Pan Baltic Scope

Co-funded by the European Maritime and Fisheries Fund of the European Union

Assessing economic, social, cultural and ecosystem service impacts in maritime spatial planning (MSP) in the Baltic Sea region

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Authors: Maija Holma[1], Elina Laurila[1], Heini Ahtiainen[1], Marie Hallberg[2], Michael Kull[3], Triin Lepland[4], Soile Oinonen[5] and Jaan Urb[4]

Affiliation of authors:

[1] Baltic Marine Environment Protection Commission (HELCOM)
[2] Swedish Agency for Marine and Water Management (SwAM), Sweden
[3] Nordregio
[4] Ministry of Finance, Estonia
[5] Finnish Environment Institute (SYKE), Finland

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Swedish Agency for Marine and Water Management
BSH Bundesamt für Seeschiffahrt und Hydrographie
Ministry of Environmental Protection and Regional Development of the Republic of Latvia
Danish Maritime Authority
VASAB
Republic of Estonia Ministry of Finance
Satakuntaliitto The Regional Council of Satakunta
SYKE
Nordregio
Ålands landskapsregering

Contents

List of abbreviations

BSR = Baltic Sea region

CBA = cost-benefit analysis

CEA = cost-effectiveness analysis

EBA = ecosystem-based approach

EIA = environmental impact assessment

ES = ecosystem service

ESA = economic and social analyses

GES = good environmental status

GIS = geographic information systems

MCDA = multi-criteria decision analysis

MSFD = Marine Strategy Framework Directive

MSP = maritime spatial planning

MSPD = Maritime Spatial Planning Directive

PGIS = participatory GIS

PPGIS = public participatory GIS

SEA = strategic environmental assessment

SEEA = the system of environmental-economic accounting central framework

SEEA-EEA = SEEA experimental ecosystem accounting framework

Summary

Maritime spatial planning (MSP) affects human welfare in various ways, including impacts on economic, social, cultural and ecosystem service aspects. A comprehensive understanding and quantification of these impacts is important for evaluating how MSP affects humans and society. According to the EU Maritime Spatial Planning Directive and the HELCOM-VASAB guidelines, MSP should rely on the ecosystem-based approach and consider economic and social aspects in planning. The ecosystem-based approach is an interdisciplinary and integrated strategy for accounting for the complexity of the ecosystems and their relationship with the social and economic systems. However, while consideration of economic and social aspects is needed to meet the objectives and principles of MSP, rigorous and extensive analyses of these impacts are rarely applied and there is a lack of decision support tools for economic and social problems in MSP.

The aim of this report is to provide insights into how economic, social, cultural and ecosystem service impacts could be understood and assessed in the context of MSP, what kind of methods, approaches and concepts are available for their assessment, examples of studies that could provide useful results, and what is the current status of the assessment of these impacts in the Baltic Sea. The report includes a literature review and the results of a survey to MSP authorities in Baltic Sea region of existing data and approaches to assess economic, social, cultural and ecosystem service impacts in MSP.

The literature review shows that there are several tools and methods for assessing economic, socio-cultural and ecosystem service impacts, but only few case studies using these methods to support MSP, especially in the Baltic Sea region. Economic impacts are usually assessed in monetary terms, for example using gross value added, market prices and willingness to pay. Socio-cultural impacts can be evaluated with several proxy indicators and are often measured with employment or by mapping cultural ecosystem services or socially and culturally important sites. Spatially explicit economic and socio-cultural impact assessment tools are important in the context of MSP, and some of them already exist.

Based on the responses on the survey to MSP authorities in the Baltic Sea region, there are spatial data on economic activities as well as ecologically, culturally and socially important sites in most countries. The share of environmental data of all data is often large, and monetary data are used only rarely. Impacts on ecosystem services are in some cases considered and even mapped, but their values are mostly missing. The most

significant obstacles for impact assessments seem to be the lack of resources and expertise, as well as the early phase of the planning process.

Based on the results of the review and survey, there are multiple knowledge gaps and development needs in MSP related to the assessments of economic, socio-cultural and ecosystem services impact assessments. Overall, more knowledge, resources and expertise are required to improve the assessment of these impacts. A common understanding of the impacts and their assessment would be a useful starting point. One of the most pressing needs is to develop spatial approaches, data and results for the assessment of economic, socio-cultural and ecosystem service impacts that are of practical relevance to MSP. The use of existing frameworks, tools and results should be investigated and enhanced. Cross-border cooperation in the Baltic Sea region would improve the coherence of data, approaches and results across countries, and could be a way to move towards filling in some of the knowledge gaps.

1. Introduction

The marine environment affects human welfare through a complex interweaving of economic, environmental and socio-cultural factors. Maritime spatial planning (MSP) seeks to balance these factors in time and space for the benefit of society through consideration of their interlinkages and spatial-temporal relationships. The concept of MSP refers to analysing and allocating human activities in marine areas through a political process (IOC-UNESCO 2019). It is a way to manage different sea uses and deliver social and economic outcomes. MSP can also have various impacts on the environment, for example, provide multiple ecological benefits including identification of areas of high biological importance and diversity, allocation of space for nature conservation and reducing impacts of human uses on marine ecosystems (Katsanevakis et. al. 2011, IOC-UNESCO 2019).

The regulation for MSP in the Member States of the European Union is established with the EU's Maritime Spatial Planning Directive (MSPD, 2014/89/EU)[1] that creates the definitions, objectives and minimum requirements for MSP. MSPD requires all EU member states with coastal areas to have maritime spatial plans by March 2021 (MSPD Art. 15, point 3). In the Baltic Sea region, MSP is guided by the principles and guidelines established by HELCOM and VASAB (2010, 2016).

Both the EU MSPD and the HELCOM-VASAB guiding principles for MSP build on the ecosystem-based approach (EBA), and include the consideration of sustainable development, land-sea interactions, stakeholder participation, use of best available data and trans-boundary cooperation. Moreover, a long-term perspective, precautionary principle, area-based planning and continuous planning are included in the principles (HELCOM and VASAB 2010). Other relevant regulations include the EU Marine Strategy Framework Directive (MSFD, 2008/56/EC)[2], the EU Strategic Environmental Assessment Directive (SEA, 2001/42/EC), the EU Environmental Impact Assessment Directive (EIA, 2011/92/EU) and EU Water Framework Directive (WFD, 2000/60/EC). The EU MSFD aims to achieve good environmental status of European marine waters by 2020, SEA ensures the environmental aspects and sustainability to be considered in planning processes, EIA aims to integrate environmental protection into the preparation and authorisation of public and private projects and WFD focuses on achieving a good status of inland and coastal water bodies.

[1] Maritime Spatial Planning directive: http://data.europa.eu/eli/dir/2014/89/oj
[2] Marine strategy framework directive: https://eur-lex.europa.eu/eli/dir/2008/56/oj

Within the EU, the aim of integrated marine policy is to balance sectoral interests, as described in the Maritime Spatial Planning Directive (EU 2014), while achieving sustainable management and use of marine resources in accordance with the EU sustainable development strategy, maintaining good environmental status (GES) according to the EU Marine Strategy Framework Directive (EU 2008), and requiring integration of the economic, social and ecological dimensions of the use of marine resources. The EU MSPD states that "When establishing and implementing maritime spatial planning, Member States shall consider economic, social and environmental aspects to support sustainable development and growth in the maritime sector, applying an ecosystem-based approach, and to promote the coexistence of relevant activities and uses" (EU 2014, Art. 5, point 1). The foundation of the EU MSPD in the principles of sustainable development and ecosystem-based approach calls for consideration of economic, ecological and social aspects, and the interlinkages between the ecosystem and socio-economic systems (EU 2014, HELCOM and VASAB 2016). The information about these impacts is also needed to consider the long-term impacts of MSP which is included in the HELCOM-VASAB guiding principles.

Although the EU MSPD calls for the consideration of environmental, economic and social aspects in national maritime spatial plans (MSPD Art. 6, point 2b) and the identification of current and future marine activities and uses (MSPD Art. 8), Member States have considerable freedom in implementing the directive. The EU MSPD or other relevant documents do not further specify the analyses or outputs required, which leaves considerable room for interpretation and can result in differences in the approaches and results across countries in how they assess the economic, social, cultural and environmental impacts of MSP. Thus, while consideration of economic and social aspects is needed to meet the objectives and principles of MSP, rigorous and extensive analyses are rarely applied. There is also a lack of decision support tools for economic and social decision problems in MSP, and only few data layers of socio-economic information exist (Ehler and Douvere 2009), despite the acknowledged importance of considering economic, social and cultural impacts in MSP (Pinarbasi et al. 2017).

In comparison to the EU MSPD, specific economic and social analyses are requested in setting up national marine strategies in the EU MSFD: the use of marine waters, cost of degradation, as well as cost-effectiveness and cost-benefit analysis of new measures (MSFD Art. 8, point 1c and Art. 13, point 3). Although these analyses are required, the methods or approaches to be applied by Members States are not specified in the MSFD directive. For this reason, the European Commission has developed guidance

documents on the methods and approaches applicable for the MSFD (European Commission 2010, 2014).

Economic, social, cultural and environmental aspects can be integrated to MSP with the ecosystem-based approach (EBA), which is the overarching strategy for many marine policies (EU 2014, HELCOM and VASAB 2010, 2016). EBA integrates the conservation of the marine environment and sustainable use of marine resources in the spatial planning (EU 2014). The links between the environment and human welfare can also be assessed utilizing the concept of ecosystem services, which describes the contribution of the ecosystem to human well-being. Here, the ecosystem is thought to provide many ecosystem services that in turn provide benefits to people (e.g. MEA 2005, Fisher et. al. 2009).

Aims of the report

This report gives an overview of the existing tools and data for assessing the economic, social, cultural and ecosystem service impacts in MSP, as well as describes how these impacts are being assessed in national MSP in the Baltic Sea region. We explore the existing literature, models and current practices utilised in the assessment of economic, social and cultural impacts and ecosystem services for the marine environment. The aim is to provide insights into how these impacts could be understood and assessed in the context of MSP, what kind of methods, approaches and concepts are available for their assessment, examples of studies that could provide useful results, and what is the current status of their assessment in the Baltic Sea. This enables enhanced consideration of the relationship between the marine ecosystem and the social and economic system, and the impacts MSP has on society and human welfare. The report is based on an extensive literature review of relevant studies, as well as on a targeted survey to MSP experts in the Baltic Sea region.

This report approaches the assessment of economic, social, cultural and ecosystem service impacts in national MSP from three perspectives. First, previous experiences from conducting economic and social analyses in the Baltic Sea region, within the context of MSFD, are presented (section 3), followed by discussing the different concepts for linking the sea and society to support MSP, including the economic, social and cultural impacts, ecosystem-based approach and ecosystem services (section 4). Second, the results of the literature review and existing models and assessments are collated to form a coherent view of the current knowledge (section 5), and the survey results are presented to show the current practices used for assessing economic, social

and cultural impacts in national MSP in the Baltic Sea Region (section 6). Finally, knowledge gaps and conclusions are provided (sections 7 and 8).

In this report, the term "economic and social analyses" (ESA) is used to capture various assessments that aim to link the marine environment to the society and human welfare, including the contribution from marine uses to the economy and employment, the assessment and valuation of ecosystem services, valuation of the environment, cost-effectiveness analysis and cost-benefit analysis, among others.

The information and the conclusions presented in this report have been used as a basis for constructing recommendations for developing a framework for economic and social analyses in MSP, which have also been published as an output from Activity 1.2.5 Economic and Social Analyses of the Pan Baltic Scope project (Ahtiainen et al. 2019).

2. Current status of MSP and regional economic and social analyses in the Baltic Sea region

While providing general information on the assessment of economic, social, cultural and ecosystem service impacts in MSP, this report focuses on the Baltic Sea region. The Baltic Sea is a semi-closed water area surrounded by nine countries (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden). It is characterised by having a shallow water body, brackish water, high biological diversity and vulnerable environment. The area also provides multiple possibilities for sea uses. The spatial distribution of human activities in the Baltic Sea is well documented, and assessments of the impacts these activities induce in the marine environment have recently been made (e.g. HELCOM 2018a). In addition to knowing the distribution of activities and their impact on the environment, marine planners need information on the relative economic and socio-cultural impacts of the marine uses under consideration. However, data availability limits the holistic assessment of economic, social and cultural impacts for MSP, and explains why spatially explicit regional economic and social analyses (ESA) have been scarce to date.

