Preface

In the Baltic Sea, where the transboundary aspects of environmental problems are highly evident, HELCOM plays a central role in coordinating environmental management objectives and in the implementation of actions and measures.

The HELCOM holistic assessments of the ecosystem health of the Baltic Sea are reoccurring, transboundary, cross-sectoral assessments that look at the effects of our activities and measures on the status of the environment. The knowledge produced through these assessment processes supports environmental policy and is incorporated into the ecosystem-based management of the Baltic Sea, as well as into national, regional and global measures.

These holistic assessments cover a broad range of topics relevant to the state of the ecosystem, environmental pressures, societal drivers and the effects on human well-being. The assessment presented here, the third HELCOM holistic assessment of the state of the Baltic Sea (HOLAS 3), also specifically enables tracking our progress towards the implementation of the 2021 HELCOM Baltic Sea Action Plan goals and objectives. It also functions as a regional contribution to the reporting required under the Marine Strategy Framework Directive for those HELCOM Contracting Parties that are also EU Member States, and it may support achievement of or reporting under other international policy initatives, e.g., the UN Sustainability Development Goals.

The holistic assessments cover 'moments' in time over the dynamic life history of the Baltic Sea, supporting the adaptive development of assessment methods, measures and policies. The third HELCOM holistic assessment focuses on describing the status for the years 2016-2021, contributing to our ambition at HELCOM to develop, update and share knowledge about the state of the Baltic Sea environment.

This summary report builds on, and integrates, results from a wide range of assessment products produced within the third HELCOM holistic assessment. The role of this summary report is to link information from the underpinning assessment products together, thus highlighting the holistic aspects. With this in mind, the summary report focuses on presenting the results and on an in-depth look at why we are seeing these results, providing over-arching context and analysis. The report helps develop a clearer picture of where we are and how things are connected, supporting coordinated and effective measures to strengthen the Baltic Sea environment.

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Executive summary

The Baltic Sea has unique biodiversity, and people around the region depend on its ecosystem in ways that are not always directly apparent or appreciated. But in spite of its ecological, economic and cultural importance, biodiversity is continuously being degraded and lost. The importance of functioning ecosystems for human well-being is too often underestimated or not fully recognized in planning and decision-making. Key pressures on the Baltic Sea ecosystem include eutrophication, pollution from hazardous substances, land use and overfishing, but several other pressures also add to the total impact.

Exeutive summary in short

- The Baltic Sea is under increasing impacts from climate change and biodiversity degradation catalysed by eutrophication, pollution, land use and resource extraction. Little to no improvement of the Baltic Sea environment occurred during the assessment period.
- Measures to reduce pressures on the Baltic Sea are working, when they are implemented, and the agreements in the updated Baltic Sea Action Plan remain highly relevant.
- The effects of climate change are expected to increase in the future, increasing the need for measures to enhance ecosystem resilience and mitigate their negative impacts.
- Transformative changes are needed in all socioeconomic sectors interacting with or affecting the Baltic Sea environment. Actions are needed both to stop current negative trends and to protect and restore ecosystems.
- Ecosystem knowledge and policies for the Baltic Sea environment have developed substantially within the past six years.
- Implementing the updated Baltic Sea Action Plan, facilitating ecosystem-based management and minimizing impacts from climate change are focal areas for HELCOM in the coming years.

State of the Baltic Sea
Third HELCOM holistic assessment 2016–2021

Countries around the Baltic Sea have agreed to improve the state of its ecosystem

The HELCOM Baltic Sea Action Plan includes measures that countries have agreed on as highly important to halt the deterioration of the Baltic Sea environment, strengthen biodiversity and improve the living conditions of future generations. HELCOM carries out holistic assessments every six years to follow up on how well the agreement is functioning, focusing on how the Baltic Sea ecosystem is doing. These holistic assessments involve several hundred experts on a wide range of topics, from monitoring to system-level evaluations. The third HELCOM holistic assessment focuses on the years 2016-2021 and includes results at various levels of detail, including monitoring data, indicator reports and thematic assessments. This summary report highlights and synthesizes the main findings.

The measures of the Baltic Sea Action Plan also support several other environmental commitments of the Baltic Sea countries, including the United Nations Sustainable Development Goals. The holistic assessment also helps EU countries within HELCOM meet the requirements for coordinated reporting under the EU Marine Strategy Framework Directive.

The state of the Baltic Sea ecosystem has not improved

The knowledge base of this holistic assessment is more comprehensive than that of previous HELCOM assessments. Several uncertainties have been reduced, and assessment approaches improved. Unfortunately, the results show only little or no improvement in the state of the Baltic Sea environment in 2016-2021. Indicator-based assessments show cases of poor status in environmental pressures across the full spatial extent of the Baltic Sea. Across pelagic habitats, benthic habitats, fish, waterbirds and marine mammals, only a few indicators reached their threshold values in parts of the Baltic Sea, and none in all assessed areas. For some species groups, such as marine mammals and fish, the integrated status has worsened compared to the previous assessment. Many commercial fish stocks in the Baltic Sea are in an especially poor state.

This deterioration jeopardizes the sustainable use of species in the Baltic Sea, and it also impacts ecosystem functions that are of central importance for humans. The poor environmental status of the Baltic Sea clearly affects, for example, the profitability of fisheries and tourism, and it also impacts a wide range of ecosystem services on which we depend. Considering the high costs of inaction, achieving a healthy Baltic Sea is also an investment in the sustainable economic and societal development of our region. Achieving good environmental status in national marine waters by 2040 has been estimated to be worth 5.6 billion euros per year to the people around the Baltic Sea.

When implemented, regional measures are working

However, the assessment also shows that measures to reduce pressures on the Baltic marine environment are working, when they are implemented. As a result of regional agreements, inputs of nutrients have reached sustainable levels in some parts of the Baltic Sea, and so have levels of some hazardous substances that were previously problematic. Actions for biodiversity conservation have also increased, and the Baltic Sea region is on track to reach the global target of 30% protected area by the year 2030. Such coordinated measures are essential to enable the recovery of the Baltic ecosystem over time. These are fundamental steps and necessary actions, and it is imperative that we build on them further.

Among current key priorities, lowering the input of nutrients to regionally agreed maximum levels in all sea basins remains a central objective. In addition, strengthening the coordination of management measures to limit the distribution of a wide range of hazardous substances is needed. Transitioning to ecosystem-based management is called for to ensure that fishing does not have negative effects on food web functions or ecosystem resilience. This need is further increased by climate change.

