Baltic Marine Environment Protection Commission

BLUES

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A1.1 Efficiency and measures: Analyses to support effective regional measures

Main report

Activity 1- Analyses and measures

2023

HELCOM

BLUES

Co-funded by the European Union

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HELCOM BLUES project website
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HOLAS 3

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HELCOM BLUES Activity 1

As the Activities A1.1-A1.3 are the premise for building an improved approach for conducting regional analyses for supporting the effective implementation of marine policies and the third State of the Baltic Sea report (HOLAS 3), the resulting deliverables, namely the outputs of the task A1.4 "Effectiveness of measures and policy-support", with its five subtasks, are described in more detail below. The supportive tasks for achieving this, namely A.1.1 (Developing the assessment framework), A1.2 (Improved data for the assessment), A1.3 (Estimation of benefits), are described in table 1 of this document, and summarised in the overall project summary report. Please see below for a summary of Activity 1 for these results for task 1.4.1-1.4.5, including a section on key messages and use of results.

Results summary

A1.4.1 Conduct use of marine waters analysis

The Baltic Sea countries receive considerable economic and societal benefits from the use of the Baltic Sea. These benefits include jobs, income, natural resources, and various other contributions to personal well-being. For example, fish for nutrition from wild capture fisheries and aquaculture are worth 163 million euros in gross value-added to Baltic Sea economies and offshore wind turbines generate 9.2 terawatt hours of electricity worth an estimated 878 million euros per year.

The Baltic Sea countries receive significant economic and social benefits from the use of the Baltic Sea. These benefits include jobs, income, natural resources, and various other contributions to personal well-being. While many of these activities can result in degradation of the environment, they are also critical to human well-being. Measures for the protection and management of the marine environment have impacts in terms of environmental benefits, but also potential economic or societal costs. A use of marine waters analysis provides a perspective on the socio-economic values we currently receive from the Baltic Sea to inform such discussions. The use of marine waters analysis was completed for eight different activities and thus extended from previous HOLAS II assessments. Three activities were included for the first time in HOLAS 3 and other additionally deemed relevant human activities are summarised as well to enable future analyses. The analysed human activities include the following:

- Fish and shellfish harvesting
- Aquaculture
- Tourism and leisure
- Marine Transport
- Renewable energy generation (HOLAS 3 now includes economic data)
- Extraction of oil and gas (NEW to HOLAS 3)

- Extraction of minerals (NEW to HOLAS 3)
- Waste treatment and disposal (NEW to HOLAS 3)

Other activities were not directly included in the assessment but listed as potential relevant with more collated information. The report on the use of marine water analyses was written as part of the HOLAS 3 thematic assessment for Economic and Social Analyses and is available as A1.4 Annex 1, Chapter 3.

A1.4.2 Carry out improved effectiveness of measures analysis

Significant advances in the framework, model, and code have been achieved and place the SOM analysis on good footing to become a valuable management tool. Future efforts can continue these advancements particularly regarding code implementation. More detailed information on the advancements and steps to be done for carrying out a complete analysis are described in A1.4.2 Annex 1 and 2.

A1.4.3 Cost of degradation

Reaching good environmental status in national marine waters by 2040 is collectively estimated to be worth 5.6 billion euros per year to the region's population. This estimate is based on an individual willingness-to-pay, ranging from 13€ (Russia) to 111€ (Denmark) per person per year. Benefit transfer was required to generate estimates for five of the nine Baltic Sea countries, which increases the estimate's uncertainty. The region is also estimated to be missing out on 9 billion euros in recreational benefits per year due to degraded environmental conditions. This estimate is based on individual forgone benefit estimates, ranging from 33€ (Russia) to 206€ (Denmark) per person per year. Benefit transfer was required to generate estimates for six of the nine Baltic Sea countries, which increases the estimate's uncertainty. These estimates provide two overlapping perspectives on the cost of environmental degradation in the Baltic Sea and should not be summed. The report on the cost of degradation was written as part of the HOLAS 3 thematic assessment for Economic and Social Analyses and is available as A1.4 Annex 1, Chapter 4.

