HELCOM core indicator report
July 2018

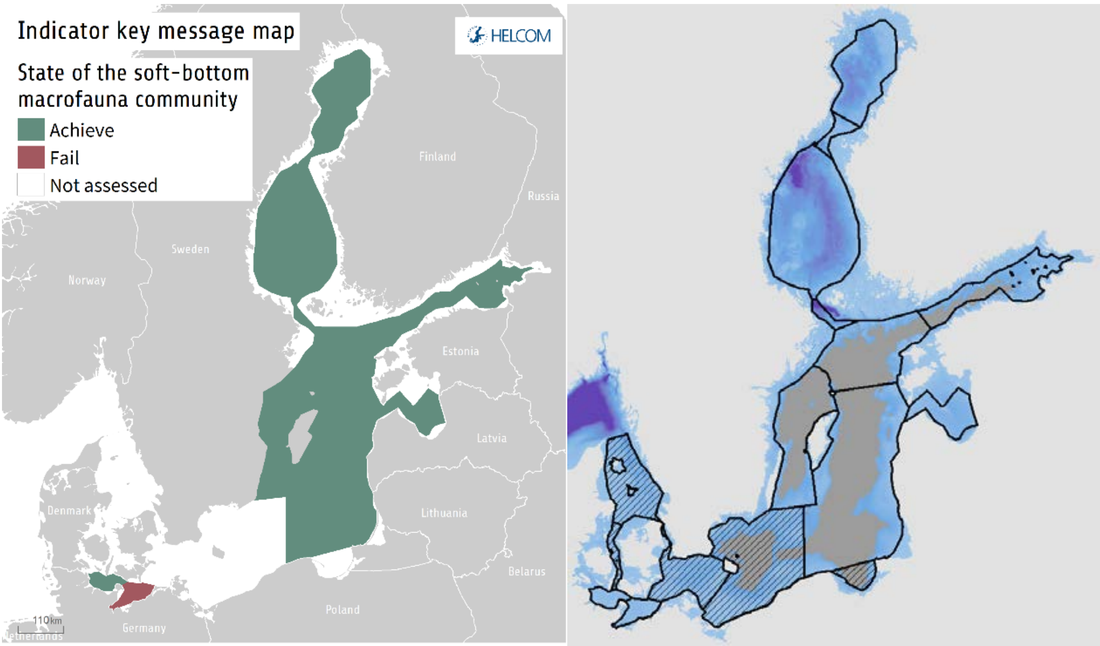
State of the soft-bottom macrofauna community

Key Message

The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

The indicator evaluates the status of the soft-bottom macrofauna community occurring in the open sea areas of the Baltic Sea. In Northern Baltic Proper, Gulf of Finland, Eastern Gotland Basin and Western Gotland Basin only areas above the permanent halocline are assessed. The current assessment result shows good status in most of the evaluated assessment units.

The indicator is not used in coastal areas which are assessed by national methods or in areas below the halocline which should be assessed using the Oxygen debt indicator. The indicator takes into account the relative proportion of sensitive and tolerant species, as well as species richness and abundance.



Key message figure 1. Status assessment results based evaluation on the indicator 'State of the soft-bottom macrofauna community'. The assessment is carried out using Scale 4 HELCOM assessment units (defined in the [HELCOM Monitoring and Assessment Strategy Annex 4]). The indicator evaluates the open sea areas of the Baltic Sea. The right panel shows the open sea areas and the areas below the permanent halocline (grey) that are not assessed with this indicator. Striped assessment units are not assessed due to lack of agreed threshold values. **Click here to access interactive maps at the HELCOM Map and Data Service:** [State of the soft-bottom macrofauna community]**.**

The current evaluation spans the years 2011-2016, and is based on monitoring data reported by HELCOM Contracting Parties. The status of the indicator is good in all assessed subbasins, except the Bay of Mecklenburg.

The confidence in the indicator result is considered to be **high**. The spatial data coverage is low in the Northern Baltic Proper, the Gulf of Finland and the Eastern and Western Gotland Basins. Temporal coverage of data is intermediate in all assessment units.

The indicator is applicable in the open sea areas from all countries bordering the Baltic Sea. Currently it is operational only in the evaluated areas due to the lack of agreed threshold values in some assessment units.

Relevance of the core indicator

Soft-sediment macrofauna species in the Baltic Sea include animals such as clams, mussels, worms and crustaceans. The animals live on the seafloor as well as burrowed into the sediments, thus forming an important link between sediments and the water column. Soft-sediment macrofauna species act as predators and decomposers and also form an important link in the marine food web by coupling the pelagic and benthic environments as well as constituting an important food source for other animals, such as fish and water birds.

This indicator evaluates the status of the environment using an index developed to show changes in the relative abundance of sensitive and tolerant species, as well as the diversity of the community in soft sediments.

