D4.4 Report on regional workshop on use of ecological-economic research to support and improve marine policy implementation in the Baltic Sea region

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PREFACE

The overall aim of the joint HELCOM - BONUS BALTICAPP workshop, organized 29-30 March in Stockholm, was to build understanding on how ongoing ecological-economic research can support and improve marine policy implementation and integrated management, focusing on the Baltic Sea. Emphasis was on the interaction between science, policy and management. One aim of the workshop was specifically to identify existing gaps and priorities for future research in order to reach policy objectives under the HELCOM Baltic Sea Action Plan and relevant directives, focusing on the EU Marine Strategy Framework Directive (MSFD) and the EU Maritime Spatial Planning Directive (MSPD). The workshop covered following themes: scenarios and projections for the future, marine ecosystem services and benefits, marine and maritime spatial planning and policy implementation and integration.

A background material was produced with fact sheets linked to all presentations, presented in part 1 of this publication. Three group discussions were held linked to themes above, documented in part 2 of this publication. Program and participant list are found in annex I and II.

Table of contents

Part 1: Background material

HELCOM - BONUS BALTICAPP regional workshop on the use of ecological–economic research to support and improve marine policy implementation in the Baltic Sea region

The HELCOM – BONUS BALTICAPP regional workshop taking place 29-30 March at Stockholm University aims to build understanding on how ongoing ecologic-economic research can support and improve marine policy implementation and integrated management, and to identify existing gaps and priorities for future social and economic research in order to reach policy objectives in the Baltic Sea region.

The workshop is targeted to experts, as well as policy-makers and managers responsible for environmental protection, marine and maritime spatial planning, climate adaption and different economic sectors impacting or dependent on marine ecosystem services e.g. agriculture, fisheries, shipping, tourism, recreation and offshore energy.

The workshop will elaborate on how regional economic and social analyses, and results and tools provided by BONUS research and innovation projects can contribute to marine management and policy-making. Furthermore, existing gaps and priorities for future research will be identified in order to help reaching policy objectives under the HELCOM Baltic Sea Action Plan and relevant directives, such as the EU Marine Strategy Framework Directive and EU Maritime Spatial Planning Directive.

A jointly developed document, prioritising future ecological-economic research needs answering to the operational, medium term and long term policy needs, is expected as one of the main outcomes of the workshop.

The workshop focuses on future scenarios, marine modeling, use of marine waters, cost of degradation, ecosystem service values and cost-benefit analysis, and emphasizes on the interface between science, policy and management.

Participants will have the opportunity to find out the latest research results in these fields, contribute to identifying relevant links to various policies and discuss future development needs to serve policy implementation in the best possible way.

The workshop covers following themes: scenarios and projections for the future, marine ecosystem services and benefits, marine spatial planning and policy implementation and integration. Presented in this background document are fact sheets linked to presentation topics under each theme in order for participants to prepare in the best possible way before the workshop.

Extending Shared Socio-economic Pathways for the Baltic Sea region for use in studying regional environmental problems (BONUS BALTICAPP)

Zandersen, M., Hyytiainen, K., Meier, H.E.M., Tomzcak, M., Bauer, B., Haapasaari, P., Olesen, J.E., Gustafsson, B., Kosenius, A.K., M., Refsgaard, J.C., Fridell, E., Pihlainen, S., Letissier, M.

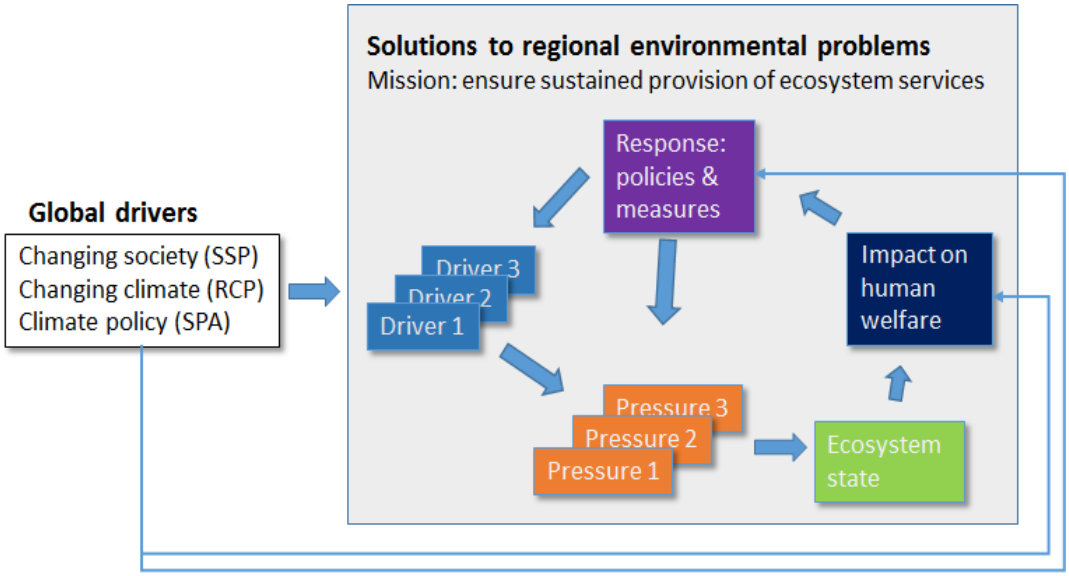
The Baltic Sea is an ecologically vulnerable aquatic ecosystem that is greatly influenced by human activities and the climatic system: i) diffuse and point nutrient loads from agriculture, industry and waste water treatment plants have particularly over the past 60 years caused strong eutrophication and large areas of dead sea bottoms in the Baltic Sea, threatening a range of important ecosystem services; and ii) perhaps increasing runoff integrated over the entire Baltic Sea catchment area in future climate, which in turn accelerates nutrient loads to the sea, while the resilience of the marine ecosystem is weakened due to higher surface water temperatures.

Scenarios that combine socio-economic and climate pathways can be powerful tools to help evaluate the challenges and uncertainties in ecosystem management and the scale of human contributions to regional environmental change under different plausible futures. Such scenarios can be used as input to integrated assessments to investigate how changes in nutrient emissions and subsequent responses in the ecosystem, combined with uncertainty about both future climate impacts and societal developments, may develop and what actions would be needed to obtain good environmental conditions.

Global climate futures, i.e. Representative concentration pathways (RCPs) and socioeconomic futures, i.e. Shared Socioeconomic Pathways (SSPs) were initially developed to address global challenges to mitigate and adapt to climate change. These can also be directly applied as tools when analyzing solutions to regional environmental problems, which would necessitate extending the pathways to regional sectors.

This presentation offers a methodology and a collaborative and interdisciplinary attempt to formulate harmonized multiple socio-economic pathways of the Baltic Sea region that integrate key sectors in a DPSIR framework and use the Shared Socio-economic Pathways (SSPs) as a basis in order to study key environmental problems of the Baltic Sea.

We propose sectoral narratives of the sustainability pathway (SSP1), the Middle of the Road (SSP2), Regional Rivalry (SSP3), Inequality (SSP4) and Fossil Fueled Development (SSP5) focusing on nutrients, fishing and shipping.



Framework for analysing and managing regional environmental problems: DPSIR extended with global drivers.

Projections of Baltic Sea state under changing climate and society: first achievements (BONUS BALTICAPP)

Sofia Saraiva, H.E. Markus Meier, Helén Andersson, Anders Höglund, Christian Dieterich, Matthias Gröger

1. The study is being developed under the Baltic APP project: Well-being from the Baltic Sea – applications combining natural science and economics.

2. The aim is to build spatially and temporally detailed projections of water quality and lower trophic levels for the Baltic Sea using coupled climate-environmental models.

3. The methodology follows the same rational as previous projections (ECOSUPPORT project) including now a series of improvements and updates of data and knowledge.