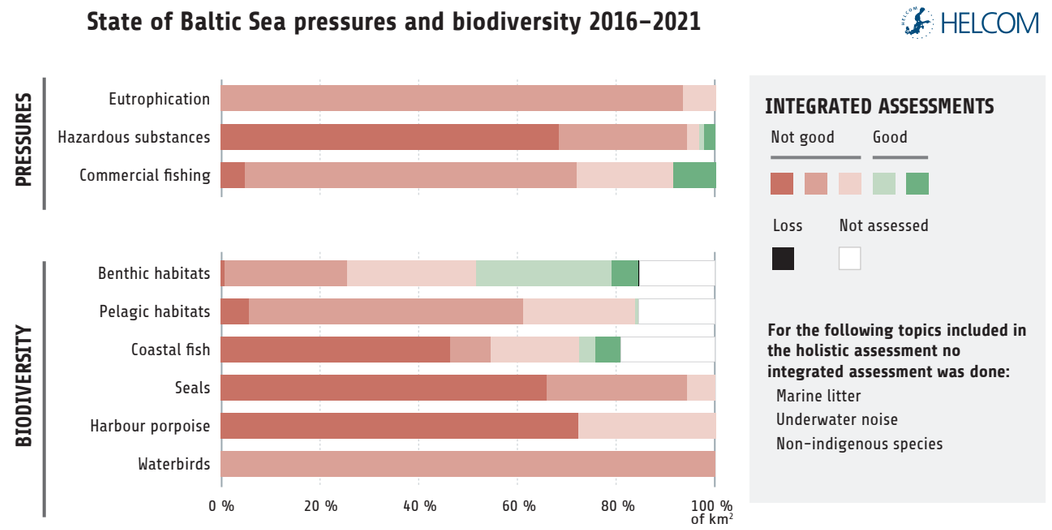

Figure ES1. Summary of the integrated assessment results of pressures and status for the Baltic Sea showing the proportion of the Baltic Sea in the different assessment status categories (based on square kilometres). Integrated assessment results are shown in five categories with three representing degrees of poor status and two representing degrees of good status, as shown in more detail in the different chapters of the report.

Policy statements

- National work in HELCOM countries is at the core of implementing the Baltic Sea Action Plan and improving the health of the Baltic Sea.
- The third HELCOM holistic assessment highlights the importance of measures to strengthen Baltic Sea biodiversity.
- Achieving a healthy Baltic Sea ecosystem requires measures both to limit the extent and intensity of current human-induced pressures and to protect and restore species and habitats.
- An urgent need is to equip our shared Baltic Sea ecosystem with the capacity to withstand the future effects of climate change.
- A central task for HELCOM is to incorporate current knowledge developments in an ecosystem-based management framework that supports, and is supported by, national, regional and global actions that enable a sustainable future for the Baltic Sea region.

The need for stronger measures is accentuated by climate change

Climate change increases the risk of biodiversity loss in the Baltic Sea and aggravates the impact of existing pressures. The impacts of climate change have increased in the Baltic Sea region lately and are predicted to continue doing so in the near future. Assessments show that the water temperature is rising, the ice extent in winter is decreasing and the annual mean precipitation is increasing over the northern part of the region. The increased likelihood of marine heatwaves, climate variability and extreme weather events is of growing concern. These changes affect the abundance and distribution of species in the Baltic Sea, and hence also ecosystem functions and the delivery of ecosystem services. Measures are needed to limit global warming, strengthen the resilience of the natural ecosystem and enhance its potential to mitigate climate change effects.

Ecosystem-based approaches can support environmental measures

The poor status of many species and habitats reflects their response to multiple pressures acting in concert rather than to individual pressures. For example, benthic habitats can be impacted by a combination of physical disturbance, eutrophication and the effects of food web disruptions. Mobile species, including fish, waterbirds and marine mammals, are affected by pressures throughout their distribution area. Several environmental objectives for the Baltic Sea will likely require a combination of measures targeting various pressures and climate change effects in order to be achieved. Transformative changes are called for in all socioeconomic sectors interacting with or affecting the Baltic Sea environment in order to protect and rebuild ecosystems and halt existing negative trends.

Maintaining the natural structure and function of food webs can be expected to strengthen the resilience of the ecosystem against multiple human pressures. Food webs cannot be directly managed, but their structure and function can be improved by proper management of the human activities and pressures that affect the species involved in them. Since all parts of the ecosystem are interconnected, changes in the status of one species in the food web will affect others. Integrating food web knowledge into the design and implementation of management measures (for example, by identifying and coordinating a combination of actions that support key species) is expected to increase the effectiveness of measures to strengthen the species, habitats and food webs of the Baltic Sea.

To this end, ensuring continued, coordinated monitoring, assessment and analysis among Baltic Sea countries, and developing these further, are key to ensuring the coherence and communication needed to support environmental policy towards the ecosystem approach.

Summary of assessment results per assessment element

Status of biodiversity in the Baltic Sea

1. **Pelagic habitats**, including phytoplankton and zooplankton, Pelagic habitats, including phytoplankton and zooplankton, do not have good status in any open sea subbasin. The status is most deteriorated in the central and northern Baltic Sea, and the situation has worsened in the Bothnian Bay. Four out of thirteen assessed coastal areas have good status for phytoplankton. When eutrophication indicators are also included in the assessment, no open sea or coastal pelagic habitats have good integrated status.
2. **Benthic habitats** generally do not have good status in the southern Baltic Sea, while their status is good in open sea areas in the northernmost subbasins. Oxygen conditions are worsening. The oxygen debt below the halocline is increasing in all basins, especially in the Baltic Proper, and the increase between the previous and current assessment periods was very steep. Most coastal areas do not have good status.
3. **For fish,** only four out of fifteen assessed commercial stocks have good status. The status has declined for three stocks, improved for one and remained unchanged for eight stocks that were also assessed in the previous assessment period. The integrated status of coastal fish is good in only two of the twenty-two assessed areas, representing a worsened situation.
4. **Waterbirds** do generally not have good status, although there is variability between groups with different feeding behaviours. The status of benthic feeders and waders is not good in any part of the Baltic Sea. Surface-feeders have good status only in the Gulf of Bothnia. Grazing feeders do not have good status in the Kattegat, the Northern Baltic Proper or the Åland Sea. Pelagic feeders have good status in several subbasins. Many bird species characteristic of the Baltic Sea have decreased in abundance over the past few decades.
5. **Marine mammals** are represented by four species in the Baltic Sea. Grey seals and harbour seals are increasing in some areas, but the indicators for population growth rates, as well as reproductive and nutritional status, do not reach threshold values. Behavioural change in the ringed seal, possibly explained by a warming climate, has impaired the quality of monitoring data to evaluate its status in the Bothnian Bay. The status of the harbour porpoise is not good.
6. **Food web** assessments address the species interactions and energy flows that support ecosystem health. Changes in the status of a food web occur through impacts on its interacting species as these are mediated to other species and trophic guilds. Major changes in the abundance and biomass of species, driven by human pressures, have been associated with changes in the food webs of the Baltic Sea in recent times, and several examples of food web disruptions and putative tipping points are a cause for concern.

How can we protect and restore the Baltic Sea and its biodiversity?