A1.4.4 Cost-benefit analysis

This analysis reviews the methodology and state-of-the-art of regional cost-benefit analyses (CBA). It also assesses the legal and political status of CBA in Baltic Sea protection, and the critical components of utilizing the method, particularly information on costs and benefits. Finally, the analysis explores how much decision makers can rely on environmental CBAs for various topics of Baltic Sea protection based on the currently available information. Generally, in emerging environmental problems, such as marine litter, decision makers should understand the uncertainty of the CBA and put emphasis on the precautionary principle. In emerging problems both the actions to mitigate the problems as well as the severity of the environmental risk are still poorly known. Obtaining more detailed information is costly and time consuming. Hence, decision making should be guided by the CBA but not rely solely on it. We also show that with more thoroughly understood problems, CBA offers a transparent and effective way of analysing the policy alternatives. The report on the CBA was written as part of the HOLAS 3 thematic assessment for Economic and Social Analyses and is available as A1.4 Annex 1, Chapter 6.

Instead of focusing on 1-2 environmental topics, a gap analysis with available data review for all 9 topics were included in an overview available for an indicative evaluation of general information conditions for cost-benefit analyses. These topics include:

- Biodiversity/habitats
- Birds
- Fish
- Hazardous substances
- Marine mammals
- Marine litter
- Nutrients
- Non-indigenous species
- Underwater noise

The more detailed example analysis (on marine litter lists requirements, challenges and recommendations for each of the steps to carry out a full Baltic Sea marine litter CBA.

1.4.5 Incentives and implementation of measures

Cost-effectiveness is one of the key goals of marine protection. Cost-effective allocation of measures ensures that we obtain as high an environmental status with our protection efforts as possible. The measure allocation indicates which measures we use, where, and how intensively. However, to obtain the planned benefits the measures need to be implemented. In practice, implementation of new things can occur only by altering existing instruments and incentives or by designing and introducing new ones. Therefore, instrument analysis of at least on a rudimentary level should be incorporated in national marine protection plans. These should include at least indicating the instruments available and the pivotal decision makers for activating the instrument or changing the way it is used. With point sources, this should also mean evaluating the political and economic frictions in tightening the effluent limits: how likely it is that it can be done? With diffuse sources, agriculture in particular, we should include consideration on the coherence of the intended changes with the network of existing agricultural subsidies and programs: How likely is it that an impact will go through the system and actually reduce the loading to the sea? This way, marine protection plans would become more realistic. If a plan including the instrument analysis would seem not to achieve the targets, societies would be able to allocate more resources for the marine protection. For the benefit of the Baltic Sea, the plans should be as realistic as possible.

There are few characteristics in how instruments for nutrient loading can and have been utilized around the Baltic Sea. Municipal wastewater treatment plants are regulated with permits. The costs are the higher, the stricter the abatement levels. The costs will be transferred to directly to water bill payers and indirectly to taxpayers. Therefore, there is a general tendency of observing tighter permitting limits for wealthier countries.

The report (A1.4.5 Annex 1) recommends Contracting Parties to focus on making sure each measure in their national plans has a clearly identified, concrete policy instrument, suitable for triggering the desired action. Transparent plans on how to utilize instruments will increase the effectiveness of the implemented polices. It would be particularly important to take the incentive availability account already at the stage of planning the set of measures: if there is no plausible way to implement a measure, the government

