

Indicator 1	Chlorophyll a concentration as an indicator of phytoplankton biomass
<p><i>Please provide scientific background for the indicator including reference materials</i></p> <p>Background Phytoplankton increases along with increased eutrophication, as a result of increased nutrient concentrations. Chlorophyll-a concentration is used as a proxy of phytoplankton biomass. It should be noted that this indicator alone does not assess the eutrophication status. However, the indicator is proposed as it is widely measured by participating countries of the Regional Seas Conventions and Action Plans.</p> <p>Method: 1. <u>In-situ sampling</u> Based on the monitoring guideline by HELCOM and OSPAR, following guideline could be used. Unit: Microgramme per litre (mg/m⁻³) Sampling season: Sampling needs to cover the entire growth season Sampling depth: For open sea, the upper water column (1 m, 5 m, 10 m, 15 m and 20 m). In coastal waters, without stratification, samples from 1 m or vertically integrated samples (1 – 10 m) should be analysed. Sample handling: Samples need to be filtered immediately after sampled. Analytical procedure: Spectrophotometer or fluorometer can be used. Standard procedure is described in UNESCO (1994).</p> <p>2. <u>Remote sensing observations derived from satellite imagery (e.g. NOWPAP)</u> Alternatively, remote sensing data could be used to estimate chlorophyll concentrations. This information could also be supplemental to method 1.</p> <p>Quality Control: Several Regional Seas programme has quality control procedure such as UNEP MAP, HELCOM and OSPAR.</p> <ul style="list-style-type: none"> E.g. HELCOM Quality Assurance <p>Reference:</p> <ul style="list-style-type: none"> HELCOM: COMBINE Annex C-4 UNEP MAP Technical Reports Series No. 163 NOWPAP Marine Environmental Watch System OSPAR JAMP Eutrophication Monitoring Guidelines 	
<p><i>Please indicate monitoring points and frequency (maps may be attached)</i></p> <p>Monitoring points: National monitoring stations. In ROPME Sea Area, ROPME organises oceanographic cruises.</p> <p>Frequency: Regional Seas monitor the indicator once a year or per oceanographic cruise</p>	
<p><i>Please indicate organisation(s) monitoring the indicator</i></p> <p>Member countries to the Regional Seas Conventions and Action Plans are responsible for monitoring.</p>	

Please indicate the data source(s), spatial coverage, temporal coverage, frequency of updates

Spatial coverage: Regional Seas member states

Temporal coverage: Depends on the member states but abundant data from 2000

Frequency of updates: Annual / per cruise

Data base: [HELCOM](#), MEDPOL database, [NOWPAP](#), ROPME (disclosed)

