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Background

The first integrated assessment of the Baltic Sea marine biodiversity was carried out in 2009 (HELCOM 2009) and the assessment was updated for the Initial Holistic Assessment in 2010 (HELCOM 2010). Both the assessments were made using the HELCOM Biodiversity Assessment Tool (BEAT 1.0).

The HELCOM biodiversity assessment tool has been further 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 project develops methodological approaches for the integrated assessment of biodiversity to be used in HOLAS II. Guidance to the tool development has been given by State and Conservation Working Group (STATE & CONSERVATION 4-2016), expertise from the Contracting Parties through two HELCOM BalticBOOST workshops (BalticBOOST Biodiv WS 1-2016 and BalticBOOST Biodiv WS 2-2016) and by the HOLAS II core team (HOLAS II 4-2015, HOLAS II 5-2016, HOLAS II 6-2016). An initial workshop on the development of the assessment tool was held before the start of BalticBOOST (Biodiversity tool WS 1-2015).

The first HELCOM BalticBOOST workshop on the HOLAS II biodiversity assessment tool recommended that the HELCOM HOLAS II biodiversity assessment tool should be based primarily on a similar concept as in the initial holistic assessment but improvements from later projects should be included to the development of the tool. The evolving revision of the European Commission Decision on GES criteria has also been taken into account to ensure that Contracting Parties that are EU Member States can use the results for the reporting under the Marine Strategy Framework Directive (MSFD) reporting in 2018. Information on how recommendations from the second BalticBOOST workshop and HOLAS II 6-2016 has been taken into account is included in Annex 1.

This document presents the proposed structure and methodology of the updated biodiversity assessment tool. The new tool is proposed to be named BEAT 3.0.

Action requested

The Meeting is invited to:
- <u>agree</u> on the method for assessing the status of biodiversity and <u>endorse</u> its use in the HOLAS II project,
- <u>consider</u> the proposed spatial resolution of the biodiversity assessment,
- <u>evaluate</u> and <u>propose</u> the approach to be used when assessing confidence for criteria that are lacking indicators.

A biodiversity assessment tool for use in HOLAS II

Contents

1. Development of a biodiversity assessment tool (BEAT 3.0)

The BalticBOOST project has had as a task to develop a tool to assess biodiversity in HOLAS II, taking into account that the biodiversity assessment should be based on the HELCOM core indicators. To guide the work two workshops have been arranged: HELCOM BalticBOOST Biodiv WS 1-2016 and HELCOM BalticBOOST Biodiv WS 2-2016. As preparatory work BalticBOOST evaluated available integrated biodiversity assessment tools and the properties of HELCOM core indicators and the findings were presented at the first workshop. The first workshop recommended building the assessment tool on the basic features of HEAT and NEAT (developed in FP7 DEVOTES project), including a nested and hierarchical structure and allowing for both 'weighted averaging' and the 'one-out-all-out' approach (OOAO) as integration rules. BalticBOOST was asked to test the use of OOAO at lower and higher levels of the assessment structure. Further, BalticBOOST was asked to develop solutions for including indicators with a trend based GES boundary as well as principles to define the minimum and maximum values for indicators to allow for normalization of indicators in the tool. The workshop also noted that weighing indicators based on ecological relevance should be avoided, apart for the option to exclude indicators in areas where they are not considered relevant when downscaling to lower spatial scales.

Based on the recommendations from the first workshop and from HOLAS II 5-2016, BalticBOOST developed the tool and tested it with regard to assessment structure (species vs criteria approach), integration rules, spatial representation of indicators, number of indicators used and coverage of MSFD criteria. The results from the tests were presented and evaluated at the second workshop. Recommendations from the second workshop and the further work developing the tool according to the recommendations are detailed in Annex 1. The recommendations were also discussed at HOLAS II 6-2016. Summarizing the outcomes from HELCOM BalticBOOST Biodiv WS 2-2016 and HOLAS II 6-2016 it was proposed that 'weighted averaging' should be used as an integration method up to the ecosystem component level. Although the position of all Contracting Parties were not yet set, it was proposed that integration all the way to the biodiversity level should be made, applying OOAO in the last step. For Contracting Parties being EU Member to be able to use the results for MSFD reporting the structure of the assessment, applying the species or criteria approach, need to take into account the ongoing revision of the European Commission Decision on GES criteria and development of associated guidance on implementation of MSFD Article 8. In this regard it can be noted that both approaches can be applied in the tool. The approach on how to include indicators with a trend based GES boundary was supported, but it was noted that slope of the trend can also be applied if the minimum and maximum values of the slope can be defined.

