main components of the National Framework of MPA Network Design and Management mapped onto the adaptive management cycle. Each Regional Plan contains all components described under Assess and Plan.

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just actions in order to make further progress. For example, the regional Protection Objective for eelgrass beds in the Baltic Proper is 80%. By regularly assessing what the current protection level for eelgrass is and how the protection is progressing, it is possible to evaluate whether the progress is sufficient. If it is not, priority actions and work plans can be adapted to increase protection.

A review of the progress and the effectiveness of the MPA Network level is needed at least once a year, including an update of the evidence base with the latest data from monitoring and mapping efforts (Step 8) and a review of the priorities for action (Step 9).

Periodically, it might also be necessary to review the Goals and Objectives themselves. For example, if the Conservation Status of a Nested Target changes to the worse, it might require more protection than previously thought, which could be achieved by adjusting the Protection Objective or Regulation Objective for that Nested Target. In some situations, there might be reason to revisit the taxonomies of Targets and Nested Targets or of Threats and Stresses, e.g. if international or national priorities or obligations change, or if new Threats or Stresses emerge. A review of the Goals and Objectives in the Regional Plans and of the taxonomies (Steps 2–8) is likely needed at least once every five years.

From time to time, it might even be necessary to review the Theory of Change and the other basic components and concepts of the Framework, as they contain some uncertainties and assumptions. For example, it is assumed that the legal protection of marine areas will lead to reduced harmful human activities in those areas. It is further assumed that reduced harmful human activities inside MPAs will lead to improved status of the marine environment. The evidence base for these cause-effect relationships, however, is still limited today. Taking an adaptive management approach is crucial for dealing with these uncertainties. The Framework (Part II) probably needs to be reviewed at least once every five years.

Throughout the process, lessons learned should be recorded and a structure for sharing developed, so that teams and partners can benefit from the experiences and learning created.

In this step, a plan for adaptive management of the MPA Networks has been developed. For this adaptive management to fully function, the existing governance structure of MPAs must be revised.

STEP 10.2 PLANNING THE GOVERNANCE STRUCTURE

Whereas the management of an individual MPA is typically the responsibility of a particular county, the management of an entire network of MPAs requires the involvement of various actors. Hence, adaptations to the current governance structure are proposed below that would support effective MPA Network management.

Adaptations to governance often require long processes, to ensure political buy-in and to carefully weigh suitable alternatives for achieving the desired outcome. The governance structure described in this section is, therefore, nothing more than a pragmatic proposition, and does not reflect a formally agreed change to the governance of MPAs in Sweden.

The following conditions are deemed critical for enabling effective management of an MPA Network:

- The CABs, together with the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency, need to have the mandate to work for the implementation of – and need to be held accountable for achieving – the Network's Goals and Objectives.
- The protection of marine areas needs to be just one of several well-aligned elements of Integrated Marine Management.
- Government budget allocations for MPA management need to be sufficient.

In line with the Programme of Measures for the MSFD, the establishment of three *Regional Councils* is proposed, each responsible for the management of a distinct regional MPA Network. Each council works towards the achievement of the regional Goals and Objectives. All those who are responsible for MPAs in a region should be members of the respective council.

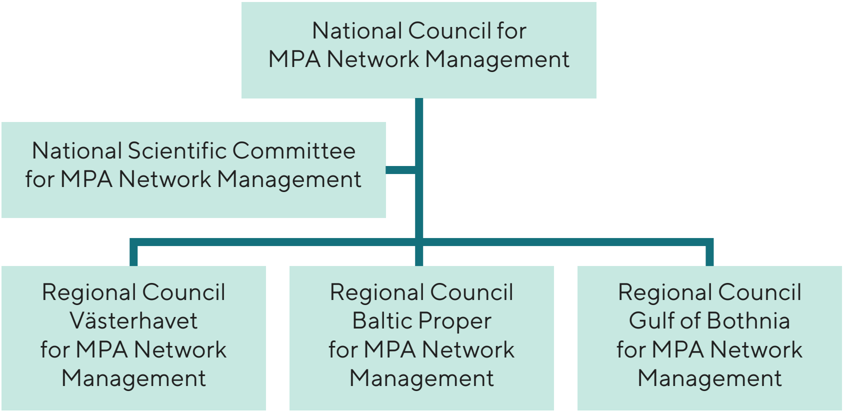

Figure 21. Proposed structure for the management of Regional MPA Networks in Sweden. Lines imply multi-directional information exchange rather than top-down hierarchical relations.

As the MPA Networks in Sweden are part of a national undertaking, the establishment of a *National Council* is also proposed, responsible for addressing cross-regional priorities and working towards achieving the national ambitions for MPAs. It is important to include a Swedish Agency for Marine and Water Management representative working with the EU Habitats Directive in this council. Ideally, the National Council for MPA Network Management is one among various thematic councils that together ensure Integrated Marine Management.

Further, the proposal includes support for the Regional and National Councils from a *National Scientific Committee*. The main tasks of this Committee are to ensure the use of best available data and information, and to help set priorities to improve that information.

Figure 21 shows a diagram of the proposed structure, and Table 7 (on the next spread) summarises the proposed members and responsibilities of the Councils and Committee.

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Table 7. Summary of proposed members and responsibilities of the Regional Council, the National Council and the Scientific Committee.

Members	Main responsibilities
Regional Council	
Members: • The regional MPA Network coordinator. They serve as the chair of the regional council and coordinates regular meetings. • For each CAB, the person who has the overall responsibility for MPAs in that CAB. • The person responsible for MPAs on the national level (Swedish Agency for Marine and Water Management). • A representative of the Scientific Committee.	**Main responsibilities:** • Attain the Goals and Objectives agreed on in the Regional Plan. • Ensure the availability of transparent, up-to-date, and publicly accessible information on the Goals, Objectives, and Status of the MPA Network. • Identify and decide on: - Regional priorities for additional and improved protection translated to concrete measures for each CAB. - Regional issues that stretch beyond MPAs and which are lacking coordination (i.e. contradictions or gaps in legislation, policies and resource allocation decisions), hampering the achievement of Goals and Objectives, to inform the National Council. - Regional monitoring priorities, to inform national monitoring efforts. - Regional budgetary priorities, as input to national budgeting. • The Chair of each Regional Council briefs the National Council.
National Council	
Members: • The person responsible for MPAs on the national level (Swedish Agency for Marine and Water Management). They serve as the chair and coordinates yearly meetings. • The Regional MPA Network coordinators. • The chair of the Scientific Committee. • A representative from the Swedish Environmental Protection Agency. • Swedish Agency for Marine and Water Management Coordinators of relevant national initiatives (e.g. data management, fisheries, MSP, research, MSFD, Green Infrastructure), as well as international initiatives such as the Habitats Directive.	**Main responsibilities:** • Advance on issues that hamper the achievement of regional Goals and Objectives. • Filter national priorities for additional or improved protection to serve as the basis for implementation by each region. • Collaborate with other national agencies, initiatives, and processes to deal with lacking coordination and other issues as needed for the fulfilment of MPA Network Goals and Objectives. • Determine national budgetary priorities and main messages, and make them available for annual reporting on MPAs to the Government.
National Scientific Committee	
Members: • The Coordinator of the Scientific Committee. They serve as the chair of the Scientific Committee and coordinates regular meetings. • The person responsible for MPAs on the national level (Swedish Agency for Marine and Water Management). • The person/institute responsible for ensuring that the most current MPA data is included in the MPA Network Dashboard. • Representative(s) of relevant scientific institutes involved in data sourcing and updating for MPA management. • Representative(s) of relevant data handling units in the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency (e.g. related to Symphony, the Dashboard, reporting formats and databases).	**Main responsibilities:** • Ensure that the dashboard and the regional status reports are based on best available knowledge and that these reports are as scientifically objective as possible. • Bring the latest science to the Regional and National Councils on issues as prioritised by the regions. • Prioritise data gaps and develop proposals to fill these gaps, including proposals for national monitoring and research.

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Eider ducks.
Photo: Ingrid Nordemar.

Part IV

WORK IN PROGRESS

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This document only represents a first attempt at a framework with the definitions, guiding principles, and methodology needed to guide MPA Network Design & Management. It will be refined over time, as it is put into practice and learning is generated about what works and what does not.

For the regional MPA Networks in Sweden, plenty of work remains to fully operationalise the steps as laid out in the Framework. One of the priorities will be to deal with the most pressing data gaps that need to be filled for the system to work better (see step 9.3 in Part III). These gaps, made visible in the Dashboard, relate to baseline data on the occurrence and Conservation Status of many Nested Targets, data on the occurrence of Threats, and data on regulations across MPAs in Sweden. Another important challenge is to find a way to start practising adaptive management (see step 10.1 without pending governance issues being fully resolved.

There is also more conceptual work to be done. The list below summarises the priorities for further development of guidance, templates, and systems:

Developing a monitoring system: Improving the evidence base for MPA Network management will require – among other things – a continuous flow of data on a set of standardised indicators resulting from ongoing monitoring efforts. Standardising the indicators will help ensure that data can be aggregated easily from the level of the individual MPA to the county, from the counties to the regional MPA Network, and from the regional networks to the national level. Development of a cost-effective, practical, and good-quality monitoring system for MPAs will therefore be one of the priorities of the coming years. As part of this system, standardised indicators will be developed for all components of the Framework: for measuring the extent to which Protection and Regulation Objectives are met, for measuring the Conservation Status, spread, and occurrence of Targets and Nested Targets, for measuring the occurrence of Threats etc. It is important to ensure that MPA monitoring is an integral part of national marine monitoring.

Improving guidance and templates for MPA budgeting: The management of MPAs, the implementation of monitoring schemes, and the implementation of network priorities (e.g. designation of new MPAs, spatial analysis, and setting baseline data) are only possible if sufficient resources are allocated. To facilitate sufficient allocation of budget to the designation, monitoring, and management of MPAs, transparent and practical budgeting guidance and templates need to be developed.

Improving guidance on connectivity: Ensuring connectivity within an MPA Network is one of the key challenges. There is still a lack of knowledge about the spread of marine species as well as a lack of methods for analysing whether a Network is well-connected. Continued collaboration between counties and insights from national and international research are needed to develop practical approaches to measuring, improving, and maintaining connectivity in the MPA Network.

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Improving guidance and templates for MPA design, management, monitoring, and reporting: It is crucial to align the designation, management, monitoring, and reporting of individual MPAs with the Framework and the taxonomies used in the design and management of the entire MPA Network. Clear guidance and (digitised) templates that incorporate the same principles, definitions, components, and taxonomies will help improve adaptive management of the individual MPAs, and will increase the probability that information can flow between MPAs and across the different levels.

Guidance for expanding the MPA Network: In the near future, Sweden will most probably increase its current aim of protecting 10% of the marine area to 30%, in line with work in progress within the CBD and the EU Biodiversity Strategy. In order to meet the 30% aim, countries are exploring how to best incorporate Other Effective Conservation Measures (OECMs) into marine conservation. In addition, a new category of 'strictly protected' marine areas is being developed. Increasing the total amount of MPA area to 30%, integrating OECMs, and paying special attention to strictly protected marine areas will require adjustments to the Framework, in particular to setting Protection Objectives (Step 5).

The list above is not exhaustive, and there are various other issues that require continued discussions, e.g. improving understanding of the impacts of climate change, improving MPA Network management in the context of Integrated Marine Management, and integrating ecosystem services and the link to the Blue Growth agenda.

Photo: Trygve Finkelsen / Shutterstock.

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Glossary

This section provides an overview of the most central terms used in this document. The source of the definition is captured in parentheses. Specifically, (CS) indicates that the definition is the same as in the Conservation Standards, and (adapted for the Framework) indicates that one or more existing definitions have been adapted for the purposes of the Framework.

A

Adaptive Management – The incorporation of deliberate learning into professional practice to reduce uncertainty in decision making. Specifically, it is the integration of design, management, and monitoring to enable practitioners to systematically and efficiently test key assumptions, evaluate the results, adjust management decisions, and generate learning. The Conservation Standards explicitly bring adaptive management principles into conservation practice. (CS)

Assumption – An explicit statement of what a team assumes is true. Assumptions are the logical sequences linking project strategies to one or more Targets as reflected in a Theory of Change. Assumptions may also include a team's expression of how they anticipate external variables to influence the achievement of results. (CS)

C

Connectivity – A well-connected MPA Network is characterised by the functioning exchange of individuals and genes between different ecosystems and ecosystem components. The opportunity for exchange depends on the occurrence of good quality habitats and ecosystems, of relevant size, and scattered throughout the seascape. (adapted for the Framework)

Conservation Standards (CS) – A common framework and set of best practices that explicitly incorporate principles of collaboration, evidence-based conservation, and adaptive management. (CMP)

Conservation Status (or Status) – The overall health of a Nested Target. Ideally, the Conservation Status also expresses the development of the Status over time, in order to convey the trend (adapted for the Framework).

E

Ecological representativity – A representative MPA Network encompasses geographically well-distributed, relevant proportions of the full range of ecosystems and ecosystem components that occur in a marine region. (adapted for the Framework)

Effective Management – An MPA Network is effectively managed if its ecological (Nested) Targets are sufficiently protected, the negative effects of human activities are reduced, and favourable Conservation Status is achieved. (adapted for the Framework)

Evidence base – The body of all data, studies, syntheses/systems, and theory being used as evidence for a particular set of hypotheses (Suter, 2016). It is composed of the optimal combination of available data of sufficient quality, expert opinions, and studies.

F

Functionality – A functional MPA Network will maintain and improve the Status of ecosystems, habitats, and species that it aims to protect. (adapted for the Framework)

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G

Geographic Scope – The spatial demarcation of a conservation initiative. It is determined by distinct biological features, ecosystem types and functions, the similarity of occurring Threats, and administrative areas. (CS, adapted for the Framework)

Goal – A formal statement detailing a project's desired impact, such as the desired future Status of a (Nested) Target. A good Goal meets the criteria of being specific, measurable, achievable, results-oriented, and time-limited (SMART). (CS)

K

Key Attribute – An aspect of a (Nested) Target's biology or ecology that, if present, defines a healthy (Nested) Target and, if missing or altered, would lead to the outright loss or extreme degradation of that Target over time. (Also known as a key ecological attribute). (CS)

M

Marine Protected Area, MPA – A geographically defined marine area, whose primary and clearly stated purpose is marine conservation and which is regulated and managed through legal or other effective means to achieve this purpose. In the Framework, the following legally binding designation types for MPAs are considered: 1. Marine National Park, 2. Marine Nature Reserve; 3. Marine Biotope Protection Area, and 4. Marine Natura 2000 site. These areas are designated according to the Swedish Environmental Code. (the Framework)

N

Natura 2000 – A network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. It stretches across all 27 EU countries, both on land and at sea. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under both the Birds Directive and the Habitats Directive. EU member states have legal obligations regarding the management of Natura 2000 sites and the achievement of favourable conservation status for those habitats and species that fall within their territory.

O

Objective – A formal statement detailing the desired outcome of a project, such as reducing a critical Threat. A good Objective meets the criteria of being specific, measurable, achievable, results-oriented, and time-limited (SMART). If the project is well-conceptualised and -designed, the realization of a project's Objectives should lead to the fulfillment of the project's Goals and ultimately its Vision. (CS) Also see Protection Objective, Regulation Objective, and Threat Reduction Objective.

Other effective area-based conservation measures (OECMs) – Geographically defined areas other than a protected area, which are governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values. (CBD, 2018)

P

Protection Objective (PO) – A formal statement detailing the desired proportion of a (Nested) Target that is protected by MPA legislation, i.e that is part of the MPA Network. (the Framework)

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R

Regulation Objective (RO) – A formal statement detailing the recommended regulation of a harmful human activity (Threat). (the Framework)

S

Sensitivity – An expression of severity and irreversibility of the impact of a particular (potential) Threat to a Nested Target. It is based on an assessment of Stresses caused by that Threat. (adapted for the Framework)

Status – See Conservation Status.

Stress – An impaired aspect of a conservation target that results directly or indirectly from human activities. For example, low population size due to habitat loss, reduced river flows due to dams, and increased sedimentation due to dredging. (CS, adapted for the Framework)

T

Targets & Nested Targets – Ecological systems/habitats and specific species that were chosen to represent and encompass the full suite of biodiversity in the selected geographic Scope. Conservation of the Targets should, in theory, ensure the conservation of all ecosystems and species within the Scope. (CS, adapted for the Framework)

Theory of Change – A series of causally linked assumptions about how a team thinks its actions will help it achieve both intermediate results and longer-term conservation and human well-being goals. A Theory of Change can be expressed in the text, diagrammatic (e.g. a results chain), or other forms. (CS)

Threat – (short for Direct Threat) Primarily a human activity that immediately degrades one or more (Nested) Targets (e.g. dredging or unsustainable fishing). Threats can also be natural phenomena altered by human activities (e.g. increase in extreme storm events due to climate change). Typically a Threat is tied to one or more stakeholders. (CS)

Threat Reduction Objective (TRO) – A formal statement detailing the desired reduction of a harmful human activity (Threat). (CS)

V

Vision Statement – A description of the desired state or ultimate condition that a project is working to achieve. A complete vision can include a description of the biodiversity of the site and/or a map of the project area, as well as a summary vision statement. It should be 1. relatively general, i.e. defined broadly enough to encompass all project activities; 2. inspirational in outlining the desired change in the Targets; and 3. simple and concise so that all participants can remember it. (CS)

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Annexes

ANNEX 1: Details on the process and the teams

Process

The process started late 2017 and gathered full steam one year later, when the different teams (see next section) had been fully established. Around 60 people participated in the overall process, with many people participating in more than one team. A series of 8 workshops around key components (see Figure A1.1) ensured alignment in thinking between the separate teams working in parallel on the Framework, the Regional Plans, and the Dashboard.

Each workshop focused on a few topics. For example, Workshop 2 focused on agreeing on the final Nested Targets and defining the Protection Objectives and Threats. Members of the Core Team typically facilitated the workshop sessions, which had a common structure: first, an introductory plenary session, followed by Regional Teams working in breakout groups on the specifics for their region or addressing different aspects, and finally reconvening in plenary for sharing and discussion (see photographs in Figures A1.2 and A1.3).

Between the main workshops listed in Figure A1.1, the Regional Teams arranged separate writing workshops ('skrivarstugor') whenever extra time was needed to go into more detail on a particular topic, e.g. development of Threat Reduction and Regulation Objectives.

Outcomes from the workshops and writing workshops were discussed, fine-tuned, and agreed on by the Core Team, before finally being incorporated into the Framework and the Regional Plans. While most workshops were held face-to-face, the last few ones were organised virtually, due to Covid-19 restrictions.

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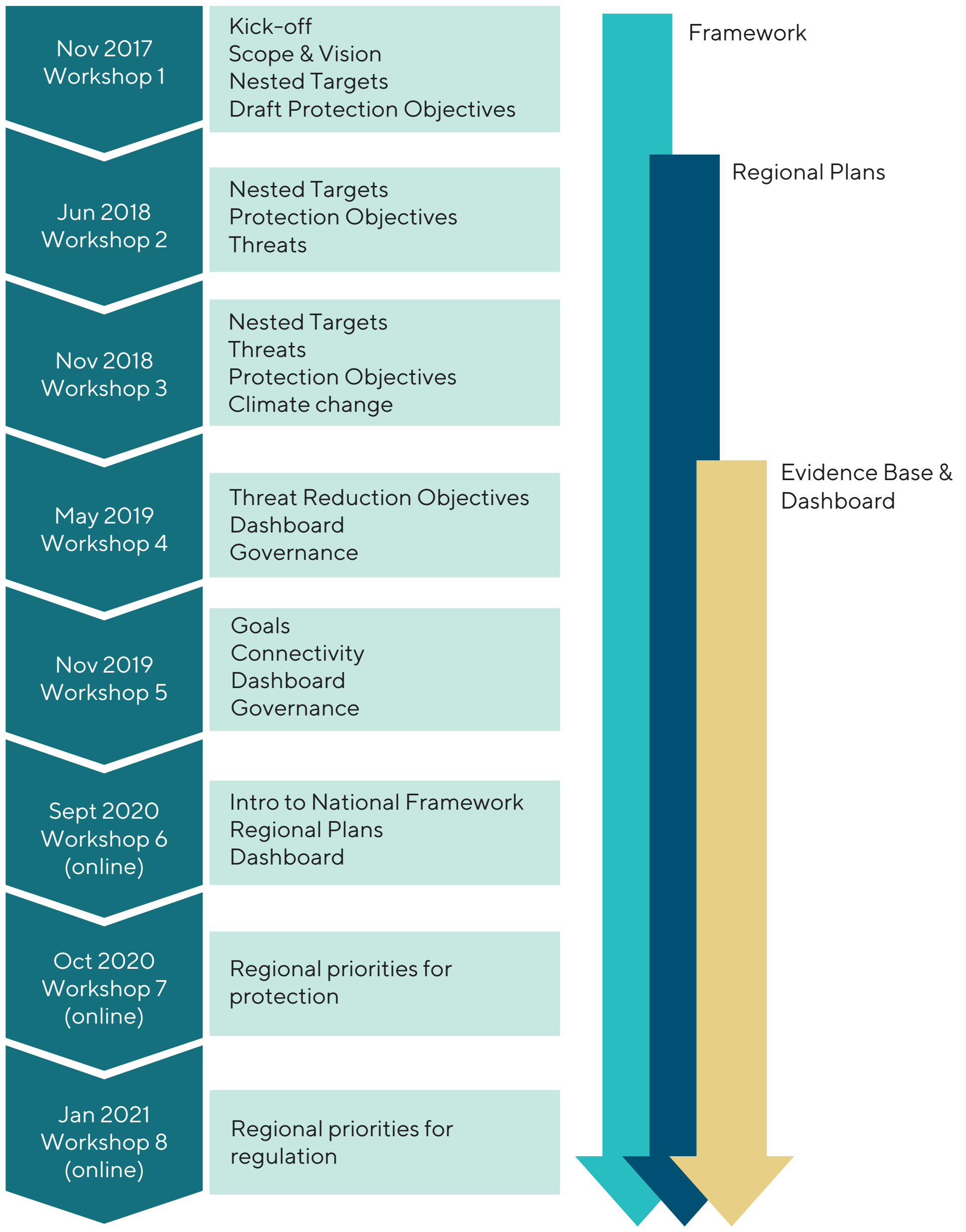

Figure A1.1: Simplified overview of the process to design the Framework, the Regional Plans, and the Dashboard (from November 2017 to January 2021). For definitions, see the Glossary or the relevant steps in Part III.

