HELCOM

Water transparency

INDICATOR TYPE: Core
INDICATOR CATEGORY: State
BSAP SEGMENT: Eutrophication
MSFD CRITERIA: D5C4

Water transparency

Table of contents

1 Key message

This core indicator evaluates summer-time (June – September) water clarity based on average Secchi depth during the assessment period 2016-2021.

In open sea areas, good status for water clarity has been achieved in the Kattegat. Single coastal assessment units achieving good status are found in Danish, Finnish, German, Polish and Swedish coastal areas. However, 18 of the total 19 open sea assessment units as well as most of the coastal waters remain in a below-good status.

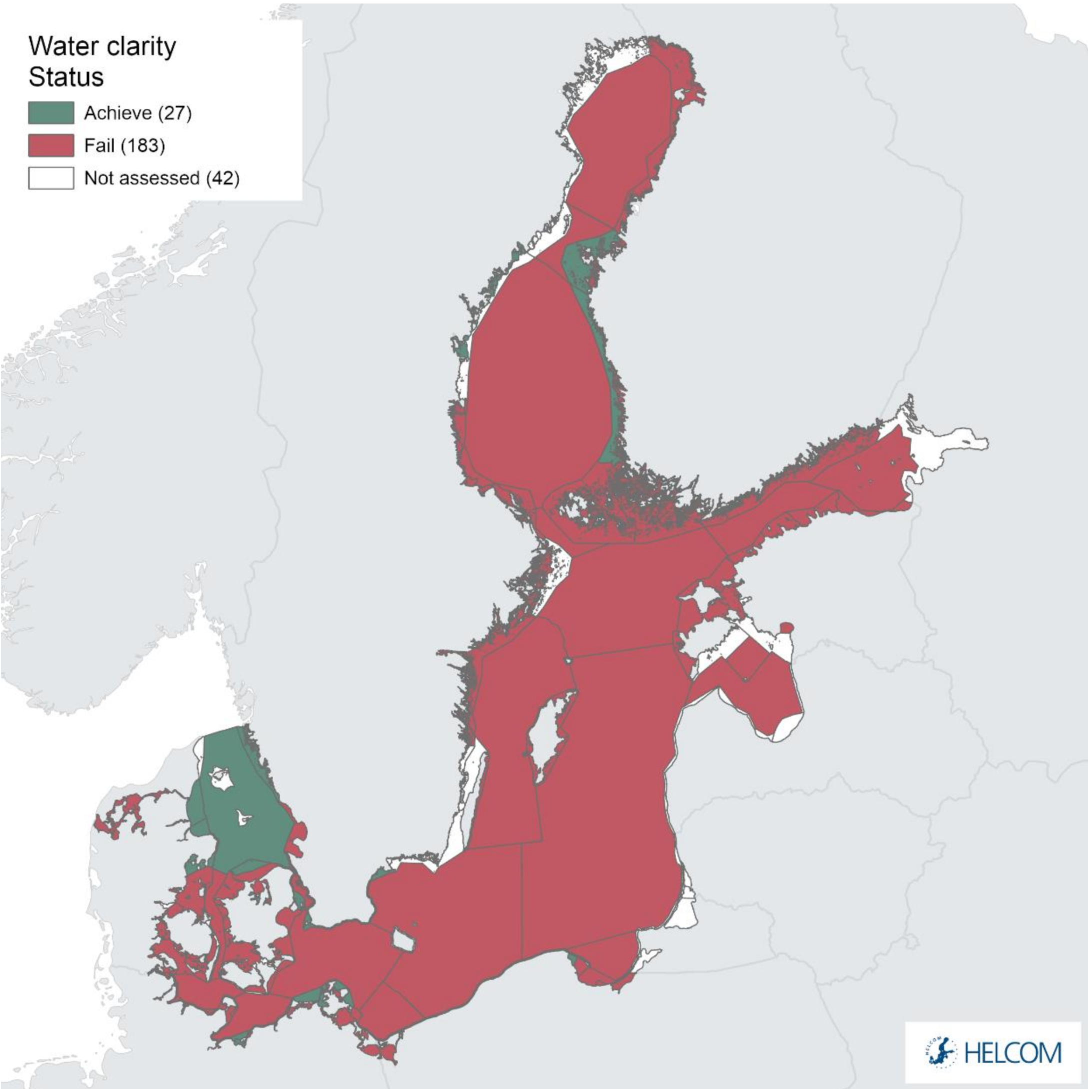


Figure 1. Status assessment evaluation of the indicator 'Water clarity'. The assessment is carried out using Scale 4 HELCOM assessment units (defined in the HELCOM Monitoring and Assessment Strategy Annex 4).
See 'data chapter' for interactive maps and data at the HELCOM Map and Data Service.

Since the early 1900's, there has been a general long term decrease in summer-time water clarity in most of the Baltic Sea. Since the 1990s, water clarity has improved in the southwestern assessment units (Kattegat, Sound, Great Belt and Kiel Bay). In the rest of the Baltic Sea, water clarity has either decreased (Arkona Basin, Eastern Gotland Basin, Western Gotland Basin, Northern Baltic Proper, Eastern Gotland Basin and Gulf of Finland Western) or remained stable during that time (Results figure 3). In comparison to the HOLAS II period (2011-2016), only the Sound has changed its status from achieving to failing good status. The status has improved in seven subbasins and deteriorated in nine sub-basins.

The confidence in the water clarity status evaluation is high in the southwestern parts of the Baltic Sea. In the Quark, Åland Sea, Gulf of Finland Eastern, Gulf of Finland Western and Gulf of Riga open-sea assessment units the indicator confidence was low, due to insufficient sampling. In the remaining open-sea assessment units the indicator confidence was moderate.

The indicator is applicable in the waters of all countries bordering the Baltic Sea.

1.1 Citation

The data and resulting data products (e.g. tables, figures and maps) available on the indicator web page can be used freely given that it is used appropriately and the source is cited. The indicator should be cited as follows:

HELCOM (2023). Water clarity. HELCOM core indicator report. Online. [Date Viewed], [Web link].

ISSN 2343-2543.

2 Relevance of the indicator

Eutrophication is caused by excessive inputs of nutrients (nitrogen and phosphorus) resulting from various human activities. High availability of nutrients and their ratios form the preconditions for increased algal growth, reduced water clarity and increased oxygen consumption. Water clarity is affected by the light attenuation of the media, caused mainly by water itself, planktonic organisms - especially phytoplankton, suspended particulate matter, chromophoric dissolved organic matter (CDOM), and inorganic compounds. In the open oceans, phytoplankton is the dominating optical constituent but in the Baltic Sea water clarity is dominated by CDOM. In the North-eastern parts the main source of CDOM is humic substances in run off from land. In the other parts, phytoplankton growth is the main source for CDOM and hence related to nutrient inputs. Reduced water clarity is often a result of the eutrophication cascade, although especially in the North-eastern parts, increase in coloured dissolved substances may have played an important role.

Eutrophication assessment

The status of eutrophication is assessed using several core indicators. Each indicator focuses on one important aspect of the complex process. In addition to providing an indicator-based evaluation of the water clarity, this indicator also contributes to the overall eutrophication assessment along with the other eutrophication core indicators, being included in criteria group "indirect effects of eutrophication".

2.1 Ecological relevance

Role of water clarity in the ecosystem

Water clarity is affected mainly by the concentration of particles causing scattering of light, therefore enhancing light absorption. Light absorption is mainly due to water itself, CDOM, detritus and to phytoplankton. The concentration of detritus particles and CDOM is the result of organic matter accumulated over time due to high nutrient loadings and in particular in the eastern Baltic Sea to a high natural contribution of humic materials from rivers draining peat land and forested areas. Eutrophication increases light attenuation, through nutrients increasing the amount of living organisms. Turbid waters affect the ecosystem through decreases in light availability below the surface.

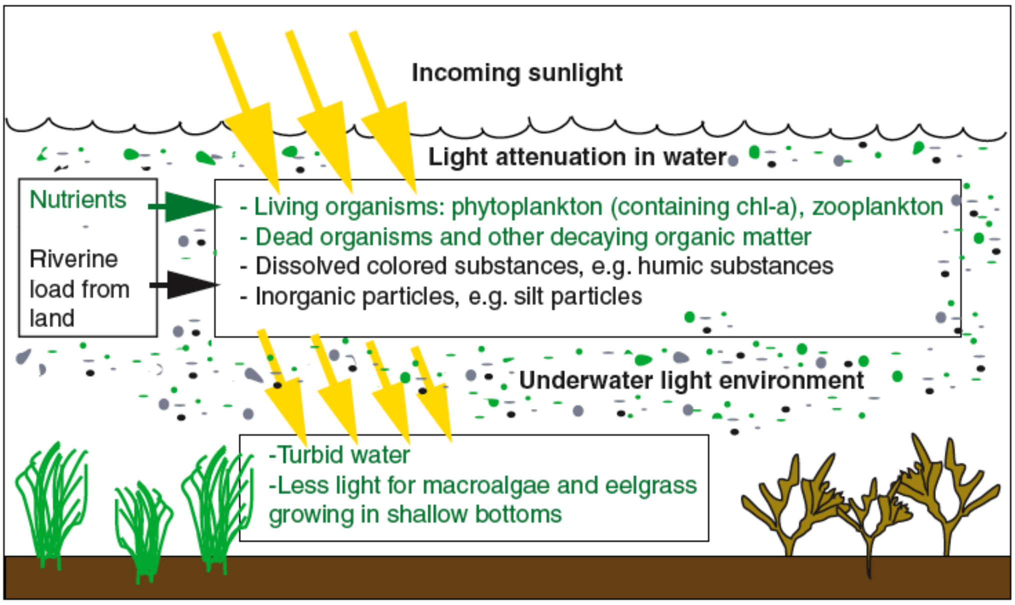


Figure 2. Simplified conceptual model for water clarity in the Baltic Sea. Figure from HELCOM 2009.

2.2 Policy relevance

Eutrophication is one of the four thematic segments of the HELCOM Baltic Sea Action Plan (BSAP) with the strategic goal of having a Baltic Sea unaffected by eutrophication (HELCOM 2021). Eutrophication is defined in the BSAP as a condition in an aquatic ecosystem where excessive inputs of nutrients stimulate the growth of algae which leads to imbalanced functioning of the system. The goal for eutrophication is broken down into five ecological objectives, of which one is “clear water”, possible to assess using Secchi depth as a proxy.

The EU Marine Strategy Framework Directive (2008/56/EC) requires that “human-induced eutrophication is minimized, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters” (Descriptor 5). ‘Photic limit (transparency) of the water column’ is listed as a criteria element in MSFD GES Decision ((EU) 2017/848) for assessing the secondary criterion D5C4 ‘The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment’.

The EU Water Framework Directive (2000/60/EC) requires good ecological status in the European coastal waters. Good ecological status is defined in Annex V of the Water Framework Directive, in terms of the quality of the biological community, the hydromorphological characteristics and the chemical characteristics, including water clarity.

Table 1. Overview or relevant policy for this indicator.

<table>
<tr><th></th><th>Baltic Sea Action Plan (BSAP)</th><th>Marine Strategy Framework Directive (MSFD)</th></tr>
<tr><td>Fundamental link</td><td>Segment: Eutrophication

Goal: “Baltic Sea unaffected by eutrophication”
Ecological objective: “Concentrations of nutrients close to natural levels”, “Clear waters”, “Natural level of algal blooms”, “Natural distribution and occurrence of plants and animals”, and “Natural oxygen levels”.
Management objective: “Minimize inputs of nutrients from human activities”
The achievement of regional nutrient input targets – Maximum Allowable Inputs (MAI) and Nutrient Input Ceilings (NIC) – for all sub-basins, as identified in this BSAP, is the key prerequisite for achieving the ecological objectives.</td><td>Descriptor 5 Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters – Macrofaunal communities of benthic habitats.
Criteria D5C4 The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment. The threshold values are as follows:
(a) in coastal waters, the values set in accordance with Directive 2000/60/EC;
(b) beyond coastal waters, values consistent with those for coastal waters under Directive 2000/60/EC. Member States shall establish those values through regional or subregional cooperation.
Feature – Eutrophication.
Element of the feature assessed – Transparency.</td></tr>
<tr><td>Complementary link</td><td></td><td></td></tr>
<tr><td>Other relevant legislation:</td><td colspan="2">EU Water Framework Directive
UN Sustainable Development Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) is most clearly relevant, though SDG 12 (Ensure sustainable consumption and production patterns) and 13 (Take urgent action to combat climate change and its impacts) also have relevance.</td></tr>
</table>

2.3 Relevance for other assessments

This indicator is utilised in the integrated assessment of eutrophication (HEAT tool).