HOLAS II 6-2016 supported the recommendation to include relevant HELCOM core indicators on eutrophication in the biodiversity assessment as well as biological WFD indicators to increase the representation of indicators reflecting condition of habitats. As the tool and the indicators enables use of the most detailed spatial level without influencing the assessment result as shown through tests, BalticBOOST recommends the use of spatial assessment level 4 in HOLAS II, noting that in this case the assessment results will be available at all spatial assessment levels.

In parallel to the biodiversity assessment, the assessment confidence also needs to be assessed. The BalticBOOST Biodiv WS1-2016 outlined the principles for the confidence assessment, which were further developed by BalticBOOST. The confidence is assessed for each indicator including four aspects of confidence: confidence of the classification, temporal coverage, spatial representation and methodological confidence. For all categories instructions on how to evaluate the indicator confidence in three classes (High, Intermediate and Low) were developed. Indicator Lead and co-Lead country representatives were then asked to evaluate the confidence of the indicators. HELCOM BalticBOOST Biodiv WS 2-2016 supported the proposed approach to assess confidence, but also asked to refine the methodology on how to handle confidence of the assessment in cases where indicators are lacking.

2. Methodology of BEAT 3.0

BEAT 3.0 is an indicator-based tool for integrated assessment of biodiversity status. In parallel with the biodiversity assessment, the confidence of the assessment is evaluated. BEAT 3.0 is run as a R-script, currently available from https://github.com/NIVA-Denmark/BalticBOOST.

2.1 Application of indicators

BEAT 3.0 allows direct use of indicators with value increasing or decreasing with improved biodiversity, unimodal indicators and conditional indicators. For these types of indicators the indicator value, range of the indicator (min-max values) and GES boundary are needed as inputs to the tool. Indicators based on trends can be included using a two-step qualitative approach where the status (GES/sub-GES) and distance to the GES boundary are evaluated (Figure 1). Using the slope of the trend as indicator value is also possible if the maximum value of the slope can be defined. Based on the minimum, maximum and GES boundary, BEAT normalizes the indicator results to a scale from 0 to 1, where the GES boundary is set at 0.6. The normalized indicator values are referred to as Biological Quality Ratios (BQR values). The assessment results are also presented as BQR values, with values above 0.6 indicating GES.

How to define status and input value to BEAT 3.0 for trend indicators

1. Judge if the indicator is in GES or not

2. Judge the distance to GES

3. Define the status

4. Input value to BEAT 3.0
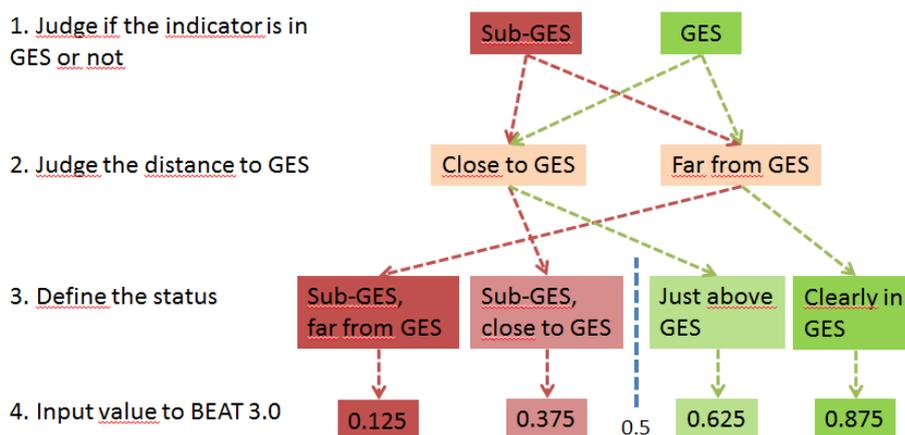
In the indicator results the trends are to be used as defined in the indicator reports.
This method will only be used to define the input value into BEAT 3.0

Figure 1. Approach for how to include indicators with a trend based GES definition in BEAT 3.0.

In the HOLAS II biodiversity assessments the HELCOM biodiversity core indicators that are linked to MSFD criteria under descriptors 1, 3, 4 and 6 will be used. In addition, relevant WFD and eutrophication core indicators (linked to MSFD descriptor 5) describing habitat quality (Secchi depth, Chlorohyll-a and Phytoplankton biomass for pelagic habitats, Oxygen, Benthic fauna and vegetation indices for benthic habitats) will be included.