4. Projections are performed with the latest version of the coupled physical-biogeochemical model of SMHI (RCO-SCOBI).

5. 4 different global climate models solutions downscaled to the Baltic Sea region as atmospheric conditions:
   - Model A: MPI-ESM-LR (http://www.mpimet.mpg.de/en/science/models/mpi-esm.html);
   - Model B: EC-EARTH (https://www.knmi.nl/kennis-en-datacentrum/achtergrond/ec-earth-goals-developments-and-scientific-perspectives);
   - Model D: HadGEM2-ES (http://www.metoffice.gov.uk/research/modelling-systems/unified-model/climate-models/hadgem2);
   - Model E: IPSL-CM5A-MR (http://icmc.ipsl.fr/).

6. Latest runoff projections from a hydrological model E-HYPE model built under the same global climate models (results from IMPACT2C and SWICCA projects).

7. 3 different possible nutrient scenarios built under different assumptions on socio-economic projections:
   - BSAP: effective implementation of the Baltic Sea Action Plan. Loads to the Baltic are imposed and assumed constant for the future.
   - Reference: nutrient sources remain constant through the future and loads are computed by E-HYPE model assuming only changes in climate.
   - Worst Scenario: assumes the cumulative effect of the changes in climate and changes projected by the socio-economic pathway that leads to the highest nutrient loads (SSP5).

8. Long spin up run: simulations start in 1850 to minimize the influence of chosen initial conditions

9. Additional scenarios assuming no climate change were built by randomly repeating present climate conditions as simulated with one of the GCMs (ModelA). The aim is to compare with the climate scenarios from the same model and perform an impact assessment study on climate change
10. First achievements will be presented and discussed.

Scenario analysis (impacts by 2050) for the Baltic Sea Basin (BONUS SOILS2SEA)

Alena Bartosova, Jørgen E. Olesen, Jens Christian Refsgaard, Chantal Donnelly, Christen Duus Børgesen, Mohamed Jabloun

BONUS Soils2Sea exploits the fact that the retention (removal by biogeochemical processes or sedimentation) of nutrients in groundwater and surface water systems shows a significant spatial variation, depending on the local hydrogeological and riverine regime. This can be used to achieve the goals for nutrient load reduction set out in the Baltic Sea Action Plan. The traditional uniform regulations do not account for local data and knowledge and are much less cost-effective than spatially differentiated regulations with measures targeted towards areas where the natural retention is low.

An important component in Soils2Sea is to analyze how differential regulation as well as changes in land cover, agricultural practices, and climate may affect the nutrient (nitrogen and phosphorus) losses from land areas. Several scenarios are executed in order to test how robust differentiated nutrient load reduction measures are towards plausible climate change and land use changes. For this purpose coherent climate and land use/management scenarios for individual catchments and the entire Baltic basin are being developed and tested. The overall objectives of the scenario analyses in Soils2Sea are twofold:

- Analyze how changes in regulatory paradigms will affect nutrient loading to the BalticSea
- Analyze how climate changes and associated land use changes will affect nutrient loading to the Baltic Sea.

The new scenarios framework developed by the climate change research community over the recent years consists of two sets of pathways: Representative Concentration Pathways (RCPs) that describe the extent of climate change and Shared Socioeconomic Pathways (SSPs) that depict plausible socioeconomic conditions during the ongoing 21st century. The SSP narratives extended to accommodate the analysis of complex interaction effects of multiple human impacts on a large regional ecosystem, such as the Baltic Sea, were used to develop our scenarios. Namely, we selected SSP1 (Sustainability, tracking the green road), SSP2 (Middle of the road), and SSP5 (Fossil-fueled development (tracking the highway).

At the Baltic scale the objectives are to:

- Analyze how combinations of changes in climatic conditions with targeted changes in land use and land management will affect nutrient loading to the Baltic Sea
- Provide scenarios for 2050 with estimates of potential future land use and climate change
- Analyze how effective spatially differentiated measures are at reducing loads to the Baltic Sea and if this changes in a future climate.

The scenarios of land use change together with projections of changes in land management feed into scenario studies at both catchment and Baltic Basin scales. The climate change scenarios consider a 20 year period for 2041-2060 compared with baseline period of 1991-2010. Several climate model runs are used to consider the uncertainty. Mitigation scenarios are considered separately for the Baltic Basin scale and for individual case study catchments. The scenario analyses for the Baltic Basin scale are being conducted using the HYPE model and consider spatially differentiated measures to reduce nutrient losses from agriculture and enhance retention in the landscape. All scenarios will be compared to a reference that represents the current situation.

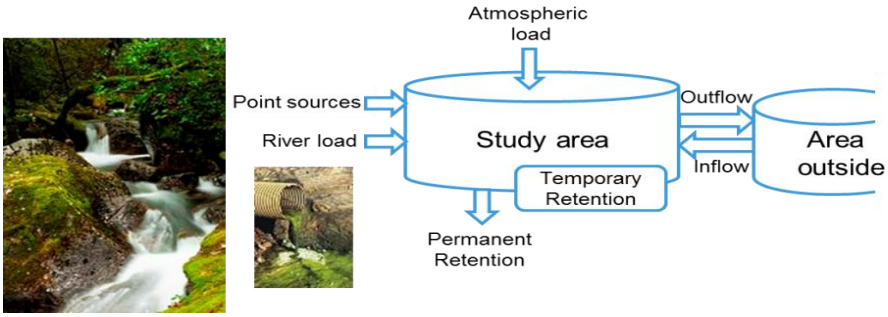
SMHI

Nutrient retention in the Stockholm Archipelago using the Swedish Coastal zone Model - a study within the project BONUS COCOA– Nutrient COcktails in the COAstal zone of the Baltic Sea

Elin Almroth-Rosell, Moa Edman, Kari Eilola, H.E. Markus Meier and Jörgen Sahlberg

The Swedish Coastal zone Model (SCM) was used in a retention and a nutrient scenario study in the Stockholm Archipelago for the period 1990-2012. The study showed that about 65-72 % of the nutrients entering the Stockholm Archipelago from land never reached the open Baltic Sea, and thus the nutrients were retained in the coastal zone.

In the nutrient scenario experiment the nutrient load from land decreased with 20 % and 12 % for nitrogen and phosphorus, respectively, regarding the nutrient load level of year 2010. The result showed that the amount of nitrogen in the archipelago decreased quickly, while it took about 20 years before phosphorus had reached new lower concentrations. In the long term the nutrient reductions resulted in a decrease of the anoxic bottoms with about 30 %, lower concentrations of chlorophyll and a decrease of the export to the open sea of nitrogen with 62 %.



Simplified scheme of the retention calculations in the study area.

BONUS COCOA

The objective of COCOA is to identify major pathways of nutrients and organic material in various coastal ecosystems around the Baltic Sea. An ensemble of biogeochemical models will be used in combination with field studies at different coastal study sites around the Baltic Sea to identify major pathways of nutrients and organic material in various coastal ecosystems.

Nutrients and organic matter are transformed and retained along the land-sea continuum, and COCOA will quantify how physical and chemical conditions as well as the biological components of the coastal zone affect the biogeochemical processes.

The project will investigate if transformation and retention processes may have changed over time, and how coastal ecosystem services are affected by these changes. As a result, COCOA will outline management responses to improve the ecological status for coastal ecosystems degraded by eutrophication.

