



Document title Outcome of the HELCOM SPICE BSII Workshop

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Outcome of HELCOM SPICE workshop on assessment of cumulative pressures and impacts in HOLAS II

Introduction

The Project for Developing the Second Holistic Assessment of Ecosystem Health in the Baltic Sea (HOLAS II) runs from December 2014 to June 2018. The project will assess the overall environmental status of the Baltic Sea and its pressures, and evaluate progress in relation to the goals of the Baltic Sea Action Plan (BSAP). It will be developed so that it can also be used by the Contracting Parties also being EU Member States in the reporting under the EU Marine Strategy Framework Directive (MSFD). A first version of the 'State of the Baltic Sea' report will be published in June 2017.

The assessment of cumulative pressures and impacts in HOLAS II uses the Baltic Sea Impact Index (BSII), which has been developed under the [HELCOM TAPAS project](#) and guided by the previous workshops [HELCOM Pressure index WS 1-2015](#), [HELCOM TAPAS Pressure index WS 1-2016](#), and [HELCOM TAPAS Pressure index WS 2-2106](#).

The implementation of the BSII is carried out under the HELCOM SPICE project: 'Implementation and development of key components for the assessment of Status, Pressures and Impacts, and Social and Economic evaluation in the Baltic Sea marine region'. HELCOM SPICE is an EU co-financed project¹ with the task to support the HOLAS II project. The project runs from January 2017-December 2017.

Workshop

The workshop was held on 21 March 2017 at the premises of the Helsinki Secretariat, Finland.

The aim of the Workshop is to verify and summarize results for the cumulative impact assessment of HOLAS II which is assessed using the Baltic Sea Impact index.

The agenda of the Meeting is contained in **Annex 1**.

The Meeting was attended by representatives of Denmark, Finland, Germany, Lithuania, Poland, and Sweden. The list of Workshop Participants is contained in **Annex 2**.

Monika Stankiewicz, Executive professional secretary, welcomed the participants to the workshop.

The Workshop was chaired by Samuli Korpinen, Finland and Lena Bergström, HELCOM Secretariat, acted as secretary to the workshop.

¹ under the call "Implementation of the Second Cycle of the Marine Strategy Framework Directive: achieving coherent, coordinated and consistent updates of the determinations of Good Environmental Status, initial assessments and environmental targets" (DG ENV/MSFD Second Cycle/2016)

Draft results of the Baltic Sea Impact Index

1. An addendum to the workshop document 3 was distributed to the Workshop participants as paper copies and made available as a workshop document ([Document 3 Add.1](#)). The addendum contains updated results for the Baltic Sea pressure and impact indices (BSII and BSPI), based on all pressure and ecosystem component layers to include, as well as a layers showing anomalies in long term salinity, temperature and pH, which are currently not included in any results. Document 3 was furthermore revised to clarify the use of ecosystem component layers and to include missing legends ([Document 3 Rev1](#)).
2. The Chair clarified the framework for the workshop:
 - a. The aim of the workshop is to conclude on results and propose key messages for the State of the Baltic Sea report.
 - b. The method for the assessment of cumulative impacts based on the BSII in HOLAS II has been agreed by processes outline in document 2, and will not be open for discussion at this time, with exception for the calculation of cumulative impact which will be addressed by the workshop.
 - c. The approval process for the ecosystem component data layers is still partly ongoing and corrections to some of the layers will still be made.
 - d. Minor corrections to data set may still be possible, but any improvements that would need more substantial work cannot be made before the release of the first version of the 'State of the Sea' report, but may be considered for when the 'State of the Baltic Sea report' will be updated in 2018.
 - e. If the review of the results reveals problems in data or methodology, the workshop is invited to recommend short-term and long-term solutions to improve the assessment.
3. The workshop welcomed the information that Denmark and Sweden have agreed to include the assessment of Kattegat and the Sound in the "State of the Baltic Sea" report.
4. The Project coordinator of the HOLAS II project presented the content of and timeline to finalize the first version of the State of the Baltic Sea report by June 2017 (Document 1, Presentation 1).
 - a. The first version of the report will be ready in June 2017 and will present the results as available now and including any improvements to the BSII that can be made within a short time frame, and in addition there will be a possibility to make additional corrections to the ecosystem components and pressure layers, pending personnel resources, in autumn 2018.
5. The workshop considered document 2:
 - a. An addendum to document 2 was made available to clarify how the sensitivity score were obtained, including an assessment of certainty in the results ([Document 2 Add.1](#)). A summary of the outcome of the production of sensitivity scores will be included in the supplementary report, and could also show the dispersion from the mean.
 - b. The workshop was informed that the sensitivity scores used in the calculation of the BSII as presented to the workshop was based on the HOLAS II expert survey only while no information based on literature was not included as indicated in document 2.
6. The workshop discussed the preliminary results from the BSII index as presented in document 3 and its addendum (Annex 1, Presentation 2).
7. In general, the workshop considered that the HOLAS II BSII is based on considerably more structured process and better input data than the previous BSII assessment and welcomed the new spatial layers of pressures and ecosystem components.