Indicator results will be collected in a HELCOM workspace in a format that can be used as input to BEAT 3.0. In the workspace Contracting Parties can check and approve the indicator results.

2.2 Information and data input to the tool

Input tables to the tool are:

Spatial assessment units (SAU.txt file) – a hierarchical list of the assessment units with four levels. All assessment units are assigned to a level (according to the HELCOM spatial assessment unit levels 1-4) and

are linked to the relevant higher level unit. The area (km^2) of all spatial assessment units are specified here and used in the assessment to assign weights to the indicators in the integrations (weighted averaging based on area).

Ecosystem components (EcosystemComponents.txt file) – a hierarchical list of the ecosystem components (birds, fish, mammals, pelagic habitats, benthic habitats) with four levels (1=Biodiversity, 2=Ecosystem component, 3=Species/habitat group, 4=Species/habitat element). Each component is linked to the relevant higher level ecosystem component.

Descriptors (descriptors.txt file) – a list of the MSFD descriptors

Criteria (criteria.txt file) – a list of the MSFD criteria. This list will be updated to follow the tentative decision, in November 2016, to revise the European Commission Decision on GES criteria.

Indicator catalogue (IndicatorCatalogue.txt file) – a list assigning the indicators to ecosystem component and relevant MSFD criteria.

Indicators (indicators.txt file)– table of observed value, minimum and maximum values, GES boundary and confidence evaluations for the indicators linked to the spatial assessment unit. One row is added for each assessment unit the indicator is used in. Instructions on how to define minimum and maximum values for the indicators can be found in the request sent to the indicator Lead and co-Lead country representatives (HOLAS II 5-2016 Document 4-1 Annex 1).

Indicator group (ooao.txt file) – Indicators/parameters to be treated in within conditional indicators

Of these input tables, the spatial assessment units, ecosystem components, descriptors and criteria do not need to be changed (if used in the HELCOM and MSFD context), but if adding indicators to the tool one needs to follow the steps and updates of the input files as outlined in the Step-wise description of the tool (section 7).

3. Assessment structure

BEAT 3.0 uses the spatial and ecosystem component structures as outlined in the input files. Indicators are given weight based on the levels of ecosystem component and assessment unit they are assigned to, weighing equally among ecosystem components and using an area based weighing for spatial assessment units, but allocating weights only to ecosystem components and spatial assessment units represented by indicators. Area based weighing is only done if there is a wish to aggregated the assessment results from level 4 towards higher assessment unit levels (i.e. sub-basins). Figure 2 illustrates the assessment structure for ecosystem components and the distribution of weights to indicators.

a)

Biodiversity
N_{ind}= >3 *(0)*
Weight =1 *(0)*

OOAO

Ecosystem component

Mammals
N_{ind} = >3 *(0)*
Weight = 0.2 *(0)*

Fish
$N_{ind} > 0$
Weight = 0.2

Birds
$N_{ind} > 0$
Weight = 0.2

Pelagic habitat
$N_{ind} > 0$
Weight = 0.2

Benthic habitat
$N_{ind} > 0$
Weight = 0.2

Species/habitat group

Toothed whales
$N_{ind} = 0$
Weight = 0

Seals
N_{ind} = >3 *(0)*
Weight = 0.2 *(0)*

Species/habitat group element

Ringed seal
$N_{ind} = 3$
Weight = 0.1

Grey seal
$N_{ind} > 0$
Weight = 0.1

Harbour seal
N_{ind}= 0
Weight = 0

Indicator 1
Weight = 0.03

Indicator 2
Weight = 0.03

Indicator 3
Weight = 0.03

b)

Biodiversity
N_{ind}=0
Weight =0

OOAO

Ecosystem component

Mammals
$N_{ind} > 0$
Weight = 0.2

Fish
$N_{ind} = 3$ (0)
Weight = 0.2 (0)