Figure A1.2: Workshop 3, November 2018, working with Threats.

Figure A1.3: Workshop 4, May 2019, brainstorming ideas for Dashboard views.

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Teams

The work was carried out by four teams working in parallel, each on particular tasks (see Figure A1.4):

- The *Core Team* was in charge of the overall coordination and development of the Framework. Members: Project manager and technical staff from SwAM, coordinators and process leaders of the Regional Teams from the CABs, and a methodological expert and overall project leader from FOS Europe (consultant).
- The two *Regional Teams*, of the Baltic Proper and the Gulf of Bothnia, were in charge of testing and using the Framework and the Dashboard in the development of the Regional Plans. Members: coordinators and process leaders from the CABs (also part of the Core Team) and staff of relevant CABs who work with marine conservation.
- The *Dashboard Team* was in charge of compiling the evidence base and creating a dashboard. Members: selected members from the Core Team and several experts in dashboard design and data management (consultants).

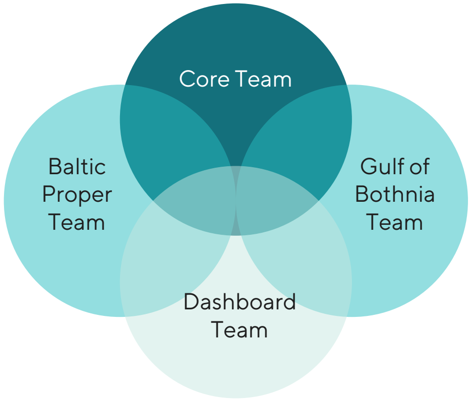

Figure A1.4: Four teams working in tandem and comprising around 60 people, of which some were members of more than one team.

In addition, other experts relevant to marine conservation provided advice, insight, and feedback throughout the process.

The parallel work of the four teams provided a mechanism for peer review. In addition, the fact that the regional leaders and process facilitators were also part of the Core Team, and some also of the Dashboard Team, helped ensure alignment and cross-fertilisation of insights between the Teams.

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ANNEX 2: Descriptions of Nested Targets in Sweden

This Annex (working version June 2021) describes the Nested Targets in the Baltic Proper and the Gulf of Bothnia.

The descriptions include, for each Nested Target:

- brief facts and description of the Nested Targets
- brief summary of the main threats
- status assessment according to the Habitats Directive and the HELCOM Red List

Some Nested Targets are found along the entire coast of the Baltic Proper (BP) and the Gulf of Bothnia (GB), whereas others occur only along the southern or northern part of the coast. This is marked with BP and GB in the heading of each text.

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Habitat types in the Habitats Directive

Sandbanks (1110); BP, GB

Sandbanks that are permanently covered with seawater, usually in relatively shallow water but may extend down to a maximum depth of 30 m below sea level. The banks are topographically different from the surrounding bottom areas. Shallow vegetation-free bottoms of sand or sandy loam are very important as nursery areas for flatfish. The sandbanks can also be covered with eelgrass and other seed plants. The banks that are located further out from the coast have a good water exchange and often serve as a refuge for marine species displaced from the more coastal areas.

The main threats to sandbanks are extraction of sand, discharge of nutrients (leading to increased production of filamentous algae and drifting algal mats), various forms of exploitation such as ports, bridges, and piers, and dredging.

According to the latest reporting on the Habitats Directive (SEPA, 2020)[1] sandbanks in the Baltic Sea are considered to have poor conservation status, and the habitat type is classified as vulnerable (VU) according to the HELCOM Red List (2013).

Estuaries (1130); BP, GB

Estuaries are river mouths where freshwater mixes with more saline seawater, and where both marine and freshwater environments are present. Estuaries have a complex composition of species of both animals and plants from marine and brackish water. They have great importance for migratory fish, such as salmon, trout, eels, and sea lamprey, and are significant foraging and wintering areas for many bird species. These areas are often protected areas with special regulations for fishing.

1 Swedish Environmental Protection Agency 2020. Sveriges arter och naturtyper i EU:s art- och habitatdirektiv. Resultat från rapporteringen 2019 till EU av bevarandestatus 2013–2018.

The main threats to estuaries are river regulation, various forms of exploitation such as ports, bridges, and piers, dredging, oil spills, and nutrient releases.

According to the latest reporting on the Habitats Directive (SEPA, 2020), estuaries are considered to have poor status. Estuaries are classified as critically endangered (CR) according to the HELCOM Red List (2013).

Mudflats and sandflats not covered by seawater at low tide (1140); BP, GB

These areas of shallow, sandy, and muddy bottoms are exposed at low tide. In the Baltic, these seabeds are often free of macro-vegetation, but blue-green algae, diatoms, and filamentous algae may occur. They often have a rich benthic fauna of various burrowing worms and clams in the sediment, and epifauna of crustaceans and molluscs on the bottom. These areas are important as nursery areas for flatfish and as resting and feeding area for shorebirds.

The main threats to exposed mudflats and sandflats are extraction of sand, various forms of exploitation such as ports, bridges, piers, and dredging, as well as nutrient releases.

According to the latest reporting on the Habitats Directive (SEPA, 2020), mudflats and sandflats have unfavourable status in the Baltic Sea. The habitat type is classified as vulnerable (VU) according to the HELCOM Red List (2013).

Coastal lagoons (1150); BP, GB

This mosaic biotope complex consists of shallow bays that are separated from the sea by headlands or by dense vegetation, restricting the exchange of water. Lagoons are often very productive, because they warm up early in the spring and get a supply of nutrients from the surrounding land and from foraging birds. Sometimes there are freshwater outflows that create a habitat similar to a small estuary. Such environments are

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particularly valuable because the outflows favour freshwater spawning fish. These habitats are generally rich in plant and animal communities and are an important habitat for various bird and fish species such as perch, pike, and roach. The vegetation binds the sediments and reduces the turbidity of the water. Land elevation and sedimentation reduce water turnover in the lagoons, leading to changes in the shape and function of these habitats over time. The early stages of isolation – precursors to flads and gloe lakes – often have a species-rich, heterogeneous underwater vegetation similar to that found in open bays. Common species are watermilfoil, pondweed, and bladderwrack. In later stages, the lagoon disappears, leaving behind gloe lakes with a less species-rich and more homogeneous vegetation, often dominated by relatively tall Charales, *Najas marina* and pondweed[2].

The habitat is threatened by exploitation such as the construction of piers, boating[3] and dredging[4], as well as eutrophication. Toxins from recreational boats and dredging can have major consequences in the habitat, as water exchange is limited.

According to the latest reporting on the Habitats Directive (SEPA, 2020), lagoons in the Baltic Sea are considered to have poor status, mainly due to eutrophication and exploitation. The habitat type is classified as vulnerable (VU) according to the HELCOM Red List (2013).

2 Edlund J and Siljeholm E. (2012). Identifiering av marina naturvärdesobjekt i Östergötland – en metodstudie. County Administrative Board of Östergötland, report 2012:12.
3 Moksnes P-O, Eriander L, Hansen J, Albertsson J, Andersson M, Bergström U, Carlström J, Egardt J, Fredriksson R, Granhag L, Lindgren F, Nordberg K, Wendt I, Wikström S, Ytreberg E. (2019). Fritidsbåtars påverkan på grunda kustekosystem i Sverige. Swedish Institute for the Marine Environment report 2019:3.
4 Vägledning för 1150 Laguner, Swedish Environmental Protection Agency 2011.

Inlets and bays (1160); BP, GB

Inlets and bays have a limited influence of freshwater, are often sheltered from strong waves, and contain different types of sediments and substrates. This habitat complex is made up species-rich communities of benthic plants and animals. It harbours fields of vascular plants, algae, and perennial macroalgae, whose structure and function are important for fish recruitment and abundant bird life. The bays are normally larger than 25 hectares.

The habitat is threatened by exploitation such as the construction of piers, boat traffic, and dredging, and eutrophication. Inlets and bays require a natural water turnover that is not disturbed by constructions, piers, etc.

The latest reporting for the Habitats Directive assesses inlets and bays as having unfavourable status in the Baltic Sea. The habitat type is classified as vulnerable (VU) according to the HELCOM Red List (2013).

Narrow Baltic bays (1650); BP, GB

This habitat type is characterised by long and narrow bays of the Baltic Sea, separated from the open sea by headlands and forming a complex mosaic habitat that is rich in various kinds of plant and animal communities. Soft sediments accumulate in the bays, providing suitable conditions for vascular plants. These narrow bays are important spawning and nursery grounds for many fish species and valuable feeding areas for birds. This habitat type does not occur south of Kalmar County.

The habitat type is adversely affected by exploitation through e.g. piers, water activities, dredging and dumping, intensive boat traffic, eutrophication, and runoff from surrounding agricultural land.

In the latest reporting for the Habitats Directive, narrow Baltic bays are considered to have poor status in the Baltic Sea

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(SEPA, 2020). The habitat type is classified as vulnerable (VU) according to the HELCOM Red List (2013).

Reefs (1170); BP, GB

These areas have bottoms of over 50% coverage of hard substrates. The reefs can either be topographically distinct from the surrounding seafloor, or similar in composition. Reefs are often characterised by a zonation of benthic plant communities with high primary production and a high diversity of species of algae. Frequent and prosperous seaweed belts are a prerequisite for a high biodiversity consisting of fish, mussels, moss animals and other soft and hard bottom species to thrive. Reefs that occur further out to sea are called shoals. These are areas raised from the bedrock, which differ from shallower coastal areas in that they are surrounded by deeper water. From the point of view of nature conservation, the shoals often act as refuges for organisms that were previously common in shallower, more coastal areas, but which have disappeared or decreased in those areas as a result of increased disturbance and pollution. They house species and habitats that are characteristic of more undisturbed aquatic environments, and can serve as refuges.

Reefs are threatened, among other things, by eutrophication, drifting algal mats, swell from shipping, oil spills and chemicals, construction, and cables and pipelines.

The conservation status of reefs in the Baltic Sea according to the latest reporting on the Habitats Directive (SEPA, 2020) is poor (unfavourable–bad) and the habitat type is classified as vulnerable (VU) according to HELCOM's Red List of biotopes.

Baltic esker islands (1610); BP, GB

Islands consisting mainly (at least 50%) of relatively well-sorted materials of sand, gravel, and stone, formed during the melting of the inland ice sheet. Esker islands may be low and treeless, or high and covered in heath or occasional groves of trees. The beaches consist of sand, gravel, and/or pebbles, often with larger stones. The shore area is a mosaic of plant and animal communities both below and above the water surface. The habitat type also includes the aquatic environment to the depth limit of the attached macrovegetation (overlap with other priority Nested Target: Large perennial brown algae). It has been suggested that a buffer zone of about 200 m can be set up around the islands[5] The islets and islands are important breeding grounds for birds and resting places for seals.

The conservation status of the esker islands was assessed as poor (unfavourable–bad) according to the latest reporting on the Habitats Directive (SEPA, 2020), and the habitat type is assessed as near threatened (NT) according to the HELCOM Red List (2013).

Boreal Baltic islets (1620); BP, GB

Groups of or individual smaller islands and islets in the Baltic Sea. The islands consist of bedrock or moraine, and are often at exposed sites. Bare rock faces are common, but on the islands smaller individual trees can occur, such as conifers, and also deciduous trees as in, for example, Blekinge and Stockholm archipelago. Submerged vegetation down to the depth distribution limit is also included in the habitat (overlaps with other priority Nested Target: Large perennial brown algae). The islets and islands are important nesting sites for birds and resting places for seals.

The conservation status of boreal Baltic islets was deemed unfavourable–inadequate in the latest reporting on the Habitats Directive (SEPA, 2020), and the status is near threatened (NT) according to HELCOM's (2013) Red List of biotopes.

5 Fyhr F, Enhus C and Naeslund M. (2013). GIS-utsökning av Natura 2000-naturtyper – 1610 rullstensåsöar i Östersjön, 1620 skär i Östersjön, samt potentiella 1110 sandbankar och 1170 rev. Västernorrland, Stockholm, Södermanland, Östergötland, Blekinge, Skåne, Gullmarsfjorden och Skagerrak. AquaBiota Report 2013:03.

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Submerged or partially submerged sea caves (8330); BP

Knowledge about sea caves, their occurrence, appearance, structure, function, fauna, and flora is generally poor both in Sweden and in the EU. The habitat type is described very briefly in the EU Interpretation Manual (European Commission DG Environment 2013): 'Submerged or partially submerged sea caves. Caves situated under the sea or opened to it, at least at high tide, including partially submerged sea caves. Their bottom and sides harbour communities of marine invertebrates and algae'.[6]

A proposal for Swedish guidance on the habitat type was developed in connection with the basic inventory of sea caves by the Swedish Agency for Marine and Water Management in Skåne (Kullen) and along the High Coast in 2016. The proposal states that sea caves are those caves that are 'wholly or partly submerged, i.e. all caves where all or part of the bottom is covered by seawater at high tide'. Furthermore, they should be 'naturally formed and have ceilings, walls, and floors', and be large enough to accommodate an adult. Sea caves constitute habitat for communities of sessile invertebrates and algae, but may also provide habitat for fish. The species composition varies depending on water cover, salinity, exposure, and lighting conditions.

Underwater habitats and macrophytes

Meadows of vascular plants (25-100% coverage); BP, GB
Key habitat (HELCOM Underwater Biotopes)

Shallow bottoms often host meadows of both low-growing and tall species of vascular plants, such as pondweed and watermilfoil. These have an important role as habitat-forming primary producers. The meadows have several important functions, such as nutrient uptake and sediment stabilisation. By attenuating waves and currents, and by stabilising the sediment with a widespread network of rhizome and root fibers, vascular plant meadows effectively counteract erosion. The meadows also take up nutrients and carbon, helping to reduce the effect of both eutrophication and climate change. The habitat usually consists of several different species that have varying requirements for their living environment and sometimes form mixed communities together with Charales. Different plant species have different sensitivity to human influences, such as increased nutrient levels, turbidity or boat traffic. There is a positive correlation between the presence of the more sensitive species, such as *Eleocharis acicularis, E. parvula, Ruppia cirrhosa* (as well as Charales, eelgrass, and *Chorda filum*)[7] and the amount of fish fry of warm water species such as perch and pike[8]. The habitat is also considered valuable because it forms a three-dimensional structure and is important as a spawning area for fish such as pike, perch, and roach. In the Baltic Sea, tall vascular plants generally occur at a depth down to about 4–6 m in protected or highly protected environments. The highest values are linked to meadows with a coverage rate of 25-100% (Mosaic, ecosystem components).

The meadows are threatened by dredging, recreational boating through e.g. anchoring, swells, and resuspension, construction of and shading from piers, as well as recreational fishing of large predatory fish.

According to a status classification based on vegetation in shallow marine environments, approximately 40-60% of these meadows are estimated to have fair or worse status[9].

Meadows of *Najas marina* (25-100% coverage); GB
Key habitat (HELCOM Underwater Biotopes)

Najas marina is common in sheltered bays, where it grows in shallow, soft, and muddy bottoms. It often forms dense mats down to about 1.5 m. Meadows of *Najas marina* build a three-dimensional

6 Basinventering av havsgrottor (8330) i Skåne län. Swedish Agency for Marine and Water Management report 2016:28

7 Svealandskusten – https://havet.nu/svealandskusten/?d=3448

8 Hansen J and Snickars M. (2014). Appling macrophyte community indicators to assess anthropogenic pressures on shallow soft bottoms. Hydrobiologia 738:171–189.

9 Skydda och vårda våra viktiga vikar, version 2.0, updated 2018, Jönsson R and Fredriksson S et al.

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structure in the water. As they grow in shallow, sheltered locations, they warm up in early spring, and are thus important habitats and nursery areas for fish. The meadows likely also contribute to the filtering of runoff water from the coastal area and stabilise sediments. The highest values are linked to meadows with a coverage rate of 25-100% (Mosaic, ecosystem components).

Meadows of *Najas marina* are adversely affected by eutrophication, constructions in water, and physical disturbance from recreational boats.

Meadows of *Najas marina* are included in HELCOM's classification of underwater biotopes (equivalent to HUBs AA.H1B5 and AA.J1B5) and are classified as near threatened (NT) according to HELCOM's Red List.

Meadows of Charales (25-100% coverage); BP, GB
Key habitat (HELCOM Underwater Biotopes)

Stoneworts (Charales) occur on shallow soft bottoms in the Baltic Sea, mostly down to about 3 m in protected to moderately exposed areas. Stonewort meadows build a three-dimensional structure in the water. As they grow in shallow, sheltered locations, the meadows warm up in early spring, and are thus important habitats and nursery areas for fish. The meadows probably also contribute to the filtering of runoff water from the coastal area and stabilise sediments. Stoneworts are an 'indicator species', because they are the first species to disappear if water quality deteriorates. The highest values are linked to meadows with a coverage rate of 25-100% (Mosaic, ecosystem components).

The meadows are threatened by the same factors as meadows of vascular plants, i.e. dredging, recreational boating through e.g. anchoring, swells, and resuspension, construction of and shading from piers, as well as recreational fishing of large predatory fish.

According to the HELCOM Red List (2013) of underwater habitats, the status of Charales beds (equivalent to HUBs AA.H1B4, AA.I1B4, AA.J1B4, AA.M1B4)[10] is near threatened (NT), and the overall status assessment is similar to that for meadows of vascular plants, i.e. 40-60% of the environment has fair or worse status.

Unattached bladderwrack (25-100% coverage); BP, GB
Key habitat (HELCOM Underwater Biotopes)

Populations of unattached bladderwrack might occur on sandy bottoms in semi-protected sites, either uniformly or together with, for example, vascular plant[11]. In some places, the unattached bladderwrack covers larger areas than the attached variety. Although the bladderwrack is not attached, the populations occur in the same place year after year. Generally, this seaweed is small, with centimetre-long shoots and a ball- or cauliflower-like appearance, but there are also groups of larger plants, with a height of up to five decimetres. The assessment is that even unattached bladderwrack plays an important ecological role, e.g. by providing a three-dimensional structure on soft bottoms, by small animals like mussels and insects finding food and shelter between the plants, and by being perennial.[12,13] The highest values are linked to areas with a coverage rate of 25-100% (Mosaic, ecosystem components).

Knowledge of unattached bladderwrack is still limited, but the populations are probably negatively affected by those factors that affect sandy and shallow bottoms, i.e. dredging, sand extraction, waves, cable and pipelines, and eutrophication.

10 Biotope information sheet, HELCOM redlist https://Helcom.fi/wp-content/uploads/2019/08/HELCOM-Red-List-AA.H1B4-AA.I1B4-AA.J1B4-AA.M1B4.pdf

11 Var finns den frilevande blåstången? E. Schagerström, S. Quarfordt,& S. Wikström. Svensk Botanisk Tidskrift 114: 5 (2020)

12 Biotope information sheet, HELCOM redlist https://Helcom.fi/wp-content/uploads/2019/08/HELCOM-Red-List-AA.M1Q2-AA.H1Q2.-AA.I1Q2-AA.J1Q2.pdf

13 Edlund J and Siljeholm E. (2012). Identifiering av marina naturvärdesobjekt i Östergötland – en metodstudie. County Administrative Board of Östergötland, report 2012:12.

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According to HELCOM (2013), soft bottoms dominated by stable collections of small adult unattached bladderwrack (dwarf form, HUBs AA.M1Q2, AA.H1Q2. AA.I1Q2, AA.J1Q2, J1Q2) constitute a threatened biotope in the Baltic Sea, and are considered endangered (EN)[14].

