
Document title	Danish comments related to pelagic habitats and current indicators
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Background

In preparation for the Second HELCOM Indicator Workshop a list of questions was sent out to relevant HELCOM Expert and Working Groups. The document below provides a compilation of responses from Denmark related to the topic of pelagic habitats (and the HELCOM indicators currently listed under that category).

Action requested

The Workshop is invited to take note of this information and use it as required during the discussion.

Danish comments related to pelagic habitats and current indicators

- **Phytoplankton community composition as a food web indicator.**

This indicator is developed by Lehtinen et al. (2016). The indicator requires harmonised, and quality checked data on high-quality species-level data. Its use and interpretation requires statistical skills and expert knowledge on local and common phytoplankton ecology, since it does not produce a simple indicator value but requires concluding interpretation of results from three types of analyses (class level trends, species-level trends, genus-level community analysis) in addition to basic information from the study area. This indicator is complicated, and the indicator is accordingly to Lehtinen et al. , not planned developed further since funds and time is limited.
- **Phytoplankton species assemblage clusters based on environmental factors**

There is no scientific report on the modus operandi in the primary literature. DCE is are not aware of this indicator.
- **Phytoplankton taxonomic diversity**

The indicator utilizes the approach for detecting changes in the alpha diversity of phytoplankton described by Uusitalo (2013). The index uses the well-known Shannon diversity index but is modified in this version to include species that account for 95% of the biomass. That is, rarely observed species are not included in the indicator. The methodology is simple and widely accepted. Focusing on 95% of the biomass may wrongly reduce diversity under bloom conditions. As an example, Skeletonema biomasses during typical spring bloom may bias the diversity to lower values.

Moreover, to use diversity indicators requires phytoplankton data collected and analyses by consultants that perform similar. The latter was not the case during that past two inter calibrations held in Denmark (Jakobsen 2012; Jakobsen 2018) a short discussion on the issues in English can be found in Jakobsen et al. (2015). That is measures to avoid such human-driven confusion needs to be taken before any diversity indicator can be calculated.
- **Diatom-dinoflagellate ratio**

Bioscience is skeptical about the Diatom-Dinoflagellate Index indicator. The indicator, as presented, is determined relative to the level around 1900 as the reference state (Wasmund 2017). The 1900 level is determined for individual stations, where the ratio is determined by qualitative species, determined by the methods that were used approx. 100 years ago. The indicator claims that the relationship between the two taxonomic groups, diatoms and dinoflagellates is governed by the influence of anthropogenic influences. From DCE point of view, this is questionable and is not funded on solid scientific experimental evidence but theoretical hypothesis base on field observations. As an example, the ratio may as well be governed by wind-driven turbulent mixing of the water column and natural fluctuations in the nutrient. This applies to the present as well as in 1900. To that end, there are no Danish data that allows the calculation of the Diatom-Dinoflagellate index until around 1980 and solid, reliable Danish data only appear around 1988-1990, and it is therefore not directly possible to use empirical values as references. Furthermore, the interpretation is questionable, since the index is founded on the assumption that diatoms represent high GES values, whereas dinoflagellates represent low GES values.

It should be noted that the DCE has tried to use plankton indicators (Carstensen et al. 2014, see page 21). Here, a strong correlation between silica and nitrogen was found, which ultimately contradicts the rationale behind the Diatom-Dinoflagellate Index proposed to be used in HELCOM. In conclusion, DCE is skeptical to this indicator and finds it scientifically weakly substantiated, and conclusions based on this ratio carries a high risk of erroneous conclusions.

Conclusion

The indicators relevant to phytoplankton somehow are overlapping. It appears that the number could be reduced by skipping **Phytoplankton species assemblage clusters based on environmental factors, Diatom-dinoflagellate ratio, Seasonal succession of dominating phytoplankton groups**, and focusing on the remaining phytoplankton indicators. To that end, there are no coordinated efforts in the HELCOM PEG group to jointly work on phytoplankton indicators, due to lack of national and international funding.

Reference List

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