Current status of maritime spatial planning in the BSR

The state of MSP varies across the Baltic Sea region (European MSP Platform 2019). Latvia and Lithuania are the only countries in the BSR with existing plans. The plan of Latvia was approved on 2019 and it is aims at the sustainable and efficient future use of marine areas. In Lithuania, the maritime plan is included in the terrestrial planning that

was created in 2015. Denmark, Finland, Estonia, Lithuania and Germany already have some sub-national plans approved. Denmark has done some sectoral plans and the finishing of the national plan will take place in 2019 and 2020. Finland has an existing plan for the Kymenlaakso area. The other marine areas are divided into three sub-national planning areas that are expected to get their plans approved on the beginning of 2020. Åland is doing the MSP separately from other parts of Finland, producing the plan in 2019 and doing revision in 2020. The existing plans of Estonia cover the Hiiu Island and Pärnu Bay areas. The planning solution of unplanned areas is supposed to be published in the spring 2020. In Germany, the North Sea and Baltic Sea German exclusive economic zone and the areas of three coastal federal states are already planned. The first draft of remaining plans will be done in winter 2020 and the whole planning process is supposed to come to an end in 2021. Currently, there are no existing plans in Poland or Sweden. Poland is creating several plans on different scales. Drafting of the plans is continuing in 2019. Sweden has submitted the plans for three sub-national areas and approval of the government is expected in 2020. Table 1 summarizes the current status of national MSP in the Baltic Sea region.

Table 1. MSP in Baltic Sea Region countries

	Existing plans	Planning scale	Planning phase
Denmark	Sectoral plans	National	Assessment 2019-2020, entry into force in 2020-2021
Estonia	Hiiu island, Pärnu bay	National	Plan is expected to be approved at the end of 2020
Finland	Kymenlaakso	Sub-national (3 plans); Åland doing a separate plan	Plans are expected to be approved at the beginning of 2020
Germany	North Sea and Baltic Sea EEZs; Schleswig Holstein; Mecklenburg Vorpommern; Lower Saxony	National and sub-national	The first draft in 2020. The whole planning process ending in 2021
Latvia	National plan	National	Plan approved 2019
Lithuania	National plan	National	Plan approved 2015
Poland	-	Plans on different scales	Drafting going on in 2019
Russia	-	National	Legislation and planning process under development
Sweden	-	Sub-national (3 plans)	Plans are expected to be approved in 2020

Spatial assessment of the impacts of MSP

Spatial consideration of economic, social and cultural impacts is an emerging field of knowledge. The set of methods and tools used thus far is still limited in their ability to handle multi-objective management decisions and to connect changes in the provision of ecosystem services to welfare benefits. Most of the literature is from recent years, and approaches for assessing economic and socio-cultural impacts are currently under development. All marine uses cannot be characterized with existing statistics and economic indicators, as the required data are either not suitable or not (yet) available. For example, statistics on recreation and tourism struggle to appropriately represent the extent of marine and coastal tourism, in particular, often excluding recreation by local residents. An MSP data study conducted by the European Commission points to a data

gap in socio-economic data for various marine uses and socio-cultural information, stating that available data is mainly descriptive, and evidence related to future uses and activities is still rare (Cahill et al. 2016). Also, spatial data on economic impacts needs to be produced since it is important for impact assessment and engagement of stakeholders.

The tools currently used in ESA have rarely been applied in maritime spatial planning, mainly due to data limitations. However, synergies exist between other EU marine policies, and the experiences of applying ESA in, for example, the MSFD setting can be used to support the goals of MSP (Oinonen et al. 2016). Current work on MSP can substantially benefit from the regional ESA results presented in the thematic assessment of economic and social analyses as part of the 'State of the Baltic Sea' report (HELCOM 2018b). Linking the use of marine waters analysis and the cost of degradation analysis through the cumulative impact assessment[3] to show how the state of the Baltic Sea affects the economic performance of the different sectors and activities, as well as exploring the role of land-sea interaction, would be a worthy extension to the existing system, and would further support the inclusion of ESA into MSP. Moreover, to tackle the insufficiency in measuring the negative environmental impacts of economic activities in the System of National Accounting (SNA), the development of environmental-economic accounts and marine ecosystem accounts is required. Essentially, regionally coherent data and framework for including ecosystem services values in MSP is needed.

Currently available Baltic Sea spatial data

The following Baltic Sea spatial data are currently available:

- Spatial data compiled by HELCOM is openly available via the HELCOM Map and Data service[4]. In the current data presented, a wide range of spatial data on human activities is provided, however monetary data is lacking and not presented.

- The 'State of the Baltic Sea' thematic assessment on cumulative impacts describes the spatial distribution of pressures and impacts in the Baltic Sea

[3] Cumulative impact assessment explores how the human activities contribute to pressures on the environment, what are the key pressures and whether they can be modified as well as how the state of the species and habitats are affected by the pressures.

[4] HELCOM Map and Data service available at http://maps.helcom.fi/website/mapservice/

(HELCOM 2018a). Cumulative impacts were evaluated using two methods; the Baltic Sea Pressure Index (BSPI) and The Baltic Sea Impact Index (BSII)[5].

- The HELCOM Maritime Assessment report summarizes and visualizes the available regional data on human activities (HELCOM 2018d).
- Spatial data compiled by Nordregio within the Nordic countries is available in the State of the Nordic Region 2018 report (Nordic Council of Ministers 2018).

The data sources above provide a wide range of spatial data on human activities. However, activities are not characterized in terms of their economic and socio-cultural impacts, and monetary data are largely lacking.

National mapping of culturally important sites

Estonia has mapped culturally and socially important sites in the Estonian coast and marine area (Metspalu and Ideon 2017).

Finland has set up the ancient relics register that contains information on about 2000 underwater discoveries, however the findings are largely based on information from recreational divers, and there has not been a systematic inventory of the relics in Finland (Kaituri et al. 2017).

Sweden has made a preliminary study of the important marine underwater cultural heritage sites (Naturvårdsverket 2007). Mapping of the important areas has led to description of 25 selected heritage sites in the Swedish marine waters.

Previous economic and social analyses for the Baltic Sea region

Previous Baltic Sea region-level economic and social analyses (ESA) have been conducted for the cost of degradation of the marine environment and use of marine waters, as described in Figure 1 and presented in the HELCOM HOLAS II 'State of the Baltic Sea' report[6] (HELCOM 2018c). Detailed results and method descriptions are available in a HELCOM thematic assessment on economic and social analyses (ESA) (HELCOM 2018b). The use of marine waters analysis describes the contribution marine sectors and activities make to the economy or human welfare, and the cost of degradation analysis identifies the economic benefits forgone if good environmental

[5] See also development work on Cumulative impacts assessment in the Pan Baltic Scope Project (Bergström et al. 2019).
[6] All related reports and data are available at http://stateofthebalticsea.helcom.fi/about-helcom-and-the-assessment/downloads-and-data/.

status (GES) of the marine environment is not achieved. The results of the economic and social analyses for HELCOM HOLAS II, supported and developed through earlier projects[7], demonstrate an example of regional scale ESA in the Baltic Sea area.

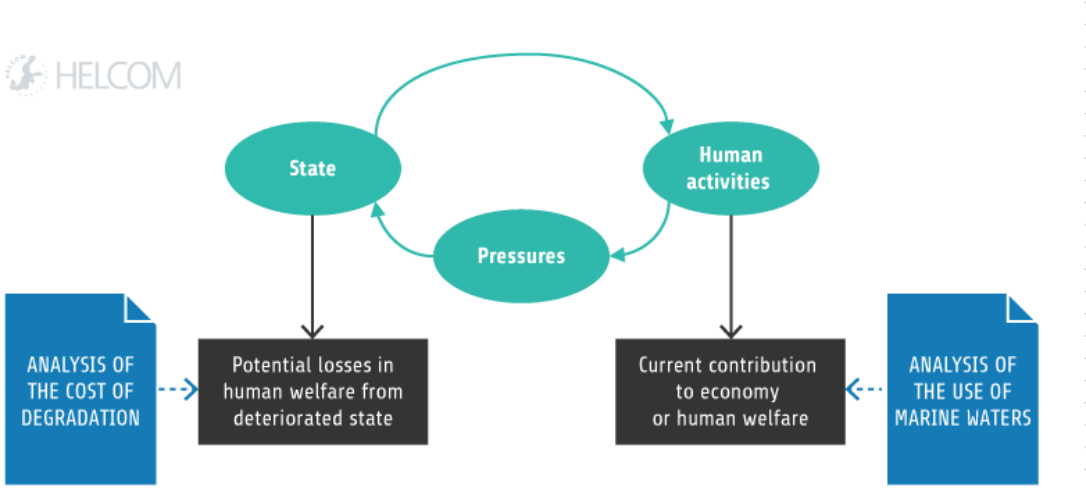

Figure 1. Roles of economic and social analyses and cumulative impact assessment in the holistic assessment of the Baltic Sea. Human activities contribute to the national and regional economies and human welfare, which is measured in the economic and social analysis of the use of marine waters. The state of the marine environment affects human welfare. Welfare losses from not being in a good environmental status (GES) are estimated through the cost of degradation analysis. The environmental status also affects the economic contribution from many activities, such as recreation and fish/shellfish harvesting, as shown in the figure by the feedback link from 'state' to 'activity' (HELCOM 2018b).

In the HELCOM 'State of the Baltic Sea' report, the current contribution of selected activities and services to economy and human welfare are measured using economic indicators for fish and shellfish harvesting, aquaculture, tourism and leisure, and energy production and transport. Potential losses in human welfare if GES is not reached are calculated for eutrophication, recreation and selected aspects of biodiversity, using the thematic approach and the ecosystem services approach within the cost of degradation analysis. Figure 2 outlines the approaches, topics and indicators used in the analyses.

[7] The EU co-funded HELCOM TAPAS and SPICE projects.

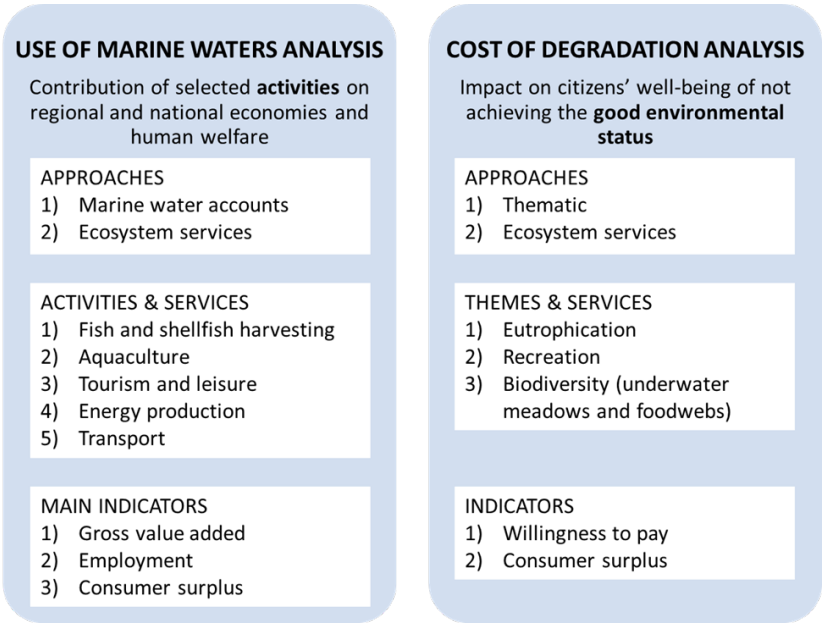

Figure 2. Approaches for the HELCOM regional economic and social analyses applied in the State of the Baltic Sea report (HELCOM 2018b).

3. Assessing the linkages between the sea and society to support MSP

Methods

This report builds on two data sources: 1) a literature review of existing assessment of economic, social, cultural and ecosystem service impacts relevant to MSP, and 2) survey directed to MSP planners and policy-makers to collect data on the current status of assessing these impacts in the Baltic Sea region.