(Almroth-Rosell, E., Edman, M., Eilola, K., Meier, H.E.M., Sahlberg, J., 2016. Modelling nutrient retention in the coastal zone of an eutrophic sea. Biogeosciences 13, 5753-5769. 10.5194/bg-13-5753-2016)

Regional economic and social analysis in the Baltic Sea (HELCOM TAPAS and SPICE projects)

Soile Oinonen, Finnish Environment Institute, Finland

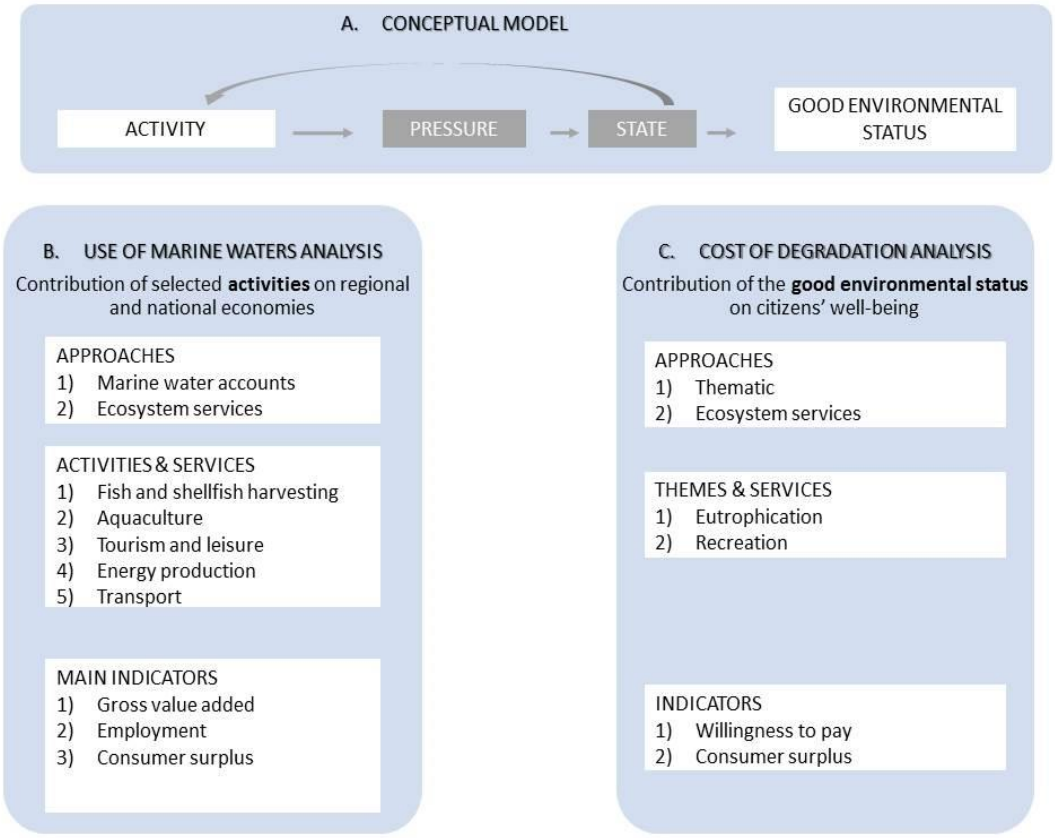
Economic and social analyses (ESA) illustrate the importance of the Baltic Sea marine environment to the society and the contribution marine environment makes to citizen's well-being and to national and regional economies. HELCOM, together with the Finnish Environment Institute and SEI Tallinn, has lead work on the regional ESA in the Baltic Sea (TAPAS[1] and SPICE[2] projects in 2016-2017). The aim has been to develop a framework and collect data to produce comparable information on the economic and social importance of the marine environment in the Baltic Sea region. Thus far, the analyses have focused on the use of marine waters and cost of degradation for the HELCOM State of the Baltic Sea assessment (HOLAS II) in 2017 and the Marine Strategy Framework Directive' s intermediate assessment in 2018. The framework is a mixture of the Driver-Pressure-State-Impact (DPSIR), marine water accounts, ecosystem services and thematic approaches.

Existing statistical information is supplemented with existing peer reviewed studies to provide as holistic as possible illustration using selected indicators. (Figure 1) The results could also contribute and bring insight into the marine spatial planning process and the mapping and assessment on the state and economic value of ecosystem services and their integration to the national accounting system requested by the EU Biodiversity strategy.

HELCOM expert network on economic and social analyses has been established to further develop methodological aspects and to share and exchange knowledge. The work continues in 2017 on further developing the approaches and analyses for ecosystem services, baseline for economic and social analyses, and integrating activities, pressures, environmental state and effects on human well-being in a single framework.

[1] Development of HELCOM tools and approaches for the second holistic assessment of ecosystem health of the Baltic Sea

[2] Implementation and development of key components for the assessment of status, pressures and impacts, and social and economic evaluation in the Baltic Sea marine region



Framework for regional economic and social analysis in the Baltic Sea. White boxes show the present status of application and the grey boxes and arrows show future developments towards more integrated analysis.

Benefits from marine and coastal recreation (BONUS BALTICAPP)

Heini Ahtiainen, Christine Bertram, Jürgen Meyerhoff, Kristine Pakalniete, Eija Pouta & Katrin Rehdanz

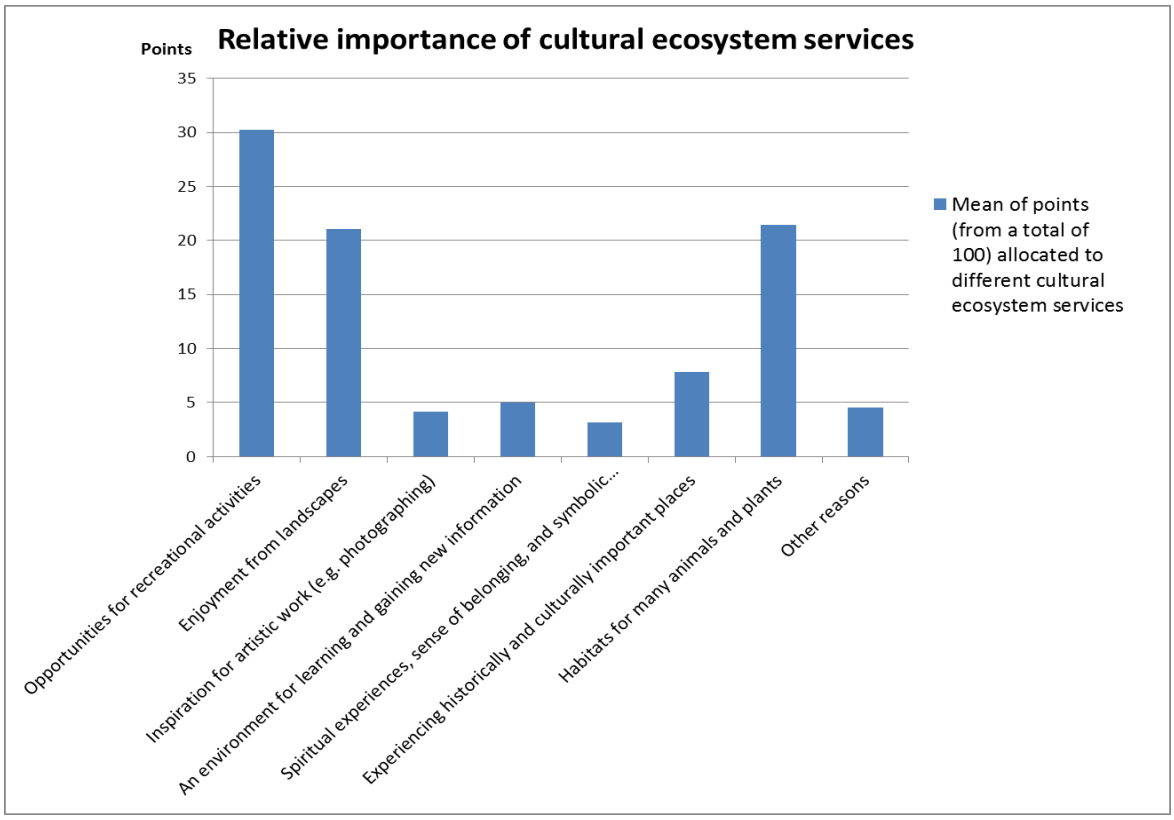
One of the tasks of the BONUS BALTICAPP project was to measure the importance of cultural ecosystem services in the Baltic Sea and the impact on human well-being from changes in the state of the marine environment.

