BONUS BASMATI
Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services

BONUS
Science for a better future of the Baltic Sea region

BONUS BASMATI – SUPPORTING MARITIME SPATIAL PLANNING WITH SCIENCE

SUMMARY REPORT OF THE BONUS BASMATI PROJECT RESULTS

Deliverable 7.7

Editors: Vesa Arki, UTU; Julia Ajanko, UTU; Hanna Luhtala, UTU; Harri Tolvanen, UTU

Authors: Juris Aigars, LIAE; Julia Ajanko, UTU; Vesa Arki, UTU; Aurelija Armoškaite, LIAE; Ida Maria Bonnevie, AAU; Elin Cedergren, Nordregio; Søren Qvist Eliasen, Nordregio; Anne Erkkilä-Välimäki, UTU; Pia Frederiksen, AU; Kira Gee, Nordregio; Alberto Giacometti, Nordregio; Henning Sten Hansen, AAU; Wanda Holzhüter, IOW; Pyry Kettunen, FGI; Christian Koski, FGI; Michael Kull, Nordregio; Hanna Luhtala, UTU; Lotta Maack, IOW; Marie Maar, AU; John Moodie, Nordregio; Andrea Morf, Nordregio; Juha Oksanen, FGI; Kristīne Pakalniete, AKTiiVS Ltd.; Ingrīda Puriņa, LIAE; Mikko Rönneberg, FGI; Hannah Schartmann, IOW; Kerstin Schiele, IOW; Lise Schrøder, AAU; Solvita Strāķe, LIAE; Miriam von Thenen, IOW; Harri Tolvanen, UTU; Maija Viška, LIAE

Project partners:
Aalborg University, Denmark (AAU) (lead partner)
Aarhus University, Denmark (AU)
Finnish Geospatial Research Institute, Finland (FGI)
Latvian Institute of Aquatic Ecology, Latvia (LIAE)
Leibniz Institute for Baltic Sea Research Warnemünde, Germany (IOW)
Nordregio, Sweden (Nordregio)
University of Turku, Finland (UTU)

This report is a publicly accessible deliverable by the BONUS BASMATI project. The present work has been carried out within the project ‘Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services (BONUS BASMATI)’, which has received funding from BONUS (art. 185), funded jointly by the EU, Innovation Fund Denmark, Swedish Research Council Formas, Academy of Finland, Latvian Ministry of Education and Science and Forschungszentrum Jülich GmbH (Germany).

CONTENTS

Photo: Julia Ajanko

PREFACE

The overall objective of BONUS BASMATI has been to develop integrated and innovative solutions for Maritime Spatial Planning (MSP) from a local scale to a Baltic Sea Region scale; this has been pursued by means of multi-level governance structures and interactive information technology aiming at developing an ecologically and socio-economically sound network of protected marine areas covering the Baltic Sea.

Based on results of former and ongoing MSP projects, the BONUS BASMATI project has analysed governance systems and their information needs regarding MSP in the Baltic Sea region in order to develop an operational, transnational model for MSP, while maintaining compliance with existing governance systems. To facilitate broad access to information and to foster collaboration among MSP authorities and stakeholders in the Baltic Sea Region, a suite of methods and tools to enable maritime spatial planning has been developed. Included in the suite are concepts for the assessments of plan-proposals, the Baltic Explorer platform for collaborative planning, and specific spatial decision support tools.

Maritime spatial planning is a rather new, complex and quite demanding discipline applying a holistic and ecosystem-based approach in order to balance blue growth interests and the various maritime uses with the protection of the marine environment. Maritime spatial planning is also a comprehensive collaborative learning process crossing borders as well as disciplines. The aim of this report, presenting the main outcomes of the BONUS BASMATI project ‘Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services’, is to contribute to this process; the target group will be public authorities, professional stakeholders, and others interested in maritime spatial planning. For readers interested in more details and scientific results, the full list of BONUS BASMATI publications is included in the report.

BONUS BASMATI project coordinator

Professor Henning Sten Hansen, Aalborg University, Denmark

DECISION SUPPORT FOR MARITIME SPATIAL PLANNING

Overall, marine space is under increasing pressure from human activities. Traditionally, the activities taking place in oceans and seas were fishery and transport of goods and people. Today, offshore energy production, aquaculture, and sea-based tourism are important contributors to the global economy. This creates competition and conflicts between various uses and requires overall regulation and planning. Maritime activities generate pressures on the marine ecosystems, and in many areas severe impacts can be observed. Maritime spatial planning (MSP) is seen as an instrument to manage the seas and oceans in a more sustainable way, but to achieve this information and tools are needed.

BONUS BASMATI Project Findings presents the main results of the BONUS BASMATI project to the maritime spatial planning community, to relevant stakeholders, such as fishermen, environmental NGO's, the offshore energy sector, the maritime traffic sector, and to the general public interested in sustainable use of the seas and oceans. The project outcomes will be presented under two main headlines: *Concepts and approaches* and *Platforms and tools.*

In order to address the need for integrated and innovative solutions for maritime spatial planning, BONUS BASMATI project has focused on the concepts and frameworks for decision support in maritime spatial planning. The outcomes include concepts for sustainability impact assessments of plan proposals related to marine and coastal ecosystem services and marine protected areas as well as a concept for data management. The chapter *Framework for sustainability impact assessment of plan proposals*, presents the BONUS BASMATI outcomes on how to assess the integrated social, economic, and environmental impacts of plan proposals for sustainable development of marine space. The chapter *An ecosystem service approach to marine protected areas*, presents a concept for designation of marine protected areas based on the value of the marine seabed habitats and their contribution to human wellbeing via the ecosystem services' approach. The following chapter *Data harmonisation facilitates planning across borders and scales* presents a framework with effective steps towards a more coherent data management, which may foster better use of data in maritime spatial planning processes. Stakeholder involvement is essential for a proper maritime spatial planning process, and hence the chapter *Involving stakeholders – Why, Who, When and How?* addresses stakeholder involvement in the whole process of maritime spatial planning. The experiences of the Baltic Sea Region planners concerning how to address stakeholder involvement are presented, and how to involve the business sector is discussed as an example of a target group.

As part of the BONUS BASMATI project, digital decision support platforms and tools for maritime spatial planning have been developed, these will be presented in five chapters: 1) Baltic Explorer – new tools for collaboration 2) SPACEA – a GIS toolbox to facilitate easy spatial and environmental suitability analysis, 3) ESA4MSP – an ecosystem service assessment tool, 4) MYTILUS – a toolset for assessing the impacts of maritime activities, and 5) SEANERGY – a tool for analysing conflicts and synergies between different marine uses.

Photo: Julia Ajanko

CONCEPTS AND APPROACHES

The European Union maritime spatial planning directive requires a holistic approach for the allocation of marine space. Consequently, specific attention towards land-sea interactions, environmental, economic, social and safety aspects, stakeholder involvement, use of the best available data, transboundary cooperation, and an ecosystem-based approach is needed. In order to support the maritime spatial planning processes in the member states, the BONUS BASMATI project has carried out extensive research developing concepts and methodologies addressing the needs for impact assessments of plan proposals, operational approaches to ecosystem-based management, coherent data management and processes of stakeholder involvement. The BONUS BASMATI concepts have been tested in case studies, where maritime spatial planners and stakeholders have contributed to the discussions and further development of the methodologies.

Photo: Juris Aigars

Framework for sustainability impact assessment of plan proposals

The increasing focus on the sustainable use of the sea space while maintaining blue growth poses challenges for maritime spatial planning in the Baltic Sea Region. Current impact assessment frameworks are not sufficiently addressing the integrated social, economic, and environmental impacts of plan proposals for sustainable development of marine space. In order to approach this challenge, the BONUS BASMATI project has developed a sustainability assessment framework that helps to structure and select the relevant indicators for evaluating the integrated impacts of plan proposals and facilitate discussions on planning issues among stakeholders.

Key points:

- Integration of the ecosystem service cascade into a systemic framework on interactions between society and the environment enables the evaluation of the sustainability of plan proposals.
- The framework addresses the often-overlooked social dimension of sustainability.
- Ecosystem assessments within MSP require quantification of ecosystem services and establishing links between ecosystem capacity, services and the associated benefits and values.
- The sustainability framework can be applied in impact assessment of plan proposals.
- The new integrated framework provides a way for structuring discussions and communicating planning issues with stakeholders.

Designing a sustainability assessment framework

In the Baltic Sea Region, the marine ecosystems are increasingly affected by human activities. In MSP, a large focus is on the co-location of various maritime activities and their cumulative impacts. However, this approach tends to downplay some impacts of plan proposals. While strategic environmental assessments of draft plans are often required, the evaluation of socio-economic impacts is optional. Strong representation of especially the social sustainability values attached to the sea are rarely seen.

Improvements in impact assessment frameworks can increase visibility of the different dimensions of sustainability and thereby facilitate selection of relevant ecosystem services and indicators for comparing different plan proposals and for prioritising activities and values related to sea areas. The BONUS BASMATI project has developed a sustainability assessment framework that addresses additional social issues, such as how different stakeholders experience and value the services and related benefits provided by marine ecosystems, or to which extent they have access to these benefits. The latter can be seen to reflect fairness in the distribution of benefits.

As an organising tool, the sustainability framework structures the ecosystem services in a way that allows selection of the relevant indicators for assessment, and the use of different valuation methods. For the stakeholder involvement process, the framework provides a way of structuring discussions and communicating assessment issues between experts, policy makers, and stakeholders – and makes visible the values of stakeholders that are less empowered.