Policy relevance of the core indicator

	BSAP Segment and Objectives	MSFD Descriptors and Criteria
Primary link	Biodiversity • Thriving and balanced communities of plants and animals	D6 Sea-floor integrity D6C5 The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), does not exceed a specified proportion of the natural extent of the habitat type in the assessment area. D5 Eutrophication D5C8 The species composition and relative abundance of macrofaunal communities, achieve values that indicate that there is no adverse effect due to nutrient and organic enrichment.
Secondary link		D4 Food-web D4C1 The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures.

Cite this indicator

HELCOM (2018). State of the soft-bottom macrofauna community. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

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State of the soft-bottom macrofauna community HELCOM core indicator report 2018 (pdf).

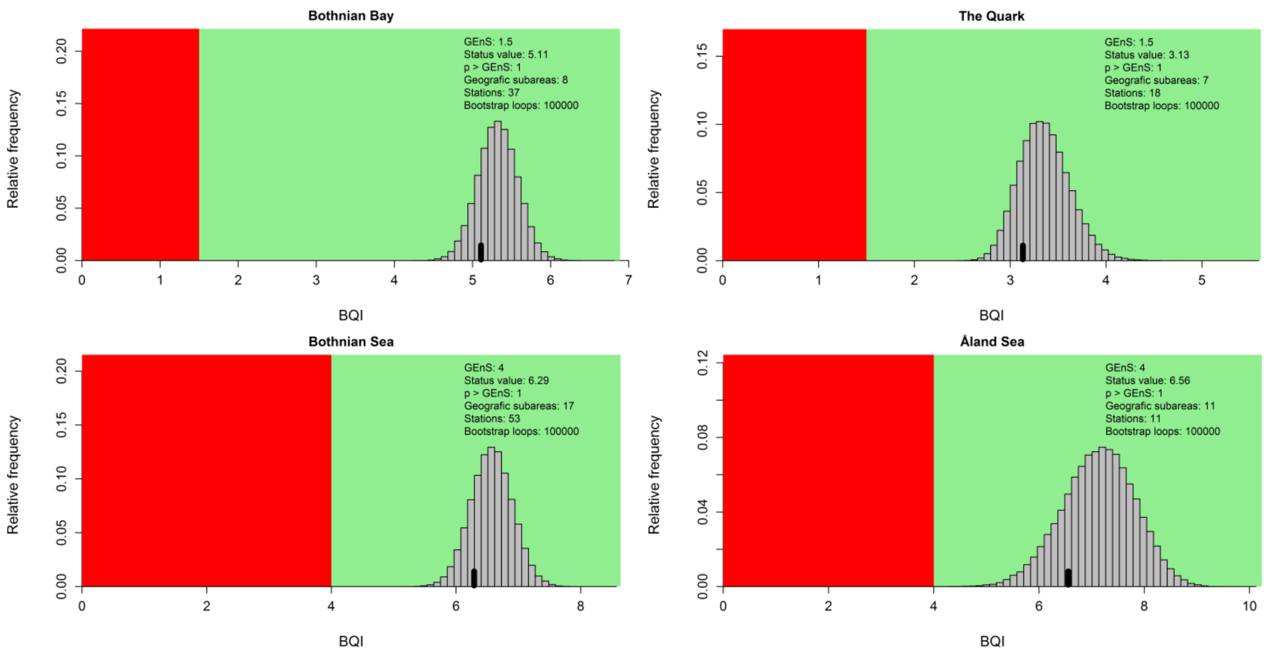
Results and Confidence

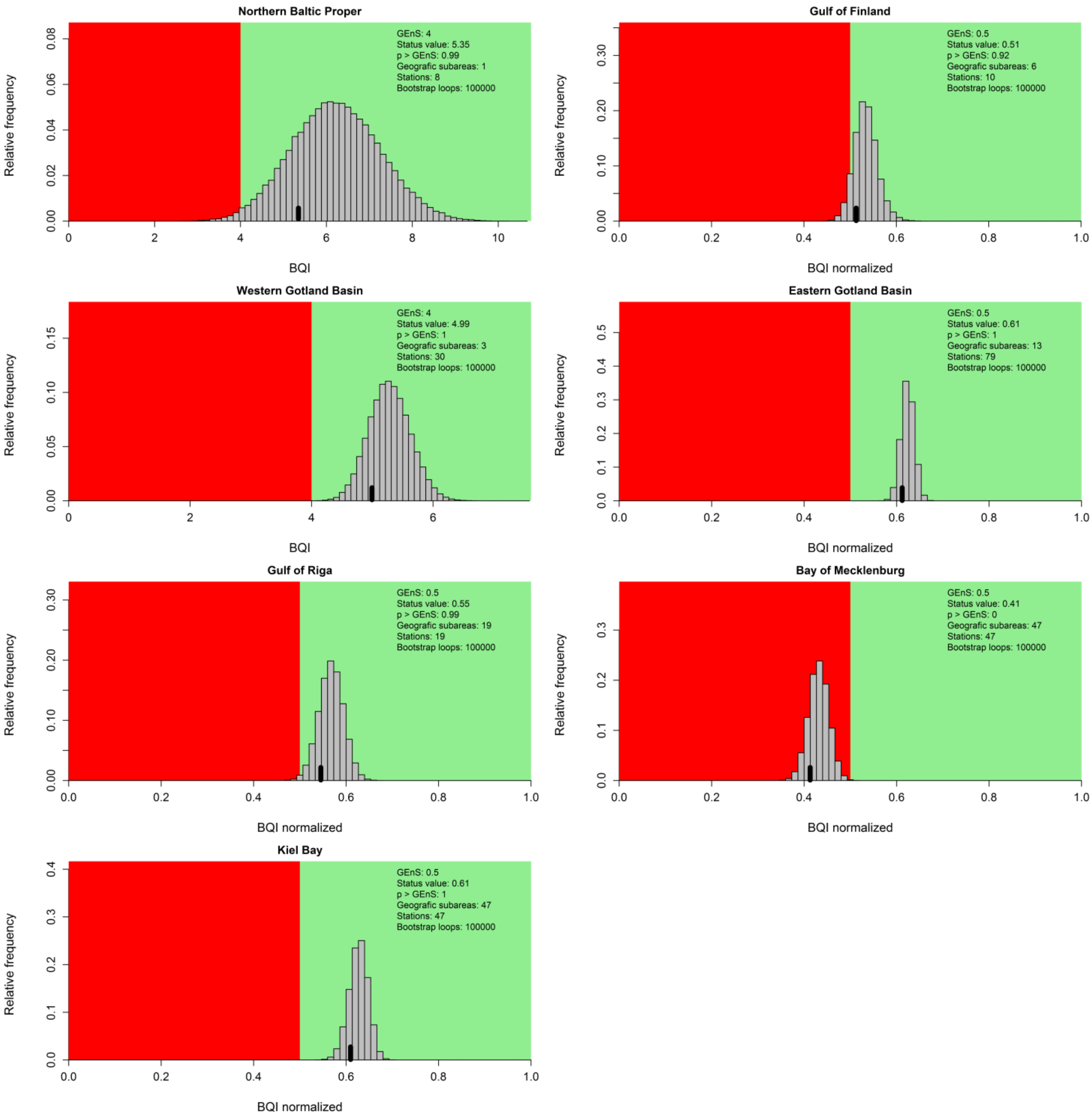
The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

During the 2011-2016 period, the results indicated good status in all the evaluated open sea assessment units apart from the Bay of Mecklenburg (Results figure 1).