Eelgrass beds (25-100% coverage); BP
Key habitat (HELCOM Underwater Biotopes)

Eelgrass is a very important key species that creates species-rich habitats on shallow bottoms in the Baltic Sea, where it can form vast meadows and provide habitat for many fish and invertebrates. The meadows occur on sandy and soft bottoms from about two to 6–8 meters deep, and often grow along with other phanerogams. By attenuating waves and currents, and by stabilising the sediment with a widespread network of rhizome and root fibers, eelgrass effectively counteracts erosion. The meadows also take up nutrients and carbon, which helps to reduce the effect of both eutrophication and climate change.

Eelgrass meadows are threatened by eutrophication, increased physical exploitation, and overfishing. Small-scale exploitation (piers and marinas), as well as increased boat traffic including anchoring on shallow bottoms, can negatively impact the meadows. Over the past 50 years, the distribution of eelgrass has decreased by more than 25%, to different extents in different parts of the Baltic Sea[15]. Since 2016, there is an action plan for eelgrass in Swedish waters. The highest values are linked to meadows with a coverage rate of 25-100% (Mosaic, ecosystem components).

According to HELCOM (2013), soft bottoms dominated by eelgrass in the Baltic Sea are considered near threatened (NT) (equivalent to HUBs AA.H1B7, AA.I1B7, AA.J1B7; AA.M1B7). Eelgrass is considered vulnerable (VU) according to the Swedish Red List (2020)[16]. Eelgrass meadows can be designated as biotope protection areas under the regulation on protected areas (1998:1252) in the Environmental Code.

Areas with *Chara horrida*; BP
Swedish Red List

Chara horrida is a red-listed, large stonewort (Charales), usually 40–50 cm high, but it may reach over 1 m high in some bays with dense mats of stoneworts. The most distinctive feature is its long thorns. In Sweden, *Chara horrida* occurs along the Baltic coast from the border of Skåne/Blekinge in the south to Uppland in north, including also the islands Öland and Gotland. The species is endemic to the Baltic Sea and has been found in Germany, Estonia, Denmark, and Finland in addition to Sweden[17,18].

Areas with *Chara horrida* should be protected to the greatest extent possible from exploitation such as new piers, intensive boat traffic, and dredging. Nutrient input should be reduced in places where the species occurs or may occur.

Chara horrida is considered as near threatened (NT) according to both the Swedish Red List and the HELCOM Red List (Artdatabanken 2020, HELCOM 2013), and is included in an action plan for endangered species (Swedish Agency for Marine and Water Management, 2020:17).

Areas with *Chara braunii*; GB
HELCOM Red List

Chara braunii is also red-listed. Unlike other Swedish species in the genus, it is completely devoid of bark, and is thus easily recognised. The species is monoicous and can grow up to 40 cm, but the plants in the Gulf of Bothnia are usually smaller than 10 cm. *Chara braunii* is likely an annual plant that winters in the

14 Biotope information sheet, HELCOM redlist https://Helcom.fi/wp-content/uploads/2019/08/HELCOM-Red-List-AA.M1Q2-AA.H1Q2.-AA.I1Q2-AA.J1Q2.pdf
15 Biotope information sheet, HELCOM redlist https://helcom.fi/wp-content/uploads/2019/08/HELCOM-Red-List-AA.H1B7-AA.I1B7-AA.J1B7-AA.M1B7.pdf
16 Red-listed species in Sweden 2020, SLU Artdatabanken.
17 Artfakta, SLU Artdatabanken https://artfakta.se/naturvard/taxon/chara-horrida-329
18 Swedish Agency for Marine and Water Management (2020). Åtgärdsprogram för sällsynta kransalger längs kusten. Report 2020:17.

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form of oospores. In Sweden, fertile plants have been found from July to September. The species is usually abundantly fertile. It occurs on soft bottoms in sheltered bays in the Norrbotten archipelago, where the salinity does not exceed 3 psu.

Areas with *Chara braunii* should be protected to the greatest extent possible from exploitation such as new piers, intensive boat traffic, and dredging. Nutrient input should be reduced in places where the species occurs or may occur.

According to the Swedish Red List, *Chara braunii* is considered as near threatened (NT) (Artdatabanken, 2020), and according to the HELCOM Red List (2013), it is vulnerable (VU). It is included in an action plan for endangered species (Swedish Agency for Marine and Water Management, 2020:17).

Areas with *Hippuris tetraphylla*; GB
HELCOM Red List

Hippuris tetraphylla is a red-listed, clone-forming water plant that grows in clusters and whose upright, almost straight, unbranched stems reach up from the water. The stem, generally reddish, features rings of 4–6 flat, wide, blunt blades. The somewhat modest flowers sit in the leaf axils. The species grows on very soft bottoms only in sheltered locations, usually in narrow bays. Dispersal of *Hippuris tetraphylla* probably occurs both sexually (by seeds) and vegetatively (with detached pieces of rhizomes), but the exact conditions have not been further investigated[19].

The species may be adversely affected by overgrowing due to land uplift, without new suitable environments appearing near the newly overgrown areas.

Hippuris tetraphylla is included in Annex 2 of the EU Habitats Directive and, according to the latest assessment, does not reach favourable conservation status (SEPA, 2020). According to the Swedish Red List, *Hippuris tetraphylla* is considered critically endangered (CR) (Artdatabanken, 2020), and according to HELCOM's Red List assessed as endangered (EN) (2013).

Areas with *Alisma wahlenbergii*; GB
HELCOM Red List

Alisma wahlenbergii is globally red-listed as rare and is included in the EU Habitats Directive Annex 2, which means that it is to be protected in the Natura 2000 network. It grows completely submerged at a depth of 0.2–2 m in naturally nutrient-rich freshwater or slightly brackish water. The bottom usually consists of sand or loam. *Alisma wahlenbergii* is uncompetitive and usually grows in sites that are free of large aquatic plants such as reeds, rushes, and lilies. However, it often grows together with other small underwater plants with similar requirements, such as pondweed.

The species is likely to benefit from moderate beach grazing that keeps the reeds away.

Alisma wahlenbergii is globally red-listed as rare, and is listed as near threatened (NT) in Sweden (Artdatabanken, 2020) and as vulnerable (VU) in the HELCOM Red List (2013).

Areas with sedges (25-100% coverage); GB
Key habitat (HELCOM Underwater Biotopes)

Areas with sedges are usually found in river mouths and in sheltered bays and lagoons along the Gulf of Bothnia. Generally shallower than 1 m, they are dominated by *Schoenoplectus tabernaemontani* and *Bolboschoenus maritimus*, but also *Eleocharis uniglumis* and *E. palustris* can occur. The biotope serves as recruitment area for e.g. pike and perch. Its three-dimensional structure provides important breeding, foraging, and resting areas for several coastal bird species. The substrate, consisting mainly of clay or mud, hosts a rich infauna of worms, crustaceans, mussels, and insect larvae. Protected from waves, these shallow areas are highly productive. Reeds occur in the

19 Åtgärdsprogram för bevarande av ishavshästsvans (*Hippuris tetraphyllum*). Swedish Environmental Protection Agency report 5556.

same type of environment and often form a mosaic environment with the sedges. The highest values are linked to areas with 25-100% coverage (Mosaic, ecosystem components).

Sedge biotopes are strongly associated with estuaries and protected bays, and are threatened by the same type of activities, i.e. nutrient discharge, river regulation, various forms of exploitation such as ports, bridges, and piers, dredging, and oil spills.

Sedge biotopes are classified as near threatened (NT) in the HELCOM Red List (equivalent HUB AA.H1A2 is 'Baltic photic muddy sediment dominated by sedges (Cyperaceae)'.

Large perennial brown algae (25-100% coverage); BP, GB
Key species and endemic species

Large perennial brown algae are bladderwrack, toothed wrack, and *Fucus radicans*. Shallow hard bottoms are characterised by perennial algae communities, whose three-dimensional structure contributes to biodiversity. The bladderwrack area often extends from a depth of about 0.5 to 5–8 m. It acts as a substrate for other algae as well as protection, recruitment, and foraging areas of fish and other organisms. A structural key species in the Baltic Sea, bladderwrack is common on moderately exposed bottoms[20]. Research indicates that up to 70% of all Baltic Sea species make use of bladderwrack communities during their lifetime[21]. Toothed wrack also occurs along the east coast, at their northern distribution border (salinity 7 psu). It usually dominates the deeper parts of the wrack area, down to 8-10 m deep, but can also occur together with bladderwrack. *Fucus radicans* dominates in the Bothnian Sea, from Öregrund to Umeå. Many communities consist of only a few clones, and along the Swedish coast up to 70-80% of the clusters can consist of one female clone. *Fucus radicans* is likely endemic to the Baltic Sea. The highest values are linked to areas with a coverage ratio of 25-100% (Mosaic, ecosystem components).

Large perennial brown algae on shallow hard bottoms are threatened and adversely affected by essentially the same factors as reefs, i.e. eutrophication, drifting algal mats, swells from shipping, discharge of oil and chemicals, construction of piers and other structures, and cables and pipelines. As bladderwrack has a limited spread (0.5-2 m), it is susceptible to fragmentation through small-scale coastal exploitation.

The status assessment of hard bottom vegetation has previously been included in the Water Framework Directive, but there is no current assessment. Therefore, there is also no assessment within the MSFD. According to HELCOM's assessment of underwater habitats (2013), hard bottoms dominated by large perennial brown algae are in the least concern (LC) category (equivalent to HUB 'Baltic photic rock and boulders (or coarse substrate or mixed substrate) dominated by *Fucus* spp'. AA.A1C1, AA.I1C1 and AA.M1C1).

Blue mussel beds (25-100% coverage in the Baltic Proper, >10% in the Gulf of Bothnia); BP, GB
Key species

Mussels often live in dense communities – mussel beds – which cover areas from a few square meters to several hectares. They occur mainly on hard bottoms, but are also found on sand and gravel surfaces and even on soft bottoms. In such areas, the mussels attach to each other instead of the bottom. The blue mussel is a key species of the Baltic Sea and mussel beds are a key habitat. Blue mussel beds and biogenic reefs form varied three-dimensional microhabitats for several other species, and thus provide the conditions for rich biodiversity. Mussel beds offer protection and food for a wide range of other invertebrates, such as snails, crayfish, isopods and various worms. Blue mussels are eaten by, among others, eider, long-tailed duck, and flounder.

20 MARBIPP – https://www.marbipp.tmbl.gu.se/2biotop/5tang/6arter/1.html
21 Edlund J and Siljeholm E. (2012). Identifiering av marina naturvärdesobjekt i Östergötland – en metodstudie. County Administrative Board of Östergötland, report 2012:12.

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The biotope is threatened by physical impact from, for example, trawling, dredging, dumping, and extraction of sand and stone. Increased sedimentation and changes in water temperature and pH may adversely affect some species.

There is currently no national or general status assessment for blue mussel beds or biogenic reefs (not carried out within Natura 2000 or HELCOM), but it is likely that the status is the same as for reefs, i.e. threatened and in unfavourable-bad conservation status .

Perennial red algae (25-100% coverage); BP, GB
Key species

Below the perennial brown algae, hard bottoms are often dominated by perennial red algae. This group is capable of living in environments with a little less light, and thus can grow a little deeper than the brown algae. Red algae often form continuous mats, along with blue mussels. In these environments, several species of invertebrates find living space. Perennial red algae are common in the Baltic Sea, and are therefore of particular structural importance and fulfil key functions, just like large perennial brown algae.

The red algae community is considered sensitive to, among other things, structures in water, dredging, cables and pipelines, bottom trawling and bottom-set nets.

The corresponding HELCOM biotope is called 'Baltic photic rock and boulders dominated by perennial foliose red algae' (AA.A1C3). According to HELCOM's Red List of underwater habitats, perennial red algae are classified as Least Concern (LC) (2013). There is no other status assessment.

Perennial filamentous algae (25-100% coverage); GB
Key species

Perennial filamentous algae grow mainly on hard substrates, mostly in moderately to heavily exposed areas at depths of 5–20 meters. In the Gulf of Bothnia, there are generally various kinds of green, brown, and red algae. Characteristic species are *Polysiphonia nutans*, *Cladophora rupestris*, *Aegagropila linnaei* and *Battersia arctica*. Perennial filamentous algae form considerable surface-covering habitats in the Gulf of Bothnia where there are no other larger perennial macroalgae. The habitat is therefore believed to contribute significantly to biodiversity, in particular northwards from the northern Quark. The highest values are linked to areas with a coverage rate of 25-100% (Mosaic, ecosystem components).

The equivalent HELCOM biotope is called 'Baltic photic rock and boulders dominated by perennial filamentous algae' (AA. A1C5). The habitat is not red-listed, but is believed to be a key habitat in the northern Gulf of Bothnia.

Sediment bottoms with high densities of fauna; BP, GB
Key habitat (HELCOM Underwater Biotopes)

Sediment bottoms with fauna are HELCOM underwater biotopes. High densities of fauna indicate bottoms without oxygen deficiency, resulting in higher value and functions for the habitat. There is currently no supporting knowledge of the distribution of high densities of fauna on soft bottoms, but on the other hand, maps of individual species, such as *Monoporeia affinis* and *Macoma baltica*, may be available. *Monoporeia affinis* is a small crustacean that lives buried in soft substrate bottoms, from a couple of meters down to 70 meters. It eats plankton that has fallen to the bottom, and is itself eaten by other crustaceans and fish. *Macoma baltica* is a marine mussel species found in the sediment bottoms in the Baltic Proper.

This habitat is sensitive to e.g. sand and gravel extraction, dredging and dumping, cables and pipelines, military exercises, and bottom trawling.

According to the HELCOM Red List (2013) of underwater habitats, sediment bottoms with fauna are classified as near threatened (NT) (equivalent to HUBs AB.H4UI and AB.H3N1).

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Presence of seasonal ice; GB

Key habitat (HELCOM Underwater Biotopes)

Sea ice occurs in the Baltic for a few months each year, usually from November or December to April or May. During a normal winter, ice spreads out across the Bothnian Gulf, most of the Bothnian Sea, the Gulf of Finland, the Åland Sea, and the northern Baltic Proper. During mild winters, only the Bothnian Bay and the northernmost part of the Bothnian Sea are covered. Ice thickness varies from a few inches in the south up to over one metre in the north. There is considerable interannual variation in terms of distribution, thickness, and duration.

Sea ice plays a significant role in the Baltic Sea ecosystem. It regulates surface water salinity and stratification, which affects the spring bloom of algae and nutrient transport. The ice is also important to the seal population in the Baltic Sea, especially the ringed seal, which is entirely dependent on the ice when giving birth. The grey seal, too, likes to find sea ice in the spring. Without ice during breeding, there is a risk that the mortality rate among pups increases, as seals need to crowd onto islands and islets to give birth.

Climate change poses a serious threat to this biotope. The thickness and extent of sea ice is projected to decrease by more than 50% by the year 2100. Maritime traffic that breaks up the ice is also likely to have a negative impact on ice formation.

Seasonal sea ice is included in HELCOM's list of biotopes (HUB: AC) and is classified as vulnerable (VU) (2013).

Presence of oxygenated water masses below the halocline; BP

Key habitat (HELCOM Underwater Biotopes)

This pelagic habitat is an underwater biotope according to HELCOM and occurs below the permanent halocline (60–80 meters), which means that the habitat is generally in the aphotic zone. The salinity is usually above 12 psu. The habitat is an environment for marine zooplankton, likely feeding on organic matter, ciliates, and heterotrophic flagellates. Oxygenated water with a salinity of 12–18 psu is also important for the survival of cod eggs.[22] The spread of the oxygenated water column below the halocline varies, depending both on the inflow of salt water and the spread of the oxygen-depleted bottoms.

The main threat to this habitat is eutrophication and the spread of anoxic bottoms. The introduction of alien species is potentially also a threat to this environment.

The habitat is included in HELCOM's list of underwater habitats (HUB: AE.O5), and is classified as endangered (EN) (2013).

Essential habitats for fish

Essential links for migratory fish (including eel, salmon, sea trout and sea lamprey); BP, GB

HELCOM Red List

For fish species that migrate between freshwater and saltwater, river mouths and estuaries are important nodes and transport routes, i.e. essential links[23].

Eel, salmon, sea trout, and sea lamprey are either listed as important for protection in the Habitats Directive, red-listed, or both.

The eel occurs, or rather used to occur, throughout the country except the mountain region and some waters in the southern Swedish highlands. It is also found along the coasts, including around Öland and Gotland. The eel lives in freshwater, but migrates to the Sargasso Sea to spawn. For a more detailed description of the situation of the eel and for a list of national and international measures, please refer to report 2019:4 of the Swedish Agency for Marine and Water Management. The eel is considered critically endangered (CR) according to the Swedish Red List (Artdatabanken, 2020) as well as according to HELCOM (2013).

22 Historien om Östersjötorsken, Stockholm University Baltic Sea Centre report 1/2018.

23 Marin grön infrastruktur – naturvärdesbedömning, nyckelfaktorer och påverkansfaktorer. AquaBiota 2016:06.

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The salmon is a markedly migratory fish. It hatches and spawns in running freshwater, but in between, it grows in the sea or in lakes. After 1-4 years in the sea, the salmon returns to the same freshwater for spawning. There are currently 30 stocks of wild salmon in the Baltic Sea, of which 16 are in Sweden, and the development of stocks differs in different rivers and from year to year. Conservation areas can be found along the entire Baltic Sea coast outside watercourses for salmon and trout, as well as in all or part of the watercourses themselves. According to the Swedish Red List, salmon is classified as Least Concerned (LC) (Artdatabanken, 2020).

The sea trout is born in freshwater streams and then wanders out to sea, where it stays from six months to three years sea before wandering back to spawn. The status of the Baltic Proper trout stocks has been unchanged from 1990 to 2017, but the recommendation is nevertheless that catches should not be increased in the Baltic Proper or the Gulf of Bothnia.[24]

The sea lamprey is found in the southern Baltic Sea along the coasts of Skåne and Blekinge, and is rare in the rest of the Baltic Sea. In the larval stage, it lies buried in the bottom of a watercourse, but after six to eight years, a metamorphosis occurs: the characteristic mouth is formed, with its sharp teeth and a round suction disc, and the sea lamprey wanders downstream towards the sea. As an adult, it parasitically lives on other fish in the sea, such as cod and salmon. After one to two years, it returns to a river to spawn.[25] The species is listed in Annex 2 to the Habitats Directive, and it is incumbent on Sweden to ensure that stocks achieve favourable conservation status. According to the CABs' inventories, the stock is currently estimated to consist of only 100 individuals[26]. In the most recent reporting for the Habitats Directive in 2019, Sweden reported poor (unfavourable–bad) status for sea lampreys. The 2020 Swedish Red List classifies sea lampreys as endangered (EN) (Artdatabanken, 2020).

The main threats to essential links are considered to be the same as for estuaries, i.e. nutrient discharge (leading to increased production of filamentous algae and drifting algal mats), river regulation, various forms of exploitation such as ports, bridges, and piers, dredging, and oil spills.

In general, the status of essential links is deemed to be poor/unfavourable. The assessment is based mainly on the status of estuaries (Natura 2000: unfavourable–bad; HELCOM: CR), but also to some extent on the status of the individual species.

Recruitment areas for coastal-living predatory fish (perch, pike, pike-perch and burbot); BP, GB
Key species

Shallow areas near the coast are important recruitment areas for coastal predatory fish. The perch spawns during April–June in shallow water (0.5-)[27], where the roe is attached to vegetation or other structures. The young perch is relatively stationary, but can wander to playgrounds, rarely farther than 10 km. It is also common for coastal stocks to migrate up into freshwater to spawn. The amount of suitable recruitment and growth habitats for the perch is crucial for the size of the stocks. Within HELCOM, the environmental status of coastal fish is assessed for the entire the Baltic Sea, and for the four stations in the Baltic Sea, the assessment for perch shows both good and not good environmental status (50/50).[28]

24 Fisk- och skaldjursbestånd i hav och sötvatten 2018 —Resursöversikt. Swedish Agency for Marine and Water Management report 2019:4.

25 https://www.havochvatten.se/hav/fiske-fritid/arter/arter-och-naturtyper/havsnejonoga.html.

26 Havsutsikt 2, 2019.

27 Snickars M, Sundblad G, Sandström A, Ljunggren L, Bergström U, Johansson G and Mattila J. (2010) Habitat selectivity of substrate-spawning fish: modelling requirements for the Eurasian perch *Perca fluviatilis*. Mar Ecol Prog Ser Vol. 398: 235–243.

28 Fisk- och skaldjursbestånd i hav och sötvatten 2018 — Resursöversikt. Swedish Agency for Marine and Water Management report 2019:4.

