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Introduction

The HELCOM HOLAS II project 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 Contracting Parties also being EU Member States in the reporting under the EU Marine Strategy Framework Directive (MSFD). One main focus during 2016 is to develop methods and tools for carrying out the assessments, including the thematic assessment of biodiversity status.

The biodiversity assessment tool is developed under the BalticBOOST project, which is coordinated by HELCOM and co-financed by the EU and runs from September 2015 to December 2016. The work package on biodiversity assessment within BalticBOOST supports the HOLAS II project by developing and proposing methodological approaches for integrated assessment of biodiversity.

Guidance to the tool development is provided by the HELCOM State and Conservation Working group, the HOLAS II core team, and through expertise from the Contracting Parties through two HELCOM BalticBOOST workshops, this workshop being the second one. Based on previous guidance a set of tests have been carried out by BalticBOOST to support development of the tool for use in HOLAS II and the results of the test will be evaluated at the workshop.

Workshop

The Workshop was held from 14:00 on 14 September 2016, to 18:00 on 15 September, 2016 at the premises of NIVA Denmark Water Research (Ørestads Boulevard 73) in Copenhagen, Denmark.

The workshop evaluated the development of the biodiversity assessment tool and provided final feedback on the planned assessment of biodiversity to be carried out as part of HOLAS II.

More specifically, the workshop:

- evaluated the outcome of testing different structures of the tool
- considered the indicators to be included in the assessment
- detailed the needed remaining steps to operationalize the biodiversity assessment tool
- considered outputs from the tool and how to include information on uncertainty and confidence in the assessment.

The Workshop was chaired by Mr. Samuli Korpinen, SYKE, Finland, under the HELCOM BalticBOOST project.

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

The Workshop was attended by representatives of Denmark, Estonia, Finland, Germany, Latvia, Poland and Sweden, as well as ICES, invited experts and BalticBOOST project partners. The list of Workshop Participants is contained in **Annex 2**.

Lena Bergström, HELCOM Secretariat, acted as secretary to the workshop.

Outline and timeline of the HOLAS II biodiversity assessment

1. Samuli Korpinen, representative of Lead partner SYKE, gave an introduction to the BalticBOOST work to develop the biodiversity assessment tool and the aims of the workshop (**Presentation 1**).
2. The Secretariat presented the timeline for the HOLAS II assessments and outlined preliminary plans for how results could be included in the printable version of the HOLAS II report and in the more extensive online web-based version of the report (**Presentation 2**).
3. The workshop noted that results from the integrated assessment will be presented in the HOLAS II report, but that results for individual HELCOM core indicators will also be presented.

Structure of the Biodiversity Assessment Tool (BEAT 3.0),

4. Ciarán Murray, BalticBOOST/NIVA Denmark, presented the biodiversity assessment tool that has been developed (**Presentation 3**).
5. Key information needed for each indicator and spatial assessment unit is: the observed value, the GES boundary, the range of potential values (min-max values), the confidence assessment by four categories, and the relevant grouping attributes (such as descriptor, criteria, species group, and ecosystem component). The collected information for all indicators is referred to as 'the indicator catalogue'.
6. Confidence is assessed based on information from the experts that have been involved in the indicator development by asking the experts to judge confidence (Low, Intermediate or High) in the assessment based on: accuracy of the indicator estimate, spatial representation, temporal coverage and monitoring methodology. In the tool the confidence classes Low, Intermediate or High are transformed to numerical values of 0, 0.5 or 1. This enables aggregation of the confidence values for all indicators.
7. The workshop further noted that the tool can perform assessments for indicators with monotonous and unimodal responses, as well as conditional indicators, and that it enables weighting the contribution of each spatial assessment unit (by including information on the area of the assessment unit). The tool does not presently allow direct weighting of ecosystem components but is structured so that different ecosystem components at the same level are represented equally regardless of the number of indicators used in each case.
8. The tool is customized for the hierarchical and nested HELCOM spatial assessment units defined on scales 1-4, and enables biological grouping according to the levels of biodiversity, ecosystem components, species groups/habitat types, and species.
9. The tool's code is written in R, and the tool will later be available for testing in a web application ([Shiny app](#)), similar to that already developed for the [Hazardous Substances assessment tool](#).

Evaluation of results from the BalticBOOST case studies

10. Henrik Nygård, BalticBOOST/SYKE, gave a general introduction to the evaluation of assessment scenarios carried out to test the structure of BEAT 3.0 (**Document 1, Presentation 4**). The scenarios were based on recommendations from HELCOM BalticBOOST Biodiv WS 1-2016 and HOLAS II 5-2016.
11. Test scenarios have been conducted to study the criteria-approach vs the species approach (re. HOLAS II 5-2016, para 4.14), for the following themes:
 - a. differences between integration approaches (OOAO vs averaging in each assessment unit),
 - b. aspect of spatial representation (indicator-defined scales, direct down-scaling to the lowest spatial unit, down-scaling using weights),
 - c. effect of the number of indicators used
 - d. multiple use of indicators (used only once, used once per relevant descriptor, used for all relevant criteria).