authorities should not count on it as part of measures achieving ecological improvements. It is also important to note that currently the instruments are only loosely integrated in the planned measures in the Baltic Sea countries. Integrating instruments to policy design would offer ample room for improving the efficiency of Baltic Sea protection overall, and for Contracting Parties individually.
One concrete recommendation is that when identifying these instruments and marine protection policies – either completely new ones or changes in utilizing the existing ones – at least their most obvious interactions with existing freshwater policies, but also climate and biodiversity policies should be identified. If possible, the analysis should go further into the coherence of different policies and the implications of the cross-effects into environmental and economic efficiency of the policies. Furthermore, Contracting Parties should try to take such effects into account already at the stage of planning national strategies for key sectors. We recommend for stating the Baltic Sea explicitly in national environmental strategies. It would also be beneficial to explicitly address the potential effects of national strategies of key sectors (agriculture, forestry, industries with important point source loads). It would be necessary to explicitly determine the priorities. If this is not done, areas with no direct commercial interest or with strong public good character (such as Baltic Sea protection) may be given a minor role in national plans, if conflicting with economically powerful industries.
Finally. monitoring and data collection will improve the efficiency of BSAP implementation dramatically – *but only if the intended measures are explicitly paired with instruments and incentives.*
The report on incentives is available as report A1.4.5 Annex 1. Two papers have been also published on this topic, but are not yet publicly available. However, information from them has been incorporated into the report A1.4.5 Annex 5, and more information can be requested from the authors (please see below table 1).

Bonus output: Socioeconomic assessment of the Baltic Sea marine ecosystem services for assessing well-being impacts of marine protection and management policies
This assessment has been developed as part of the HELCOM BLUES project to address the gaps and needs for further development of the ES approach and assessments to support the Baltic Sea policies. The assessment contributes to implementation of the BSAP actions by (i) further development of the sea region policy assessment framework (developed in ACTION and continued in BLUES) by integrating the ES approach for more explicit linking the marine environment and human well-being and assessing the well-being impacts of policies; (ii) developing a sea region scale approach and assessments for quantitative and monetary estimation of the ES benefits and socioeconomic values and (iii) providing an initial demonstration on how such socioeconomic assessments can be used in policy development. The developed approach aimed in particular to improve the links between the ecosystem (its components, generating the ES) and benefits to humans and to cover diversity of the values, which cannot be reduced to one (monetary) metrics. The work was done in collaboration with HELCOM MetDev project (HELCOM Holistic Assessment Methodology Development Project) and the ES supply analysis for HOLAS 3, which developed quantitative estimates on the ES supply and benefits, ensuring the links between the marine ecosystem and human well-being. The given report summarises the

results of the ES assessment work done as part of the BLUES project and is available as A1.4 Annex 2.

Key messages

Science

1. The newly collated datas (costs) or updated (benefits) by HELCOM BLUES should be used and further developed in future projects.
2. The Sufficiency of Measures model is continuing to improve, but still requires development to realize its management potential. The solid coding foundation laid out by BLUES will allow for smoother integration of diverse data and structures in the future.
3. Cost-effectiveness analyses should take into account the available incentives to implement the intended set of measures.

Policy makers

4. Despite the large value currently derived from the Baltic Sea, the value can still be greatly increased through environmental improvement. To increase this value, coordination of Baltic Sea protection policies need to be maintained and intensified
5. Further improvement of the use of marine waters and cost of degradation analyses depends on data standardization and data development policies
6. Data sharing and data centralization for costs and effectiveness of environmental measures should be a high priority nationally and regionally

Use of results

In the immediate future, the results of BLUES Activity 1 will be used in the third holistic assessment of the Baltic Sea (HOLAS 3) to illustrate the value of the Baltic Sea to society, the value lost due to degradation, and tools we can use to improve environmental management. This work has been incorporated into dedicated chapters in the thematic assessment of economic and social analysis, which 5facilitate regional analyses for supporting the effective implementation of marine policies. The results also serve to fulfil actions HT15 and HT18 on the topic of “Enabling ecosystem-based management” from the 2021 Baltic Sea Action Plan.

The HELCOM countries which are also EU Member States can also use the results of the analyses for reporting obligations under the MSFD, art. 8 and 13.

Longer term, the cost and benefit data can support science and management throughout Europe and beyond by increasing access to critical data. The advancements of the sufficiency of measures framework and model, including coding, data processing, framework extension, topic structure development, and data gathering, all support the goal of having a fully functional, well tested management model ready when HOLAS 4 assessments become available. Many of the HELCOM BLUES project deliverables are developed at regional level but can be taken- with adjustments- also to enhance the work for other RSC.