To this end, survey data were collected in Finland, Germany and Latvia to reveal the diverse benefits from the Baltic Sea to human well-being. The surveys were implemented in November 2016 – February 2017 using representative samples of the populations in these countries. The data include in total 4800 responses.

The survey data allow analysis of

- Relative importance of different cultural ecosystem services (see Figure)
- People's perceptions of marine water quality
- Locations people visit for Baltic Sea recreation and recreation hotspots
- Value of marine and coastal recreation
- How eutrophication affects the value of marine and coastal recreation
- What kind of benefits people obtain from improving the state of the marine environment with regard to Marine Strategy Framework Directive descriptors of good environmental status.

The data allow mapping recreation locations and benefits of improving the state of the Baltic Sea. The value estimates will be included in a cost-benefit analysis of nutrient abatement at the level of the entire Baltic Sea, performed in the BONUS BALTICAPP project.



Sustainable governance of marine space: exploring the capacity of MSP as a policy integrator in the BSR (BONUS BALTSPACE)

Michael Gilek, Södertörn University, Sweden

Marine spatial planning (MSP) is a key governance approach that aims to deliver sustainable use of marine space and its resources. Presently, MSP is of high interest in the international marine policy arena, leading many countries around the world to develop and implement marine spatial plans. In parallel, a considerable amount of disciplinary and interdisciplinary research is being carried out on MSP and related aspects of marine governance.

Research on MSP from European regional seas (e.g. the Baltic Sea) and elsewhere, shows that perceptions on what sustainable marine development is and how it could or should be achieved through MSP practices differ substantially among countries, sectors, actors and scientific disciplines.

Integration is a key concept in sustainability (integrating a range of thematic pillars) but also in MSP from a practical governance perspective, requiring integration across, for example, multiple scales and between sectoral interests. This presentation aims to discuss how integration can mean different things and is variably expressed across Baltic Sea MSP contexts with implications for different dimensions of sustainability.

Drawing on findings from the interdisciplinary research project BONUS BALTSPACE on the challenges and opportunities of MSP in countries around the Baltic Sea, the presentation will focus on: 1) outlining an analytical framework that has been developed to allow examination of integration and various sustainability dimensions linked to MSP practices; 2) exploring how MSP practice/implementation in particular case study contexts play out and can be understood in terms of integration and various sustainability discourses/dimensions.

In summary, despite substantial differences among countries, MSP practices in the BSR mainly focus on integrating environment and economic imperatives through for example ecological services work. However, in doing so social sustainability concerns related to democratic practice, equity, societal choice etc. are still often undeveloped. Hence, the results suggest that, in addition to the current focus on developing technical tools and guidelines on e.g. integration of quantitative data, MSP processes are in dire need of improved methods and processes of engagement to support wider deliberation.

MSP aims

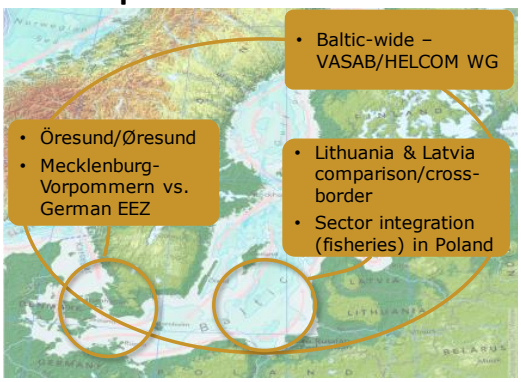
Problems

- Increasing use
- Fragmentation
- Trade-offs
- National & sectoral interests
- Knowledge
- Legitimacy

Integration challenges

- Multi-scale and transboundary
- Policy and sector
- Stakeholder
- Knowledge

In-depth case studies of MSP



Ecosystem services in MSP: Ecosystem services approach as a common Nordic understanding for MSP

Mats Ivarsson, Anthesis Enveco Group, Sweden

This study describes and communicates a proposal for a new tool on how to incorporate an ecosystem services approach into the maritime spatial planning process. The proposed tool provides a prototype for a stepwise methodology to analyze linkages between maritime activities and ecosystem services, and to assess the status of marine ecosystem services as a part of the MSP process. The report addresses the Nordic co-operation needs, economic valuation of ecosystem services and trade-offs between concurrent use of the marine areas and ecosystem services. It includes:

- a review of existing ecosystem services typologies, and specifically, the typology developed for marine spatial planning purposes which was chosen for the application
- support to the user in identifying and selecting relevant maritime sectors and activities to be included in assessments of alternative or opposing planning scenarios
- support to the user in linking environmental pressures of identified maritime sectors and resulting impacts on ecosystem services
- a method for assessing the severity of the impacts on ecosystem services by means of a scoring system, the results are used to underpin relative comparisons of the impacts represented by alternative or opposing planning scernarios
- support for economic valuation of identified changes in the quality and provisioning of ecosystem services
- support for analysis of distributional effects related to identified changes in the quality and provisioning of ecosystem services as well as trade-off analysis between alternative or opposing planning scenarios.

The study was financed by the Nordic Council of Ministers and the report will be published during spring 2017. The project team consist of researchers from Anthesis Enveco in Sweden, Vista Analysis in Norway and SYKE - Finnish Environment Institute.

Swedish Agency for Marine and Water Management

Swedish marine spatial plans and environmental assessment

Jan Schmidtbauer Crona, Swedish Agency for Marine and Water Management

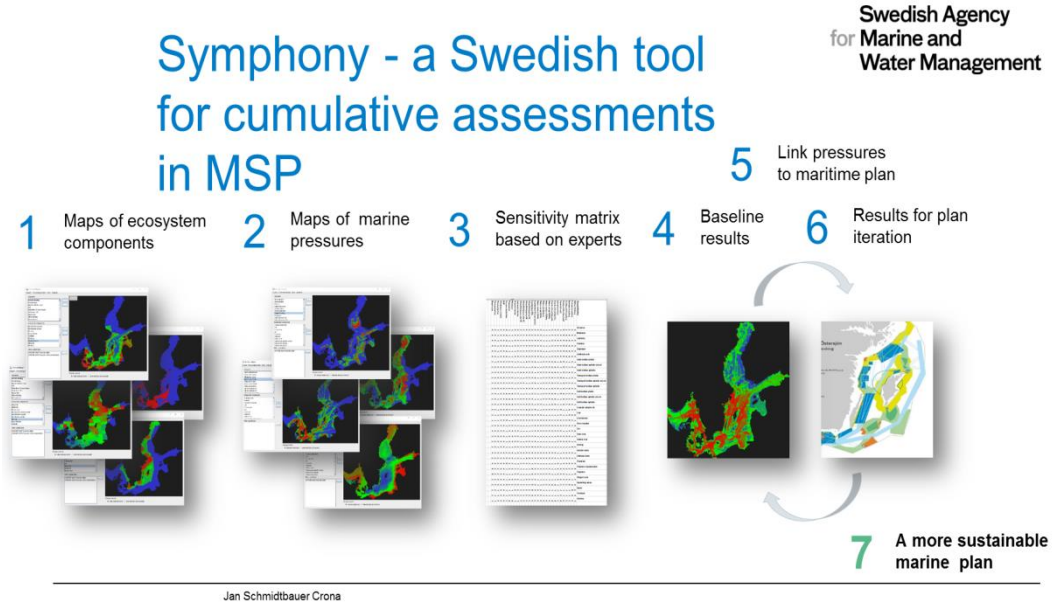
Sweden is applying the Ecosystem Approach in national MSP. Three draft marine spatial plans have been published including SEA-documents. All available in Swedish for download on: https://www.havochvatten.se/hav/samordning--fakta/havsplanering.html

The plans and the SEAs are out for informal dialogue during spring 2017.

One of the aims of the plans is to safeguard marine green infrastructure and the provisioning of ecosystem services.

In parallel, the cumulative assessment tool Symphony is developed to be used for assessment of different plan alternatives cumulative impacts.

