Document title	Future work on HELCOM indicators - Hazardous substances
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Background

The following document contains a brief topic summary that addresses the overall aim of indicator work and assessments on the given topic. It outlines the current status and gives an indication of the work needed to adjust/develop the identified indicators. Potential avenues of cooperation are also described. Where possible the information has been compiled based on responses received from the HELCOM indicator questionnaire process and revised based on comments received at the 1st HELCOM Indicator Workshop. This is particularly the case for the section on the aims of the work, which was a focus of attention at that 1st indicator workshop.

Action requested

The Workshop is invited:

- to take note of the information and use it as needed to support the discussion
- provide comments or corrections as needed

Hazardous substances

Future work on HELCOM indicators – towards the 3rd Holistic Assessment of the Baltic Sea 2023.

Indicators under discussion

1. *Hexabromocyclododecane (HBCDD)
2. *Metals lead (Pb), cadmium (Cd) and mercury (Hg)
3. *Perfluorooctane sulphonate (PFOS)
4. *Polyaromatic hydrocarbons (PAHs) and their metabolites
5. *Polychlorinated biphenyls (PCBs) and dioxins and furans
6. *Radioactive substances: Cesium-137 in fish and surface seawater
7. *TBT and imposex
8. *Polybrominated diphenyl ethers (PBDEs)
9. *Diclofenac
10. White tailed sea eagle productivity
11. *Reproductive disorders: malformed embryos of amphipods
12. *Operational oil-spills from ships
13. Copper
14. Biological effects
15. Pharmaceutical related

*Completed indicator questionnaires received.

Discussion was held related to these issues at expert group meeting of EN-HZ and CG PHARMA.

These indicators appear in the additional document that considers the HELCOM indicator-policy match and scoring (Document 17 - HELCOM indicator-policy matching and draft scoring, and annex). Further relevant information related to hazardous substance monitoring and assessments for those HELCOM Contracting Parties that are also EU Member States can be found in the JRC Technical Report: Marine Chemical contaminants – support for the harmonization of MSFD D8 methodological standards.

Aim

A Baltic Sea regional assessment of hazardous substances that suitably, both spatially and temporally, and via regionally agreed lists, covers concentrations of identified priority substances (and substances of concern) that have the potential to cause harm.

In the short term a review of spatial coverage and regionally agreed lists would be a valuable starting point. Furthermore, an effective assessment should also address biological effects of these substances where possible and all indicator evaluations should be carried out against threshold values that are indicative of levels below which no harm is caused, neither to the environment nor to human health through the food chain. A linkage between sources, pathway, and status in the marine environment is also important to develop with these indicators. An overall integrated assessment of hazardous substances is also needed. Ways to address emerging substances (e.g. a possible screening indicator) should be considered in longer-term work, as should the development of indicators that address foodstuffs since it requires clarification on the concept and stronger linkages with relevant food agencies, and the development of an approach to follow up after acute pollution events.

General introduction and current status

Twelve hazardous substance indicators were utilised in the 2018 State of the Baltic Sea report, seven of which (substance concentration indicators) were used in the integrated assessment of hazardous substances. In several cases a single indicator consists of a number of grouped substances (e.g. PBDEs) or a number of independently assessed substances (e.g. metals). The threshold values applied in indicators are summarised in the Thematic Assessment of Hazardous Substances (pages 14-15). Of those indicators not included in the integrated assessment, the TBT and imposex and Diclofenac indicators were tested, the reproductive disorders indicator was applied as a supplementary indicator in Swedish and Finnish waters, and the while-tailed sea eagle and oil spills indicators were addressed separately. A number of other substances that may represent potential areas of concern or valid indicators (or initial evaluations) have also been proposed, including aspects related to pharmaceuticals. An initial discussion on developing a copper indicator, and the relevance of this directly to marine activities, has also been discussed (proposal to crate a candidate indicator sent to State and Conservation). The recent EN-HZ meeting considered that biological effects may represent a relevant workshop, potentially as a back-to-back event with a future physical meeting of the group, that would revisit and initiate specific development in this area.