Calculation of cumulative impacts

8. The workshop considered if the Baltic Sea impact index should be presented based on the sum, average or results for the most sensitive ecosystem component, and the use of median values was

also discussed. No final recommendation was made but pros and cons of the different options were lifted, tending towards favouring using the mean.

- a. It would be preferred to use an approach that is as comparable as possible to similar assessments in other regions. Both the mean and the sum have been used in other studies recently.
- b. The mean would be preferred in the case that there are many categorical variables or presence/absence data, and that the sum would be preferred when most of the data is continuous.
- c. The “most sensitive component” approach was also promoted as it is the most precautionary, although noting that the aspect on impacts on ecosystem component can also be shown in dedicated graphs focusing on this issue.
- d. In the initial HOLAS, the sum was used. However, the workshop noted that the possibility to make direct comparison with the previous HOLAS II is limited even should the sum be used also in HOLAS II, because of the improvement and added number of underlying data layers.
- e. The ‘median approach’ can be expected to be less sensitive (less precautionary) than the other options.
- f. The ‘mean approach’ seems to be most influenced by the information of pressures and less sensitive to gaps in data.
- g. Maximum and sum are relatively more influenced by the information on underlying ecosystem components.
- h. Areas with more detailed information on ecosystem components seem generally to have higher impact, but the probability of such biases is smallest when using the mean approach.

The Baltic Sea Pressure Index

9. The workshop discussed the preliminary results for the Baltic Sea Pressure Index (BSPI) as presented in Document 3 Add.1 , figure 5, and noted the following
 - a. The maps showing results of the BSII and the BSPI appear similar when the mean approach is used for the BSII.
 - b. The BSPI results show better the presence of activities.
10. The workshop discussed the fact that observed differences in intensity of pressures between countries could be due to unbalances in what data has been reported. One example is the case of dredging and cables in Finland, which are presented at a more detailed level than for other countries. This fact should be presented in the assessment. For example, a data matrix could be included to present information on from which countries certain information has been obtained and in which countries other source of information been used.
11. The workshop noted that the impact in the Danish fiords appears lower than expected and considered that the nutrient pressure layers in the coastal waters require re-checking.

Sensitivity scores

12. The workshop discussed the results regarding sensitivity scores, and took note of additional information that the expert survey to obtain sensitivity scores was answered by 81 experts, and is the basis for the sensitivity scores that were applied in the current version of the BSII. Reasons for this are given in Addendum to Document 2 where also the results from literature review are given.

13. The meeting took note that the expert-based scores have been evaluated against the number of expert responses behind the score, standard deviation of the responses and the experts' self-evaluation of the confidence of the score. The chair also informed that comparison with expert sensitivity scores of the Swedish SYMPHONY project was made and the correlation was very good.
14. The meeting considered the following points as regards the sensitivity scores:
 - a. The scores could be evaluated by ranking them in relation to their evidence base or level of certainty, noting that this information is available in the expert survey.
 - b. The scores from the expert survey should be compared with information in other sources, including the HELCOM red lists.
 - c. The sensitivity scores reflect both direct and indirect pressures on the ecosystem components, and the scores for different pressure- ecosystem component linkages should be evaluated to ensure that the role of indirect effects is not inflated, for example by comparing the score for indirect effects of fishing as with the scores for direct effects of other pressures.
 - d. The impact scores do currently not take into account that the fisheries are selective for different species as the data for different species is lumped together. The workshop recommended that sensitivity scores for fish impacts should be based on species-specific information and make use of existing information on fishing mortality. This development could take place for the update of the HOLAS II (see below the development of pressure layers).
 - e. The linkage between harbour porpoise and pressures on marine mammals should be checked and corrected in cases where harbour porpoise is erroneously linked to pressures that only act on seals, such as seal hunting. This can be done by setting the respective sensitivity score to zero.
15. The meeting noted that some checking of the sensitivity scores can be made already for the first version of HOLAS II, but more comprehensive development will be aimed at for the 2nd version in the autumn 2017.