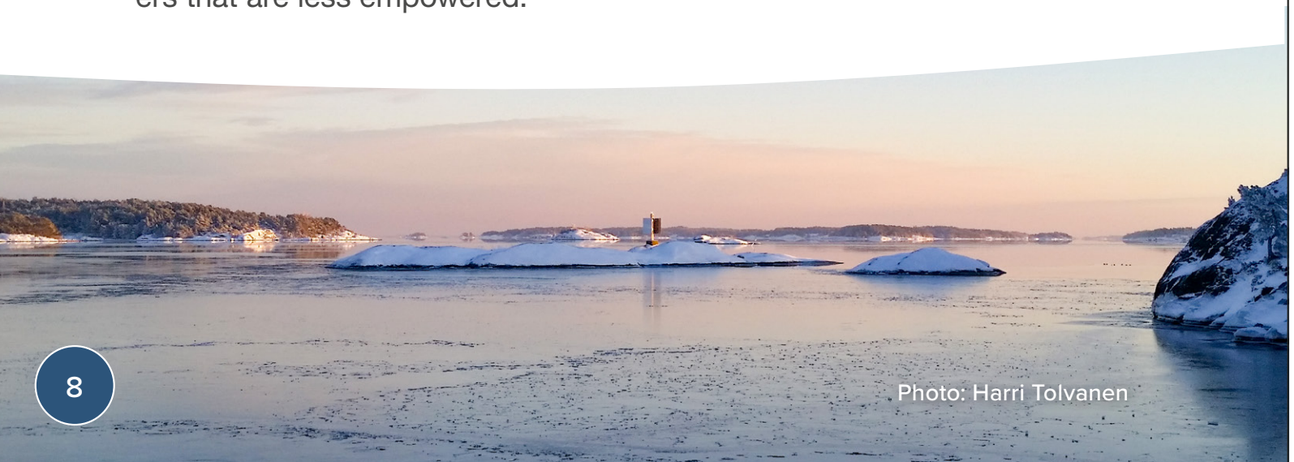

Photo: Harri Tolvanen

The BONUS BASMATI sustainability assessment framework

The developed sustainability assessment framework integrates the ecosystem service cascade with the DPSIR framework (Driving forces, Pressures, State, Impact, and Responses). The focus has been especially placed on the impacts, which are divided into three categories:

a. impacts on the state of the ecosystems and the capacity to provide services

b. impacts on the ecosystem services

c. impacts on the benefits and values, including the distribution of the benefits among existing and new beneficiaries.

The resulting framework enables the assessment of human activities at sea by indicating how they will influence the ecosystems positively or negatively, and how the related services and human benefits will change because. Furthermore, it allows for an assessment and comparison of the benefits and beneficiaries between alternative plan proposals.

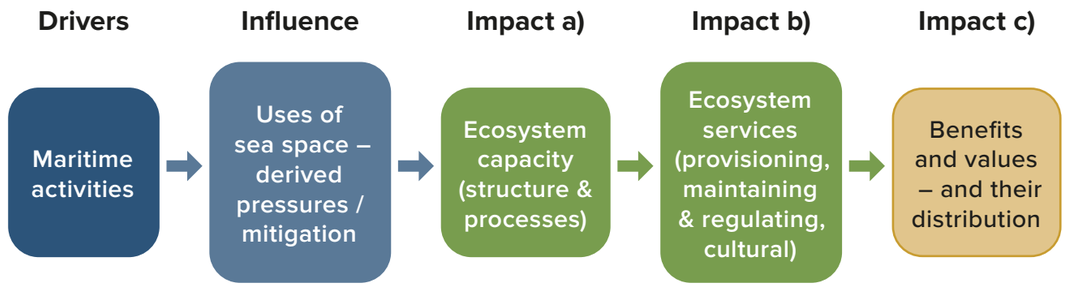

Fig. 1. BONUS BASMATI framework for sustainability assessment in MSP.

Including the social dimension of sustainability

The framework addresses the often-overlooked social dimension of sustainability in several ways:

- The ecosystem cascade allows the inclusion of social benefits into assessments, such as ‘feeling of belonging’ linked to seascapes, or employment fostering coherent and vibrant coastal communities.
- It allows values to be attached to benefits derived from ecosystem services, such as recreational values from outdoor life, health impacts from amenity values, or aesthetic values from the sea- and coastal landscapes. Different groups of people may value benefits differently.
- By introducing the distributional aspect of benefits, assessments can reveal who will benefit from changes in sea use. This accommodates fairness, which is a criterion in social sustainability that has previously received less attention.

Taking the framework into action

In order to apply the sustainability assessment framework, a baseline for the ecosystem services is required. As the direct quantification of ecosystem services is in most cases not possible, the development of indicators becomes a necessity. An indicator pool was developed, which offers a suitable starting point for selecting indicators for ecosystem service assessments in MSP.

Depending on the context, the departure point when using the framework can be different.

- **Stock-taking:** In expert assessment of plan alternatives, it is useful to start by deciding which activities are planned, and what ecosystem services and indicators in the impact categories would potentially be affected by these activities.
- **Scenario analysis:** In a local stakeholder situation, it may be beneficial to start discussing what the existing benefits from the sea activities are, and which ecosystem services they depend on. Thereby working back to the state of the ecosystems and how this could change under new uses and influences.

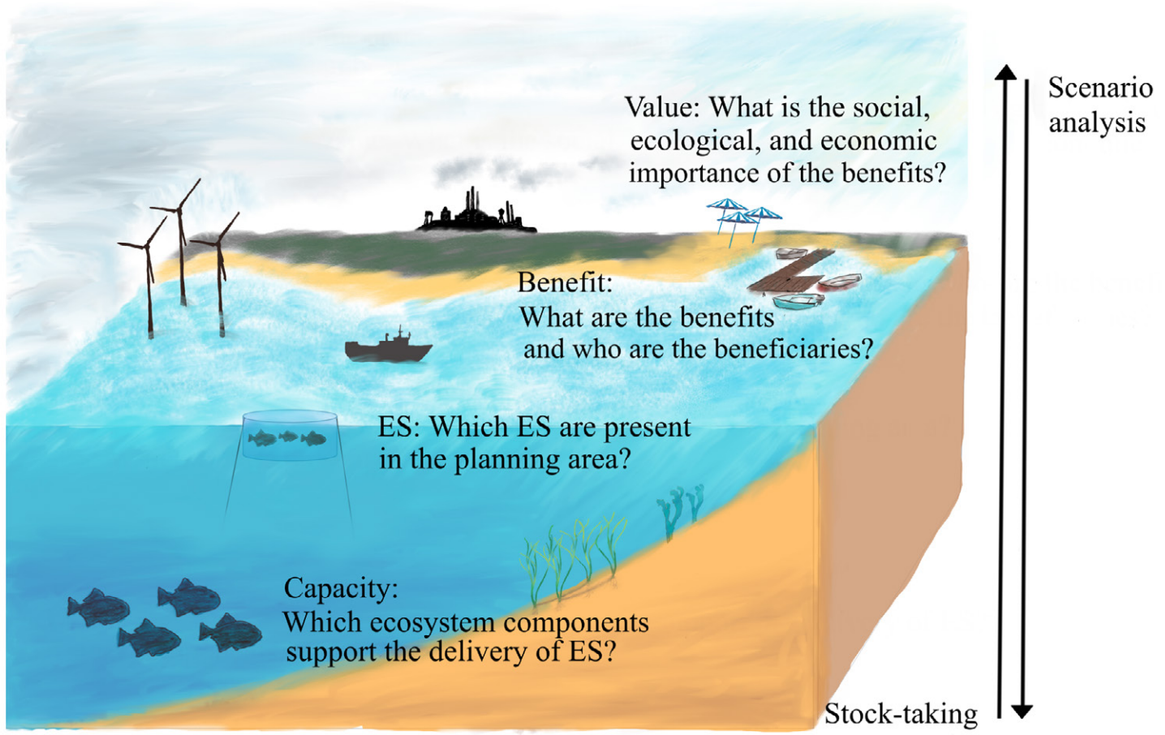

Fig. 2. The ecosystem cascade to structure MSP analyses (Source: von Thenen et al. 2020)

Experiences of applying the sustainability framework in planning tasks

In BONUS BASMATI parts of the sustainability framework were demonstrated in two studies.

First, the framework was utilised in an expert judgement-based analysis of plan scenarios in Latvia. The work emphasised the need of integrated ecosystem service assessments which consider the environmental, social, and economic impacts of management decisions, placing particular focus on the designation of marine protected areas. The study shows how the different impact categories of ecosystem service capacity, services and benefits, as well as values can be implemented in practice when designating marine protected areas. The assessment of ecosystem service supply works as the baseline for evaluating how different planning scenarios will influence the ecosystems capacity to supply services. This will then directly affect the number and type of benefits received from the planning area. The valuation of these benefits creates the context in which these decisions are made: do we protect the marine environment and the associated services, even if it will restrict sustainable economic activities?

The second study focused on the identification of suitable locations for mussel farming and exemplified several aspects of the assessment framework. The work provides an example of a sea use that depends on suitable environmental conditions to provide ecosystem services. In the study, possible mussel farming sites in the south-western Baltic Sea were first identified with the help of a geospatial suitability analysis, after which the actual services provided by the mussel farms were analysed further according to the assessment framework.

Photo: Liisa Kemppainen

An Ecosystem Service approach to Marine Protected Areas

Adopting ecosystem services in maritime spatial planning can support balancing the need to protect ecosystems, whilst encouraging sustainable resource use and solving conflicts between different marine uses. However, the concept of ecosystem services has not yet been widely adopted for policy support, particularly with respect to marine ecosystems. The research carried out in BONUS BASMATI provides new insight about the relationship between marine protected areas, and the supply and value of ecosystem services in terms of ecological, social and economic gains and losses.

Key points:

- Combining ecosystem service supply assessments with socio-economic assessment may advance the use of ecosystem service approaches in decision making and maritime spatial planning.
- While designation of new marine protected areas improves the ecosystem services supplied by marine habitats, it comes at a cost due to restrictions on offshore economic activities. Hence an assessment of the positive and negative welfare impacts is important for MSP.

The ecosystem service approach

Marine protected areas are an important instrument for protecting the marine environment and, at the same time, ensuring the sustainability of essential ecosystem services and the associated benefits. These include for example clean water environments for recreation, and the intrinsic value of nature and marine environments as sources for healthy and nutritious food. However, when designated inappropriately the marine protected areas risk ineffectively protecting the marine environment, whilst placing restrictions on human activities, which may impair human well-being and livelihoods. To ensure success, the environmental, economic and social impacts of the designation of marine protected areas must be considered.

Ecosystem service assessments can identify and describe the links between ecosystems and human well-being and make the ecological as well as socio-economic value of ecosystems more accessible for conservation management. Nevertheless, most ecosystem service assessments conducted today rarely estimate the supply of services in practice. This is particularly true for the deep-sea environments, where remote locations, environmental conditions, and its unfamiliarity to many people create challenges.