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The pike spawns from March to June in flooded grasslands and wetlands as well as in vegetation-covered shallow bays where the water temperature rises rapidly in the spring. Like many other coastal freshwater species, the pike can also wander up into freshwater to spawn. The roe is slightly sticky and attaches to the vegetation. The pike usually lives close to the shore, protected by vegetation. Tagging studies of coastal pike have shown that more than 90% of tagged fish are recovered within a radius of five km from the place of tagging. Genetic analyses also show that pikes are often stationary and that genetic exchange between areas is limited. The knowledge base on the pike stock situation is limited, but the available data suggest that stocks in the outer archipelagos of the Baltic Proper and along the open coastlines are in weak condition and are likely to have been declining over the last 20-30 years. The annual incidence of pike fry in these areas is generally low or non-existent.

Like the perch, the pike is a predatory fish of great ecological importance in the Baltic Sea ecosystem. Through their predation, these fish can regulate the numbers of smaller fish, such as stickleback, resulting in an increase in the species eaten by those smaller fish, i.e. small crustaceans, which in turn can regulate the amount of filamentous algae. This trophic chain effect means that pike and other predatory fish contribute to healthy stocks of vegetated substrates.

The essential habitats of both perch and pike are adversely affected by, for example, the expansion of piers and marinas and by dredging. The extent and quality of these habitats have decreased since the mid-20th century, largely through coastal exploitation. Protecting and recreating such environments can be a way of promoting the stocks of predatory fish in coastal areas.

The pike-perch spawns in warm and turbid water in sheltered bays, usually at a few meters' depth. As fry, it subsists on plankton, fish fry, and crustaceans. The pike-perch has good vision in the dark – during the summer, it is most active at night, and in other seasons at dusk.

The burbot is essentially a freshwater fish, but it also occurs in the Baltic Sea, from the Bothnian Bay down to Kalmarsund. The burbot prefers cold water, and during the winter, when it spawns, it stays near the coast and also moves up into the watercourses. Larger individuals mainly hunt fish, but crayfish and fish roe are also included in the diet. Smaller burbot live off mayfly larvae, crustaceans, mussels, and shells. Spawning takes place from December to March in shallow water (0.5-3 m) and often in running water. A large female can lay up to five million eggs, which hatch after 20-60 days. The eggs contain oil that allows the roe to float freely in the water column. The fry gathers in estuaries next to reeds and other vegetation. According to the Swedish Red List, the status of the burbot is vulnerable (VU) (Artdatabanken, 2020).

In general, the status of the recruitment areas for these species (perch, pike, pike-perch and burbot) is considered unfavourable. The assessment is mainly based on the status of shallow bays, inlets, lagoons, and vascular plants[29], but also to some extent on stock assessments.

Recruitment areas for whitefish; BP, GB

Fish in the Habitats Directive; HELCOM Red List

Whitefish is found in two different ecotypes in the Baltic Sea: one spawns in the sea and the other in rivers and freshwater. Some are plankton-eaters all their lives, others switch to eating bottom-dwelling animals and fish. Tagging has shown that the sea-spawning whitefish is fairly stationary with hikes up to 20 km. The whitefish requires cold and relatively oxygen-rich water.[30] The spawning usually takes place in autumn, when whitefish prefers sand and gravel bottoms. The roe then lies on the bottom through the winter, until it hatches in spring after the ice breaks up or when water temperature starts to rise above 2–4 degrees

29 Skydda och vårda våra viktiga vikar, version 2.0, updated 2018, Jönsson R and Fredriksson S et al.

30 Fisk- och skaldjursbestånd i hav och sötvatten 2018 — Resursöversikt. Havs- och vattenmyndighetens rapport 2019:4.

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Celsius. The fry of sea-spawning whitefish prefer shallow sand or gravel bottoms, or rocky bottoms with some sand, that warm up early in spring. They dwell in shoals after hatching, often at a depth of more than 1 m. Whitefish fry can also be found on rocky and vegetated substrates, although in lower densities[31].

There is no exploratory fishing or national monitoring of whitefish, but geographical models of suitable habitats as well as field surveys carried out in the Gulf of Bothnia in recent years show that several of the whitefish's former spawning areas are no longer suitable, as they are affected by eutrophication[32]. Reduced ice and increasing seal populations can contribute to a negative trend for whitefish.

The whitefish is listed in Annex 5 of the Habitats Directive, and thus the state of the species for the biogeographical area of the Baltic Sea is reported every 6 years, according to Article 17. In this assessment, the state of the whitefish is considered poor (unfavourable–bad; Artadatabanken, 2019). In the Swedish Red List, the whitefish is considered of least concern (LC), but according to HELCOM's assessment (2013), the whitefish is endangered (EN) in the Baltic Sea.

Recruitment area for flatfish (two ecotypes, one of them endemic to the Baltic Sea); BP
Endemic species

Flatfish is included in the action plan because it can be considered one of the key Baltic fish species, along with coastal predatory fish, herring, and cod. It is commonly found in the Baltic Sea up to the Åland Sea. Recent studies have shown that the two different types of flounder in the Baltic Sea are genetically distinct, and the new species of Baltic Sea flounder (*Platichthys solemdali*) is thus endemic to the Baltic Sea. The Baltic Sea flounder spawns on the bottom in coastal shallow areas, while the previously known flounder (*P. flesus*) spawns floating roe at greater depths in the open sea, both in the western and southern parts of the Baltic Sea and in the deeper parts of the Baltic Proper.[33,34] They thrive on soft sand and mud bottoms or among large brown algae in shallow water. At night, they seek food such as clams, bristle worms, crustaceans, and smaller fish.

A study modelling flounder spawning and presence in the Baltic Sea shows that the spawning habitat for flounder with roe in the water column has decreased significantly in the central Baltic Sea over the past twenty years, which may partly explain the decrease in biomass of the species in the area[35].

An assessment of the status of flounder (both types) and perch is included in the MSFD, in the indicator 'Presence of key species of fish in coastal waters'. Overall, the assessment shows that good status is reached in the majority of the areas assessed in the last 10-15 years. However, for a more comprehensive and reliable status assessment, monitoring should be extended to cover more coastal water types[36].

Recruitment area for herring; BP, GB
Key species

Herring is found in all seas around Sweden, in both spring- and autumn-spawning ecotypes. They gather in large schools

31 Sik i Östersjön – en kunskapssammanställning, Swedish Agency for Marine and Water Management report 2019:10.

32 Veneranta L, Hudd R and Vanhatalo J. Reproduction areas of sea-spawning coregonids reflect the environment in shallow coastal waters. Marine Ecology Progress Series. 2013, 477:231–50.

33 Momigliano P, Denys GPJ, Jokinen H and Merilä J (2018) *Platichthys solemdali* sp. nov. (Actinopterygii, Pleuronectiformes): A New Flounder Species From the Baltic Sea. Front. Mar. Sci. 5:2255.

34 Nissling A, and Wallin I. Beståndsövervakning för hållbar förvaltning av flundra på Gotland, 2019.

35 Orio A et al. Characterizing and predicting the distribution of Baltic Sea flounder (*Platichtys flesus*) during the spawning season. Journal of Sea Research. 2017;126 (Supplement C): 46–55.

36 Faktablad för att bedöma god miljöstatus enligt havsmiljöförordningen. Förekomst av nyckelart av fisk i kustvatten – abborre och skrubbskädda (Östersjön).

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in coastal shallow water or on shoals out in the sea. Spawning takes place above sand, gravel, or stone bottoms (reefs) of varying depths at 0.5–100 m[37]. The eggs sink to the bottom, where they form large egg masses. The larvae live in the water column, and their main food consists of zooplankton, blue mussel larvae, small crustaceans, and fish larvae. Sprat also spawn at varying depths, at 10-40 m, either on the coast or further out to sea. Herring and sprat have significant roles in the ecosystem as a food source for cod and other fish, razorbill and guillemot, and marine mammals. They are of great economic importance for Swedish commercial fishing.

The main threats to herring and sprat are likely the exploitation of their spawning habitats, such as the extraction of sand, gravel, and stone, environmental toxins, as well as fishing and predation from marine mammals and birds.

According to the assessment of environmental status under the MSFD, the status of herring is considered good in the Baltic Sea, indicating functional recruitment. However, there are signs that herring is becoming leaner, and that the fishing of spawning herring has increased in parts of the Baltic Sea, which may have consequences for e.g. cod.[38] However, the status of herring in the Gulf of Bothnia is not considered to be in good status[39].

Recruitment areas for grayling; GB
Fish in the Habitats Directive; HELCOM Red List

The grayling belongs to the salmonids. It is mainly a freshwater species, but also occurs in the brackish waters of the Gulf

37 Fisk- och skaldjursbestånd i hav och sötvatten 2019 — Resursöversikt. Swedish Agency for Marine and Water Management report 2020:3.
38 https://balticeye.org/sv/hallbart-fiske/policy-brief-minska-sill-och-skarpsillsfisket-for-torskens-skull/
39 Faktablad för att bedöma god miljöstatus enligt havsmiljöförordningen. Fiskeridödlighet; Lekbiomassa (SSB) för alla kommersiellt nyttjade populationer.

of Bothnia. Coastal grayling occurs in two main ecotypes: one grows up in the sea but swims up rivers to spawn, and the other spends its entire lives in the sea and spawns in shallow water on exposed beaches. The spawning of coastal grayling in brackish water is a unique adaptation that, as far as we know, is mainly found in Västerbotten and Norrbotten.

The spawning takes place in late April or early May, just before or just after the ice breaks up. Coastal grayling seem to prefer spawning in very shallow water, at about 30–50 cm, on exposed beaches. The spawning area is dominated by stones and boulders, while the roe itself is laid in places with slightly finer gravel or pebbles. The roe hatches after two to three weeks, depending on the temperature. Freshly hatched fry between 10-20 mm stay in very shallow water along the beach during the first few weeks. The grayling grows to a length of 10 cm during its first summer[40].

The considerable lack of knowledge and data on the grayling in the Gulf of Bothnia makes it difficult to assess how much the species has decreased and why. Possible explanations are obstacles to migration, acidification of watercourses, as well as increased competition and predation in combination with climate change and overfishing in the coastal environment[41].

The grayling is classified as Least Concern (LC) in the Swedish Red List (Artdatabanken, 2020) but as endangered (EN) by HELCOM (2013). The grayling is listed in Annex 5 of the Habitats Directive and thus the state of the species is reported every 6 years in accordance with Article 17. In the reporting for 2019, the status of grayling was deemed poor (unfavourable-bad) in the Baltic Sea marine region (SEPA, 2020).

40 Harr i Bottniska viken – en kunskapssammanställning, Swedish Agency for Marine and Water Management report 2017:30.
41 Harr i Bottniska viken – en kunskapssammanställning, Swedish Agency for Marine and Water Management report 2017:30.

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Recruitment areas for vendace; GB

Fish in the Habitats Directive

Vendace occurs in the Gulf of Bothnia, particularly in Västerbotten and Norrbotten. Smaller populations can also be found further south. The species occurs in schools in the pelagic water. Their diet consists of planktonic crustaceans and insect larvae. In summer, vendace is found mainly in the Gulf of Bothnia, and in the autumn, it migrates to the coast to spawn, especially in the northern Gulf of Bothnia archipelago. The spawning takes place in October–December, in shallow bays and often near estuaries, over sand and gravel bottoms where the eggs sink to the bottom and hatch the following spring. A normal-sized female produces about 2 000 eggs, which is relatively few compared to other species of similar size. Vendace roe is a delicacy, and vendace is commercially fished in the Bothnian Bay as well as in Lakes Vänern, Vättern and Mälaren[42].

Knowledge of the stock structure of vendace in the Gulf of Bothnia is limited, and more knowledge is needed to assess e.g. predation and the influence of ringed seal.

The vendace is listed in Annex 5 of the Habitats Directive and thus the state of the species for the biogeographical area of the Baltic Sea is reported every 6 years, in accordance with Article 17. According to the latest reporting, the status of vendace is unfavourable–inadequate (Artdatabanken 2019).

Recruitment areas for cod; BP

Key species

When it comes to fish, Baltic Sea offshore areas are relatively species-poor, and are dominated by three species: cod, sprat, and herring. Cod, a keystone species of great importance for the ecosystem, is on the top of the food web. The Baltic Sea cod has adapted to the low salinity: whereas Atlantic cod eggs require a salinity of almost 30 psu to stay afloat, the eggs of the Baltic cod float at a salinity of 12 to 18 psu. However, the Baltic Sea cod lives on the edge of its range, and it can only reproduce in the deepest areas of the Baltic, where salinity is highest. As oxygen-poor areas have expanded in the Baltic Sea, cod spawning grounds have shrunk, and since the late 1980s, spawning has been possible almost exclusively in the Bornholm basin. There are indications that there is another spawning area for cod in a deep area of the Åland Sea, where the salinity is about 7–8 psu[43].

The threats to cod are many: severe fishing pressure, anoxic bottoms, food shortage, parasite infestation, growing seal populations, and climate change. However, it is not entirely clear how everything interacts. Marine protected areas alone will not be a sufficient tool for protecting and strengthening cod stocks – international fishing regulation and management are needed. Ideally, management should act by reducing catches, to provide the necessary conditions for strong stocks as a buffer against climate-related changes[44]. The management and protection of the stock in the Åland Sea, where cod may have adapted to lower salinity levels, is particularly important in view of possible climate change. Protection of cod spawning areas can be a tool to protect against negative effects of e.g. dumping of dredge masses, structures that can affect e.g. water circulation and salinity, and shipping that causes noise[45].

The status of cod stocks in the Baltic Sea is considered to be very poor. Both biomass and growth are in decline, and the condi-

42 https://www.havet.nu/livet/art/sikloja and Fisk- och skaldjursbestånd i hav och sötvatten 2019 Resursöversikt, Swedish Agency for Marine and Water Management report 2020:3.

43 Bergström U, Christiansen H, Florin A-B, Lunneryd S-G, and André C, Genetisk undersökning av torsk från Ålands hav. Project report for BalticSea2020, 2015-06-30.

44 Voss R et al. Ecological-economic sustainability of the Baltic cod fisheries under ocean warming and acidification. Journal of Environmental Management, Volume 238, 2019).

45 https://www.havet.nu/?d=190&id=48353

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tion and health of the fish are poor[46]. Cod is listed as vulnerable (VU) on both the Swedish Red List (Artdatabanken, 2020) and the HELCOM Red List (2013). According to the MSFD indicator assessment, cod does not achieve good environmental status.

Areas of special importance for birds and marine mammals

All relatively bare islands and skerries can be valuable nesting grounds for coastal and marine bird species, if there are foraging areas nearby. Nesting islands vary in size, and colonies can be located on a certain part of an island. Defining density threshold values in the form of nests per hectare is therefore difficult or practically impossible. Birds often form mixed colonies with other bird species, and they usually come back to nest year after year, sometimes to the exact same cliff shelf, boulder, bush, or tree. In recent years, major changes have taken place among the archipelago's nesting coastal birds. Small fish-eating birds like terns and razorbill have increased, while mussel-eating diving ducks like velvet scoter and eider have decreased. A species that has decreased sharply is the herring gull[47], which nests on skerries and islets, most often in colonies, and plays a starring role on nest-dense skerries, where it can have a protective effect against predators.

Different species have different sensitivity to disturbance, and the effect of repeated or continuous disturbance can be difficult to predict. Birds can be disturbed by different sounds or visual impressions, possibly also by ground vibration[48]. Disturbance in the form of outdoor activities, boating, construction, and water activities should be minimised during the nesting period, and is generally regulated with an access ban (at least 100 m). Predation on birds and eggs from e.g. foxes, eagles, and mink can pose a threat, and may need to be minimized.

46 Historien om Östersjötorsken. Stockholm University Baltic Sea Centre report 1:2018.

47 Handlingsplan för grön infrastruktur i Östergötland.

48 Effekter av störningar på fågellivet. Swedish Environmental Protection Agency report 5351:2004.

Wintering area for long-tailed ducks (October-March) (max down to 25-30 m); BP
HELCOM Red List

While it breeds on the Arctic tundra, the long-tailed duck is one of the few bird species in the Swedish fauna where a significant part of the world population depends on marine areas within the Swedish economic zone[49]. Hoburg Shoal and the North and South Midsea Shoals are by far the most important wintering areas for the long-tailed duck. Other important areas for wintering are around Öland and Gotland as well as in the Stockholm archipelago, where they occur in thousands both in the outer archipelago and in the shallow bays of the inner archipelago. In winter, the birds dive to the bottom for food. They prefer blue mussels, but also eat some crustaceans and other mussel species.

Oil spills from ships, by-catch in nets and displacement effects from offshore wind turbines pose some of the major threats to the long-tailed duck.

Due to its rapid decrease, wintering long-tailed duck are classified as endangered (EN) both in the Swedish Red List (Artdatabanken, 2020) and in the HELCOM Red List (2013).

Spring resting areas for eider; BP
HELCOM Red List

Eider winter mainly in Danish waters, but move to Swedish and Finnish waters in March-April before breeding. They stay near the nesting area for about a month before laying eggs. These spring resting areas are important for the birds to strengthen their condition in preparation for egg laying and incubation.

49 Sjöfåglars utnyttjande av havsområden runt Öland och Gotland, betydelsen av marint områdesskydd. County Administrative Board of Gotland, 2018.

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The eggs are laid in late April and early May. Spring resting areas for eider have a high ecosystem component score in Mosaic. In the Baltic Proper, there are particularly important spring resting areas that are considered to have the capacity to limit the population. Other well-known spring resting areas are found in the Stockholm archipelago.

Disturbances in the form of boat and maritime traffic, construction, and structures in water should be avoided and minimised while the eider is staying at the spring resting areas.

The eider has decreased drastically in numbers in Sweden and Finland over the past 20 years and is classified as endangered (EN) in both the Swedish Red List (Artdatabanken, 2020) and the HELCOM Red List (2013). It is therefore important to protect the specific places where the eider still occurs and that are considered critical for the successful nesting of the species.

Wintering and resting areas for greater scaup, red-breasted merganser and smew; BP, GB
HELCOM Red List

Several of the diving ducks use the sea throughout their lives. Tufted duck (LC), common goldeneye (LC), and greater scaup (VU) winter in the Baltic Sea and subsist on bottom fauna. Tufted duck and common goldeneye appear to have increasing or stable populations, while the wintering population of greater scaup has decreased by at least 10% in the last 20 years (Kjell Larsson). In Swedish resting and wintering areas, greater scaup often spend the day in protected coastal areas in bays and harbours, and at night fly out to foraging areas at sea (usually shallower than 1 m and with good access to mussels). Red-breasted merganser and smew are slightly smaller diving ducks. During mild winters, red-breasted merganser occurs in large numbers in the eastern part of the Baltic Sea. It often winters at sea, either by the coast, in estuaries, coves, and lagoons, or out in open water. In the Baltic Sea, it mainly uses shallow waters down to a depth of about 2 . The diet probably consists mostly of fish, but the knowledge base is limited. The smew winters in large congregations along the coasts of eastern Skåne, Blekinge, eastern Småland and Öland. Its food consists mainly of molluscs and water insects as well as a small proportion of fish[50].

Disturbances in the form of boat and maritime traffic, construction, and structures in water should be avoided and minimised while these birds are in wintering and resting areas.

The wintering sites for greater scaup are classified as endangered (EN) in both the Swedish Red List (Artdatabanken, 2020) and the HELCOM Red List (2013).

Both red-breasted merganser and smew are classified as least concern (LC) in the Swedish Red List (Artdatabanken, 2020), but the smew is listed in the Birds Directive and HELCOM (2013) classifies it as vulnerable (VU) during wintering.

Nesting and breeding sites for eider and velvet scoter; BP, GB
HELCOM Red List

Eider usually nest on small islands or islets, in scattered pairs or sometimes in colonies. Like many other ducks and waders, they can sometimes seek shelter and nest in gull colonies, but also under piers and boathouses. Usually, the nest is located between grass stalks, in a crevice, or behind a rock or bush, and sheltered from the wind. Some eider couples return to the exact same nesting place year after year. Throughout the summer, the female keeps the chicks close to the nesting site[51]. The eider's diet consists mainly of mussels, especially blue mussels, which are mainly collected in shallow areas down to 6–10 m deep[52]. Crustaceans and occasional fish are also included in

50 Artfakta, SLU Artdatabanken.
51 http://www.fageln.se/art/ejder.aspx
52 Guillemette M, Woakes AJ, Henaux V, Grandbois J-M and Butler PJ, 2004. The effect of depth on the diving behaviour of common eiders. Can. J. Zool. 82, 1818–1826. doi:10.1139/z04-180.

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the diet. Small chicks live off crustaceans, small molluscs, and insects[53].

Velvet scoter nest on islands in the archipelago, where they feed by diving for small animals such as mussels, crustaceans, and shells. Along the Baltic coast, velvet scoter usually nest on islands, well protected in dense, low vegetation. In the outer archipelago, nests are sometimes placed in gull colonies, commonly with lesser black-backed gulls. The velvet scoter breeds later than other coastal birds: the eggs are laid from late May to June, and the litters appear in July. The chicks, which are ready to fly at 2 months, find their own food at a very young age but stay close to the female. The litters split up easily in case of disturbances from boat traffic.

Oil spills, bycatch, and decreased access to blue mussels have been highlighted as some of the causes of declining eider and velvet scoter populations. One theory is that the decline is caused by a lack of thiamine, i.e. vitamin B1. Another suggested threat is predation from the growing population of eagles and from mink.