Annex: Original submissions from RSCAPs

1.1 HELCOM

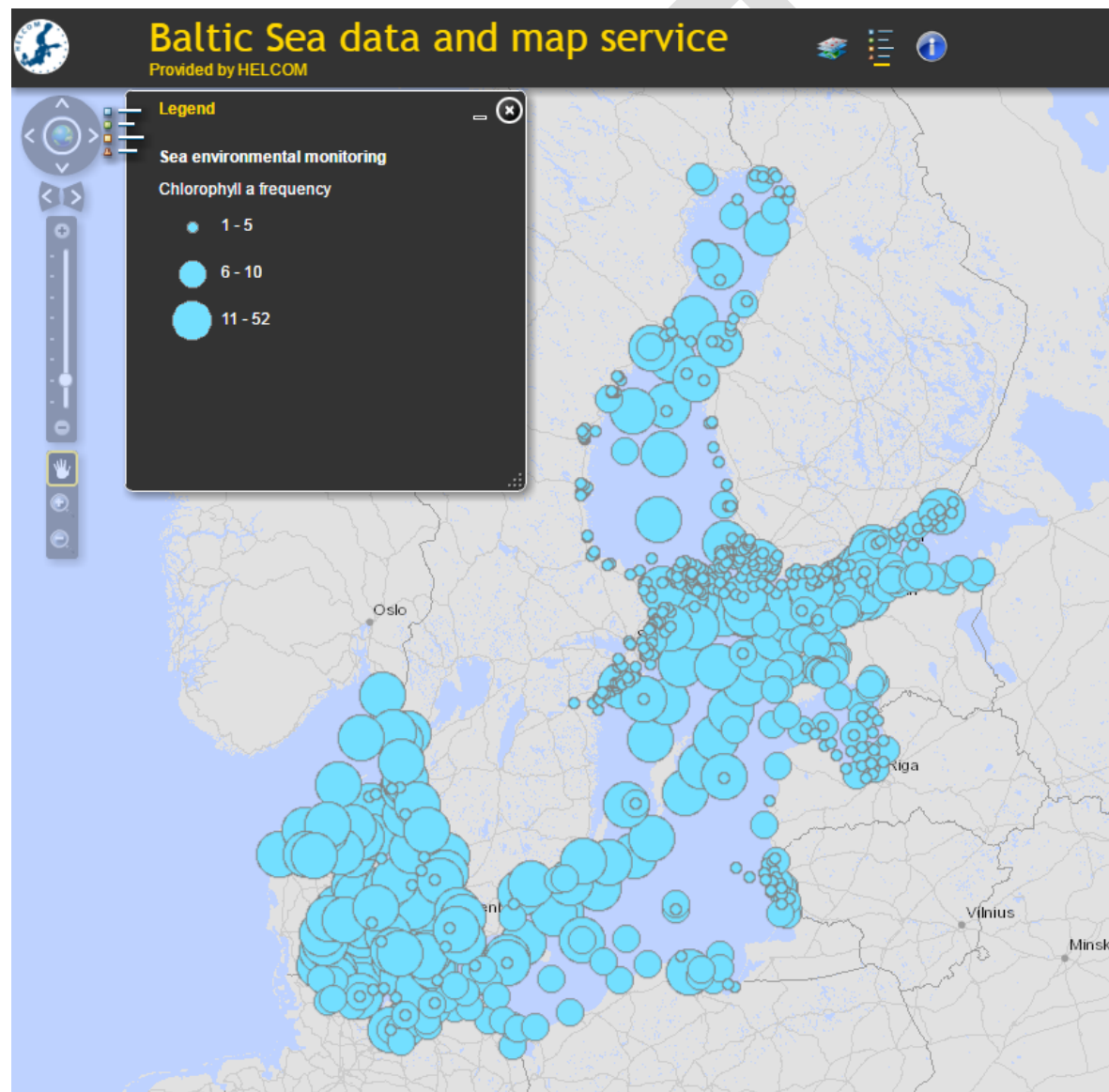
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<p>In HELCOM, the status of eutrophication is assessed using five core indicators. Chlorophyll-a is one of these eutrophication core indicators. Each indicator focuses on one important aspect of the complex phenomenon.</p> <p>Phytoplankton increases along with increased eutrophication, as a result of increased nutrient concentrations. Chlorophyll-a concentration is used as a proxy of phytoplankton biomass. This core indicator focuses on one important aspect of the complex phenomenon, but does not alone assess the eutrophication status.</p> <p>Phytoplankton quantity is a direct proxy of eutrophication, through the increase of nutrient concentration. The nutrient load is in some areas increased by internal nutrient loading from the sea bottom, accelerated by oxygen depletion. Phytoplankton increase in turn adds to the oxygen depletion, when sedimenting to the bottom, causing a vicious circle of eutrophication. Biotic and abiotic changes, such as climate change or changes in herbivory, also affect the phytoplankton quantity.</p> <p>Note that data on inputs of nutrients (N and P) to the sea (through rivers, direct discharges to the sea from the coast and deposition of nitrogen through air) are also collected (annually) within HELCOM.</p>	

Please indicate monitoring points and frequency (maps may be attached)

HELCOM data collection is based on agreed standards, guidelines and procedures to ensure comparability across the Baltic Sea Region. Monitoring of chlorophyll is considered as fully coordinated within HELCOM meaning that [common monitoring guidelines](#), common quality assurance programme and database exists.

Chlorophyll-a is monitored by coastal and open sea in-situ monitoring, complemented with ship-of-opportunity flow-through data and earth observation (MODIS, VIIRS).

At least 15 observations during the period June-September should be made yearly in each assessment unit. The compilation of observations is expected to be distributed spatially within the assessment unit in a non-biased way.



Please indicate organisation(s) monitoring the indicator

As stated in HELCOM Monitoring and Assessment [Strategy](#) - National competent authorities conduct monitoring and report the data to HELCOM.

Please indicate the data source(s), spatial coverage, temporal coverage, frequency of updates

As stated in the HELCOM Data and Information [Strategy](#) (Chapter 2, Collection of data), HELCOM data and information system rely on data derived from publicly funded monitoring programmes by the Contracting Parties but the Contracting Parties may also report data collected by private bodies, e.g. compliance monitoring related to environmental permitting.

