Baltic Marine Environment Protection Commission

Working Group on the State of the Environment and Nature Conservation

Tallinn, Estonia, 7-11 November, 2016

STATE & CONSERVATION 5-2016

Document title	Proposal on adjustments to the HELCOM Eutrophication Assessment Tool (HEAT 3.0) for use in HOLAS II
Code	4J-4
Category	DEC
Agenda Item	4J – HELCOM indicators and assessment tools
Submission date	14.10.2016
Submitted by	HELCOM IN Eutrophication

Background

In HELCOM the Eutrophication Assessment Tool (HEAT 3.0) is used to assess the status of eutrophication according to the methodology outlined in the HELCOM EUTRO-OPER project report. HOLAS II aims to develop the 2nd HELCOM holistic assessment so that it can be used by the Contracting Parties also being EU Member States in the reporting under the Marine Strategy Framework Directive (MSFD) in 2018. Thus, the HELCOM assessment of eutrophication should aim at being aligned with the methodological standards on good environmental status of marine waters laid down by the European Commission. At present, the methodological standards, presented in the Commission Decision 2010/477/EU, are under review and a proposed revision is currently under public consultation (Commission Decision on GES criteria, version 14.09.2016).

Furthermore, the BalticBOOST project, while developing the Biodiversity Assessment Tool (BEAT), has proposed methods for scaling indicators and developing the confidence assessment methodology. The proposals have the potential of further improving also HEAT 3.0, as well as harmonizing the outcomes of the biodiversity and eutrophication status assessments.

This document proposes adjustment to the HEAT 3.0 assessment tool for use in HOLAS II based on the proposed revision of the Commission Decision on GES criteria and developments under the BalticBOOST project.

Action required

The Meeting is requested to:

- take note of how the HELCOM core indicators and pre-core indicator align to the proposed revision of the Commission Decision on GES criteria,
- endorse the proposal to adjust the structure of HEAT 3.0 as needed to align the tool to the tentative agreement to revise Commission Decision on GES criteria,
- endorse the proposal to scale (normalize) indicators used in the eutrophication assessment,
- endorse the proposal to develop the confidence assessment in accordance to the methodology developed for the HELCOM biodiversity assessment.

Introduction

For the use in HOLAS II, the HELCOM Eutrophication Assessment Tool (HEAT 3.0) is proposed to be adjusted as follows:

1. adapt to potential changes required by revision of Commission Decision on criteria and methodological standards on good environmental status [draft v5; Ref. Ares(2016)5301702 - 14/09/2016].

2. scale the indicators through introducing (hypothetical) minimum and maximum values, similarly as proposed for the HELCOM Biodiversity Assessment Tool (BEAT) being developed under the BalticBOOST project.

3. develop further the status confidence methodology, which at present only takes into account temporal coverage of monitoring data, to take into account also spatial representability, accuracy and methodological confidence, as proposed for the HELCOM Biodiversity Assessment Tool (BEAT) being developed under the BalticBOOST project.

1. Adapting to potential revision of Commission Decision

In the role of HELCOM as coordinating platform for the regional implementation of the Marine Strategy Framework Directive (2008/56/EC), the HELCOM assessment of eutrophication in HOLAS II should aim at being aligned with the methodological standards on good environmental status of marine waters laid down by the EU Commission. At present, the methodological standards, presented in the Commission Decision 2010/477/EU, are under revision. A proposal for new standards replacing the present ones is available for public consultation until 12th October 2016 (version 14.09.2016). A final decision on the revision of the Commission Decision on GES criteria is expected in November 2016.