The velvet scoter and eider are both heavy diving ducks that have previously been common in the east coast archipelago, but which in the last 25-30 years have decreased in numbers, including around Öland and Gotland[54]. According to the Swedish Red List, the eider is classified as endangered (EN) and velvet scoter as vulnerable (VU) (Artdatabanken, 2020). The nesting and breeding grounds for eiders are classified according to the HELCOM Red List (2013) as vulnerable (VU) and for velvet scoter as endangered (EN). Within the MSFD, populations of eiders and velvet scoter are deemed not to achieve good status.

53 Artfakta, SLU Artdatabanken.
54 Sjöfåglars utnyttjande av havsområden runt Öland och Gotland, betydelsen av marint områdesskydd. County Administrative Board of Gotland, 2018.

Nesting and breeding sites for black guillemot; BP, GB
HELCOM Red List

The black guillemot is a marine species that breeds only along the coasts, mainly on islands in the outer and middle archipelagos. The diet consists primarily of demersal fish, such as eelpout, taken in up to about 30 m depth. In recent decades, black guillemot have declined sharply in numbers along the coast between Kalmar and Uppland, with only a few pairs nesting in this area. Also in the Stockholm archipelago, where the majority of the Swedish population nests, the numbers have decreased.

For nesting, the black guillemot requires predator-free areas. Because of the spreading of mink, coastal black guillemot colonies have disappeared in many places and the species has been increasingly pushed towards the outer archipelago or islands far out from the mainland. Bycatch in fishing gear and oil spills are also considered a threat to the species.

Nesting and breeding sites for black guillemot are classified as near threatened (NT) both in the Swedish Red List (Artdatabanken, 2020) and in the HELCOM Red List (2013).

Nesting and breeding sites for common guillemot and razorbill; BP, GB
Key species

Common guillemot nest on steep cliffs but also under boulders and in rocky crevices, in colonies that often amount to thousands of pairs. Egg laying takes place in May and June, and the chicks leave the nest when they are 2–3 weeks old, at the end of June and early July. The chick cannot yet fly, and instead jumps off the cliff shelf, sometimes dozens of metres, and lands on the beach or in the water where the parents are waiting[55].

Razorbill nest in colonies on cliffs and rocky beaches. Egg laying normally takes place from early May to mid-June. The chicks first stay in the sheltered nests, where they are fed by

55 http://www.fageln.se/arter/sillgrissla.aspx

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the parents. When they reach about two weeks of age, the parents call them down to the water and take them out to sea, where they keep being fed by at least one parent[56]. The main food for common guillemot and razorbill in the Baltic Sea is pelagic fish, mainly herring.

During nesting, the species can be negatively affected by predators such as mink, fox, and eagle. Bycatch during foraging is also considered one of the major threats.

Common guillemot and razorbill are considered character species in the archipelago and their populations are considered viable. Continued work to protect and manage nesting and breeding sites is important.

Nesting and breeding sites for lesser black-backed gull and herring gull; BP, GB
HELCOM Red List; Swedish Red List

Lesser black-backed gull like to nest on treeless skerries in bays or out in the archipelago. They usually build their nests out of dry grass and moss in an elevated location. The species often breed in colonies, but single breeding pairs are not rare. At the breeding ground, each couple has their own territory, and the eggs are laid in May or June[57].

Herring gull often nest in colonies with other gulls on bare or rocky islands in the archipelago, but single nest sites can also be found. The nest is usually placed on bare, steep cliffs. In the inner archipelago, herring gull nests can also be found in sparse, rocky forest on smaller islets.[58]

There are likely several interacting factors affecting the populations. Toxins and food shortages as well as disturbance from boat traffic and outdoor activities can negatively affect the species.

56 http://www.fageln.se/arter/tordmule.aspx
57 http://www.fageln.se/art/silltrut.aspx
58 http://www.fageln.se/art/gratrut.aspx

Nesting and breeding sites for lesser black-backed gulls are vulnerable (VU) according to HELCOM's Red List (2013). In the Baltic Sea, it is considered a separate population (Baltic lesser black-backed gull), red-listed as its own vulnerable (VU) subspecies in the Swedish Red List. According to the Swedish Red List, herring gull is also vulnerable (VU).

Nesting and breeding sites for Caspian tern; BP, GB
HELCOM Red List

The Caspian tern nests on flat stony and sandy islands in the sea near the coast or in the outer archipelago. It usually nests in colonies.

The Caspian tern is very sensitive to disturbances during the nesting period and may abandon the nests if attacked by e.g. mink, eagles, or gulls. If it finds a site without disturbance, it may stay for the rest of its life, and even several following generations can choose the same nesting site[59]. Almost all Caspian tern colonies are today located in bird sanctuary areas with access bans during the breeding and nesting season. In the event of an oil spill incident, these few colony islands should be a high priority for protection against oil slicks.

According to the Swedish Red List, the Caspian tern is near threatened (NT) (Artdatabanken, 2020) and the nesting and breeding sites are classified as vulnerable (VU) in to the HELCOM Red List.

Wintering areas for black-throated and red-throated diver; BP
HELCOM Red List

Some black-throated and red-throated divers stop by the Baltic Sea on their way to wintering areas in the North Sea, the Atlantic and the Black Sea, and are regularly seen during the winter and migration periods at shoals and in the waters of the southern and central Baltic Sea.

59 http://www.fageln.se/arten/skraentaerna.aspx

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Studies have shown that divers avoid offshore wind farms and are susceptible to disturbance from ships, and that their distribution can be affected by intensive shipping. More knowledge of their wintering areas is needed to identify specific coastal and marine areas where protected areas could benefit divers.

According to the Swedish Red List, the red-throated diver is near threatened (NT) (Artdatabanken, 2020), and wintering areas for both black-throated and red-throated diver are considered by HELCOM to be critically endangered (CR) (2013).

Islands and islets for harbour seal (moulting, breeding and resting); BP
Marine mammals in the Habitats Directive; HELCOM Red List (Kalmarsund)

The harbour seal is found in coastal areas where there is access to large areas of shallow soft bottoms and suitable islands and islets for moulting and breeding. The harbour seal gives birth to one cub per year and lactates for about five weeks. Normally born in June without an embryonic coat, the cub can swim and dive shortly after birth, but lactation must take place on land or at the water's edge, and the harbour seal is dependent on good resting places for moulting when the outer skin must maintain a high temperature. In the Baltic Sea, harbour seal are found in Kalmarsund and Måkläppen (Falsterbo, Skåne).

Most of the important islands and islets for seal seals in the Baltic Sea are currently protected in reserves or as seal protection areas. The population of the Baltic Sea (Kalmarsund) is genetically distinct from that on the west coast. The main pressures affecting the distribution of the seal are considered to be bycatch, hunting, and disturbance of habitat. Due to few individuals and low genetic variation, the population of the Baltic Sea can therefore be particularly sensitive to human influences such as environmental toxins and climate change.

In the latest Swedish Red List (Artdatabanken, 2020), and according to the HELCOM Red List (2013), the Baltic Sea population is classified as vulnerable (VU). The harbour seal is also listed in the Habitats Directive, whose latest assessment considers the status as poor. In the latest assessment within the MSFD (Swedish Agency for Marine and Water Management, 2018), the population in Kalmarsund reaches the threshold, i.e. the recruitment areas are used and the population is not declining[60].

Islands and islets for ringed seal (moulting and resting); GB
Marine mammals in the Habitats Directive; HELCOM Red List

The Baltic Sea population of ringed seals amounts to just over 10 000 animals. The population consists of three subpopulations (Gulf of Bothnia, Gulf of Finland, Gulf of Riga) which are not genetically distinct. During the ice-free season, ringed seals live in the open sea and can occasionally be seen perched on small rocks, but it mostly stays away from humans. For reproduction, the ringed seal is completely dependent on stable ice, where the female gives birth to its cub during February-March in caves of ice and snow. At birth, the cub has a white fur coat that effectively insulates it in air, but very poorly in water. It therefore needs to stay out of the water throughout lactation. The cub suckles for 3-8 weeks, after which its coat moults and it enters the water, thereby ending cub-mother contact. In late April and early May, all animals (except cubs) moult, preferably perched on the spring ice, or on smaller stones.

The greatest human pressures on ringed seal populations are considered to be bycatch, hunting, disturbance of habitat and the reduced distribution of ice in the Baltic Sea.

The ringed seal is considered of least concern (LC) and is therefore not red-listed in Sweden (Artdatabanken, 2020). However, it is included in the Habitats Directive, and in the latest reporting on Article 17 (2019), Sweden deemed its conservation status to be poor (unfavourable–bad) in the Baltic Sea. According to HELCOM's Red List (2013), the ringed seal is considered

60 Faktablad för att bedöma god miljöstatus enligt havsmiljöförordningen, Utbredning av knubbsäl.

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vulnerable (VU), and according to the assessment of good environmental status under the MSFD (Swedish Agency for Marine and Water Management, 2018), the ringed seal in the Gulf of Bothnia reaches the threshold in terms of abundance but not for the rate of growth[61].

Islands and islets for grey seal (moulting, breeding and resting); BP, GB
Marine mammals in the Habitats Directive

Islands and islets are important resting areas for grey seals when giving birth to cubs and moulting, i.e. during spring and summer (February–June). It is also common for grey seals to give birth on the ice. Otherwise, grey seals spend all their time in the sea throughout the year, both sleeping and eating there. Most grey seals are found in the Stockholm and Södermanland archipelagos.

The greatest human pressures on the grey seal population are considered to be bycatch, hunting and disturbance of habitat, as well as changes in food availability and the food web[62].

The grey seal is considered of least concern (LC) both according to the Swedish Red List (Artdatabanken, 2020) and according to the HELCOM Red List (2013). The species is also on the Habitats Directive list, and the conservation status of the species in the Baltic Sea was deemed favourable in the latest reporting (SEPA, 2020). The MSFD assesses that the status of its breeding sites is good , except in the south-western Baltic Sea. The health of grey seals, assessed e.g. with a blubber thickness indicator, does not achieve good status (Swedish Agency for Marine and Water Management, 2018).

61 Faktablad för att bedöma god miljöstatus enligt havsmiljöförordningen, Abundans och trender för vikaresäl.
62 Faktablad för att bedöma god miljöstatus enligt havsmiljöförordningen, Abundans och trender för gråsäl.

Harbour porpoises (core areas); BP
Marine mammals in the Habitats Directive; HELCOM Red List

The harbour porpoise, a small, shy toothed whale that occurs in Swedish coastal waters, needs protected areas where it can give birth. The porpoise's gestation and lactation periods are long, which means that there is really no time of year when porpoises can be disturbed without the risk of impact on the population level. Areas used for breeding and special behaviours, such as resting, foraging, or social behaviour, are called core areas[63]. These areas are important for the survival of the population. There is currently good evidence on porpoise areas during the reproductive season as well as at other times of the year. New data on core porpoise areas are continuously collected (e.g. by the County Administrative Boards of Blekinge, Kalmar and Gotland) and the management of porpoises should therefore be adaptive and include new knowledge as it becomes available.

The main human pressures on the harbour porpoise population are considered to be shipping, underwater noise from various activities and sonar, and bycatch.

The Baltic Sea population is genetically distinct from other populations and is considered a separate subspecies. In the Swedish Red List (Artdatabanken, 2020) and according to HELCOM (2013), the Baltic harbour porpoise is classified as critically endangered (CR).

63 Carlström J och Carlén I. 2016. Skyddsvärda områden för tumlare i svenska vatten. AquaBiota Report 2016:04.

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ANNEX 3: Generic Goals for Nested Targets

Target	Nested target	Goal
Shallow soft bottoms	Sandbanks	The Conservation Status of sandbanks (1110) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Estuaries	The conservation Conservation Status of estuaries (1130) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Mudflats and sandflats not covered by seawater at low tide	The Conservation Status of mudflats and sandflats not covered by seawater at low tide (1140) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Coastal lagoons	The Conservation Status of coastal lagoons (1150) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Inlets and bays	The Conservation Status of inlets and bays (1160) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Narrow Baltic bays	The Conservation Status of narrow Baltic bays (1650) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Blue mussel beds	The Conservation Status of blue mussel beds within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Meadows of vascular plants	The Conservation Status of meadows of vascular plants in MPAs is stable and a growing proportion has Favourable Conservation Status.

Target	Nested target	Goal
Shallow soft bottoms	Meadows of *Najas marina*	The Conservation Status of meadows of *Najas marina* within MPA Network is stable and a growing proportion has Favourable Conservation Status.
	Meadows of Charales	The Conservation Status of meadows of Charales in MPAs is stable and a growing proportion has Favourable Conservation Status.
	Unattached bladderwrack	The conservation Conservation Status of unattached bladderwrack MPAs is stable and a growing proportion has Favourable Conservation Status.
	Eelgrass beds	The Conservation Status of eelgrass beds in MPAs is stable and a growing proportion has Favourable Conservation Status.
	Areas with *Chara horrida*	The Conservation Status of areas with *Chara horrida* within MPAs is stable and a growing proportion of stocks has Favourable Conservation Status.
	Areas with *Chara braunii*	The Conservation Status of the areas with *Chara braunii* within MPAs is stable and a growing proportion of stocks has Favourable Conservation Status.
	Areas with *Hippuris tetraphylla*	The Conservation Status of the areas with *Hippuris tetraphylla* within MPAs is stable and a growing proportion of stocks has Favourable Conservation Status.
	Areas with *Alisma wahlenbergii*	The Conservation Status of the areas with *Alisma wahlenbergii* within MPAs is stable and a growing proportion of stocks has Favourable Conservation Status.

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Target	Nested target	Goal
Shallow soft bottoms	Areas with sedges	The Conservation Status of the areas with sedges within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Essential links for migratory fish	The Conservation Status of essential links for migratory fish in the MPA is stable and a growing proportion are in favorable conservation Conservation Status
	Recruitment areas for coastal living predatory fish	The Conservation Status of recruitment areas for coastal living predatory fish within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Recruitment areas for whitefish	The Conservation Status of the recruitment area for whitefish within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Recruitment areas for flatfish	The conservation Conservation Status of the recruitment area for flatfish within MPAs is stable and a growing proportion of the habitats is in a favorable conservation Conservation Status.
	Recruitment areas for vendace	The Conservation Status of the recruitment areas for vendace within MPAs is stable and a growing proportion of the habitats has Favourable Conservation Status.
Deep soft bottoms	Sandbanks	The Conservation Status of sandbanks (1110) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Sediment bottoms with fauna	The Conservation Status of sediment bottoms with fauna within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Presence of seasonal ice	The Conservation Status of seasonal ice in MPAs is stable and a growing proportion of the habitat has Favourable Conservation Status.

Target	Nested target	Goal
Deep soft bottoms	Presence of oxygenated water masses below the halocline	The Conservation Status of the oxygenated water masses below the halocline in MPAs is stable and a growing proportion of the habitat has Favourable Conservation Status.
	Recruitment areas for cod	The Conservation Status of the recruitment area for cod within MPAs is stable and a growing proportion of the habitats has Favourable Conservation Status.
Shallow hard bottoms	Reefs	The Conservation Status of reefs within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Baltic Esker islands	The Conservation Status of Baltic esker islands (1610) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Boreal Baltic islets	The Conservation Status of boreal Baltic islets (1620) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Submerged or partially submerged sea caves	The conservation Conservation Status of submerged or partially submerged sea caves (8330) within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Blue mussel beds	The Conservation Status of blue mussel beds within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Large perennial brown algae	The Conservation Status of large perennial brown algae in MPAs is stable and a growing proportion has Favourable Conservation Status.
	Perennial red algae	The Conservation Status of perennial red algae within MPAs is stable and a growing proportion has Favourable Conservation Status.

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Target	Nested target	Goal
Shallow hard bottoms	Perennial filamentous algae	The Conservation Status of nerennial filamentous algae within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Reruitment areas for herring	The Conservation Status of the recruitment areas for herring within MPAs are stable and a growing proportion of the habitats has Favourable Conservation Status.
	Recruitment areas for grayling	The Conservation Status of the recruitment areas for grayling within MPAs is stable and a growing proportion of the habitats has Favourable Conservation Status.
Deep hard bottoms	Blue mussel beds	The Conservation Status of blue mussel beds within MPAs is stable and a growing proportion has Favourable Conservation Status.
	Reefs	The Conservation Status of reefs within MPAs is stable and a growing proportion has Favourable Conservation Status.
Areas of importance to marine mammals and seabirds	Wintering area for long-tailed ducks	The Conservation Status of wintering areas for Long-tailed duck in MPAs is stable and a growing proportion of the habitat has Favourable Conservation Status.
	Spring resting areas for eider	The Conservation Status of spring resting areas for eider is stable within MPAs and a growing share of the habitat is in favorable conservation
	Wintering and resting areas for greater scaup, red-breasted merganser and smew	The Conservation Status of wintering and resting areas for greater scaup, red-breasted merganser and smew within MPAs is stable and a growing proportion of the habitat has Favourable Conservation Status.
	Wintering areas for black-throated and red-throated diver	The Conservation Status of wintering areas for black-throated and red-throated diver in MPAs is stable and a growing proportion has Favourable Conservation Status.

Target	Nested target	Goal
Areas of importance to marine mammals and seabirds	Nesting and breeding sites for eider and velvet scoter	The conservation Conservation Status of breeding areas for eider and the velvet scoter within MPA Network is stable and a growing proportion has Favourable Conservation Status.
	Nesting and breeding sites for black guillemot	The Conservation Status of nesting and breeding sites for black guillemot in MPA Network is stable and a growing propor-tion has Favourable Conservation Status.
	Nesting and breeding sites for common guillemot and razorbill	The Conservation Status of nesting and breeding sites for common guillemot and razorbill in MPA Network is stable and a growing proportion has Favourable Conservation Status.
	Nesting and breeding sites for lesser black-backed gull and herring gull	The Conservation Status ofNesting and breeding sites for lesser black-backed gull and herring gull in MPAs is stable and a growing proportion has Favourable Conservation Status.
	Nesting and breeding sites for Caspian tern	The conservation Conservation Status of breeding sites for the Caspian tern in MPAs is stable and a growing proportion has Favourable Conservation Status.
	Islands and islets for harbour seal	The Conservation Status of islands and islets important for the harbor seal in MPAs is stable and an increasing propor-tion has Favourable Conservation Status.
	Islands and islets for ringed seal	The Conservation Status of islands and is-lets important for ringed seals in MPA Net-work is stable and an increasing proportion has Favourable Conservation Status.
	Islands and islets for grey seal	The Conservation Status of islands and islets important for the gray seal in MPAs is stable and an increasing proportion has Favourable Conservation Status.
	Main areas for harbour porpoises	Conservation Conservation Status of the main areas for harbour porpoises in MPAs is stable and the species has Favourable Conservation Status.