It should be noted that the indicator only represents the areas above the permanent halocline (< 60m depth, Key message figure 1). This approach is instituted since significant areas within the Northern Baltic Proper, Gulf of Finland, Eastern Gotland Basin and Western Gotland Basin suffer from hypoxia. No reliable threshold value capable of differentiating between the status of areas only affected by natural hypoxia or those hypoxic areas driven by anthropogenic eutrophication was definable. Thus it is recommended that the oxygen debt indicator is used to evaluate the status below the halocline in these subbasins.

Furthermore, it should be noted that the indicator and its associated threshold values are still being tested in some countries and there may be need for further development as a result of the outcome of the testing. The overall results should thus only be considered as intermediate. In particular it should be noted that the threshold value is considered intermediate in the Gulf of Finland, Gulf of Riga, and Eastern Gotland Basin.





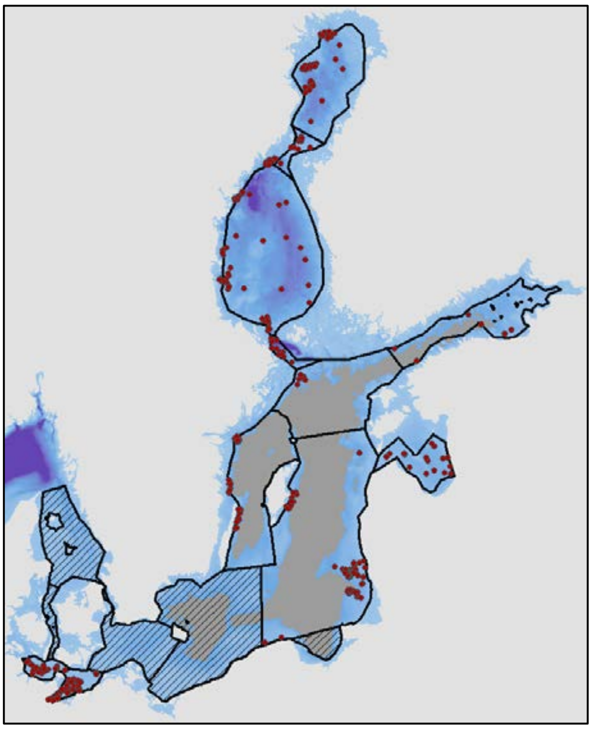
Results figure 1. Evaluation results for the subbasin open sea assessment units. The histograms reflect the distribution of the 100 000 bootstrapped mean BQI values and the black bar show the evaluation value (20th percentile) which is compared to the threshold value (see Assessment Protocol for details). The red and green areas correspond to failing and achieving the assessment unit specific threshold value respectively.