Pollution

Reducing eutrophication is a key measure for improving both pelagic and benthic habitats in the Baltic Sea, and it will also have positive effects on mobile species that depend on these habitats. The increase of areas with poor oxygen conditions in the Baltic Sea is strongly linked to eutrophication. Eutrophication status has shown no signs of recovery since the previous assessment period. Inputs of nutrients have been reduced, but not all basins have achieved the Maximum Allowable Inputs (MAI) targets. Inputs of nitrogen are still too high in the Baltic Proper and the Gulf of Finland, and possibly the Gulf of Riga, while inputs of phosphorus are too high in all subbasins except the Bothnian Bay, Bothnian Sea, Danish Straits and the Kattegat.

Hazardous substances affect the status of several species and habitats. In the past, environmental contaminants decimated marine mammal and bird populations of the Baltic Sea. While many of the substances of the past are now banned, and their impacts relieved, hazardous substances are still the most widespread and impactful pressure in the Baltic, and emerging hazardous substances are a concern. The contamination status of the Baltic Sea has improved to some extent, but it was still assessed as either bad or poor in 80% of the assessed spatial units. The results partly reflect data availability, as units assessed with better status tended to be represented by fewer variables or lower assessment confidence. However, there are trends of improvement for several substances at the level of monitoring stations. Six open sea subbasins have improved their status category, although they are still not in good status. Only a small fraction of potentially hazardous substances is measured and assessed.

Marine litter can have direct effects on animals, as well as on human activities. Eleven out of sixteen assessed sub-basins exceeded the HELCOM threshold value for beach litter, with the highest amounts in the Sound, the Gulf of Riga, and the Eastern Gotland Basin. Most beach litter items are plastic, though the overall occurrence of plastic items has decreased. Litter on the seafloor is monitored through fish trawling surveys. Glass, metal, rubber, natural litter and single-use plastics have not increased in weight or number on the seafloor. Fisheries-related litter has increased in weight but not in number, and seafloor litter in the categories “plastics” and “other litter” have increased.

The introduction of non-indigenous species affects food webs by inducing changes in species interactions (for example, by competing with naturally occurring species). The arrival of non-indigenous or cryptogenic species to the Baltic Sea increased sharply in the second half of the last century and has not shown signs of decline since then. Thirteen non-indigenous or cryptogenic species were recorded for the first time in the Baltic Sea during 2016-2021, meaning the threshold value of zero new introductions was clearly exceeded. Most new non-indigenous species arrive in the Baltic Sea in connection with maritime transport and shipping.

Underwater noise can have harmful effects on species if the levels are too high. The status of underwater noise in the Baltic Sea was evaluated as good with respect to the risk that continuous underwater noise leads to behavioural disturbance of fish or marine mammals. With respect to the risk that human-induced sound masks natural sounds, the status is evaluated as good for marine mammals, but not good for fish in 9 out of 17 assessment units. Noise levels are clearly highest in shipping lanes. Loud impulsive noise can induce a range of effects depending on its intensity. Even if they don’t persist for a long time, activities such as explosions and piling may have effects at vast distances from the source unless mitigation measures are used.

Activities at sea

Fishing has had a significant impact on the Baltic Sea over the past few decades. Over the current assessment period, only four out of fifteen commercial stocks that could be fully evaluated showed good status on average. Eight out of seventeen evaluated stocks failed to achieve their threshold value for the fishing pressure indicator. For the stock size indicator, two pelagic stocks, four demersal stocks and eels failed to reach their threshold values. Fourteen stocks were evaluated with respect to a new indicator for age or size structure. Three of these showed negative trends, while the others showed a positive or no significant trend over time, though in several cases this reflects the indicator remaining at low levels. The deterioration of fish stocks affects not only the prospects of fishing but also of marine mammals and many fish and waterbird species that are dependent on prey fish.

Unintentional by-catch is of concern with regards to marine mammals and sea birds, which mainly drown in gillnets but also in trawls. Based on available data, the highest impact of by-catches likely occurs from the Kattegat to the Eastern Gotland basin. By-catch is a problem for species with poor conservation status, such as the harbour porpoise in the Baltic Sea.

Seafloor disturbance is a pressure that must be reduced for the status of benthic habitats in the Baltic Sea to improve. The effects of bottom trawling in the south-western Baltic Sea and the Kattegat are key concerns, and the risk of cumulative impact from physical pressures is also highest in these areas. In addition, habitat alterations in coastal areas (due to construction and dredging, for example) are a risk to fish and sea bird habitats. Erosion and habitat disturbance from boating and shipping can also have a high impact in some areas.

Seafloor loss is defined as a change of seabed substrate or morphology that has lasted for more than twelve years or is expected to do so. Seafloor loss is estimated to potentially affect less than one% of the total Baltic Sea area. The Sound experiences the highest potential loss, above four%, while loss is clearly below one% in the other the subbasins.

Protection and restoration status of the Baltic Sea

Marine protected areas are spatially defined areas that are selected for protection because they can be particularly useful to safeguard marine ecosystems, processes, functions, habitats and species, and they are managed to support this purpose. Today, the Baltic network of protected areas covers approximately 16.5% of the Baltic Sea, including just above 13% that are HELCOM marine protected areas. The area is expected to increase in the near future as a result of efforts to reach the spatial protection targets of the Baltic Sea Action Plan, the EU Biodiversity Strategy and the Global Biodiversity Targets of the UN Convention on Biological Diversity. For the protection to be effective, it should also be ensured that the MPAs form an ecologically coherent network.

Coastal and marine restoration is still in its infancy in the Baltic Sea, and there is a clear need to build a knowledge base and the capacity to ensure its successful implementation through knowledge-sharing and following up on existing and planned restoration initiatives.