An approach to designation of marine protected areas

The BONUS BASMATI project introduces a method for linking different marine habitats to the ecosystem services they supply. It enables identification of potential marine protected areas by highlighting the key species and habitats that ensure the sustainability of the ecosystem services and therefore require higher protection regimes.

The results of the project illustrate how this kind of sustainability framework can be applied when analysing alternative plans related to a maritime spatial planning process. By employing a tailor-made integrated assessment tool, the impacts on the environmental, and the socio-economic sustainability of ecosystem services due to pressures on seabed habitats inflicted by new maritime sectors can be analysed. See the chapter on the ecosystem service assessment tool ESA4MSP for more information.

The project results illustrate how ecosystem-based management enables monetary valuation of the impacts of the designation of marine protected areas. Overall, acknowledging that the combination of ecosystem assessment methods with socio-economic assessments when making decisions could lead to a more efficient use of ecosystem-based approaches in MSP.

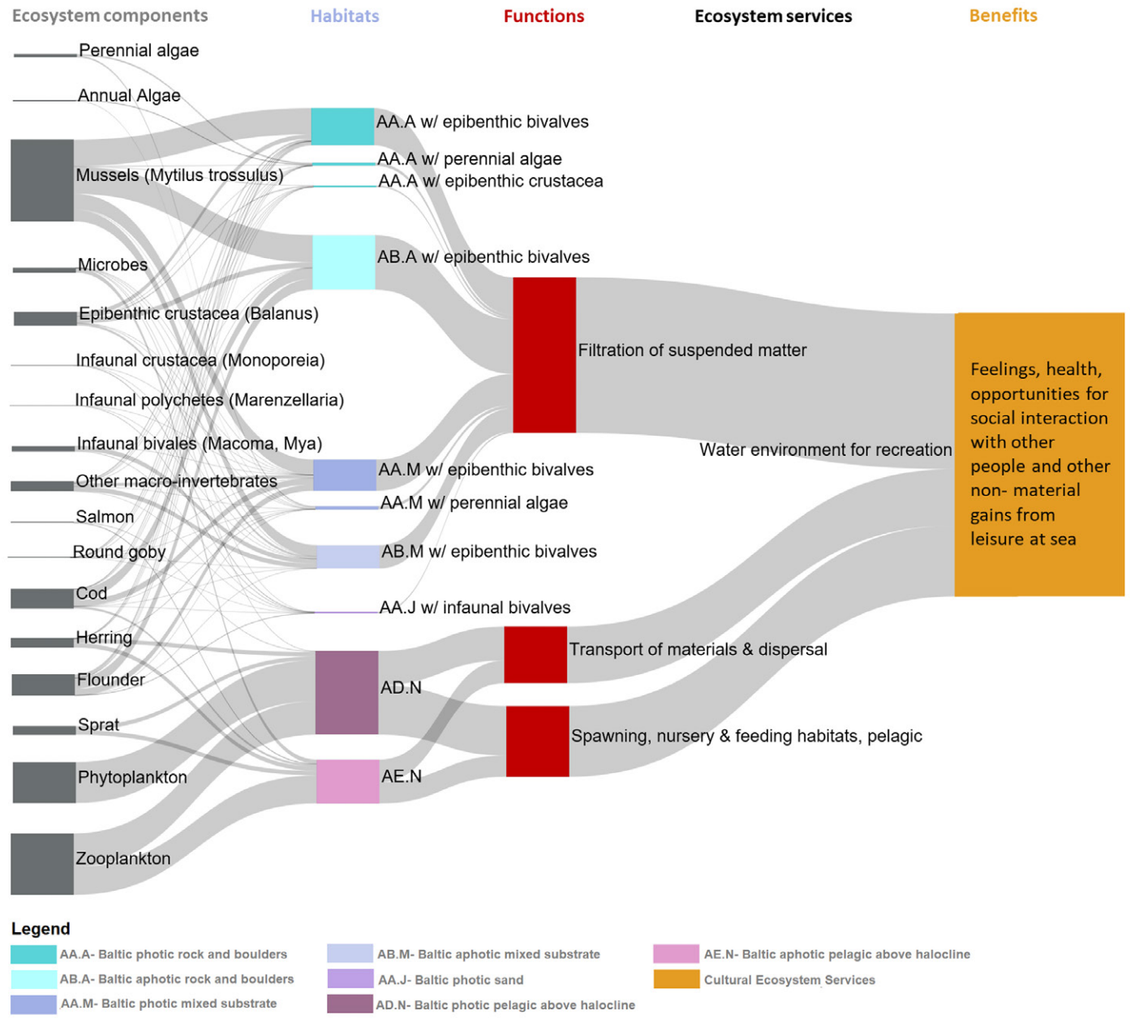

Fig. 3 The network diagram depicts the links as well as the strength of connections between species, ecosystem functions and services ensuring the flow of ecosystem services as described in the cascade framework.

Integrating ecosystem service assessment into the designation of marine protected areas

As part of BONUS BASMATI, a case study was carried out in the marine waters under Latvian jurisdiction (South-Eastern Baltic Sea). The ongoing maritime spatial planning process in Latvia provided a testbed for the development of the concept of integrating an ecosystem service assessment into the designation of marine protected areas as well as the ecosystem service assessment tool ESA4MSP for graphic decision support. See the chapter on the ESA4MSP tool for a more detailed description.

Step 1: Quantitatively linking different marine species and habitats to the ecosystem services they supply showed that marine habitats and species can be ranked in order of importance for the service supply and therefore provide a basis for ecosystem-based management in maritime spatial planning. In addition, the collected information can improve stakeholder's overall understanding of the connection between the marine ecosystem and human well-being.

Step 2: Designation of marine protected areas based on the information collected and the key species and habitats identified, ensures the sustainability of ecosystem services and secures areas that required higher protection regimes. In Latvia, marine protected areas are currently present only in the territorial waters but new protection areas are planned for the exclusive economic zone, which might cause conflicts between the ecological, social and economic values connected to the areas. Three future scenarios depicting variation in the size of potential protected areas were constructed and analysed. In the reference scenario, no new areas were designated, however, the other two scenarios showed moderate and high protection options by increasing the coverage of new marine protected areas.

Step 3: Evaluating the impacts of these alternative scenarios on human welfare was done by using results from a national economic valuation study. The impacts were valued based on the citizens' willingness to pay for the changes created by the marine protected areas; the changes will involve positive impacts (benefits) from the improved state of the ecosystem services and negative impacts (costs) due to restrictions on offshore economic activities in the marine protected areas. The results of the study show that society derives diverse values from marine protected areas and supports protection of the offshore seabed habitats and the ecosystem services they provide. The benefits from the improved state of the ecosystem services would considerably exceed the costs in both scenarios used for the analysis of the marine protected areas. However, the scenario with the moderately sized marine protected area could bring higher net benefits than the maximum size scenario.

The Latvian case highlights how integrated ecosystem service assessments can aid ecosystem-based management by enabling monetary valuation of the impacts of designating marine protected areas.

Photo: Harri Tolvanen

Data harmonisation facilitates planning across borders and scales

Maritime spatial planning is a highly data intensive process, demanding a great deal from the quality and availability of relevant data. Furthermore, good data management is a fundamental pillar for successful cross-border maritime spatial planning. The data harmonization framework produced in BONUS BASMATI includes the often missing spatial and temporal data properties and non-spatial information. The framework provides effective steps towards a more coherent data management and may foster better use of data in planning processes.

Key points:

- Data harmonisation makes working with spatial data and stakeholders easier for MSP planners.
- Uniform quality standards are needed for management of cross-border MSP data.
- The vertical and temporal dimensions of data need to be acknowledged better, as they both enhance the usability of datasets.
- Flexible solutions for the technical design of metadata serve different user needs.
- The data discussion in MSP is highly focused on spatial data, maps, and geospatial analysis. However, non-spatial data can also be included in the same information system and the planning analysis.

Overcoming data harmonisation challenges

During MSP processes, data is collected and evaluated by a variety of administrative, scientific and other stakeholder personnel, not all of whom are experts in the respective discipline. Analysis that relies on the given information should be possible without expert knowledge. Hence, well prepared data is crucial for coherent MSP processes. However, definition of common quality standards and the harmonisation of cross-border data have been challenged by differences in national data collection protocols and data formats, as well as language barriers.

A comprehensive data harmonisation framework produced in BONUS BASMATI is based on the existing HELCOM-VASAB data specifications. The HELCOM-VASAB specifications are based on INSPIRE principles and they aim to facilitate harmonisation of spatial datasets. The recommendations prescribe how MSP data can be structured to be coherent and effective

and be used for cross-border planning. The new framework builds on these data specifications by adding categories for spatial and temporal properties of datasets, more solid technical design of metadata and inclusion of non-spatial data into a common information system, for example ArcGIS.

By adapting the proposed data harmonisation framework, MSP planners can ease their own work when collecting and comparing information based on shared quality standards. Well-founded harmonisation of data can reduce misinterpretation and enable easy access and understanding for planners, stakeholders and other users. Furthermore, the framework facilitates analysis of potential areas of conflict or co-location of activities.

Spatial and temporal data properties

The new categories for spatial and temporal properties of datasets describe these dimensions using predefined categories with clear descriptions.

- The spatial dimension of data is divided into two sub-dimensions: the vertical and horizontal dimension. The vertical dimension provides information on whether the objects of interest occur in the surface water, on the seafloor, or somewhere in between. In addition, data can be from above the sea surface. The horizontal dimension represents different spatial scales from local to international.
- The temporal dimensions describe the occurrence, frequency and timeline of the data. Whether activities take place once a year or several hours a day, and whether they have regular frequency patterns, makes a difference for planning considerations.

The spatial and temporal information can aid planners to define if certain phenomena occur simultaneously in the same location and whether they affect each other or not. This identification of opportunities for co-location can benefit both planners and stakeholders.