The literature review was conducted by collecting existing peer-reviewed and grey literature via internet searches in 2018 and 2019. Web-based search engines (Web of Science, JSTOR, ScienceDirect and Google Scholar) were used with the following search terms:

> economic and social analyses AND marine planning; maritime spatial planning AND economic; Baltic AND System of Environmental-Economic

Accounting OR SEEA; strategic environmental assessment AND economic AND Baltic; social AND maritime spatial planning; maritime spatial planning AND cultural heritage; ecosystem services AND marine AND spatial; viewshed analysis AND marine.

In total, the searches recovered 348 articles and documents that were further examined by manual reading of abstracts. Documents that described the spatial assessment of economic, social or cultural impacts were deemed relevant. Additional material was found from the references of those documents. Also, literature suggestions from project partners were considered. In total 43 articles or documents were included in the qualitative analysis.

The additional data on economic, social and cultural impacts in national MSP was collected with questionnaire survey. The questionnaires were sent out in two stages: first in 2018 and second in 2019. The contact information from former questionnaires sent within the Pan Baltic Scope project was used for identifying potential respondents, i.e., experts of MSP in the Baltic Sea Region. The survey was conducted via a web-based survey provider, Survey Monkey. The questionnaires were used to find out the utilization of economic and socio-cultural impact data and ecosystem approach in national MSP. The questionnaires can be found in Annex I.

Ecosystem-based approach

Human uses cause pressures on environment and ecosystem services that can be integrated into MSP with the ecosystem-based approach (Reid et. al. 2005). In short, the ecosystem-based approach (EBA) refers to a holistic strategy for accounting for the complexity of the ecosystems and their relationship with the socio-economic systems. EBA focuses on preserving the marine ecosystems and ecosystem services in order to support human needs (Ansong et. al. 2017). It provides spatial tools to marine area management, aiming at the good environmental status and sustainable use of marine resources.

Economic and social analyses are needed to fully apply the EBA and to implement ecosystem-based management in the Baltic Sea – a fact that is also recognized by the HELCOM Contracting Parties in the HELCOM Ministerial Declaration of 2018[8].

[8] Declaration of the Ministers of the Environment of the Baltic Coastal Countries and the EU Environment Commissioner, HELCOM Brussels Declaration 2018 is available at: http://www.helcom.fi/Documents/HELCOM%20at%20work/HELCOM%20Brussels%20Ministerial%20Declaration.pdf

Importantly, the ecosystem approach not only considers dynamics within an ecosystem but also the linkages between the ecosystem and human society. The EBA considers humans as an integral part of the ecosystem, since humans derive benefits from the services provided by the ecosystem and also act as a driver influencing the ecosystem (Levin et al. 2009). The aim of the approach is to manage human activities in a way that ensures the sustainable use of marine areas (HELCOM and VASAB 2010). Economic and social analyses are needed to assess the interaction between ecosystem and socio-economic system (HELCOM and VASAB 2016). Moreover, adoption of the EBA requires knowledge of the complex linkages between natural capital, referring to both living elements, such as fish and algae, and abiotic elements, such as sand and gravel, and the flows of interaction of these components (Levin et. al. 2009).

According to the MSPD, ecosystem-based approach should be applied to MSP in order to promote sustainable growth of maritime economies, sustainable development of marine areas and the sustainable use of marine resources (EU 2014). In addition, HELCOM and VASAB have listed the ecosystem service approach as one of the key principles of MSP (HELCOM and VASAB 2010). The aim is to ensure that good environmental status can be maintained and the capacity of environment to handle human uses is not exceeded (EU 2014). The approach is crucial for protecting and enhancing the environment and sustaining the provision of the ecosystem services. It enables ecological, economic and social sustainability of marine areas (Foley et. al 2010). With the approach, interactions between ecosystems and human uses can be integrated to decision-making and planning to maintain the sustainability the marine areas (Buhl-Mortensen et al. 2017). According to European commission (2019 a) integration of ecosystems into marine policies is important because it can help decision makers to define critical areas for the regulation.

Ecosystem-based approach is essentially a problem-solving framework, which starts with identifying the management problem, followed with identifying ecosystem services provision and social, economic and politico-cultural contexts and their definition in terms of scale (Nahuelhual et al. 2017). Chosen services are then modelled, mapped and valued, and in the end management options and their opportunity costs are analysed via scenarios of future states and/or policy interventions.

Economic and socio-cultural impacts

Multiple economic, ecological and social benefits can be achieved with ecosystem-based MSP (IOC-UNESCO 2019). Apart from some ecological changes, they may be difficult to measure. Sea areas have a significant economic role since they offer functions for

maritime trade and transport, food, materials and energy, as well as tourism and recreation (Tarviainen et. al. 2015). The field of blue economy, including all marine-based economic activities, offers as many as 4 million jobs and generates a gross added value of almost €180 billion annually in EU (European commission 2019 b). Particularly marine transport, coastal and maritime tourism, ship building and fisheries have a great monetary value and a significant role in employment. Economic impacts in MSP include both direct and indirect effects (European Commission 2011). The direct impacts are related to shorter and cost-efficient administrative procedures, reducing transnational costs, improving climate investments and finding optimal locations for economic activities. Combining different activities on the sea area and efficient use of resources and space can also be seen as the benefits of MSP (European Commission 2011; IOC-UNESCO 2019).

The socio-cultural impacts in MSP are very multifaceted (MCKinley et. al. 2019). They include perspectives of human society like attitudes, values and behaviours. Also, structures of the social organisations and communities are related to socio-cultural impacts. Scholte et. al (2015) define socio-cultural values as the importance of ecosystem services that people obtain as individual or group values. McKinley et. al (2019) have discussed the socio-cultural aspects of MSP. According to their list, the socio-cultural impacts include cultural ecosystem services, understanding of the benefits of the sea on human life, marine citizenship, attitudes, well-being, human activities, social values and sociodemographic phenomena such as mobility, equity and migration. Also, public access in marine areas can be seen as one aspect of social impacts in MSP (Swedish Agency for Marine and Water Management 2018). The concept of cultural impacts in MSP is very close to the social impacts (Gee et. al. 2017). The social impacts refer to wider scale social values, while cultural impacts are more related to the wellbeing and identity of local people.

Also, the concept of cumulative impacts is central to impact assessments. In Pan Baltic Scope project cumulative impacts are defined as “impacts on the environment that result from several human activities and pressures acting together, as caused by past, present or any possible foreseeable actions within the project or work task to solve”. The impact assessment helps to evaluate combined effects of human activities on the environment. The impacts are assessed on the specie and habitat scales and transboundary issues are also considered (Bergström et. al. 2019[9]). Concept of

[9] See also development work on Cumulative impacts assessment in the Pan Baltic Scope Project (Bergström et al. 2019).

cumulative impacts is central to this report also since it combines social, economic and environmental impacts in MSP and helps to integrate the impacts into decision making.

Ecosystem services

The concept of ecosystem services enables identifying and quantifying the link between human welfare and the marine environment (Nahuelhual et al. 2017). Thus, it can be considered as one of the ways to operationalize EBA. Ecosystem services provide goods and benefits that are directly or indirectly consumed or enjoyed by people. The services are produced through processes of ecosystems and the interaction between abiotic and biotic environments. They can also be seen as contributions of ecosystems for human well-being. The key to defining the concept is the final output from ecological system that people consume for their well-being (MEA 2005; Haines-Young & Potschin 2011). It is important to note that the components of the ecosystem services cascade become services only if there are people who benefit from them (EEA 2015).

According to three most commonly used ecosystem service categorization frameworks (MEA, TEEB and CICES[10]), ecosystem services can be divided into three categories: provisioning, regulating and cultural services (Figure 3) (MEA 2005; TEEB 2012a; CICES 2019). Provisioning services refer to products obtained from ecosystems, including the material and energy outputs. Regulating services cover the benefits that ecosystems provide by acting as regulators of the environmental events. The nonmaterial benefits obtained from ecosystems are called cultural services. The cultural ecosystem services are tightly bound to human values, such as recreation, aesthetic experiences, spiritual enrichment, cognitive development and non-use/existence values of the environment. In addition, the classifications sometimes separate supporting or maintenance services, which form the basis for all other ecosystem services. Supporting services includes all the ecosystem processes that characterise ecosystems and facilitate final ecosystem service outputs (MEA 2005; TEEB 2012a; CICES 2019).

[10] Millennium Ecosystem Assessment (MEA), The economics of ecosystems and biodiversity (TEEB) and Common international classification of ecosystem services (CICES).

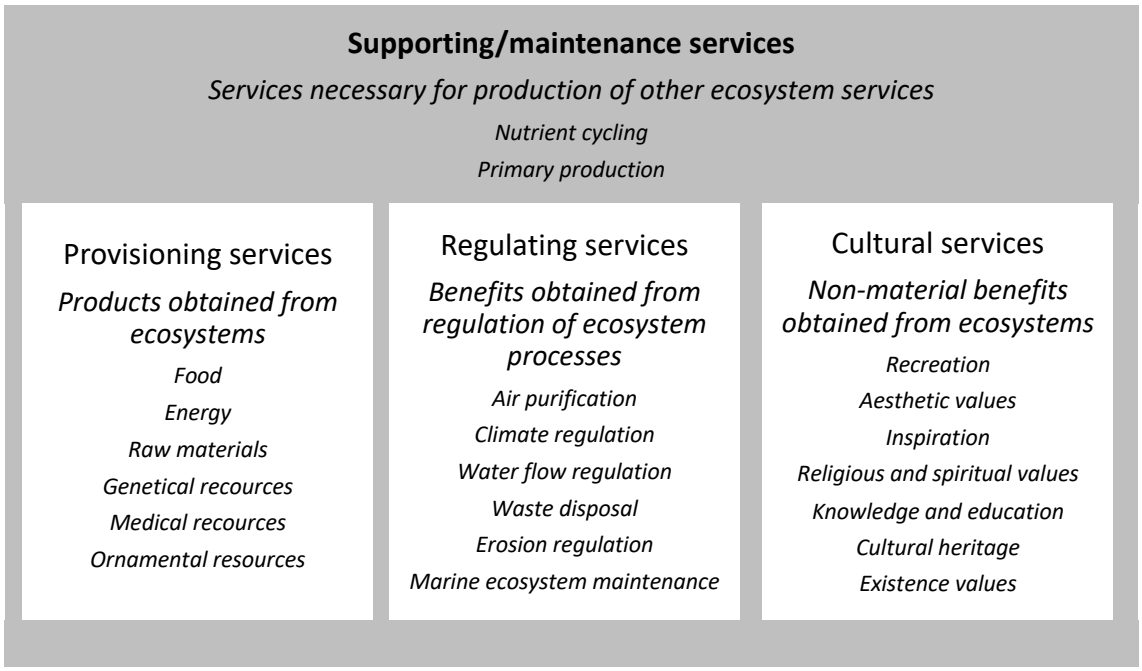

Figure 3. Marine ecosystem service classification (based on MEA 2005 and Böhnke-Henrichs et. al. 2013)

Ecosystem services can also be classified based on the process behind the service production and their link to human well-being into intermediate and final services (Fisher et. al. 2009). The intermediate services are products of complex interactions of ecosystem processes. They include mostly supporting and regulating services, such as water cycling, primary production and water quality regulation (Jones et. al. 2011). Final services are directly linked to human welfare and produced through the interaction of intermediate services (Boyd & Banzhaf 2007, Fisher et. al. 2009). The final services cover mainly cultural and provisioning services, but also some regulation services (Jones et. al. 2011) since the difference between two classes is not always clear (Boyd & Banzhaf 2007). The division for intermediate and final services is important because it helps to avoid double-counting of the value of ecosystem services.

A conceptual approach for incorporating ecosystem services to MSP developed by Ivarsson et al. (2017) requires spatial analyses in order to identify the areas, which deserve special attention in planning and management. However, practical applications of ecosystem services concepts are rare in marine planning and management, although research on the topic already exists and the need to implement the concept in a spatial context has been identified (see e.g. ICES 2017a). Currently, the availability of spatial data limits the use of the approach in MSP. Also, the complexity of the system brings difficulties in the practical applications.

Ecosystem services can be integrated to MSP as part of the ecosystem-based approach. Stithou (2017) has reviewed the use of socio-economic inputs in ecosystem-based MSP processes covering socio-economic objectives, their indicators, stakeholder engagement, and the data, methods and tools for such processes. The review emphasizes the role of economic valuation in assessing ecosystem services as a tool for integrating the ecosystem approach into marine planning and management. According to European commission (2019 a) ecosystem services need to be integrated in early phase of MSP. In this way they can become part of the policy formation and later be changed into concrete measures. Moreover, ecosystem services need to be mapped and ecosystem assessment tools can be used in decision making. These findings, together with the recommendations developed under the HELCOM SPICE project, support the need for a deeper analysis of ecosystem services, as described in this report.