Table 1. Overview of HELCOM BLUES A1 deliverables and outputs

Task	Deliverable	Notes	Output
1.1	Description of the improved assessment framework for sufficiency, effectiveness, and economic impacts of measures		A1.1 Annex 1. Description of the improved SOM assessment framework, model and code
1.2.3	Data for assessing the effectiveness and costs of regionally coordinated actions	See also Table 2 below.	A1.2 Annex 1. BLUES Cost Data inventory
1.3.1	Results of a literature review on marine valuation studies		A1.3 Annex 1. BLUES Benefit Data inventory
1.3.2	Improved approach for assessing regional benefits	Final document to be published on the HELCOM website, expected in April 2023 as part of the HOLAS 3 thematic assessment report on ESA	A1.4 Annex 1. HOLAS 3 Thematic assessment report on Economic and Social Analyses. Available as Annex 1.1
1.3.2	Regional benefit estimates of achieving good environmental status	Final document to be published on the HELCOM website, expected in April 2023 as part of the HOLAS 3 thematic assessment report on ESA	A1.4 Annex 1. HOLAS 3 Thematic assessment report on Economic and Social Analyses. Available as Chapter 4
1.4.1	Results of regional analyses of the use of marine waters	Final document to be published on the HELCOM website, expected in April 2023 as part of the HOLAS 3	A1.4 Annex 1. HOLAS 3 Thematic assessment report on Economic and Social Analyses. Available as Chapters 3

		thematic assessment report on ESA	
1.4.2	Results for the improved sufficiency and effectiveness of measures analysis	Deliverable not fully achieved. For discussion of current status and the circumstances leading to incompletion please see the last section o this document	Description in A1.4.2 Annex 1 Discussion of current status; A1.4.2 Annex 2 Model package
1.4.3	Results of regional analyses of the cost of degradation	Final document to be published on the HELCOM website, expected in April 2023 as part of the HOLAS 3 thematic assessment report on ESA	A1.4 Annex 1. Draft Thematic Report on Economic and Social Analyses. Available as Chapter 4
1.4.4	Approach for and results of a regional cost-benefit analysis of achieving good environmental status for 1-2 environmental topics	Final document to be published on the HELCOM website, expected in April 2023 as part of the HOLAS 3 thematic assessment report on ESA. Funder notified of slight adjustment of scope during progress report (Oct 2021), no objection received.	A1.4 Annex 1. Draft Thematic Report on Economic and Social Analyses. Available as Chapter 6
1.4.5	Description of incentives and regulations around the Baltic Sea countries to mitigate nutrient loading	Please note that the two papers may not yet be publicly available but have been incorporated into A1.4 Annex5 report. More information can be requested from the authors.	A1.4.5 Annex 1. The role of policy instruments in planning and implementing efficient protection for the Baltic Sea. Two papers as supportive information (not public yet):

			Iho and Ahtiainen 2023 (manuscript). MANAGEMENT OF BALTIC SEA EUTROPHICATION. To be published by Water Encyclopedia by Elgar Iho and Ahtiainen 2023 (manuscript). ENVIRONMENTAL ECONOMICS FOR EFFICIENT MARINE PROTECTION: THE EXAMPLE OF THE BALTIC SEA. To be published by Water Encyclopedia by Elgar
Bonus output		This deliverable supports subtasks 1.1.2, 1.3.1, 1.3.2, 1.4.1, and 1.4.3 to ensure a consistent approach across all tasks and within HOLAS 3 thematic assessment report on ESA.	A1.4 Annex 2. Socioeconomic assessment of the Baltic Sea marine ecosystem services for assessing well-being impacts of marine protection and management policies.

Table 2. Data improvements for assessing the effectiveness and costs of regionally coordinated actions. Information stated as. Additional information is available from the HELCOM BLUES Activity 1 partners.