3 Threshold values

Status evaluation is measured in relation to scientifically based and commonly agreed sub-basin specific threshold values, which define the values that should not be exceeded (Figure 3).

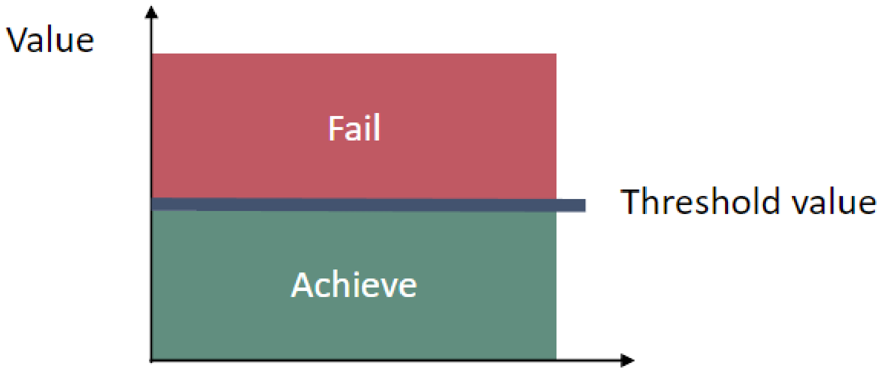


Figure 3. Schematic representation of the threshold value applied in the water clarity core indicator, the threshold values are assessment unit specific (see table 1).

3.1 Setting the threshold value(s)

These indicator threshold values were based on the datamining results obtained in the TARGREV project (HELCOM 2013), taking also advantage of the work carried out during the EUTRO PRO process (HELCOM 2009) and national work for EU WFD. The final threshold values were set through an expert evaluation process done by the intersessional activity on development of core eutrophication indicators (HELCOM CORE EUTRO) and the targets were adopted by the HELCOM Heads of Delegations 39/2012. For the Western and Gulf of Finland Eastern assessment units (SEA-013A and SEA-013B), threshold values were rescaled from the Gulf of Finland assessment unit (SEA-013) value used in HOLAS II (HOD 61-2021 document 5-1-Rev.1 Workspace ATT.13 Rev.1), as adopted by the HELCOM Heads of Delegations 61/ 2021. For the new assessment unit Pomeranian Bay (SEA-007B), there was no appropriate threshold available, and therefore the threshold for Bornholm Basin (SEA-007) was used. This threshold is however most likely too high, resulting in too bad a classification result.

Table 2. Assessment unit specific threshold values for the water clarity core indicator. Due to lack of separate threshold for Pomeranian Bay, the threshold for Bornholm Basin was used also for this assessment unit which has been separated from the Bornholm Basin assessment unit for HOLAS 3.

HELCOM_ID	Assessment unit (open sea)	Threshold value (Secchi depth, m)
SEA-001	Kattegat	7.6
SEA-002	Great Belt	8.5
SEA-003	The Sound	8.2
SEA-004	Kiel Bay	7.4
SEA-005	Bay of Mecklenburg	7.1
SEA-006	Arkona Sea	7.2
SEA-007	Bornholm Basin	7.1
SEA-007B	Pomeranian Bay	7.1
SEA-008	Gdansk Basin	6.5
SEA-009	Eastern Gotland Basin	7.6
SEA-010	Western Gotland Basin	8.4
SEA-011	Gulf of Riga	5.0
SEA-012	Northern Baltic Proper	7.1
SEA-013A	Gulf of Finland Western	5.9
SEA-013B	Gulf of Finland Eastern	5.3
SEA-014	Åland Sea	6.9
SEA-015	Bothnian Sea	6.8
SEA-016	The Quark	6.0
SEA-017	Bothnian Bay	5.8

4 Results and discussion

The results of the indicator evaluation underlying the key message map and information are provided below.

4.1 Status evaluation

Current status of water clarity in open-sea areas

In open sea areas, good status (Secchi depth above defined threshold value, which reflects good conditions) for water clarity was achieved only in the Kattegat. The eutrophication quality ratio (EQRS) was lowest in the Pomeranian Bay (0.12), Western Gotland Basin (0.17) and Gulf of Riga (0.17). The bad status of Pomeranian Bay reflects at least in part the likely too high threshold, which was developed for Bornholm Basin, where the coastal influence is lower than in the Pomeranian Bay.

The EQRS was between 0.2 and < 0.4 in Bay of Mecklenburg, Arkona Basin, Gdansk Basin, Eastern Gotland Basin, Northern Baltic Proper, Gulf of Finland Western, Gulf of Finland Eastern and the Quark and between 0.4 and < 0.6 in the Great Belt, the Sound, Kiel Bay, Bornholm Basin, Åland Sea, Bothnian Sea and Bothnian Bay (Figure 4 and table 3). Water clarity in Kiel Bay was just below the threshold for good status. In general, the average water clarity has remained relatively constant during the assessment period (Figure 5).

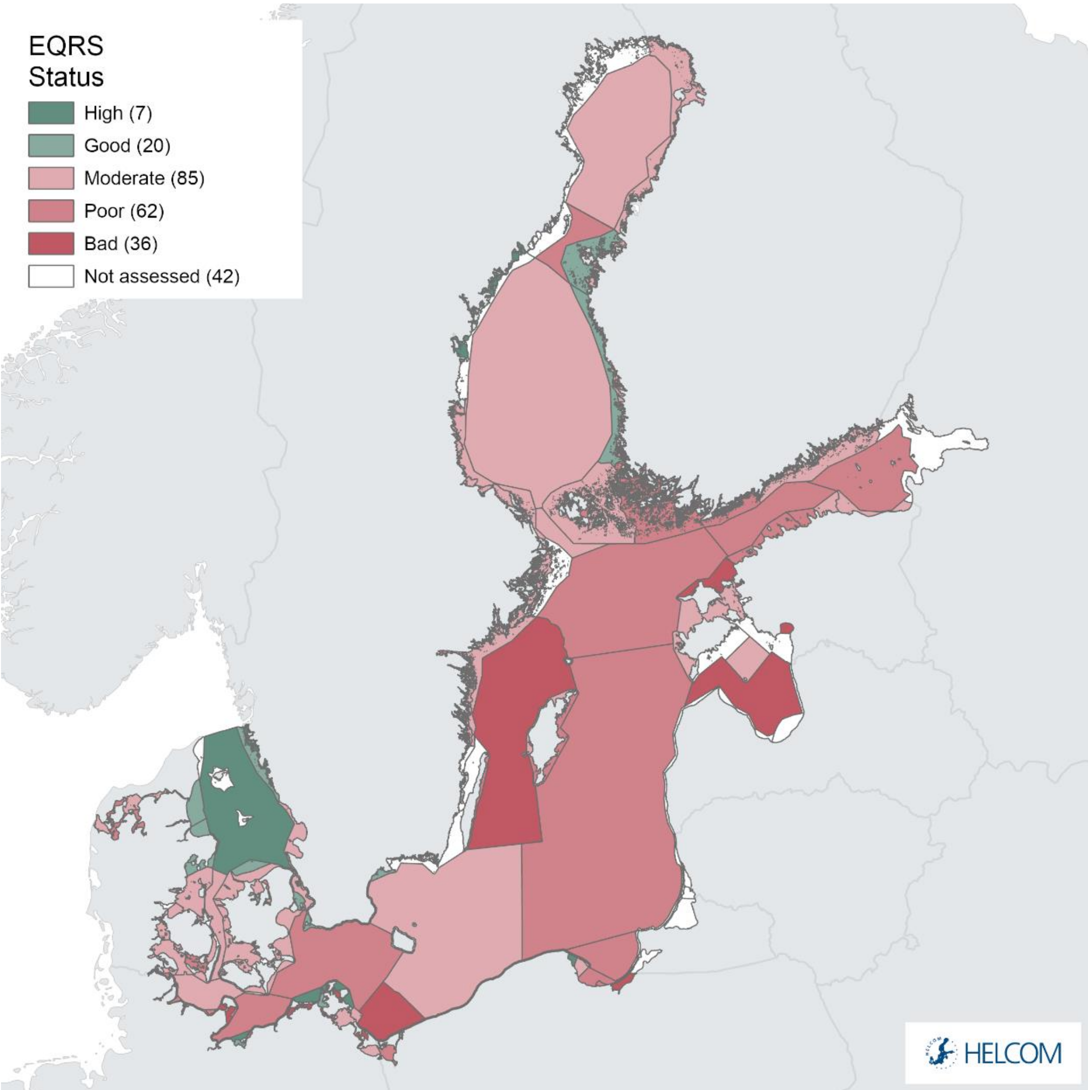


Figure 4. Status of the water clarity in 2016-2021, presented as Ecological Quality Ratio Scaled (EQRS). EQRS shows the present condition in relation to the reference value, decreasing along with increasing eutrophication. The threshold for good status value is EQRS = 0.6, with values above this threshold achieving good status.

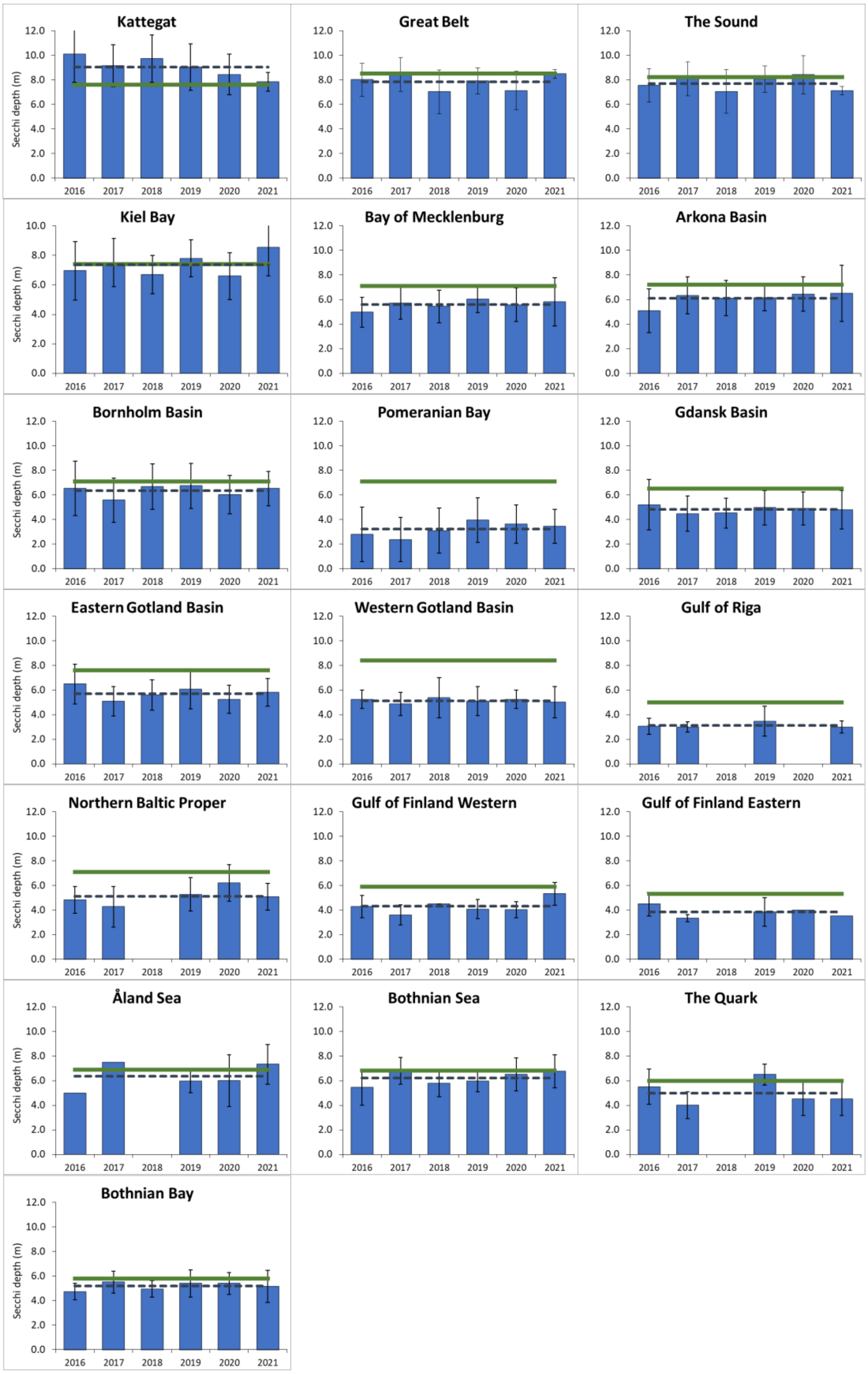


Figure 5. Average of Secchi depth for June to September for each year from 2016 to 2021 with assessment period average shown as dashed dark blue line and threshold value (green continuous line). Standard error is shown on each bar. Where no data was available an empty space is shown where the bar would be.