Ecosystem component layers

16. The workshop considered the development of the ecosystem layers as a major milestone in the HELCOM work.
17. The workshop took note of information from the Secretariat that focus of the work to develop ecosystem component layer has been to produce Baltic wide maps based on available data and models, and that a prerequisite for including ecosystem components in the BSII is that the maps are Baltic-wide. The data approval process has revealed some need for corrections to the data layers, and these are being made within the time frame for publication of the first version of the State of the Baltic Sea report, to the extent that it is possible. In the preparation of the updated version of 'State of the Baltic Sea' report the development towards more precise maps will continue for selected data layers, pending available resources.
18. The workshop took note of the following more specific information from the Secretariat on the data approval process:
 - a. The Natura2000 layers have been corrected according to the comments and are currently under approval.
 - b. For fish and pelagic habitats some corrections are still needed.
 - c. Flounder will not be included due to insufficient data.
 - d. Seal-haul out layers will not be used as recommended by SEAL EG.
19. The workshop evaluated the ecosystem component layers included in the BSII, and recommended the following:

- a. Areas where data is lacking or partially missing should be shown when ecosystem or pressure layers are presented in separate, and that cases where conclusions could be uncertain due to lack of underlying data should be clearly indicated also in results based on those layers.
- b. The workshop considered the layers representing the distribution of seals, taking note that this is based on categorical information from the red list on the distribution of seals and has been produced in communication with the distribution team within the HELCOM expert group on seals, and noted that the seal layers must be checked and harmonized regarding the classes used (3 or 4 classes) with explanation what the classes mean (this is included in Document 3 Rev1).
- c. Sweden commented the low resolution of the seal layer in combination with the hunting data was cause for concern as it produces unrealistic impact levels (aside of the sensitivity scores).

Pressure layers

20. The workshop recommended that the pressures layers should be scaled to be consistent in relation to each other before calculating the BSII, and discussed the possibility to weight their levels in relation to management thresholds (the fishing and seal hunting layers), noting however that this would require substantially more work but could be considered for the updated version of the State of the Baltic Sea report, or to lower the sensitivity scores.
21. The workshop evaluated the pressures layers included in the BSII, and recommended the following:
 - a. Information on the spatial distribution of impulsive noise is not included for all countries and will be updated for the 2nd version of the HOLAS II through a data call in autumn 2017.
 - b. Seabird hunting and seal hunting were combined in the sensitivity scores but the same score should be used separately for the pressure layers.
 - c. The data for nutrient concentrations in coastal waters should be verified as it seems to be underestimating nutrient levels in some areas. SPICE project will contact ICES to get access to the Contracting Parties' coastal data submitted to EIONET.
 - d. Germany commented that the nitrogen layer should be checked regarding some coastal areas, but also for the offshore parts. As data are taken from COMBINE monitoring stations, the stations could be marked as dots, and the colour and the size of the dot could indicate the degree of pressure and its spatial extent, and that this methods should always be used when point sources are shown.
 - e. The data layer for non-indigenous species needs to be updated with data for more recent years, and the parameters for how the layers is normalised should be presented in the supplementary report.
 - f. The layers should be visualised so that areas being under no pressure are not equalled to those with lack of data.
 - g. A layer on hazardous substances is currently missing. The CHASE output was planned to be used but has not been included in the current version. The meeting discussed the difficulties:
 - i. will the CHASE results be applicable if the result is determined by a single substance (PBDE) or should the contamination pressure be defined by other layers?
 - ii. could sediment pollution (concentrations in sediment) be used as a proxy for contamination? Swedish Geological Survey has made such a map for a wide area in the Baltic Sea which could be improved by other data, however the assessment period differs.
 - iii. could EMODnet chemistry data be used to improve sediment contamination data?