A method for multi criteria sustainability appraisal is also developed in spring 2017.



BLUE2 Project: Study on EU integrated policy assessment for the freshwater and marine environment, on the economic benefits of EU water policy and on the costs of its non-implementation

Guenter Hoermandinger, European Commission, Directorate-General for Environment, Marine Environment

The BLUE2 Project has two parts. Part A is about the economic benefits of EU water policy and the costs of its non-implementation, and Part B) is on developing an integrated policy assessment capacity. There is some degree of overlap between the two parts. Part A will serve to increase the understanding of the full value of water and water services and how water resources contribute to economic development and citizens' well-being. It will provide more insight into the functioning of the EU Water Framework Directive. Part B will support the European Commission's policy assessment capacity which is centred around models of the physical, chemical and biological aspects of freshwater and marine environments. These models are held by the Commission and are not part of this project. Instead, the project will help in collecting and preparing input data on environmental pressures, costs and performance of measures to be taken, definition of scenarios, and socio-economic assessment of the model output.

Department of Environmental Science
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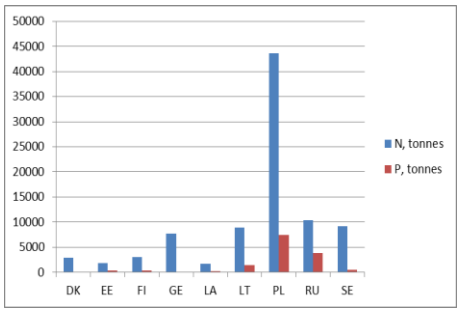
Go4 Baltic

Policies to reduce marine eutrophication in the Baltic Sea - cost-effectiveness, incentives and interactions with agricultural and climate policy targets (BONUS GO4BALTIC)

Berit Hasler, Aarhus University, Denmark

"The easiest way for a country to avoid compliance with an international agreement, is to never sign it" (Barrett and Stavins, 2003, here from Elofsson & von Brömsen 2017). This is however not the case for the HELCOM Baltic sea Action plan (BSAP), nor the United Nations Framework Convention on Climate Change (UNFCC).

The nutrient load reductions required by the BSAP are agreed and distributed among the countries according to maximum allowable inputs (MAI) to the sea-subbasins , with the aim to obtain good ecological status in these. The reduction targets are agreed between the contracting parties. The country allocated targets from 2013 are presented in Figure 1. The largest reductions are required in Poland, for both nitrogen (N) and phosphorus (P). However, cost-effectiveness has not been guiding this distribution of reduction requirements between the countries, and a number of studies indicate that substantial cost-savings could be achieved allowing for trading the reduction requirements between countries to achieve more cost-effective reductions of the nutrient loads (Elofsson 2010, Hasler et al 2014, Ahlvik et al 2014, Hyytiainen et al 2014).

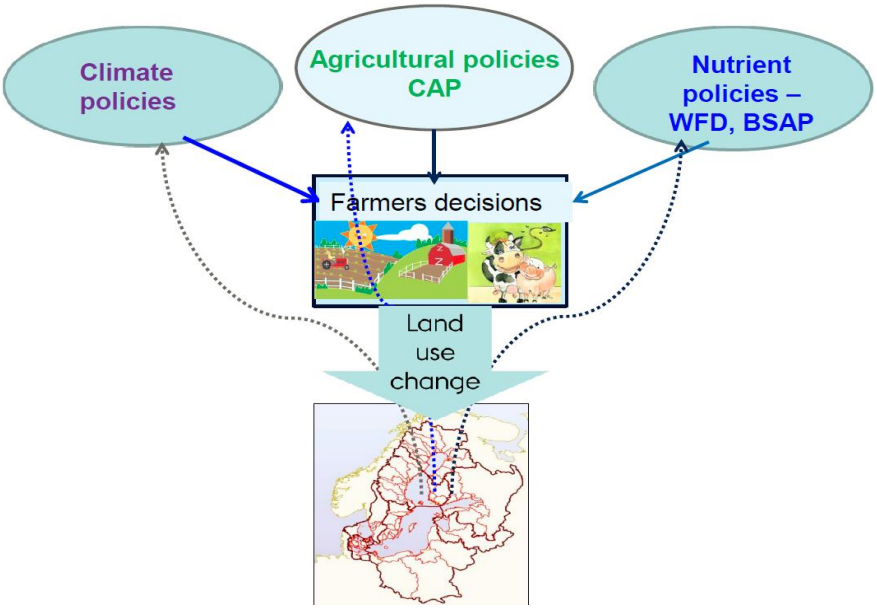


Country allocated targets for N (Nitrogen) and P (phosphorus) reduction, tonnes (total)

Adopted after HELCOM 2013b (DK: Denmark, EE: Estonia, FI: Finland, GE: Germany, LA: Latvia, LT: Lithuania, PL: Poland, RU: Russia, SE: Sweden). http://www.helcom.fi/baltic-sea-action-plan/nutrient-reduction-scheme/targets

GHG reductions to obtain climate policy objectives/commitments are also regulated at an international multilateral level, according to the UNFCC and EU's unilateral commitment on 20% reductions of GHG emissions (1990 levels by 2020). The EU policy includes the Emission trading scheme (ETS), which regulates industry, and the Effort sharing decision scheme (ESD)- which includes sectors such as agriculture. Several studies, e.g. DeCara & Fayet (2011), conclude this allocation is not cost-effective, - the costs of a 10% reduction in EU could be reduced by a factor two to three compared to the fixed targets, if a flexible cap-and-trade system were introduced.

The cost-effectiveness can be improved by joint implementation of agricultural, water and climate policies in the Baltic region, by measures that favors all policies. These potentials are being explored in the BONUS Go4baltic project . www.Go4baltic.au.dk



Part 2: Outcome group discussions

The two first group sessions (first on scenarios and second on ecosystem services and economic analysis) were conducted by applying a "world café"-format, which is a commonly used method for exchange of ideas and accessing collective intelligence. The task was formulated as the one of jointly populating a matrix (see table 1) that has the two directives (MSFD 2008/56/EU and MSPD 2014/89/EU) as rows and three blank columns indicating the (1) Challenges created by the EU Directive and the associated national legislation to the research community (2) Need of data and models that could be used to address the critical questions (3) Solutions and opportunities, tools and analysis applicable for meeting the requests from policy implementation.

The participants were divided into three groups, discussed each of the topic 20 minutes adding cumulatively on the notes that earlier groups had produced. Two facilitators were assigned for each discussion topics to guide the discussion and notes were taken for each topic. Below are meeting notes from all group discussions.

Matrix guiding the group discussion

DIRECTIVE	GOAL, MISSION	CHALLENGES	DATA NEEDS, GAPS	SOLUTIONS & OPPORTUNITIES TOOLS & ANALYSIS
Marine Strategy Framework Directive 2008/56/EU (MSFD)	Achieving and maintaining the good environmental status of the sea			
Maritime Spatial Planning Directive 2014/89/EU (MSPD)	Promote sustainable growth of the maritime and coastal economies Promote sustainable use of marine goods and services for the present and future generations Ecosystem-based approach & adaptive management			

Group discussion I: Scenarios

Questions addressed:

Policy frameworks such as the HELCOM Baltic Sea Action Plan and Marine Strategy Framework Directive (MSFD) and Maritime Spatial Planning Directive (MSPD) target at achieving the good environmental state of the sea. Scenario work & modeling may serve these policies by providing information on:

- possible future developments of the marine environment under current or planned level of mitigation effort and environmental regulation
- the magnitude of effort (challenge) needed to reach the target
- impacts of global factors (such as climate change) on the level of challenges
- What are the possible uses for projections in policy design and planning?
- Eutrophication: for the purposes of policy planning and design
- Time horizon & time step of projections: how long is appropriate in policy planning?
- What is the appropriate spatial detail?
- Interaction between plausible global developments – capacity (= possibilities for nutrient abatement) – societal need? Realistically achievable target?
- Tools exist for eutrophication, what about other environmental problems or hazards?
- Future data/information needs from the point of view of policy design?
- How to get prepared (and increase the adaptation capacity to) to (yet unknown) global changes?
- How to account for the multiple pressures?
- How best to address multiple targets or multiple minimum threshold levels of indications?