Table 3. Threshold values, concentration during the assessment period (2016-2021 average), Ecological Quality Ratio Scaled (EQRS) and status of water clarity measured in Secchi Depth in the open-sea basins. EQRS is a quantitative value for the level of eutrophication, calculated from the ratio between the reference value and the present concentration. When EQRS ≥ 0.6 good status is achieved.

Assessment unit (open sea)	**Threshold (m)**	**Average 2016-2021 (m)**	**Ecological quality ratio (scaled) (EQRS)**	**Status (fail/achieve threshold value)**
Kattegat	7.6	9.1	0.86	Achieve
Great Belt	8.5	7.8	0.48	Fail
The Sound	8.2	7.7	0.51	Fail
Kiel Bay	7.4	7.4	0.59	Fail
Bay of Mecklenburg	7.1	5.6	0.29	Fail
Arkona Basin	7.2	6.1	0.38	Fail
Bornholm Basin	7.1	6.3	0.44	Fail
Pomeranian Bay	7.1	3.2	0.12	Fail
Gdansk Basin	6.5	4.8	0.23	Fail
Eastern Gotland	7.6	5.7	0.25	Fail
Western Gotland	8.4	5.1	0.17	Fail
Gulf of Riga	5	3.1	0.17	Fail
Northern Baltic	7.1	5.1	0.23	Fail
Gulf of Finland	5.9	4.3	0.24	Fail
Gulf of Finland	5.3	3.8	0.23	Fail
Åland Sea	6.9	6.4	0.48	Fail
Bothnian Sea	6.8	6.2	0.47	Fail
The Quark	6	5.0	0.37	Fail
Bothnian Bay	5.8	5.2	0.50	Fail

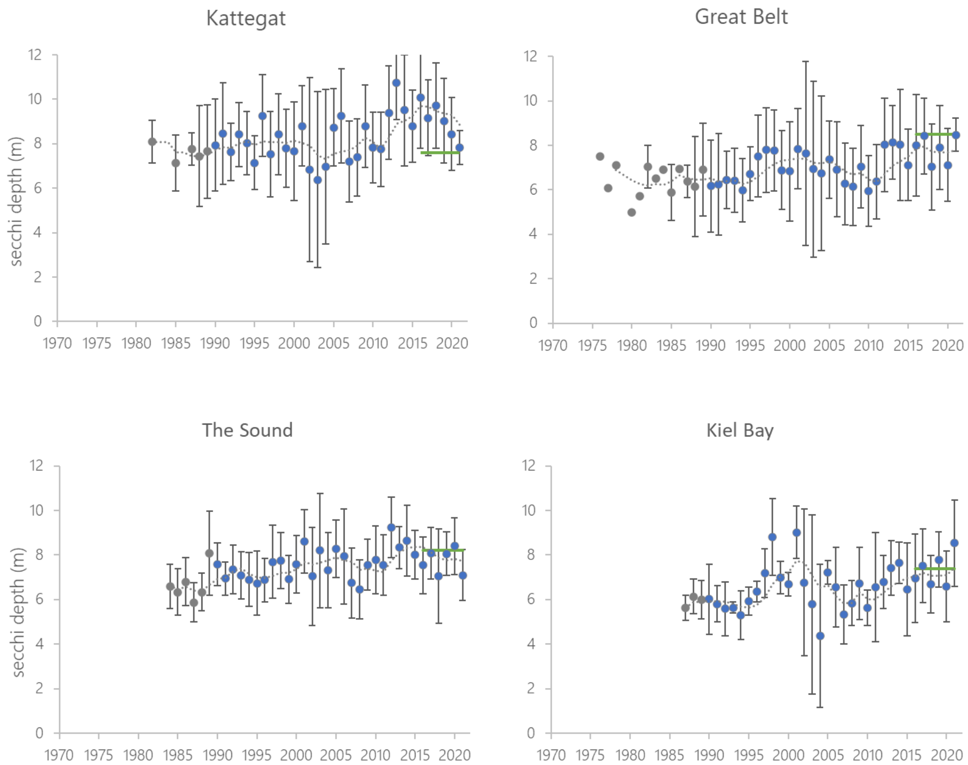
Indicator results in coastal waters

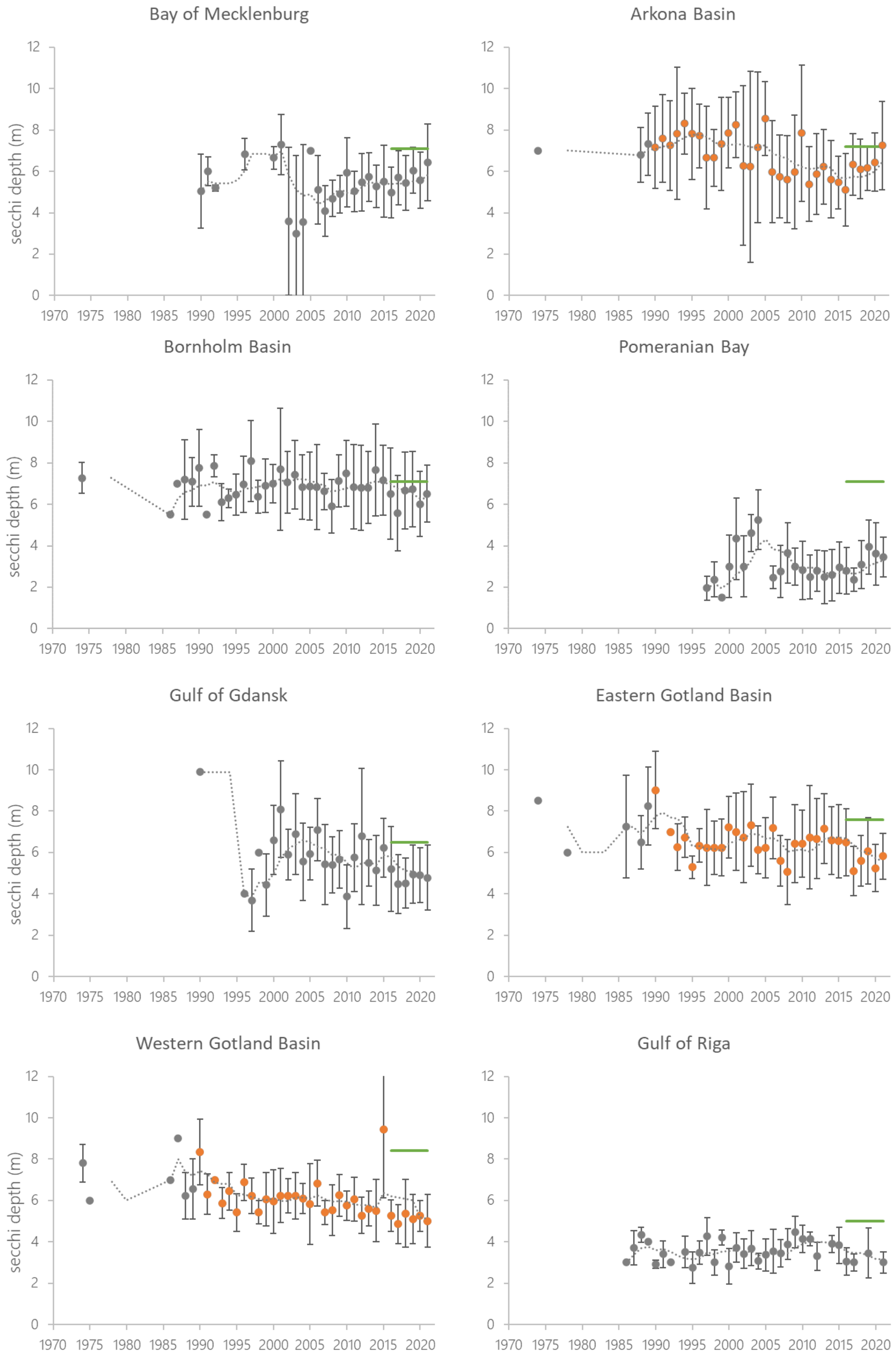
The coastal waters of the Baltic Sea are mostly evaluated below the threshold of good status. Yet a large proportion of the coastal waters of Kattegat have reached good status, similarly to the open-sea area. Single coastal assessment units achieving good status are found in The Sound, Mecklenburg Bight, Arkona Sea, Gdansk Basin, Bornholm Basin, Western Gotland Basin, Bothnian Sea and The Quark. The good status in the Finnish coastal areas of Bothnian Sea and Quark possibly reflects the documented positive trends in secchi depth in these areas. This may reflect the simultaneous decrease in dissolved coloured substances (iron (Fe)) (Fleming-Lehtinen *et al.* 2014).

4.2 Trends

Long-term trends

The long-term series for water clarity has shown a steadily deteriorating situation over the last century, most profoundly in the north-eastern sub-basins (Fleming-Lehtinen & Laamanen 2012). Over the past three decades from 1990-2021, water clarity has decreased significantly in five of the 19 sub-basins (Arkona Basin, Western Gotland Basin, Northern Baltic Proper, Eastern Gotland Basin and Gulf of Finland Western) (Figure 6). In the most South-Western sub-basins (Kattegat, Great Belt, The Sound and Kiel Bay) the water clarity has significantly increased, but the trend has levelled off or even reversed since about 2012 for The Kattegat, Great Belt and The Sound (Figure 7), which corresponds with an increase in chlorophyll concentrations and nitrogen inputs. The water clarity has improved significantly since the low values in early 1990s also in the Bothnian Sea. It has remained relatively stable in the rest of the assessment units.