Confidence of the indicator status evaluation

The overall confidence of the indicator result is generally **high**, however regional differences occur as there is variation in how well the spatial and temporal data covers individual assessment units.

In all assessment units, the certainty of the status classification was high (Result table 1). In the areas of good status the probability of being above the threshold was high (p>0.97) and in the Bay of Mecklenburg which was determined to be below the threshold value, the probability for being above the threshold was 0.

The spatial data coverage was considered to be high in the Bothnian Bay, the Quark, the Bothnian Sea, the Åland Sea, the Gulf of Riga, the Bay of Mecklenburg and the Kiel Bay. In the Gulf of Finland, the Northern Baltic Proper and the Western and Eastern Gotland Basins, the sampling stations are less abundant and relatively poorly spatially distributed (see Results figure 2). The temporal coverage of the data is considered to be intermediate since even if data has been collected in all years during the assessment period and in all assessment units, with the exception of the Åland Sea where data from 2011 is missing, individual stations within an assessment unit may not have been sampled in all years. Sampling effort also varies, ranging between 1 and 10 samples per station and year. However, this sampling imbalance is handled via the bootstrap method used to calculate the actual indicator value used for status evaluation (see Assessment protocol).



Result figure 2. Soft-bottom macrofauna stations used in assessment. The grey area represent below halocline depths and are only assessed with the indicator 'Oxygen debt'. Hatched areas represent areas where no thresholds have been agreed and hence no assessments were done.

Result Table 1. Confidence assessment of the indicator evaluation in individual assessment units. See text for further explanations.

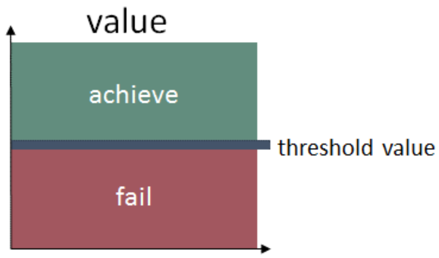
Assessment unit	Certainty of classification	Spatial coverage	Temporal coverage
Bothnian Bay	High	High	Intermediate
The Quark	High	High	Intermediate
Bothnian Sea	High	High	Intermediate
Åland Sea	High	High	Intermediate
Northern Baltic Proper	High	Low	Intermediate
Gulf of Finland	High	Low	Intermediate
Western Gotland Basin	High	Intermediate	Intermediate
Eastern Gotland Basin	High	Low	Intermediate
Gulf of Riga	High	High	Intermediate
Bay of Mecklenburg	High	High	Intermediate
Kiel Bay	High	High	Intermediate

The confidence of the indicator results was assessed using spatial and temporal data coverage and an estimate of the probability that the status is above the threshold derived from the distribution of the 100 000 bootstrapped BQI-values (see Assessment protocol). Methodological confidence was considered to be high as differences in sampling gear (e.g. sieve mesh sizes) are already corrected for in the subsets (see Assessment Protocol).

Thresholds and Status evaluation

The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

Thresholds values have been set using two different approaches, dependent on which method for species sensitivity values was used. The threshold value concept is a defined value that should be achieved in order to indicate good status (Thresholds figure 1).



Thresholds figure 1. Schematic figure of the threshold value concept applied in the core indicator.

In Bothnian Bay, The Quark, Bothnian Sea, Åland Sea, Northern Baltic Proper and Western Gotland Basin, where the method follows Leonardsson *et al*. (2009), the Swedish intercalibrated BQI good-moderate threshold values, developed for outer coastal waters under the EU Water Framework Directive, are considered to also be applicable for the open sea assessment units. The establishment of these threshold values is based on both statistical tests and expert judgment, using data from areas without local disturbance to define high and good status as baselines, as described in Leonardsson *et al*. (2009).

In Gulf of Finland, Gulf of Riga, Eastern Gotland Basin, Bay of Mecklenburg and Kiel Bay the threshold is defined based on methods described in Schiele *et al*. (2016). In this method the described fauna sub-sets that occur in the assessment unit are first identified. Threshold values are then calculated for each subset according to a pragmatic statistical scheme developed by Perus *et al*. (2007) and later modified during an intercalibration process, as described by Carletti & Heiskanen (2009). In short, this method sets threshold values as 0.6 times the 10^{th} percentile of the top 10 % of all index values within a subset.

Threshold values for all open sea assessment units are shown in Thresholds table 1.

