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-

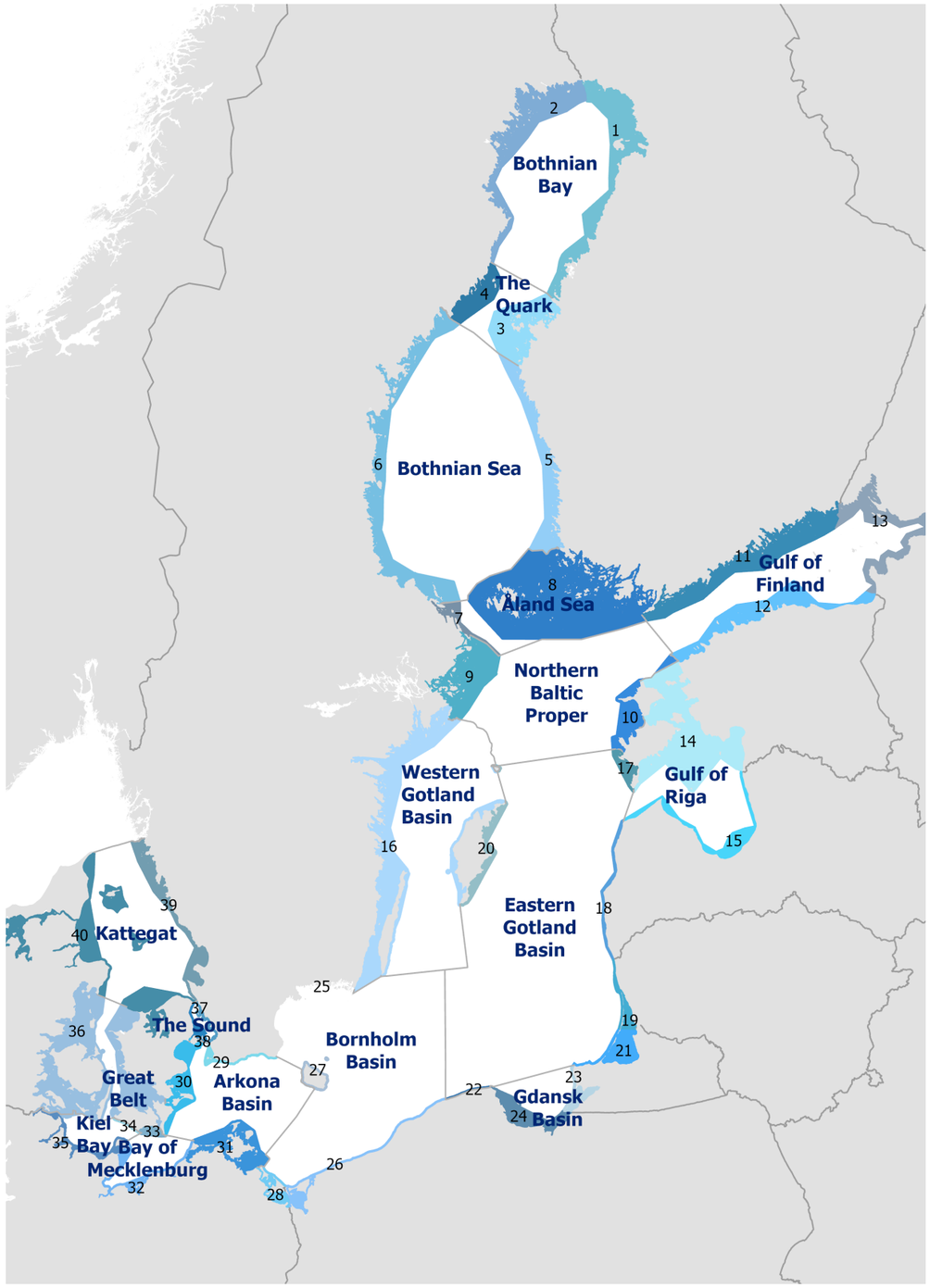

Figure 1.4. The spatial assessment units are a key tool for carrying out regional assessments coherently across the wide variety of topics and features of HOLAS while ensuring that each is assessed at an ecologically relevant scale.

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

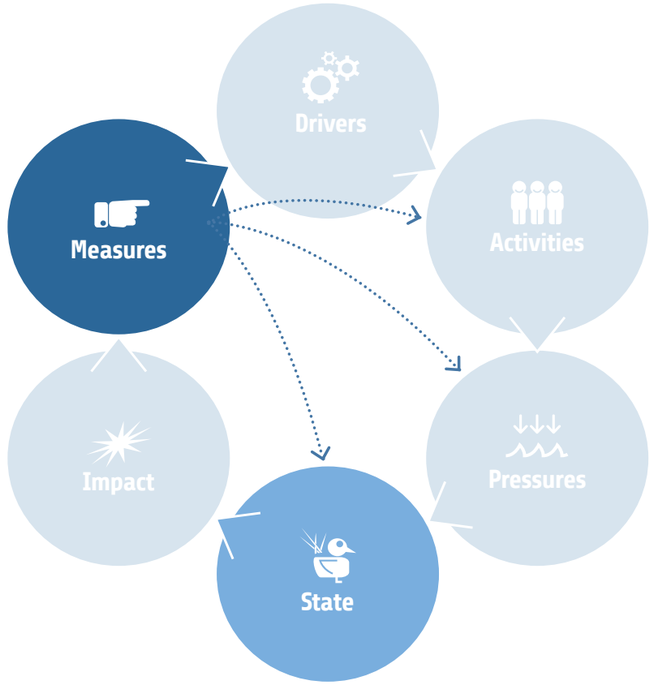

Figure 1.5. The conceptual management framework HELCOM works in and within which the holistic assessment is made. As a basis for further development of the holistic assessment, HELCOM has used a version of the Driver–Activities–Pressures–State–Impacts–Response (DAPSIR) framework, modified to fit the 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.