Bay of Mecklenburg
Arkona Basin
Bornholm Basin
Pomeranian Bay
Gulf of Gdansk
Eastern Gotland Basin
Western Gotland Basin
Gulf of Riga
secchi depth (m)
0
2
4
6
8
10
12
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

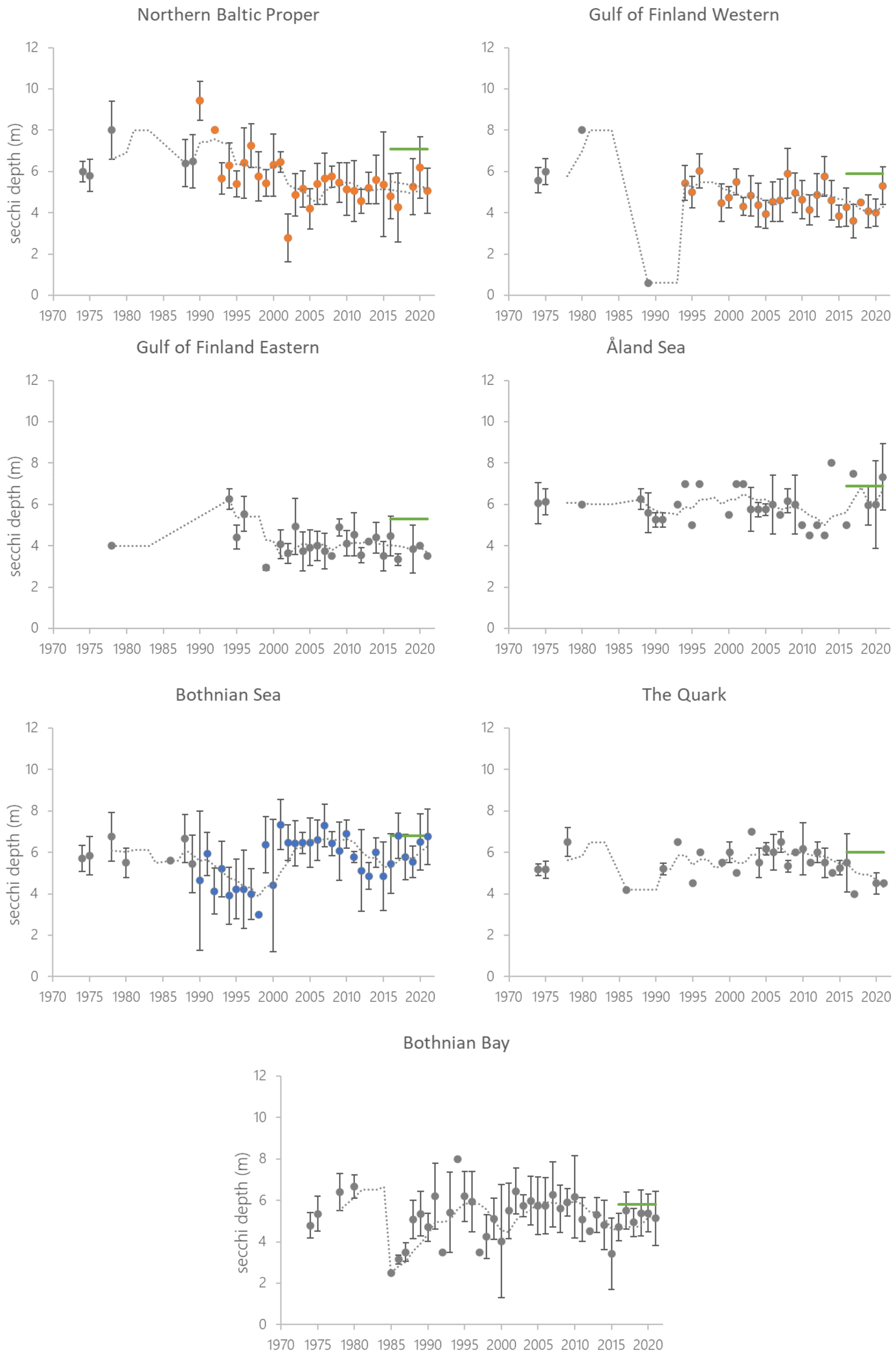


Figure 6. Temporal development of water clarity (measured as Secchi depth in summer) in open sea assessment units from 1970s to 2021. Dashed lines show the five-year moving averages and error bars the standard deviations. Green lines indicate the indicator threshold values. Significance of trends was assessed with a Mann-Kendall non-parametric tests for the period from 1990-2021. Significant ($p<0.05$) improving trends are indicated with blue and deteriorating trends with orange colour.

4.3 Discussion text

Assessment results for water clarity were compared between the latest two assessments of HOLAS II and HOLAS 3. The Sound was the only assessment unit that changed its status from achieving good status to failing good status, reflecting the reversal of positive development in this assessment unit since about 2012 (Results Table 2, Results Figure 4). Seven assessment units had improving status, three assessment units had stable status and nine assessment units had deteriorating status.

Table 4. Evaluations of the water clarity indicator during the HOLAS II and HOLAS 3 periods, coloured red or green depending on whether the assessment unit fails or achieves the threshold, respectively. The trend from the previous to present assessment period is addressed alongside a description of outcome (a change of 15 % is deemed significant).

HELCOM Assessment Unit name	EQRS HOLAS II Average 2011-2016 (EQRS)	EQRS HOLAS 3 Average 2016-2021 (EQRS)	Distinct trend between current and previous assessment
Kattegat	0.89	0.86	No distinct change
Great Belt	0.44	0.48	No distinct change
The Sound	0.60	0.51	Distinct deteriorating change
Kiel Bay	0.51	0.59	Distinct improving change
Bay of Mecklenburg	0.23	0.29	Distinct improving change
Arkona Basin	0.27	0.38	Distinct improving change
Bornholm Basin	0.57	0.44	Distinct deteriorating change
Pomeranian Bay	0.10	0.12	Distinct improving change
Gulf of Gdansk	0.43	0.23	Distinct deteriorating change
Eastern Gotland Basin	0.42	0.25	Distinct deteriorating change
Western Gotland Basin	0.28	0.17	Distinct deteriorating change
Gulf of Riga	0.24	0.17	Distinct deteriorating change
Northern Baltic Proper	0.21	0.23	No distinct change
Gulf of Finland Western	0.29	0.24	Distinct deteriorating change
Gulf of Finland Eastern	0.29	0.23	Distinct deteriorating change
Åland Sea	0.32	0.48	Distinct improving change
Bothnian Sea	0.29	0.47	Distinct improving change
The Quark	0.46	0.37	Distinct deteriorating change
Bothnian Bay	0.41	0.50	Distinct improving change

5 Confidence

Confidence of the indicator status evaluation

The confidence of the indicator status evaluation is based on the spatial-, and temporal coverage of data as well as the accuracy of the classification result. The Quark, Åland Sea, Gulf of Finland Western, Gulf of Finland Eastern and Gulf of Riga assessments were determined to be of low overall confidence. High overall confidence was found in the Southwestern assessment units (Kattegat, Great Belt, Kiel Bay, Bay of Mecklenburg, Arkona Basin and Bornholm Basin). In the remaining open-sea basins, the overall Confidence was moderate for the indicator.

Accuracy was high in all assessment units, aside from Åland Sea, which was moderate, due to a very low amount of samples (7) and relatively high standard error. Spatial confidence was low in most of the assessment units. It was High in the Kattegat, Bay of Mecklenburg and Arkona Basin, and moderate in Kiel Bay and Gulf of Gdansk. Temporal confidence was high in most of the assessment units, but moderate in the Gulf of Gdansk and low in the Northern Baltic Proper, Gulf of Finland Western and Eastern, Gulf of Riga, Åland Sea and the Quark.

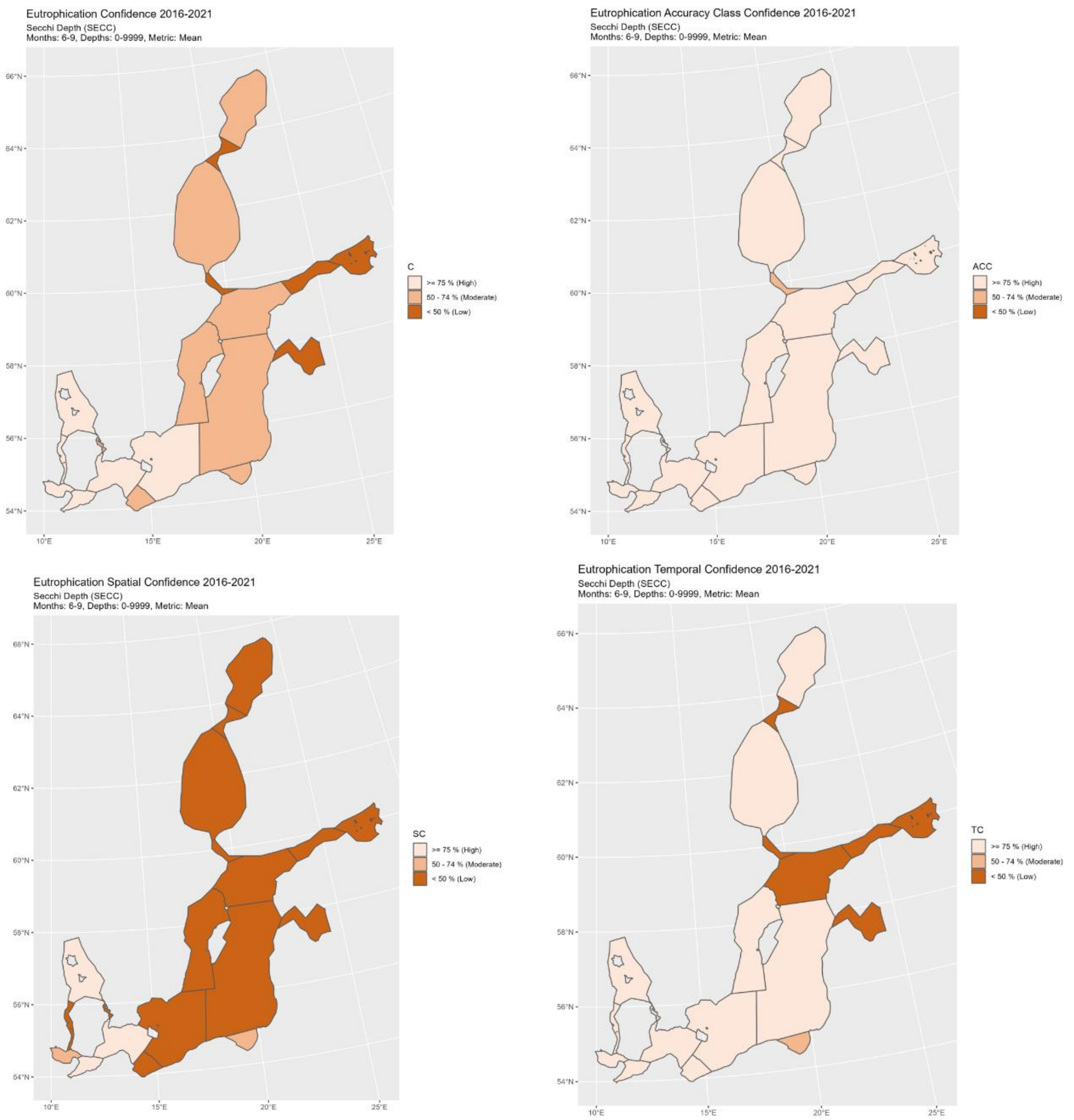


Figure 7. Indicator confidence (C), determined by combining information on spatial and temporal confidence and the confidence on accuracy of the GES evaluation, accuracy confidence (ACC), spatial confidence (SC) and temporal confidence (TC). Low indicator confidence calls for increase in monitoring.

6 Drivers, Activities, and Pressures

Water clarity in the Baltic Sea is affected mainly by the concentration of phytoplankton and chromophoric dissolved organic matter (CDOM). Of these, phytoplankton concentration is directly linked to anthropogenic pressures, i.e.. nutrient increase.

For HOLAS 3 initial work has been carried out to explore Drivers (and driver indicators) to evaluate how such information can be utilised within the DAPSIM management framework. It is recognised that only a small portion of the drivers via proxies such as relevant human activities have been addressed for eutrophication assessment. Wastewater treatment (Drivers and driver indicators for Wastewater Treatment) and agriculture (Drivers and driver indicators for Agricultural Nutrient Balance) have been explored in these pilot studies for HOLAS 3.

Diffuse sources constitute the highest proportion of total nitrogen (nearly 50%) and total phosphorus (about 56%) inputs to the Baltic Sea (HELCOM 2022a). For total nitrogen, atmospheric deposition on the sea has the second highest share (24%) followed by natural background loads (20%) and point sources (9%). Natural background loads have the second highest share of total phosphorus inputs to the Baltic Sea (20%), followed by point sources (17%) and atmospheric deposition (7%). Point sources include activities such as municipal wastewater treatment plants, industrial plants and aquacultural plants and diffuse sources consists of anthropogenic sources as agriculture, managed forestry, scattered dwellings, storm water etc.

