



Baltic Marine Environment Protection Commission

Working Group on the State of the Environment and Nature
Conservation

STATE & CONSERVATION
15-2021

Online, 4-8 October 2021

Document title	Total phosphorus indicator – proposal of new threshold values for the Western Baltic Sea
Code	3J-50
Category	DEC
Agenda Item	3J- Progress of relevant HELCOM expert groups and projects
Submission date	13.9.2021
Submitted by	IN-Eutrophication

Background

Total phosphorus concentrations are a HELCOM core indicator and have been assessed in HOLAS II based on an agreed methodology and threshold values in all basins except Kiel Bay, Bay of Mecklenburg, Arkona Basin, Bornholm Basin, Eastern Gotland Basin. For these five basins, there was so far no agreement on suitable threshold values. STATE & CONSERVATION 14-2021 invited IN EUTRO to suggest threshold values for all relevant assessment units for the total phosphorus indicator, utilizing the upcoming IN EUTRO meetings, and to submit this information to STATE & CONSERVATION 15-2021. The meeting encouraged all relevant CPs to strive to find an acceptable solution to ensure inclusion in HOLAS III and invited relevant national contacts to participate in IN EUTRO 20-2021. IN EUTRO 21-2021 finalised the discussion on the total phosphorus indicator and suggested to propose suitable threshold values for those basins that could not be assessed in HOLAS II. These threshold values and their associated rationale are reported in this document. An acceptance of the threshold values would enable an assessment of total phosphorus concentrations in the whole open Baltic Sea for HOLAS III.

Action requested

The Meeting is invited to consider and endorse the proposed approach, specifically the new threshold levels, for use in the HOLAS III assessment.

Total phosphorus indicator – proposal of new threshold values for the Western Baltic Sea

Indicator name
Total phosphorus concentration
Scale of assessment for HOLAS III and rational
The indicator will be applied at scale 4 (Division of the Baltic Sea into sub-basins and further division into coastal and off-shore areas and division of the coastal areas by WFD water types or water bodies), as has been the case in HOLAS II. There have been changes made to the Baltic Sea sub-basins that will affect all eutrophication indicators and will therefore also affect total phosphorus concentrations (see discussion at STATE & CONSERVATION 14 and documents 4J-82 Rev.1 and 4J-90). Firstly, the influence of the Odra plume has been considered and the area was removed from the Bornholm Basin (SEA-007), resulting in the new assessment area Pomeranian Bay (SEA-007B). Secondly, the Gulf of Finland (SEA-013) was split into two assessment units, Gulf of Finland Western (SEA-013A) and Gulf of Finland Eastern (SEA-013B) and the easternmost part has been reclassified to represent Russian coastal and transitional waters. The implications of splitting the assessment units, in particular for new suitable threshold levels for all eutrophication parameters, are not subject of this document and are reported in documents the document titled 'Setting new threshold values for Pomeranian Bay and Bornholm Basin for the eutrophication assessment in HOLAS III' (3J-87) that is also submitted to this meeting.
Spatial coverage of the indicator for HOLAS III
The spatial coverage of the indicator will increase for HOLAS III. The open Baltic Sea assessment units Kiel Bay (SEA-004), Bay of Mecklenburg (SEA-005), Arkona Basin (SEA-006) and Bornholm Basin (SEA-007) and Pomeranian Bay (SEA-007B) will be covered. The increased spatial coverage is due to an agreement on new threshold values for these basins (see below). For the Eastern Gotland Basin, it was not possible to agree on a threshold value for total phosphorus and the indicator can therefore not be assessed in HOLAS III in this basin.
Methodology to be applied for HOLAS III and rational
There are no changes to the methodology to be applied in HOLAS III.
Threshold value setting logic and rational
In general, threshold values for total phosphorus concentrations are based on the TARGREV-project (see BSEP 133 https://helcom.fi/media/documents/Eutorophication-targets_BSEP133.pdf), including some adjustments for some basins (see HELCOM 38-2017). The TARGREV-project has investigated long-term time series for eutrophication parameters in the Baltic Sea basins with the aim to identify break points in these time series that indicate a shift from a non-eutrophic to a eutrophic condition. Unfortunately, for nutrients the time series only date back to 1970 and therefore falls into a period that marks the onset of eutrophication. For DIN and DIP there were model results available for 1900 and the target values for these parameters have been derived by averaging between the status of 1900 and the status of the 1970s. However, the models used were not capable to provide results for total nutrient concentrations, therefore the target values for total nutrient concentrations have been based on 1970. Thus, the TARGREV project did in fact not suggest absolute target values but indicated that suitable target values should be smaller than the provided values. Applying the threshold values proposed by TARGREV would results in good status for Kiel Bay and Mecklenburg Bay (see table 1 below),

which are then in disagreement with the assessment of other eutrophication effect indicators that do not yet achieve good status. Hence, the TARGREV values are not regarded as scientifically suitable for assessing the Western Baltic Sea.