Relevant species (regional lists of species for the assessment)

Lists of substances that are relevant considerations include the HELCOM list of priority substances (HELCOM RECOMMENDATION 31E/1), the EU list of priority substances in the field of water policy (DIRECTIVE 2008/105/EC) and the EU Water Framework Directive Watch List plus proposals related to the update of that watchlist (JRC Technical Report: Review of the 1st Watch List under the Water Framework Directive and recommendations for the 2nd Watch List). A comparative analysis of these lists, a comparison with existing HELCOM indicators, and a review of substances and indicators discussed at the expert group level (e.g. proposals for possible indicators) may support further developments and priority setting for the future.

Development/adjustment work

This group of indicators has high relevance including substances that can be directly linked to human activities and certain biodiversity components (e.g. biological effects). A number of general issues related to hazardous substances assessment indicator work have been raised, such as: linkages between load/source-pathways-status, normalisation factors (use of Al or Li in sediment analyses), application of standard conversion factors (e.g. regional lipid concentration values), alternative sediment monitoring approaches (e.g. use of dated cores – and possibility to establish regional Background Assessment Concentrations, BAC, from this), application of 'master stations' for less regular monitoring of designated substances (e.g. substances categorised as 'substances of concern', as compared to those listed as 'priority action substances'), inclusion of Zebra mussels, application of conversion factors for concentrations in different biota tissue types and the potential for this to be applied to food stuff analyses, the normalisation for tropic position (and an associated assessment of uncertainty), and various developments related to confidence setting of the integrated assessment (e.g. independent assessment of metals and inclusion of relevant major drivers of overall condition in confidence evaluation). In the future, the appropriate inclusion of biological effect and other indicators (i.e. those not representative of substance concentrations) into integrated approaches needs to be explored, as does the practical implementation of radioactive substances data into the integrated assessment tool once build into the ICES developed assessment portal. Further development of the automated assessment tool has also been discussed, for example to identify data outliers and to provide an output that indicates why data is omitted from full assessment.

Hexabromocyclododecane (HBCDD): Data coverage needs to be considered, especially for certain areas where extensive gaps occur in the current assessment (e.g. the Gulf of Finland and Gulf of Riga), potentially representing the need for increased monitoring. Longer time trend data (i.e. in future assessments) should improve the assessment as currently contains a large amount of 'initial' data assessments (2 or less years of data). The assessment and calculation should be adjusted to represent a defined trophic level according to the threshold values applied (e.g. EU derived EQS values). This will require clarification of the trophic level used and the respective biomagnification effects. Considered important that such substances should be monitored to reflect the fact that large amounts are currently utilised, for example in building materials, and that appropriate disposal will be pertinent in the future.

Metals (Hg, Cd and Pb): Gaps due to low level of monitoring/reporting in seawater (Pb and Cd) should be examined to assess if simply missing from the HELCOM COMBINE data, or if deemed an inappropriate source of monitoring by some countries. Discussion related to most appropriate sampling matrix may also be relevant. Availability of biota data for Cd (fish) requires assessment as well as addressing the study reservations on the current threshold value (initiated within EN-HZ), though application of established BAC threshold values or a regionally agreed threshold value for this matrix are possible alternatives that could be explored.

Perfluorooctane sulphonate (PFOS): Data coverage needs to be considered and may require extended monitoring. Longer time trend data (i.e. in future assessments) should improve the assessment as currently contains a large amount of 'initial' data assessments (2 or less years of data). It is considered important that monitoring is maintained as PFOS is a major problem in many European countries due to release for example from firefighting foams. Although in general concentrations in biota in the Baltic Sea are below the EQS threshold value assigned, most current monitoring stations are located in reference area, so more measurements are needed in areas where contamination may be more prevalent to verify status assessment. The assessment and calculation should preferably also be adjusted to represent a defined trophic level according to the threshold values applied (e.g. EU derived EQS values). This will require clarification of the trophic level used and the respective biomagnification effects. Protocol should be developed by EN-Hazardous substances.

Polyaromatic hydrocarbons (PAHs) and their metabolites: Availability of monitoring data from all areas not currently complete and spatial distribution of biota sampling is generally poor compared to sediment sampling, indicating that increased monitoring in biota may be relevant. Other approaches may also be valid, such as: exploring water as a sampling matrix and the use of caged mussels or passive samplers. In addition the inclusion of metabolite compounds remains to be carried out once study reservations on application and threshold values have been overcome (discussion underway). Clear guidelines on monitoring type and frequency, development of assessment criterion for sum or individual PAHs in sediment and biota, and links between biological effects and concentration levels in biota and sediment should be investigated to substantiate the assessment levels developed/used, with indication of level of harm to organisms or ecosystem when criterion are exceeded.