A significant reduction of nutrient inputs has been achieved for the whole Baltic Sea. The normalized total input of nitrogen was reduced by 12% and phosphorus by 28 % between the reference period (1997-2003) and 2020 (HELCOM 2023). The maximum allowable input (MAI) of nitrogen in this period was fulfilled in the Bothnian Bay, Bothnian Sea, Danish Straits and Kattegat and the maximum allowable input of phosphorus in the Bothnian Bay, Bothnian Sea, Danish Straits and Kattegat.

Further developing an overview of such components and the relevant data to be able to better quantify the linkages within a causal framework provide the opportunity for more informed management decisions, for example targeting of measures, and can thereby support the achievement of Good Environmental Status.

Table 5. Brief summary of relevant pressures and activities with relevance to the indicator.

	General	Activity: MSFD Annex III, Table 2b	Pressure: MSFD Annex III, Table 2a
Strong link		Cultivation of living resources; Transport; Urban and industrial uses; Physical restructuring of rivers, coastline or seabed (water management)	Input of nutrients; input of organic matter
Weak link			

7 Climate change and other factors

The current knowledge of the effects of climate change to eutrophication is summarized in the HELCOM fact sheet for climate change (HELCOM and Baltic Earth 2021). The effect of climate change to the nutrient pools is not yet separable from the other pressures, and the future nutrient pools will dominantly be affected by the development of nutrient loading. The phytoplankton growth season has already prolonged due to changes in cloud cover and stratification. Climate change is, with medium confidence, considered to increase the stratification, further deteriorate near-bottom oxygen conditions and increase the internal nutrient loading. Increase in riverine dissolved organic carbon (DOC) discharge may also decrease the water clarity.

8 Conclusions

The status evaluation fails to achieve good status in all sub-basins except for Kattegat.

8.1 Future work or improvements needed

This indicator is fully operational and maintaining good monitoring is an important factor but the indicator evaluation itself is functional. The indicator should in the future be developed to include satellite remote sensing data for water clarity. For Pomeranian Bay a suitable threshold value needs to be developed. Furthermore, a better harmonisation of the thresholds for Secchi depth between coastal waters and the open Baltic Sea Basins might be necessary in the future, in particular in areas where coastal waters are already assessed as achieving good status while the open basins still fail to achieve good status.

9 Methodology

9.1 Scale of assessment

The core indicator is applicable in the 19 open sea assessment units (from one nautical mile from the baseline seawards).

The assessment units are defined in the HELCOM Monitoring and Assessment Strategy Annex 4.

9.2 Methodology applied

The open-sea core indicators are updated using data reported by Contracting Parties to the HELCOM COMBINE database hosted by ICES, using the algorithms developed for the eutrophication assessment work flow. The values are achieved using indicator specifications shown in Table 6 (see HELCOM Eutrophication assessment manual).

Table 6. Specifications of the core indicator water clarity.

Indicator	**Water clarity**
Response to eutrophication	negative
Parameters	Secchi depth (m)
Data source	Monitoring data provided by the HELCOM Contracting Parties, and kept in the HELCOM COMBINE database, hosted by ICES (www.ices.dk)
Assessment period	2016 – 2021
Assessment season	Summer = June + July + August + September
Depth	-
Removing outliers	No outliers removed
Removing close observations	No close observations removed
Indicator level	average of annual values for the average from June to September

Eutrophication quality ratio (EQR)	EQR = ES/ BEST, where BEST= ET / (1 - ACDEV / 100) ET= threshold (table 1) ACDEV= acceptable deviation: 25 % for water clarity The final EQRS values are scaled to five classes of 0.2 width.
Indicator confidence	The confidence assessment for eutrophication indicators is included in HEAT, and includes aspects of temporal, spatial and accuracy confidence. The general methodology of the confidence assessment is described in Document 4.2 of IN-Eutrophication 16-2020 and updates are described in documents 4J-80 of State & Conservation 14-2021 and 4-2 of EG-Eutrophication 20-2021. The R-code is available via https://github.com/ices-tools-prod/HEAT. The overall indicator confidence is calculated as the average of the aspects of temporal, spatial and accuracy confidence. The evaluation criteria for temporal confidence are given in the table below.

Confidence class	Evaluation criteria for general temporal confidence	Evaluation criteria for specific temporal confidence
High (100)	The evaluation is based on > 20 annual observations during the given assessment period	0 missing months per year
Medium (50)	The evaluation is based on 7 - 20 annual observations	1 missing month per year
Low (0)	The evaluation is based on < 7 annual observations	≥ 2 missing months per year

	If the specific temporal confidence is high (100) for at least half of the assessed years, it is set as high (100) for the assessment period. The total temporal confidence is the average of the general and specific temporal confidence aspects. The evaluation criteria for spatial confidence are given in the table below. Confidence class / Evaluation criteria for spatial confidence: High (100) – Sampled grid cells cover > 70 % of the assessment-unit area Medium (50) – Sampled grid cells cover 50-70 % of the assessment-unit area Low (0) – Sampled grid cells cover < 50 % of the assessment-unit area The accuracy aspect assesses the probability of correct classification (the classification being below or above the threshold for good status). The evaluation criteria for accuracy aspect are given in table below. Confidence class / Evaluation criteria for accuracy confidence: High (100) – GES has been/ not been achieved by ≥ 90 % probability Medium (50) – GES has been/ not been achieved by 70 - < 90 % probability Low (0) – GES has been/ not been achieved by < 70 % probability

Confidence class	Evaluation criteria for spatial confidence
High (100)	Sampled grid cells cover > 70 % of the assessment-unit area
Medium (50)	Sampled grid cells cover 50-70 % of the assessment-unit area
Low (0)	Sampled grid cells cover < 50 % of the assessment-unit area

Confidence class	Evaluation criteria for accuracy confidence
High (100)	GES has been/ not been achieved by ≥ 90 % probability
Medium (50)	GES has been/ not been achieved by 70 - < 90 % probability
Low (0)	GES has been/ not been achieved by < 70 % probability

In the eutrophication assessment, water clarity is included in criteria group “indirect effects” with bottom conditions (oxygen and benthic macrofauna indicators). The indicators were weighted according to their relevance for eutrophication in each sub-basin. As a general principle, the bottom conditions were given double the weight of water clarity due to their strong ecological significance (STATE & CONSERVATION 17-2022, document 5J-23 Rev.1).

For Secchi depth, the weight was further adjusted according to the available information on the light absorption by colored dissolved organic matter (CDOM) and the relationship between CDOM absorption and chlorophyll a concentration in the assessment unit (Table 7). Higher absorption of light by CDOM makes water clarity a less reliable indicator of eutrophication. Therefore, water clarity received a smaller weight in the basins with high CDOM concentration: the Gulf of Finland, Gulf of Riga and Gulf of Bothnia.

Table 7. Water clarity and bottom conditions (oxygen and benthic macrofauna indicators) have been weighted in eutrophication assessment according to available information on CDOM absorption of light and the relationship between CDOM light absorption and chlorophyll a (chl-a) concentration in the sub-basin. As a general principle, bottom conditions were given twice the weight of water clarity.

Basin	Weight of water clarity	Justification (1) Stedmon *et al*. 2000, 2) Ylöstalo *et al*. 2012)
Kattegat	0.34	No info
The Sound	0.34	Low CDOM absorption [1]
Great Belt	0.34	Low CDOM absorption [1]
Little Belt	0.34	Low CDOM absorption [1]
Kiel Bay	0.34	Assumed similar as in the Belts and Arkona Sea
Mecklenburg Bight	0.34	Assumed similar as in the Belts and Arkona Sea
Arkona Sea	0.34	Low CDOM absorption [2], medium in relation to chl-a
Bornholm Basin	0.34	Low CDOM absorption [2], medium in relation to chl-a
Pomeranian Bay	0.20	Threshold values for water clarity is not adapted for the assessment unit
Eastern Gotland Basin	0.34	Assumed similar as in the Northern Baltic Proper
Western Gotland Basin	0.34	Low CDOM absorption [2], medium in relation to chl-a
Gdansk Basin	0.34	No info
Gulf of Riga	0.20	Extremely high CDOM absorption [2], high in relation to chl-a.
Northern Baltic Proper	0.34	Medium CDOM absorption [2], medium in relation to chl-a
Gulf of Finland Western	0.20	High CDOM absorption [2], medium in relation to chl-a
Gulf of Finland Eastern	0.20	High CDOM absorption [2], medium in relation to chl-a
Åland Sea	0.34	Assumed similar as in the Northern Baltic Proper
Bothnian Sea	0.20	Medium CDOM absorption [2], medium-high in relation to chl-a
The Quark	0.20	Assumed to be similar as in the Bothnian Sea
Bothnian Bay	0.10	High CDOM absorption [2], extremely high in relation to chl-a.

9.3 Monitoring and reporting requirements

Monitoring methodology

Monitoring of water clarity in the Contracting Parties of HELCOM is described on a general level in the HELCOM Monitoring Manual in the sub-programme Water column hydrological characteristics.

Monitoring guidelines specifying the sampling strategy are adopted and published.

Current monitoring

The monitoring activities relevant to the indicator that are currently carried out by HELCOM Contracting Parties are described in the HELCOM Monitoring Manual Sub-programme sub-programme Water column hydrological characteristics**:** Monitoring concepts table.

Description of optimal monitoring

The regional monitoring effort is considered sufficient to support the indicator evaluation.

10 Data

The data and resulting data products (e.g. tables, figures and maps) available on the indicator web page can be used freely given that it is used appropriately and the source is cited.

Result: Water Clarity

Data source: The average for 2016-2021 was estimated using monitoring data provided by the HELCOM Contracting Parties, and kept in the HELCOM COMBINE database, hosted by ICES (www.ices.dk). Nominated members of HELCOM STATE & CONSERVATION group were given the opportunity to review the data, and to supply any missing monitoring observations, in order to achieve a complete dataset.

Description of data: The data includes secchi depth measurements explained in the HELCOM monitoring manual.

Geographical coverage: The observations are distributed in the sub-basins according to the HELCOM monitoring programme, added occasionally with data from research cruises.

Temporal coverage: The estimates are based on observations made between June – September during the assessment period 2016-2021.

Data aggregation: The 2016-2021 value for each assessment unit was produced as an inter-annual summer (June – September) average.

11 Contributors

Vivi Fleming and Laura Hoikkala from the Finnish Environment Institute, SYKE, Finland

HELCOM Secretariat: Joni Kaitaranta, Laura Kaikkonen, Theodor Hüttel.

12 Archive

This version of the HELCOM core indicator report was published in April 2023:

The current version of this indicator (including as a PDF) can be found on the HELCOM indicator web page.

Eaarlier versions of the core indicator report are available:

Water clarity HELCOM core indicator 2018 (pdf)

Water clarity -HELCOM core indicator report - HOLAS II component 2017 (pdf)

13 References

Directive 2000/60/EC of the European parliament and of the council of 23 October 2000 establishing a framework for community action in the field of water policy. Official Journal of the European Communities L 327/1.

Directive 2008/56/EC of the European Parliament and of the Council. 17 June 2008. Establishing a Framework for Community Action in the Field of Marine Environmental Policy. Marine Strategy Framework Directive. 22p.

Fleming, V. & Laamanen, M. (2012). Long-term changes in Secchi depth and the role of phytoplankton in explaining light attenuation in the Baltic Sea. Estuarine, Coastal and Shelf Science. s 102–103. 1–10. 10.1016/j.ecss.2012.02.015.

Fleming-Lehtinen, V., Räike, A., Kortelainen, P., Kauppila, P., Thomas, D. N. (2014) Organic carbon concentration in the northern coastal Baltic Sea between 1975 and 2011. Estuaries and coasts 38, 466-481.

HELCOM (2009) Eutrophication in the Baltic Sea – An integrated thematic assessment of the effects of nutrient enrichment and eutrophication in the Baltic Sea region. Balt. Sea Environ. Proc. No. 115B

HELCOM (2013) Approaches and methods for eutrophication target setting in the Baltic Sea region. Balt. Sea Environ. Proc. No. 133

HELCOM (2021) “Baltic Sea Action Plan. 2021 Update.” https://helcom.fi/wp-content/uploads/2021/10/Baltic-Sea-Action-Plan-2021-update.pdf.