Germany has therefore proposed different threshold values for the Western Baltic Sea basins based on a national modelling approach. The basis for these threshold values is a historic catchment modelling approach. Using the catchment model MONERIS historic nutrient inputs were derived for 1880 (a time where evidence existed that macrophytes were still abundant in coastal waters and where the required data on catchment characteristics were available from Prussian data inventories) (Hirt et al. 2013). The resulting historic riverine nutrient concentrations were extrapolated to the Baltic Sea using the spatially explicit 3D ecosystem model ERGOM-MOM (Schernewski et al. 2015). This scenario yielded reference conditions. To obtain the target values, a 50% deviation from reference conditions was assumed.

Comparing the TARGREV target values and the German target values it is evident that the differences are rather small for Bornholm Basin, but for Kiel Bay, Bay of Mecklenburg and Arkona Basin the TARGREV approach results in considerably higher threshold values compared to the German approach. IN-Eutrophication has discussed the different threshold values in a number of meetings (see e.g. IN-Eutrophication 16, document 5-3) and in IN-Eutrophication 21 came to the conclusion that the German target values should be proposed to STATE & CONSERVATION 15 for use in HOLAS III. This is also in line with the general approach taken by eutrophication experts to chose the most precautionary target, providing the highest protection level for the Baltic Sea ecosystem.

For the new assessment units Pomeranian Bay and the remainder of Bornholm Basin new threshold values are also be proposed. They are in general based on the German approach and are re-scaled for the new basin subdivision based on modelling results as described in the .document titled 'Setting new threshold values for Pomeranian Bay and Bornholm Basin for the eutrophication assessment in HOLAS III' (3J-87) that is also submitted to STATE & CONSERVATION 15.

References:

HELCOM 2013: Approaches and methods for eutrophication target setting in the Baltic Sea region. Baltic Sea Environment Proceedings No. 133, 136 pages

Hirt U., Mahnkopf J., Gadegast M., Czudowski L., Mischke U., Heidecke C., et al. 2013: Reference conditions for rivers of the German Baltic Sea catchment – Reconstructing nutrient regime using the model MONERIS. *Regional Environmental Change*, 14, pp.1123–1138

Schernewski G., Friedland R., Carstens C, Hirt U., Leujak W., Nausch G. et al. 2015: Implementation of European marine policy: New water quality targets for German Baltic waters. *Marine Policy*, 51, pp. 305-321

Threshold value(s)

Table 1 below contains the proposal for new threshold values to be applied in HOLAS III in the column "target values proposed for HOLAS III". For comparison, the TARGREV target value are also shown as well as assessment results (calculation of Eutrophication Ratio) based on the two different threshold values.

Table 1 Mean concentrations of total phosphorus for 2016-2021, TARGREV target values and target values proposed for HOLAS III and assessment results based on these target values. * Rescaled target values based on the methodology as reported in the document titled 'Setting new threshold values for Pomeranian Bay and Bornholm Basin for the eutrophication assessment in HOLAS III' (3J-87) that is also submitted to STATE & CONSERVATION 15.

	Area code	Mean 2016-2021 in $\mu\text{M/l}$	Target values proposed for HOLAS III	TARGREV target values	Eutrophication Ratio based on target values proposed for HOLAS III	Eutrophication Ratio based on TARGREV target values
Kiel Bay	SEA-004	0.71	0.41	<0.96	1.74	0.74
Bay of Mecklenburg	SEA-005	0.75	0.45	<0.98	1.67	0.77
Arkona Basin	SEA-006	0.85	0.48	<0.67	1.77	1.27
Bornholm Basin	SEA-007A	Not yet assessed	0.55*	<0.68*		
Pomeranian Bay	SEA-007B	Not yet assessed	0.74*	<0.51*		

For the Eastern Gotland Basin, there has been no agreement achieved on a suitable threshold value in IN-Eutrophication 21 and therefore, no threshold value can be suggested and the basin cannot be assessed in HOLAS III.

Other significant issues that need to be addressed or presented to State and Conservation

There are no other issues that need to be addressed prior to the HOLAS III assessment.

Latest indicator report or (for new indicators) initially completed indicator template

<https://helcom.fi/wp-content/uploads/2019/08/Total-phosphorous-HELCOM-core-indicator-2018.pdf>