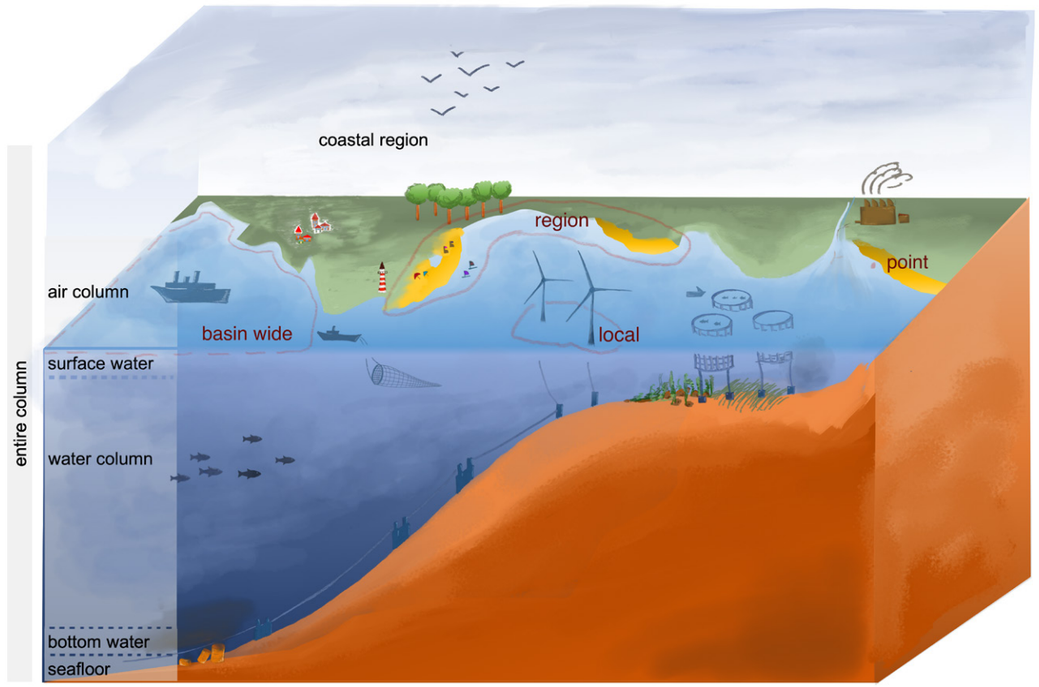

Fig. 4. Illustration of the vertical (black) and horizontal (red italic) dimensions of marine environments. (Source: Holzhüter et al. 2019.)

Photo: Hanna Luhtala

A flexible approach for the technical design of metadata

The described data properties can be stored in both the attribute table, where the information is linked directly to a spatial feature, or in a separate metadata document depending on the user needs. Both approaches have their pros and cons.

Attribute table

+ Information is accessible for data analysis and tools, risk of losing the metadata diminishes
− Increased file size, no multiple choices in attribute domains, detailed descriptions, tags etc. still require a metadata document.

Metadata document

+ Does not increase file size, multiple choices in attribute domains, can include all types of information.
− Not automatically accessible for tools and analyses, risk of losing the separate document when transferring data.

Inclusion of non-spatial data

In MSP, spatial information is commonly used. While this is not in itself a problem, it can hinder the inclusion of non-spatial data sources, such as socio-economic and policy related information, as evidence for planning processes. In many cases, these datasets can include spatial information, such as the planning area or an address, which enables their presentation as spatial data. The non-spatial information can be added into the same information system with the spatial data for easier data management and analysis.

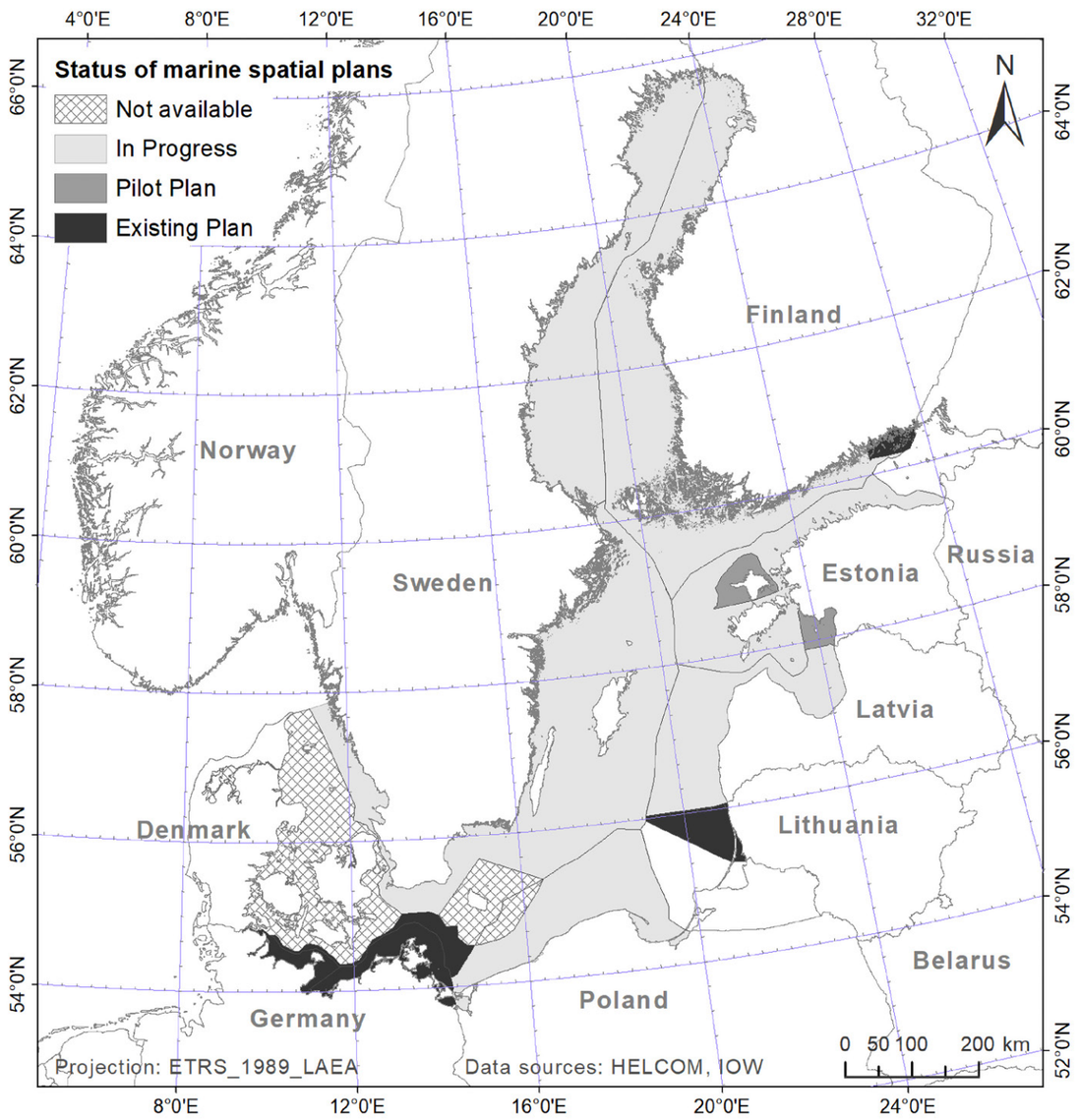

Fig. 5. The status of maritime spatial planning in the Baltic Sea EU countries as an example of implementing non-spatial data in a GIS-application. (Source: Holzhüter et al. 2019.)

Baltic Sea Atlas

A WebGIS application of the Institute for Baltic Sea Research in Warnemünde called Baltic Sea Atlas was used for storing the spatial data of BONUS BASMATI and as a visualisation test ground of the data gathered in the project. The concept of the Baltic Sea Atlas is simple and easy to operate with a large map window and basic operation tools. After the project the database will be accessible both for spatial data experts as well as non-experienced users.

The Baltic Sea Atlas can be found here:
http://bio-50.io-warnemuende.de/iowbsa/

Photo: Ivars Druvietis

Involving stakeholders – Why, Who, When and How?

Stakeholder involvement is essential for a proper maritime spatial planning process. Before involvement, we need to understand why we want stakeholders to engage, who the stakeholders are, and which interests and conflicts are central in the planning area. Knowing this, the right tools for involvement can be chosen. BONUS BASMATI has produced a handbook with information for understanding and addressing stakeholder involvement in the whole maritime spatial planning process.

Key points:

- Planners work to support solutions for co-existence and synergy, aiming for a better use of the shared marine space.
- Understanding Why, Who, When and How stakeholders should be involved is crucial.
- BONUS BASMATI has produced a handbook for planners about effective stakeholder involvement processes based on experiences from the Baltic Sea Region.
- The handbook includes methods and tools for stakeholder involvement in various stages of the MSP process.

Concepts and tools for handling stakeholder involvement

The European Union legally requires stakeholder involvement in the MSP processes. However, this can be done with different purposes in mind. Involvement can be for normative reasons, but often more instrumental reasons are also in play; to collect knowledge from the stakeholders, to inform them or to promote interaction and legitimise the planning processes. Regardless of the approach, the goal of a planning process is to decide who can use a certain shared area and for what. Therefore, conflicting interests are almost inevitable and need to be mitigated.

Conflicts can be driven by different interests, different moral and ethical values, as well as possible lack of knowledge about one's own and others' uses and needs. Because of this, the roots of the conflicts must be clear before solutions for co-existence can be found or synergies identified. The likelihood of finding concrete solutions also depends on the level of mutual understanding between the stakeholders. The planners need to take an active role in bringing together the different needs, interests and values among the stakeholders when aiming at defining potential ways to co-locate activities and create synergies in a certain sea area.

Involving stakeholders in the MSP process is a time consuming and often challenging task. According to the planners' experience from the Baltic Sea Region, participation starts long before the formal MSP process, and continues after the plan is launched. As the whole MSP process is fairly new, advice and information on how to effectively organise the stakeholder involvement in practice are welcomed. To meet these needs, BONUS BASMATI developed a handbook for planners.

From planners to planners: A Handbook of processes, methods and tools for stakeholder involvement in MSP.

The handbook developed in BONUS BASMATI is based on the MSP planners' experiences in the Baltic Sea Region and it aims to help planners in stakeholder involvement in the MSP processes. The handbook consists of two parts:

A conceptual framework for stakeholder involvement. The first part asks the questions *Why* involve stakeholders, *Who* to involve, *When* in the process and *How* to involve the stakeholders?

- **Why?** The question why is related to the degree of power-sharing in the planning process. The stairway of participation developed in the BONUS BASMATI shows how the stakeholders can be involved in planning processes with different levels of intensity and shared responsibility.

- **Who?** Who to involve in the MSP process depends on the actual scope and stage of the planning process and the context of the planning area. What needs to be acknowledged is that stakeholders' interests and capacity to influence vary depending on their legal mandate and resources.

