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Working Group on the State of the Environment and Nature  
Conservation

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| <b>Document title</b>  | Setting new threshold values for Pomeranian Bay and Bornholm Basin for the eutrophication assessment in HOLAS III |
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### Background

STATE & CONSERVATION 14 (document 4J-82-Rev.1, Presentation 8) agreed on splitting the Bornholm Basin (SEA-007) to include a new assessment unit Pomeranian Bay in the eutrophication assessment to represent the influence of the Odra plume. The Meeting also requested IN EUTROPHICATION to evaluate the existing threshold values for the HEAT related indicators in Bornholm Basin regarding their validity after splitting Bornholm Basin into two separate units and to come up with new proposals for threshold values if the need arises.

The results of this evaluation and a suitable approach to set new threshold values was presented by Germany to IN-EUTROPHICATION 21 (document 4-2) and was discussed by the concerned Contracting Parties Denmark, Germany, Poland and Sweden at the meeting. IN-EUTROPHICATION 21 took note that the Contracting Parties bordering these assessment units in general supported the use of the presented modelling approach for the Pomeranian Bay for the dissolved inorganic nutrients, total nutrients and chl a. Poland requested further information on the modelling methodology before fully agreeing on the proposed threshold values. IN-EUTROPHICATION 21 agreed to submit the proposal described in this document to STATE & CONSERVATION 15. There was agreement in IN-EUTROPHICATION 21 that the threshold values for Pomeranian Bay are reasonable and should be used in HOLAS III. Concerning the remaining part of Bornholm Basin, Denmark and Poland stated a preference to stick to the old TARGREV targets, whereas Sweden and Germany supported the new threshold values as proposed in this document.

### Action requested

The Meeting is invited to further discuss suitable threshold values for Pomeranian Bay and Bornholm Basin, endorse threshold values for use in HOLAS III and agree on a way forward.

## Setting new threshold values for Pomeranian Bay and Bornholm Basin for the eutrophication assessment in HOLAS III

### Introduction

The presently used assessment unit Bornholm Basin (SEA-007) is characterized by strong gradients of all water quality indicators. These gradients are induced by the strong influence of the Oder/ Odra river plume and amplified by a strong depth gradient from the very shallow areas of the Pomeranian Bay to the deeper open sea areas of Bornholm Basin. While the present assessment unit has a mean depth of 46.5m (standard deviation 23m), a number of monitoring stations are located in the shallow area (below 20m), which is not representative for the major part of Bornholm Basin and is also most strongly affected by the Oder/ Odra plume. This resulted in a falsification of the eutrophication assessment of Bornholm Basin which was assessed as having a worse state than the surrounding basins, as the GES thresholds are not reflecting the natural gradients.

Therefore, HELCOM STATE & CONSERVATION (14-2021; 4J-82-Rev.1) made the decision to split the Bornholm Basin into two new assessment units for the eutrophication assessment. The Pomeranian Bay was separated, becoming its own unit, in addition to the remaining part of Bornholm Basin (Figure 1).

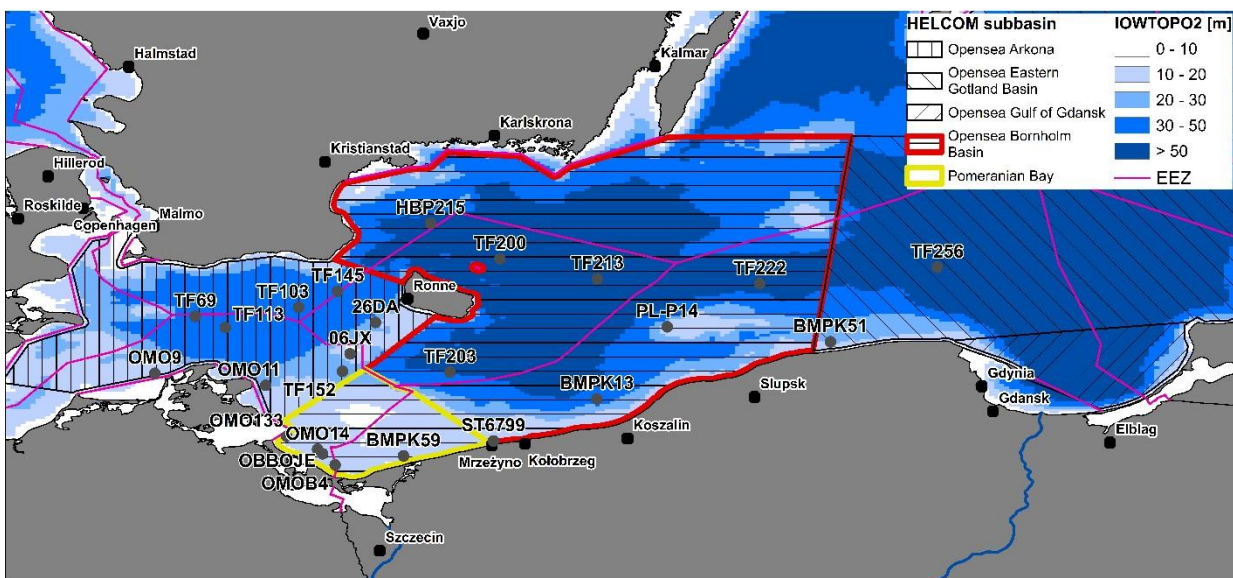


Figure 1 Map of the southern Baltic Sea, bathymetric depth taken from iowtopo2<sup>1</sup>, yellow framed is the new Pomeranian Bay unit. Regular monitoring stations are highlighted (Friedland et al., in prep.).