Birds
$N_{ind} > 0$
Weight = 0.2

Pelagic habitat
$N_{ind} > 0$
Weight = 0.2

Benthic habitat
$N_{ind} > 0$
Weight = 0.2

Species/habitat group

Demersal shelf fish
$N_{ind} = 0$
Weight = 0

Pelagic shelf fish
N_{ind}= 0
Weight = 0

Coastal fish
N_{ind}= 3 *(1)*
Weight = 0.2 *(0.067)*

Indicator 3
Weight = 0.067

Species/habitat group element

Sea trout
$N_{ind} = 1$ *(1)*
Weight = 0.067 *(0.067)*

Perch
$N_{ind} = 1$ *(1)*
Weight = 0.067 *(0.067)*

Indicator 1
Weight = 0.067

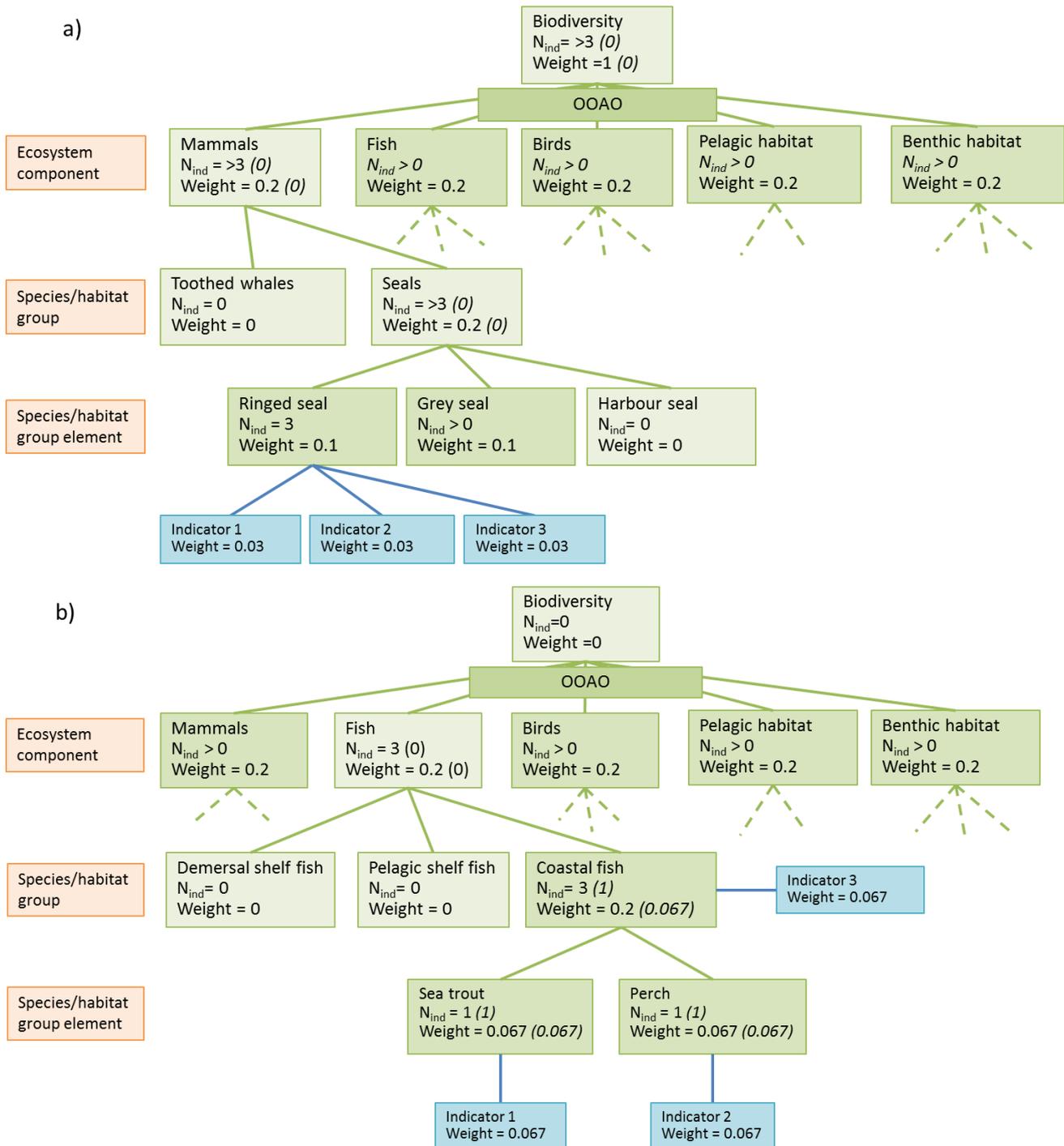**Indicator 2**
Weight = 0.067

Figure 2. Assessment structure for ecosystem components and examples of distributing weights to indicators. If all indicators are assigned to the same ecosystem component level, the weight will be distributed equally (a). If indicators are assigned to different ecosystem component level 'parent' and 'child' levels are equally weighted and the weights distributed to the indicators accordingly (b). The numbers inside the brackets refer to number of indicators assigned to the specific element and their weight. In both cases the total weight of the ecosystem component branch is 0.2, i.e. the same as for the other ecosystem components. The last integration step from ecosystem components to Biodiversity will be done applying the one-out-all-out (OOAO) principle.