Discussion topic 1: Challenges

Specific question discussed:

What kind of challenges that the marine policies and maritime spatial planning create for research?

Good environmental status (GES) is not a clearly defined goal

- There are 11 descriptors, in addition they is a mix of state and pressure descriptors, meaning there are many indicators.
- GES defined by the individual member states have so far often been more qualitative aspirations than quantitative targets. Therefore it has been hard to assess if/when they are reached.
- In the past, member states reported differently on the state and pressure descriptors. This makes it hard to compile, analyse and understand the results. This is however now clarified in a new EU Commission report.

Modelling descriptors

- Some descriptors are quite well modelled, e.g. nutrients for assessing eutrophication, but other descriptors are hard to model.
- The EU Commission develops a pan-European modelling system to evaluate performance of policies.
- A ”baseline” or business as usual scenario (BAU) is needed for comparison when modelling future scenarios.

Research/data needs

- Basic research, mapping and monitoring of the sea requires time and effort. It is not easy to study things under the surface.
- E.g. fisheries management can require decades of research on species life-cycle, migration etc. before informed management is possible.

Trade-offs and links between sectors and areas

- There are a multitude of links between land and sea that needs to be identified.
- It is often more efficient to affect sources on land than mitigating effects at sea.
- E.g. cost-benefit analyses: it is difficult to incorporate all the costs and benefits of activities affecting the sea, e.g. nutrient pollution vs. agricultural production.

Environmental economics

- Is environmental economics too driven by economics?
- Trade-offs between e.g. environmental and economic goals needs to be better understood.
- There is some inconsistency in the terminology in MSFD text, due to different cultures/traditions in different member states.

Implementation of policies

- Implementation is to some extent missing, especially at the local/municipality level at least in some countries.
- Funding is needed, e.g. MSFD is implemented mostly without additional funding at least in some countries.

Policy needs and research/communication:

- When planning research projects/funding calls, researchers need to know what is needed and for when in order to produce results that will truly be implemented in policy.
- Better network between research and policy makers is needed?
- Funding for interactions is missing.
- Funding for communication is mandatory in many projects, but often this part is not taken seriously enough and/or possibly knowledge and communication platforms are missing within the research community.
- Need to mobilise and communicate current knowledge better.
- Workshops like this are a good way to increase knowledge transfer.
- We need communicators that understand both science and policy to work at the interface (e.g. there are successful examples with policy briefs).
- Also, communication between scientists from different fields can be very challenging.
- Project reports are not easily accessible, this kind of information needs to be gathered and made available both to scientists and policy makers/managers.
- Regarding Marine and Maritime Spatial Planning: Information to planners need to be aggregated and spatial.
- Researchers are sometimes afraid to give their results/expert opinions to the management community.
- Large data correlations can be communicated as correlations without having to state that we know the exact mechanism, less risk of ”scientific shame”.

Discussion topic 2: Data needs and gaps

Specific question discussed:

How does the existing research knowledge serve policy design and implementation (both marine policies and maritime spatial planning)

- For planning various differing data sets are needed: aggregated data, high-resolution data in time and space. The latter is often lacking. However there is a need to distinguish between different sea areas. On the other hand numbers of accumulated and integrated information is needed.
- There is a need for a more holistic approach: coupled physical-biogeochemical models provide data up to the trophic level of zooplankton. Only a few food web (higher-trophic) models are available and usually not coupled to lower-trophic level models. Hence, feedback mechanisms are not considered which are important to investigate the ecosystem response to human pressure.
- Although there are a few exceptions and depending on the topic (e.g. water quality properties), input/validation data for model calibration/evaluation are sparse.
- There are differences between models describing the same process. Hence, there is a need for assessments of models and ensemble studies.
- There is a need for more socio-economic information, e.g. how changes of the marine ecosystem will affect population, cities, employment, infrastructure and vice versa.
- For many data sets storage and accessibility is limited. Data bases need to be further developed.
- For climate studies, a scale problem arises. How to downscale the information from the global to the regional scales?
- Finally, the communication between scientists and stakeholders need to be improved. The information has to be compiled by scientists in different formats to meet the needs of various stakeholders.

Discussion topic 3: Solutions and opportunities

Specific questions discussed:

- Future data/information needs in policy design & planning
- What are the relevant spatial and temporal scales of analysis?
- How to treat multiple pressures and multiple targets?

Spatial aspects

- There is need for Baltic-wide analysis about the current potential for nutrient load reductions in different economic sectors. There are tools existing for such assessments. The modelling tools could be developed as toolboxes available and made available for users. The results of the nutrient load hotspots could be documented as lists or interactive maps.
- Transboundary aspects of marine protection require more attention. How far can the countries/sectors go to mitigate the pollution/extraction of their own and how much international/cross-sectorial cooperation is needed?
- Analyses at different spatial scales/resolutions can complement each other. Coarser spatial resolution may be adequate for holistic, multi-sectorial assessments.

Temporal aspects

- In scenario work and modelling, short-term, mid-term and long-term analysis serve different purposes, and they complement each other.
- When developing baseline and policy scenarios, information on the pathway (or a family of plausible pathways) are also needed in addition to end states.
- In economic analysis, the short and medium term impacts are the most important when ranking management alternatives.

Thematic spread

- Scenarios serve as a basis for economic analyses and for the search of good and practicable solutions to the environmental problems.
- In the future, there will be an increasing need to focus more broadly on multiple environmental problems/descriptors of GES (not only eutrophication and fisheries). Projections/scenarios are needed for all relevant and potential sectors polluting the sea or extracting marine resources. More attention is needed on e.g. underwater noise (shipping, building infra), more transport and safety of vessels.
- Cost-effectiveness is one of the key determinants (but not the only) for ranking management and policy options. Assessment of the acceptability of policy options is important too.

Methodologies, methods

- Tools/approaches that combine information from structured and unstructured data, e.g. models and expert judgement, (e.g. Bayesian networks, Multi Criteria Analysis) are needed. Quantitative data/validated models are not currently available to address all 11 descriptors of GES.
- Quality checking of models based on expert judgment or alternative methods is needed.
- A healthy dose of pragmatism is needed in modelling/scenario work. The challenge for researchers is to be able to provide the decision makers tools that are based on state-of-the-art modelling and the best current knowledge. The process of iterative improvement of the decision aid tools is preferred.

Communication, dialogue

- Websites/portals/platforms/gateways that bring relevant information together are useful for the wide spectrum of users: practitioners, policy makers, modellers, the public, journalists. The Water Information System for Europe (WISE) of the European Commission and the European Environment Agency serves as a good model. The platforms could be extended by opening up all data collected by countries, including fishing/fisheries data.

Group discussion II: Ecosystem services and economic analysis

Economic and social analysis produces information on the interlinkages between society and the environment, and on importance of the marine and coastal environment to human well-being and national economies. Economic and social analysis may serve Baltic Sea Action Plan and MSFD and maritime spatial planning (e.g. MSPD) by providing information on:

- economic impacts from human activities and use of marine waters, and their trade-offs,
- benefits of improved state of the marine environment / ecosystem services (and benefit losses from not reaching the good environmental status),
- effectiveness and costs of measures to improve the state of sea and
- economic efficiency of policies by comparison of costs and benefits.

Discussion around:

- Ecosystem services/environmental problems in the Baltic Sea Region
- Methods/approaches
- Countries/areas
- Policies

Some guiding questions:

What are the possible uses for economic and social analysis in the relevant policies?

How can we better incorporate economic and social perspectives with top ecosystem-based management?

Reflect on national vs. regional work on marine ecosystem services and benefits: transboundary requirements, profit from coordination and cooperation, improving information exchange.

