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.

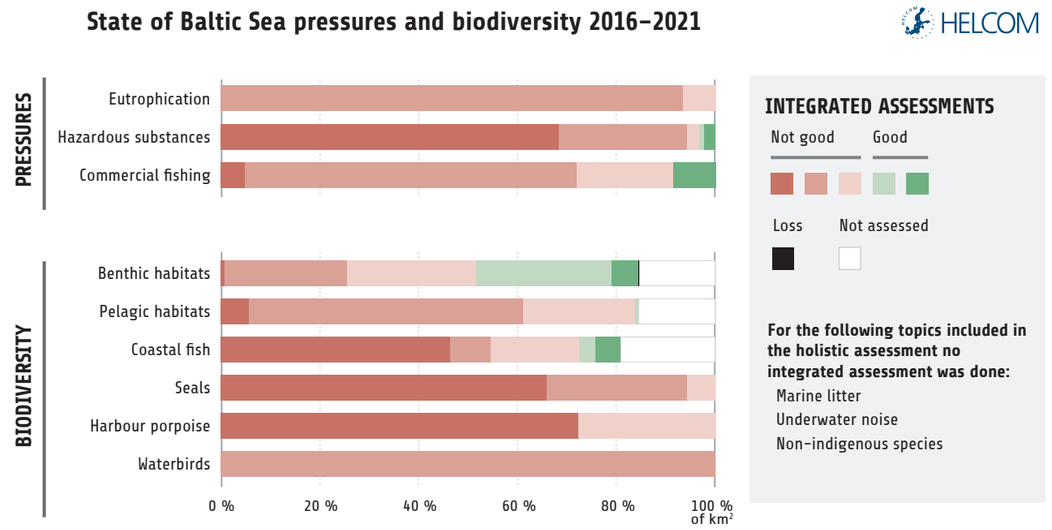

Figure ES1. Summary of the integrated assessment results of pressures and status for the Baltic Sea showing the proportion of the Baltic Sea in the different assessment status categories (based on square kilometres). Integrated assessment results are shown in five categories with three representing degrees 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.

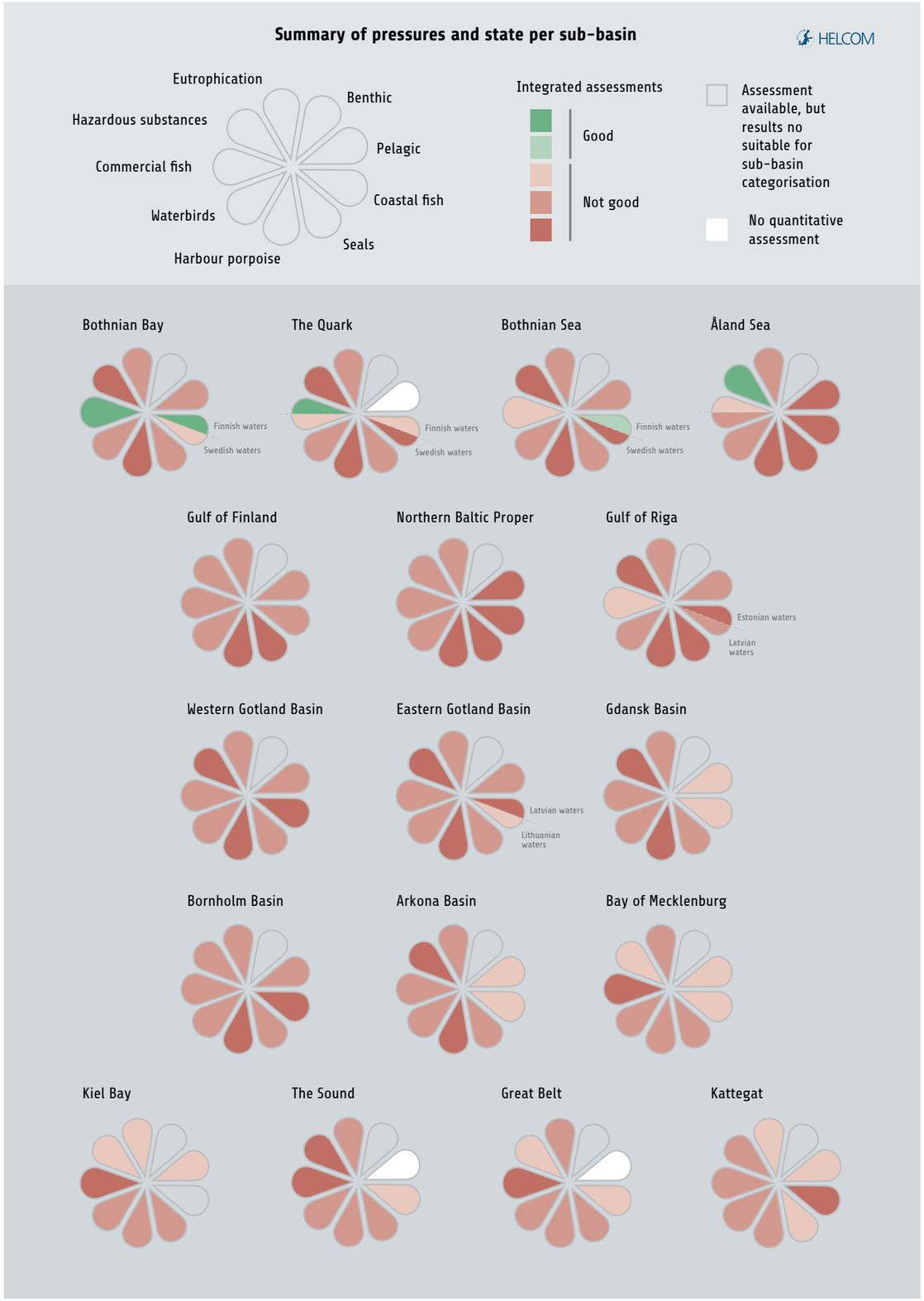

Figure ES2. Summary of the integrated assessment results of pressures and status across topics presented by the sub-basins of the Baltic Sea. For each sub-basin, each petal refers to a pressure or biodiversity ecosystem component according to its position in the flower shape, as shown in the figure legend. 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.