12. The evaluations were made using the levels of biological grouping as proposed in version 4 of the evolving European Commission Decision on GES criteria (hereafter 'draft GES decision'), all currently available core indicators and the most recent assessment results for each of these based on the online Core indicator reports. The workshop noted that parameters for conditional indicators (e.g. the zooplankton MSTs indicator and seal distribution indicators) were averaged during the evaluation, but that conditional rules can be implemented in the most recent version of BEAT 3.0.
13. In order to be able to include trend-based indicators in BEAT 3.0, a step-wise qualitative approach is proposed as a means of providing the estimates of status and information on distance to GES, as required by the tool (Document 1, figure 1). The method to estimate confidence for trend indicators has to be developed and harmonized with other indicators. The workshop took note of information from the BalticBOOST project that different options for how to solve the issue have been evaluated, including the proposal from BalticBOOST Biodiv WS 1-2016 to base this information on the slope of the trend, but that this approach was associated with problems to define maximum values for a slope.
14. If the OAO integration approach is used at the highest level of integration in the BEAT approach then the approach would be consistent with the approaches of the HEAT and CHASE tools.
15. Regarding grouping of indicators into ecosystem components or species groups, it was noted that the draft GES decision v4 mentions assessment results at the level of ecosystem components, but that a combined result at the level of biodiversity is not required.
16. The workshop noted the view of Denmark and Poland that the OAO approach should not be applied at any level of integration. The workshop further noted that Germany is of the view that the integration should not go beyond the ecosystem component level.
17. The workshop took note of the proposal from BalticBOOST on recommended ways to down-scale assessment results to lower spatial scales in order to be able to show integrated assessment results at higher integration levels (ecosystem component, biodiversity level) at lower spatial scales. The proposal also includes approaches for weighting down the contribution of indicators that are not applicable at specified assessment units on lower spatial scales, following recommendations from the first workshop on the biodiversity assessment tool (HELCOM BalticBOOST Biodiv WS 1-2016).
18. It was recalled that the first workshop on the biodiversity assessment tool recommended that the biodiversity assessment should be carried out at the highest possible resolution but did not conclude whether this refers in practice to assessment unit level 3 or 4. In HELCOM the integrated assessments on eutrophication and hazardous substances are performed at assessment level 4.
19. The workshop discussed how performing assessments at level 4 also for biodiversity may affect the credibility of the assessment results and the confidence of the assessment. The workshop recalled that assessment at lower spatial scales will require down-scaling of indicators that have been considered as most ecologically relevant to assess at higher spatial scales, the lack of monitoring of all biological components in many waterbodies (assessment unit level 4), and also noted that aggregation of data to higher assessment unit levels may in some cases enhance the representability of indicators within the assessment units.
20. The workshop noted that adequacy of monitoring is not accounted for in the tool, but is considered in the confidence assessment.
21. The workshop took note of information from BalticBOOST that using Weighted Average (WA) up to the integrated level of ecosystem components will limit the foreseen difficulties regarding down-scaling of indicator results since the assessment unit level is more coherent between indicators within an ecosystem component (e.g. within 'fish') than between ecosystem components (e.g. between 'fish' and 'birds'). In practice this would mean that e.g. the ecosystem component benthic habitats could be assessed at level 4, fish at level 3, and birds at level 1. This approach is in line with the draft GES decision v4.

22. Regarding the effect of the number of indicators included in the assessment, the workshop took note of the proposal from BalticBOOST to include relevant WFD and EUTRO indicators in the HOLAS II biodiversity assessment, as this would increase the coverage of the assessment in relation to MSFD criteria. Indicators proposed to be included are: Secchi depth, Chlorophyll-a and Phytoplankton biomass for pelagic habitats, Oxygen, Benthic fauna and vegetation indices for benthic habitats.
23. The test cases carried out by BalticBOOST showed that there were no difference in assessment results between scenarios where only core indicators were used as compared to scenarios when also WFD and EUTRO indicators were included. Pre-core indicators were not included in the evaluation since they are not yet operational.
24. The evaluation by BalticBOOST showed that including the same indicator under more than one criterion would change the result of an integrated assessment if OAOO is used in the criteria-based approach, but the result would not change if weighted averaging is used.
25. The workshop was informed that additional indicators to the core indicators to be used in HOLAS II have been proposed by Germany, Finland and Poland. Among these proposed additional indicators were pre-core indicators, WFD indicators, and conceptually redundant indicators in relation to the core indicators, resulting in a total number of two additional indicators to be considered further. One of these proposed additional indicators was geographically relevant for the BalticBOOST test case areas.
26. It was noted that even when using the relevant EUTRO and WFD indicators, there are gaps in the set of biodiversity core indicators as compared to the criteria of the European Commission Decision on GES criteria.
27. In relation to the question if the same indicator can be used for reporting under more than one descriptor, it was recalled that HOLAS II has agreed in principle that the same indicator could be used under more than one descriptor.