Indicator and underlying data available at <http://www.helcom.fi/baltic-sea-trends/indicators/chlorophyll-a>

HELCOM COMBINE database (in-situ monitoring data: <http://ocean.ices.dk/helcom/Helcom.aspx?Mode=1>)

Spatial coverage: HELCOM Marine area: Entire Baltic Sea including Kattegat

Temporal coverage: Current Indicator 2007-2011 (June-September per year)

Frequency of updates: Data is updated annually. Assessment is updated in 6-year assessment cycle (next 2018)

1.2 MAP

Indicator 1	Chlorophyll a concentration as an indicator of phytoplankton biomass Note: Chlorophyll a as indicator for eutrophication should be complemented by an indicator Concentration of key nutrients in water column
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Please provide scientific background for the indicator including reference materials

MEDPOL Database

Eutrophication is a process driven by enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, leading to: increased growth, primary production and biomass of algae; changes in the balance of nutrients causing changes to the balance of organisms; and water quality degradation. The consequences of eutrophication are undesirable if they appreciably degrade ecosystem health and/or the sustainable provision of goods and services. These changes may occur due to natural processes. Management concern begins when they are attributed to anthropogenic sources. Additionally, although these shifts may not be harmful in themselves, the main worry concerns 'undesirable disturbance': the potential effects of increased production, and changes of the balance of organisms on ecosystem structure and function and on ecosystem goods and services.

In the Mediterranean, the UNEP/MAP MED POL Monitoring programme included from its inception the study of eutrophication as part of its seven pilot projects approved by the Contracting Parties at the Barcelona meeting in 1975 (UNEP MAP, 1990a,b). The issue of a monitoring strategy and assessment of eutrophication was first raised at the UNEP/MAP MED POL National Coordinators Meeting in 2001 (Venice, Italy) which recommended to the Secretariat to elaborate a draft programme for monitoring of eutrophication in the Mediterranean coastal waters.

The MEDPOL database has over 3,000 records of chlorophyll a data from 2001 to the present in Croatia, Cyprus, Egypt, France, Greece, Israel, Slovenia, Tunisia and Turkey.

Based on this data trends analysis reports have been produced and data has been used to calculate Background Values (BCs) and Good Environment Status (GES) values.

Quality control and training to laboratories is provided through an agreement with the Quality Assurance of Information for Marine Environmental Monitoring (QUASIMEME), implemented by The Wageningen University and Research Centre, Alterra, The Netherlands.

Reference material used and corresponding reports available upon request.

IMAP Indicator for future monitoring:

Chlorophyll-a concentration in water column is an IMAP Common Indicator for the purpose of measuring Eutrophication.

Please indicate monitoring points and frequency (maps may be attached)

All 21 Contracting Parties to the Barcelona Convention submit data to the MEDPOL database on a yearly basis. Chlorophyll a is not mandatory but has been reported by the majority of countries (see map of stations included above).

Please indicate organisation(s) monitoring the indicator

MEDPOL Focal Points in each country are responsible for reporting, and in turn are supported by relevant national institutions

Please indicate the data source(s), spatial coverage, temporal coverage, frequency of updates

See map above. Data provided yearly since 1999, though as not mandatory not for all years and not all countries.

With adoption of IMAP from 2016, chlorophyll-a will be mandatory and national monitoring plans will be revised accordingly, including stations. See below Indicator Monitoring factsheet adopted by MEDPOL FP's in 2015 (UNEP(DEPI)/ MED WG.417/17)

Common Indicator Description	Description of Parameters and/or Elements, matrix	Assessment Method	Guidelines Reference Methods QA/QC	Recommendations /Additional Data needed
Common Indicator 8, COP 18 Indicator 5.2.1 : Chlorophyll-a concentration in the water column With Ecological Objective 5.2 : Direct effects of nutrient over-enrichment are prevented State,Impact indicator	Chlorophyll –a concentration in seawater (µg/l)*	UNEP/MAP MED POL State and Temporal Trend Monitoring Programme For coastal stations minimum sampling 4/year, 6-12 /year recommended. Further discussions with Focal Points needed if sampling frequency could be increased on monthly basis, in order to sufficiently support the application of assessment methods (as TRIX) taking in account the rapid	Guideline : Eutrophication Monitoring Strategy of UNEP/MAP MED POL UNEP(DEC)MED WG.231/14 Reference Methods : Sampling and Analysis Techniques for the Eutrophication Monitoring Strategy of UNEP/MAP MED POL (MAP Technical Reports Series No. 163) UNEP/MAP MED POL Inter-calibration exercises in agreement with QUASIMEME	*Unit supporting the TRIX index, with Mediterranean sub-regional specifics The indicative boundaries values for chlorophyll-a determined in the framework of MED GIG for the status classes required by the EU Water Framework Directive, namely between “good” and “moderate” status could be tested by non-EU Mediterranean countries to find out if they are relevant. Remote sensing techniques would be a useful tool for estimating chlorophyll concentrations. On a regional scale the remote sensing tool could be useful to identify

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https://www.yunbaogao.cn/report/index/report?reportId=5_15871