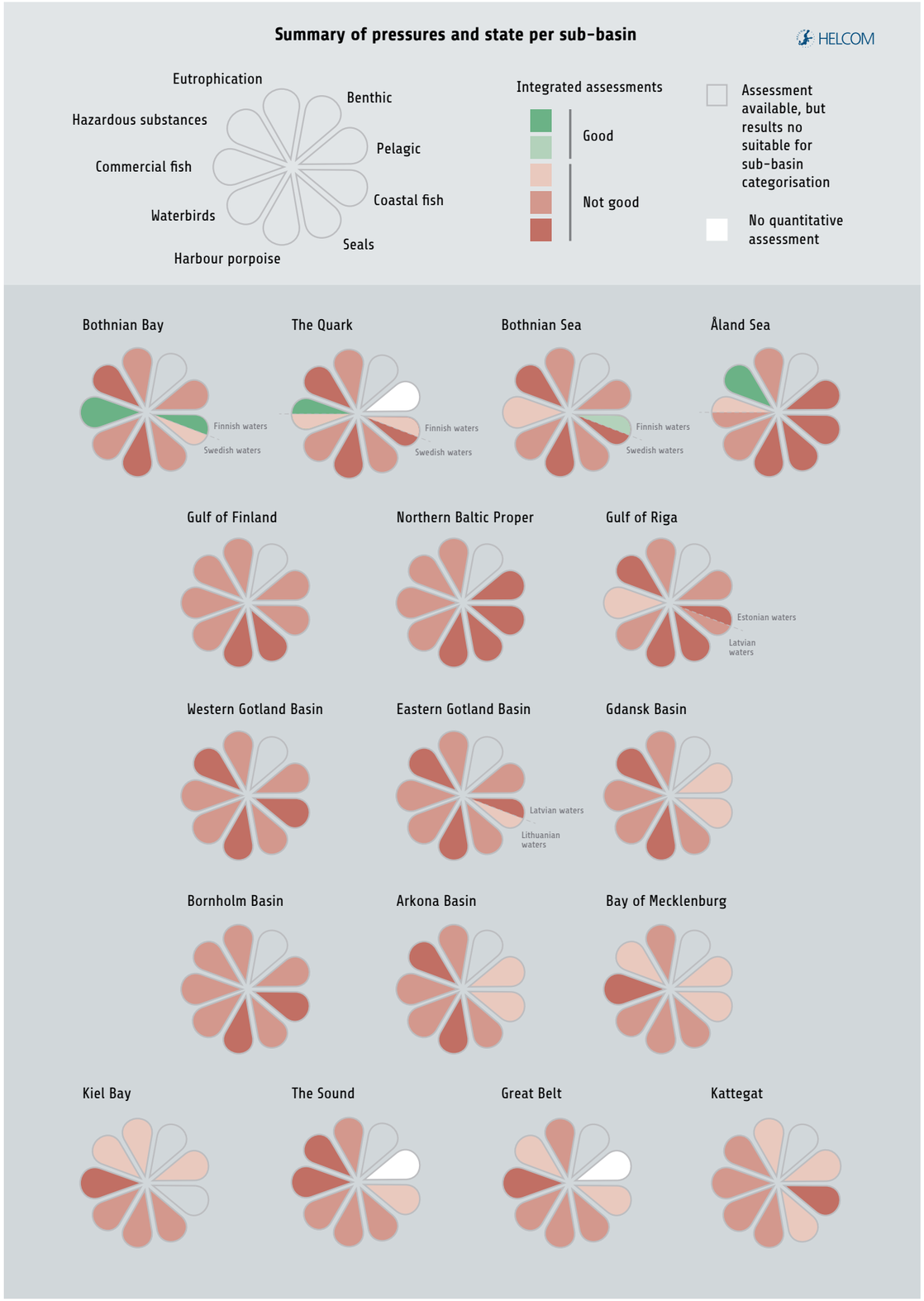

Figure ES2. Summary of the integrated assessment results of pressures and status across topics presented by the sub-basins of the Baltic Sea. For each sub-basin, each petal refers to a pressure or biodiversity ecosystem component according to its position in the flower shape, as shown in the figure legend. White petals are shown when no assessment is available, or when the assessment is currently incomplete. Integrated assessment results are shown in five categories. Further details on the assessment results are shown in the different chapters of this report, which also includes information on the status of marine litter, non-indigenous species, underwater sound, seabed loss and disturbance which are not included here as it is either not possible to aggregate the integrated assessment to sub-basin level, or no integrated assessment was available in HOLAS 3.

1. Introduction

1.1. Why is a holistic assessment of the Baltic Sea needed?

Achieving good ecosystem health is a core area of collaboration among countries bordering the Baltic Sea, which make up the Contracting Parties to HELCOM. Pressures from various human activities have an impact on Baltic Sea ecosystems, affecting the status of species and habitats, as well as human well-being. The close links between different parts of the Baltic Sea mean that actions often have to be coordinated across national borders for environmental measures to be effective. Environmental pressures vary spatially and their importance can change over time, depending on how human activities develop and on how efficiently we are able to manage and minimize negative impacts.

The third HELCOM holistic assessment (HOLAS 3) provides a wide-ranging update on the environmental status of the Baltic Sea for the time period 2016–2021. The holistic assessment helps us understand which pressures are currently of key importance and what areas will require additional measures, assuming current management measures are effective and are sufficient.

This holistic assessment captures a snapshot in time, reflecting the environmental condition and the role contemporary society plays in the dynamic life history of the Baltic Sea. In producing the assessment, researchers and experts around the Baltic Sea share insights into the various aspects that drive changes in its ecosystem. The task is not trivial. Different pressures often interact within the societal, economic and ecological complexity encompassing the Baltic Sea environment, and the effects on species and habitats may occur with a time lag or may be expressed differently between species or areas. It is crucial to produce an overview of the whole system that is as comprehensive and accurate as possible. Together, we want to understand which activities put pressures on the ecosystem and how they do so, how those pressures affect the state of the environment and biodiversity (in other words the species and habitats of the Baltic Sea), how the ecosystem and its functions are altered, and how such changes influence or can be influenced by societal factors. We want to use these insights to define new actions to renew, update and establish more effective measures to ensure a healthy Baltic Sea.

1.2. Policy use

In HELCOM, the holistic assessment provides a shared basis for following up on progress towards the objectives of the Baltic Sea Action Plan, facilitating the adaptive development of measures for the Baltic Sea environment in alignment with the ecosystem approach (Box 1.1).

The results and evaluations can be used to assess the current environmental status of the Baltic Sea and track the progress and effects of existing measures. This work supports several policies of key importance for the marine environment, helping HELCOM countries to come together and agree on the next steps to curb negative impacts and improve the status of the Baltic Sea.

1.2.1 Baltic Sea Action Plan

The Baltic Sea Action Plan (BSAP) is HELCOM's strategic programme of measures and actions for achieving a good environmental status of the sea (HELCOM 2021). The BSAP provides the concrete basis for work in HELCOM by stimulating goal-oriented cooperation among countries in the Baltic Sea region.

The BSAP is guided by the HELCOM vision of "a healthy Baltic Sea environment with diverse biological components functioning in balance, resulting in a good ecological status and supporting a wide range of sustainable economic and social activities". The 2021 BSAP is divided into four segments, each with specific goals and objectives, which have been jointly agreed amongst the Baltic Sea countries (Figure 1.1).

Each of the four segments contains concrete measures and actions to be implemented by 2030 at the latest.

The *Eutrophication* and *Hazardous substances and litter* segments mainly reflect actions needed to manage pressures stemming from land, while the *Sea-based activities* segment addresses actions needed at sea to curb negative impacts resulting from our marine activities. The segments of the BSAP are intrinsically linked, and accomplishing the goals of these segments has direct importance for securing the status of species and habitats in the Baltic Sea, which is the target of the *Biodiversity* segment. The actions under this segment focus primarily on protection and restoration.