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ANNEX 4:
Regional Protection Objectives for the Gulf of Bothnia and the Baltic Proper

Nested Target	Gulf of Bothnia Protection Objective %	Baltic Proper Protection Objective %
Sandbanks	30	30
Estuaries	50	50
Mudflats and sandflats not covered by seawater at low tide	30	30
Coastal lagoons	50	80
Inlets and bays	30	30
Narrow Baltic bays	30	30
Reefs	30	50
Baltic Esker islands	30	30
Boreal Baltic islets	30	30
Submerged or partially submerged sea caves	N/A	30
Meadows of vascular plants	50	30
Meadows of *Najas marina*	30	N/A
Meadows of Charales	50	50
Unattached bladderwrack	30	30
Eelgrass beds	N/A	80
Areas with *Chara horrida*	N/A	50
Areas with *Chara braunii*	50	N/A
Areas with *Hippuris tetraphylla*	50	N/A
Areas with *Alisma wahlenbergii*	50	N/A
Areas with sedges	10	N/A
Large perennial brown algae	50	30

Nested Target	Gulf of Bothnia Protection Objective %	Baltic Proper Protection Objective %
Blue mussel beds	50	50
Perennial red algae	30	10
Perennial filamentous algae	30	N/A
Essential links for migratory fish	30	30
Recruitment areas for coastal living predatory fish	50	50
Recruitment areas for whitefish	30	30
Recruitment areas for flatfish	N/A	30
Reruitment areas for herring	30	30
Recruitment areas for grayling	50	N/A
Recruitment areas for vendace	30	N/A
Recruitment areas for cod	N/A	80
Sediment bottoms with fauna	10	10
Areas with presence of seasonal ice	30	N/A
Presence of oxygenated water masses below the halocline	N/A	30
Wintering area for long-tailed ducks	N/A	50
Spring resting areas for eider	N/A	50
Wintering areas for greater scaup, red-breasted merganser and smew	30	10
Wintering areas for black-throated and red-throated diver	N/A	50
Nesting and breeding sites for eider and velvet scoter	50	50

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Nested Target	Gulf of Bothnia Protection Objective %	Baltic Proper Protection Objective %
Nesting and breeding sites for black guillemot	50	50
Nesting and breeding sites for common guillemot and razorbill	30	30
Nesting and breeding sites for lesser black-backed gull and herring gull	50	50
Nesting and breeding sites for Caspian tern	50	50
Islands and islets for harbour seal	N/A	50
Islands and islets for ringed seal	30	N/A
Islands and islets for grey seal	30	50
Main areas for harbour porpoises	N/A	80

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ANNEX 5: Swedish taxonomy of Threats and associated Stresses

Threat Category	Threat	Associated Stresses	Description of Threat
Physical development/ restructuring	Structures in water	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of impulsive sound • Inputs of continuous sound	Constructions in water, such as bridges, road banks, piers, harbors, foundations, fixed beacons, fills, shore alteration, erosion protection and breakwaters. Windpower is a separate Threat.
	Dumping	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of nutrients • Inputs of hazardous substances	Dumping in the sea of dredged masses from sediments and land, snow, etc. Dumping can lead to the bottom and benthic organisms being covered by material and, if permanent, to loss of habitat and species. Dumping is prohibited and requires exemption. Dumping connected to recreational boating is a separate Threat.
	Cables and pipelines	• Physical loss • Physical disturbance • Inputs of impulsive sound • Inputs of electromagnetic and seismic waves	Cables and pipelines in the sea, for example cables for windpower and telecommunications or pipelines for gas, can have an impact on the bottom. When placing cables and wires, blasting may be needed.
Energy and material recovery	Establishment of wind turbines (construction phase)	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of impulsive sound	Wind power in the sea, including skerries and small islands, can cause loud impulsive sound during the establishment, for example when piling foundations. We distinguish between establishment and production phase of wind power. Cables for wind turbines are included in the Threat 'Cables and pipelines'.
	Production of wind energy (operating phase)	• Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of continuous sound	Production of wind energy in the sea, including skerries and small islands, generates a low and constant noise including vibrations. Wind turbines can also generate light pollution, but today's knowledge about its impact is limited. We distinguish between establishment and production phase of wind power. Cables for wind turbines are included in the Threat 'Cables and pipelines'.
	Extraction of sand and stone	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Inputs of impulsive sound	This refers to the extraction of sand, stones, and rocks in the sea. When extracting sand and stone, the material is removed from the bottom, for use in for example structures, erosion protection on land, landfills etc. There is a high mortality rate in benthic organisms associated with this activity as individuals and their habitat are removed.

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Threat Category	Threat	Associated Stresses	Description of Threat
Transport and shipping	Maritime shipping	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of continuous sound • Inputs of nutrients • Inputs of hazardous substances • Oil slicks and spills • Passive introduction of invasive alien species	Shipping refers to commercial shipping and traffic such as merchant ships, passenger traffic, and archipelago traffic. Fishing vessels that are not actively fishing are also included. Shipping can cause physical disturbances from propeller action and anchorage damage. The damages are greatest in shallow areas. Shipping can also contribute to changing hydrographic conditions with increased turbidity of the water. Shipping causes mainly continuous sound, but can also generate impulsive sound, for example during cavitation from propellers. Both emissions and accidents are included. Recreational boating is a separate Threat.
	Dredging and widening for waterways	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of impulsive sound • Inputs of continuous sound	This Threat includes larger dredging and widening for fairways. The Stress of sound comes from blasting (impulsive sound) and continous sound from dreding. Dumping of the dredged material in the sea is a separate Threat as well as minor dredging connected to recreational boating.
Human activities – recreation, military activities etc.	Recreational boating, recreational life	• Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of continuous sound • Inputs of hazardous substances • Oil slicks and spills	Recreational boating, outdoor recreation, and the main activites connected to this are treated as one Threat, as the generic impact on marine values is similar. Jet skis and other water sports are included. Impact from anchoring and propeller movements can cause physical change of the sea floor. Boating can also cause changed hydrographic conditions with increased turbidity, especially in shallow areas. Discharges of nutrients are not included here, as it since 2015 has been forbidden to release toilet drains from leisure boats throughout Swedish territorial sea. However, discharges of bath/wash water can contain nutrients, so it may be relevant to regulate. It is important to emphasize that outdoor recreation is something we promote in protected areas, but on the condition of avoiding harm to marine values. Assessment should be made from MPA to MPA, based on available local knowledge (detailed habitat data, pressure from visitors etc).
	Dredging and dumping for leisure boats	• Physical loss • Physical disturbance • Changes to hydrographical conditions • Disturbance of species/food webs • Inputs of continuous sound	Minor dredging and dumping of that dredged material that is done to increase the mobility of recreational boats. Dredging for recreational boats occurs in shallow areas, whereas dumping usually is done in deep areas. Dredging for maritime shipping is a separate Threat.
	Research and exploration	• Physical disturbance • Disturbance of species/food webs • Inputs of impulsive sound	This includes different biological and physical surveys, inventories, and mapping. The impact depends on the type of activity, and assessments must therefore be made on a case-by-case basis.
	Military activities	• Physical loss • Physical disturbance • Disturbance of species/food webs • Inputs of impulsive sound • Inputs of continuous sound • Inputs of electromagnetic and seismic waves • Inputs of hazardous substances	Military activities, such as use of explosives and sonar. The impact depends on the type of activity, and assessments must therefore be made on a case-by-case basis. Many militiary activities are confidential, which complicates the assessment.

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Threat Category	Threat	Associated Stresses	Description of Threat
Hunting and fishing	Bird hunting	• Disturbance of species/food webs • Inputs of impulsive sound • Decreased populations due to extractions of species (targeted/non-targeted)	Bird hunting refers to any hunting of seabirds and coastal birds.
	Seal hunting	• Disturbance of species/food webs • Inputs of impulsive sound • Decreased populations due to extractions of species (targeted/non-targeted)	Seal hunting refers to any hunting of all seal species existing in Sweden.
	Pelagic trawling	• Disturbance of species/food webs • Inputs of continuous sound • Decreased populations due to extractions of species (targeted/non-targeted)	Pelagic trawling refers to trawling in the open water. Pelagic trawling in the Baltic Sea mainly consists of floating trawls or pair trawls (where two boats pull the trawl together). Pelagic gear that is pulled close to the bottom and causes damage is covered in the Threat 'Bottom trawling'.
	Bottom trawling	• Physical loss • Physical disturbance • Disturbance of species/food webs • Inputs of continuous sound • Decreased populations due to extractions of species (targeted/non-targeted)	Bottom trawling also includes pelagic gear that affects the bottom and tools such as "danish seine" and dredges. For both pelagic and bottom trawling there is a geographical trawling limit, which is three or four nautical miles from the Swedish coast depending on the coastline. Inside the limit, trawl fishing is prohibited, but there are several exceptions to the ban. Outside the trawling limit, bottom trawling must be regulated within the framework of the EU's common fisheries policy, and thus requires consultation with Sweden's neighboring countries and the EU Commission.
	Quantitative catching gear	• Physical disturbance • Disturbance of species/food webs • Decreased populations due to extractions of species (targeted/non-targeted)	Quantitative catching gear refers to passive fishing using bottom-anchored nets, floating nets, hook fishing (longlines that are laid out overnight), cages, and traps. Both commercial and recreational fishing is included. Gear gets lost and becomes ghost gear (continues to catch and kill marine life for a long time). Fishing with passive gear in the Baltic Sea is extensive and diverse, and includes fishing for cod, eel, salmon, whitefish, herring, perch, pike, lumpfish, european, plaice and turbot. Ghost gear is included here, but also in the Threat 'Marine litter'. Trawling is a separate Threat. Assessment should be made from MPA to MPA, based on available local knowledge (detailed habitat data, pressure from fishing etc).
	Recreational angling	• Disturbance of species/food webs • Inputs of continuous sound • Decreased populations due to extractions of species (targeted/non-targeted)	Recreational angling refers to fishing with a rod, hook, and line. Assessment should be made from MPA to MPA, based on available local knowledge (detailed habitat data, pressure from fishing etc).

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Threat Category	Threat	Associated Stresses	Description of Threat
Discharge and pollution	Industrial discharge (incl. cooling water)	• Changes to hydrographical conditions • Inputs of nutrients • Inputs of hazardous substances • Oil slicks and spills • Input of heat	Industrial discharge refers to current discharges to the water. Old discharges found in contaminated sediments are not considered here. Whether and how discharges from desalination plants affects the marine environment is currently unknown.
	Discharge from household and municipal sewage treatment plants	• Changes to hydrographical conditions • Inputs of nutrients • Inputs of hazardous substances	Discharges to the water from households and municipal treatment plants might impact the marine environement by changes in hydrographic conditions, such as increased turbidity in the water.
	Discharge from agriculture (nutrients & pesticides)	• Changes to hydrographical conditions • Inputs of nutrients • Inputs of hazardous substances	Discharges and leaks of, for example, nutrients and pesticides to the water from agricultural practices.
	Discharge from forestry (nutrients & pesticides)	• Changes to hydrographical conditions • Inputs of nutrients • Inputs of hazardous substances	Discharges and leaks of, for example, nutrients and pesticides to the water from forestry practices.
	Discharge from aquaculture (nutrients & pesticides)	• Changes to hydrographical conditions • Inputs of nutrients • Inputs of hazardous substances	Discharges and leaks of, for example, nutrients and pesticides to the water from aquacultural practices.
	Marine litter	• Disturbance of species/food webs • Inputs of hazardous substances	Marine litter refers to solid debris that ends up in the sea, both macro-debris and micro-debris. It includes lost fishing gear (ghost gear), which also contributes to the spread of microplastics. Ghost gear is also mentioned as a Stress under the Threat 'Quantitative catching gear'.
Active introduction of alien species	Active introduction of (invasive) alien species	• Disturbance of species/food webs	Active (sometimes termed 'intentional') introduction of alien species refers to release of non-native species, as well as active cultivation or aquaculture. Note that passive ('unintentional') spread of alien species is expressed as a Stress under each of the relevant Threats. Alien species are species that have spread or moved through various human activities, and thus come to areas where they did not exist naturally.

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ANNEX 6: Description of Stresses

Stress	Description of Stress
Physical loss	Physical loss refers to a permanent loss of bottom substrate or morphology. Permanent means that there has been a change in the bottom that has lasted or is expected to last for a longer period (at least 12 years). Impacts that lead to physical loss are mainly caused by structures (e.g. foundations, port facilities), extraction of materials (e.g. extraction of sand and stone) and dredging. Often, this type of impact can cause a local but permanent loss of habitat.
Physical disturbance	Physical disturbance refers to a disturbance at the bottom that is reversible if the cause of the disturbance decreases or disappears. Examples of activities that cause the Stress 'Physical disturbance' are, for example, ship traffic and leisure boats through propeller action and achorage damage. The damage is greatest in shallow areas, and is mainly concentrated around fairways and harbors.
Changes to hydrographical conditions	Hydrographical conditions include the physical qualities of the seawater such as temperature, ice conditions, salinity, depth conditions, direction and strength of currents, waves, turbidity, tidal patterns, and freshwater inflow. Changed hydrographical conditions can be caused by human activities such as structures in the water, dumping, establishment of wind power, extraction of sand and stone, etc.
Disturbance of species/food webs	This refers to disturbances in species and/or food webs that are caused by human activities. Emissions of nutrients can result in production of certain plants or that certain plant species benefit at the expense of others, and this can affect the production and presence of different animals and organisms. Fishing activitties reduces the numbers of predators in particular, which can also affect species composition, production, and dynamic in food webs.

Stress	Description of Stress
Input of impulsive sound	Impulsive sound is characterized by short-lived sounds with a very rapid (explosive) rise in sound level. Impulsive sound includes, for example, piling for the construction of wind turbines and platforms, underwater explosions and hydro-acoustic measurements such as sonar, and air cannons used in seismic surveys. Impulsive sound affects all animals that use hearing, mainly by scaring them away. The sound can scare the animals away from important areas for foraging, resting, and other important interactions. Sufficiently loud sound waves (such as underwater explosions) can also directly damage or kill organisms by destroying hearing or other organs.
Input of continuous sound	Continuous sound is characterized by a prolonged sound, which can either be constant, fluctuating, or slowly varying over a long period of time. Human activities that can generate continuous sounds are, for example, bridges, offshore wind farms, dredging, dumping, shipping and boating. Continuous sound can mask the animals' communication as well as their signals used for orientation. The highest levels of continuous sounds in the Baltic Sea are found near the major waterways.
Input of nutrients	This refers to the supply of nutrients to the sea, regardless of whether it is a case of diffuse leakage (e.g. from agriculture, forestry) or direct discharge (drainage pipes, etc.).
Inputs of hazardous substances	The supply of harmful substances to the sea, regardless of whether it is a diffuse leakage (e.g. pesticides from agriculture, forestry) or direct discharges (sewer pipes and the like). Harmful substances are a large group of different substances that in one way or another end up in the marine environment. Some substances are more harmful than others, such as heavy metals and non-degradable substances. Accumulation of persistent contaminants or their metabolites through the food chain pose a serious threat to animals at high trophic levels such as marine predators, as it affects their health and reproduction. Introduction of contaminants into the marine environment can lead to severe habitat degradation.

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Stress	Description of Stress
Oil slicks and spills	This refers to discharges and spills of oil that end up in the sea. Oil from spills and accidents has been shown to cause issues such as physical disorders, blindness, cancer, and increased mortality in many marine organisms (Crain et al. 2009).
Passive introduction of invasive alien species	This refers to the passive (sometimes termed 'unintentional') introduction of invasive alien species to the marine environment, due to e.g. shipping. Note that active ('intentional') introduction of alien species is a separate Threat. Alien species can affect our marine areas by, for example, competing with native species, altering habitats, affecting food webs, spreading diseases, or acting as parasites.
Inputs of electromagnetic and seismic waves	Electromagnetic waves (fields) occur around conductors in which current flows, for example around cables and electrodes. Cables on the seabed are found for example between Sweden and Denmark, from the mainland to islands and within the archipelago.
Decreased populations due to extractions of species (targeted/non-targeted)	This refers to the reduction of populations/stocks due to extraction of individuals, such as in hunting and fishing. Both target species and non-target species are included here. It can be as by-catches of non-target species, but also individuals of the target species that are below the size limit. Animals such as birds and seals can also accidentally be caught in fishing gear.
Input of heat	The supply of heat to the sea from any source. This is mainly the result of emssions from industries, including cooling water.

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ANNEX 7: Sensitivity Analysis (for Nested Targets identified for the Gulf of Bothnia and the Baltic Proper)

VH = very high sensitivity; H = high sensitivity; M = medium sensitivity; L = low sensitivity

Threat	Shallow soft bottoms							
	Sandbanks	Estuaries	Mudflats and sandflats	Coastal lagoons	Inlets and bays	Narrow Baltic bays	Blue mussel beds	Meadows of vascular plants
Physical development/restructuring								
Structures in water	VH	VH	VH	VH	VH	VH	VH	VH
Dumping	VH	VH	VH	VH	VH	VH	VH	VH
Cables and pipelines	VH	VH	VH	VH	VH	VH	VH	VH
Energy and material recovery								
Establishment of wind turbines	VH	VH	VH	VH	VH	VH	VH	VH
Production of wind energy	H	H	VH	M	M	M	M	H
Extraction of sand and stone	VH	VH	VH	VH	VH	VH	VH	VH
Transport and shipping								
Maritime shipping	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	VH	VH	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.								
Recreational boating, recreational life	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and dumping (leisure boats)	VH	VH	VH	VH	VH	VH	VH	VH
Research and exploration	VH	VH	VH	VH	VH	VH	VH	VH
Military activities	VH	VH	VH	VH	VH	VH	VH	VH
Hunting and fishing								
Bird hunting	H	M	M	M	M	M	M	M
Seal hunting	H	M	M	M	M	M	M	M
Pelagic trawling	H	H	M	H	H	H	M	M
Bottom trawling	VH	VH	VH	VH	VH	VH	VH	VH
Quantitative catching gear	VH	VH	VH	VH	VH	VH	VH	VH
Recreational angling	H	H	M	M	M	M	M	M
Discharge and pollution								
Industrial discharge	H	VH	VH	VH	VH	VH	VH	VH
Discharge from household and municipal sewage treatment plants	H	H	H	H	H	H	H	VH
Discharge from agriculture	H	H	H	H	H	H	H	VH
Discharge from forestry	H	H	H	H	H	H	H	VH
Discharge from aquaculture	H	H	H	H	H	H	H	VH
Marine litter	H	M	M	M	M	M	H	M
Active introduction of alien species								
Active introduction of (invasive) alien species	M	H	M	H	H	M	M	H

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Threat	Shallow soft bottoms							
	Meadows of *Najas marina*	Meadows of Charales	Unattached bladderwrack	Eelgrass beds	Areas with *Chara horrida*	Areas with *Chara braunii*	Areas with *Hippuris tetraphylla*	Areas with *Alisma wahlenbergii*
Physical development/restructuring								
Structures in water	VH	VH	VH	VH	VH	VH	VH	VH
Dumping	VH	VH	VH	VH	VH	VH	VH	VH
Cables and pipelines	VH	VH	VH	VH	VH	VH	VH	VH
Energy and material recovery								
Establishment of wind turbines	VH	VH	VH	VH	VH	VH	VH	VH
Production of wind energy	H	H	VH	VH	H	H	H	H
Extraction of sand and stone	VH	VH	VH	VH	VH	VH	VH	VH
Transport and shipping								
Maritime shipping	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	VH	VH	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.								
Recreational boating, recreational life	VH	VH	H	VH	VH	VH	VH	VH
Dredging and dumping (leisure boats)	VH	VH	VH	VH	VH	VH	VH	VH
Research and exploration	VH	VH	M	VH	VH	VH	VH	VH
Military activities	VH	VH	M	VH	VH	VH	VH	VH
Hunting and fishing								
Bird hunting	M	M	M	M	M	M	M	M
Seal hunting	M	M	M	M	M	M	M	M
Pelagic trawling	M	M	H	H	M	M	M	M
Bottom trawling	VH	VH	H	VH	VH	VH	VH	VH
Quantitative catching gear	VH	VH	H	VH	VH	VH	VH	VH
Recreational angling	M	M	H	H	M	M	M	M
Discharge and pollution								
Industrial discharge	VH	VH	VH	VH	VH	VH	VH	VH
Discharge from household and municipal sewage treatment plants	VH	VH	VH	VH	VH	VH	VH	VH
Discharge from agriculture	VH	VH	VH	VH	VH	VH	VH	VH
Discharge from forestry	VH	VH	VH	VH	VH	VH	VH	VH
Discharge from aquaculture	VH	VH	VH	VH	VH	VH	VH	VH
Marine litter	M	M	H	H	M	M	M	M
Active introduction of alien species								
Active introduction of (invasive) alien species	H	H	H	H	H	H	H	H

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Threat	Shallow soft bottoms: Areas with sedges	Shallow soft bottoms: Essential links for migratory fish	Shallow soft bottoms: Recruitment areas for coastal living predatory fish	Shallow soft bottoms: Recruitment areas for whitefish	Shallow soft bottoms: Recruitment areas for flatfish	Shallow soft bottoms: Recruitment areas for vendace	Deep soft bottoms: Sandbanks	Deep soft bottoms: Sediment bottoms with fauna
Physical development/restructuring								
Structures in water	VH	VH	VH	VH	VH	VH	VH	VH
Dumping	VH	VH	H	H	H	H	VH	VH
Cables and pipelines	VH	VH	VH	VH	VH	VH	VH	VH
Energy and material recovery								
Establishment of wind turbines	VH	VH	VH	VH	VH	VH	VH	VH
Production of wind energy	H	H	H	H	H	H	H	M
Extraction of sand and stone	VH	VH	VH	VH	VH	VH	VH	VH
Transport and shipping								
Maritime shipping	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	VH	VH	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.								
Recreational boating, recreational life	VH	VH	VH	H	H	H	H	H
Dredging and dumping (leisure boats)	VH	VH	VH	VH	VH	VH	VH	VH
Research and exploration	VH	VH	H	H	H	H	VH	M
Military activities	VH	VH	VH	VH	VH	VH	VH	VH
Hunting and fishing								
Bird hunting	M	M	M	L	M	M	H	M
Seal hunting	M	M	M	L	H	M	H	M
Pelagic trawling	M	H	VH	M	H	M	H	M
Bottom trawling	VH	VH	VH	VH	VH	VH	VH	VH
Quantitative catching gear	VH	VH	VH	H	H	H	H	M
Recreational angling	M	VH	VH	H	H	H	H	M
Discharge and pollution								
Industrial discharge	VH	VH	VH	H	H	H	H	H
Discharge from household and municipal sewage treatment plants	VH	H	M	H	H	H	H	H
Discharge from agriculture	VH	H	M	H	H	H	H	H
Discharge from forestry	VH	H	M	H	H	H	H	H
Discharge from aquaculture	VH	H	M	H	H	H	H	H
Marine litter	M	M	M	M	H	M	H	H
Active introduction of alien species								
Active introduction of (invasive) alien species	M	H	M	M	M	M	M	H