Applying the concept of ecosystem services to marine policies brings multiple advantages (Börger et al. 2016). It can help to assess trade-offs between the provision of different service and support the mapping in the provision of ecosystem services spatially. It also creates a classification to the services which can reduce the risk of double-counting of services. Moreover, the classification facilitates value transfer. The valuation of ecosystem services is crucial for marine policy since it can help to quantify both direct and indirect benefits of ecosystem services to human well-being (Austen et. al. 2019). There are still multiple development needs related to ecosystem valuation. In the future ecosystem service valuation should be integrated into marine management practises and legislation, standardized valuation system and open data bases for valuation need to be created and cross border cooperation and new Natural capital accounting system need to be developed.

In relation to maritime spatial planning, identification and valuation of ecosystem services can provide various types of information to support policy decisions (see e.g. Börger et al. 2014), including:

- Revealing the (relative) importance of different sea uses and ecosystem services in economic and social terms (e.g. revenue, employment, recreation and existence values)
- Highlighting hidden environmental and ecosystem service values (in addition to commercial/market values)
- Revealing trade-offs (and synergies) between marine uses, activities and ecosystem services

- Enhancing public participation in the planning through valuation of ecosystem services

- Enabling comparisons of the benefits and costs under alternative planning solutions at national, regional and local levels.

The ecosystem services concept is rarely applied in MSP and Böhnke-Henrichs et al. (2013) argue that this is due to the difficulties in systematic classification and assessment of marine ecosystem services. They propose a marine-focused ecosystem services typology to go beyond the limitations of terrestrial-focused typologies. In addition, while the benefits of valuing ecosystem services for MSP are recognized, it is not clear when and where to valuation should be used (Börger et al. 2014). According to Hanley et al. (2015), economic valuation is only rarely put into use in the actual management due to lack of scientific knowledge on key linkages in the valuation framework, a lack of relevant economic valuation studies, and methodological problems in applying valuation methods to marine issues. Since many of the ecosystem services provide benefits that are not realized in the markets, valuation of non-market benefits is central to form a comprehensive understanding of the economic value of marine ecosystems.

The use of ecosystem-based approach in MSP was explored in the case study of Latvia (Veidemane et. al. 2017). In Latvia, marine ecosystem services were mapped and assessed and the proposals for possible spatial locations of sea area uses were evaluated. The ecosystem-based approach was found to be a tool for address complex socio-ecological systems. However, Veidemane et. al. (2017) observed multiple challenges in relation to the use of ecosystem-based approach. The time limitations of the planning process and lack of expert knowledge created challenges for ecosystem mapping and assessment. There were also lack of monitoring data for ES assessment and difficulties for defining appropriate spatial units for exploring the multi-dimensional and unstable marine environment.

In addition to the Latvian case, The Baltic Sea region is comparatively well represented by economic valuation studies of the environment and ecosystem services (see e.g. Söderqvist and Hasselström 2008). Nevertheless, Sagebiel et al. (2016) refer to the need of a more coordinated approach to economic ecosystem services assessments in the region. The paper presents four major knowledge gaps within the Baltic Sea valuation studies:

1. Most Baltic Sea marine ecosystem services[11] have only rarely been the subject of economic assessment, except for reduction of eutrophication and recreation.

2. The number of valuation studies conducted among Baltic Sea countries is imbalanced – Eastern European countries are generally less represented compared to Nordic countries.

3. The interactions between ecosystem services have not been fully considered in the studies. Nearly all studies analysed neglect the combined effects of ecosystem services.

4. The variation in existing estimated values calls for comparable primary studies as well as a more unified valuation framework within the Baltic Sea region.

Recently, efforts have been made to fill in the above-mentioned knowledge gaps. For example, Lai et al. (2018) have modelled the marine ecosystems and fish provisioning services for herring, sprat and cod while also considering the ecosystem's capacity to provide these services. Ericsdotter et al. (2013) highlight the importance of new valuation estimates in order to be able to prioritize among available management options. The need for coordinated efforts and approaches on valuing changes in the environment and provision of ecosystem services in the Baltic Sea region has been noted also by HELCOM in economic and social analyses for the 'State of the Baltic Sea' report (HELCOM 2018a, HELCOM 2018b) and in the HELCOM SPICE project (HELCOM SPICE 2018b).

The concept of ecosystem services is closely linked to multi-objective decision making when it comes to evaluating trade-offs in the delivery of ecosystem services. The trade-off analysis approach is one way to integrate multiple ecosystem services into the planning process (Lester et. al. 2013). It can also help to reduce conflicts in the use of marine areas, manage marine resources and consider biophysical constraints (King et. al. 2015). However, there are some challenges related to the trade-off analysis, including the need of comprehensive introduction to the participants and the effectiveness being dependent on the willingness of participants. A trade-off analysis approach has a possibility to find unsuitable managing options, reveal the benefits of planning multiple services simultaneously and recognize the cooperation possibilities. It is important to

[11] As categorized by HELCOM (2010).

note that ecosystem services may interact with each other in multiple ways, which results in different types of trade-offs and management implications (Lester et. al. 2013).

The approach for analysing the relationship between human actions and ecosystem services was developed in HELCOM SPICE (2018a) project. The approach uses the ecosystem service list by Byhn et. al. 2015 where the services are listed based on their groups and statuses in different marine areas. According to HELCOM SPICE approach the relationships can be assessed with two methods. The direct method is based on expert judgement with refined assessment scale. The indirect method uses conversion factors based on existing knowledge and the sensitivity of the service is considered in the assessments. The indirect method has more potential because it considers the location, extent and dynamism of the services[12]. The direct method is highly dependent on the experts, but it can be used if there is a lack of data sets for indirect method.

Economic and socio-cultural impacts in conflict reduction

A key advantage of MSP is that it can make economic trade-offs in resource use and stakeholder values spatially explicit and can account for direct and indirect inter-sectoral interactions. Quantifying trade-offs in monetary terms improves transparency in decision-making, helps to avoid unnecessary conflicts and helps to identify synergies to focus planning, management and research efforts on finding the best possible ways to mitigate trade-offs while maximizing sectoral interests as well as creating ground for co-existence of multiple uses (TEEB 2012b). Two types of spatial conflicts between sea uses can appear; user-environment conflicts, and user-user conflicts (Ehler and Douvere 2009). User-user conflicts arise when multiple sectors, e.g. fisheries, tourism and energy, use marine resources at the same time and in the same space. User-environment conflicts are conflicts that occur between human uses and the marine environment, for example depletion of natural resources, pollution and destruction of habitats. These conflicts weaken the ability of the sea to provide the necessary ecosystem services and inevitably have an effect on the human welfare. Synergies can be defined as mutually beneficial uses of the sea space or marine resources, or shared infrastructure, technology or human resources (ICES 2018).

Quantification of economic impacts and assessment of socio-cultural impacts can strongly support achieving the holistic view required in MSP within the Baltic Sea region. Socio-economic information can be used as a basis for the stakeholder involvement, conflict resolution and synergy development. Suman (2001) have noticed the lack of

[12] See also example case study applied by Bergström et al. 2019.

stakeholder participation is one reason behind the conflicts. Kannen (2012) argues that conflicts can be reduced with integrated approach of MSP. Especially social approach is needed since people have different values, attitudes and expectations for the sea (Kannen 2012). On the other hand, conflicts can also be identified through this kind of approach. The economic and social data is also needed to estimate the impacts of existing conflicts. The conflicts have negative economic and social impacts on local people (Suman 2001). MSP offers tools to solve the conflicts which might promote social sustainability including equality, local control over marine resources and local leadership. Moreover, the conflict resolution can maintain cultural diversity and public health and increase participation on decision making.

4. Existing methods and tools for assessing economic, social and cultural impacts

Existing literature was reviewed to obtain a comprehensive view on the current approaches and results related to the assessment of economic and socio-cultural impacts in maritime spatial planning. The following gives a brief introduction to the various economic, social and cultural impacts from maritime spatial planning, and existing methods and tools for assessing them. The tables presenting examples of existing models, frameworks and assessments for economic and socio-cultural analysis used in MSP in Baltic Sea and other sea areas are included in Annex II.

Economic impacts

Marine environments provide substantial benefits to people, accruing from the use of the marine environment and ecosystem services, i.e. provision of seafood and other marine resources, regulation of the climate and the modulation of biogeochemical cycles, maintenance of water quality and support of cultural and aesthetic uses (Börger et al. 2014). Moreover, the marine environment offers possibilities for economic activities such as maritime trade and transport, tourism and fisheries (Tarviainen et. al. 2015). These activities have a significant impact on the economy and employment.

When assessing the monetary values of these services it is important to keep in mind that prices for some provisioning services are determined in markets, and to some non-market services, like the water purification market, such direct mechanisms do not exist,

and thus the prices/values need to be detected using economic valuation methods (Börger et al. 2014). As the global environmental pressures and broadening human uses cause degradation to marine environment, the need to understand the benefits of marine ecosystems in economic terms is urgent. Since MSP aims to allocate space to a range of users and co-producers of the services provided by the sea, it is useful to understand complex interactions that generate trade-offs in the delivery of ecosystem services. A trade-off analysis reveals inferior management options, highlights the benefits of managing multiple, interacting services over managing single services, and identifies sets of services that may provide win-win management options.

Definitions of economic measures

The economic impacts of MSP are mainly measured in monetary terms. In the literature, economic impacts are defined imprecisely, and the term is used in varying contexts. For this reason, the definitions of the central economic concepts are provided below, using HELCOM (2018b) as the main source.

Economic impact represents the economic contribution from an activity to the economy. It can be expressed, for example, in terms of value added, which shows the contribution of a sector to the national economy from a macro-economic perspective, or in terms of some other monetary indicator that shows the contribution of the sector to the economy, such as annual turnover of the sector. Economic impacts are widely used for assessing the economic importance of marine activities and sectors mainly because they can easily be measured and extracted, for example, from the national accounts. However, strictly speaking they do not provide information on the economic values.

Economic value is the contribution of a resource or good to the well-being of an individual or the society and can be measured in terms of people's willingness to pay (WTP) for the good. Since willingness to pay is not equal to the market price, economic value is not the same as market price (and thus statistics based on market prices measure other constructs than economic value).

Assessing economic impacts and values starts with acknowledging the existence of externalities. An external effect, i.e. externality, is present when the utility of an individual is dependent upon an activity, which is not under their control, and is not transmitted through market prices (see e.g. Coase 1960 and Buchanan and Stubblebine 1962). The cost of an externality implies a negative externality, whereas the benefit of an externality implies a positive externality. The market output of positive externalities

is usually lower and output of negative externalities is higher than what is considered optimal from society's point of view. Externalities are relevant for conflict resolution in MSP, since the presence of a conflict usually means that the costs and benefits of externalities occurring are not considered in decision-making.

Methods to assess economic impacts to support MSP

This section gives a short introduction to the methods for applying the ecosystem approach to support MSP. All the methods listed can be used for trade-off assessment and spatial analysis. The methods are listed in Table 2 and a short introduction to them is given in the following sections.