Description	**Availability**
Measure **cost datasheet**	A1.2 Annex 1. BLUES Cost Data inventory
Improved effectiveness of measures for waterbirds	More information available upon request.
Improved effectiveness of measures for marine mammals	More information available upon request.

Additional ecological data on species home range size	More information available upon request.
Modelled link between input of nutrients and water condition characteristics using BALTSEM	No applications outside SOM model
Pressure-state survey results for zooplankton	Raw surveys not suitable for dissemination, more information available upon request.
Pressure-state survey results for marine mammals	Raw surveys not suitable for dissemination, more information available upon request.
Effectiveness of measures survey results for marine mammals	Raw surveys not suitable for dissemination, more information available upon request.
Literature weighting protocol for waterbirds	More information available upon request.
Literature weighting protocol for marine mammals	More information available upon request.

Baltic Marine Environment Protection Commission

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A1.1 Annex 1

Description of the improved SOM assessment framework, model and code

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2023

A1.1 Annex 1. Description of the improved SOM assessment framework, model and code

Framework advancements

Framework advances extend beyond the current goals of the SOM model. Specifically, the boxes for “Biophysical structure and processes”, “Functions”, “Final ecosystem services”, “Benefits” and “Impacts on human well-being”, as well as all connections to and from these boxes are not part of previous ACTION modeling efforts. However, these additions, identified during the work in HELCOM BLUES, are critical for the construction of a comprehensive assessment framework and should be included in future modeling work. The primary advance in the modeled portion of the framework is the inclusion of feedback flows within and between pressures and states. Developing this feature also required revision of the pressure lists, with future adjustments anticipated as further experience is gained.

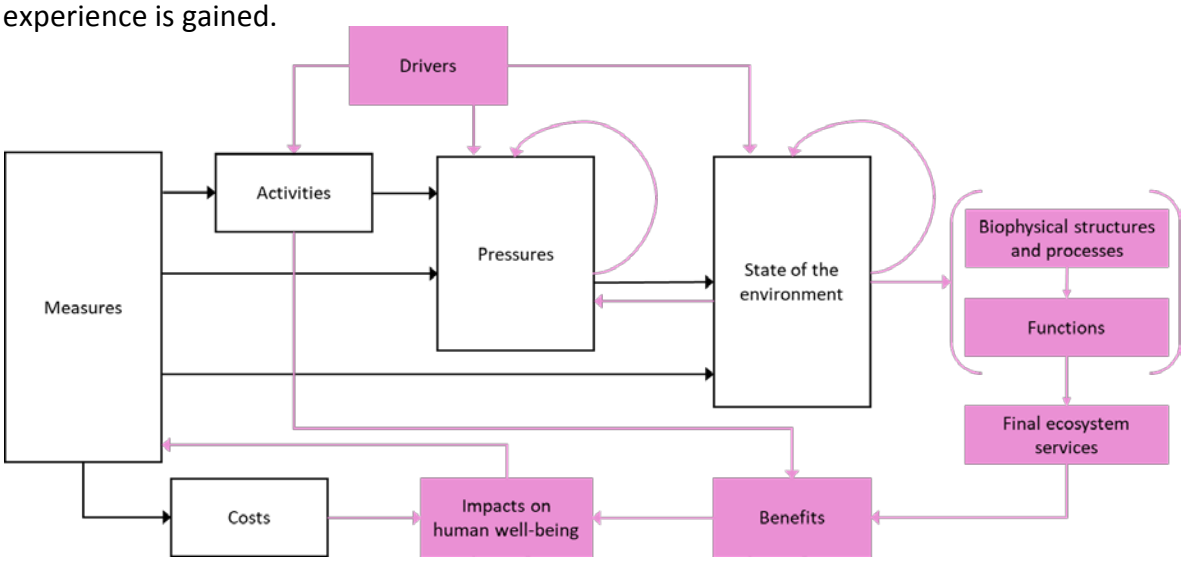

Figure 1. Conceptual framework, based on DAPSIR framework and including the ES cascade model, for assessing well-being impacts of policies for protecting and sustainable use of the marine environment. Connections and boxes in pink represent advances developed by the BLUES project.