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Threat	Deep soft bottoms			Shallow hard bottoms				
	Presence of seasonal ice	Presence of oxygenated water masses below the halocline	Recruitment areas for cod	Reefs	Baltic Esker islands	Boreal Baltic islets	Submerged or partially submerged sea caves	Blue mussel beds
Physical development/restructuring								
Structures in water	VH	M	M	VH	VH	VH	VH	VH
Dumping	VH	H	VH	VH	H	H	H	VH
Cables and pipelines	M	M	M	VH	VH	VH	VH	VH
Energy and material recovery								
Establishment of wind turbines	VH	M	M	VH	VH	VH	VH	VH
Production of wind energy	VH	M	VH	H	H	H	H	H
Extraction of sand and stone	VH	M	M	VH	VH	VH	VH	VH
Transport and shipping								
Maritime shipping	M	H	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	M	M	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.								
Recreational boating, recreational life	H	H	M	VH	VH	VH	VH	VH
Dredging and dumping (leisure boats)	VH	M	M	VH	VH	VH	VH	VH
Research and exploration	M	M	M	VH	M	M	H	VH
Military activities	H	M	M	VH	VH	VH	VH	VH
Hunting and fishing								
Bird hunting	L	L	M	M	M	M	M	L
Seal hunting	L	M	M	M	M	M	M	L
Pelagic trawling	L	M	H	M	M	M	M	L
Bottom trawling	M	M	H	VH	VH	VH	VH	VH
Quantitative catching gear	M	M	H	H	H	H	H	H
Recreational angling	M	M	M	H	M	M	M	H
Discharge and pollution								
Industrial discharge	VH	H	VH	VH	VH	VH	VH	VH
Discharge from household and municipal sewage treatment plants	H	H	VH	H	H	H	H	H
Discharge from agriculture	H	H	VH	H	H	H	H	H
Discharge from forestry	H	H	VH	H	H	H	H	H
Discharge from aquaculture	H	H	VH	H	H	H	H	H
Marine litter	H	M	M	H	M	M	H	H
Active introduction of alien species								
Active introduction of (invasive) alien species	L	L	M	H	L	H	L	H

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Threat	Shallow hard bottoms					Deep hard bottoms	
	Large perennial brown algae	Perennial red algae	Perennial filamentous algae	Reruitment areas for herring	Recruitment areas for grayling	Reefs	Blue mussel beds
Physical development/restructuring							
Structures in water	VH	VH	VH	VH	VH	VH	VH
Dumping	VH	VH	H	H	H	VH	VH
Cables and pipelines	VH	VH	VH	VH	VH	VH	VH
Energy and material recovery							
Establishment of wind turbines	VH	VH	VH	VH	VH	VH	VH
Production of wind energy	H	H	H	H	H	H	VH
Extraction of sand and stone	VH	VH	VH	VH	VH	VH	VH
Transport and shipping							
Maritime shipping	VH	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	VH	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.							
Recreational boating, recreational life	VH	VH	H	H	VH	H	H
Dredging and dumping (leisure boats)	VH	VH	VH	VH	VH	VH	VH
Research and exploration	VH	VH	H	H	H	VH	VH
Military activities	VH	VH	VH	VH	VH	VH	VH
Hunting and fishing							
Bird hunting	M	M	M	M	M	M	L
Seal hunting	M	M	M	M	M	M	L
Pelagic trawling	M	M	M	M	H	M	L
Bottom trawling	VH	VH	VH	VH	VH	VH	VH
Quantitative catching gear	M	M	M	H	H	VH	VH
Recreational angling	M	M	M	H	H	H	H
Discharge and pollution							
Industrial discharge	H	VH	VH	H	VH	VH	VH
Discharge from household and municipal sewage treatment plants	H	H	H	H	H	H	VH
Discharge from agriculture	H	H	H	H	H	H	VH
Discharge from forestry	H	H	H	H	H	H	VH
Discharge from aquaculture	H	H	H	H	H	H	VH
Marine litter	M	M	M	M	H	H	H
Active introduction of alien species							
Active introduction of (invasive) alien species	H	H	H	M	H	H	H

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Threat	Areas of particular importance to marine mammals and seabirds							
	Wintering area for long-tailed ducks	Spring resting areas for eider	Wintering and resting areas for greater scaup, red-breasted merganser and smew	Wintering areas for black-throated and red-throated diver	Nesting and breeding sites for eider and velvet scoter	Nesting and breeding sites for black guillemot	Nesting and breeding sites for common guillemot and razorbill	Nesting and breeding sites for lesser black-backed gull and herring gull
Physical development/restructuring								
Structures in water	H	H	H	H	VH	VH	VH	VH
Dumping	H	H	H	H	VH	VH	VH	VH
Cables and pipelines	M	M	M	M	M	M	M	M
Energy and material recovery								
Establishment of wind turbines	H	H	H	H	VH	VH	VH	VH
Production of wind energy	H	H	H	H	H	H	H	H
Extraction of sand and stone	M	M	M	M	M	M	M	M
Transport and shipping								
Maritime shipping	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and widening for waterways	H	H	H	H	M	VH	VH	VH
Human activities – recreation, military activities etc.								
Recreational boating, recreational life	VH	VH	VH	VH	VH	VH	VH	VH
Dredging and dumping (leisure boats)	M	M	M	H	VH	VH	VH	VH
Research and exploration	H	H	H	H	VH	VH	VH	VH
Military activities	H	H	H	H	VH	VH	VH	VH
Hunting and fishing								
Bird hunting	VH	VH	VH	VH	VH	VH	VH	VH
Seal hunting	H	H	H	VH	VH	VH	VH	VH
Pelagic trawling	H	H	H	H	VH	VH	VH	VH
Bottom trawling	H	H	H	H	VH	VH	VH	VH
Quantitative catching gear	H	H	H	VH	VH	VH	VH	VH
Recreational angling	H	H	H	H	H	H	H	H
Discharge and pollution								
Industrial discharge	VH	VH	VH	VH	VH	VH	VH	VH
Discharge from household and municipal sewage treatment plants	H	H	H	H	H	H	H	H
Discharge from agriculture	H	H	H	H	H	H	H	H
Discharge from forestry	H	H	H	H	H	H	H	H
Discharge from aquaculture	H	H	H	H	H	H	H	H
Marine litter	H	H	H	H	H	H	H	H
Active introduction of alien species								
Active introduction of (invasive) alien species	L	L	L	L	L	L	L	L

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Threat	Areas of particular importance to marine mammals and seabirds				
	Nesting and breeding sites for Caspian tern	Islands and islets for harbour seal	Islands and islets for ringed seal	Islands and islets for grey seal	Main areas for harbour porpoises
Physical development/restructuring					
Structures in water	VH	VH	VH	VH	VH
Dumping	VH	VH	VH	VH	H
Cables and pipelines	M	H	H	H	VH
Energy and material recovery					
Establishment of wind turbines	VH	VH	VH	VH	VH
Production of wind energy	H	M	M	M	VH
Extraction of sand and stone	M	H	H	H	VH
Transport and shipping					
Maritime shipping	VH	VH	VH	VH	VH
Dredging and widening for waterways	VH	VH	VH	VH	VH
Human activities – recreation, military activities etc.					
Recreational boating, recreational life	VH	VH	VH	VH	VH
Dredging and dumping (leisure boats)	VH	VH	VH	VH	VH
Research and exploration	VH	VH	VH	VH	VH
Military activities	VH	VH	VH	VH	H
Hunting and fishing					
Bird hunting	VH	VH	VH	VH	VH
Seal hunting	VH	VH	VH	VH	VH
Pelagic trawling	VH	VH	VH	VH	VH
Bottom trawling	VH	VH	VH	VH	VH
Quantitative catching gear	VH	VH	VH	VH	VH
Recreational angling	H	VH	VH	VH	VH
Discharge and pollution					
Industrial discharge	VH	VH	VH	VH	VH
Discharge from household and municipal sewage treatment plants	H	VH	VH	VH	VH
Discharge from agriculture	H	VH	VH	VH	VH
Discharge from forestry	H	VH	VH	VH	VH
Discharge from aquaculture	H	VH	VH	VH	VH
Marine litter	H	VH	VH	VH	H
Active introduction of alien species					
Active introduction of (invasive) alien species	L	M	H	M	L

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ANNEX 8: Threat Reduction Objectives and Regulation Objectives

Threat	Threat Reduction Objective (Nested Target level)	Threat Reduction Objective (MPA Network level)	Regulation Objective	Regulation Objective (Short)
Structures in water	Constructions in water does not occur in MPAs. Exceptions: Constructions in the water occurs to a limited degree, but with no negative impact in the following Nested Targets: Perennial red algae, Reruitment areas for herring, Sediment bottoms with fauna, Presence of seasonal ice, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Wintering areas for black-throated and red-throated diver.	No new constructions are occuring in MPAs.	Constructions in water are prohibited in all relevant Nested Targets (red) in MPAs, but special exceptions can be made in the Nested Targets: Perennial red algae, Reruitment areas for herring, Sediment bottoms with fauna, Presence of seasonal ice, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Wintering areas for black-throated and red-throated diver.	Prohibited
Dumping	Dumping does not occur in any of the Nested Targets in MPAs.	Dumping does not occur in MPAs.	Dumping is prohibited in all Nested Targets in MPAs.	Prohibited
Windpower (construction)	New cables and pipelines do not occur in the relevant Nested Targets in MPAs. Exceptions: New cables and pipelines occur to a limited degree, but with no negative impacts in the following Nested Targets: Baltic Esker islands , Boreal Baltic islets , Presence of oxygenated water masses below the halocline, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Islands and islets for harbour seal, ringed seal and grey seal.	New cables or pipelines do not occur in MPAs.	New cables and pipelines are prohibited in all relevant Nested Targets in MPAs, but special exceptions can be made in the Nested Targets: Baltic Esker islands, Boreal Baltic islets , Presence of oxygenated water masses below the halocline, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Islands and islets for harbour seal, ringed seal and grey seal.	Prohibited
Windpower (production)	Constructions of windpower does not occur in any of the Nested Targets in MPAs.	Constructions of windpower does not occur in MPAs.	Constructions of windpower is prohibited in all Nested Targets in MPAs.	Prohibited

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Threat	Threat Reduction Objective (Nested Target level)	Threat Reduction Objective (MPA Network level)	Regulation Objective	Regulation Objective (Short)
Extraction of sand and stone	Production of windpower occurs to a limited degree, but with no negative impact on Nested Targets. Exceptions: Production of windpower does not occur in: Estuaries, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Main areas for harbour porpoises.	Production of windpower occurs occasionaly, but with no with negative impact in MPAs.	Production of windpower is restricted in all relevant Nested Targets in MPAs, and prohibited in Estuaries, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Main areas for harbour porpoises.	Restricted
Shipping	Extraction of sand and stone does not occur in the relevant Nested Targets in MPAs. Exceptions: Extraction of sand and stone occur to a limited degree. but with no impact in the following Nested Targets: Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Wintering areas for black-throated and red-throated diver.	Extraction of sand and stone does not occur in MPAs.	Extraction of sand and stone is prohibited in all relevant Nested Targets in MPAs, but special exceptions can be made in the Nested Targets: Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Wintering areas for black-throated and red-throated diver.	Prohibited
Cables and pipelines	Shipping does not occur in all relevant Nested Targets in MPAs. Exceptions: Maritime traffic occurs to a limited degree, but with no negative inpact in the following Nested Targets: Sandbanks, Recruitment areas for cod, Sediment bottoms with fauna, Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Reefs, Blue mussel beds.	Shipping does not occur in MPAs.	Shipping is prohibited in all relevant Nested Targets in MPAs, but special exceptions can be made in the Nested Targets: Sandbanks, Recruitment areas for cod, Sediment bottoms with fauna, Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Reefs, Blue mussel beds.	Prohibited
Dredging and widening for shipping lanes	Dredging and widening for shipping lanes does not occur in MPAs. Exceptions: Dredging and widening for shipping lanes occurs to a limited degree, but with no negative impact, but with no negative impact in the following Nested Targets: Submerged or partially submerged sea caves, Presence of seasonal ice, Presence of oxygenated water masses below the halocline.	Dreding and widening for shipping lanes does not occur in MPAs.	Dredging and widening for shipping lanes is prohibited in all relevant Nested Targets in MPAs, but special exceptions can be made in the following Nested Targets: Submerged or partially submerged sea caves, Presence of seasonal ice, Presence of oxygenated water masses below the halocline.	Prohibited

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Threat	Threat Reduction Objective (Nested Target level)	Threat Reduction Objective (MPA Network level)	Regulation Objective	Regulation Objective (Short)
Recreational boating	Recreational activities occurs to a limited degree, but with no negative impact in the relevant Nested Targets in MPAs. Exceptions: Recreational activites can occur in the following Nested Targets: Sandbanks, Estuaries, Inlets and bays, Narrow Baltic bays, Areas with sedges, Reefs, Blue mussel beds, Large perennial brown algae, Perennial red algae, Perennial filamentous algae, Recruitment areas for herring, Recruitment areas for grayling, Sandbanks, Recruitment areas for cod, Sediment bottoms with fauna, Presence of oxygenated water masses below the halocline.	Recreational acitivities occurs occasionaly, but with no negative impact in MPAs.	Recreational activites are restricted in all relevant Nested Targets in MPAs, but are allowed in the Nested Targets: Sandbanks, Estuaries, Inlets and bays, Narrow Baltic bays, Areas with sedges, Reefs, Blue mussel beds, Large perennial brown algae, Perennial red algae, Perennial filamentous algae, Recruitment areas for herring, Recruitment areas for grayling, Sandbanks, Recruitment areas for cod, Sediment bottoms with fauna, Presence of oxygenated water masses below the halocline.	Restricted
Dredging and dumping	Dredging and (or dumping (leisure boats) does not occur in any of the Nested Targets in MPAs.	Dredging and/or dumping (leisure boats) does not occur in MPAs.	Dredging and/or dumping (leisure boats) are prohibited in all Nested Targets in MPAs.	Prohibited
Research and exploration	Scientific research and exploration occurs occasionaly, but with no negative impact in any of the Nested Targets in MPAs.	Scientific research and exploration occurs occasionally, but with no negative impact in MPAs.	Scientific research and exploration is restricted in all Nested Targets in MPAs.	Restricted
Military activities	Military activities occurs occasionaly, but with no negative impact in any of the Nested Targets in MPAs.	Military activities occurs occasionaly, but with no negative impact in MPAs.	Military activities are restricted in all Nested Targets in MPAs.	Restricted
Pelagic trawling	Pelagic trawling occurs to a limited degree, but with no negative impact in all relevant Nested Targets in MPAs. Exceptions: Pelagic trawling does not occur in the following Nested Target: Essential links for migratory fish, Main areas for harbour porpoises. Pelagic trawling can occur in the following Nested Targets: Sandbanks, Sediment bottoms with fauna, Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Reefs, Blue mussel beds.	Pelagical trawling occurs occasionaly, but with no negative impact in MPAs.	Pelagic trawling is restricted in all relevant Nested Targets in MPAs, but prohibited in the following Nested Targets: Essential links for migratory fish, Main areas for harbour porpoises. Pelagic trawling is allowed in the following Nested Targets: Sandbanks, Sediment bottoms with fauna, Presence of seasonal ice, Presence of oxygenated water masses below the halocline, Reefs, Blue mussel beds.	Restricted
Bottom trawling	Bottom trawling does not occur in any of the Nested Targets in MPAs.	Bottom trawling does not occur in MPAs.	Bottom trawling is prohibited in all Nested Targets in MPAs.	Prohibited

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Threat	Threat Reduction Objective (Nested Target level)	Threat Reduction Objective (MPA Network level)	Regulation Objective	Regulation Objective (Short)
Quantitative catching gear (bottom-attached nets, pelagic nets, hook fishing, cages, traps)	Fishing with quantitaitve catching gear occurs to a limited degree, but with no negative impact in all of the Nested Targets in MPAs. Exceptions: Fishing with quatitative catching gear is not occuring in the Nested Target: Essential links for migratory fish.	Fishing with quantitative catching gear occurs occasionaly, but with no negative impact in MPAs.	Fishing with quantitative catching gear is restricted in all relevant Nested Targets, but prohibited in the Nested Target: Essential links for migratory fish.	Restricted
Recreational angling (fishing with rod and line)	Recreational angling can occur in all the relevant Nested Targets in MPAs. Exceptions: Recreational angling occurs to a limited degree, but with no negative impact in the following Nested Targets: Estuaries, Essential links for migratory fish, Recruitment areas for coastal living predatory fish, Recruitment areas for white-fish, Recruitment areas for flatfish, Recruitment areas for vendance, Reefs, Blue mussel beds, Recruitment areas for grayling, Recruitment areas for cod, Reefs, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Recreational angling can occur in MPAs.	Recreational angling is allowed in all relevant Nested Targets in MPAs, but restricted in the following Nested Targets: Estuaries, Essential links for migratory fish, Recruitment areas for coastal living predatory fish, Recruitment areas for white-fish, Recruitment areas for flatfish, Recruitment areas for vendance, Reefs, Blue mussel beds, Recruitment areas for grayling, Recruitment areas for cod, Wintering area for long-tailed ducks, Spring resting areas for eider, Wintering and resting areas for greater scaup, red-breasted merganser and smew, Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Wintering areas for black-throated and red-throated diver, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Allowed
Bird hunting	Bird hunting occurs to a limited degree, but with no negative impact in all relevant Nested Targets in MPAs. Exceptions: Birdhunting does not occur in the following Nested Targets: Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Bird hunting occurs occasionaly, but with no negative impact in MPAs.	Bird hunting is restricted in all relevant Nested Target in MPAs, but prohibited in the following Nested Targets: Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Restricted

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Threat	Threat Reduction Objective (Nested Target level)	Threat Reduction Objective (MPA Network level)	Regulation Objective	Regulation Objective (Short)
Seal hunting	Seal hunting occurs to a limited degree, but with no negative impact in all relevant Nested Targets in MPAs. Exceptions: Seal hunting does not occur in the following Nested Targets: Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Seal hunting occurs occasionally, but with no negative impact in MPAs.	Seal hunting is restricted in all relevant Nested Target in MPAs, but prohibited in the following Nested Targets: Nesting and breeding sites for eider and velvet scoter, Nesting and breeding sites for black guillemot, Nesting and breeding sites for common guillemot and razorbill, Nesting and breeding sites for lesser black-backed gull and herring gull, Nesting and breeding sites for Caspian tern, Islands and islets for harbour seal, ringed seal and grey seal, Main areas for harbour porpoises.	Restricted
Industrial discharge	Industrial discharge does not occur in any of the Nested Targets in MPAs.	Industrial discharge does not occur in MPAs.	Industrial discharge is prohibited in all Nested Targets in MPAs.	Prohibited
Discharge from household and municipal sewage treatment plants	Discharge from household and municipal sewage treatment plants occur occasionaly, but with no negative impact in any of the Nested Targets in MPAs.	Discharge from household and municipal sewage treatment plants occurs occasionaly, but with no negative impacts in MPAs.	Discharge from household and municipal sewage treatment plants is restricted in all Nested Targets in MPAs.	Restricted
Discharge from forestry (nutrients & pesticides)	Discharge from forestry occur occasionaly, but with no negative impact in any of the Nested Targets in MPAs.	Discharge from forestry occurs occasionaly, but with no negative impacts in MPAs.	Discharge from forestry is restricted in all Nested Targets in MPAs.	Restricted
Discharge from agriculture	Discharge from agriculture occur occasionaly, but with no negative impact in any of the Nested Targets in MPAs.	Discharge from agriculture occurs occasionaly, but with no negative impacts in MPAs.	Discharge from agriculture is restricted in all Nested Targets in MPAs.	Restricted
Discharge from aquaculture	Discharge from aquaculture does not occur in any of the Nested Targets in MPAs.	Discharge from aquaculture does not occur in MPAs.	Discharge from aquaculture is prohibited in all Nested Targets in MPAs.	Prohibited
Marine litter	Marine litter does not occur in any of the Nested Targets in MPAs.	Marine litter does not occur in MPAs.	Marine litter is prohibited in all Nested Targets in MPAs.	Prohibited
Active introduction of (invasive) alien species (planting, release of species as well as aquaculture)	Active introduction of (invasive) alien species does not occur in any of the Nested Targets in MPAs.	Active introduction of (invasive) alien species does not occur in MPAs.	Active introduction of (invasive) alien species is prohibited in all Nested Targets in MPAs.	Prohibited

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ANNEX 9: Data Quality Assessment Questions

Questions used in the quality assessment of data sets, to judge their Validity, Reliability, Integrity, Precision, Timeliness and Efficiency.

Validity: Data should accurately and adequately measure the intended result.

- Does the collected data clearly and accurately measure the related result (indicator, intermediate result or objective)?
- Does the collected data provide an adequate measure of the related result (indicator, intermediate result or objective)?
- Is the data available at the required levels of granularity (sufficient to support aggregation and drill-down to the extent needed)?

Reliability: Data should reflect consistent collection processes and analysis methods over time.

- Is the data collection documented and sound? i.e. will repeated collections of the data produce consistent and comparable results? Does the method avoid or minimize bias and sampling error?
- Is the data analysis and processing method documented and sound? i.e. will repeated processing of the data produce consistent and comparable results?
- Can the data be verified by alternate sources?