Table 2. Methods and tools applicable for assessing the economic impacts in MSP

Method	Examples of Baltic Sea applications	Impacts assessed	Spatially explicit
Cost-benefit analysis	Hyytiäinen et al. 2015	Spatially explicit costs and benefits of nutrient abatement for the Baltic Sea	YES
	Bertram et al. 2014	Methodology for systematically identifying, analysing, categorizing, and monetizing the benefits of marine protection measures and costs and benefits of eutrophication and marine litter in German marine waters	NO
	Börger et. al. 2016	Cost-benefit analyses to support the preparation of the national Programmes of measures for the MSFD	NO
Cost-effectiveness analysis	Ahlvik et al. 2014	Spatially optimal nutrient abatement measures, effectiveness and costs of agricultural measures and improvements in the capacity of waste water treatment	YES
	Oinonen et al. 2016b	Least-cost set of measures of the Finnish Programme of Measures for reaching the targets of the EU MSFD	NO
Economic valuation of the environment	Ahtiainen 2016	Benefits of reduced eutrophication in the Baltic Sea	NO
	Czajkowski et. al. 2015	Benefits of recreational values of Baltic Sea estimated by travel costs	NO

Method	Examples of Baltic Sea applications	Impacts assessed	Spatially explicit
	Kulmala et. al. 2012	The cultural importance of Baltic salmon measured with public spending for habitat restoration and WTP.	NO
Environmental-economic accounting	Lai et al. 2018	Ecosystem accounts for marine ecosystems and fish provisioning services including ecosystem asset, ES supply and use, capacity and ES flows and ecosystem monetary asset accounts	NO
Environmental impact assessment (EIA)	Valve and Oinonen 2015	Effectiveness of the Finnish Programme of Measures for reaching the targets of the EU MSFD	NO
GIS-tools to assess spatial impacts	PlanWise4Blue 2019	The GIS-based online tool to create integrated model of spatially overlapping economic and cumulative impacts	YES
Valuation of economic impacts from activities based on prices/statistics	HELCOM 2018b	Socio-economic contribution from the use of marine waters in the Baltic Sea Region	NO

Cost-benefit analysis

Cost-benefit analysis is a tool for quantifying and comparing the costs and benefits of alternative policies and interventions in monetary terms. For example, the cost and benefits of alternative MSPs could be calculated and compared. However, the understanding of complex changes within marine ecosystems is required to infer the impact on the provisioning of ecosystem services and to evaluate and monetize the impact on social and economic benefits, and missing information makes performing reliable cost-benefit analysis a challenging task. In order to support achieving the central objectives in MSP, of balancing sectoral interests, sustainable use of marine resources, and maintaining GES of the sea, an understanding the complex human-ecological marine system is critical.

In the Baltic Sea, Bertram et al. (2014) have conducted a cost-benefit analysis, as required in the MSFD, and provide a spatial comparison between two scenario locations, defining the following solutions to the challenges in conducting cost-benefit analysis:

1. Closing the existing data gaps to allow for comprehensive and full monetization of costs and benefits of measures.

2. Improving the data availability to allow for comprehensive analysis without full monetization.
3. Performing cost-benefit analysis based on current data.

The authors state that options 1 and 3 are unlikely in the near future and suggest to follow option 2, to monetize benefits as far as is reasonably possible, and to combine both qualitative and quantitative information. Börger et al. (2016) present a cost-benefit analysis of the Finnish programme of measures within the MSFD. The analysis covers all descriptors of GES.

Hyytiäinen et al. (2015) conducted a cost-benefit analysis of improved water quality in the Baltic Sea, and used a spatially explicit bioeconomic model to assess the effects of nutrient pollution coupled with benefit estimates derived from a valuation study conducted in all the littoral countries.

Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) can be used to reveal the least-cost way of achieving the environmental objective (or alternatively, the largest change in the environment that could be accomplished with given resources). An example of a tool to be used in CEA is the decision support tool Marxan, which is a free software for cost-effective site selection (Ball and Possingham 2000 and Watts et al. 2009). It uses an optimization algorithm and is originally designed to find the most cost-efficient alternatives for suitable marine conservation areas to meet several ecological, social and economic objectives, and can be used for achieving an efficient allocation of resources across a range of different uses. It optimizes an objective function based on user defined targets. In the Baltic Sea, Göke et al. (2018) have used the Marxan tool to find the most suitable wind power sites. The authors did not include any consideration of ecosystem service values, but state that doing so is possible, as is exemplified in a land-based study related to wind power production by Egli et al. (2017). Ahlvik et. al. (2014), for their part have analysed the economic and ecological consequences of nutrient abatement in the Baltic Sea. They have combined the marine model with catchment model in order to identify the cost-efficient solutions to nutrient abatement.

Economic valuation of the environment

Economic valuation of the environment or ecosystem services reveals how changes in the marine environment impact human well-being. As the value of environmental changes cannot often be observed from markets or prices, environmental valuation methods have been developed for this kind of analysis. In MSP, these methods can be

used to assess the economic value from the changes in the ecosystem or provision of ecosystem services resulting from spatial planning, both related to the use of the marine environment (e.g. recreation) or existence and status of species and habitats (e.g. existence values). For example, establishing marine protected areas (MPAs) may improve biodiversity and ecosystem health and thus increase existence values.

In the Baltic Sea region, several valuation studies of the marine environment have been conducted (e.g. Kosenius 2010, Czajkowski et al. 2015, Ahtiainen et al. 2016), with main focus on changes related to eutrophication and recreation. The results of these studies could be used when assessing the economic impacts of environmental changes from MSP.

Environmental-economic accounting, i.e. ecosystem accounting

Ecosystem accounting is a systematic statistical framework for integrating environmental-economic indicators to the national statistical accounts, and covers both the system of environmental-economic accounting central framework (SEEA) and the SEEA experimental ecosystem accounting framework (SEEA-EEA). Ecosystem accounting can be used to assess the current contribution of ecosystem services in the national accounts, however the method cannot be used for analysis of future states. Three types of ecosystem accounts can be used: 1. *Accounts for ecosystem assets* to show the size, condition and value of an ecosystem or assets connected to it, 2. *Accounts for ecosystem capacity* to show the ability of an ecosystem to sustainably provide ecosystem services, and 3. *Accounts for ecosystem services* to record the actual ecosystem services flows from ecosystem assets to humans and economic sectors (Lai et al. 2018).

Spatial data is required in order to map and assess the value of ecosystem services in the national accounts, which makes the method relevant from the MSP perspective. The framework has been applied in the terrestrial spatial planning (see e.g. Ovando et al. 2017), and applications in the marine environment are currently emerging (see e.g. Lai et al. 2018).

Environmental impact assessment (EIA)

If maritime spatial plans are likely to have significant effects on the environment, they are subject to the EU strategic environmental assessment (SEA) directive, which applies to a range of public plans and programmes. Environmental impact assessment and strategic environmental assessment (EIA-SEA) is an example of a method for integrated assessment of environmental, social and economic considerations within MSP planning.

The most common method of predicting economic impacts in EIA-SEA is the national income and employment multiplier, whereas social impacts are often described with demographic information such as changes in population numbers (Abaza et al. 2004). The methods used for estimating socio-economic impacts in EIA-SEA provide a limited picture of the welfare provided by MSP as they do not assess the total economic value, and thus exclude many aspects of human welfare, such as the cost of degradation and value of ecosystem services. However, since the SEA protocol of the Espoo Convention obliges its Parties to assess the environmental impacts of plans and projects entailing possible trans-boundary impacts at an early planning stage, the method has the advantage of increasing the trans-boundary cohesion and cross-border cooperation. Experience from Finland suggests that building a connection between EIA and cost-effectiveness analysis is an important step forward to assess the effectiveness of measures within the MSFD (Valve and Oinonen 2015).

Valuation of economic impacts from marine activities based on prices/statistics

MSP may result in changes in various sea uses and subsequently their contribution to national economies and employment. These changes can be evaluated in monetary terms based on relevant statistics and market prices to assess the contribution of the sea uses to the economy and human welfare under different scenarios or spatial plans. There are several possible socio-economic indicators to describe the importance (or economic impact) of the activity or sector present in the marine environment, such as (gross) value added and employment. These illustrate their economic importance and benefits derived from different sea uses. Assessing the value of some sea uses, such as coastal and marine recreation, is difficult or impossible based on statistics or prices, and thus economic valuation methods are needed (see iii).

The HELCOM 'State of the Baltic Sea' report (HELCOM 2018a, HELCOM 2018b) presents analysis of the economic contribution from selected marine activities (fish and shellfish harvesting, aquaculture (marine), tourism, recreation, renewable energy generation transport infrastructure and shipping) to the economy in terms of gross value added and employment. Thus, the assessments covered partly the social impacts (employment). Some of the activities could not be described using monetary indicators due to lack of data, and the analysis was not spatially explicit, although it was country-specific.

Socio-cultural impacts

Given the difficulties in defining social and cultural dimensions (see e.g. Lehtonen 2004 and Gee et al. 2017), and the fact that these two are commonly mixed in the literature,

we present the findings of the literature review regarding social and cultural impacts of MSP jointly.

Socio-cultural impacts of MSP can be expressed with several proxy indicators. Traditionally, employment is used to measure the social impacts of a human activity. More recently, mappings of socially or culturally important sites and classifications of cultural ecosystem services have emerged to develop the evidence base for further socio-cultural assessments. An example of the diverse definitions of social impacts is found in Blau and Green (2015), who highlight stakeholder engagement, empowering native peoples and public commitment to marine research as the main social outcomes of MSP.

Although human dimensions of the marine environment are recognized as important to include into planning and decision-making, the social geography of the oceans is mostly overlooked and only few data layers of social information exist. Kenter et al. (2015) argue that social valuation of ecosystem services and policy alternatives is one of the greatest challenges facing ecological economics today. A common way to present the human dimension is to simply list human activities, where possible giving monetary values for their economic or social impact, while the processes related to community building and territorial identity, connections across communities and economic sectors, cultural perception of space, as well as the varying scales of society are largely dismissed. Culture and the marine environment are closely linked, consequently environmental degradation can cause changes in culture, which are often perceived as negative (Fletcher et al. 2014). Vice versa, the use of culturally significant sites may cause environmental degradation (Blake et al. 2017). However, producing spatial data for cultural values is a challenge since these values are abstract and difficult to extract and quantify (Blake et al. 2017).

In the MSPD, the identification of underwater cultural heritage, i.e. underwater remains of human activity, is required. The Member States have applied a wide interpretation of the cultural impacts and the identification of cultural sites is not only limited to underwater cultural heritage, thus in this review a wide interpretation of cultural impacts covers both cultural ecosystem services (CES) and coastal heritage in addition to underwater cultural heritage. This is also in line with ecosystem approach that covers the CES. In 1998, The Baltic Region Heritage Committee[13] was founded to promote the

[13] More information on Baltic Region Heritage Committee can be found via: http://baltic-heritage.eu/

potential of cultural heritage as a strategic resource for the region by focusing on the intrinsic value of cultural heritage and its sustainable management.

Development of comprehensive maritime spatial plans requires consideration of all aspects of value associated with marine biodiversity, covering both extractive and non-extractive uses of marine biodiversity. The tendency to highlight extractive uses can be due to lack of information on the value of non-extractive uses of marine biodiversity. Cultural values belong to the category of non-extractive uses, which are equally or significantly more valuable than the extractive marine uses (e.g. Ruiz-Frau et al. (2013)). Cultural ecosystem services are also frequently indirectly impacted in trade-off situations as shown in mostly land-based spatial planning cases analysed in Turkelboom et al. 2018. In a Japanese study, the cultural ecosystem services were found to be perceived least indispensable when compared to provisioning, regulating and supporting services, but to have the most influence on residents' behavioural intentions for marine conservation (Wakita et al. 2014).

Cultural ecosystem services (CES) can be regarded as cultural impacts derived from the use of marine environment or from the mere existence of the marine environment. Until recently, a majority of cultural CES studies has focused on recreation, and it is almost the only CES which has been widely studied (Fletcher et al. 2014). In the Baltic Sea, the CES have been defined e.g. in the BONUS BALTICAPP project (BONUS BALTICAPP deliverable 2.3 2016) Globally, there are some assessments of CES (see e.g. Nahuelhual et al. 2017 and Fletcher et al. 2014). Although the importance of cultural ecosystem services is theoretically addressed in the literature, cultural resources have been mostly overlooked in the management plans. This may lead to loss of cultural identity associated with these ecosystems, e.g. decrease of tourism, recreational and educational opportunities; decline in local ecological knowledge, skills and technology and loss of opportunities for social and cultural capital (Khakzad et al. 2015). There are also opposite opinions of the relationship between cultural ecosystem services and cultural impacts. Scholte et. al. (2015) have defined them conceptually different from each other. According to them, cultural ES refer to non-material and spiritual values whereas social and cultural values also include the material well-being that comes from provisioning and regulating services. Cultural ecosystem services of Baltic Sea are listed in Table 3.

Table 3. Cultural ecosystem services applicable to Baltic Sea (BONUS BALTICAPP 2016, deliverable 2.3).

