Baltic Marine Environment Protection Commission

Working Group on the State of the Environment and Nature Conservation

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Note that this document was submitted after the established deadline. It will be decided by the Meeting whether the document can be discussed or is postponed to the next meeting.

Background

The document below addresses a proposal for using sediment core data in HOLAS III as supporting contextual information in the thematic assessment of hazardous substances. The proposal has been developed under EN-HZ (e.g. EN-HZ 16-2021, document 5-1) and outlines how data from dated sediment cores can provide important insights into trends in hazardous substances in the Baltic Sea.

Action requested

The Meeting is invited to endorse the inclusion of relevant information in the HOLAS III thematic assessment of hazardous substances.

Using sediment core data on selected hazardous substances for environmental assessment of the Baltic Sea

Background and purpose

Sediment core data would make a valuable addition the HOLAS III thematic assessment of hazardous substances and provide clear and easy to understand data on trends for legacy and emerging pollutants.

Sediment cores provide an archive of pollutant levels in the aquatic environment over time. This is the case in accumulation areas, where particles with associated pollutants continuously sediment and form new layers on top of the bottom sediments. Pollutant levels in the sediment surface layer thus reflect the most recent years, with gradually older sediment downwards in the sediment core. By slicing, analyzing and dating different levels in the core, the levels of persistent pollutants and corresponding years can be determined. This reveals if trends are decreasing or increasing in the environment. The retrospective time trend analysis of sediment cores is therefore useful to assess the efficiency and sufficiency of implemented measures, as well as providing signals for new and emerging compounds.

Application in HOLAS III

The proposal is that, via a small sub-group within EN-HZ, a short overview of relevant sediment core data from the Baltic Sea region will be collated and reviewed. Where possible links will be explored between trends seen in the sediment core data and the indicators, the implementation of measures, and to the emergence of new substances. This information is proposed to form part of the Thematic Assessment of Hazardous Substances for HOLAS III and provide additional supporting contextual scientific information.

Available data

Recent and ongoing research on sediment cores in Finland has identified lower concentrations of numerous hazardous substances in upper layers (i.e. more recent years) than in lower layers (older years), illustrating decreasing trends in the environment. However, the opposite trend was detected for fluorinated compounds, i.e. PFAS. In Sweden, an ongoing study on chlorinated paraffins in offshore sediment cores has revealed substantially higher concentrations in the core from the Bothnian Bay than the cores from the Baltic Proper or the Skagerrak/Kattegat area (preliminary data).

A study on chlorinated paraffins in three sediment cores sampled close to potential sources by the Swedish coast (Yuan et al. 2017) showed that levels were highest in the core sampled close to a steel factory (Nyköping). Levels of SCCPs were declining towards the sediment surface in all three cores, while for MCCP, trends were increasing in two of three cores and finally for LCCP, two of the cores showed clear peaks around 1990, reflecting relatively widespread use followed by large decreases in Swedish imports of chlorinated paraffins from mid 1990s and onwards (Figure 1).

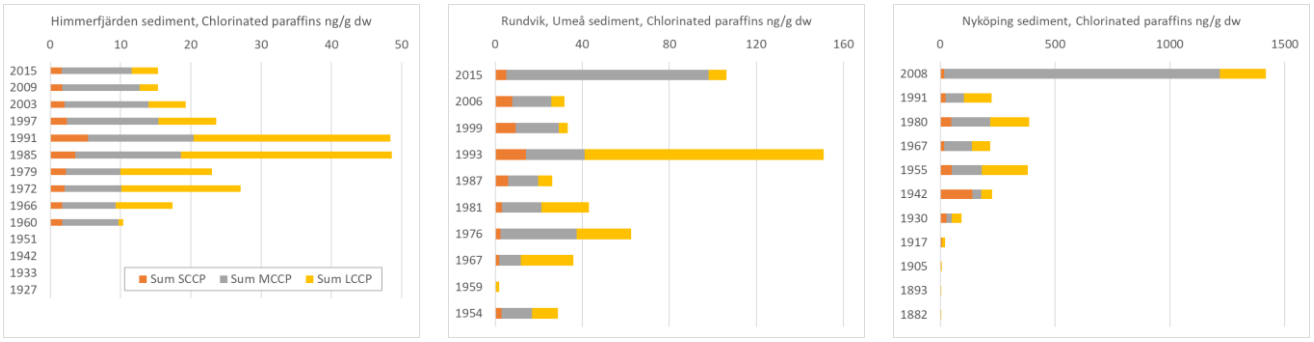

Figure 1. Chlorinated paraffins in coastal locations (Yuan et al 2017).

Alkylphenols, namely 4-tert-octylphenol and 4-nonylphenol, have been analyzed in sediment cores from the Gotland Basin, Bornholm and Gdansk Deeps (Graca et al. 2016). The trends over time were increasing for both compounds at all locations.

Levels of PCDD/Fs, i.e. dioxins, have been determined in sediment cores from the Swedish coast in the Bothnian Bay and Bothnian Sea, as well as in offshore sediment cores from these areas and the Baltic Proper (Assefa et al. 2014). The overall mean peak year for the offshore samples was 1994 while the coastal sites that had a closer proximity to sources exhibited peak years 1–2 decades earlier. Similar trends have been seen when observing PCBs in sediment cores (Sobek et al. 2015). It is thus apparent that restrictions have had effects but it was also clear that the reduction in PCB had levelled off during the last two decades, and that the levels of hexachlorobenzene were actually increasing in offshore sediments (Sobek et al. 2015).

For potentially toxic metals, a retrospective sediment study in the southern Baltic Sea (Zalewska et al. 2015) showed no decrease in the time trend for cadmium, while some decreasing tendencies could be seen for the other investigated metals. However, levels where still far above levels from the 19th century or earlier. A study from the Gulf of Finland and the Bothnian Bay, on the other hand, showed decreasing trends over time for almost all investigated metals (Vallius 2014). Even so, levels of some metals were still considered to be unacceptably high.

Other retrospective studies on contaminants in Baltic Sea sediment from the last decade, available in literature, include e.g. pentachlorophenol in the Gulf of Gdánsk (Kobusinska et al. 2014), radionuclides in the southern Baltic Sea (Zalewska & Suplinska 2013), various heavy metals in the Vistula Lagoon (Zalewska et al. 2020) and the Neva Bay (Ryabchuk et al. 2017), and tantalum and niobium in the northern Baltic Sea (Sutliff-Johansson et al. 2021).

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