- h. The layer on seal hunting has a larger spatial distribution than the actual activity, as seal hunting takes place from land and has limited distribution towards the sea. Sweden proposed that the distribution of the activity could be handled in the same way as for bird hunting which is also landbased.
- i. The workshop took note of the comment from Sweden that the seal hunting is performed under the preconditions that it should not have a negative impact on seal populations and discussed if the scaling of this layers should be corrected to ensure that its importance is not inflated. Such scaling could be based using information on the seal quotas in the Contracting Parties. This could potentially be done in the short timeframe provided clear justification. Sweden commented that the seal hunting pressure layer should preferably be adjusted by lowering the spatial distribution of the pressure, as hunting takes place from shore, or by adjusting the sensitivity score so that it reflects sensitivity at population level, given that the resolution of the input data layers is low.
- j. It was discussed if a similar approach as for seals should also be used for fishing pressure by scaling different stocks in comparison to each other in relation to fishing mortality, noting that the purpose is not to remove the pressure but to provide them at an ecologically more relevant scale. This should be considered further and could be considered in the longer timeframe for the 2nd version of the HOLAS II.
- k. The workshop noted that the new layers on pH, temperature and salinity which are presented in the addendum are presented at a more detailed spatial scale than the underlying data permits. These data layers are currently not included in the BSII. The workshop supported their exclusion, but recommended that these results are presented in the summary report in other ways (e.g. bar charts) and at a lower spatial resolution, perhaps by sub-basin.
- l. The workshop discussed how to include information on anoxic areas, and suggested that a similar approach as applied for the pH, salinity and temperature layers, based on anomalies, could be used for showing the relative change in anoxic areas and frequency of anoxic events. However, relatively good spatial information is also available for map presentation. The workshop recommended that anoxic areas should be included in the summary report as in separate but that it should also be tested for inclusion as a pressure in the BSII for the 2nd version of the HOLAS II.
- m. The workshop noted that the data layer on fishing pressure has poor resolution in relation to what can be technically achieved and that improvement should be considered for the updated version of the summary report.
- n. The level of fishing intensity in the Kattegat should be verified, and the problem with aggregation of the fish extraction layer should be corrected by disaggregating so that fish extraction pressure layer matches the fish distribution layers at species level.
- o. Data on input of heat and input on radionuclides is point data from power plants and its visibility in the pressure fact sheets should be considered by alternative methods. In addition, the radionuclide layer should be verified against the Cesium-137 core indicator, as needed.

Visualization and presentation of results

- 22. The colour scheme of the pressure and ecosystem component maps should be changed as to not use red or green in order to not implicate that it is a status assessment; the colour blue should be avoided on areas where it may risk being confused for sea areas without data (which should be presented as white or striped areas for specific layers).
- 23. The method presentation in the supplementary report could be presented together with examples to make them easier to understand.

24. It would be important to visualize the connection between cumulative pressures and underlying human activities, for example using tree maps could be used inside the grid cells.
25. The workshop discussed the method for calculating the most important pressures, noting the following:
 - a. The influence of spatial resolution should be considered to ensure that the results are not biased towards pressures layers represented by coarse data.
 - b. Regarding the identification of important pressures in different areas, the workshop discussed that information may be relevant to give in graphs, e.g. bar charts, as compared to looking at the regional map directly, also noting that uncertainties in underlying data quality may be easier to communicate at this level.
26. As additional information was proposed to show the most impacting pressures for certain ecosystem components. This could be given in several ways, e.g. charts.
27. It would be interesting to analyse the BSII results from the opposite perspective: identify areas that are not so much impacted and where they locate.

General comments to presentation of results in the State of the Baltic Sea report

28. Both the BSII and BSPI results give valuable results for the summary report. However, additional information to support the map interpretations should be given alongside, e.g.:
 - a. pressures/activities contributing the index results can be given as pie charts (or similar),
 - b. data limitations should be considered in the key messages of the summary report by providing guidance on how the results should be interpreted, and more detailed information on lacking and incomplete data should be mentioned in the supplementary report,
 - c. as an additional material each grid cell in the map could show the predominant pressure type or alternatively so-called 'tree mapping' where the grid cell is divided to proportions giving the information of the pressures and/or activities behind the result.
29. The results are useful for showing where the most impacting pressures are at the present time, but are less informative for showing the distribution of impacted ecosystem components from historical perspective. In other words, the ecosystem components are already affected by the human activities and therefore this should be kept in mind when interpreting the results.
30. Information on human activities contributing to the highest number of pressures could be included.
31. The sensitivities of ecosystem components to pressures could be organized to a traffic light matrix which could help understanding which habitats or species are most sensitive to which pressures. The most influential linkages (pressure-ecosystem component combinations) would an interesting result in itself and could also be presented in relation to their spatial distribution.

Group work

32. The workshop split into two groups to discuss key messages for the assessment of cumulative impacts. The results of discussion with proposals on key messages are presented in full in Annexes 3-4.

Annex 1. Provisional Agenda

Time	Activity
9:30	Words of welcome Introduction to the work of the day and key questions for the workshop Plenary discussion on <ul style="list-style-type: none"> - approaches used in the Baltic Sea impact index and for developing the underlying spatial data layers - proposals for presenting BSII results in the HOLAS II report
<i>12:30-13.30</i>	<i>Lunch break</i>
13:30-15:00	Work in three subgroups on the key questions <ul style="list-style-type: none"> - recommend on results to be shown in the State of the Baltic Sea report and discuss ideas on how the results could be presented - review of assessment results - draft key messages based on the results
<i>15:00-15:30</i>	<i>Coffee break</i>
15:30-18:00	Recommendations from the workshop

Annex 2. Participant list

Representing	Name	Organization	Email address
The Chair			
SPICE project	Samuli Korpinen	Finnish Environment Institute	samuli.korpinen@ymparisto.fi
Contracting Parties			
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Annex 3. Proposals for the summary report Group 1

Generally coastal areas are most impacted: Areas of high vegetation (Photic areas) and most human activities occur in the same areas.