- **When?** Stakeholder participation is important during the whole planning process, but the requirements and needs for stakeholder input vary depending on the phase of the process.

- **How?** The questions who and when influence which tools to use in the involvement process. More detailed guidance on methods and tools is presented in the second part of the book.

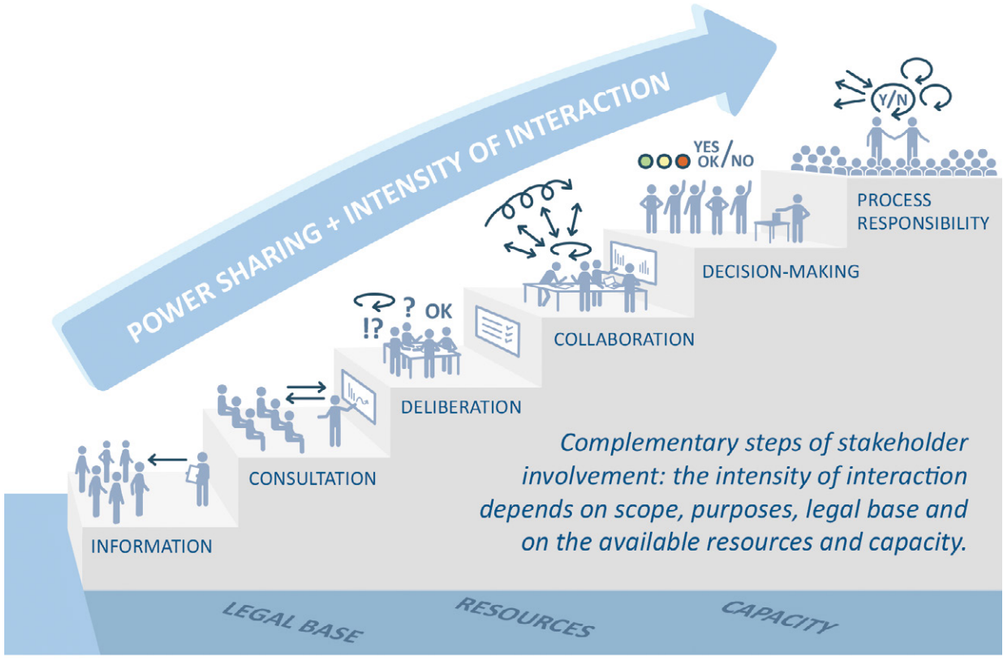

Fig. 6. The stairway of participation developed in the BONUS BASMATI illustrates the degree of power-sharing in the MSP process. (Source: Giacometti et al. 2020.)

Structured lists of how to organise stakeholder involvement. The second part of the handbook focuses on different issues that planners need to take into consideration when involving stakeholders.

- First the focus is placed on the principles of how to build up effective processes of stakeholder involvement. These principles give practical advices on the different topics, such as how to create a strategy for stakeholder involvement, how to design meetings and how to deal with feedback.
- Then alternative methods and tools for stakeholder involvement in different stages of the planning process are presented. The four stages (Scoping, Drafting and Consulting, Implementation, Evaluation and Learning) include different planning tasks and required specific solutions when implementing stakeholder involvement.

The handbook will be available on the project website together with summaries in 6 languages.

Photo: Harri Tolvanen

Business sector involvement in Maritime Spatial Planning

Promoting coastal and maritime economies is one of the central principles of MSP, which makes the business sector an important stakeholder group in the planning processes. In BONUS BASMATI, planners and experts around the Baltic Sea were interviewed about their perceptions concerning the business sector's role in the MSP processes. Furthermore, an online questionnaire was sent to companies and organisations representing the maritime transport and marine tourism sectors.

According to the planners, the planning processes are open to all those interested in MSP. However, the companies do not seem to understand the role of MSP for their business operations. This lack of knowledge and interest in turn results in inactive participation in stakeholder involvement processes. The smaller companies especially, also lack the time and resources for participation. All this emphasises the need to motivate the business stakeholders to become involved in the MSP processes. The planners perceived that willingness to participate increases when the stakeholders have an impression that they may gain or lose something.

When involving business sectors that have commercial interests in the planning area, the planners need to consider which types of stakeholders to integrate. The blue economy realm consists of various sizes and types of business operators. The business stakeholders differ from each other also in terms of authority, knowledge, capacities and interests. Both individual companies and organisations representing the blue economy sectors have their role in different planning contexts, and their views can be used to complement each other.

Involving associations and interest organisations provides…

- A wider view on the respective sector
- Communication of MSP information to the sector at large
- An intermediary actor between companies and planning authorities
- Representation for companies who lack resources to participate themselves
- An overall representation of a business sector at national and international levels

Involving the companies enables…

- Interaction leading to knowledge about the needs and opinions of other stakeholders
- Searching for potential synergies among sea users
- Discussion about conflicts that directly affects business operations
- Inclusion of entrepreneurs with strong and versatile societal views
- Acknowledging the needs of the local economy

PLATFORMS AND TOOLS

As a rather new discipline, maritime spatial planning has experienced a general lack of tools for involving stakeholders and as support for the allocation of marine space, especially methods applying an ecosystem-based approach. As a part of the research carried out in the BONUS BASMATI project, a platform for stakeholder involvement and spatial analysis tools have been developed. The Baltic Explorer is an interactive web map application developed for supporting collaboration between planners and stakeholders. Tests of the Baltic Explorer in workshops have provided further insights concerning the ways planners could utilise digital map-based communication for stakeholder involvement. The spatial tools, on the other hand, include methods for site selection for new maritime activities, for ecosystems service assessments in maritime spatial planning, for assessing the cumulative impacts of activities, as well as for analysing conflicts and synergies between different uses.

Photo: Hanna Luhtala

Baltic Explorer – new tools for collaboration

Collaborative tools can support active stakeholder participation and engagement in maritime spatial planning. To facilitate collaboration in planning workshops, an interactive web map application, Baltic Explorer, was developed as part of the BONUS BASMATI project. The development and testing of the Baltic Explorer have functioned as a study for understanding the user and technical requirements that surround collaborative spatial decision support systems in maritime spatial planning. The results have identified the key characteristics and functionalities of such systems, which can help in designing similar systems as well as related decision-making processes in the future.

Key points:

- ‘Baltic Explorer’ is an interactive web map application for facilitating collaboration in MSP workshops.
- The development and tests of use in BONUS BASMATI have identified key functional requirements for spatial decision support systems in MSP.
- Key functionalities of the system include multi-user access, user access control, cross-platform compatibility, individual and shared workspaces, as well as easy-to-use web map user interface.
- Baltic Explorer utilises free and open source web technologies and international standards. The source code is shared online at the end of the project for future deployment and development of the system.
- Use of spatial decision support systems remains challenging in MSP and further system development in connection with real-life planning situations is needed.

Supporting collaboration with the Baltic Explorer

Maritime spatial planning relies on active collaboration with stakeholders. The use of spatial decision support systems can aid the work of defining and analysing the current and future status of the marine environment by providing access to and possibilities for analysing spatial data on marine areas. Thus far, the use of such systems has been limited and there have been notable gaps in the understanding of how to develop them to be effective in MSP.

In the BONUS BASMATI project, a spatial decision support system for MSP called Baltic Explorer was designed and implemented. The Baltic Explorer combines easy-to-use spatial tools with easy-to-access data from spatial data infrastructures of several maritime actors. Users collaborate on multiple devices in the same map-based workspace, where each user can see changes made by the others. Results from the collaboration are stored in a database for future use. The system is designed to enable all participants to engage in work with the system, regardless of their skills and expertise.

Reflections on user expectations

The Baltic Explorer was designed for studying the use of collaboration tools in stakeholder workshops. By using the Baltic Explorer in planning workshops, knowledge has been gained on how collaboration, more specifically interaction and decision-making processes, can be facilitated with a spatial decision support system, when working with complex spatial problems in MSP. The stakeholder feedback provides essential information for further advances on the usability of spatial decision support systems within MSP.

Maritime spatial planners expect tools, which can be immediately implemented in their work. Participation in test situations on a prototype system may not be widely accepted due to the extra time consumption required in addition to the usual planning work. The MSP process is going through its first rounds in most Baltic Sea countries and the whole process is under refinement. Therefore, the use cases where spatial decision support systems can best support planning activities are still to be determined, and to which the BONUS BASMATI research with the Baltic Explorer is providing valuable input.

The open source Baltic Explorer is ready to be continued

Baltic Explorer has been constructed using free and open source software and the standards of the Open Geospatial Consortium. This makes the software accessible, free, transparent and flexible for future modifications. The system can be extended to suit multiple use cases by adding new functionalities, by enhancing the existing collaboration tools and by creating connections to further data sources that support the work tasks of planners.

To learn more and access the source code visit the Baltic Explorer at
http://balticexplorer.eu

Photo: Harri Tolvanen

Key functionalities

The key requirements (simple, easy to use and access, flexible and enabling multi-user participation) for a successful spatial decision support system within MSP were identified. To meet these requirements the Baltic Explorer contains the following functionalities that support the collaborative process in practice.

- A user-friendly map interface with intuitive navigation tools makes viewing and browsing of spatial information easy for all users.
- Wide access to up-to-date spatial data from the Baltic Sea Region through existing spatial data infrastructures provide the backbone for visualising the current maritime actions, identifying conflicting values and proposals for MSP.
- A possibility to create, edit and add vector features. Users can utilise drawing tools or add own vector layers to the workspace to present their perspective on the topic. They can also overlay data to view possible overlaps between current and future activities or add comments to share their views.
- Cross-platform use on computers, smartphones, tablets and touch-displays supports active participation, and makes it easy for the participant to provide input in a variety of planning situations.
- Workspaces enable multi-user collaboration in workshops and online meetings. Users can work simultaneously on individual views and see the larger view in a shared workspace, making it easy to create and share perspectives.
- The user access model allows the opportunity to assign different roles to participants. The moderator can, for example, add or remove editing rights, which can make the tool flexible for multiple situations. Clear roles support successful participation in the planning task at hand.