Thresholds table 1. Threshold values used in the open sea assessment units. In Bothnian Bay, The Quark, Bothnian Sea, Åland Sea, Northern Baltic Proper and Western Gotland Basin one threshold value per unit is given, whereas in Gulf of Finland, Gulf of Riga, Eastern Gotland Basin, Bay of Mecklenburg and Kiel Bay one threshold value per subset, irrespective of assessment unit is given. Thus one assessment unit may have more than one threshold value. Note that threshold values in assessment units where the Schiele *et al*. (2016) sensitivity value method is used will be 0.5 after normalisation to a common scale (see Assessment protocol).

<table>
<tr><th rowspan="3">Open sea assessment unit</th><th rowspan="3">Assessed depths</th><th colspan="8">Threshold value</th><th rowspan="3">BQI species sensitivity value method</th></tr>
<tr><th colspan="8">Subset according to Schiele et al. 2016</th></tr>
<tr><th>2</th><th>3</th><th>4</th><th>8</th><th>9</th><th>11</th><th>12</th><th>13</th></tr>
<tr><td>Bothnian Bay</td><td></td><td colspan="8">1.5</td><td rowspan="6">Leonardsson et al. 2009</td></tr>
<tr><td>The Quark</td><td></td><td colspan="8">1.5</td></tr>
<tr><td>Bothnian Sea</td><td></td><td colspan="8">4.0</td></tr>
<tr><td>Åland Sea</td><td></td><td colspan="8">4.0</td></tr>
<tr><td>Northern Baltic Proper</td><td><60 m</td><td colspan="8">4.0</td></tr>
<tr><td>Western Gotland Basin</td><td><60 m</td><td colspan="8">4.0</td></tr>
<tr><td>Gulf of Finland</td><td><60 m</td><td></td><td></td><td></td><td></td><td></td><td>0.93</td><td></td><td>1.07</td><td rowspan="5">Schiele et al. 2016</td></tr>
<tr><td>Gulf of Riga</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1.59</td><td>1.07</td></tr>
<tr><td>Eastern Gotland Basin</td><td><60 m</td><td></td><td></td><td></td><td>1.81</td><td>2.11</td><td></td><td></td><td></td></tr>
<tr><td>Bay of Mecklenburg</td><td></td><td>7.22</td><td>5.44</td><td>4.52</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Kiel Bay</td><td></td><td>7.22</td><td>5.44</td><td>4.52</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

No threshold value has been agreed for the following open sea assessment units: Kattegat, Great Belt, the Sound, Arkona Basin, Bornholm Basin and Gdansk Basin. The indicator is in principle applicable in these areas, and further work for these assessment units is underway.

Assessment Protocol

The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

Evaluating the status of soft-bottom macrofauna in the open sea assessment units is done using a method based on the Benthic Quality Index (BQI), where the abundance weighted proportion of sensitive to tolerant taxa and the diversity of the community are the determining parameters. In general terms, the higher the proportion of sensitive taxa and the higher the number of different species, the better the environmental status is evaluated to be.

HELCOM Contracting Parties that are also EU Member States have developed methods for assessing the coastal areas using benthic invertebrates for the purpose of the EU Water Framework Directive (WFD). WFD Good Ecological Status (GEcS) threshold values as well as the specific index to be used, have been defined in national legislation. To avoid developing two contradictory environmental status evaluations in coastal areas (both using benthic invertebrates), the national assessments from the WFD framework in coastal areas are selected, with a common HELCOM method used for evaluating the open sea areas. In the deeper parts of some open sea areas the environmental status is evaluated with the Oxygen debt indicator (see Results figure 2).

The BQI approach has been developed through several consecutive studies (Rosenberg *et al*. 2004, Leonardsson *et al*. 2009, Leonardsson *et al*. 2015, Leonardsson *et al*. 2016 and Blomqvist & Leonardsson 2016). In this core indicator the version of the index to be used is the formula presented in Leonardsson *et al*. (2009):

$$BQI = \left[\sum_{i=1}^{S_{classified}} \left(\frac{N_i}{N_{classified}} * Sensitivity\ value_i\right)\right] * log_{10}(S+1) * N/(N+5)$$

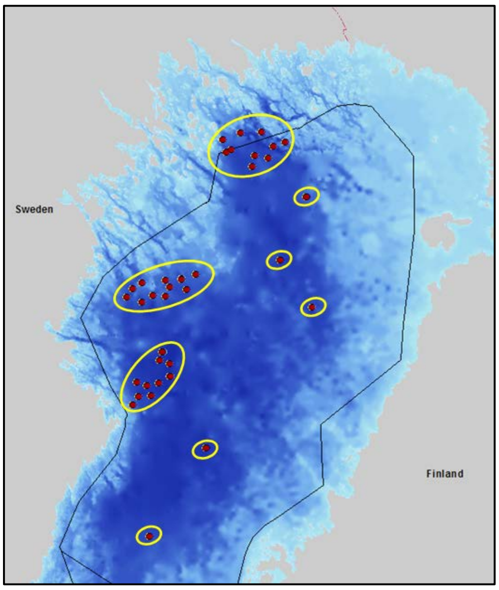
where $S_{classified}$ is the number of taxa having a sensitivity value, N_i is the number of individuals of taxon i, $N_{classified}$ is the total number of individuals of taxa having a sensitivity value, the Sensitivity $value_i$ is the sensitivity value for taxon i, S is the total number of taxa, and N is the total number of individuals in the sample (recalculated to 0.1 m^2).