The tool starts from the lowest spatial assessment level and integrates the indicators per ecosystem component level by averaging. Stepping up to the following spatial assessment level, the tool aggregates the results from the lower spatial assessment units by area weighted averaging and includes indicators assessed at this spatial level. In the result output, results for the ecosystem components and criteria are

presented at all spatial levels. The use of OOAO for integrating from ecosystem component level to biodiversity is currently not applied in the tool, and need to be done manually.

4. Confidence of the assessment

Confidence of the biodiversity assessment is based on the confidence evaluations of the indicators. The confidence need to be assessed separately for each indicator and inserted in the tool together with the indicator result. The confidence of all indicators is assessed in four categories: temporal coverage, spatial representation, confidence of classification and methodological confidence. For HOLAS II, Indicator Lead and co-Lead country representatives assess the confidence in each category into the classes High, Intermediate or Low for the indicators used in the biodiversity assessment (briefly presented below, see HOLAS II 5-2016 Document 4-1 Annex 1 for details).

4.1 Temporal coverage of monitoring data

The aspect of temporal coverage of monitoring data considers the confidence of the indicator to include year-to-year variation in the indicator result. High confidence is considered to be achieved if monitoring data is available for all years in the HOLAS II assessment period (2011-2016), or for indicators with no year-to year variation, the temporal monitoring requirements are met. Intermediate confidence is met when more than three years data is available from the assessment period and bad confidence is assigned to indicators with only one or two years of data during the HOLAS II assessment period.

4.2 Spatial representability of monitoring data

The spatial representability of monitoring data assesses how well the indicator covers the spatial variation within the assessment unit. Spatial representability is considered high if the data represents reliably at least 80% of the relevant habitat types occurring in the area, or in cases with a clear spatial gradient or patchiness in the parameter value, the monitoring set to cover at least 80% of this variation. When the representability or variation (in case of gradients) is covered by 60-79% intermediate confidence is assigned to the indicator. Confidence is considered to be bad if less than 60% of relevant habitats or less than 60% of the variation in gradients are covered.

4.3 Confidence of classification

The accuracy of the indicator result is primarily assigned as the standard error. If the standard error is not available a categorical approach is carried out. This is a compliance check by expert judgement of the probability that the indicator signal clearly reflects that GES is achieved/not achieved. High confidence is assigned if GES has 'most likely' been / has not been achieved (by at least 90% probability). Intermediate confidence is judged if the probability is 'likely' (70-89% probability) and low confidence is judged if the probability of correctly indicating the status evaluation of the indicator is 'unsure' (less than 70% probability).

4.4 Methodological confidence

The aspect of methodological confidence considers the quality of the monitoring methodology. High confidence is assigned if the monitoring has been conducted according to HELCOM guidelines (for parameters where these are available) and the data is quality assured according to HELCOM or other internationally accepted guidelines. Intermediate confidence is assigned if the monitoring has been conducted only partly according to HELCOM guidelines and/or the data originates from mixed sources, and is partly quality assured according to HELCOM or other international standards and/or the data is quality assured, but according to local standards. If monitoring has not been conducted according to HELCOM guidelines or the data has not been quality assured, the methodological confidence is considered bad.

4.5 Integration of indicator confidences

The confidence estimates are given in categorical form (low, intermediate and high confidence) and translated into numbers (0, 0.5 and 1) in the assessment tool. The translation to numeric form is essential in order to carry out the integration of the confidence through the tool. If standard error has been provided

to assess the confidence of classification, BEAT 3.0 uses Monte Carlo simulations to estimate the probability of the indicator to be correctly classified. Assessment confidence is calculated by BEAT 3.0 hierarchically, in two steps. Indicator confidence is first estimated separately for each indicator by averaging the confidences of the four categories. The indicator confidences are then combined together according to the aggregation principles of the status assessment. The final confidence result is presented in categorical form (High >0.75 ≥ Intermediate ≥ 0.5 > Low). In addition to assess the confidence of indicators, it is important to also consider how well the indicators cover the ecosystem components and MSFD criteria when assessing the overall confidence of the biodiversity assessment. How to implement this in HOLAS II has however not been agreed upon yet (see Open issues below).