HELCOM (2022) Assessment of sources of nutrient inputs to the Baltic Sea in 2017." https://helcom.fi/wp-content/uploads/2022/12/PLC-7-Assessment-of-sources-of-nutrient-inputs-to-the-Baltic-Sea-in-2017.pdf

HELCOM (2023) “Inputs of Nutrients to the Sub-Basins (2023). HELCOM Core Indicator Report. Online.” 2023.

HELCOM and Baltic Earth (2021) Climate Change in the Baltic Sea. 2021 Fact Sheet. Baltic Sea Environment Proceedings N°180. https://doi.org/ISSN: 0357-2994.

Stedmon, C.A., Markager, S., Kaas, H., 2000. Optical properties and signatures of chromophoric dissolved organic matter (CDOM) in Danish coastal waters. Estuarine, Coastal and Shelf Science 51, 267-278.

Ylöstalo, P., Seppälä, J., Kaitala, S., in prep. Spatial and seasonal variations in CDOM absorption and its relation to dissolved organic carbon and nitrogen concentrations in the Baltic Sea.

14 Other relevant resources

Additional information related to coastal evaluations is provided below.

Annex Overview of coastal evaluations reported by some Contracting Parties

Annex table 1. Results for national coastal Secchi depth indicators by coastal WFD assessment areas. The table includes information on the assessment unit (CODE, defined in the HELCOM Monitoring and Assessment Strategy Annex 4), assessment period (start year and end year), average condition during assessment period in m (ES) with standard deviation (SD), threshold values in m (ET), units, Ecological Quality Ratio (EQR) and Ecological Quality Ratio Scaled (EQRS). EQRS shows the present concentration in relation to the threshold value, decreasing along with increasing eutrophication. EQRS_class estimates the ecological status based on the EQRS value.

IndicatorID	Name	Period	Unit ID	HELCOMID	HELCOM ID description	Assessment Unit	ET	ES	SD	EQR	EQRS	EQRS Class
1007	Secchi Depth	20162020	1001	GER-001	mesohaline inner coastal waters, Wismarbucht, Suedteil	Bay of Mecklenburg	3.84	2.71	NA	0.53	0.19	Bad
1007	Secchi Depth	20162020	1002	GER-002	mesohaline inner coastal waters, Wismarbucht, Nordteil	Bay of Mecklenburg	3.84	4.01	NA	0.78	0.67	Good
1007	Secchi Depth	20162020	1003	GER-003	mesohaline inner coastal waters, Wismarbucht, Salzhaff	Bay of Mecklenburg	3.84	2.93	NA	0.57	0.24	Poor
1007	Secchi Depth	20162020	1004	GER-004	mesohaline open coastal waters, Suedliche Mecklenburger Bucht/ Travemuende bis Warnemünde	Bay of Mecklenburg	4.07	4.69	NA	0.87	0.82	High

1007	Secchi Depth	20162020	1005	GER-005	mesohaline inner coastal waters, Unterwarnow	Bay of Mecklenburg	1.85	1.93	NA	0.78	0.67	Good
1007	Secchi Depth	20162020	1006	GER-006	mesohaline open coastal waters, Suedliche Mecklenburger Bucht/ Warnemünde bis Darss	Bay of Mecklenburg	4.07	4.42	NA	0.81	0.73	Good
1007	Secchi Depth	20162020	1007	GER-007	oligohaline inner coastal waters, Ribnitzer See / Saaler Bodden	Arkona Basin	1.42	0.23	NA	0.12	0.04	Bad
1007	Secchi Depth	20162020	1008	GER-008	oligohaline inner coastal waters, Koppelstrom / Bodstedter Bodden	Arkona Basin	1.42	0.31	NA	0.16	0.06	Bad
1007	Secchi Depth	20162020	1009	GER-009	mesohaline inner coastal waters, Barther Bodden, Grabow	Arkona Basin	1.85	0.45	NA	0.18	0.07	Bad
1007	Secchi Depth	20162020	1010	GER-010	mesohaline open coastal waters, Prerowbucht/ Darsser Ort bis Dornbusch	Arkona Basin	2.90	3.71	NA	0.96	0.95	High

1007	Secchi Depth	20162020	1011	GER-011	mesohaline inner coastal waters, Westruegensche Bodden	Arkona Basin	1.85	1.90	NA	0.77	0.64	Good
1007	Secchi Depth	20162020	1012	GER-012	mesohaline inner coastal waters, Strelasund	Arkona Basin	1.85	1.29	NA	0.52	0.19	Bad
1007	Secchi Depth	20162020	1013	GER-013	mesohaline inner coastal waters, Greifswalder Bodden	Arkona Basin	1.85	1.81	NA	0.73	0.56	Moderate
1007	Secchi Depth	20162020	1014	GER-014	mesohaline inner coastal waters, Kleiner Jasmunder Bodden	Arkona Basin	1.85	0.37	NA	0.15	0.05	Bad
1007	Secchi Depth	20162020	1015	GER-015	mesohaline open coastal waters, Nord- und Ostruegensche Gewaesser	Arkona Basin	2.90	3.39	NA	0.88	0.83	High
1007	Secchi Depth	20162020	1016	GER-016	oligohaline inner coastal waters, Peenestrom	Bornholm Basin	1.42	0.57	NA	0.30	0.11	Bad
1007	Secchi Depth	20162020	1017	GER-017	oligohaline inner coastal waters, Achterwasser	Bornholm Basin	1.42	0.44	NA	0.23	0.09	Bad
1007	Secchi Depth	20162020	1018	GER-018	mesohaline open coastal waters,	Arkona Basin	2.90	2.90	NA	0.75	0.60	Moderate

					Pommersche Bucht, Nordteil							
1007	Secchi Depth	20162020	1019	GER-019	mesohaline open coastal waters, Pommersche Bucht, Südteil	Bornholm Basin	2.90	2.90	NA	0.75	0.60	Moderate
1007	Secchi Depth	20162020	1020	GER-020	oligohaline inner coastal waters, Kleines Haff	Bornholm Basin	1.42	1.27	NA	0.67	0.43	Moderate
1007	Secchi Depth	20132018	1021	GER-021	mesohaline inner coastal waters, Flensburg Innenfoerde	Kiel Bay	7.20	3.84	NA	0.40	0.15	Bad
1007	Secchi Depth	20132018	1022	GER-022	mesohaline open coastal waters, Geltinger Bucht	Kiel Bay	7.20	5.65	NA	0.59	0.28	Poor
1007	Secchi Depth	20132018	1023	GER-023	meso- to polyhaline open coastal waters, seasonally stratified, Flensburger Aussenfoerde	Kiel Bay	7.20	5.65	NA	0.59	0.28	Poor
1007	Secchi Depth	20132018	1024	GER-024	mesohaline open coastal waters, Aussenschlei	Kiel Bay	7.20	5.46	NA	0.57	0.24	Poor

1007	Secchi Depth	20132018	1025	GER-025	mesohaline inner coastal waters, Schleimuende	Kiel Bay	7.20	1.62	NA	0.17	0.06	Bad
1007	Secchi Depth	20132018	1026	GER-026A	A.mesohaline inner coastal waters, Mittlere Schlei	Kiel Bay	6.10	0.83	NA	0.10	0.04	Bad
1007	Secchi Depth	20132018	1027	GER-026B	B.mesohaline inner coastal waters, Mittlere Schlei	Kiel Bay	6.10	0.66	NA	0.08	0.03	Bad
1007	Secchi Depth	20132018	1028	GER-027	mesohaline inner coastal waters, Innere Schlei	Kiel Bay	6.10	0.66	NA	0.08	0.03	Bad
1007	Secchi Depth	20132018	1029	GER-028	mesohaline open coastal waters, Eckerfoerder Bucht, Rand	Kiel Bay	7.20	5.84	NA	0.61	0.32	Poor
1007	Secchi Depth	20132018	1030	GER-029	meso- to polyhaline open coastal waters, seasonally stratified, Eckerfoerderbucht, Tiefe	Kiel Bay	7.20	5.39	NA	0.56	0.22	Poor
1007	Secchi Depth	20132018	1031	GER-030	mesohaline open coastal waters, Buelk	Kiel Bay	7.20	5.39	NA	0.56	0.22	Poor
1007	Secchi Depth	20132018	1032	GER-031	meso- to polyhaline open coastal waters,	Kiel Bay	7.20	5.46	NA	0.57	0.24	Poor

					seasonally stratified, Kieler Aussenfoerde							
1007	Secchi Depth	20132018	1033	GER-032	mesohaline inner coastal waters, Kieler Innenfoerde	Kiel Bay	7.20	3.80	NA	0.40	0.14	Bad
1007	Secchi Depth	20132018	1034	GER-033	mesohaline open coastal waters, Probstei	Kiel Bay	7.20	5.33	NA	0.56	0.21	Poor
1007	Secchi Depth	20132018	1035	GER-034	mesohaline open coastal waters, Putlos	Kiel Bay	7.20	5.33	NA	0.56	0.21	Poor
1007	Secchi Depth	20132018	1036	GER-035	meso- to polyhaline open coastal waters, seasonally stratified, Hohwachter Bucht	Kiel Bay	7.20	5.44	NA	0.57	0.23	Poor
1007	Secchi Depth	20132018	1037	GER-036A	A.mesohaline open coastal waters, Fehmarnsund	Kiel Bay	7.20	3.71	NA	0.39	0.14	Bad
1007	Secchi Depth	20132018	1038	GER-036B	B.mesohaline open coastal waters, Fehmarnsund	Bay of Mecklenburg	7.20	4.38	NA	0.46	0.17	Bad
1007	Secchi Depth	20132018	1039	GER-037	mesohaline inner coastal waters, Orther Bucht	Kiel Bay	7.20	3.51	NA	0.37	0.13	Bad

1007	Secchi Depth	20132018	1040	GER-038A	A.mesohaline open coastal waters, Fehmarnbelt	Kiel Bay	7.20	5.54	NA	0.58	0.25	Poor
1007	Secchi Depth	20132018	1041	GER-038B	B.mesohaline open coastal waters, Fehmarnbelt	Bay of Mecklenburg	7.20	5.54	NA	0.58	0.25	Poor
1007	Secchi Depth	20132018	1042	GER-039	meso- to polyhaline open coastal waters, seasonally stratified, Fehmarn Sund Ost	Bay of Mecklenburg	7.20	5.74	NA	0.60	0.30	Poor
1007	Secchi Depth	20132018	1043	GER-040	mesohaline open coastal waters, Groemitz	Bay of Mecklenburg	7.20	5.67	NA	0.59	0.28	Poor
1007	Secchi Depth	20132018	1044	GER-041	mesohaline open coastal waters, Neustaedter Bucht	Bay of Mecklenburg	7.20	5.66	NA	0.59	0.28	Poor
1007	Secchi Depth	20132018	1045	GER-042	mesohaline inner coastal waters, Travemuende	Bay of Mecklenburg	7.20	2.18	NA	0.23	0.08	Bad
1007	Secchi Depth	20132018	1046	GER-043	mesohaline inner coastal waters, Poetenitzer Wiek	Bay of Mecklenburg	6.10	2.18	NA	0.27	0.10	Bad
1007	Secchi Depth	20132018	1047	GER-044	mesohaline inner coastal waters, Untere Trave	Bay of Mecklenburg	6.10	1.75	NA	0.21	0.08	Bad