Sensitivity values used originate from two different concepts and sources; a) literature information on sensitivity to disturbance and expert knowledge (according to Leonardsson *et al*. 2009) are used in the Gulf of Bothnia, Åland Sea, Norther Baltic Proper and Western Gotland Basin, and b) calculated values based on taxa occurrence at different diversities according to Schiele *et al*. (2016) are used in the Gulf of Finland, Gulf of Riga, Eastern Gotland Basin, Bay of Mecklenburg and Kiel Bay. The sensitivity values in Leonardsson *et al*. (2009) are constant across the whole Baltic and the same as those used for WFD assessment in both Sweden and Finland. Sensitivity values calculated according to Schiele *et al*. (2016) are different for different salinity/depth/gear subsets. Salinities for the sampling stations were retrieved using the modelled EUSeaMap values in order to have a set salinity for the sampling stations and avoid stations being assigned different subset factors based on the observed salinity at sampling. In total 19 different subsets are identified by Schiele *et al*. (2016) but only eight of these are present in the assessment units where this concept is currently used. In each of these assessment units more than one subset is present. Since each subset will have a different range of sensitivity values separate calculations have to be performed for each subset and these separate status assessments are subsequently merged to give a final assessment value for the specific assessment unit.

Assessment calculations

In the Gulf of Finland, Gulf of Riga, Eastern Gotland Basin, Bay of Mecklenburg and Kiel Bay assessment units more than one set of sensitivity values were used in the calculation of BQI, i.e. one for each Schiele subset. To make the BQI values comparable across the Schiele subsets, normalization to a common scale between 0 and 1 was done, with the threshold value scaled to 0.5 and setting the maximum observed BQI value in the subset to 1. In the assessment units where only one set of sensitivity values were used (Bothnian Bay, The Quark, Bothnian Sea, Åland Sea, Northern Baltic Proper and Western Gotland Basin) thus no normalization was needed for the BQI values.

In order to account for spatial, temporal and sample replicate imbalance a bootstrap procedure was used to estimate the 20th percentile to be compared against the threshold value. The 20th percentile is used as a precautionary or "fail-safe" approach (Carstensen 2007, Leonardsson *et al*. 2009) placing results of high uncertainty into lower status categories. Spatial imbalance with several stations concentrated to smaller parts of the assessment area is overcome by defining geographic sub-areas. Spatial imbalance often arises from different monitoring designs used by different HELCOM Contracting Parties, e.g. the cluster design in Sweden or the single station design in Finland (e.g. Assessment protocol figure 1).



Assessment protocol figure 1. Example of geographic sub-areas used to overcome spatial imbalance in the bootstrap process. Red dots represent sampling stations and yellow circles indicate geographic subareas in the Bothnian Bay assessment unit.

The bootstrap process for one assessment unit and one assessment period follows these steps:

1) Random selection of one geographic subarea
2) Random selection of one station from this subarea
3) Random selection of one grab sample from this station, irrespective of year and sample number, and store its BQI-value
4) Repeat steps 1 to 3 as many times as there are stations in the assessment unit
5) Calculate the mean of the stored BQI-values and store this mean BQI-value
6) Repeat above steps 100 000 times
7) Calculate the 20th percentile of the stored 100 000 mean BQI-values

The 20th percentile from step 7 is the indicator value to be compared with the threshold value of the specific assessment unit.

Assessment units

The indicator is calculated for HELCOM assessment unit scale 4 open sea assessment units. There are 17 open sea assessment units defined in the HELCOM Monitoring and Assessment Strategy Annex 4. The units are delineated based on the 1 nautical mile boundary from the coastal baseline.

Relevance of the Indicator

The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

Biodiversity and eutrophication assessment

The biodiversity status is assessed using several core indicators. Each indicator focuses on one important aspect of this complex issue. In addition to providing an indicator-based evaluation, this indicator will also contribute to the integrated biodiversity and eutrophication assessment.

Policy relevance

This core indicator has mainly been developed with the aim to evaluate the HELCOM ecological objective 'Thriving communities of plants and animals' (Nature conservation). Some information of relevance can be gained also when assessing 'Natural distribution and occurrence of plants and animals' (Eutrophication).

Under the EU Marine Strategy Framework Directive, the indicator describes the state of benthic habitats linking to descriptor 6: Sea-floor integrity (Criterion D6C5), descriptor 5: Eutrophication (Criterion D5C8) and descriptor 4: Food webs (Criterion D4C1).