Recommendation from the workshop

28. The workshop supported the proposed approach by BalticBOOST on how to include trend-based indicators, recognising the associated issues (see para 13), and concluded that slope-based input can also be acceptable in the tool in cases where the issue of defining the maximum values can be resolved.
29. The workshop favoured the species approach for mammals and the criteria approach for the other ecosystem components (birds, fish, benthic habitats, pelagic habitats), but concluded that the tool allows for using both approaches and that the MSFD Article 8 guidance document under development will still be decisive. The workshop recognized the advantage of having the species approach for mammals since they are included in the Annexes of the HD and a similar approach is used there.
30. The workshop recommended that integrated assessment results should be made available at higher levels of integration (for example ecosystem component level) and at a smaller spatial scale e.g. assessment units.
31. The workshop did not find a conclusive view of whether or not to make an integrated assessment to the level of biodiversity, in addition to showing results at the level of ecosystem components. The workshop recognized that results at biodiversity level can potentially be attractive for communication purposes but will be of less relevance for management. The workshop concluded that the message of overall biodiversity status should be included in the HOLAS II report but that the most appropriate way to communicate this should be considered further.

32. The workshop supported the use of weighted averaging as integration approach up to the level of ecosystem components/MSFD elements. The workshop however recommended that an assessment building on the OOA structure is made in parallel, to also represent a worst case scenario.
33. The workshop could not agree if a tentative assessment of biodiversity (i.e. combining the ecosystem component) should be based on OOA or weighted averaging between ecosystem components.
34. The contribution of some indicators to assessment units at lower spatial scale can be down-weighted if this is clearly motivated and communicated with the experts in the concerned countries.
35. BalticBOOST will evaluate further how results at assessment unit level 3 and 4 would be presented in order to find out what is the lowest possible spatial resolution.
36. The workshop could not make recommendations on the use of additional indicators based on the outcome of the BalticBOOST evaluations but recommended the inclusion of additional indicators on a theoretical basis in order to increase the overall confidence of the assessment.
37. The workshop concluded that the same indicator should be considered only once in the integrated biodiversity assessment, noting that the BEAT tool is structured so that double counting does not occur when using the default setup.
38. The workshop supported that selected indicators from D3, D5 and D6 can also be used in the biodiversity assessment, besides the already chosen indicators from D1 and D4.

Connections between the HELCOM and OSPAR assessments

39. Norbert Häubner, Sweden, presented the structure and work project EcApRHA to support the regional roof report of the OSPAR region (**Presentation 5**).
40. The workshop noted the need to achieve coherence between the assessment approaches applied in the OSPAR and the HELCOM regions, as particularly motivated for countries reporting on the status of waters in both regions.
41. The workshop further noted that the set of common indicators for the OSPAR region is not yet fully operational. The workshop noted that OSPAR indicators and national indicators of Denmark, Germany and Sweden for waters in the OSPAR region could potentially be assessed using the BEAT tool.

Recommendation from the workshop

42. The workshop recommended that the BalticBOOST project communicates with the EcApRHA project and ongoing regional assessments in OSPAR, and noted that Sweden is willing to offer support and assistance to such activities.

Approach for estimating uncertainties and confidence in the assessment

43. Henrik Nygård, SYKE, presented the proposed approach for estimating uncertainties and confidence of the assessment, including preliminary results from cases studies (**Presentation 6**)
44. The workshop noted the outcome from the first workshop on the biodiversity tool where it was proposed that the assessment of confidence should be presented directly linked to the assessment of status.
45. Confidence in the indicators based assessment is proposed to be assessed based on four aspects:
 - a. accuracy of the indicators result, for example the precision of the estimate in relation to the class boundary. The tool also allows for entering standard error values.
 - b. temporal coverage of the indicator (how well does the data cover the concerned assessment period)
 - c. spatial representation, and
 - d. methodological confidence.

Indicator experts are asked to estimate the confidence of the indicators based on these four categories into the classes “high”, “intermediate”, “low”. A definition of the classes for each category is given. Experts are encouraged to, as far as possible, base the judgement on numerical information. Estimates of confidence is given by the experts at the same spatial level as the indicator assessment results, so that different confidence estimates can be given to different geographical areas.