Class	Application to the Baltic Sea
Experiential use of plants, animals and land-/seascapes in different environmental settings	Bird watching, diving, snorkelling
Physical use of land-/seascapes in different environmental settings	"beaching", walking, hiking, boating, angling, hunting, bird watching, photographing
Scientific and other knowledge formation	Ecological, social and cultural research on Baltic Sea environment, other "hobby" based knowledge generation
Educational	Environmental education: literature, lessons, camps, excursions
Heritage, cultural	Literature on culture of Baltic sea, museums, ruins, cultural landscape
Cultural diversity	Diversity of local livelihoods (e.g. fishing, tourism, handicrafts) affected by ecosystems
Entertainment	TV programmes, multimedia, literature on Baltic sea
Aesthetic	Paintings, music, performances inspired by the Baltic Sea ecosystems
Social	Diving, fishing, boating, bird watching communities, social relation related to research, environmental actions (nature conservation)
Sense of place	Places such as sea shores, fishing villages that people attach themselves
Symbolic	Charismatic species (seals, fish species, birds) or other objects such as visual image, belief, action that represent, stand for, suggest an idea linked to Baltic Sea environment
Sacred and/or religious	Spiritual, ritual identity, holy places, or sacred plants of animals and their parts
Existence	Enjoy knowing that the site/Baltic sea is existing
Bequest	Other people in my generation are able to enjoy the water quality improvements. Future generations will be able to enjoy the water quality improvements

The methods for assessing the cultural impacts in MSP found in the literature are listed below in Table 4 and a short introduction to the methods in given in the following sections. According to Scholte et al. (2015), the techniques used for collecting socio-cultural values[14] of ecosystem services can be grouped into techniques that collect socio-cultural values by asking for respondents' values in a direct manner, i.e. stated values, and techniques that collect socio-cultural values indirectly by observing behaviour or analysing texts and other types of media, i.e. revealed values.

Table 4. Methods and tools for assessing the socio-cultural impacts in MSP

Method	Examples of Baltic Sea applications	Impacts assessed	Spatially explicit
Questionnaires and personal interviews	Ahtiainen et al. 2019	Cultural ecosystem services provided by the Baltic Sea marine environment	NO
Generic feature mapping	des Clers et. al. 2008	Mapping fishermen's knowledge	YES
Participatory mapping i.e. public participation GIS or volunteered geographic information	BONUS BALTICAPP 2019 Strickland-Munro et. al. 2016	Mapping of recreation visits to the Baltic Sea Mapping social and cultural values and management preferences in Kimberly region, Australia.	YES YES
Observation approaches	Smallwood & Beckley 2012	Identification of recreational fishing activities based on land-based and aerial observation surveys	YES
Document research: Viewshed analysis	Depellegrin 2016	Cumulative visual impacts assessed for shipping, existing or	YES

[14] Scholte et al. (2015) define socio-cultural values of ecosystem services as the importance people, as individuals or as a group, assign to ESs.

Method	Examples of Baltic Sea applications	Impacts assessed	Spatially explicit
		planned offshore wind energy prospects, offshore oil platforms and nature protected areas covering a visibility zone of 223,641 km2 (54 % of the entire Baltic Sea)	
Expert based approach	Ruskule et. al 2018 Gee et. al. 2017	Mapping and assessment of cultural ecosystem services in Latvian coastal areas Identification of culturally significant areas	YES NO
Assessing social capital in the context of ecosystem services	Barnes-Mauthe et. al. 2015	Identification and quantification social capital and other ecosystem service values held in the Velondriake region in Madagascar.	NO

Questionnaires and personal interviews

Questionnaires usually consist of individual rankings of ecosystem service values according to importance. Although the method is costly, and may be hard to apply for complex themes, the use of a survey is a robust technique for gathering large quantitative data sets (Scholte et al. 2015). Unstructured interviews can be used to gain understanding of how and why people value ecosystem services, and provide information about intangible ESs by allowing respondents to talk freely in an interactive manner. In the BONUS BALTICAPP project, surveys conducted in Finland, Germany and Latvia were used to collect detailed information of the importance of cultural ecosystem

services in the Baltic Sea area, focusing on recreation (see e.g. BONUS BALTICAPP 2016, Ahtiainen et al. 2019).

Generic feature mapping

In generic feature mapping, respondents are asked to rank specific landscape or seascape features by using for example photos which are then linked to maps representing the feature. The approach usually focuses on visual preferences. An example of acknowledging the importance of territorial identity and connections among communities is the mapping of 'social landscapes', which are based on local knowledge (Ehler and Douvier 2009).

Participatory mapping i.e. public participation GIS or volunteered geographic information

Tulloch (2008) has defined public participatory GIS (PGIS) as "field within geographic information science that focuses on ways the public uses various forms of geospatial technologies to participate in public processes, such as mapping and decision making". It is used to community empowerment, foster social identity and build social capacity (Brown & Kyttä 2014). Today it is mostly used in developing countries where the data Is collected collectively in community workshops as non-digital format. The public participation GIS (PPGIS) refers to more developed participatory mapping that enhances public involvement to inform land use planning and management. PPGIS data is normally collected in digital format with web-based surveys in developed countries (Brown & Kyttä 2014).

Participatory mapping techniques that are based on individual interviews or questionnaires can be effective in revealing benefits and values associated with CES (Martin et al. 2016), and the technique is widely used. In this approach, respondents point out locations where certain values can be found. This can be done for example by placing dots on areas that are considered valuable or on areas where the respondents enjoy cultural services, for which the spatial familiarity is necessary. Most of the reviewed studies in Scholte et al. (2015) used participatory mapping to assess spatial values of how socio-cultural values were related to specific locations, which resulted in value hot-spots.

There are many ways to communicate and interact with participants. To estimate the monetary value of cultural ecosystem services, for example photo manipulations, i.e. photo-realistic montages, can be used to illustrate likely landscape changes (vanBerkel and Verburg 2014). This approach does not require spatial familiarity, and is thus

practical for estimating recreational values. To communicate scientific research for general public in order to use it as the basis for sound planning and management, ArcGIS based 'story maps' can be used to express the spatial data as has been done under BONUS BALTICAPP project. In the project, story maps for Recreation in the Baltic Sea under Climate Change and Ecosystem Services and Climate Change in the Baltic Sea have been published.

Observation approaches

In observation approaches, values are derived by directly looking at people's actions and behaviour. The approach has mostly been used in connection with recreation values, for example to derive the recreational importance of an area via observations of the number of visits.

Document research: Viewshed analysis

In document research the values of individuals, groups or the wider public is approximated by looking at texts, images, or other forms of media. This approach allows quantitative analysis of a large sample (Scholte et al. 2015). Viewshed analysis is used to determine locations visible to an observer in all directions (Line of sight… 2018). The analysis is carried out with GIS applications and outputs a map of visible and non-visible areas of surroundings.

Depellegrin (2016) has used this analysis to map the visuality zone that might be affected by existing or planned coastal activities. The tool also allows the classification of the visibility zone due to their cumulative viewshed characteristics. This approach is a useful tool for the ecosystem trade-off analysis, especially when recreation and landscapes or seascapes are in focus. Griffin et. al. (2015) have used the tool in practice by analysing the visibility zone of offshore wind farm in Northeastern United States. He created two models to describe the wind energy value and the visibility of the potential windfarms on surrounding areas to find the best locations for windfarm. The visibility is measured in viewer days that refers the sum of the days that all the viewers can see the windfarm. The viewshed analysis is based on the elevation of the area. The best possible location can be found on the areas with highest wind energy value and the lowest viewer days.

Expert-based approaches

In expert-based approaches, experts can be asked to express their own values or can be asked to provide information about the values of others. The advantage of using this approach is that the experts are usually familiar with complex jargon and technical issues surrounding the topic. However, experts are driven by their personal experience and

knowledge, and the values shared by the wider community may not be expressed in the expert-based approach. Especially intangible values, such as sense of place, may be challenging to assess via this approach. The approach is used in MSP in Baltic Sea region since Latvian expert knowledge-based mapping tool was used to map the regulating and maintenance services (Ruskule et. al. 2018). Gee et. al. (2017) have also used expert knowledge-based data with different method. They used workshop discussion in order to map cultural ecosystem services.

Assessing social capital in the context of ecosystem services

Social capital is recognized as an important contributor to human welfare, and the connection between social capital, human well-being, and environmental sustainability has been studied recently (see e.g. Costanza 2000, Lehtonen 2004 and Howarth and Farber 2002). Social capital can be defined as the individual and collective benefits embedded in relationships between people and communities. A novel approach is to consider social capital in the context of ecosystem services, however few ecosystem service assessments and economic valuations have analysed it (Barnes-Mauthe et al. 2015). Barnes-Mauthe et al. (2015) argue that social capital and ecosystems are linked since strong social bonds can enhance ecosystem services flows by facilitating collective action and sustainable natural resource governance, while recognizing the impact of ecosystem change over networks of trust, reciprocity and exchanges within communities (Figure 4).

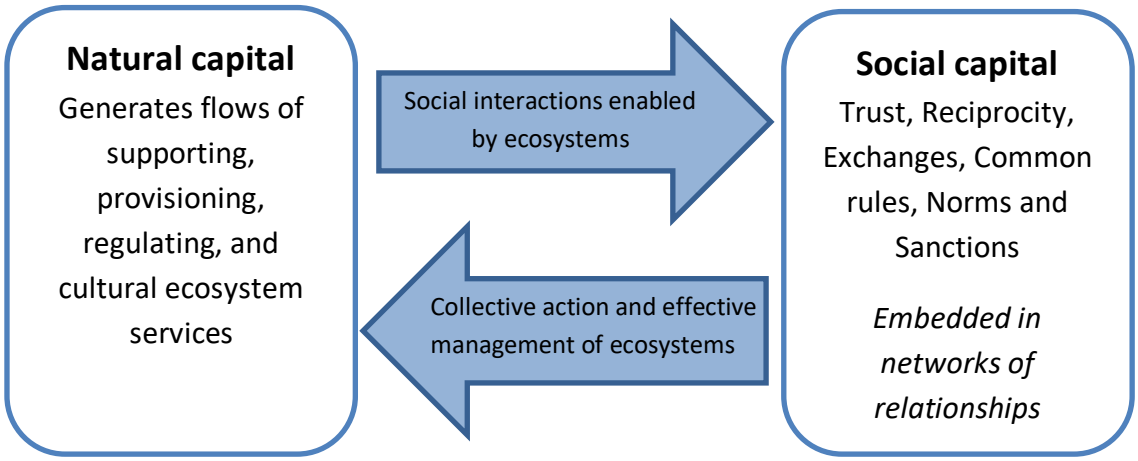

Figure 4. Feedback relationship between natural and social capital. Additions to social capital are conceptualized as an ecosystem service (top arrow); and social capital can in turn directly

affect natural capital by facilitating collective actions and effective ecosystem management (bottom arrow). Source: Barnes-Mauthe et al. 2015.

Barnes-Mauthe et. al. (2015) started a research program in order to identify and quantify the social capital as an ecosystem service in locally managed marine area of Velondriake region in Madagascar. They measured indicators including trust, community involvement, and social cohesion with simple questionnaires targeted for key informants, focus groups and experts. These kinds of studies offer crucial information on how social capital can affect and be affected by and how it can be valued as one of the ecosystem services.

Spatial multi-criteria decision analysis

Roy (1996) has defined multi-criteria analysis as "a decision-aid and a mathematical tool allowing the comparison of different alternatives or scenarios according to many criteria, often conflicting, in order to guide the decision maker towards a judicious choice". Spatial multi-criteria decision analysis (MCDA) refers to multi-criteria analysis used in problems and decisions with spatial dimensions (Chakhar & Mousseau 2008). Geographical information systems (GIS) provide a set of tools for handling and analysing the spatial information. In combination with multi-criteria analysis techniques, GIS can be used to evaluate alternatives on the basis of multiple criteria and objectives.

MCDA has already been used in a few studies in marine context in Baltic Sea region. In Sweden the approach is used to sustainability assessments. The Swedish experience of using sustainability assessments is described in Box 5.1. The approach is also used in the Archipelago Sea in Finland to rearrange the aquaculture production while maintaining the economic, ecological and social conditions (Tammi & Kalliola 2014). MCDA was used compare five possible locations for consolidated aquaculture production in terms of economic, ecological and social criteria.

Box 5.1. An example of using sustainability assessments to support Swedish MSP

What are sustainability assessments and why they are used?