If the proposed revision is agreed, certain changes in the HELCOM eutrophication assessment methodology are called for in order for the Contracting Parties being EU Member States to be able to use the results of the HOLAS II project in the 2018 MSFD reporting. Briefly, the proposed revision include the following changes:

- the set of indicators (now called “elements” in the proposed revision of the Commission Decision on GES criteria) is quite similar to that applied before, with the inclusion of macrofaunal communities as a potential new element/indicator,
- the elements/indicators are not grouped into three, but instead into 3-8 Criteria, depending on the number of elements/indicators used; most of the Criteria would consist of only one element/indicator,
- in open-sea assessment units, an estimate of the extent of the area (as a proportion) that is not subject to eutrophication shall be given,
- in coastal assessment units, the requirements of the Water Framework Directive (2000/60/EC) indicators shall be taken into account when making the assessment of eutrophication.

a) Adapting HEAT to the new set of elements and criteria

The present set of HELCOM core indicators of eutrophication, together with the proposed and tentative core indicators, fit well within the criteria proposed by EU (Table 1). Two of the proposed 3 primary Criteria (*Nutrient concentration* and *Chlorophyll a concentration*) as well as one secondary Criteria is covered by an operational core indicator in all open-sea assessment units. Furthermore, the third primary Criteria (*Concentration of dissolved oxygen*) is covered by a core indicator in half of the open-sea assessment units, and by a proposed core indicator in the remaining ones. Indicators are also proposed for additional secondary Criteria (*Number, extent and duration of harmful algal blooms*; possibly also *species composition and abundance of macrophauna*).

Table 1. The eutrophication indicators agreed, proposed or potentially proposed to be applied in HOLAS II, listed according to the criteria presented in the Proposal for a Commission Decision on GES Criteria [draft v5; Ref. Ares(2016)5301702 - 14/09/2016]. The table shows the proposed new criteria, whether it is primary or secondary (ie. compulsory or non-compulsory), whether the indicator is aimed to be applied in HOLAS II, name of the indicator and information on whether it is suitable for coastal or open-sea areas. Note that in coastal areas, the national indicators will be applied, and thus each of the coastal indicators listed here will not necessarily apply for all coastal assessment units.

New criteria	Criteria description	Primary / Secondary criteria	Element	HOLAS II: YES-available, proposed, NO-not available	Indicator name	Coastal / Open-sea
D5C1	Nutrient concentration	Primary	Dissolved Inorganic Nitrogen	YES	Average DIN concentration in surface (0-10 m) during winter	Open
			Dissolved Inorganic Nitrogen	YES (WFD)	WFD indicators on DIN collated in EUTRO-OPER	Coastal
			Total Nitrogen	proposed	Total nitrogen concentration (pre-core)	Open
			Total Nitrogen	YES (WFD)	WFD indicators on TN collated in EUTRO-OPER	Coastal
			Dissolved Inorganic Phosphorous	YES	Average DIP concentration in surface (0-10 m) during winter	Open
			Dissolved Inorganic Phosphorous	YES (WFD)	WFD indicators on DIP collated in EUTRO-OPER	Coastal
			Total Phosphorous	proposed	Total phosphorous concentration (pre-core)	Open
			Total Phosphorous	YES (WFD)	WFD indicators on TP collated in EUTRO-OPER	Coastal
D5C2	Chlorophyll a concentration	Primary	Chlorophyll a	YES	Average chlorophyll-a concentration in the surface (1-10 m) during summer	Open
			Chlorophyll a	YES (WFD)	WFD indicators on chlorophyll or biovolume collated in EUTRO-OPER	Coastal
D5C3	Number, extent and duration of HAB	Secondary	Harmful algal blooms	proposed	Cyanobacterial surface accumulations (pre-core)	Open
D5C4	Photic limit / water transparency	Secondary	Transparency of water	YES	Average secchi depth during summer	Open
			Transparency of water	YES (WFD)	WFD indicators on water clarity or turbidity collated in EUTRO-OPER	Coastal
D5C5	Concentration of dissolved oxygen	Primary	Dissolved oxygen	YES	Oxygen debt (below halocline)	Open
			Dissolved oxygen	proposed	Shallow water bottom oxygen (candidate)	Open
			Dissolved oxygen	YES (WFD)	WFD indicators on oxygen concentration or hypoxia collated in EUTRO-OPER	Coastal
D5C6	Abundance of oppurtunistic macroalgae	Secondary	Opportunistic macrophytes	YES (WFD)	WFD indicators on macrophytes collated in EUTRO-OPER	Coastal
D5C7	Macrophyte communities	Secondary	Perennial macrophytes	YES (WFD)	WFD indicators on macrofauna collated in EUTRO-OPER	Coastal
D5C8	Species composition and abundance of macrofauna	Secondary	Macrofaunal communities	YES (WFD)	WFD indicators on macrofauna collated in EUTRO-OPER	Coastal
			Macrofaunal communities	tentative	BQI	Open

