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Background

In HOLAS II the concentrations of total nitrogen (TN) and total phosphorus (TP) have not been assessed in the Western Baltic Sea due to a lack of agreement on target values in this area. In particular, the targets for total nutrients are still lacking for the Kiel Bay, Mecklenburg Bay, Bornholm Basin and Arkona Basin.

IN Eutrophication 15 noted that Germany will nationally consult whether the TARGREV target values for Bornholm and Arkona Basin can be accepted, as they are not far from the national targets. IN Eutrophication 15 further noted that Germany is not in a position to accept the TARGREV targets for Kiel Bay and Mecklenburg Bay on a scientific expert level, as they are significantly higher than the national targets and they would lead to good status for the nutrients in these basins while eutrophication effects still occur, which is not plausible. Germany volunteered to prepare a document for IN Eutrophication 16 with test assessments and an argumentation why Germany considers the TARGREV targets as being too high. This argumentation as well as an update on the results of the national consultation concerning the target values for the Bornholm and Arkona Basin can be found in this document.

The ultimate aim is to agree on suitable target values for TN and TP in the Western Baltic Sea, so that these parameters can be assessed Baltic-wide in HOLAS III.

Action requested

The meeting is invited to:

- take note and discuss the arguments provided in this document
- decide on further steps concerning suitable target values for TN and TP for the Western Baltic Sea

Agreement on target values for TN and TP in the Western Baltic Sea

Introduction

In HOLAS II the concentrations of total nitrogen (TN) and total phosphorus (TP) have not been assessed in the Western Baltic Sea due to a lack of agreement on target values in this area. In particular, the targets for total nutrients are still lacking for Kiel Bay, Mecklenburg Bay, Bornholm Basin and Arkona Basin.

Comparison of TARGREV target values and German target values

Currently, there are two different sets of target values under discussion, the HELCOM target values proposed by the TARGREV-project and target values used by Germany (see table 1). The underlying conceptual approaches for these target values differ.

The TARGREV-project (HELCOM 2013) 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 data back to 1970 and therefore falls into a period that marks the onset of eutrophication according to Andersen et al. 2017 (Fig.1). 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 1970ies. However, the models used were not capable to provide results for total nutrient concentrations, so that **for total nutrient concentrations the target values have been based on 1970**. Therefore, the TARGREV project did in fact not suggest absolute target values but indicated that **suitable target values should be smaller than the provided values**. The values initially proposed by the project did not contain sufficient data from German waters and were therefore re-calculated after inclusion of the German data (therefore, two values are provided in table 1 in the 4th column).

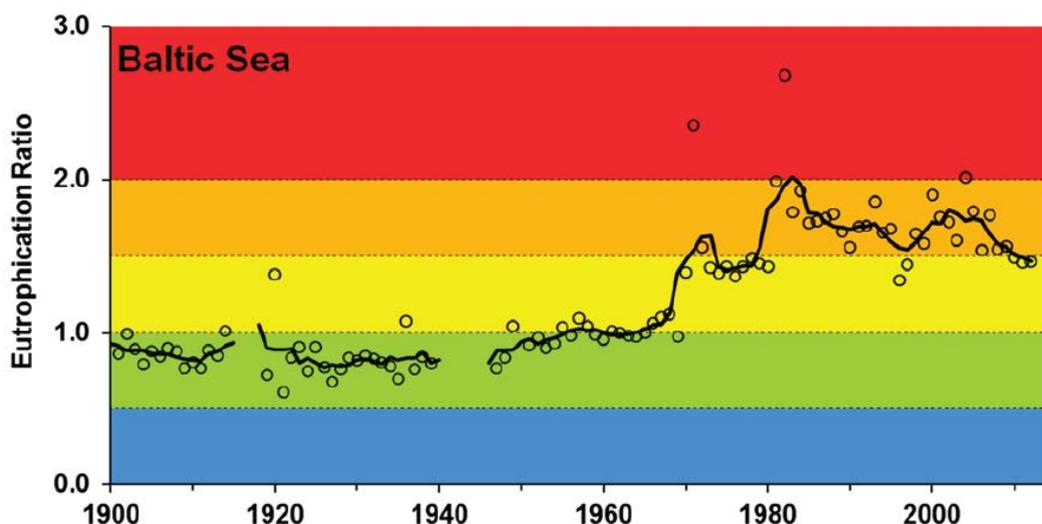


Fig. 1 Integrated assessment of eutrophication in the Baltic Sea 1901-2012 combining all 621 individual classifications of eutrophication status into a single assessment. The solid line is the 5-year average. From: Andersen et al. 2017.

Germany has based the derivation of target values for nutrients (and chlorophyll-a) to be used under the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD) on 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. Furthermore, maximum allowable nutrient inputs and target concentrations for German rivers were calculated and these were compared with the country-allocated reduction targets of the BSAP. For TP inputs the reduction requirements of the BSAP were sufficient to achieve good status for chlorophyll-a in German coastal waters while for TN inputs much higher reductions were necessary. Based on this comparison we consider that a harmonisation of the target values and reduction requirements of the BSAP and the WFD/MSFD has been achieved.