### Proposal for GES thresholds for new assessment units

Using a long-term model simulation from the biogeochemical model system ERGOM-MOM (Neumann et al. 2015, 2017, 2020), the Leibniz Institute for Baltic Sea research Warnemuende (IOW) in Germany computed the spatially averaged concentrations of winter DIN, winter DIP and summer chlorophyll-a (May to September) for the upper 10m for *i*) the whole Bornholm Basin, *ii*) the Pomeranian Bay and *iii*) the remaining part of Bornholm Basin, after Pomeranian Bay was separated. Using these spatially averaged concentrations of regions *i*) to *iii*), IOW computed the ratio of Pomeranian Bay to the original Bornholm

<sup>1</sup> <https://www.io-warnemuende.de/topography-of-the-baltic-sea.html>

Basin and the remaining part of Bornholm Basin to the original Bornholm Basin for the time period around 1960, assuming the water quality to be still good (Schernewski et al. 2015) at that time. By multiplying these ratios with the already harmonized and coordinated GES threshold values for summer chlorophyll and winter dissolved nutrients (DIN and DIP) of Bornholm Basin (HELCOM 2018a, b, c), suitable GES thresholds for Pomeranian Bay and the remaining part of Bornholm Basin could be derived.

Following the natural gradients, the newly derived GES thresholds for Pomeranian Bay are all above the existing ones (from TARGREV) for the original Bornholm Basin, while they are lower for the remaining part of Bornholm Basin (Table 1). The same approach was applied to derive suitable GES thresholds for the Total Nitrogen and Total Phosphorus concentrations (Table 2). As no GES thresholds for total nutrients are adopted for the original Bornholm Basin yet, IOW used the 3 proposed GES thresholds by: TARGREV (HELCOM 2013), Germany (IN-EUTROPHICATION 5-2016 Doc 4-4) and Poland (HELCOM IN-EUTROPHICATION 5-2016).

The proposed method seems suitable, as the derived GES thresholds are consistent to the existing ones and they are following the natural gradients. Especially for the Pomeranian Bay the resulting threshold values are much higher than the threshold values for Bornholm Basin and assessing this basin with the threshold values of Bornholm Basin would result in an unreasonably bad eutrophication status.

*Table 1 Present GES threshold concentrations for winter nutrients and summer chlorophyll-a as applied in the HOLAS II assessment (HELCOM 2018a, b, c) and proposed threshold values in the new assessment units (Friedland et al. in prep.) The Arkona Basin is shown for reference.*

|   |                      | Summer Chl-a<br>[µg/l] | Winter DIN<br>[µmol/l] | Winter DIP<br>[µmol/l] |
|---|----------------------|------------------------|------------------------|------------------------|
| Present threshold                         | Arkona Sea           | 1.8                    | 2.9                    | 0.36                   |
|   | Bornholm Basin (BB)  | 1.8                    | 2.5                    | 0.30                   |
| Proposed threshold value<br>for HOLAS III | Pomeranian Bay (PB)  | 2.86                   | 5.53                   | 0.40                   |
|   | Remaining part of BB | 1.55                   | 1.80                   | 0.28                   |

*Table 2 Derived GES thresholds for TN and TP concentrations following the different proposals (HELCOM 2013; IN Eutrophication 52016 Doc 4.4; CORE-EUTRO 7-2012 Doc 3/9/Add. 1) (Friedland et al., in prep.). In the original TARGREV report (HELCOM 2013), German data from the 1-12 nm area were missing. An update of results is included in CORE EUTRO 7-2012 Doc. 3/9/Add. 1). The Arkona Basin is shown for reference.*

|  | Arkona Sea  | Bornholm Basin | New proposal for<br>Pomeranian Bay<br>based on | New proposal for<br>Remaining part of<br>BB based on |
|--|-------------|----------------|--|--|
| <b>Total Nitrogen concentration [µmol/l] – annually averaged</b> |             |                |  |  |
| TARGREV target (<)<br>without/with German data                   | 17.39/17.25 | 16.05/16.05    | 21.2   | 14.8   |
| German threshold proposal  | 19.5        | 18.0           | 23.8   | 16.7   |
| Polish threshold proposal  |             | 14.4           | 19.1   | 13.3   |

| Total Phosphorus concentration [ $\mu\text{mol/l}$ ] – annually averaged |           |           |             |           |
|--|-----------|-----------|-------------|-----------|
| TARGREV target (<)<br>without/with German data                           | 0.67/0.66 | 0.54/0.55 | 0.68/0.69   | 0.51/0.52 |
| German threshold proposal  | 0.48      | 0.59      | <b>0.74</b> | 0.55      |
| Polish threshold proposal  |           | 0.61      | 0.77        | 0.57      |

Concerning total nitrogen and total phosphorus it is proposed to use the threshold values marked in grey from table 2. These are based on the German modelling approach. The TARGREV values are not regarded as suitable for Pomeranian Bay, since few data from this area were included in the TARGREV project. For the remaining part of Bornholm Basin a final conclusion has not been reached at IN-EUTROPHICATION 21. There is the option to use either the original TARGREV threshold values for this basin highlighted in yellow in table 2, the rescaled threshold values based on the German approach (highlighted in green) or the rescaled values based on the TARGREV approach (highlighted in blue).

The ERGOM-MOM model is currently not capable of making a proposal for suitable threshold values for secchi depth, so that this eutrophication indicator needs to be assessed based on the old threshold values for Bornholm Basin. The same is the case for the Cyanobacterial Bloom index (CyaBI) indicator.

## References

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