Fitting the existing, proposed and tentative core indicators into the criteria framework now under consultation (draft v5; Ref. Ares(2016)5301702 - 14/09/2016) would call for substantial changes in the grouping of the elements/indicators (Figure 1). The number of Criteria would increase, and subsequently, each criteria would consist of less elements/indicators; most of them would include only one element/indicator.

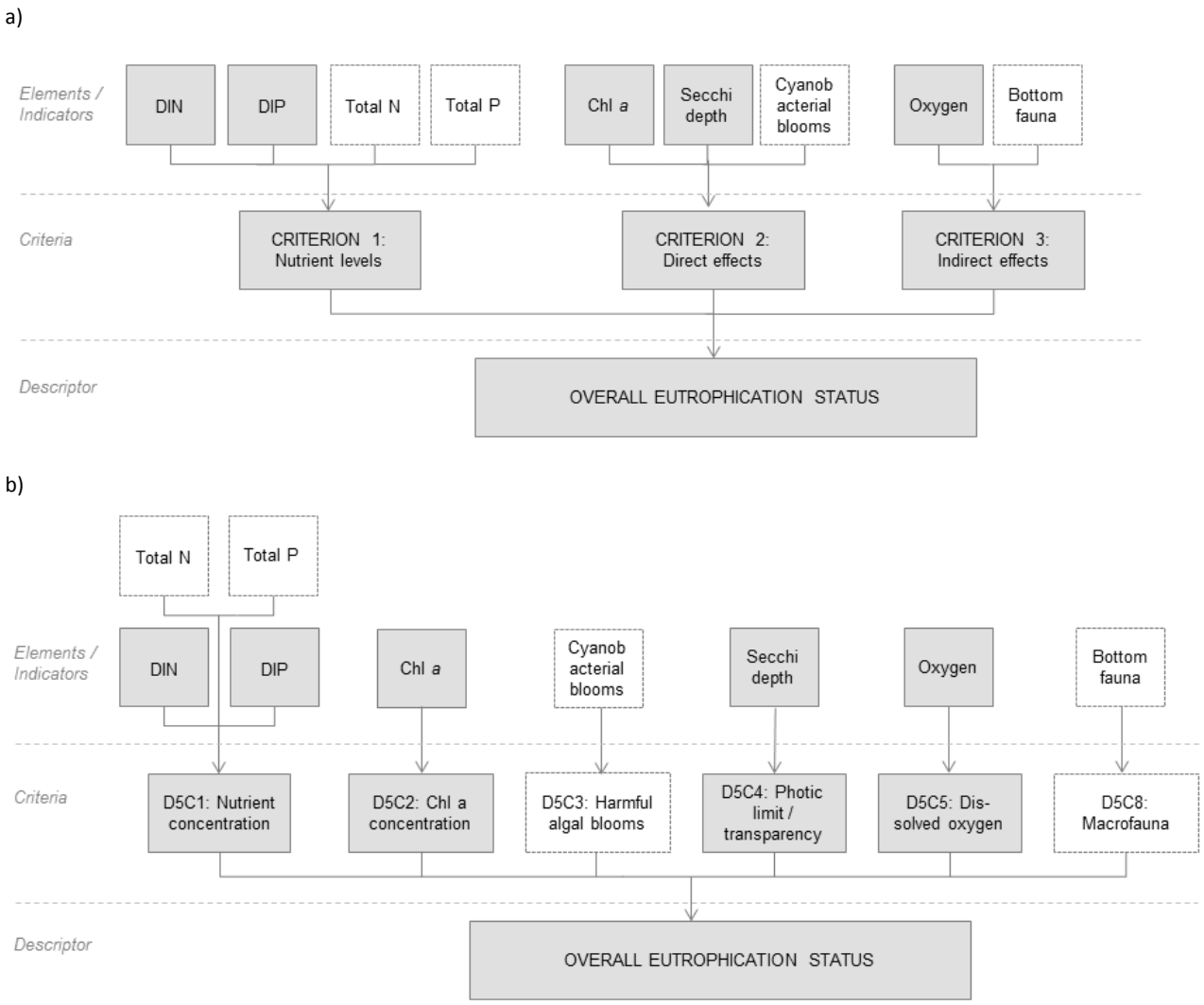


Figure 1. A comparison of a) the aggregation of elements/indicators into criteria according to the present methodological standards (2010/477/EU), applied by HEAT 3.0, and b) the aggregation according to the proposed methodological standards [draft v5; Ref. Ares(2016)5301702 - 14/09/2016]. The present CORE indicators are shaded gray, whereas the elements/indicators (and subsequent criteria) not yet agreed upon are signaled by dashed lines and no shading. See Table 1 for closer description of elements/indicators and criteria.

Introducing new criteria consisting of only one element/indicator calls for a discussion on the aggregation approach. If the one-out-all-out principle is applied between Criteria, as is done in HEAT 3.0, each element/indicator (except those of Criteria 1 – *nutrient concentration*) determined below GES would have the potential of dominating the outcome of the status assessment. As the elements/indicators are often sensitive also to non-anthropogenic or non-eutrophication-related variation, this might cause false conclusions. Alternative approaches, such as additional grouping or weighted averaging, will be proposed by HOD 51-2016 by the HELCOM IN Eutrophication in case the proposed revision of the Commission Decision is adopted.

b) Estimating the proportion of eutrophicated area