Polychlorinated biphenyls (PCBs) and dioxins and furans: Data coverage needs to be considered, especially for certain areas where extensive gaps occur in the current assessment. This is particularly so for the dioxin-like PCBs, dioxins and furans component. Monitoring and assessment guidelines need to be developed for dioxins and furans in biota and harmonisation should be improved to ensure all parameters vital for indicator evaluation are listed (e.g. supporting parameters and minimum requirements to be included in indicator evaluations). Trophic level adjustment, and related development work needed. Furthermore, monitoring frequencies, cooperation on sampling, and

passive sampling options may be relevant to overcome costly sampling needs. Comparison with OSPAR approaches may also be valid and discussion related to existing study reservation (CB-118) is underway.

Radioactive substances Cesium-137 in fish and surface seawater: The indicator is operational throughout the Baltic Sea. Spatial coverage for both water and biota data is reasonably high, and data are regularly reported and reviewed through the HELCOM MORS group. There are some areas where samples are not taken/or data in not currently reported, which if addressed may increase coverage and confidence in future assessments. Practical developments on how to include this data stream (external from database where other hazardous substances are currently collated) to the automated indicator evaluation system for the integrated assessment need to be considered.

TBT and imposex: The indicator is essentially operational (in so far as practical development is concerned) throughout the Baltic Sea. It is currently only tested in the State of the Baltic Sea report due to the need for final regional agreement related to threshold values and application of the indicator. The assessment approach (including earlier work by Sweden and the 2018 assessment) should be reviewed to initiate this process. Sampling is dominantly in sediment and greater coverage in all matrix types, but especially water and biota, would create a better evaluation with higher confidence. Further studies are required to understand the 'life-cycle' of the contaminant.

Polybrominated diphenyl ethers (PBDEs): Increased spatial and temporal monitoring would benefit the indicator evaluation. Many stations assessed are also reference stations and may not always encompass the most polluted areas. The EQS threshold value currently applied for biota is potentially due for revision (under the relevant EU systems through which it was derived) and this may influence future assessments. The assessment and calculation should preferably also be adjusted to represent a defined trophic level according to the threshold values applied (e.g. EU derived EQS values). This will require clarification of the trophic level used and the respective biomagnification effects. Protocol should be developed by EN-Hazardous substances. Detection limits are also very close to the threshold value applied.

Diclofenac: The indicator is not operational but was tested in the State of the Baltic Sea report. The indicator lacks a lead/co-lead but is situated in CG PHARMA. There is no current monitoring and assessment guideline, no active monitoring (other than earlier data collection required from HELCOM countries that are also EU Members States to assess this substance on the Watchlist), and no databases or indicator evaluation system exists. Following other hazardous substances indicators it is likely that HELCOM scale 4 is the most appropriate assessment scale. Much will likely depend on the pending decision within the EU related to if this substance is placed on the list of priority substances, or if within HELOCM there is a regional decision to assess the status of this pharmaceutical in the future. Inclusion as a fully operational indicator is viable, if decision made to do so, with a guideline, threshold values, addition to the HELCOM COMBINE database, and adjustment of indicator evaluation automated system being needed (agreement/development).

White tailed sea eagle productivity: The relevance of this indicator as a biodiversity component (i.e. since it is addresses productivity and breeding success) has been discussed, though the effect-based link to hazardous substances as a relevant pressure is clearly shown. The question of monitoring more direct effects of hazardous substances, such as eggs shell thickness or contaminant concentrations in abandoned/dead eggs was raised. Data in some coastal areas needs further development to ensure appropriate selections are made (e.g. only data from coastal region considered). Currently the work of collecting (via HELCOM data call), hosting and analysing the data, and the indicator evaluations, is all carried out by the indicator lead. A suitable data reporting

system and database solution that is centralised would benefit the indicator, as would automation of the indicator evaluation. The indicator also requires the development of monitoring and assessment guidelines.