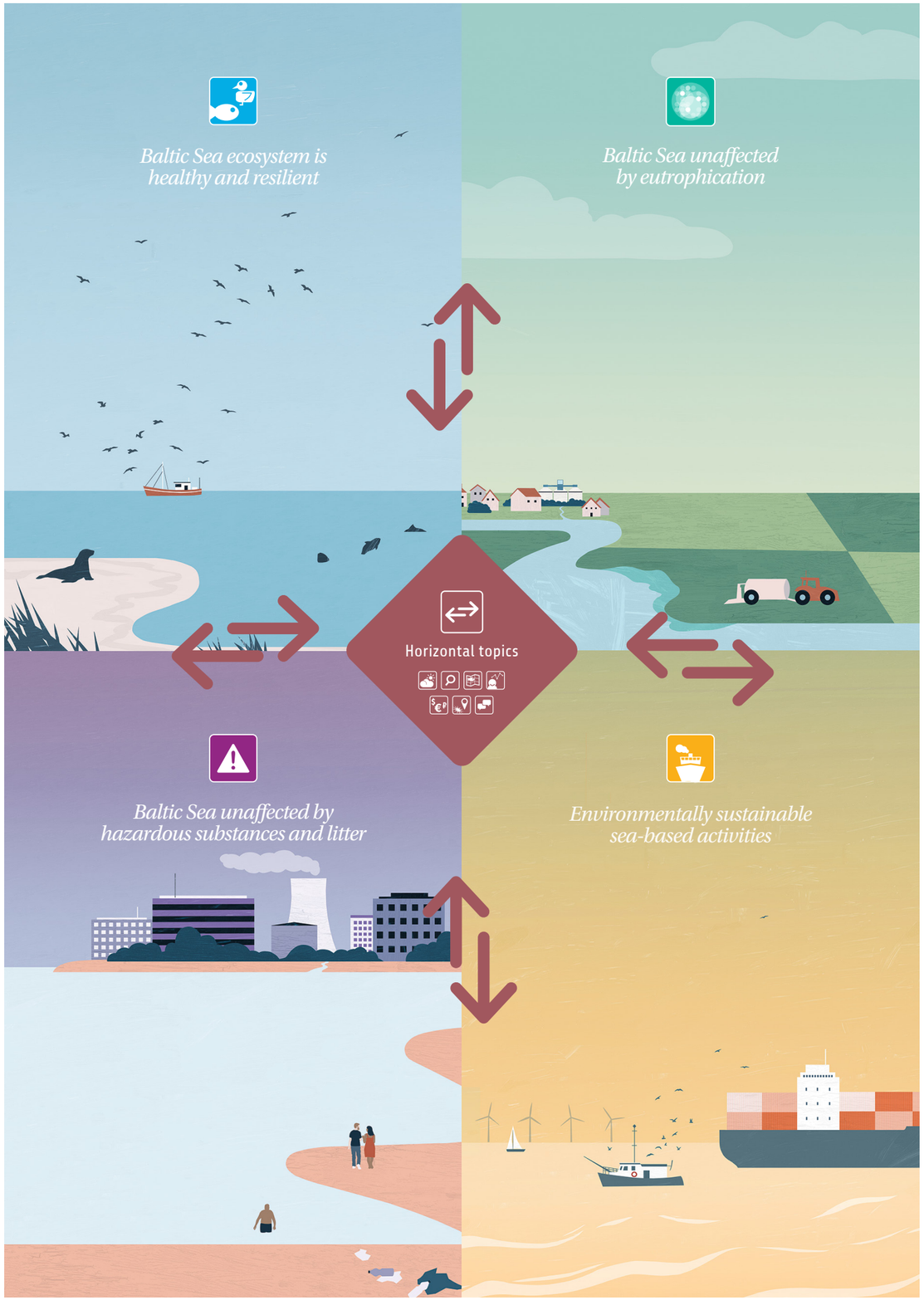

Figure 1.1. The four main segments of the Baltic Sea Action Plan (BSAP) focus on Biodiversity, Eutrophication, Hazardous substances and litter, and Sea-based activities. These segments support each other and share cross-cutting topics. The cross-cutting topic of the BSAP are climate change, monitoring, maritime spatial planning, economic and social analyses, knowledge exchange and awareness raising, hot spots, and financing.

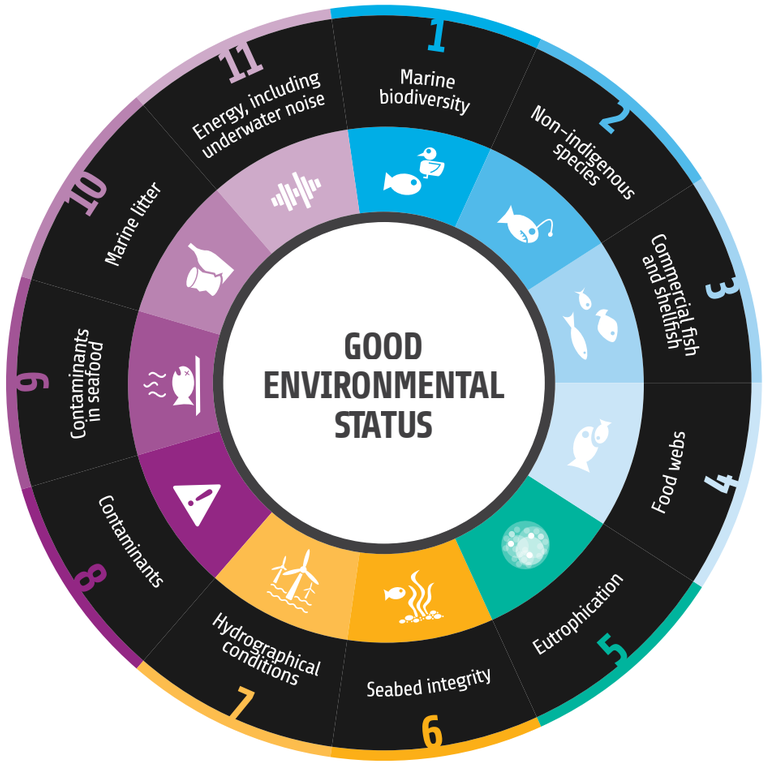

Figure 1.2. The EU Marine Strategy Framework Directive aims for good environmental status based on eleven descriptors covering different aspects of the marine environment

The BSAP also includes a number of horizontal topics. These address cross-cutting issues which have the potential to markedly influence the successful implementation of the BSAP. These include climate change, monitoring, maritime spatial planning, economic and social analyses, knowledge exchange and awareness raising, hot spots and financing.

1.2.2 Marine Strategy Framework Directive and other EU legislation

The Marine Strategy Framework Directive (MSFD) is the legal instrument for the protection of the seas in the European Union. The overarching goal of the MSFD is to achieve a good environmental status of the marine waters within the European Union, which is specified using eleven descriptors (Figure 1.2). EU Member States are required to report on the status of their marine environments (using indicators) in relation to these descriptors in six-year assessment cycles (EC 2017 a,b). While member states define the indicators and their threshold values, they are often required to do so through regional cooperation, and their data collection and assessment approaches need to be as coherent as possible in order to be meaningful, particularly within the same marine region.