5. Results and outputs

Once all input tables are in order, running the BEAT R-script will produce result output tables with integrated BQR values and confidence assessments for all ecosystem components and spatial assessment units. To facilitate the presentation of the results a visualization tool is also developed. BEAT 3.0 and the connected visualization tool allow for presenting the results according to the outputs outlined by BalticBOOST Biodiv WS1-2016:

Main outputs:
- Integrated biodiversity status
- Status per descriptor [for MSFD reporting]
- Status per ecosystem component [for MSFD reporting]
- Confidence of the integrated biodiversity status
- Confidence per ecosystem component

Additional outputs:
- Data and status per indicator
- Indicators and status per GES criteria
- Confidence on indicator level

6. Open issues

The spatial resolution of the biodiversity assessment has been discussed throughout the BalticBOOST project, but a final decision on the spatial assessment level to be used has not been decided. From the start it has been outlined that biodiversity assessment should be made at an ecologically relevant scale. The core indicators have been developed at the relevant spatial scale of the ecosystem component and data availability. BalticBOOST Biodiv 1-2016 concluded that the integrated assessment results would be most useful at the most detailed spatial level and BalticBOOST Biodiv 2-2016 recommended that results should be made available at a smaller spatial scale. BalticBOOST tested the BEAT tool at spatial assessment levels 3 and 4 and found no differences in the results, as presented on HOLAS II 6-2016 (Presentation 3). Thus, BalticBOOST recommends that the biodiversity assessment is done at spatial assessment level 4, noting that the results will also be available at the other spatial assessment levels.

The overall confidence assessment should take into account how well the indicators used in the biodiversity assessment cover ecosystem components and MSFD criteria. The approach how this should be implemented in HOLAS II has not yet been settled. As the biodiversity core indicators are quite broad and covering many aspects of the ecosystem component they represent, BalticBOOST Biodiv 2-2016 considered that even if an ecosystem component is represented by only one indicator the confidence do not need to be downshifted. However, if any MSFD criteria lack indicators, this should be accounted for in the overall confidence assessment. BalticBOOST tested two approaches: 1) to automatically set low confidence for the ecosystem component if all criteria are not covered, 2) assign 0 for those criteria lacking indicators. HOLAS II 6-2016 noted that further testing is needed before the approach can be decided on. The tests need to

especially take into account that all criteria are not relevant for all ecosystem components and also to adjust the criteria to the latest version of the proposed revision of guidance for MSFD Article 8.

BalticBOOST will further test the approaches, and present the results of the tests to State & Conservation 5-2016 for evaluation.

7. Comparison of the assessment tool to the proposed revision of the Commission Decision on GES Criteria (version 14.9.2016)

The BEAT 3.0 was tested following the 2010 Commission Decision on GES criteria. However, the tool allows for adjusting to the proposed revised version of the Commission Decision by updating the criteria.txt and EcosystemComponent.txt files accordingly, and by assigning the indicators to the relevant criterion in the IndicatorCatalogue.txt file. Of these tasks, the critical one is the assignment of indicators to the criteria, where indicator experts may need to be consulted. If the proposed revision is approved, the biodiversity assessment in HOLAS II will address criteria D1C1-6, D4C1-4 and D6C4-5.

The BalticBOOST project will carry out an in depth comparison of the assessment tools versus the Commission Decision on GES criteria after the tentative decision has been taken (November 2016).