1007	Secchi Depth	20162020	1048	GER-111	mesohaline inner coastal waters, Nordruegensche Bodden	Arkona Basin	1.85	1.27	NA	0.51	0.19	Bad
2007	Secchi Depth	20142019	2001	DEN-001	Roskilde Fjord, ydre	Kattegat	NA	NA	NA	0.42	0.34	Poor
2007	Secchi Depth	20142019	2002	DEN-002	Roskilde Fjord, indre	Kattegat	NA	NA	NA	0.68	0.55	Moderate
2007	Secchi Depth	20142019	2006	DEN-006	Nordlige Øresund	The Sound	NA	NA	NA	0.74	0.61	Good
2007	Secchi Depth	20142019	2016	DEN-016	Korsør Nor	Great Belt	NA	NA	NA	0.56	0.45	Moderate
2007	Secchi Depth	20142019	2017	DEN-017	Basnæs Nor	Great Belt	NA	NA	NA	0.51	0.41	Moderate
2007	Secchi Depth	20142019	2018	DEN-018	Holsteinborg Nor	Great Belt	NA	NA	NA	0.75	0.61	Good
2007	Secchi Depth	20142019	2024	DEN-024	Isefjord, ydre	Kattegat	NA	NA	NA	0.66	0.53	Moderate
2007	Secchi Depth	20142019	2025	DEN-025	Skælskør Fjord og Nor	Great Belt	NA	NA	NA	0.67	0.54	Moderate
2007	Secchi Depth	20142019	2028	DEN-028	Sejerø Bugt	Great Belt	NA	NA	NA	0.57	0.46	Moderate
2007	Secchi Depth	20142019	2029	DEN-029	Kalundborg Fjord	Great Belt	NA	NA	NA	0.62	0.50	Moderate
2007	Secchi Depth	20142019	2034	DEN-034	Smålandsfarvandet, syd	Great Belt	NA	NA	NA	0.63	0.51	Moderate
2007	Secchi Depth	20142019	2035	DEN-035	Karrebæk Fjord	Great Belt	NA	NA	NA	0.55	0.44	Moderate
2007	Secchi Depth	20142019	2036	DEN-036	Dybsø Fjord	Great Belt	NA	NA	NA	0.83	0.71	Good

2007	Secchi Depth	20142019	2037	DEN-037	Avnø Fjord	Great Belt	NA	NA	NA	0.55	0.44	Moderate
2007	Secchi Depth	20142019	2044	DEN-044	Hjelm Bugt	Arkona Basin	NA	NA	NA	0.66	0.53	Moderate
2007	Secchi Depth	20142019	2046	DEN-046	Fakse Bugt	Arkona Basin	NA	NA	NA	0.60	0.49	Moderate
2007	Secchi Depth	20142019	2047	DEN-047	Præstø Fjord	Arkona Basin	NA	NA	NA	0.59	0.48	Moderate
2007	Secchi Depth	20142019	2048	DEN-048	Stege Bugt	Arkona Basin	NA	NA	NA	0.51	0.40	Moderate
2007	Secchi Depth	20142019	2049	DEN-049	Stege Nor	Arkona Basin	NA	NA	NA	0.49	0.40	Poor
2007	Secchi Depth	20142019	2059	DEN-059	Nærå Strand	Great Belt	NA	NA	NA	0.26	0.21	Poor
2007	Secchi Depth	20142019	2062	DEN-062	Lillestrand	Great Belt	NA	NA	NA	0.39	0.31	Poor
2007	Secchi Depth	20142019	2068	DEN-068	Lindelse Nor	Great Belt	NA	NA	NA	0.64	0.51	Moderate
2007	Secchi Depth	20142019	2072	DEN-072	Kløven	Great Belt	NA	NA	NA	0.62	0.50	Moderate
2007	Secchi Depth	20142019	2074	DEN-074	Bredningen	Great Belt	NA	NA	NA	0.19	0.15	Bad
2007	Secchi Depth	20142019	2080	DEN-080	Gamborg Fjord	Great Belt	NA	NA	NA	0.73	0.59	Moderate
2007	Secchi Depth	20142019	2082	DEN-082	Aborg Minde Nor	Great Belt	NA	NA	NA	0.12	0.09	Bad
2007	Secchi Depth	20142019	2083	DEN-083	Holckenhavn Fjord	Great Belt	NA	NA	NA	0.32	0.26	Poor
2007	Secchi Depth	20142019	2084	DEN-084	Kerteminde Fjord	Great Belt	NA	NA	NA	0.79	0.67	Good

2007	Secchi Depth	20142019	2085	DEN-085	Kertinge Nor	Great Belt	NA	NA	NA	0.56	0.45	Moderate
2007	Secchi Depth	20142019	2086	DEN-086	Nyborg Fjord	Great Belt	NA	NA	NA	0.62	0.50	Moderate
2007	Secchi Depth	20142019	2087	DEN-087	Helnæs Bugt	Great Belt	NA	NA	NA	0.66	0.53	Moderate
2007	Secchi Depth	20142019	2089	DEN-089	Lunkebugten	Great Belt	NA	NA	NA	0.67	0.54	Moderate
2007	Secchi Depth	20142019	2090	DEN-090	Langelandssund	Great Belt	NA	NA	NA	0.71	0.57	Moderate
2007	Secchi Depth	20142019	2092	DEN-092	Odense Fjord, ydre	Great Belt	NA	NA	NA	0.65	0.52	Moderate
2007	Secchi Depth	20142019	2093	DEN-093	Odense Fjord, Seden Strand	Great Belt	NA	NA	NA	0.25	0.20	Bad
2007	Secchi Depth	20142019	2101	DEN-101	Genner Bugt	Great Belt	NA	NA	NA	0.48	0.38	Poor
2007	Secchi Depth	20142019	2102	DEN-102	Åbenrå Fjord	Great Belt	NA	NA	NA	0.53	0.43	Moderate
2007	Secchi Depth	20142019	2103	DEN-103	Als Fjord	Great Belt	NA	NA	NA	0.52	0.41	Moderate
2007	Secchi Depth	20142019	2104	DEN-104	Als Sund	Great Belt	NA	NA	NA	0.76	NA	NA
2007	Secchi Depth	20142019	2105	DEN-105	Augustenborg Fjord	Great Belt	NA	NA	NA	0.44	0.35	Poor
2007	Secchi Depth	20142019	2108	DEN-108	Avnø Vig	Great Belt	NA	NA	NA	0.33	0.26	Poor
2007	Secchi Depth	20142019	2109	DEN-109	Hejlsminde Nor	Great Belt	NA	NA	NA	0.43	0.34	Poor
2007	Secchi Depth	20142019	2110	DEN-110	Nybøl Nor	Great Belt	NA	NA	NA	0.58	0.47	Moderate
2007	Secchi Depth	20142019	2113	DEN-113	Flensborg Fjord, indre	Great Belt	NA	NA	NA	0.53	0.42	Moderate

2007	Secchi Depth	20142019	2114	DEN-114	Flensborg Fjord, ydre	Great Belt	NA	NA	NA	0.53	0.42	Moderate
2007	Secchi Depth	20142019	2123	DEN-123	Vejle Fjord, indre	Great Belt	NA	NA	NA	0.61	0.49	Moderate
2007	Secchi Depth	20142019	2124	DEN-124	Kolding Fjord, indre	Great Belt	NA	NA	NA	0.41	0.32	Poor
2007	Secchi Depth	20142019	2125	DEN-125	Kolding Fjord, ydre	Great Belt	NA	NA	NA	0.52	0.42	Moderate
2007	Secchi Depth	20142019	2128	DEN-128	Horsens Fjord, indre	Great Belt	NA	NA	NA	0.52	0.42	Moderate
2007	Secchi Depth	20142019	2137	DEN-137	Randers Fjord, ydre	Kattegat	NA	NA	NA	0.37	0.29	Poor
2007	Secchi Depth	20142019	2138	DEN-138	Hevring Bugt	Kattegat	NA	NA	NA	0.75	0.61	Good
2007	Secchi Depth	20142019	2140	DEN-140	Djursland Øst	Kattegat	NA	NA	NA	0.80	0.68	Good
2007	Secchi Depth	20142019	2141	DEN-141	Ebeltoft Vig	Great Belt	NA	NA	NA	0.77	0.64	Good
2007	Secchi Depth	20142019	2142	DEN-142	Stavns Fjord	Great Belt	NA	NA	NA	0.49	0.39	Poor
2007	Secchi Depth	20142019	2144	DEN-144	Knebel Vig	Great Belt	NA	NA	NA	0.67	0.54	Moderate
2007	Secchi Depth	20142019	2145	DEN-145	Kalø Vig	Great Belt	NA	NA	NA	0.77	0.64	Good
2007	Secchi Depth	20142019	2146	DEN-146	Norsminde Fjord	Great Belt	NA	NA	NA	0.38	0.30	Poor
2007	Secchi Depth	20142019	2147	DEN-147	Århus Bugt og Begtrup Vig	Great Belt	NA	NA	NA	0.82	0.70	Good
2007	Secchi Depth	20142019	2157	DEN-157	Bjørnholms Bugt, Riisgårde Bredning, Skive Fjord og Lovns Bredning	Kattegat	NA	NA	NA	0.42	0.34	Poor

2007	Secchi Depth	20142019	2158	DEN-158	Hjarbæk Fjord	Kattegat	NA	NA	NA	0.25	0.20	Poor
2007	Secchi Depth	20142019	2159	DEN-159	Mariager Fjord, indre	Kattegat	NA	NA	NA	0.30	0.24	Poor
2007	Secchi Depth	20142019	2160	DEN-160	Mariager Fjord, ydre	Kattegat	NA	NA	NA	0.57	0.46	Moderate
2007	Secchi Depth	20142019	2165	DEN-165	Isefjord, indre	Kattegat	NA	NA	NA	0.81	0.68	Good
2007	Secchi Depth	20142019	2200	DEN-200	Kattegat, Nordsjælland	Kattegat	NA	NA	NA	0.67	0.54	Moderate
2007	Secchi Depth	20142019	2201	DEN-201	Køge Bugt	Arkona Basin	NA	NA	NA	0.68	0.55	Moderate
2007	Secchi Depth	20142019	2204	DEN-204	Jammerland Bugt og Musholm Bugt	Great Belt	NA	NA	NA	0.51	0.41	Moderate
2007	Secchi Depth	20142019	2205	DEN-205	Kattegat, Nordsjælland >20 m	Kattegat	NA	NA	NA	0.76	0.62	Good
2007	Secchi Depth	20142019	2206	DEN-206	Smålandsfarvandet, åbne del	Great Belt	NA	NA	NA	0.62	0.50	Moderate
2007	Secchi Depth	20142019	2207	DEN-207	Nakskov Fjord	Great Belt	NA	NA	NA	0.59	0.48	Moderate
2007	Secchi Depth	20142019	2209	DEN-209	Rødsand og Bredningen	Great BeltandBay of Mecklenburg	NA	NA	NA	0.72	0.58	Moderate
2007	Secchi Depth	20142019	2212	DEN-212	Faaborg Fjord	Great Belt	NA	NA	NA	0.62	0.50	Moderate
2007	Secchi Depth	20142019	2214	DEN-214	Det Sydfynske Øhav	Great Belt	NA	NA	NA	0.49	0.39	Poor

2007	Secchi Depth	20142019	2216	DEN-216	Lillebælt, syd	Great Belt	NA	NA	NA	0.69	0.56	Moderate
2007	Secchi Depth	20142019	2217	DEN-217	Lillebælt, Bredningen	Great Belt	NA	NA	NA	0.57	0.46	Moderate
2007	Secchi Depth	20142019	2219	DEN-219	Århus Bugt syd, Samsø og Nordlige Bælthav	Great Belt	NA	NA	NA	0.72	0.59	Moderate
2007	Secchi Depth	20142019	2222	DEN-222	Kattegat, Aalborg Bugt	Kattegat	NA	NA	NA	0.74	0.60	Good
2007	Secchi Depth	20142019	2224	DEN-224	Nordlige Lillebælt	Great Belt	NA	NA	NA	0.72	0.59	Moderate
2007	Secchi Depth	20142019	2231	DEN-231	Lillebælt, Snævringen	Great Belt	NA	NA	NA	0.54	0.43	Moderate
2007	Secchi Depth	20142019	2232	DEN-232	Nissum Bredning	Kattegat	NA	NA	NA	0.58	0.47	Moderate
2007	Secchi Depth	20142019	2233	DEN-233	Kås Bredning og Venø Bugt	Kattegat	NA	NA	NA	0.45	0.36	Poor
2007	Secchi Depth	20142019	2234	DEN-234	Løgstør Bredning	Kattegat	NA	NA	NA	0.52	0.42	Moderate
2007	Secchi Depth	20142019	2235	DEN-235	Nibe Bredning og Langerak	Kattegat	NA	NA	NA	0.69	0.56	Moderate
2007	Secchi Depth	20142019	2236	DEN-236	Thisted Bredning	Kattegat	NA	NA	NA	0.37	0.30	Poor
2007	Secchi Depth	20142019	2238	DEN-238	Halkær Bredning	Kattegat	NA	NA	NA	0.24	0.19	Bad
3003	Secchi Depth	20162021	3001	EST-001	Narva-Kunda Bay CWB	Gulf of Finland	NA	NA	NA	0.61	0.49	Moderate