What are the future development needs in ecosystem services and benefits research to serve policy implementation in the best possible way?

What are the current and new/future policy requirements in the national and regional scale (MSFD, MSPD, others?)

Are there key issues/knowledge gaps to tackle in research in the operational, medium and long term (from the point of view of research and policy)?

How can research serve the policy-making process better?

Discussion topic 1: Challenges

- One challenge is the interpretation of numerical outcomes of nonmarket valuation studies. If the underlying assumptions and limitations are not properly accounted for, the policy guidance can go very wrong. It is important to put adequate effort on how the non-market valuation results are communicated to the policy-makers and the public: What do the survey results tell us about the perceptions and underlying thinking of the public? How should the value estimates obtained from individual surveys be interpreted? How large are the uncertainties involved? What are the main sources of uncertainties? Are the value estimates universal or is it specific to the location and place?
- In assessment of the economic impacts of changes on marine ecosystem, the opportunities for blue growth (i.e. the positive impact on businesses) are important. One challenge is to make the monetary estimates of intangible goods and services (such as the improved possibility for recreation) and the value of enhanced business opportunities (such as improved conditions for tourism) commensurable.
- How do the value estimates of non-tangible services (such as recreation) compare with the value estimates of marine good and services that are exchanged in markets?
- The different time frames of the policies can be challenging for the researchers.
- Countries have different attitudes on how economic analyses may serve policy planning and implementation (e.g. some countries do not use valuation research based on expressed preferences in policy planning and implementation)
- Regional coordination creates challenges for valuation research. Can the research results be comparable between countries? Can the benefits from one country be transferred to another country?
- There might sometimes be lack of resources to conduct socio-economic studies. However, such studies can be seen as the key to take the natural science research to the political level. Ecosystem services serve as a common ground between natural scientists and economists.

Discussion topic 2: Data needs and gaps

- Both policies require the use of causal models linking human activities, pressures, impacts and human well-being.
- Identifying links and synergies between BSAP and MSFD, and MSPD.
- Research needs to be linked to all the descriptors of Good environmental status, not only focus on recreation and eutrophication, analyses on the other descriptors is needed too.
- Covering all countries and descriptors is a challenge.
- New analysis is needed for each round of BSAP and the MSFD. This is a challenge.
- How to change people's/policy-makers' behaviour is important. More focus is on the environment/sustainability than the aims of the directives.
- Survey responses/results could be used to communicate to policy-makers and show the importance of the environment.
- Expert assessment and people's assessment, how can we link and compare these?
- Need to ensure that people understand and accept the valuation survey and questions.
- Guidance on how to use the results of valuation studies is needed.
- Marginal benefit functions would be good so that we can compare with marginal costs. Total values vs. marginal values.
- There are data gaps regarding the use of marine waters analysis in statistics, including inland vs. marine, different regional seas, what is marine and coastal tourism, defining coastal areas. Better statistical data are needed.

- The link between the ecosystem and the statistical data (fisheries, tourism) is missing.
- Data should be open and made available for everyone.
- Stakeholder involvement from policy-makers to the public is important.
- Addressing national authorities, reaching out on ecosystem services and giving means on safeguarding of resources and coastal societies (there should be more focus on this than reporting for the directives).
- In at least the MSP work, there is a challenge in integrating research/science and administration because the processes are going on at the same time.
- Information is needed on how environmental quality affects people's behaviour, e.g. recreation.
- Need to develop ways how information can be generalized to other areas/countries.
- The EU Commission Directorate Maritime (DG MARE) has commissioned a study on the value of Marine Protected Areas (MPAs).
- Information is needed on how different marine spatial plans affect the economy and human well-being.
- Social aspects related to coastal communities should be studied.
- Regarding cultural heritage in MSP: Do people value the areas more if they can be used or if they cannot. There is a need of information on people's preferences and values.

Discussion topic 3: Solutions and opportunities

Specific topics discussed:

- Economic and social analyses produce information on the interlinkages between society and the environment.
- Economic impacts from human activities and use of marine waters and their trade-offs
- Benefits of improved state of the marine environment/ecosystem services (and benefits losses if not reaching GES)
- Effectiveness and costs of measures to improve state
- Economic efficiency of policies
- Need of data and models that could be used to address the critical questions, existing gaps
- MSFD and MSPD are different in that MSFD focuses on Good environmental status (GES) focusing on Programmes of Measures (PoMs). Promoting sea-based economies is typically one of the goals of MSP.

Solutions and opportunities:

- It would help the analysis and to reach the objectives if there we could be more transparency in financial flows (pension fund investment; energy, technology) generally.
- There is a lack of financial mechanisms in place to support implementation of both directives.
- There is a need to eliminate harmful instruments and incentives (e.g. environmental harmful subsidies under the Common Agriculture Policy, CAP) in order to reach the objectives of both directives.
- There is a need for taxation to steer production in addition to above (in line with the polluter pays principle).
- Monitoring of practices could be a good supplement (e.g. frequency, consequences of not following good farming practice).
- There is a need for prioritisation of sustainable projects and to ensure financing (e.g. through price increases)

- The use of scenarios to direct planning and policy prioritisation is needed. For example in order to understand the distribution of pressures on ecosystem services, from which activities and whether there are linkages.
- One possible way is to pool economic analyses from national level to supra-national level. In OSPAR there are different approaches but a common story. Business as usual (BAU) is described by member states.
- There is a need to become better at using marine data from specific companies/private sectors/consulting companies (e.g. dredging, oil and gas). Private companies often have a lot of important data relevant for MSPD and also for MSFD. It should be easier to use these data. More dialogue is further required with the private sector.
- There is also a need for close stakeholder involvement. For example in coastal communities, integrated coastal zone management is one way of more adapted management that can help national institutions in implementation of directives.
- An instrument for coastal communities is to give more sense of ownership to communities. Make them more engaged in collecting information and to address issues. It could be an active framework to feed back to government.
- There should be opportunities for remote communities to play a part in national development – when is a value created, when are there problems/barriers?
- There is still a lack of monetary values available, but the use of expert judgements used/qualitative analysis can be one way.
- There is a need for regional coordination regarding ecosystem services. Pilot projects of what we are able to achieve could be an opportunity to improve the knowledge level.
- 11 descriptors (MSFD) require a full valuation. To date we only have a partial picture even though information is increasing. There are opportunities if countries can agree on a common framework to carry out studies that are needed (e.g. the HELCOM initiative). Regional analyses are however different from sub-national analyses, so there is a need for agreements across countries.
- Cost benefit analysis (CBA) are only required by MSFD of new measures (PoM) (as a clarification).
- Integrated models that are coming offer opportunities to cover multiple benefits and can become state of the art models.

Part 3: Outcome discussion on future research needs

The third group discussion taking place the second day of the workshop (30 March), aimed at discussing and jointly identify future research needs in order to reach policy objectives in the Baltic Sea Region (of marine policies such as Baltic Sea Action Plan and the MSFD, or of Maritime Spatial Planning (MSPD)) and). All participants (about 35 participants) were given 5 min to reflect by themselves and were given a paper to document their personal preferred research need. These could be for any field and linked to one of the policies or general. Participants discussed in groups of two about their documented research needs with the purpose to agree on one research need (10 min). Discussions were then held in groups of four participants to do the same (all groups of two met another group of two) (15 min). In plenary, each group of four participants presented their jointly chosen research need in the large group. Presented research needs were documented on a large screen. Finally, a discussion was held around these research needs led by the moderator.

The seven top research needs developed:

1. **Holistic framework and integrated approaches needed**

   Integrated approaches and analyses are needed to support policy implementation (both BSAP and MSFD, and MSPD). This requires more multidisciplinary research. Integrated analyses mean, for example, linking human activities, pressures, environmental state and impacts on human welfare (e.g. using DPSIR), and integrating ecosystem services and their values in the assessments.