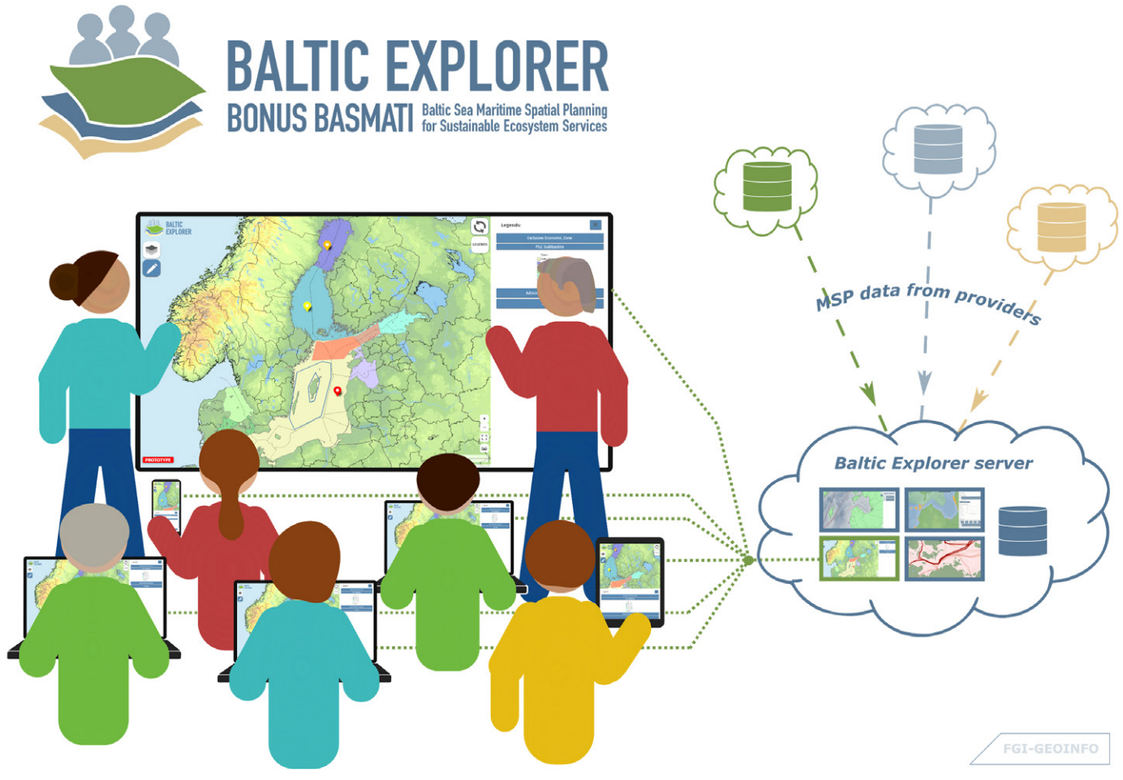

Fig. 7. The collaborative GIS ‘Baltic Explorer’ allows for facilitated maritime spatial planning among planners and stakeholders as real-time group work using shared workspaces and fetching data from interfaces of remote providers.

Is stakeholder involvement in MSP ready for digital map applications?

The testing of the Baltic Explorer in stakeholder and target group workshops indicated differences in its acceptance. Planners and organisation representatives with experience of GIS see many opportunities for the application. They see the interactive elements as promising for dialogue and knowledge exchange within public authorities internally and between organisations. However, the digital mapping tools seem to be still too unfamiliar for dialogues between planners and 'ordinary people living their coastal lives', as expressed by a planner. The planners also avoid using digital maps in meetings with stakeholders, fearing that the dialogue will be swamped by a fascination with the technique and the challenges it creates; therefore, in many cases the planners still prefer face-to-face dialogues and paper maps. Hence, it seems that the target group ready for the Baltic Explorer are those with experience in map applications and GIS.

Photo: Hanna Luhtala

SPACEA – a GIS toolbox to facilitate easy spatial and environmental suitability analysis

Planning decisions based on spatial analyses where biological requirements of species and different spatial interests of stakeholders are combined can resolve conflicts and create synergies between different users and the environment. With the help of a new GIS toolbox SPACEA, planners can gain a quick overview of the planning areas' spatial and environmental suitability for different activities. In BONUS BASMATI, SPACEA was used to identify suitable sites for mussel farming. At these and additional sites, the synergies between mussel and fish farming were demonstrated by an ecological model in terms of nutrient removal and improved water transparency.

Key points:

- A GIS toolbox SPACEA was developed to facilitate easy spatial and environmental suitability analyses.
- Planners can use the toolbox to identify the most suitable locations for proposed activities in the planning area.
- The spatial suitability analysis was demonstrated by identifying appropriate mussel farming sites in the south-western Baltic Sea.

Easy suitability analysis

In BONUS BASMATI, suitable mussel farming sites were identified in the South-Western Baltic Sea by applying a geospatial suitability analysis. This work formed the basis for a new user-friendly GIS toolbox called SPACEA, meant for performing spatial analyses that support decision making in MSP. Planners can use the tools to analyse where an activity could be placed in a planning area based on spatial availability and the environmental suitability of different locations.

The SPACEA toolbox consists of five tools, which together are used to make the suitability analysis. When all the tools are applied, the final outcome is a raster map showing which areas could be suitable for a specific marine use. The flexibility of the toolbox also allows the opportunity to use the tools separately for multiple purposes. The tools can use both data related to the environment and to the marine uses as input. Planners need to make sure that the input data is of good quality, relevant and at the right scale for evaluating the suitability.

The toolbox is designed to require minimal input from the user and can be used by people with different levels of GIS expertise. The novice users with less experience can use the tools in ArcGIS with a similar interface to the other tools provided by the software. More experienced users can run and modify the tools python scripts in the manner they see best.

Photo: Harri Tolvanen

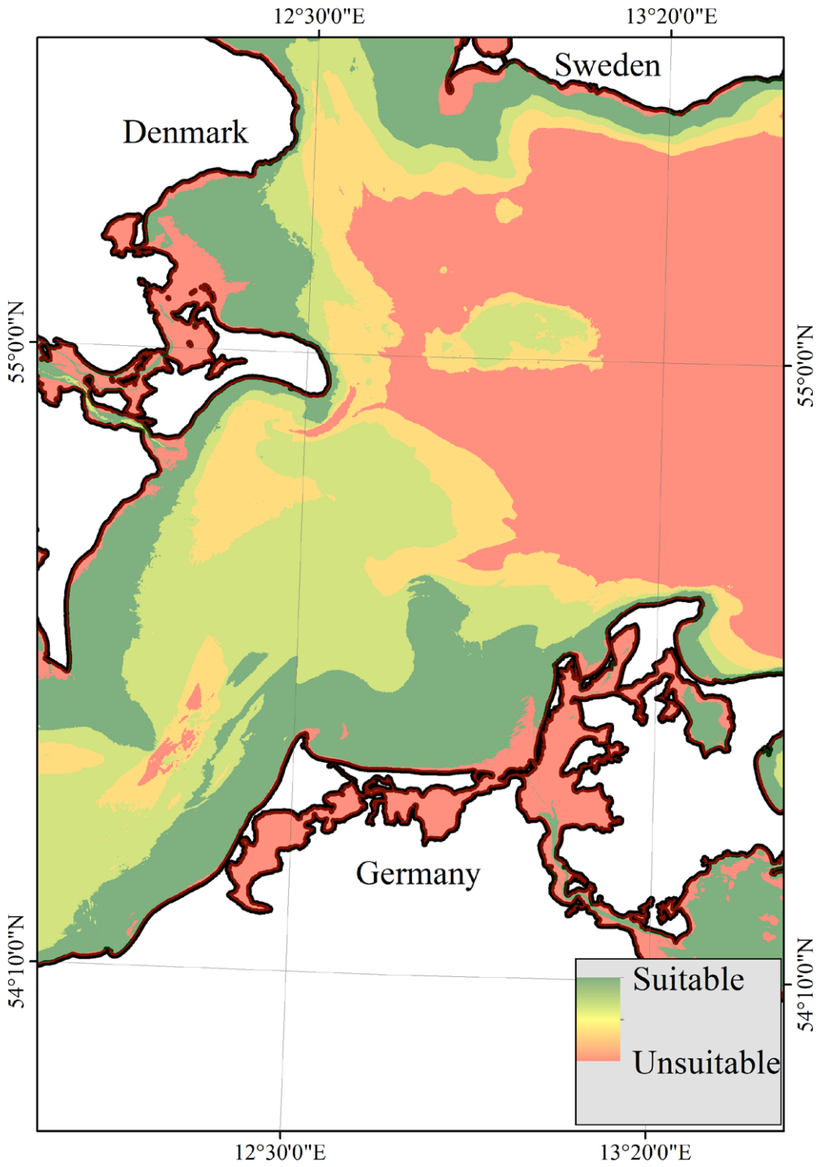

Fig. 8. Example of applying a SPACEA tool to identify suitable depth ranges for mussel farms. A depth between 5-10 metres is considered most suitable and a depth above 30 metres as unsuitable due to more efforts regarding anchoring.

Demonstrating the synergies between mussel farming and other sea uses

SPACEA was applied to the Hjelm Bay area to identify suitable sites for mussel farming. An ecological model was then applied to model mussel growth at these sites. The study showed that mussel farming can remove nutrients from the sea and improve water transparency. For example, Hjelm Bay is characterised by low chlorophyll and salinity levels, which results in reduced growth and nutrient removal compared to other areas in Denmark. Nevertheless, it was estimated that a mussel farm in Hjelm Bay can increase water transparency up to 200 metres distance from the farm. Improved water transparency can have broader ecosystem effects, such as an increase in eelgrass and macroalgae vegetation. Eelgrass stabilises sediments and takes up nutrients, as well as providing a nursery habitat for fish and invertebrates.

Another modelling exercise done in Samsø Belt showed that one mussel farm of 36 hectares could potentially remove 17–31% of the released nitrogen from a fish farm producing 2300 tons of rainbow trout. The study even reasserted the effect on water transparency. However, mussel farms should not be located immediately next to fish farms in order to avoid an increased benthic impact. Optimally mussel farms should be located on the coastal side of fish farms, where they effectively increase water transparency.

Photo: Juris Aigars

ESA4MSP – an ecosystem service assessment tool

In order to enhance ecosystem service assessments, the ESA4MSP tool has been developed. The tool supports the inclusion of the concept of integrated ecosystem service assessment in to decision-making by linking marine ecosystem components, functions and services. In BONUS BASMATI, ESA4MSP was used to support the designation of marine protected areas. The tool can even be used to graphically represent the assessment process and its results.