The presented proposal for methodological standards requires an estimate of the proportion of the open-sea areas (in percentage) not affected by eutrophication. The present indicator methodology specifies GES-targets as an average over assessment units, and adequate and unbiased but not necessarily spatially intense monitoring within these areas. Neither the indicator approach nor the monitoring allows accurate calculations of such spatial estimates within assessment units.

Instead, robust estimates could be calculated at the regional sea level. This is proposed to be done through by calculating a weighted average of the the element/indicator-, Criteria- or overall eutrophication status, basing the weighting on the spatial proportion of each assessment unit of the entire Baltic Sea.

2. Min-max estimates allowing more exact scaling

In order to make the indicators truly comparable in the integrated assessment, they should be scaled (normalized). Normalization is also useful when estimating the relative distance to GES, which is required information for some of the integration methods that are going to be evaluated, e.g. averaging. The following approach, here adapted to suit HEAT and the eutrophication indicators, has been proposed for the HELCOM Biodiversity Assessment Tool (BEAT) being developed under the BalticBOOST project.

For scaling, the assessment tool needs input on the indicator value and its GES boundary, but also on the potential range of the indicator values (min-bad and max-high values). If sufficient data covering the whole spectrum of the indicator is available, as for the present HELCOM CORE indicators of eutrophication (DIN, DIP, chla, Secchi, oxygen debt), sufficient min-bad and max-high can be obtained from data. In some cases the numerical properties of the indicator will be decisive, e.g. in the cases where indicators are estimated eg. as proportions, ratios or normalized values.

The min-bad and max-high values are proposed to be agreed by HELCOM IN-Eutrophication, along with other similar indicator-specific methodological specifications, applying the following approach for indicators where the whole range of possible values is not represented in the data (see the provided example, Figure 2).