Sustainability assessments aim to aid decision- and policy-makers on what actions to take or avoid in an attempt to make society more sustainable (Sala et al. 2015). The assessments cover more and broader aspects compared to a standard environmental impact assessments, and deal with impacts related to all three perspectives of sustainable development, i.e. economic, social and environmental perspectives. The assessments provide valuable information to the maritime spatial planning process, and to the decision-makers adopting the plans. From an ecosystem approach perspective, the assessment aims to recognise the human and society as significant and interconnected components of the ecosystem. Such interconnection embraces the dependency of humans and society on ecosystems and their services, and the society as a driving force for pressures on marine ecosystems.

How the method is applied?

In sustainable assessments a multi-criteria analysis method is used to measure the sustainability of the proposed marine spatial plans. Within the multi-criteria analysis, criteria are chosen to represent the three perspectives of sustainability; economic, environment and social.

a. Criteria related to the economic dimension include estimated profitability within specific sectors and for sectors dependent on ecosystem services, such as tourism and fishery, consider estimation of consequences related to ecosystem services.
b. Criteria related the environment include aspects of climate change, carbon dioxide and cumulative impact on ecosystem components that are based on results from the planning tool Symphony (Hammar et al. 2018)
c. Criteria related to the social dimension consider estimation of consequences and include criteria for co-existence and accessibility, identity, employment, culture and gender.

The criteria are then reviewed, approximated and summarised for each activity and theme presented in the marine spatial plan. The final summary result and each single criteria and dimension taken into account, give an indication if the plans are within the right direction in relation to sustainability. The result also provides further information of potential conflicts of interest and if more aspects should be considered to improve the spatial plans in relation to future sustainable uses of marine resources, which then can be included and considered in the revision of the plan prior to the next stage, the review stage.

Experiences from using the method

The sustainability assessment and use of the multi-criteria analyses can be considered as a first step within a holistic assessment approach, in line with the application of an ecosystem-based approach stated in the EU MSPD Article 5(14) and MSFD Article 1(3). In addition to the legal requirement to prepare strategic environmental assessments (SEAs) for the Swedish marine spatial plans, the Swedish Agency for Marine and Water Management (SwAM) has prepared sustainability assessments of the consultation versions of the marine spatial plans for Gulf of Bothnia, Baltic Sea and Skagerrak/Kattegat (SwAM 2018a-d).

Experiences of using the method have been twofold. It is a quite intricate method when it comes to choosing criteria, measuring and approximating within the different dimensions, but also comparing within and between criteria and the over-all result. The method is also quite complex, which makes communication and comprehension of the result difficult for analysts as well as stakeholders. On the other hand, the assessments highlighted the interconnection between society and marine spatial plans, such as land and sea interaction and potential impact, both positive and negative, on humans, the environment, society and between and on different industry sectors, which are to be considered in the revision of the plan.

5. Survey on economic, social, cultural and ecosystem service impacts in MSP in the Baltic Sea region

Surveys were used in order to collect information on the current practices of including economic, social and cultural impacts and ecosystem services in national MSP. The questionnaires were sent out in two stages: first in 2018 and second in 2019 to collect additional information. The contact information from former questionnaires sent within the Pan Baltic Scope project was used for identifying potential respondents, i.e., experts of MSP in the Baltic Sea Region. The survey was conducted via a web-based survey provider, Survey Monkey. The questionnaire included an introduction, questions related to the respondent's background followed by the questions on economic, social and cultural impacts in MSP. The questionnaires are provided in Annex I.

It is worth noticing that the respondent group is limited to only one MSP expert from each country/region, and thus the responses do not necessarily represent the current situation in all areas, especially when spatial planning is conducted at a sub-national level (e.g. Finland, Germany). This implies that respondents may be responsible for one planning scale, and their responses reflect the situation in their respective region but not necessarily in all sub-regions or the national level. Therefore, there are some gaps in the results and the answers need to be considered as indicative. Additionally, although 9 experts answered the first stage of the survey, only 5 of them answered the second stage of the survey. Thus, the number of responses varies between 5 and 9 depending on the question.

Background of the respondents

Responses to the first stage of the survey were received from Finland, Denmark, Estonia, Germany, Poland, Lithuania, Sweden, Latvia and Åland, which, although part of Finland, has its own planning area. Second stage survey was answered by Finland, Estonia, Germany, Latvia and Åland. Russia is the only country with no answers which might be because its MSP legislation and planning process is still under development (Country Fiche Russia 2019). The respondent group included planners, researchers and policy makers who take part the national, multi-national or sub-national MSP processes (Table 5). Most of them have responsibilities related to MSP management, coordination and cooperation. In almost all the countries, the MSP process is carried out on a national level. Finland and Sweden are executing sub-national plans, but with national coordination.

Table 5. The background information of the respondents

Country	The role of the respondent	MSP scale	Scale of respondents' responsibility
Finland	Researcher	3 sub-national plans	Sub-national region
Denmark	Planner	–	–
Estonia	Planner	National	Multi-national
Germany	Planner	National and sub-national	National
Poland	Planner	–	–
Åland	Planner	National	National
Lithuania	Policy maker	–	–
Sweden	Planner	3 sub-national plans	–
Latvia	Planner	National	National

Data collection and use to inform MSP in responding countries

The overall observation based on the responses is that most MSP countries have collected data related to economic impacts and high ecological values (Table 6). However, there seems to be a lack of ecosystem services data in many countries. Some tools to collect the data are already used, but still many obstacles to data collection exist. Generally, the respondents feel that planning is at such an early phase that these aspects are not considered yet or lack of knowledge has delayed the impact assessments. Also, the geographic scale and taking every stakeholder into consideration have caused problems in assessing the impacts in MSP. Some countries are planning to collet required data and Denmark will use the data from other authorities.

Different kinds of data sets are used to inform MSP process. Five of the respondents estimated the types of data used to inform MSP in their planning areas, Finland, Estonia, Germany, Åland and Latvia. According to respondents, qualitative data is used the most in Åland and Finland, where the quantity of qualitative data is more than 60 % (Figure 5). Quantitative data has a bigger role in MSP in Latvia and Estonia, where more than half of the data is numerical. These countries also include monetary data the most, as monetary data is up to 13% of all MSP data in Estonia and more than 5% in Latvia. Germany is different in data usage since it doesn't use any monetary data even though quantitative data forms half of all data.

The share of environmental data of all data used to inform MSP is, in general, high in the BSR (Figure 5). More than half of all data used in MSP is related to environmental topics in all the respondent countries. Especially respondents from Finland, Germany and Åland estimate that the share of environmental data is high.

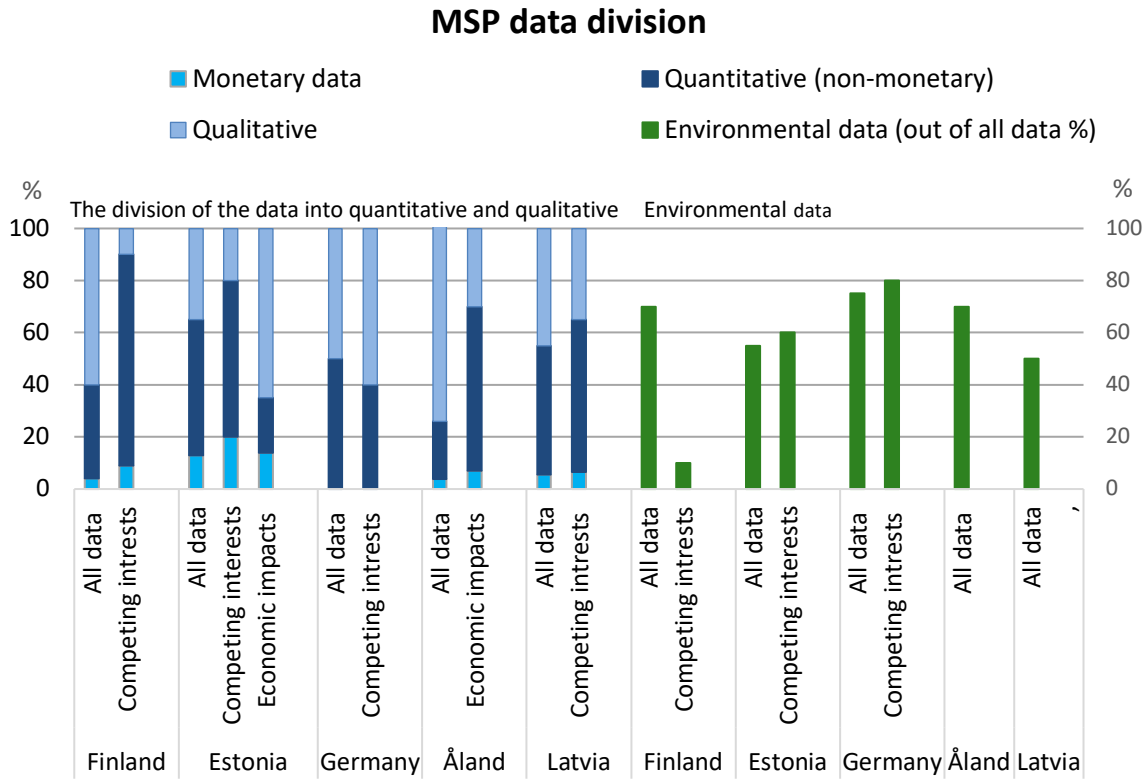

Figure 5. The MSP data division to qualitative, quantitative and environmental data in Finland, Estonia, Germany, Åland and Latvia.

Table 6. Economic, cultural, social and ecosystem service data collected for MSP in BSR based on the questionnaire

	Finland	Denmark	Estonia	Germany	Poland	Åland	Lithuania	Sweden	Latvia
Are competing interests considered?	Yes	Yes	Yes	Yes	Yes	Under develop-ment	Yes	Yes	Yes
Are economic impacts planning decisions considered?	No	No	Yes	No	–	Yes	–	Yes	No
Are there any spatial data on economic impacts in your area's MSP?	–	–	Yes	Yes	Yes	No	Yes	Yes	Yes
Are socially and culturally important objects and sites mapped in your area's MSP?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Are the areas of high ecological value mapped in your area's MSP?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Are the economic consequences of ecological changes considered in your area's MSP?	Under develop-ment	–	Yes	No	–	No	–	–	No
Are impacts on ecosystem services considered within your area's MSP?	Yes	No	Yes	Under develop-ment	Yes	Under develop-ment	No	Yes	Yes
Have you conducted ecosystem services mapping in order to collect spatial data?	No	–	Under develop-ment	–	Yes	–	–	No	Yes
Are economic (monetary) values of ecosystem services considered?	No	No	Partly	No	No	Under develop-ment	No	Yes	No
Are alternative spatial plans developed in addition to the primary plan?	No	–	No	Yes	–	No	–	–	No

Economic and socio-cultural impacts

The economic impacts in MSP can be approached by considering competing interests between different actors. According to respondents, most of the data on computing interests is produced as quantitative data. Finland, Estonia and Latvia prefer quantitative and monetary data, unlike Germany who uses more qualitative data. Monetary data is used the most in Estonia. Most of the countries have produced a high share of environmental data related to competing interests and for example in Germany 80 % competing interest data is related to environmental topics. Multiple tools, including GIS, interviews, strengths, weaknesses, opportunities, and threats -analysis (SWOT) and expert knowledge are used to collect data on competing interests (Table 7). Even though all respondents didn´t specify their knowledge about the topic, no obstacles for collection data on competing interests came up in the responses. The respondents were also asked if economic impacts of planning decisions are considered. Only three of the respondents knew that their country had data for evaluating such economic impacts. In Estonia, the data is estimated to be mostly quantitative and monetary data, but in Germany also qualitative data is used (figure 5). However, most of the BRS countries have also some spatial data on economic impacts. The economic impact data is mostly produced with cost-benefit analyses, impact assessment tools and economic models (Table 7). The main reasons for not having the data are the early phase of the planning process and lack of resources.

The issues related to the social and cultural impacts of MSP were approached by researching if socially and culturally important sites or high ecological values are mapped in BSR countries. According to the responses, all responding countries except Germany have performed mapping of these impacts. However, the mapping has mostly been based on interviews and expert assessment, and only Poland and Åland have carried out GIS-based research. Even though data are produced in many countries, they are used only in few countries. Usually, the spatial data of socially and culturally important sites is not integrated into the planning, except in Finland and Denmark, where the important sites are used as a source of local knowledge and for integrated analysis. Also, the monetary benefits or damages of ecological changes in MSP are considered only in Estonia and in the future also in Finland.