The MSFD is an overarching framework that strives to establish an ecosystem-based, adaptive, and integrated approach to the management of all human activities that have an impact on the marine environment. The MSFD does not aim to replace other related EU policies but makes links to them to support harmonised assessment and monitoring. Examples of EU policies of direct relevance for the implementation of the EU MSFD are the Birds and Habitats Directive (EU 1992), the Water Framework Directive (EC 2000), and the EU Common Fisheries Policy (EU 2013).

1.2.3 The Global Sustainable Development Goals

The HELCOM Baltic Sea Action Plan and HELCOM activities are well aligned with the Sustainable Development Goals of the United Nations (Figure 1.3), which provide a global blueprint for peace and prosperity for people and our planet (UN 2015). The seventeen goals were adopted by all United Nations Member States in 2015. Rooted in an urgent call for action by both the Global South and the Global North, the Sustainable Development Goals recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality and spur economic growth while tackling climate change and working to preserve our forests and oceans.

SDG targets addressed

- **2.4** *By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.*
- **6.3** *By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally*
- **6.5** *By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate*
- **12.2** *By 2030, achieve the sustainable management and efficient use of natural resources*
- **12.4** *By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment*
- **12.5** *By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse*
- **13.2** *Integrate climate change measures into national policies, strategies and planning*
- **14.1** *By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution*
- **14.2** *By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans*
- **14.c** *Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want*
- **14.4** *By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics*
- **14.5** *By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information*
- **15.8** *By 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems, and control or eradicate the priority species*

Biodiversity · Eutrophication · Hazardous substances, marine litter, underwater noise, non-indigenous species · Economic and social analyses · Spatial pressures and impacts

Figure 1.3. Sustainable Development Goals and their links with HOLAS 3, based on information in the 2021 HELCOM Baltic Sea Action Plan (BSAP).

1.3. Data and methods underlying the assessment

1.3.1 The HELCOM monitoring programmes

The holistic assessments are based on extensive data collected in a comparable manner throughout the Baltic Sea region to create the most accurate and comprehensive overview of the state of the Baltic Sea.

Maintaining regionally agreed monitoring programmes is a well-established function of HELCOM. Countries around the Baltic Sea carry out the monitoring in line with commonly agreed procedures and collate the data in centralized, open databases (HELCOM 2013a). Monitoring of the physical, chemical and biological variables of the Baltic Sea open sea area started as early as 1979, and monitoring of the input of nutrients and hazardous substances began in 1998. The monitoring programmes are developed continuously. There are now 40 jointly agreed HELCOM monitoring programmes being implemented by the countries around the Baltic Sea. These programmes cover the sources and inputs of human pressures and various variables that reflect the state of the environment. The monitoring data are used in various assessments to evaluate the state of the marine environment and to reveal long-term trends.

Despite recent developments to improve the assessment, several data gaps are still evident and need to be filled in future work. In some cases, data gaps exists because monitoring to support the assessed indicators (see Section 1.3.2) does not cover the full extent of the Baltic Sea region or there is insufficient sampling density. For some elements, regionally coordinated monitoring is still under development or is missing. More details for specific indicators and elements are given in the reports summarized in this report (HELCOM 2023a-e) and the indicator reports.

BOX 1.1.

HELCOM policy and work are guided by the ecosystem approach

Marine governance following the ecosystem approach places ecosystem dynamics at the heart of the management of human activities and grounds policymaking in a scientific understanding of the environment. It focuses on the structure and functioning of the ecosystem as a whole, highlights our dependency on the health of the ecosystem, and acknowledges that different parts of the ecosystem are linked to each other. Ecosystem-based management necessitates the development of comprehensive integrated policies reaching across sectors and management levels. With an integrated perspective to the management of human activities, ecosystem-based management aims to ensure successful and sustainable societal and ecological outcomes. HELCOM contributes to the operationalization of ecosystem-based management throughout the implementation of the HELCOM Baltic Sea Action Plan.

1.3.2 The HELCOM indicators

The HELCOM indicators are the basis for evaluating progress towards our identified objectives for the marine environment.

The indicators are developed by HELCOM expert groups following a set of key principles that address factors such as ecological relevance, policy relevance, measurability, and connection to human pressures. HELCOM core indicators must be quantitative and their underlying monitoring data and evaluation approaches must be harmonised across the Baltic Sea. The observed status of each core indicator in defined spatial units (see section 1.3.4) is evaluated against a regionally (or sub-regionally) agreed threshold value. Indicators are evaluated as either achieving or failing to achieve their threshold value. The evaluations thus help us understand the current situation in relation to our objectives, what direction we are moving in, and whether we need to take action (HELCOM 2020).

To avoid gaps in the holistic assessment and ensure that available knowledge of key importance is shared, the indicator evaluation results are supplemented with qualitative information for aspects that cannot be addressed quantitatively.

A central part of HELCOM's work is to develop and improve the set of indicators over time to enable better and more comprehensive assessments of the state of the environment and the pressures that affect it. There are currently almost 60 HELCOM indicators in use and reported in this assessment (Table 1.1).

Table 1.1. List of HELCOM indicators used in HOLAS 3.

Indicator name	**Indicator category** (Core, Pre-core, Supplementary, Element and Driver)
Distribution of Baltic grey seals	Core
Distribution of Baltic ringed seals	Core
Distribution of Baltic harbour seals	Core
Population trends and abundance of grey seals	Core
Population trends and abundance of ringed seals	Core
Population trends and abundance of harbour seals	Core
Nutritional status of seals	Core
Reproductive status of seals	Core
Harbour porpoise distribution	Pre-core
Harbour porpoise abundance	Pre-core
Abundance of waterbirds in the breeding season	Core
Abundance of waterbirds in the wintering season	Core
Breeding success of waterbirds	Pre-core
Number of drowned mammals and waterbirds in fishing gear	Core
Abundance of coastal fish key functional groups	Core
Abundance of key coastal fish species	Core
Size structure of coastal fish	Core
Abundance of salmon spawners and smolt	Core
Abundance of sea trout spawners and parr	Core
Zooplankton mean size and total stock	Core
Seasonal succession of dominating phytoplankton groups	Pre-core
Diatom/Dinoflagellate index	Pre-core
State of the soft-bottom macrofauna community	Core
Cumulative impact from physical pressures on benthic biotope (CumI)	Core
Baltic Sea acidification	Element
Inputs of nitrogen and phosphorous to the sub-basins	Core
Total nitrogen concentrations	Core
Total phosphorus concentrations	Core
Dissolved inorganic nitrogen (DIN)	Core
Dissolved inorganic phosphorus (DIP)	Core
Chlorophyll a	Core
Cyanobacterial bloom index	Pre-core
Water transparency	Core
Oxygen debt	Core
Shallow-water bottom oxygen	Core
Cadmium	Core
Copper	Core
Lead	Core
Mercury	Core
Hexabromocyclododecane (HBCDD)	Core
Polybrominated biphenyl ethers (PBDE)	State
Perfluorooctane sulphonate (PFOS)	Core
Polychlorinated biphenyls (PCB) and dioxins and furans	Core
Polyaromatic hydrocarbons (PAH) and their metabolites	Core

Table 1.1. (Continued). List of HELCOM indicators used in HOLAS 3.