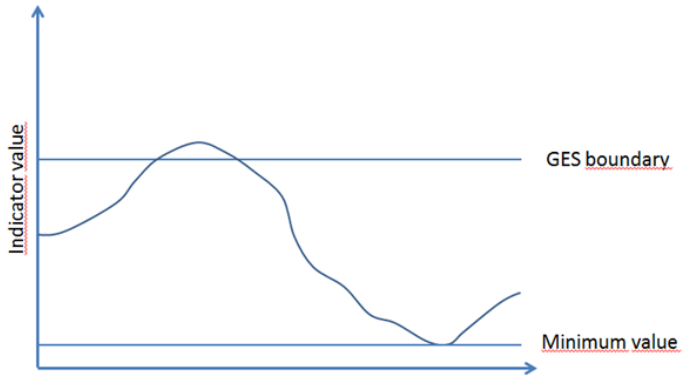
Defining the max-high value (in the following order of preference)

- if sufficient long-term data covering high conditions exists: eg. extremes of annual 95-percentiles
- when using EQR: MAX = 1
- if information on reference conditions is available: MAX = reference condition
- if a Target (or Good/Moderate boundary) and Acceptable Deviation is already agreed: MAX =Target + Acc.Dev.
- if no ref.cond, but several class boundaries are set and agreed: extrapolate MAX from Good/Moderate and High/Good boundary values
- when assuming linearity: based on min-bad value, if already set
- theoretically highest possible value

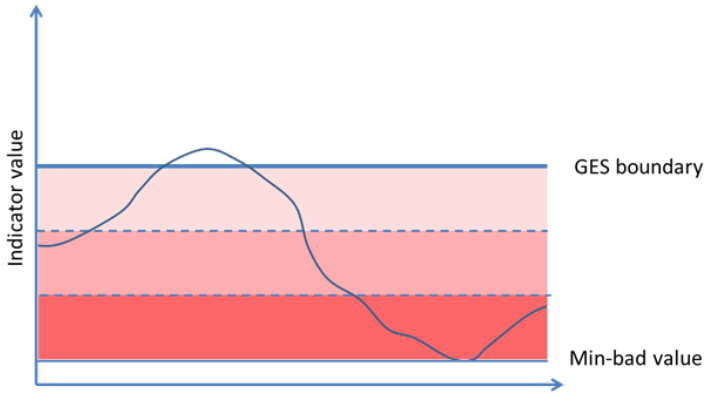
Defining the min-bad value (in the following order of preference)

- if sufficient long-term data covering deteriorated conditions exists: eg. extremes of annual 5-percentiles
- when using EQR: MAX = 0
- if several class boundaries are set: extrapolate MAX from Moderate/Poor and Poor/Bad boundary values
- when assuming linearity: based on max-high value, if already set
- theoretically worst possible value

1. Define min-bad value from data, EQR etc.



2. Split into three classes (referring to 5-class classification).



3. Define max-high value through data, reference condition, class boundaries, EQR etc.. Then split into two classes. The distance between class boundaries is not necessarily the same ablove and below GES, if the data does not behave linearly.

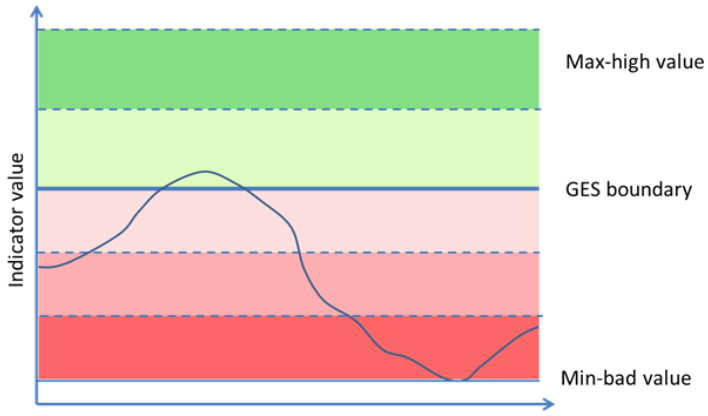


Figure 2. Example for an indicator with GES boundary and data available for deteriorated conditions assuming linearity.

HELCOM IN-Eutrophication proposes to develop HEAT 3.0 further for use in HOLAS II, by taking into use the min-max values.