Role of soft-bottom macrofauna in the ecosystem

Macrofauna species live in the sediment or at the interface between the water mass and the sediment. The macrozoobenthic community influences the marine nutrient turnover by coupling biological and physicochemical cycles of both compartments, known as the benthic-pelagic coupling. Foraging and burrowing activities in sediment influences the oxygenation of the sediment and other biogeochemical processes. In addition to forming a link between the water mass and the sediments, the macrozoobenthic species also form an important link in the marine food web. Many of the macrozoobenthic species are primary consumers that filter particles from the water or graze on and in the sediments, while others are predators and scavengers. Furthermore, many marine top-predators feed on these macrozoobenthic species. Moreover, as the main part of the seafloor is covered by soft sediments, the macrozoobenthic community is clearly a key component to be considered in any assessment of the status of the environment.

The composition of the macrozoobenthic community varies across environmental gradients and reflects parameters such as salinity, oxygen, food supply, biotic interactions and hydrological conditions. Changes in environmental parameters will result in changes in community composition. In addition to changes due to natural environmental fluctuations, the composition is also affected by anthropogenic pressures. Generally, Baltic soft-bottom macrofauna are characterized by small shallow-dwelling species, owing to low salinity and transient hypoxia. Historically it was only in the southern Baltic where more mature communities composed of deeper-dwelling and/or larger species could have developed, for example: some long-lived bivalves and large polychaetes. In the open sea areas of the northern subbasins, the soft-bottom macrofauna community is dominated by a small number of species, including for example: the amphipods *Monoporeia affinis* and *Pontoporeia femorata*, the isopod *Saduria entomon*, the polychaets *Bylgides sarsi* and *Marenzelleria* spp., and the bivalve *Limecola balthica.* In the open sea areas of the southern subbasins the communities are markedly different with a dominance of clearly marine species, including for example: the bivalves *Arctica islandica* and *Astarte borealis* and numerous species of polychaetes. This latitudinal distribution pattern is defined by the gradient of decreasing salinity towards the north, which decreases soft-bottom macrofauna diversity, affecting both the structure and function of the communities (Elmgren 1989, Rumohr *et al*. 1996, Bonsdoff & Pearson 1999, Villnäs & Norkko 2011, Gogina *et al*. 2016).

The distribution of soft-bottom macrofauna communities is also driven by strong vertical gradients. Generally, more species-rich and abundant communities are found in shallow-water habitats (with higher habitat diversity) compared to the deep-water communities which are dominated by only a few species (Andersin *et al*. 1978). The Baltic Proper has a more or less permanent halocline at 60-80 m, whereas in the Gulf of Bothnia stratification is weak or absent. The halocline in deeper waters and seasonal pycnoclines in coastal waters restrict vertical water exchange, which may result in oxygen deficiency, a factor that is undoubtedly the most significant threat to the biodiversity of Baltic Sea soft-sediment macrofauna communities. In the open sea, the communities have for several decades been severely affected by oxygen depletion. Current evidence suggests that the spatial and temporal extent of oxygen deficiency has increased over the past decades. Consequently, only the area above the halocline, i.e. not suffering from permanent hypoxia, is assessed using this indicator.

The soft-bottom macrofauna species that make up the community have different characteristics and react differently to anthropogenic pressures. Thus an evaluation of the community composition and abundances of species in the community for a specific area represents a good indicator for evaluating the status of the environment. In more southerly regions of the Baltic Sea where conditions are more marine (i.e. higher salinity) the macrozoobenthic community is further considered to be a good indicator due to the fact that the species are relatively stationary and long-lived species (years to decades). Monitoring such species enables the integration of environmental information and reduces fluctuations in the dataset once natural variability has been taken appropriately into account, and increases certainty should few samples be required to represent a larger area or time period.

The assessment results show good status for most basins, even in eutrophic or otherwise impacted areas. As the indicator concept is based on sensitive species and diversity, the impacts of the main pressures affecting the benthic fauna are expected to be reflected in the assessment results. Further development of the indicator and its assessment thresholds may be needed to achieve better alignment between the assessment of pressures and their impacts on benthic habitats and benthic fauna.

Human pressures linked to the indicator

	General	MSFD Annex III, Table 2a
Strong link	eutrophication, seabed disturbance e.g. trawling, contamination e.g. oil spill	Physical - Physical disturbance to seabed (temporary of reversible) Substances, litter and energy - Inputs of nutrients – diffuse sources, point sources, atmospheric deposition - Inputs of organic matter – diffuse sources and point sources - Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) – diffuse sources, point sources, atmospheric deposition, acute events Biological - Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities)
Weak link		

Soft-bottom macrofauna community composition is a good indicator of environmental status because the results integrate several pressures on the environment over a moderate period of time. The quality of the soft-bottom macrofauna community implies that status changes can, however, only be indirectly linked to anthropogenic pressures. The soft-bottom macrofauna community structure is affected by eutrophication (including oxygen deficiency), changes in water and sediment quality and hydrographic conditions such as salinity or temperature, as well as physical damage to the seafloor (Relevance of the indicator table 1).