8. Step-wise description to apply the biodiversity assessment tool

1. Add the indicator to the indicator catalogue. Make sure to link the indicator with the correct ecosystem component ID and MSFD criteria. The ecosystem component ID is found in the EcosystemComponents.txt file
2. Insert the indicator results to the Indicators file. Add one row for each spatial unit the indicator has results for. For HOLAS II it is recommended that the assessment is carried out on spatial assessment level 4. Thus, indicators assessed at higher spatial levels need to be downscaled to level 4, i.e. adding the indicator result for all spatial assessment units at level 4.
3. Specify the spatial assessment unit (ID is found in the SAU.txt file) and indicator ID (found in the IndicatorCatalogue.txt file).
4. Specify the indicator type (1: indicator value increasing/decreasing with improved/worsened environmental status, 2: indicator with an optimal range/interval).
5. Insert the minimum and maximum values the indicator value have. Instructions on how to set the minimum and maximum values are found in HOLAS II 5-2016 Document 4-1 Annex 1. Make sure the minimum and maximum values are inserted correctly into the Bad and High columns, depending on if increasing value mean improved status (Minimum = Bad, Maximum =High) or decreasing value means improved status (Minimum = High, Maximum = Bad).
6. Insert the GES boundary (ModGood column)
7. For type 2 indicators the optimal value is inserted in the High column. Minimum value is inserted in the Bad column, lower GES boundary in the ModGood column, higher GES boundary in ModGood2 column and maximum value in Bad2 column.
8. Insert the indicator result (obs column).
9. Insert the standard error of the indicator result (if available)
10. Define and insert the confidence scores (High = 1, Intermediate = 0.5, Low = 0) for each of the four categories: confidence of classification (ConfA), temporal coverage (ConfT), spatial representation (ConfS) and methodological confidence (ConfM). The confidence can be inserted in numerical or text format. Instructions on how to assess the confidence in the different categories are found in HOLAS II 5-2016 Document 4-1 Annex 1. If standard error has been provided ConfA can be left empty.

11. If the indicator uses a conditional approach, i.e. several parameters with GES boundaries, all parameters and their results are inserted as separate indicators following the instructions above. The parameters are grouped in the ooao.txt file, where the indicator ID's of the parameters used in the indicator are given the same group ID.
12. Run the R script BOOSTbiodiv.R (make sure to specify the work directory location of the include.R file).
13. Result files are found in the …/results_scen folder.

Annex 1. Recommendations from BalticBOOST Biodiv WS 2-2016 and HOLAS II 6-2016

Below, the recommendations from BalticBOOST Biodiv WS 2-2016 are summarized and the work further in BalticBOOST is outlined. The numbering refers to the Outcomes of BalticBOOST Biodiv WS 2-2016. After each section, BalticBOOST present how the recommendations are accounted for in the further work in the project.

Structure of BEAT 3.0 and evaluations of the tests

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.

BalticBOOST: Detailed instructions on how to include indicators with a trend-based GES approach will be made and sent to the indicator experts of the indicators in question.

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.

BalticBOOST: BEAT 3.0 allow for applying both species and criteria approach and the choice on approach can be made when the guidance document is available.

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.

BalticBOOST: This is already implemented in the BEAT 3.0.

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.

BalticBOOST: BEAT 3.0 allow both approaches.

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 OOAO structure is made in parallel, to also represent a worst case scenario.

BalticBOOST: The weighed averaging is used as default in BEAT 3.0. As the result output is produced for all integration levels, the OOAO can be applied at any chosen level.

33. The workshop could not agree if a tentative assessment of biodiversity (i.e. combining the ecosystem component) should be based on OOAO or weighted averaging between ecosystem components.

BalticBOOST: See above, both approaches can be applied in BEAT 3.0.

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.

BalticBOOST: Down-scaling of indicators will be necessary in order to present the results at a finer resolution. The down-weighting of indicators in areas where they are not applicable will be done by not assessing the indicator in those areas.

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.

BalticBOOST: Tests showed that the differences in assessment results between assessment unit 3 and 4 are minor (if downscaling indicators to assessment unit 4). As the BEAT tool and the indicators enables use of the most detailed spatial level without influencing the assessment result, BalticBOOST recommends the use of spatial assessment level 4 in HOLAS II, noting that in this case the assessment results will be available at all spatial assessment levels.

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.

BalticBOOST: Further testing with including "fake indicators" will be done, to see if the results from the earlier tests (that the assessment result did not change remarkably with additional indicators) are still valid.

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.

BalticBOOST: Indicators will be included only once and assigned to only one criterion per descriptor.

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.

BalticBOOST: The biodiversity assessment will be done utilizing all relevant indicators agreed on, noting the assignment to criteria above.

Confidence assessment

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.

BalticBOOST: Accuracy of the result will be referred to as confidence in classification. The temporal coverage, spatial representation and methodological confidence are considered as reflecting the confidence of the assessment, although they indirectly also reflect 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.

BalticBOOST: With the time-frame given a fully data-driven confidence approach is not realistic, but this should be the aim in the future and the options for this should be looked at closer well in advance of coming assessments.

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.

BalticBOOST: The project will test options for how to assess the overall confidence of the assessment in cases where criteria and/or ecosystem components are lacking. A proposal will be presented to HOLAS II 5-2016.

Visualization of the results

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

BalticBOOST: The project will take these points into account in the further development of the visualization tool.

60. The workshop recommended that visualisation tool output should be harmonised with MSFD reporting needs.

BalaticBOOST: This will be taken into account.