3003	Secchi Depth	20162020	3002	EST-002	Eru-Käsmu Bay CWB	Gulf of Finland	NA	NA	NA	0.55	0.44	Moderate
3003	Secchi Depth	20212021	3003	EST-003	Hara and Kolga Bay CWB	Gulf of Finland	NA	NA	NA	0.38	0.25	Poor
3003	Secchi Depth	20162021	3004	EST-005	Muuga-Tallinna-Kakumäe Bay CWB	Gulf of Finland	NA	NA	NA	0.49	0.38	Poor
3003	Secchi Depth	20212021	3005	EST-006	Pakri Bay CWB	Gulf of Finland	NA	NA	NA	0.45	0.37	Poor
3003	Secchi Depth	20212021	3006	EST-007	Hiiu Shallow CWB	Gulf of Riga	NA	NA	NA	0.32	0.18	Bad
3003	Secchi Depth	20182021	3007	EST-008	Haapsalu Bay CWB	Gulf of Riga	NA	NA	NA	0.29	0.17	Bad
3003	Secchi Depth	20212021	3009	EST-010	Soela Strait CWB	Northern Baltic Proper	NA	NA	NA	0.76	0.58	Moderate
3003	Secchi Depth	20212021	3010	EST-011	Kihelkonna Bay CWB	Eastern Gotland Basin	NA	NA	NA	0.53	0.44	Moderate
3003	Secchi Depth	20162021	3011	EST-013	Pärnu Bay CWB	Gulf of Riga	NA	NA	NA	0.28	0.15	Bad
3003	Secchi Depth	20162018	3012	EST-014	Kassari-Õunaku Bay CWB	Gulf of Riga	NA	NA	NA	0.70	0.56	Moderate
3003	Secchi Depth	20212021	3013	EST-016	Väinameri CWB	Gulf of Riga	NA	NA	NA	0.65	0.52	Moderate
3003	Secchi Depth	20212021	3014	EST-017	NW part of the Gulf of Riga CWB	Gulf of Riga	NA	NA	NA	NA	NA	NA

3003	Secchi Depth	20212021	3015	EST-018	NE part of the Gulf of Riga CWB	Gulf of Riga	NA	NA	NA	NA	NA	NA
3003	Secchi Depth	20212021	3016	EST-019	Central part of the Gulf of Riga CWB	Gulf of Riga	NA	NA	NA	0.60	0.49	Moderate
4005	Secchi Depth	20162021	4001	FIN-001	Lounainen sisäsaaristo	Åland Sea	NA	NA	NA	NA	0.29	Poor
4005	Secchi Depth	20162021	4002	FIN-002	Lounainen ulkosaaristo	Åland Sea	NA	NA	NA	NA	0.40	Poor
4005	Secchi Depth	20162021	4003	FIN-003	Suomenlahden sisäsaaristo	Gulf of Finland	NA	NA	NA	NA	0.41	Moderate
4005	Secchi Depth	20162021	4004	FIN-004	Suomenlahden ulkosaaristo	Gulf of Finland	NA	NA	NA	NA	0.50	Moderate
4005	Secchi Depth	20162021	4005	FIN-005	Lounainen välisaaristo	Åland Sea	NA	NA	NA	NA	0.33	Poor
4005	Secchi Depth	20162021	4006	FIN-006	Merenkurkun sisäsaaristo	The Quark	NA	NA	NA	NA	0.55	Moderate
4005	Secchi Depth	20162021	4007	FIN-007	Merenkurkun ulkosaaristo	The Quark	NA	NA	NA	NA	0.64	Good
4005	Secchi Depth	20162021	4008	FIN-008	Selkämeren sisemmät rannikkovedet	Bothnian Sea	NA	NA	NA	NA	0.41	Moderate
4005	Secchi Depth	20162021	4009	FIN-009	Selkämeren ulommat rannikkovedet	Bothnian Sea	NA	NA	NA	NA	0.61	Good

4005	Secchi Depth	20162021	4010	FIN-010	Perämeren sisemmät rannikkovedet	Bothnian Bay	NA	NA	NA	NA	0.46	Moderate
4005	Secchi Depth	20162021	4011	FIN-011	Perämeren ulommat rannikkovedet	Bothnian Bay	NA	NA	NA	NA	0.53	Moderate
4005	Secchi Depth	20162021	4012	FIN-012	Åland innerskärgård	Åland Sea	NA	NA	NA	0.37	0.37	Poor
4005	Secchi Depth	20162021	4013	FIN-013	Åland mellanskärgård	Åland Sea	NA	NA	NA	0.53	0.49	Moderate
4005	Secchi Depth	20162021	4014	FIN-014	Åland ytterskärgård	Åland Sea	NA	NA	NA	0.60	0.53	Moderate
7011	Secchi Depth	20162021	7001	POL-001	PL TW I WB 9 very sheltered, fully mixed, substratum: silt/sandy silt/silty sand; ice cover >90 days, water residence time 52 days	Bornholm Basin	1.90	1.45	0.26	0.57	0.29	Poor
7011	Secchi Depth	20162021	7002	POL-002	PL TW I WB 8 very sheltered, fully mixed, substratum: silt/sandy silt/silty sand; ice cover >90 days, water residence time 52 days	Bornholm Basin	1.90	1.33	0.18	0.52	0.22	Poor
7011	Secchi Depth	20162021	7003	POL-003	PL TW I WB 1 very sheltered, fully mixed, substratum: silt/sandy silt/silty	Gdansk Basin	0.75	0.43	0.12	0.43	0.16	Bad

					sand; ice cover >90 days, water residence time 52 days							
7011	Secchi Depth	20162021	7004	POL-004	PL TW II WB 2 very sheltered, fully mixed, substratum: lagoonal fine snd medium grained sand/silty sand; residence time 138 day, ice cover >90 days	Gdansk Basin	1.50	2.16	0.17	1.00	1.00	High
7012	Secchi Depth	20162021	7005	POL-005	PL TW III WB 3 partly protected, partly stratified, substratum: medium grained sand/pebbles/marine silty sand; ice-incidental	Gdansk Basin	4.50	4.22	0.63	0.70	0.51	Moderate
7012	Secchi Depth	20162021	7006	POL-006	PL TW IV WB 4 partly stratified, moderately exposed, substratum: sand/silt; ice - incidental	Gdansk Basin	4.50	3.67	0.66	0.61	0.35	Poor
7012	Secchi Depth	20162021	7007	POL-007	PL TW V WB 6 river mouth, partly stratified, partly sheltered,	Bornholm Basin	4.50	2.28	0.87	0.38	0.16	Bad

					substratum: medium grained sand/silty sand							
7012	Secchi Depth	20162021	7008	POL-008	PL TW V WB 5 river mouth, partly stratified, partly sheltered, substratum: medium grained sand/silty sand	Gdansk Basin	3.00	2.33	0.87	0.58	0.34	Poor
7012	Secchi Depth	20162021	7009	POL-009	PL TW V WB 7 river mouth, partly stratified, partly sheltered, substratum: medium grained sand/silty sand	Bornholm Basin	3.75	2.16	0.48	0.43	0.18	Bad
7012	Secchi Depth	20162021	7010	POL-010	PL CWI WB2 coastal waters, moderately exposed, fully mixed, substratum:sand/fine sand	Gdansk Basin	5.60	4.40	0.55	0.59	0.30	Poor
7012	Secchi Depth	20162021	7011	POL-011	PL CWI WB1 coastal waters, moderately exposed, fully mixed, substratum:sand/fine sand	Gdansk Basin	3.50	3.50	0.60	0.75	0.59	Moderate

7012	Secchi Depth	20162021	7012	POL-012	PL CWI WB3 coastal waters, moderately exposed, fully mixed, substratum:sand/fine sand	Gdansk Basin	5.60	2.47	0.56	0.33	0.12	Bad
7012	Secchi Depth	20162021	7013	POL-013	PL CW II WB 8 central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Bornholm Basin	5.60	3.50	0.94	0.47	0.20	Poor
7012	Secchi Depth	20162021	7014	POL-014	PL CW II WB 6W central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Bornholm Basin	5.60	4.06	0.46	0.54	0.24	Poor
7012	Secchi Depth	20162021	7015	POL-015	PL CW II WB 6E central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Bornholm Basin	5.60	4.41	0.51	0.59	0.29	Poor
7012	Secchi Depth	20162021	7016	POL-016	PL CWII WB5 central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Eastern Gotland Basin	5.60	4.13	0.62	0.55	0.26	Poor
7012	Secchi Depth	20162021	7017	POL-017	PL CWII WB4 central Polish coast, coastal	Gdansk Basin	5.60	5.13	0.82	0.69	0.47	Moderate

					waters, exposed, fully mixed, substratum: sand/pebbles/gravel							
7012	Secchi Depth	20162021	7018	POL-018	PL CW III WB 9 central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Bornholm Basin	3.80	3.24	0.68	0.64	0.38	Poor
7012	Secchi Depth	20162021	7019	POL-019	PL CW III WB 7 central Polish coast, coastal waters, exposed, fully mixed, substratum: sand/pebbles/gravel	Bornholm Basin	5.60	3.46	0.90	0.46	0.20	Bad
8007	Secchi Depth	20182018	8001	SWE-001	1s West Coast inner coastal water	Kattegat	5.52	6.84	NA	0.86	0.85	High
8007	Secchi Depth	20182018	8002	SWE-003	4 West Coast outer coastal water, Kattegat	Kattegat	7.98	8.55	NA	0.82	0.68	Good
8007	Secchi Depth	20182018	8003	SWE-004	5 South Halland and north Öresund coastal water	Kattegat	7.98	6.80	NA	0.65	0.52	Moderate
8007	Secchi Depth	20182018	8004	SWE-005	6 Öresund inner coastal water	The Sound	7.50	5.08	NA	0.51	0.44	Moderate
8007	Secchi Depth	20172017	8005	SWE-006	7 Skåne coastal water	Arkona Basin	7.00	7.18	NA	0.72	0.63	Good

8007	Secchi Depth	20182018	8008	SWE-009	10 Öland and Gotland coastal water	Eastern Gotland Basin	7.00	3.80	NA	0.38	0.38	Poor
8007	Secchi Depth	20182018	8009	SWE-010	11 Gotland north-west coastal water	Western Gotland Basin	7.00	4.03	NA	0.40	0.40	Moderate
8007	Secchi Depth	20172017	8010	SWE-011	12n Östergötland and Stockholm archipelago	Northern Baltic Proper	6.81	4.65	1.87	0.48	0.45	Moderate
8007	Secchi Depth	20172017	8011	SWE-012	12s Östergötland and Stockholm archipelago	Western Gotland Basin	7.08	4.51	NA	0.45	0.43	Moderate
8007	Secchi Depth	20172017	8012	SWE-013	13 Östergötland inner coastal water	Western Gotland Basin	5.70	2.32	NA	0.29	0.29	Poor
8007	Secchi Depth	20172017	8013	SWE-014	14 Östergötland outer coastal water	Western Gotland Basin	7.00	5.67	NA	0.57	0.51	Moderate
8007	Secchi Depth	20172017	8015	SWE-016	16 South Bothnian Sea,inner coastal water	Bothnian Sea	4.90	4.34	NA	0.62	0.55	Moderate
8007	Secchi Depth	20172017	8016	SWE-017	17 South Bothnian Sea, outer coastal water	Bothnian Sea	7.00	6.20	NA	0.62	0.55	Moderate

8007	Secchi Depth	20172017	8017	SWE-018	18 North Bothnian Sea, Höga kusten, inner	Bothnian Sea	3.14	5.05	NA	0.71	0.82	High