46. The confidence of the assessment is assessed using the same integration approach structure (the same aggregation nodes) as the status-assessment that it considers.
47. The workshop noted the proposal from BalticBOOST for how to assess representability of the different components, so that:
 - a. if a criterion lacks indicators, the overall confidence is automatically set to “low”
 - b. if one indicator group (e.g. all marine mammals/birds/fish etc.) is assessed using only one indicator the overall confidence is automatically set to “low” regardless of the confidence of the indicator.
48. The workshop noted that some guidance on how to assess representability can be obtained from the revision of the commission decision under development which also includes consideration of the primary and secondary criteria.
49. The proposed cut-off between high and intermediate confidence is 0.75.

Recommendation from the workshop

50. The workshop recommends that accuracy of the indicator results should rather be referred to as confidence in the classification, and noted that the latter three confidence aspects have similar properties, reflecting confidence in the data.
51. The workshop supported the approach proposed by BalticBOOST on how to classify confidence in the assessment, realizing that this is the most practical way forward given the state of development and design of the indicators to be included, but noted that an important aim for future development is to increasingly use data-driven approaches.
52. The workshop discussed how to handle cases where indicators are lacking and how this would affect the confidence in the integrated assessment. BalticBOOST will test methods for how to assess confidence further and evaluate how the results could be represented in the assessment. The test includes evaluation of a potential solution where a criterion that is not represented by indicators will get 0 confidence.

Progress with the web workspace for the tool

53. Georg Martin, BalticBOOST/EMI, presented a proposal for a data/visualization tool for the biodiversity assessment (**Presentation 7**),
54. The visualisation tool is proposed to be associated with the assessment tool at the biodiversity assessment workspace, which is being established at the Secretariat.
55. The purpose of the visualization tool is to facilitate interpretation and screening of the assessment results, building on the output tables given by BEAT 3.0. The tool is primarily intended as a web-based tool for exploring the results but it is proposed to also make it possible to print a page summaries (“Assessment report”, see **Presentation 7** for a draft example) e.g. with key information related to a species HELCOM sub-basin, such as the assessment score, number of indicators included and confidence in the assessment separately for the four classes of confidence.
56. The workshop considered different options for how to present the results by different groups, which are selected on the entrance page to the visualization tool, such as;
 - a. indicator type (e.g. core indicators, WFD indicators, additional indicators)

- b. spatial assessment unit
 - c. MSFD criteria
 - d. level of biological grouping (biodiversity, ecosystem components, species group)
57. The Secretariat outlined the ongoing process for developing a web interface to facilitate the biodiversity assessment.
58. The workshop noted that in contrast to the EUTRO assessment, which is fully automated, the biodiversity assessment will need a higher level of manual input e.g. the indicator results. Countries will be requested to submit indicator results to the Secretariat for some indicators (e.g. for indicators used under the WFD). For indicators on e.g. seals and coastal fish, the calculation of indicator results will be assigned to expert groups, and countries may only be asked to verify the input data. The process will be outlined at State and Conservation 5-2016.

Recommendation from the workshop

59. The workshop supported the work to develop a visualisation tool and gave the following more detailed views on how it should be developed,
- a. the confidence in the assessment could potentially be shown in the same graph as the assessment outcome, for example by color-coding or error bars
 - b. focus on the key information in order to make the results as easy as possible to interpret
 - c. consider including the broad habitat types
 - d. instances of missing data should be clearly shown
60. The workshop recommended that visualisation tool output should be harmonised with MSFD reporting needs.
61. The workshop noted that there is a conflict between the timelines for the BalticBOOST project and the revision of the commission decision on GES, but that the outcome of the vote on the revision is foreseen to affect the assessment structure as well as the visualization tool. The BalticBOOST project will consider the fact that late changes to both the BEAT and the visualisation tools may be required and as far as possible prepare solutions for these needs.

Annex 1 Workshop Agenda

Wednesday 14 September	
14:00	<p>Arrival and words of welcome</p> <p>Workshop outline and way forward of the HOLAS II biodiversity assessment</p> <p>Structure of the Biodiversity Assessment Tool (BEAT 3.0), including test scenarios, aggregation methods and spatial assessment scales</p> <p>Presentation of the R-based tool (BEAT 3.0)</p>
18:00	End of day 1
Thursday 15 September	
9:30-12:30	<p>Evaluation of results from the BalticBOOST case studies</p> <p>Approach for estimating uncertainties and confidence in the assessment</p> <p>Progress with the web workspace for the tool</p>
12:30-13:30	<i>Lunch break</i>
13:30-18:00	<p>Planned outputs from the assessment</p> <p>Conclusions and further steps</p>
18:00	End of Workshop



Baltic Marine Environment Protection Commission

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Copenhagen, Denmark, 14-15 September 2016



Annex 2 List of participants

Representing	Created By	Organization	Email address
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