Reproductive disorders: malformed embryos of amphipods: The indicator is a supplementary indicator (currently applied only in SWE and FIN waters) and is a direct biological effects indicator. The indicator offers a link between contamination in sediments (often a major sink) and biota. Expansion to other areas of the HELCOM region and expansion to other suitable species (e.g. eelpout and others) is viable, though resources would be important. Data and monitoring availability would need to be assessed and addressed if not currently available. Monitoring in addition to that used in the existing indicator is known for the Gulf of Finland (Russia) and the Gulf of Riga (Latvia) where a project is underway and may provide a template for expanding the indicator to new species/regions. Expansion would require development of database solution and a review of threshold values, supported by the existing solid grounding in published research and clear statistical and assessment framework.

Operational oil-spills from ships: The indicator is hosted by the HELCOM IWGAS group. The indicator is operational (spatial extent), however the duration aspect of spills is not directly assessed with the indicator in its current form. An evaluation of the monitoring that takes place to ascertain if gaps are due to lack of reporting or lack of monitoring may be relevant. Aerial monitoring focusses on oil but does also cover other spills. When detecting a spill of other substances often it is unknown what kind of substance is detected due to lack of sufficient sensor systems. Due to large variety of MARPOL Annex II substances it is difficult to identify single substances. Relevant developments could include: evaluation of alternative monitoring approaches (e.g. Remotely Piloted Airborne Vehicles (RPAS), use of satellites, and the fusion of such data sets), further linkages to HELCOM recommendations related to this topic, and linkage of the indicator text to HELCOM response tools and manuals where possible. Classification of significant pollution events and the follow up monitoring related to such events may require definition and development, respectively.

Other indicators possibilities discussed at expert group level: A number of substances of potential interest as future indicators were raised during the process. These included: Copper (proposal that it become a candidate indicator made by EN-HZ), antimicrobial agents (including Amoxicillin, Ciprofloxacin), Macrolide antibiotics, Methiocarb, Neonicotinoids, Metaflumizone, Oestrogenic compounds (including: including: 17-Alpha-ethinylestradiol (EE2), 17-Beta-estradiol (E2), Estrone (E1)), Carbamazepine, Primidone, and Nonyl- and Octyl-phenols. A number of these substances may have related development/technical hurdles involved, for example analytical capability for Oestrogenic compounds, though others may also have sufficient data available to explore initial assessments to evaluate further development work.

Note: many of the above issues or potential obstacles also have resource implications.

Potential obstacles

To increase spatial coverage, particularly at the HELCOM assessment unit scale 4 it is likely that further monitoring may be required. Some aspects related to the spatial coverage may be resolved with planned changes (as above) that may prevent data being excluded from assessments, though this is not relevant in all areas that lack coverage. In addition the timing of certain external processes (e.g. agreement or revision of EQS values – such as for Diclofenac or PBDEs) may not be fully aligned with this HELCOM process. Such analyses are often costly and may prevent further monitoring being implemented and aspects such as normalisation to trophic level may be challenging (e.g. PFOS logKow value is quite low), with such developments requiring analytical and research support.

Frequency

Annual updates possible for those indicators covered by the automated assessment system (once development completed) and proposed that a brief annual update of key message supported by a review of data and trends/changes takes place in the EN-HZ meeting each year. Overall status assessment (and full indicator report update plus integrated assessment) proposed on a 3 or 6 year basis.

Potential for cooperation

Cooperation with OSPAR (e.g. where similar indicators exist) and ICES is also relevant and should be continued. Cooperation with, and feedback from, EU processes such as the Descriptor 8/9 workshop and JRC reviews will likely be relevant for further work on aspects such as the substances of interest and the integration of hazardous substances indicators. Linkages with the ICES marine chemistry (MCWG) and biological effects of contaminants (WGBEC) working groups may also be relevant and possibly EMODnet chemistry should looked at to if extensive data is available there but not included in HELCOM databases (though such data is of unknown quality, i.e. not evaluated by HELCOM quality checking processes).

For PBDEs further discussion between DG SANCO, EFSA and DG ENV may also provide valuable information.

Future work related to oil spills may also benefit from cooperation through with the corresponding data set of the BONN Agreement and maybe EMSA (SafeSeaNet).

Other issues

The workshop is invited to document other aspects they consider to be relevant to the development of this specific indicator category.

A number of issues raised previously (though not an exclusive list) that may be relevant for discussion include: integration rules, appropriate coordination with WG Chemicals, appropriate coordination with MSFD CIS processes, and appropriate coordination with OSPAR.