3. Improving the confidence assessment

At present, HEAT 3.0 assesses confidence as a product of status- and target confidences. Target confidence describes the reliability on the method and/or data used to set the targets, and in terms of the database algorithms, it is pre-defined along with the targets. Status confidence, on the other hand, is based on the temporal coverage of the monitoring data, and can be produced by the database algorithms.

The BalticBOOST project, while developing the Biodiversity Assessment Tool (BEAT), defined and developed the confidence assessment methodology further. Firstly, it was proposed that indicator confidence should be based only on the confidence of the monitoring data. The argument was that targets, although scientifically based, are finally a product of political decision-making, and as such not comparable in terms of

confidence. The confidence was proposed to be determined through four confidence aspects: 1) Temporal coverage, 2) spatial representability, 3) Accuracy and 4) Methodological confidence.

a) Temporal coverage of monitoring data

The aspect of temporal coverage of monitoring data considers the confidence of the indicator to include year-to-year variation in the indicator result. High confidence is considered to be achieved if monitoring data is available for all years in the HOLAS II assessment period (2011-2016), or for indicators with no year-to year variation, the temporal monitoring requirements are met. Intermediate confidence is met when more than three years data is available from the assessment period and bad confidence is assigned to indicators with only one or two years of data during the HOLAS II assessment period.

The temporal coverage can be directly calculated from the eutrophication assessment data, using the database algorithms developed in connection with the eutrophication assessment database.

b) Spatial representability of monitoring data

The spatial representability of monitoring data assesses how well the indicator covers the spatial variation within the assessment unit. In the BEAST tool, spatial representability is considered high if the data represents reliably at least 80% of the relevant habitat types occurring in the area, or in cases with a clear spatial gradient or patchiness in the parameter value, the monitoring set to cover at least 80% of this variation. When the representability or variation (in case of gradients) is covered by 60-79% intermediate confidence is assigned to the indicator. Confidence is considered to be bad if less than 60% of relevant habitats or less than 60% of the variation in gradients are covered.

For the data-driven eutrophication indicators, the spatial representability could be calculated by the database algorithms, once the measure of spatial representability has been agreed upon. The measure should however be relatively simple, describing for example the variability in the latitude-longitude, how well the data is spread in a grid etc.

c) Accuracy of indicator result

The accuracy of the indicator result is primarily assigned as the standard error of the monitoring data. The standard error can be achieved from all the present CORE eutrophication indicators, and the eutrophication database algorithms could be developed to calculate it.

If potential new indicators lack a value for standard error, an optional approach would be needed. For biodiversity indicators, as proposed by BalticBOOST, a categorical approach is carried out if the standard error is not available in new indicators. This is a compliance check by expert judgement of the probability that the indicator signal clearly reflects that GES is achieved/not achieved. High confidence is assigned if GES has 'most likely' been / has not been achieved (by at least 90% probability). Intermediate confidence is judged if the probability is 'likely' (70-89% probability) and low confidence is judged if the probability of correctly indicating the status evaluation of the indicator is 'unsure' (less than 70% probability). This type of accuracy could not be calculated by the database algorithms.

d) Methodological confidence

The aspect of methodological confidence considers the quality of the monitoring methodology. High confidence is assigned if the monitoring has been conducted according to HELCOM guidelines (for parameters where these are available) and the data is quality assured according to HELCOM or other internationally accepted guidelines. Intermediate confidence is assigned if the monitoring has been conducted only partly according to HELCOM guidelines and/or the data originates from mixed sources, and is partly quality assured according to HELCOM or other international standards and/or the data is quality assured, but according to local standards. If monitoring has not been conducted according to HELCOM guidelines or the data has not been quality assured, the methodological confidence is considered bad.

Methodological confidence is not calculated from the data, but is predefined for each parameter, based on information available in the HELCOM Monitoring Manual.

HELCOM IN-Eutrophication proposes to develop HEAT 3.0 further for use in HOLAS II, by developing the confidence assessment as presented here.