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.

BalticBOOST: The project will take this into account in planning the rest of the work and try to take this into account by preparing flexible solutions that can be modified later.

HOLAS II 6-2016

Below, the outcome points relevant for the biodiversity assessment are listed:

4.16 The Meeting took note of the presentation by Henrik Nygård, representative of BalticBOOST partner SYKE, Finland, on the development of the biodiversity assessment tool (BEAT 3.0) and the recommendations from the workshop HELCOM BalticBOOST Biodiv WS 2-2016 (**documents 2-5 and 4-1, Presentation 3**).

4.17 The Meeting noted that the spatial integration follows the hierarchical nested structure according to the assessment units agreed in the HELCOM Monitoring and Assessment Strategy and that the workshop recommended to down-scale assessment results to allow for an assessment at the highest possible spatial resolution.

4.18 The Meeting further noted that the structure of the assessment tool is based on a hierarchical structure that makes it technically possible to consider results at 4 levels i.e. biodiversity, criteria elements (mammals), species groups (seals), species (grey seal), as each indicator used in the assessment is assigned to an ecosystem component and MSFD criteria.

4.19 The Meeting recalled that a set of tests were made using the BEAT 3.0 tool based on proposals from the first HELCOM BalticBOOST workshop on the biodiversity assessment tool (HELCOM BalticBOOST Biodiv WS 1-2016) and as further discussed and agreed by HOLAS II 5-2016 and State and Conservation 4-2016. The tests included to evaluate the use of the so called criteria vs species-based approach (see e.g. Annex 3, Outcome of HOLAS II 5 2016), weighted averaging vs OOAO at different levels of integration, and the use of different number of indicators in the assessment.

4.20 The Meeting supported the recommendation from the workshop to use weighted averaging as a default integration approach, at least to the level of ecosystem components, taking note that the position in Germany is not set yet.

4.21 The Meeting did not support the proposal of the workshop to complement the weighted averaging approach with presentation of the "worst case scenario" based on the OOAO approach at all levels, as it was not clear how such assessment results would be used or interpreted. The Meeting noted that the underlying information for the 'worst case scenario' is readily available at all assessment levels through the results of the individual indicator evaluations.

4.22 The Meeting proposed to continue the integration all the way to the level of biodiversity making use of the OOAO approach between elements to arrive at the status of biodiversity, as this was conceived as more transparent and technically more robust, taking note that the position of Denmark and Poland on this issue is not yet set.

4.23 The Meeting underlined that the presentation of the status of biodiversity should also provide information on the status of elements and that this should be considered in the development of visualization of results.

4.24 The Meeting noted that BEAT 3.0 allows assessments using both the species and the criteria based approach. The Meeting noted that for the HOLAS II biodiversity assessment, the tool can be customized in this and other regards as needed, pending the revision of the Commission Decision on GES criteria and taking into account the development of the article 8 guidance.

4.25 The Meeting supported the recommendation from the workshop to make use of relevant HELCOM core indicators on eutrophication also in the biodiversity assessment as well as biological WFD indicators to increase the representation of indicators reflecting the condition of habitats.

4.26 The Meeting discussed the proposal on how to assess confidence in the assessment, and requested the BalticBOOST project to develop the proposal further and present the results to State and Conservation 5-2016, including to evaluate the consequences of each of the two options for how to deal with cases when

a primary criterion is not represented by any indicator (i.e. to automatically set the assessment result to "low" or to the set the confidence to 0 for that criterion).

4.27 The Meeting took note that the R-script for the biodiversity assessment tool can be made available to Contracting Parties at any time and that the tool will also be made available as a web application within the life time of the BalticBOOST project.

4.28 The meeting took note of the proposal on how to visualize the results of the biodiversity assessment by the BalticBOOST project partner Estonian Marine Institute, University of Tartu, Estonia (Presentation 4). The Meeting noted the different options to present results e.g. by type of indicator (e.g. HELCOM core indicator, WFD indicator), spatial assessment unit, criteria, ecosystem components, broad habitat types, by use of petal charts. The visualization tool is a means to sort and visualize the assessment results from the biodiversity assessment, and to enhance the user-friendliness and transparency of assessment results, and does not preclude the use of other type of visualization products in the HOLAS II summary report.

4.29 The Meeting stressed the importance for Contracting Parties to clarify the national position on the structure of the biodiversity and hazardous substance assessment tools in advance of State and Conservation 5-2016.