Relevance of the indicator table 1. The effect of anthropogenic pressures on macrozoobenthic diversity.

Status of diversity	Anthropogenic pressure
Improved	Slight eutrophication
Reduced	Severe eutrophication (incl. oxygen deficiency)
Reduced	Physical disturbance (due to abrasion, smothering, changes in siltation)
Reduced	Physical loss (due to sealing or selective extraction)
Reduced	Introduction of synthetic compounds (due to ship accidents or harbours)
Altered	Changes in the hydrological conditions (due to changes in salinity and/or temperature)

The anthropogenic pressure the indicator clearly reacts to in large areas of the Baltic Sea is eutrophication that causes hypoxia and anoxia in bottom waters (Pearson and Rosenberg 1978, Hyland *et al*. 2005, Norkko *et al*. 2006). Hypoxia has resulted in habitat destruction and the elimination of benthic macrofauna over vast areas, and has severely disrupted benthic food webs. In food-limited soft-bottom macrofauna communities, an increase in organic material input and subsequent disturbance are initially seen as large fluctuations in benthic diversity, abundance and biomass. Species composition changes as conditions deteriorate, and the advantage gained by smaller-sized and/or tolerant species results in decreasing total biomass and diversity of the soft-bottom macrofauna community as sensitive, large-sized and long-lived species disappear. At advanced stages of organic enrichment, most bottom-water oxygen is consumed by the aerobic microbial decomposition of organic material, resulting in hypoxia and anoxia and initiating the release of toxic hydrogen sulphide from the sediments. At these advanced stages of hypoxia and anoxia, soft-bottom macrofauna is eliminated and important ecosystem services are lost.

The most severe damage from the physical pressure of trawling is apparent in the southern areas of the Baltic Sea where trawling intensity is higher and the soft-bottom macrofauna community is dominated by very long-lived species of clams and mussels. In other coastal areas the main physical damage of relevance to the soft-bottom macrofauna community stems from dredging activities and dumping of dredged materials. Dredging and dumping activities can change local hydrographical conditions as well as change siltation rates, especially in the short term.

Monitoring Requirements

The indicator and some of its associated threshold values are still being tested in some countries. *Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.*

Monitoring methodology

Monitoring of soft-bottom macrofauna is described in general terms in the **HELCOM Monitoring Manual** in the Programme Topic Benthic community species distribution and abundance. Monitoring specifically on soft-bottom macrofauna communities is further described in the sub-programme: Softbottom fauna. The Monitoring Concepts Table summarizes ongoing monitoring activities.

Monitoring guidelines describing the sampling strategy are to be included in the **HELCOM Monitoring Manual**. The guidelines are currently under development and will be included once agreement has been reached.

Current monitoring

The monitoring activities relevant to this indicator, as currently carried out by HELCOM Contracting Parties, are described in the **HELCOM Monitoring Manual**

Sub-programme:

Softbottom fauna

The Monitoring Concepts Table lists the Contracting Parties currently monitoring soft-bottom macrofauna.

Description of optimal monitoring

For an optimal assessment of the status of soft-bottom communities, the benthic macrofauna should be monitored in all coastal and open sea assessment units. Monitoring design should optimally take into account the habitat heterogeneity within the assessment unit to cover the spatial variation in communities. Ideally, the same methodology should be applied throughout the Baltic Sea.

Data and updating

The indicator and some of its associated threshold values are still being tested in some countries. *Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.*

Access and use

The data and resulting data products (tables, figures and maps) associated with this indicator, and available here can be used freely given that the source is cited. The indicator should be cited as follows:

HELCOM (2018) State of soft-bottom macrofauna community. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543

Metadata

Result: State of the soft-bottom macrofauna community

Data: State of the soft-bottom macrofauna community

The snapshot dataset on macrofauna includes data from DK, EE, FI, DE, LV, LT, PL, SE.

Data was extracted from the HELCOM COMBINE database, hosted by ICES. The extracted dataset was supplemented with additional data from Estonia, Latvia, Lithuania and Germany.

Offshore waters: Monitoring started in some places in 1964. Current status assessment based on data from 2011-2016. Monitoring is on-going and contracting parties report data annually to the HELCOM COMBINE database.

Contributors and references

The indicator and some of its associated threshold values are still being tested in some countries.
Further development may be necessary to make the indicator suitable in all subbasins. The current results should thus to be considered as intermediate.

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HELCOM Intersessional Network on Benthic habitat monitoring (IN-BENTHIC)

Archive

This version of the HELCOM core indicator report was published in July 2018:

State of the soft-bottom macrofauna community HELCOM core indicator report 2018 (pdf).

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HELCOM core indicator report
ISSN 2343-2543