Indicator name	**Indicator category** (Core, Pre-core, Supplementary, Element and Driver)
TBT and imposex	Core
Diclofenac	Pre-core
Radioactive substances: Cesium-137 in fish and surface waters	Core
White-tailed sea eagle productivity	Core
Reproductive disorders: Malformed amphipod embryos	Supplementary
Oil-spills affecting the marine environment	Core
Beach litter	Core
Litter on the seafloor	Pre-core
Continuous low frequency anthropogenic sound	Pre-core
Distribution in time and space of loud low- and mid-frequency impulsive sounds	Pre-core
Trends in arrival of new non-indigenous species	Core
Driver Indicator name	**Indicator category**
Fishery Operations	Driver
Total Allowable Catch	Driver
Agricultural Nutrient Balance	Driver
Wastewater Treatment	Driver

1.3.3 Integrated and thematic assessments

The integrated assessments combine indicator evaluation results and data to produce more holistic overviews of specific topics.

Different integrated assessment tools have been developed to address several of the themes covered by the holistic assessments. The BEAT tool addresses the biodiversity theme, HEAT addresses eutrophication, and CHASE is designed for the integrated assessment of hazardous substances. These tools all use HELCOM indicators as their basis. The tool outputs show whether the integrated status is good or not in five assessment result categories. The results thus also provide an understanding of how far we are from reaching good status. Two assessment categories represent different levels of good status and three represent different levels of not good status. The tools also produce assessments of confidence in the results, reflecting the spatial and temporal data quality as well as the confidence in the methodology and evaluation.

The SPIA tool, which can be used to show the spatial distribution of pressures and impacts, does not use indicators as a basis for its assessment. Instead, it spatially plots and integrates data on ecosystem components, such as species or habitats, as well as human activities, together with the pressure they can exert and their potential impact on the environment.

The integrated assessment tools are presented in more detail in the thematic assessments on biodiversity (HELCOM 2023a), eutrophication (HELCOM 2023b) and hazardous substances (HELCOM 2023c). Thematic assessments directly supporting this holistic assessment also cover economic and social analyses (HELCOM 2023d) and spatial analyses of pressures and impacts (HELCOM 2023e, see also Table 1.2).

1.3.4 HELCOM spatial assessment scales

The HELCOM spatial assessment units divide the Baltic Sea into ecologically relevant divisions with the aim of reporting indicator evaluations and integrated assessment results at their most ecologically relevant scale under a shared and coherent approach (Figure 1.4). The system is nested, which means that spatial assessment units with higher spatial resolution can fit into units with lower spatial resolution (with a few minor exceptions). The applied levels of scale are:

- Level 1. HELCOM Marine area: The whole Baltic Sea, encompassing the entire HELCOM area,
- Level 2. HELCOM Subbasins: Division of the Baltic Sea into 17 subbasins,
- Level 3. HELCOM Subbasins with coastal and offshore divisions (national coastal areas)
- Level 4a. HELCOM Subbasins with coastal water types or water bodies aligned with the Water Framework Directive (WFD)
- Level 4b. HELCOM Subbasins with coastal WFD water types or water bodies with specific subdivisions for eutrophication assessment

In addition, assessments may be evaluated in aggregations of these assessment units where ecologically relevant (e.g., depending on population or species distribution extent).

1.3.5 Assessment period of HOLAS 3

The HELCOM holistic assessments provide recurrent updates on the state of the Baltic Sea over a given time period. Each HEL-

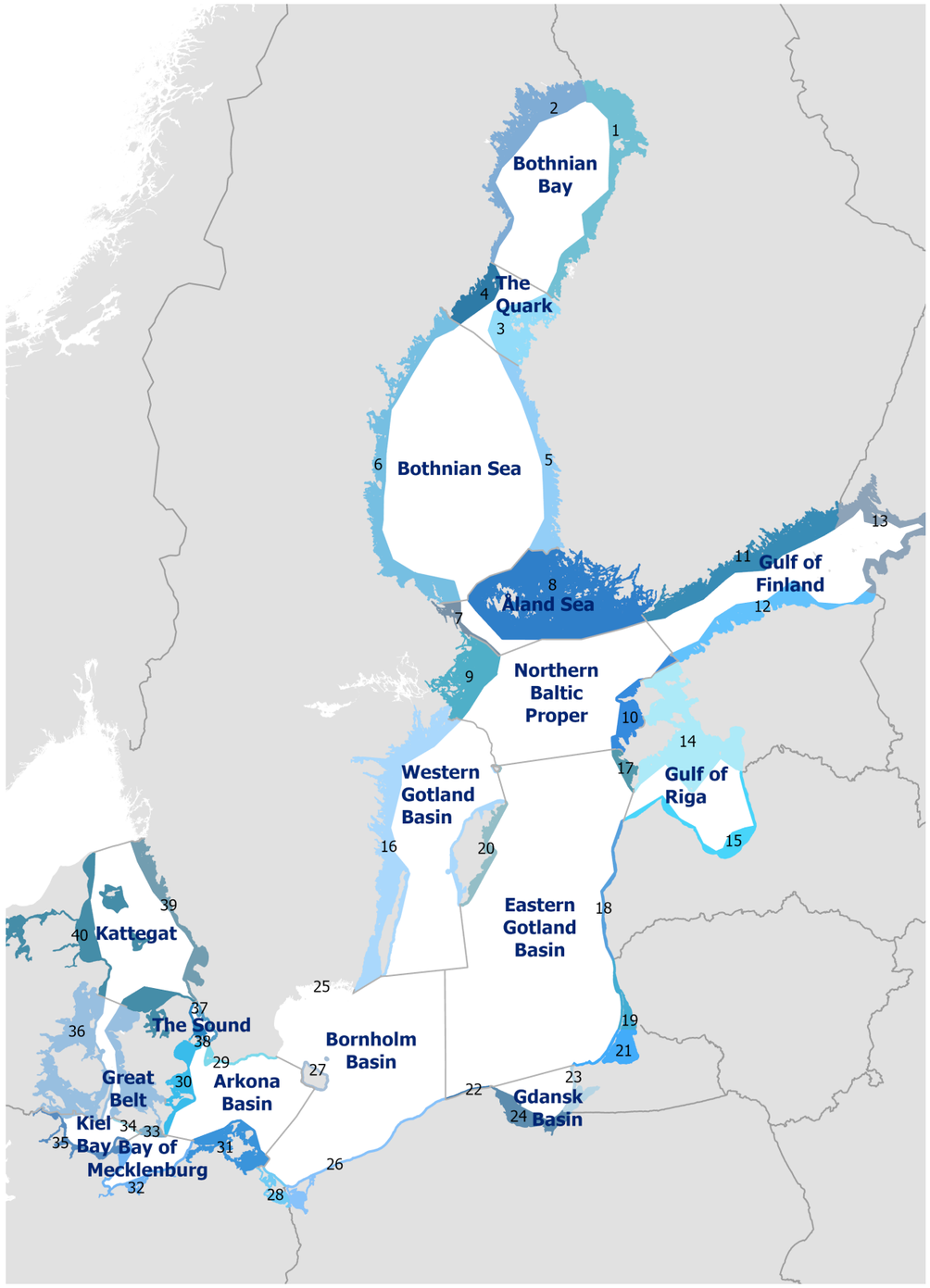

Figure 1.4. The spatial assessment units are a key tool for carrying out regional assessments coherently across the wide variety of topics and features of HOLAS while ensuring that each is assessed at an ecologically relevant scale.