Comparing the TARGREV target values and the German target values it is evident that the differences are rather small for the Arkona and Bornholm Basin. Except for TP in the Arkona Basin the TARGREV-values are slightly lower than the German values. Considering that 1970 marks the onset of eutrophication in the Baltic Sea (see Fig.1) it might be plausible that the TARGREV target values and the German target values are rather comparable. Based on data from 2011-2015 an assessment for these two basins using both target values shows a difference in the class only for the Arkona Basin, where using the TARGREV target value leads expectedly to a slightly better assessment outcome (see table 1).

The situation is different for Kiel and Mecklenburg Bay. Here, the TARGREV target values are considerably higher than the German target values. This results in an assessment where TN and TP achieve good status in these basins while based on the German target values these basins are not in good status (see table). Given that in the HOLAS II assessment (HELCOM 2018) the other eutrophication parameters DIN, DIP, Chlorophyll-a and Secchi depth (and for Bay of Mecklenburg also cyanobacterial blooms) all fail to achieve good status and the overall eutrophication status is "not good" in these basins the TARGREV target values are not plausible. They lead to contradictions in the eutrophication assessment.

Table 1 Mean concentrations of TN and TP for 2011-2015, German and TARGREV target values and assessment results based on these target values.

	Mean 2011-2015* in $\mu\text{M/l}$	German target values	TARGREV target values with/without inclusion of German data	Eutrophication Ratio based on German target values	Eutrophication Ratio based on TARGREV target values
Total Nitrogen					
Kiel Bay	16.8	16.4	<22.2 / < 22.31	1.02	0.75
Mecklenburg Bay	19.5	16.7	<21.7 / < 21.81	1.17	0.98
Arkona Basin	21.0	19.5	<17.4 / < 17.25	1.08	1.22
Bornholm Basin	30.1	18.0	<16.1 / < 16.05	1.67	1.88
Total Phosphorus					
Kiel Bay	0.69	0.41	<0.96 / < 0.91	1.71	0.76
Mecklenburg Bay	0.75	0.45	<0.98 / < 0.89	1.67	0.84
Arkona Basin	0.84	0.48	<0.67 / < 0.66	1.75	1.27
Bornholm Basin	1.00	0.59	<0.54 / < 0.55	1.69	1.82

*The mean concentrations of 2011-2015 were assessed in the German MSFD Article 8 report of 2018. It would be useful to check the target levels against more recent concentrations that could be calculated by HEAT 3.0. When the TARGREV targets have been initially discussed in IN Eutrophication (see document 4-2 of IN Eutrophication 4) the mean concentrations for TN and TP were mostly much higher for 2007-2011 and the use of the TARGREV values did not lead to a good status in Kiel and Mecklenburg Bay.

Conclusions and proposal for a way forward

After carefully scrutinizing the target values provided by the TARGREV project Germany has concluded that they are not acceptable for Germany for the assessment of Kiel Bay, Mecklenburg Bay, Arkona Basin and Bornholm Basin. Germany would like to continue to use the national target values in future eutrophication assessments. For Germany, these have the advantage that they are harmonised with the target values that are used for the WFD in coastal waters and they yield plausible assessment results compared to the other eutrophication parameters, most importantly DIN and DIP.

Considering that the primary aim should be a plausible assessment of eutrophication Germany suggests that for Kiel Bay and Mecklenburg Bay Denmark scrutinises whether the German target values could be used in these two basins. This would also be in line with the recommendations of the TARGREV project that has proposed that the target values should in fact be lower than those provided by the project. It would also be in line with the general approach for target setting that has been used in HELCOM so far. In fact all target values provided by TARGREV underwent scrutiny and where there was scientific doubt about their applicability and lower target values existed (e.g. from EUTRO and EUTRO PRO projects) it was decided to take the lower values based on a precautionary approach.

For Arkona and Bornholm Basin the argumentation is more difficult since for these basins the TARGREV target values are mostly slightly lower than the German target values. Poland currently uses 14.43 $\mu\text{M/l}$ for TN and 0.61 $\mu\text{M/l}$ for TP for Bornholm Basin. The target for TP is close to the German target value but the target for TN is much lower than the German target value and also lower than the TARGREV target value. One possible solution for the future might be splitting off the Pomeranian Bay from the Bornholm Basin in a way that Germany does not have a share anymore in the Bornholm Basin. In that case, pending acceptance by Poland and Sweden the TARGREV target values could be used for Bornholm Basin. For Arkona Basin, the only short-term solution would be an acceptance of the German target values by other HELCOM Contracting Parties even though the target for TN is slightly higher than the TARGREV target.

In the long term (post HOLAS III) more evidence might become available for a plausible target setting in the Western Baltic Sea. There are further results expected from Danish work on nutrient targets. Germany plans to run a research project in 2020-2022 that will model the status that can be achieved by implementing the national input ceiling (NIC) of the BSAP in the Western Baltic Sea by using a 3D ecosystem model. This approach will indicate which nutrient concentrations are achievable.

References

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