Key points

- The ecosystem service assessment tool links the marine ecosystem components with functions and services and provides a way to quantitatively assess the contribution of marine species and habitats in the supply of ecosystem services.
- Ranking of marine habitats and species based on their importance for the ecosystem service supply creates a basis for ecosystem-based management and the designation of marine protected areas.
- Used in maritime spatial planning processes, the graphical representation of the results facilitates communication with non-experts.

Visual decision support linking marine ecosystems and their service supply

As part of the BONUS BASMATI project the graphic ecosystem service assessment tool, ESA4MSP, was developed in order to enable ecosystem service assessments by linking elements of the ecosystem service cascade with a visualisation. In the project, the tool was applied to support the designation of marine protected areas.

The ecosystem service assessment tool quantifies the links between various marine ecosystems and their service supply. The definition of the links follow the cascade framework by employing three levels: 1) Importance of different species in the maintenance of marine habitat types; 2) The capacity of different habitat types to produce ecosystem functions; 3) The importance of the functions for different ecosystem services, including provisioning, cultural, as well as regulation and maintenance services.

The tool consists of two parts:

- A matrix following the ecosystem services cascade structure for quantifying the contribution of ecosystem components in the provision of ecosystem services.
- A linkage diagram for visualising the interactions between the elements.

Testing of the ESA4MSP tool in relation to the designation of marine protected areas as part of the maritime spatial planning processes has illustrated how graphical support can enable communication with non-experts. For more information on the work see the box Integrating ecosystem service assessment into the designation of marine protected areas on page 16.

MYTILUS – a toolset for assessing the impacts of maritime activities

Tools for supporting ecosystem-based maritime spatial planning need to consider the impacts of various maritime activities on the environment and communicate the benefits and trade-offs of different planning alternatives to stakeholders. In the BONUS BASMATI project, the MYTILUS toolset was developed to carry out high-performance calculations of cumulative impact assessment to support planners evaluate the effects of human activities on marine ecosystems and the possible conflicts between these activities.

Key points:

- MYTILUS is a user-friendly open source toolbox for the assessment of the cumulative impacts of various maritime activities on marine ecosystems and the associated services.
- A scenario-based approach is applied to analyse and visualise the effects of different maritime spatial planning proposals in a high-performance environment.
- The calculations of spatial distributions of impacts and pressures can be performed on any scale using various input dataset.
- In addition to the ecosystems, the impacts of various maritime activities on each other can be estimated.

Scenarios and optimised locations

The MYTILUS toolbox developed in BONUS BASMATI enables the assessment of the cumulative impacts of various maritime activities on marine ecosystems and the associated services. This approach acknowledges that in many cases marine ecosystems are not only affected by a single human activity but by the combined effect of several activities. The tool applies a scenario-based approach, providing an easy and efficient way to analyse and visualise the effects of different planning alternatives.

To support decision-making, the tool provides a way to establish a baseline against which the effects of the planned activities and changes caused by large scale processes such as climate change or technological development can be evaluated. Planners can test how the addition of new activities changes the cumulative impact on specific marine ecosystems and use this information to optimise the locations of new activities and to identify areas where activities should be limited.

Flexible and user-friendly tool suits different users

The flexibility of the tool makes it valuable for different users. While novice GIS users will benefit from the ease of use and the visualisation capacities of the tool, experts in spatial analysis will be able to take advantage of the option to tweak the variables and parameters used in the analysis. The use of high-performance computing enables the use of the tool at stakeholder events where the effects of new spatial planning proposal can be demonstrated without much delay.

The tool uses raster data of the ecosystem distribution and pressures caused by human activities as input. Data from multiple scales can be used and positive results of the tool's effectiveness in planning on different scales have been noticed in tests using HELCOM data at the Baltic Sea and at the more detailed level using data from the Swedish MSP process.

The toolbox is stand-alone software with a user-friendly interface. It also supports the easy exchange of data to frequently used GIS software for map making or further analysis. The easy-to-use approach makes sure that planners do not waste time meant for planning work in learning about new software.

> The MYTILUS software is open source and freely available from the developer at **hsh@plan.aau.dk**.

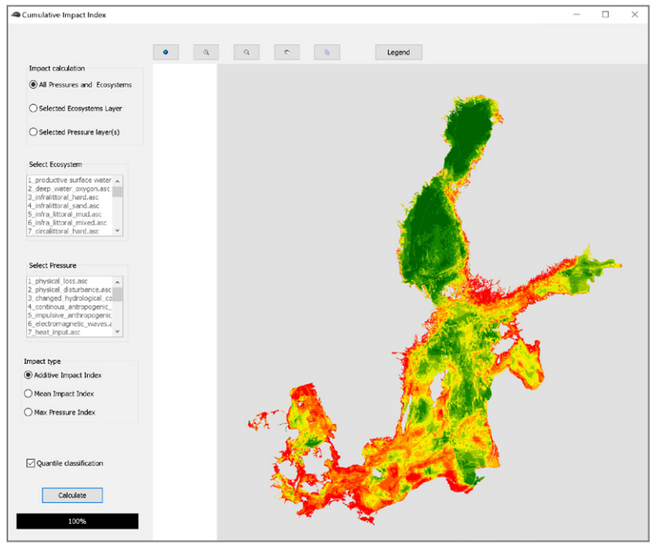

Fig. 9. The cumulative impact of pressures on ecosystems in the Baltic Sea

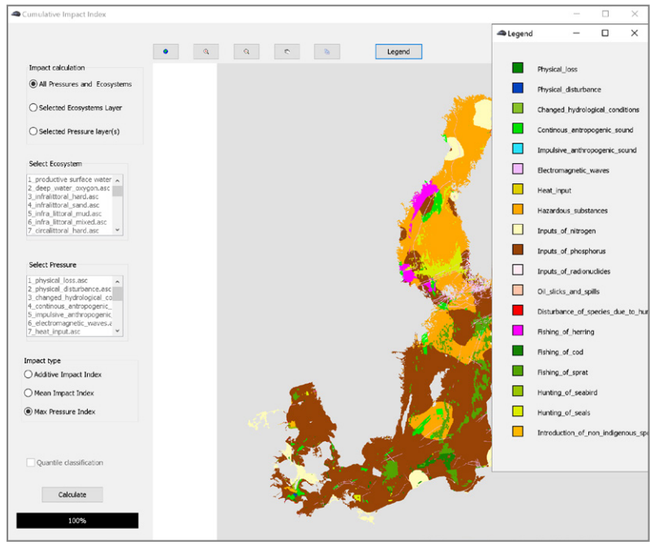

Fig. 10. The pressures providing the highest impact on ecosystems in each area

Photo: Ivars Druvietis

SEANERGY – a tool for analysing conflicts and synergies between different marine uses

The SEANERGY tool was developed as a part of the BONUS BASMATI project to facilitate a cross-sectoral approach to maritime spatial planning and to help planners and stakeholders look for co-location options. SEANERGY provides options to spatially analyse different stakeholder activities with the aim of strengthening synergies and decreasing conflicts between them.

Key points:

- Co-locating marine uses can optimize the use of marine space, increase synergies between marine uses, decrease conflicts, and free space for other purposes.
- Only marine uses that have limited conflict and do not cause too much pressures on the environment can be located together.
- The new SEANERGY tool can facilitate spatial exploration of synergies and conflicts between marine uses.

Creating a co-location tool

The co-location concept highlights the positive links created when marine uses are located close to each other. However, both negative and positive links exist between marine uses. Four types of spatial-temporal links can be considered to affect the ability to co-locate: location links, environmental links, technical links, and user attraction links. Synergies occur when no marine use experiences any overall negative impact from an interaction.

By combining results from previous studies, knowledge about the potential conflict-synergy degree for different marine uses was synthesised into a pairwise use-use matrix. Thereafter, the tool SEANERGY was developed to facilitate options to spatially explore the conflict-synergy links provided by the matrix.

The tool uses HELCOM marine use data as input. It finds overlaps of marine uses and calculates overall synergy-conflict scores based on the matrix. The user can choose to focus on all marine uses at once or on only one use and its links to other uses. In addition to visualising scores on maps, the tool also outputs some statistical information about the distribution of potential conflicts and synergies for the different marine uses.

The tool was developed in Python 2.7.16 as a toolbox extension to the program ESRI ArcMap. The tool requires ArcMap to run, but both the tool, the source code and the synergy-conflict matrix are freely available on GitHub here:

https://github.com/IdaMBonnevie/SEANERGY.git

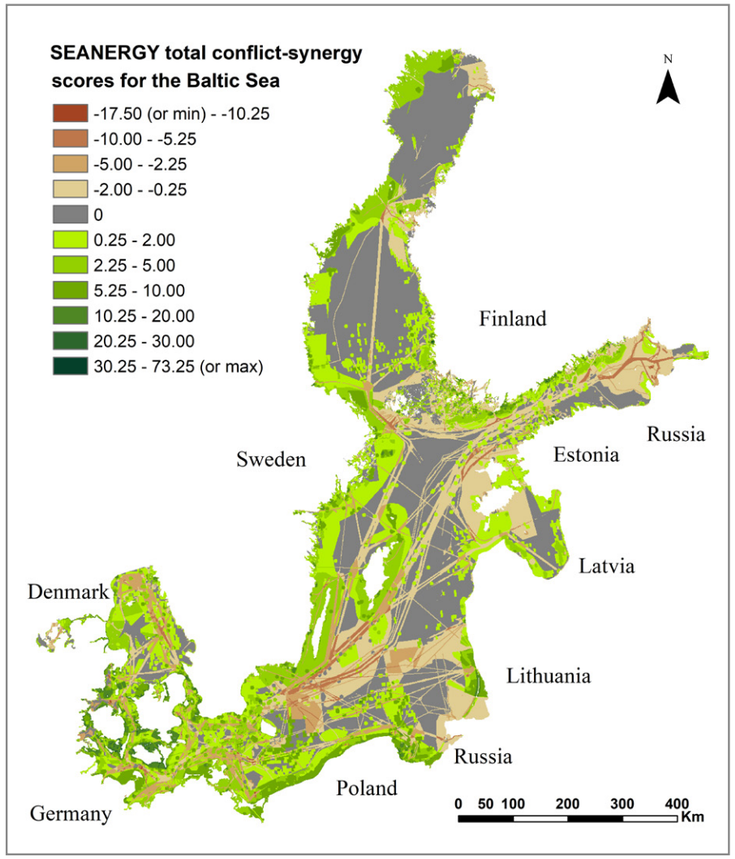

Fig. 11. A total conflict-synergy score map for the Baltic Sea area.