Table 1.2. HOLAS 3 assessment products underpinning this summary report. In addition to these, introductory videos to explain concepts related to the assessments (developed primarily under the BLUES project) and other products to facilitate access to the HOLAS 3 results are available (see the State of the Baltic Sea website).

HOLAS 3 products
Thematic Assessments Reports: — Thematic assessment of biodiversity 2016-2021 — Thematic assessment of eutrophication 2016-2021 — Thematic assessment of hazardous substances, marine litter, underwater noise and non-indigenous species 2016-2021 — Thematic assessment of economic and social analyses 2016-2021 — Thematic assessment on spatial distribution of pressures and impacts 2016-2021
Updated data and data layers (HELCOM Map and Data Services)
59 indicator reports (see also Table 1.1)
HELCOM Metadata catalogue

COM holistic assessment covers a timespan of six years, referred to as the assessment period. The third HELCOM holistic assessment (HOLAS 3) focuses on the years 2016–2021. The HOLAS 3 assessment period partially overlaps with that of HOLAS II, which covered the period 2011-2016 (HELCOM 2018). The first HOLAS (HELCOM 2010) covered the years 2003-2007. These holistic assessments also aim to explore changes in status compared to prior assessment periods. Furthermore, the assessments reflect improvements in our understanding of how the components of the Baltic Sea ecological and societal systems are connected, incorporating enhancements in knowledge into each assessment.

1.4. How to read the summary report

The HELCOM holistic assessment is a multi-layered product representing varying levels of detail for each of the topics covered, and several assessment products underpin this summary report. Detailed data and results generated by national monitoring and regional data collection form the basis of the assessment, contributing to indicator evaluations. These, in turn, contribute to integrated results at overarching levels in the thematic assessments (HELCOM 2023a-e). This approach allows anyone to explore and utilise the results at whatever scale is most relevant while maintaining ecological relevance at the core.

The HELCOM indicator reports and thematic assessments directly underpin the results presented in this summary and offer more detailed and technical information (Table 1.2).

The aim of this summary report is to connect information from the underpinning assessment products to provide a more holistic view of the overall status of the Baltic Sea. The holistic approach strives to acknowledge the variety of roles that different species have in the ecosystems, as well as how they link together. The health and existence of each species in the Baltic Sea depends on interactions with several other species, habitats and environmental conditions, and each species fulfils certain ecological functions, many of which are vital for the ecosystem to function as a whole. An important implication is that the degradation of one element of the ecosystem, or the deterioration of one species, could damage other parts of the ecosystem. As will be evident from further reading, pressures and human-induced impacts can lead to modifications in the entire food web, leading to further reduced stability and resilience.

The summary report strives for a combined view and analysis of where we are today with the protection of the Baltic Sea environment and why the status is as it is. Our activities at sea and on land cause pressures on the marine environment, and these pressures have negative impacts on the species and habitats that we all depend for our survival and well-being. To keep the negative impact of our activities within the bounds that the ecosystem can tolerate, we must understand the effects of our actions and use that information to manage the activities that have a negative impact. This is accomplished by establishing well-founded and ecologically relevant targets and objectives to work towards and taking concrete measures to ensure we reach them. Figure 1.5 shows the management framework HELCOM works in and within which the holistic assessment is made. Observations of deteriorated species and habitats indicate the need for measures to stop the negative trends and restore ecosystems in order to realize sustainable outcomes for the natural environment and ourselves, now and in the future. The summary report aims to support further discussion and analysis of the actions we need to take to ensure a more sustainable future.

State of the Baltic Sea
Third HELCOM holistic assessment 2016–2021

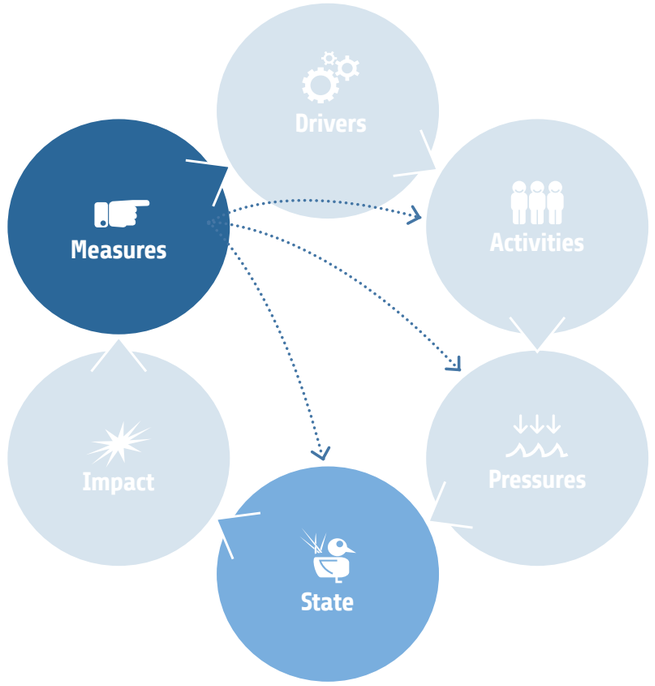

Figure 1.5. The conceptual management framework HELCOM works in and within which the holistic assessment is made. As a basis for further development of the holistic assessment, HELCOM has used a version of the Driver–Activities–Pressures–State–Impacts–Response (DAPSIR) framework, modified to fit the work under HELCOM and address the needs of the holistic assessment. This approach has been taken to strengthen the holistic aspect of the assessment, providing a clearer picture both of what we know across interlinked elements of the framework and of areas where further development or information is needed. In the modified management framework, Response has been replaced with Measures, reflecting the terminology used in the Baltic Sea Action Plan, and the definition of Impact has been expanded to include both perspectives presented in the assessment: impact on the environment and on society. The majority of the assessment work focuses on the environmental perspective (HELCOM 2023a, HELCOM 2023b, HELCOM 2023c, HELCOM 2023e), with the assessments presented under the Thematic Assessment on Economic and Social Analyses (HELCOM 2023d) representing the societal perspective.