Integrity: Data should have safeguards to minimize risk of error or data corruption.

- Are procedures in place to minimize basic errors (data entry/transcription errors, accidental change)?
- Does the source data come from a trusted source with acknowledged expertise in this specific area (are they seen as the best available)?
- If multiple data points need to be combined, are they coherent enough (i.e. use comparable methods, granularity, time frames etc.)?

Precision: Data should have a sufficient level of detail to permit management decision making.

- Is the data sensitive enough to register expected changes?
- Is the data available at the required resolution and spatial scales?
- Is the data precise and devoid of ambiguity?

Timeliness: Data should be available at a useful frequency and be current enough to influence management decision-making.

- Are data available frequently enough to reflect trends?
- Where multiple data elements are combined, do they represent compatible points in time so that comparisons and trend analyses are possible?
- Are data available frequently enough to inform program management decisions?

Efficiency: Data collection and analysis should be performed at a cost (financial and time) commensurate with the value of the related indicator and result.

- Is there an efficient process for measuring the indicator?
- If not, are the inefficiencies considered acceptable given the priority of the related indicator?
- Is there an efficient process for the team to collect, store, and analyse the data?

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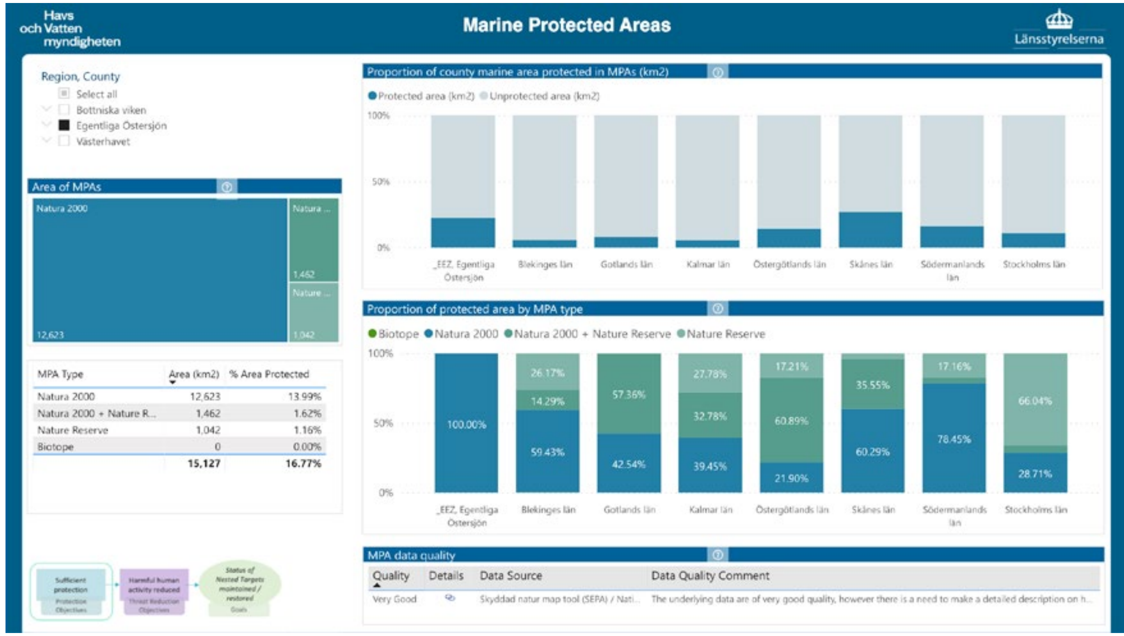
ANNEX 10: Examples of Dashboard Pages

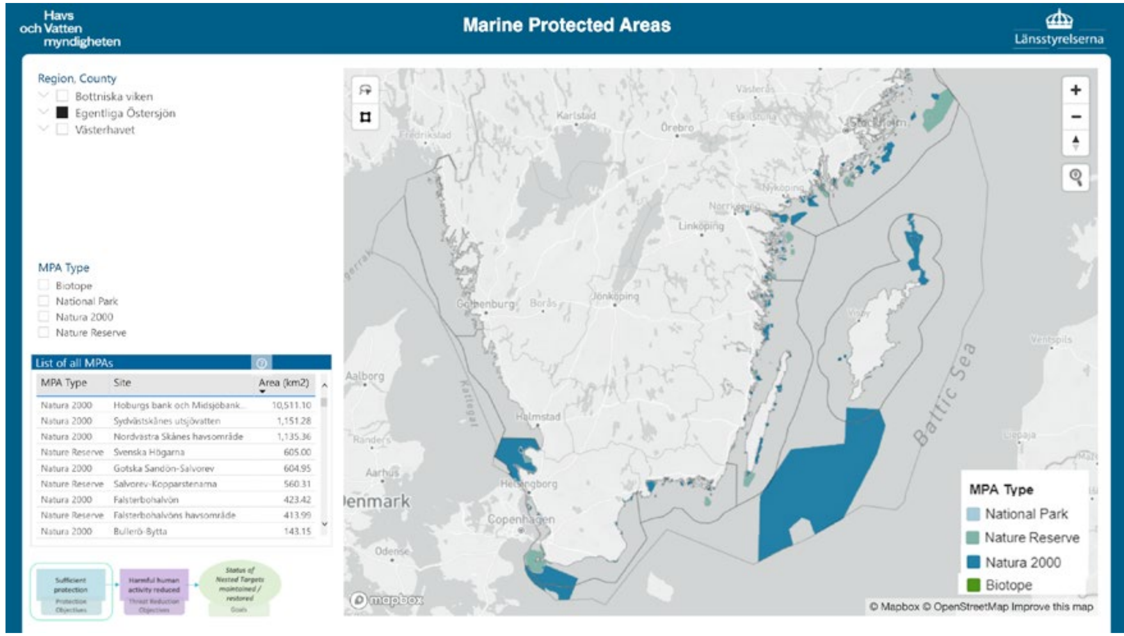
Marine Protected Areas

The dashboard page 'Marine Protected Areas' shows the types of MPAs in each marine region and its counties, including how much area is covered by each type. In the example, the selected region is the Baltic Proper. Some types of MPAs tend to overlap with each other, and these overlapping areas are shown as a separate category. This information is relevant for the 'sufficient protection' part of the TOC (shown in the bottom left corner of the dashboard page).



Map of MPAs

One dashboard page is dedicated to a map of the MPAs in Sweden. On the left panel, we have selected the Baltic Proper marine region, and the map shows all MPAs of the different types within that region. The table on the left lists all MPAs within the selected region, including their names, types, and sizes. This information is relevant for the 'sufficient protection' part of the TOC (shown in the bottom left corner of the dashboard page).



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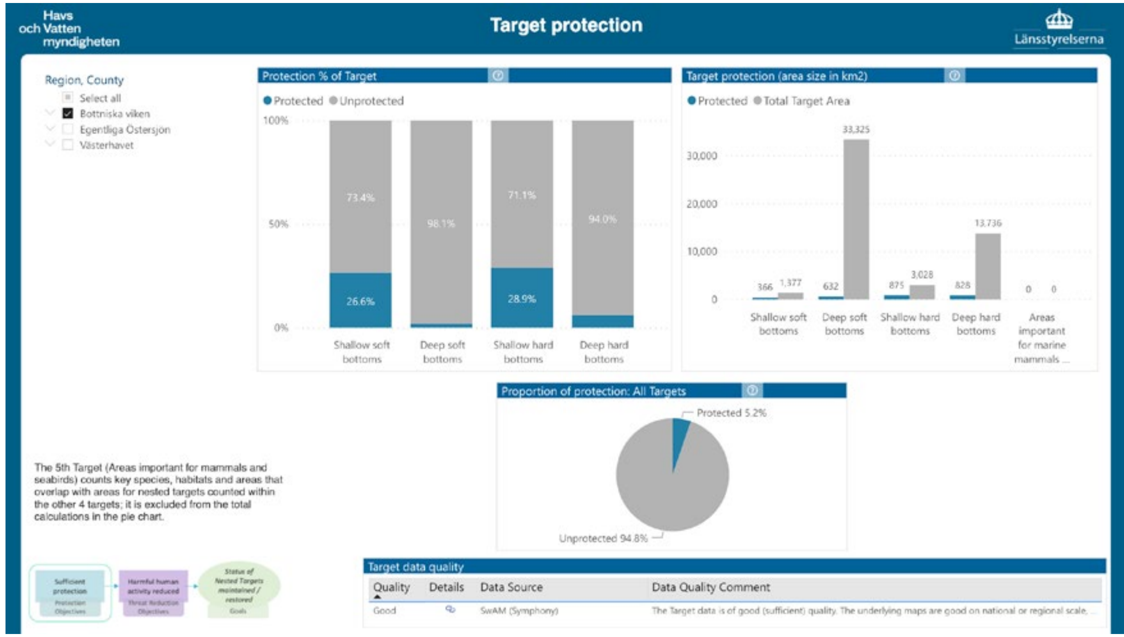
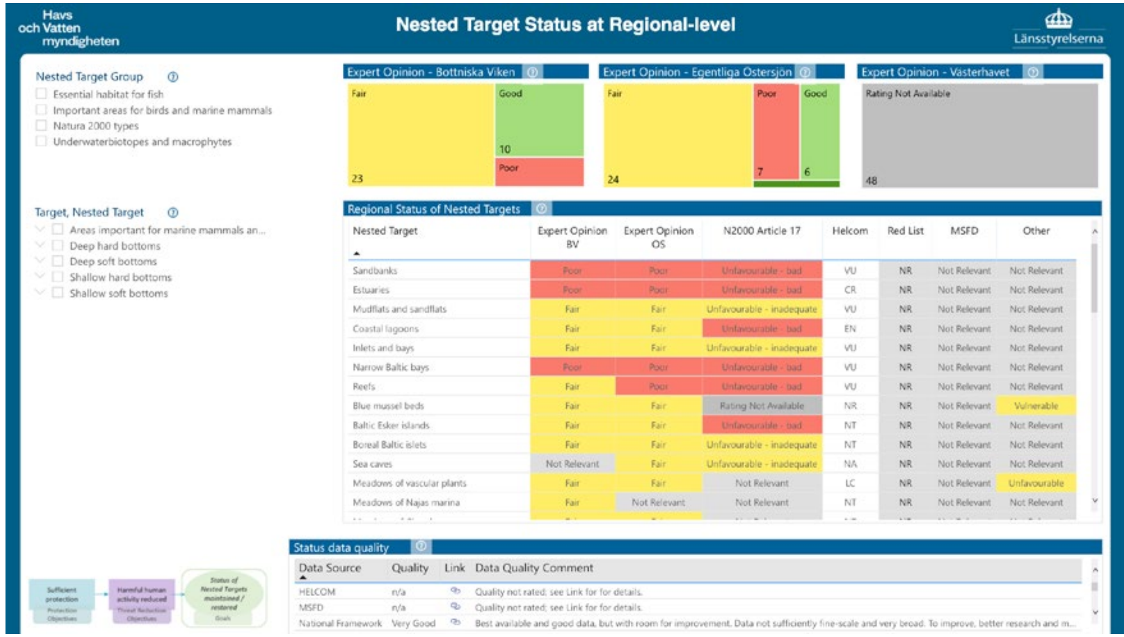
Target protection

The ‘Target protection’ page shows how much of each of the four Targets (see Step 3) is under protection in the different regions and counties (the Target ‘Areas important for mammals and seabirds’ is excluded here). On the left, we have selected the Gulf of Bothnia marine region, and on the right, we can see the protection level of each Target, both as a proportion of the area of occurrence and in square kilometres. The pie chart at the bottom shows the total for all four Targets. The table at the very bottom shows the data quality rating for the used dataset. This information is linked to the ‘sufficient protection’ part of the TOC (shown in the bottom left corner of the dashboard page).



Nested Target status at regional level

This page contains information about the Conservation Status (see Step 4) of Nested Targets. On the left panel, there are options for selecting a particular Target. The tree-maps on top of the page show how many Nested Targets within a particular region have a particular Status. The table in the middle displays different status indications according to different sources. At the bottom, there is information about the quality of the Status data. This information is linked to the ‘status’ part of the TOC (shown in the bottom left corner of the dashboard page).



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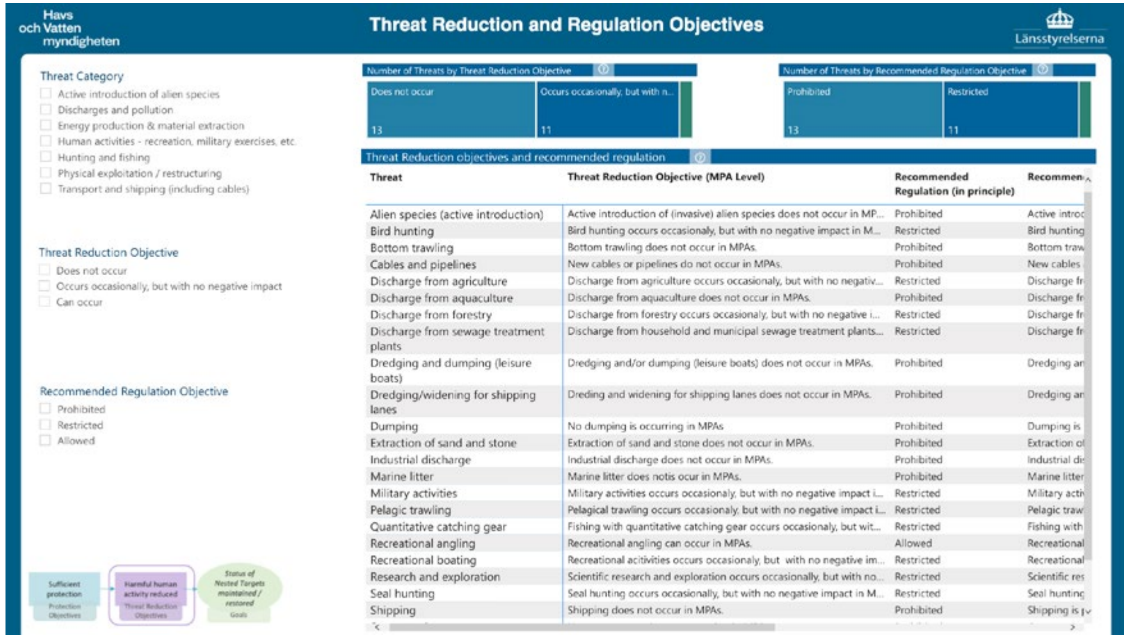
Threats to MPAs

The dashboard page 'Threats to MPAs' (see Step 6) shows how prevalent each Threat is in the MPAs. On the left, we have selected the Baltic Proper marine region and the two threat categories High and Very High. In the graphs on the right, we can see which Threats are the most significant for the MPAs by surface area, as well as how much of the MPAs are exposed to these Threats. The bottom graph shows the proportion of area both inside and outside MPAs impacted by these Threats. This information is linked to the 'harmful human activities reduced' part of the TOC (shown in the bottom left corner of the dashboard page).

Threat Reduction and Regulation Objectives

This page shows the generalised, Network-level Threat Reduction Objectives for each Threat (see Step 7). Using the panel on the left, we can filter the table by Threat category, Threat Reduction Objective category, and Regulation Objective category. The tree-maps on the top show a summary of Threats falling within each category of Threat Reduction Objectives and Regulation Objectives. This information is linked to the 'harmful human activities reduced' part of the TOC (shown in the bottom left corner of the dashboard page).



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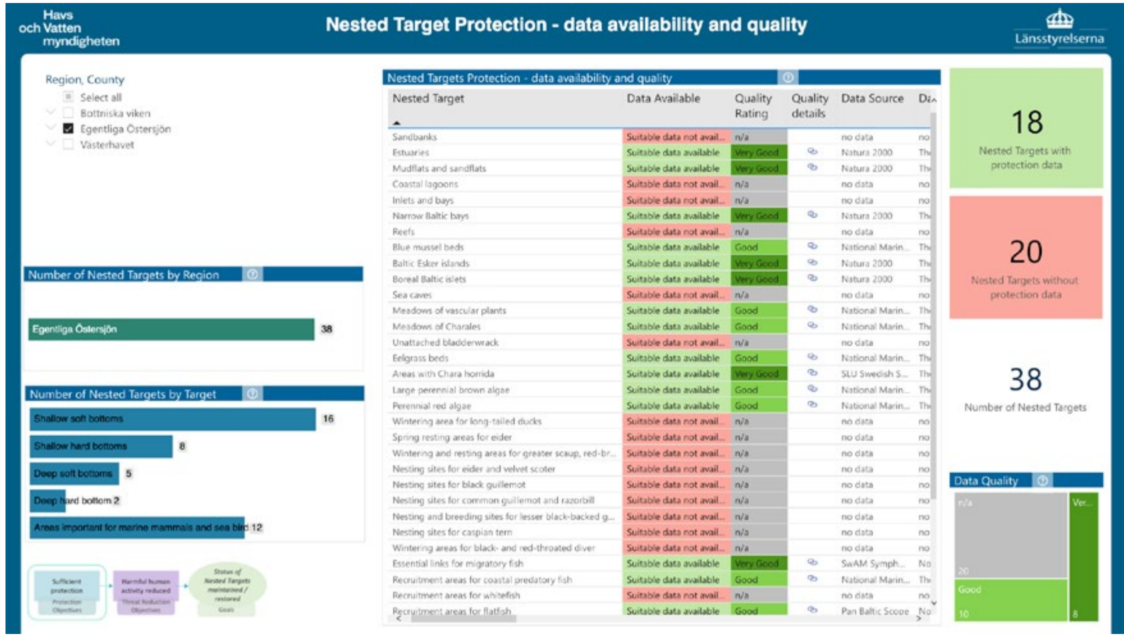
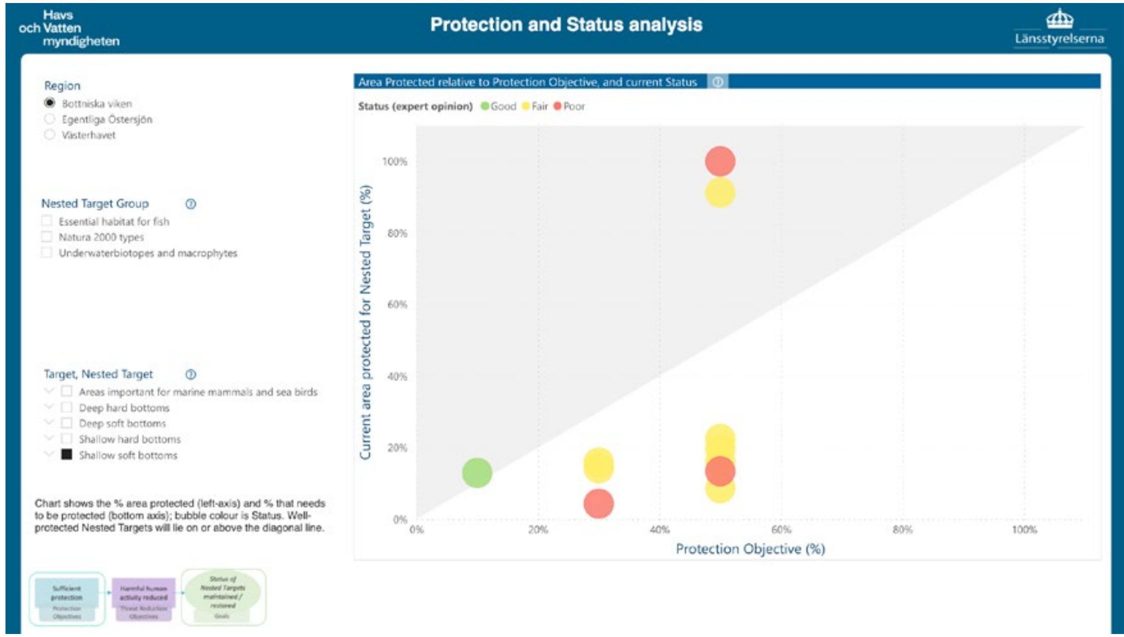
Nested Target protection – data availability and quality

This is an example of one of the ‘Data availability and quality’ pages. On the left, we have selected the Baltic Proper, and the table shows the full list of Nested Targets in this region with information on which have suitable data available and which do not. It also shows the data source and quality rating of the data, with links to the quality assessment files (see Step 8). The tree-map graph in the lower right corner shows the summary of the quality ratings for those Nested Targets for which there is available data.



Protection and Status analysis

The dashboard page ‘Protection and Status Analysis’ shows the correlation between protection and status of Nested Targets. On the left panel, we have selected the Gulf of Bothnia for marine region and shallow soft bottoms for Target. The graph on the right shows a bubble for each Nested Target in the shallow soft bottoms of the Gulf of Bothnia. Nested Targets located above the diagonal line have reached their Protection Objectives, whereas Nested Targets below the line have not. The colour of the bubbles indicates the status of the Nested Targets. This view helps identify those Nested Targets that need protection and attention (see Step 9).



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