Model advancements

Several framework and model related advancements have been made during HELCOM BLUES in comparison to the previous ACTION project. Below is a list with the most important considerations and improvements.

Added topics

Zooplankton was added to the model including full topic structure and survey. New development of GES threshold values (e.g. beach litter) were considered and ready to be taken for incorporation.

Updated topics

Marine mammals received a full topic structure review and update. Waterbirds received a partial topic structure review and update. Assessed species should be re-evaluated before any future survey efforts.

Climate change

Climate change related pressures are important when considering the total pressure but are not manageable pressures in the MSFD context. Climate change related pressures will be included in a topic's pressure list as necessary and will be treated largely as a normal pressure during calculations. However, the pressures will be unique in the following ways:

- The pressures will be linked to exogenous climate scenario(s) which will not affect other pressures.
- The pressures will be reported in a non-manageable category indicating the percentage contribution of climate change related pressures to the total pressure.

If the probability distribution of the total non-manageable pressures overlaps with the probability distribution of the total required pressure reduction by:

- 0% then green flag indicating that reaching the threshold value is not likely to be impeded by climate change
- E.g., 0 - 10% then yellow flag indicating long-term awareness is recommended
- E.g., >10% then red flag indicating near-term awareness is recommended.

North Sea

A separate spatial unit will be added for the North Sea for use primarily by non-indigenous species and input of nutrients. This improves the transboundary effect tracking for both topics and clarifies input sources for non-indigenous species.

Adjustment for adaptive management measures

Previous model iterations had difficulty with high levels of interannual measure adaptations such as is found in adaptive management regimes like the Common Fisheries Policy (CFP). Rather than attempting to track specific measures which are likely to change before model results are available, the CFP will be treated as a measure with effectiveness based on the annual likelihood of a stock reaching or maintaining good status.

Spatial protections

Areas protected from fishing activity may contain greater biomass of fisheries impacted species than unprotected areas. The positively impacted species depend on several factors including habitat distribution, species movement including migration, the gear types being excluded, species demographics, and the size of the protected area. Dedicated modeling exercises can more accurately project the effects of any given protected area, however, theoretical (e.g., Green et al. 2015) and observational (Di Franco et al. 2018) research does support a relationship between the home range size of a species and the required size of a protected area to achieve an increase in biomass of a fisheries impacted species.
Following the work of Di Franco et al., it is assumed that protected areas smaller than twice the average home range size of a species will not affect that species' abundance. If a

protected area is equal or greater to the average home range size an effect of [TBD] will be applied to the species' abundance in the protected area.

Human activities list

For clarity, the activity "urban uses (land use)" was changed to "urban land use (incl. storm water runoff)".

Pressure list

The pressure list has been updated for clarity, completeness and to conform with the elimination of pressure-input/pressure distinction.

1. "Physical loss of marine habitats" and "physical disturbance of marine habitats", are renamed to "physical loss of the seabed" and "physical disturbance of the seabed".
2. Pressure "loss/degradation of land-based seal haulout sites" is added and "loss/degradation of river, lake, or land habitat" is renamed to "loss/degradation of river, lake, or land habitat, excluding seal haulout sites".
3. "Change in hydrologic conditions" is renamed to "change in hydrologic conditions caused by human infrastructure".
4. "Species disturbance: obstructions and collisions" is renamed to "collision with human structures" and "loss of river continuity".
5. "Effects of eutrophication" is renamed to several to be determined specific pressures like water clarity and bottom water hypoxia.
6. Addition of "habitat loss from reduced sea ice cover or snow accumulation due to climate change".
7. "Human-induced food web imbalance" is renamed to "human-induced but now naturally sustaining food web imbalance".
8. Add pressure "species disturbance or displacement by above water portions of marine structures".

Code advancements

Code advancements have been made and implemented into the model framework and detailed documentation is available as A1.4.2 Annex 2 Model package.