FINAL REMARKS

Maritime spatial planning is a complicated task balancing the extended use of marine space (blue growth) with the protection of the marine ecosystems. This challenge is addressed in the European Union Directive on Maritime Spatial Planning by emphasising the need to apply an ecosystem-based approach in planning processes. From 2017 to 2020, the BONUS BASMATI project has aimed at developing methods and tools to support maritime spatial planning apply an ecosystem-based approach.

The countries around the Baltic Sea are in different phases of the planning process: while Germany is already finishing the second round of maritime spatial planning, other countries like Denmark and Finland are in earlier stages of the process. Maritime spatial planning is a new task for most countries, and therefore making the first plans has been a learning process, with such challenges as trying to identify appropriate strategies to reach the goal. Water does not recognise national borders, and transnational cooperation with neighbouring countries is required in the maritime spatial planning process.

BONUS BASMATI has addressed some of the main challenges in maritime spatial planning: How to apply an ecosystem-based approach, how to establish stakeholder involvement (even involving stakeholders from neighbouring countries), and how to provide access to common tools to identify appropriate locations for new maritime activities without harming the marine ecosystems or creating conflicts with existing maritime activities. The set of methods and tools developed during BONUS BASMATI is by no means complete, but it can be used to support maritime spatial planners in various steps in the planning process. All the tools are freely available from the project partners, and consequently interested authorities, researchers, and stakeholders are therefore encouraged to test and evaluate the tools.

The BONUS BASMATI project has focused on planning the marine space and as a result has not considered some other important aspects, such as land-sea interaction, and the effect of climate change on marine ecosystems. Handling of the land-sea interaction requires holistic and coherent planning of the coastal zone, which is complicated by the fact that the national authorities are often responsible for the marine space, while local and regional authorities are the main actors in terrestrial planning. As regarding climate change, current knowledge of the effects on marine ecosystems is still too uncertain to make precise assessments, nevertheless, these effects cannot be neglected in the planning process either. Accordingly, these items are on our research agenda and will be addressed in upcoming research projects.

FURTHER RESOURCES

For the most up-to-date resource list, please visit the BONUS BASMATI website at www.bonusbasmati.eu

Scientific articles

Armoškaitė A, Puriņa I, Aigars J, Strāķe S, Pakalniete K, Frederiksen P, Schrøder L, Hansen HS, 2020. Establishing the links between marine ecosystem components, functions and services: An ecosystem service assessment tool. Ocean & Coastal Management 193, 105229. https://doi.org/10.1016/j.ocecoaman.2020.105229

Bonnevie IM, Hansen HS, Schrøder L, 2019. Assessing use-use interactions at sea: A theoretical framework for spatial decision support tools facilitating co-location in maritime spatial planning. Marine Policy 106, 103533. https://doi.org/10.1016/j.marpol.2019.103533

Bonnevie IM, Hansen HS, Schrøder L, 2020. SEANERGY - a spatial tool to facilitate the increase of synergies and to minimise conflicts between human uses at sea. Environmental Modelling and Software 104808. https://doi.org/10.1016/j.envsoft.2020.104808

Frederiksen P, Morf A, von Thenen M, Armoškaitė A, Luhtala H, Schiele K, Strāķe S, Hansen HS. Proposing an ecosystem services-based framework to assess sustainability impacts of maritime spatial plans (MSP-SA). Ocean & Coastal Management, under review.

Hansen HS, 2019. Cumulative Impact of Societal Activities on Marine Ecosystems and Their Services. In: Misra S et al. (eds) Computational Science and Its Applications – ICCSA 2019. Lecture Notes in Computer Science, vol 11621. Springer, Cham. https://doi.org/10.1007/978-3-030-24302-9_41

Hansen HS, 2020. A Toolset to Estimate the Effects of Human Activities in Maritime Spatial Planning. In: Gervasi O et al. (eds). 20th International Conference on Computational Science and Its Applications - ICCSA 2020. Lecture Notes in Computer Science, in press.

Holzhüter W, Luhtala H, Hansen HS, Schiele KS, 2019. Lost in space and time? A conceptual framework to harmonise data for marine spatial planning. International Journal of Spatial Data Infrastructures Research 14, 108–132. https://ijsdir.sadl.kuleuven.be/index.php/ijsdir/article/view/494

Koski C, Rönneberg M, Kettunen P, Eliasen SQ, Hansen HS, Oksanen J. Utility of Collaborative GIS for Maritime Spatial Planning – Design and Evaluation of Baltic Explorer. Transactions in GIS, under review.

Luhtala H, Erkkilä-Välimäki A, Eliasen SQ, Tolvanen H. Business sector involvement in maritime spatial planning – experiences from the Baltic Sea region. Marine Policy, under review.

Moodie JR, Kull M, Morf A, Schrøder L, Giacometti A, 2019. Challenges and enablers for transboundary integration in MSP: Practical experiences from the Baltic Scope project. Ocean & Coastal Management 177, 1–21. https://doi.org/10.1016/j.ocecoaman.2019.04.002

Morf A, Moodie J, Giacometti A, Kull M, Gee K, Piwowarzyk J, and Zaucha, J, Kellecioglu I, Luttmann A, Strand H, Schiele K, 2019. Towards sustainability of marine governance from a stakeholder integration perspective: challenges and enablers for stakeholder involvement in transboundary Marine Spatial Planning (MSP) in the Baltic Sea Area. Ocean & Coastal Management 177, 200–212. https://doi.org/10.1016/j.ocecoaman.2019.04.009

Maar M, Larsen J, von Thenen M, Dahl K, 2020. Site selection of mussel mitigation cultures in relation to efficient nutrient compensation of fish farming. Aquaculture Environment Interactions 12, 339–358. https://doi.org/10.3354/aei00361

Pakalniete K, Ahtiainen H, Aigars J, Puriņa I, Armoškaitė A, Hansen HS, Strāķe S. Economic valuation of ecosystem service benefits and welfare impacts of offshore marine protected areas: a study from the Baltic Sea. Ecosystem Services, submitted manuscript.

Rönneberg M, Eliasen SQ, Kettunen P, Koski C, Oksanen J, 2019. Designing Access Control of a Spatial Decision Support System for Collaborative Maritime Spatial Planning. In: Gartner, Georg & Huang, Haosheng (eds). Adjunct Proceedings of the 15th International Conference on Location-Based Services, 271–276. https://doi.org/10.34726/lbs2019.28

Schiele KS, Pinkau A. Strategic Environmental Assessment in marine spatial planning of the North Sea and the Baltic Sea – an implementation tool for an ecosystem-based approach? Marine Policy, submitted manuscript.

von Thenen M, Frederiksen P, Hansen HS, Schiele KS, 2020. A structured indicator pool to operationalize expert-based ecosystem service assessments for marine spatial planning. Ocean & Coastal Management 187, 105071. https://doi.org/10.1016/j.ocecoaman.2019.105071

von Thenen M, Hansen HS, Schiele, K, 2020. SPACEA: a custom-made GIS toolbox for basic marine spatial planning analyses. In: Gervasi O et al. (eds). 20th International Conference on Computational Science and Its Applications - ICCSA 2020. Lecture Notes in Computer Science, in press.

von Thenen M, Hansen HS, Schiele KS. A generalised marine planning framework for site selection based on ecosystem services. Marine Policy, submitted manuscript.

von Thenen M, Maar M, Hansen HS, Friedland R, Schiele KS, 2020. Applying a combined geospatial and farm scale model to identify suitable locations for mussel farming. Marine Pollution Bulletin 156, 111254. https://doi.org/10.1016/j.marpolbul.2020.111254

Selected project reports

Giacometti A, Kull M, Moodie JR, Morf A, Kaae BC, Schiele K, von Thenen M, Reiter IM, Schrøder L, Hansen HS, Dahl K, Luhtala H, Erkkilä-Välimäki A, Armoškaitė A, Strāķe S, 2018. Thematic Scoping/Vision Document: report outlining the main conflict and potential synergy areas in crossborder MSP. BONUS BASMATI Deliverable 2.2, October 2018.

Giacometti A, Morf A, Gee K, Kull M, Luhtala H, Eliasen SQ, Cedergren, E, 2020. Handbook: Process, Methods and Tools for Stakeholder Involvement in MSP. BONUS BASMATI Deliverable 2.3, February 2020.

Holzhüter W, Schiele K, von Thenen M, Maack L, Luhtala H, Viška M, Strāķe S, 2019. Database including spatial data on ecosystem services and (anthropogenic) pressures. BONUS BASMATI Deliverable 3.2, June 2019.

Kettunen P, Koski C, Rönneberg M, Oksanen J, Schrøder L, Hansen HS, 2020. Baltic Explorer web-map and multi-touch application. BONUS BASMATI Deliverable 5.5, August 2020.

von Thenen M, Schiele KS, Frederiksen P, Aigars J, Pakalniete K, Strāķe S, Puriņa I, Hansen HS, Schrøder L, 2018. Proposal for an ecosystem service framework for assessment of impacts of planning alternatives in a MSP perspective. BONUS BASMATI Deliverable 4.1, February 2018.

Other resources

BONUS BASMATI Newsletters and Policy briefs:
https://bonusbasmati.eu/results-material/other-documents/

BONUS BASMATI videos: https://bonusbasmati.eu/results-material/videos/

Nordregio Magazine 2, 2020: BONUS BASMATI: maritime planning for the future.
https://nordregio.org/nordregio-magazine/issues/
bonus-basmati-maritime-planning-for-the-future/

BONUS BASMATI

Baltic Sea Maritime Spatial Planning for Sustainable Ecosystem Services

www.bonusbasmati.eu

BONUS BASMATI project has received funding from BONUS (ART 185), funded jointly by the EU and Innovation Fund Denmark, Swedish Research Council Formas, Academy of Finland, Latvian Ministry of Education and Science and Forchungszentrum Jülich GmbH (Germany).