Explaining the spatial distribution of most pressures in general terms.

We suggest giving pressure categories to the pressures. If that is too difficult on political side, maybe instead of numbers High-Low (legend).

Anoxic areas should be presented in some form

Nutrients are underestimated, not indigenous species overestimated. Can the inputs of nutrients from the rivers added

We would like the map on lack of data/ reporting status

Suggestion to show some major individual human activities, just to get hold on what kind of information is included in the modeling (physical disturbance activities especially)

Calculate the % of areas influenced by high pressures

Explain the scale and categories.

The Swedish table with the ecosystems most/least affected by the pressure (with Swedish layout)

Suggest testing the one raster showing the biggest impact on each individual pixel

Suggestion to use words describing the magnitude on some charts. Pressure (magnitude/area) Holas 1 report Fig 4,1). Make sure to tell uncertainties if rankings are made on the charts.

Tell about data that has not been included: Marine litter etc.

What method should we choose to show as Baltic Sea impact index. Sum/mean/maximum we don't have clear answer. Have the group considered to use median instead of mean.

Annex 4. Proposals for the summary report Group 2

What kinds of key messages (from a regional perspective)?

1. What are the major impacts, where are they and how do they rank?
2. How do these impacts differ in each sub-basin?
3. What is the quality of the data used?

Visual materials – what kinds?

- We could perhaps include pie-charts or similar graphics to show the relative influence of the major impacts at a sub-basin level on the overall impact map.
- We would like to see another chart that indicates the relative confidence/quality in these data because it is clear that some areas seem to have a high relatively high impact score due to more data and other low due to no data.
- Regarding sum vs mean. The mean method appears to be less sensitive to a lack of data so we think that is preferable but we think it important to also understand the quality (including gaps) of the data (perhaps in each sub basin)
- We think that it is valuable to be able to understand what activities contribute to the pressure maps as this has been a recurrent question.
- Tree mapping could be one way to show the data that underpins each pressure map visually.
<https://en.wikipedia.org/wiki/Treemapping>
- <https://flowingdata.com/2010/02/11/an-easy-way-to-make-a-treemap/>

Source data comments:

Quality

- It is important that the source of the data and the quality of these input data are visible somewhere.
- If there are areas where there are no data due to a lack of provision from some countries we think that this should be evident somehow.
- We would recommend that the quality of the data is estimated and that limitations and recommendations for data improvement are noted. This might for example also refer to the resolution of the data.
- We should be able to distinguish between low impact and no data because where there is more data there appears to be higher impact.

Sensitivity matrix

- We think the sensitivity matrix needs a more thorough review. One example would be seal hunting impacting on bubble reefs or seagrass.
- We think that it would be useful to rank the confidence associated with the scores matrix for example based on the quality (assumptions vs empirical evidence), specificity (focused on the specific pressure/ecosystem interaction) of the evidence).
- Ranking and colouring of the sensitivity matrix is a good idea. This would highlight which ecosystem components are most sensitive to which pressures.
- Regarding the data for non-indigenous species – some data appears to be missing so this data we should check the data sources.

Ecosystem Components.

- The report is focused on pressures so it makes sense that there are cumulative maps of pressures but from a management perspective it is also interesting to know where there are high value ecosystem components that are not impacted (i.e. the inverse of the Baltic Sea Stressor Impact).

Aggregation

- We think that there is an issue with aggregating the fishing data because fishing is species specific. Extracting herring in the Baltic for example might not impact on the cod component but if the pressure (extraction) is aggregated it probably will.
- There is a similar issue with aggregating mammals e.g. Seals, Birds and Porpoise. Hunting seals for example should not impact on the porpoise ecosystem component but it appears to and we think this is due to aggregation of the pressures.

Anoxia and Toxins

- The Baltic Sea overall looks like there is low pressures where in reality there are areas that are anoxic (permanently) and heavily polluted. It is important that there is a link to this knowledge/information.
- Eutrophication is not well shown in the model for example – there is a low sensitivity score for mytilus to nutrients which makes sense if there is lots of oxygen but not the water becomes anoxic so it may be important to show a layer like the frequency of eutrophic events as a pressure (like in Balance 2006).

Nutrients

- The nitrogen and phosphorus data both look strange – there seems to be missing data inshore in Poland and Sweden for example. This should be checked.