   There is no need to always attempt at developing fully integrated approaches and to attempt making all values commensurable. A combination of impact assessments and economic research results expressed in qualitative, quantitative, semi-quantitative or monetary units will give a good basis for making overall synthesis.

2. **More research on environmental topics with less knowledge**

   In order to perform better integrated analyses, there is also a need for more research in general on environmental topics with less knowledge (e.g. marine litter, alien species, and hazardous substances).

3. **More focus on the distribution of benefits and ethical issues**

   More focus is needed on the distribution of benefits (both use and non-use values) from ecosystem services across society (both for marine policies and maritime spatial planning). Researchers also need to pay attention to values attributed to ethical issues stated by stakeholders (that can be seen as non-negotiable values).

4. **Enable inclusion of all values**

   There is a need for research that enables comparing environmental (non-market) values to market values and taking non-market values into account in decision-making.

5. **Develop solutions for management of data**

   Open source observational data is needed to develop and validate models, available to download and easy to find for all countries around the Baltic Sea (e.g. ocean modelling and climate research). Management of data therefore needs to be done in an interdisciplinary manner. Good communication between administrators and researchers (e.g. data sharing, transparency of data and synthesis knowledge) is further key, in order to improve analyses required by both policies.

6. Develop solution-oriented regional approaches

There is a need to develop common methods and tools for how to apply the ecosystem approach and ecosystem-based management in practice that can be shared and used for analysis for the MSFD, MSPD and the Baltic Sea Action Plan (BSAP) (solution-oriented approach). Further, there is a need to build regional methods and tools, and capacities in countries around the Baltic Sea to use such tools.

7. Identify "bottle necks"

There is a need for solution-oriented analysis of identifying key challenges and "bottle necks" that make it difficult to reach policy objectives, and suggest solutions how to solve these issues in order to reach objectives. There could be overlaps between requirements and implementation of maritime spatial planning and marine policies (MSPD and BSAP).

Annex I: Program

Program for the joint HELCOM - BONUS BALTICAPP workshop on the ecological–economic research to support marine policy implementation in the Baltic Sea region

Venue: De DeGeersalen, Svante Arrhenius väg 14, Stockholm University campus, Stockholm, Sweden

Dates: 29-30 March 2017

Moderator: Gun Rudquist (Baltic Sea Centre, Stockholm University)

Host: Bo Gustafsson (Baltic Sea Centre, Stockholm University)

29 March 2017	
10:00	Words of welcome (*coffee available from 9:00*) Bo Gustafsson, Baltic Sea Centre, Stockholm University
10:10	Developments and needs in marine policies (Monika Stankiewicz, Executive Secretary, HELCOM)
10:20	Developments and needs in maritime spatial planning (Juan Ronco Zapatero, European Commission, Directorate-General for Maritime Affairs and Fisheries)
Theme 1. Scenarios and projections for the future	
10:30	Plausible future developments for the Baltic Sea environment (Marianne Zandersen, BONUS BALTICAPP)
11:00	Projections of Baltic Sea state under changing climate and society (Sofia Saraiva BONUS BALTICAPP)
11:15	Scenario analysis (impacts by 2050) for the Baltic Sea Basin (Alena Bartosova, BONUS SOILS2SEA)
11:30	Importance of the Baltic Sea coastal areas as nutrient filters (Elin Almroth-Rosell, BONUS COCOA)
11:45 - 13:00	*Lunch break*
13:00	**Group discussions Theme 1**
14:00	Summary from group discussion
14:30 - 15:00	*Coffee break*
Theme 2. Marine ecosystem services and benefits	
15:00	Regional economic and social analyses (Soile Oinonen, HELCOM TAPAS and SPICE projects, WG POMESA, Finnish Environment Institute)
15:30	Marine and coastal recreation in the Baltic Sea (Heini Ahtiainen, BONUS BALTICAPP)
16:00	**Group discussions Theme 2**
16:45	Summary from group discussion
17:00	End of day 1

19:00	*Dinner (at own expense)*

30 March 2017	
9:15	Short reflections from day 1
Theme 3. Marine spatial planning	
9:30	Sustainable governance of marine space: exploring the capacity of MSP as a policy integrator in the BSR (Michael Gilek, BONUS BALTSPACE)
9:50	Method for integrating ecosystem services into marine spatial planning (Mats Ivarsson, Anthesis Enveco Group)
10:10	Swedish marine spatial plans and environmental assessment (Jan Schmidtbauer Crona, Swedish Agency for Marine and Water Management)
10:30	**Open discussion on marine spatial planning**
11:00 - 11:45	*Lunch break*
Theme 4. Policy implementation and integration	
11:45	The BLUE2 project - EU integrated policy assessment for the freshwater and marine environment (Guenter Hoermandinger, European Commission, Directorate-General for Environment, Marine Environment)
12:00	Policies to reduce marine eutrophication in the Baltic Sea - cost-effectiveness, incentives and interactions with agricultural and climate policy targets (Berit Hasler, BONUS GO4BALTIC)
12:20	**Reflections from day 1 and 2**
12:40	**Group discussions and drafting of research needs**
14:15	Summary research needs
14:30	**End of workshop**

Annex II: Participant list

Name	Organization	Country
Kari Hyytiäinen	University of Helsinki	Finland
Bo Gustafsson	Baltic Nest Institute, Stockholm University	Sweden
Soile Oinonen	Finnish Environment Institute	Finland
Rob van der Veeren	Ministry of Infrastructure and Environment	Netherlands/OSPAR
Emmi Nieminen	Finnish Environment Institute	Finland
Oleg Savchuk	Baltic Nest Institute, Stockholm University	Sweden
Barbara Bauer	Stockholm University	Sweden
Maciej T. Tomczak	Baltic Sea Center, Stockholm University	Sweden
Michelle McCrackin	Baltic Sea Centre, Stockholm University	Sweden
Elena Valkama	Natural Resources Institute Finland (LUKE)	Finland
Alena Bartosova	SMHI	Sweden
Markus Meier	Leibniz Institute for Baltic Sea Research Warnemünde	Germany
Eva Ehrnsten	University of Helsinki, Tvärminne Zoological Station	Finland
Joachim Schellekens	Ecorys	Netherlands
Elin Almroth-Rosell	SMHI	Sweden
Heini Ahtiainen	Natural Resources Institute Finland / HELCOM Secretariat	Finland
Asker Juul Aagren	The Danish Environmental Protection Agency	Denmark
Guenter Hoermandinger	European Commission	EU
Agata Święcka	Ministry of Maritime Economy and Inland Navigation	Poland
Max Vretborn	Swedish Agency for Marine and Water Management	Sweden
Sofia Saraiva	SMHI	Sweden
Jan Schmidtbauer Crona	Swedish Agency for Marine and Water Management	Sweden
Kerstin Bly Joyce	Baltic Sea Centre, Stockholm University	Sweden
Mattias von Brömssen	Ramböll - Blue2	Sweden
Ottilia Thoreson	WWF Baltic Ecoregion Programme	Sweden
Jens Christian Riise	RAMBOLL	Denmark
Juan Ronco Zapatero	EU COMMISSION DG MARE	EU

Thorsten Blenckner	Stockholm University	Sweden
Magda Wilewska-Bien	Chalmers	Sweden
Eija Pouta	Natural Resources Institute Finland (Luke)	Finland
Kristine Pakalniete	AKTiiVS Ltd.	Latvia
Michael Gilek	Södertörn University	Sweden
Mats Ivarsson	Anthesis Enveco Group	Sweden
Berit Hasler	Aarhus University, Department of Environmental Science	Denmark
Gordon Campbell	European Space Agency	
Annika Svanbäck	Stockholm University	Sweden
Marianne Zandersen	Aarhus University	Denmark
Johanna Andreasson	Swedish Agency for Marine and Water Management	Sweden
Metta Wiese	WWF Sweden	Sweden
Gun Rudquist	Baltic Sea Centre, Stockholm University	Sweden
Monika Stankiewicz	Executive Secretary	HELCOM