Table 7. Methods and tools versus obstacles for collecting MSP data

	Tools and methods used	Obstacles
Evaluating competing interests	• Consultant reports • Cumulative impact assessment • Expert interviews • Expert judgement • GIS-analyses • Involvement of authorities • Participatory GIS • Public meetings • Sectoral development scenarios • Stakeholder dialogue • SWOT-analyses • Zonation analyses	
Assessing and mapping economic impacts	• Cost-benefit analyses • Economical models • Environmental impact assessment • Environmental-economic accounting • Impact assessment system (OSR) • Sustainability appraisal	• Lack of personnel • Lack of resources • Mapping is not seen necessary • No need for conflict resolution • Not all aspects are considered in this phase of the MSP process • Some impacts are included in other sectoral documents
Mapping socially and culturally important objects	• Document research • Expert based approach • Generic feature mapping • Interviews • Observation approaches • Participatory GIS • Questionnaires	

Ecosystem service impacts

The impacts on ecosystem services are already considered in many BSR countries and some countries are developing methods to integrate ecosystem services impacts into the MSP. Figure 6 presents the responses for ecosystem service-related questions. The first question was about the consideration of ecosystem service impacts in MSP. In the follow-up questions the respondents of Denmark and Lithuania mentioned that their countries are still lacking the ecosystem service considerations since there is no legislative basis and knowledge for that. The respondents of Finland, Estonia, Poland, Latvia and Sweden indicated that the impacts on ecosystem services are considered, but only Poland and Latvia have already mapped the services. In addition to mapping, the data is produced by expert evaluations. The respondents of Finland and Sweden considered that the countries haven't been able to do the mapping because of the lack of the resources, data gaps, technical issues or problems with definitions.

The second main question about ecosystem services was to find out how familiar respondents are with non-market valuation of ES (Figure 6). Most of the respondents are only somewhat familiar with the topic and only respondents of Denmark and Poland are very familiar with non-market valuation. In the third question, the respondents estimate that economic values of ecosystem services are only rarely considered even though some ecosystem service data already exist (Figure 6). According to responses, the only country considering the economic values of ecosystem services is Sweden, who uses literature and expert knowledge as background information. The lack of knowledge, resources, regulation and valuation studies are also reasons for failing to consider economic values. The knowledge about the non-market valuation of ecosystem services varies between the respondents.

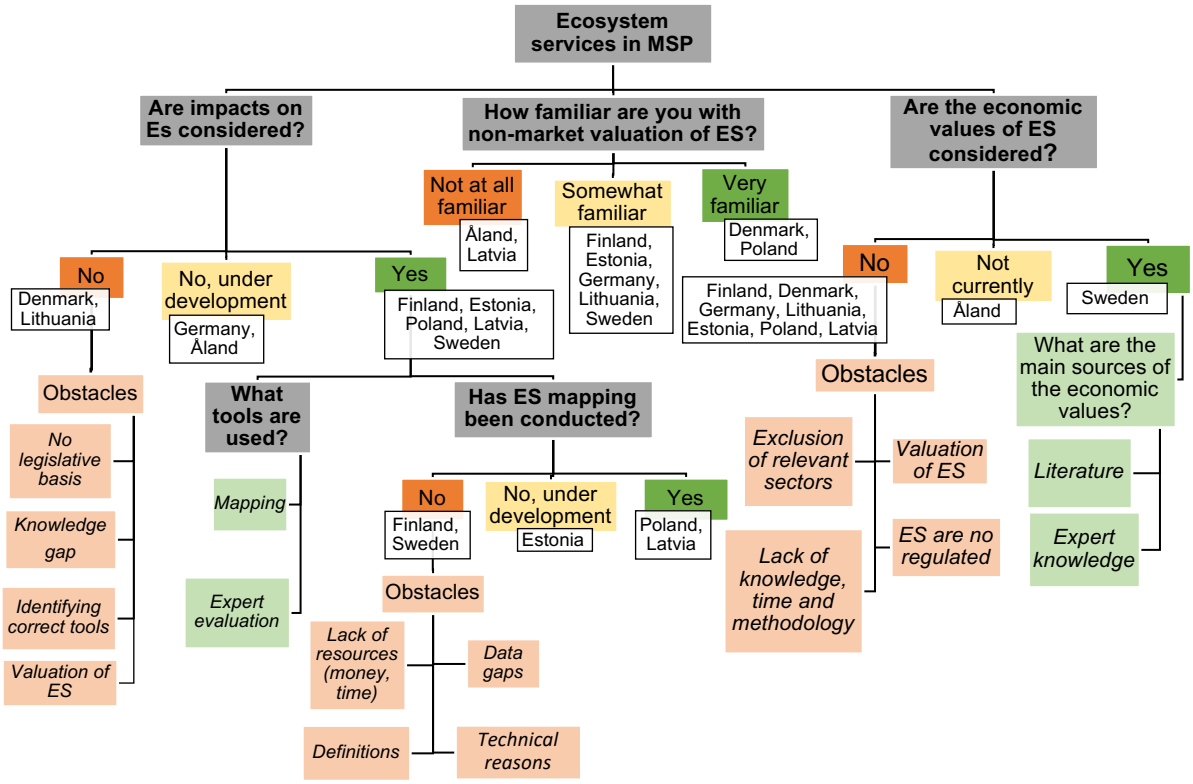

Figure 6. Integration of the ecosystem service concept in MSP in the Baltic Sea region. The figure is based on three main questions and two follow-up questions of the Survey Monkey questionnaire.

The responses of the questionnaire are very incomplete for ecosystem services since many questions related to the topics are skipped. Only respondents of Finland, Estonia and Latvia have estimated the division of ecosystem services data to monetary, quantitative and qualitative data. According to estimations of these respondents the monetary data used is relatively low. The monetary data seems to have the biggest role in Latvia where the share is estimated to be around 7 %. The respondent of Latvia also evaluates the share of other quantitative data higher than Finland and Estonia. According to respondent of Finland, monetary and other quantitative data cover approximately half of all ecosystem service data. Estonia is the only country that is evaluated to have more qualitative data on ecosystem services.

Evaluation of the questionnaire data

The aim of the survey was to gather information to assess the current status of assessing economic, social, cultural and ecosystem service impacts in MSP in the BSR. However, the sample size is rather limited. The respondent group is limited to one respondent per

country which causes some uncertainties. The respondents represent different planning scales, or they might take part only in subnational planning which might not capture all aspects of national scale planning. There might also be multiple planning organizations which may mean that additional methods and data are used in the country's MSP than identified in the survey responses.

Responses to both step 1 and step 2 questionnaires are not available for all countries. In addition, there are some missing responses in the questionnaire data which causes some data gaps also in this report. It is important to note that the missing information does not necessarily imply that the impact is not considered, or that data do not exist.

Despite the possible representativeness issues, the responses provide an overview of how the economic, cultural, social and ecosystem service impacts are considered in the MSP in the BSR, and reveal obstacles and information gaps in practical planning. Most of the questions were responded by several or all respondents and some additional information was received in the open responses and via email correspondence. The expert knowledge and assessments are crucial for developing the use of economic and socio-cultural impact analysis in MSP. Even though the questionnaire data would not provide complete information of all the national plans, it does so for selected geographic areas, and can be used to supplement the literature review.

6. Discussion and conclusions

Key findings of the literature review and the survey

The aim of this report was to provide insights into how economic, social, cultural and ecosystem service impacts could be understood and assessed in the context of MSP, what kind of methods, approaches and concepts are available for their assessment, examples of studies that could provide useful results, and what is the current status of their assessment in the Baltic Sea region. The topic was approached through a literature review and a survey targeted to MSP planners in the BSR countries. In addition, the ecosystem-based approach and ecosystem services as ways to link the ecosystem and social and economic systems were presented to provide supporting information. The information collected for this report has been used as a basis for producing recommendations for developing a regional framework for economic and social analyses to support MSP (see Ahtiainen et al. 2019). It provides information about the potential

tools of impact assessments and helps to integrate the assessments into national planning practises.

The legislation of maritime spatial planning in Europe and the Baltic Sea region is based on the EU Maritime Spatial Planning Directive that regulates also the economic, social and environmental impact assessments of MSP. However, currently there is lack of knowledge and data to fully integrate these assessments into the planning, and especially socio-cultural and monetary impact data are missing. A regional framework and results for assessing economic and social impacts from different sea uses and the degradation of the marine ecosystem in the BSR were developed in the HELCOM HOLAS II and State of the Baltic Sea report (HELCOM 2018c) and multiple potential tools for impact assessments exist. Still, most of these tools and methods are not commonly used in MSP and only few case studies relying on them can be found. The tools include both methods for assessing economic and socio-cultural impacts. Economic impacts are mostly measured in monetary terms, for example as market prices, gross value added or willingness to pay. Socio-cultural impacts include employment, cultural ecosystem services and people's social values related to marine areas, such as emotional connection to marine areas.

As part of this report, a survey targeted to MSP planners in the BSR was carried out to collect information on the current practices of including impact assessments and ecosystem services in national MSPs. The respondents represent eight Baltic Sea countries and different authorities and planning scales. According to the survey responses, competing interests of MSP are widely considered with multiple methods. Economic activities are often mapped but the economic impacts of MSP are still only rarely considered. Monetary data is used only rarely to measure economic impacts compared to qualitative data and non-monetary quantitative data. Mapping has been frequently used to identify socially and culturally important locations. In general, the respondents feel that more knowledge and resources are needed to integrate economic and socio-cultural impact assessments into MSP. There is also a lack of ecosystem service consideration in MSP and especially their valuation, although ecosystem services and high ecological value areas are often mapped, and a large share of MSP data relates to the environment.

Knowledge gaps in assessing economic, social and cultural impacts in MSP

This section discusses the current knowledge gaps in assessing economic, social and cultural impacts in the spatial context. It combines the information about knowledge gaps from previous studies and this report. The MSP data study (Cahill et. al. 2016) has

previously listed MSP knowledge gaps that are also taken into account in this report. The findings of the MSP data study and other previous studies are here considered in relation to findings of this report.

Spatial data

Spatial data are needed to create spatially explicit planning for marine areas. The uniqueness of the area and the environment should be considered in impact assessments and planning (Gilliland & Laffoley 2008). As a part of ecosystem-based approach, new measuring and modelling units are needed since governmental areas do not follow the features of the environment. The spatial units should rather be based on for example ecosystem boundaries.

There is also a need for new kind of spatial data since only few spatial data sets of economic and socio-cultural impacts of MSP have been made, although the ecologically and culturally important places and economic activities are already often mapped. Cahill et. al. (2016) mention that spatial characteristics of marine areas also cause the need for different kind of data sets. The level of detail and type of spatial data can vary considerably across applications (Apolloni et. al. 2018; Ban et. al. 2013; Raoux et. al. 2018), which makes their use in the same context challenging. The third spatial dimension of water column and dynamicity also cause challenges for mapping marine areas (European Commission 2019a).

Land-based values

When estimating the value of non-market benefits associated to marine ecosystem services, it is important to note that the values are actually land-based, since the benefits accrue to people who live on land. To be able to assess the values of ecosystem service provision and human activities in MSP, the ecosystem services should be valued at sea. Many methods to execute impact assessments include research of values and preferences of the locals. For example, willingness to pay is often mapped based on the home locations of the respondents, although the answers are related to marine areas (Norton and Hynes 2018). There is a need to develop new methods to combine these values to the sea areas.

It is also important to consider land-sea interactions as a part of economic and social analysis. Marine ecosystem services are often consumed on land but for land-sea interactions it is important to map ecosystem services where they are located. For considering land-sea interactions, different kinds of tools and methods, such as qualitative, quantitative and monetary indicators, are needed.

Use of previous knowledge and land use planning practises

This report has listed many methods and tools to assess economic and socio-cultural impacts in MSP. Still these methods are only rarely used. The MSP data study (Cahill et. al. 2016) has also identified the problem of using socio-economic data in MSP. Both this report and the MSP data study show that many data sets and tools already exist but there are difficulties in integration them into MSP. The questionnaire responses show that the lack of knowledge and expertise are often obstacles for the use of these methods and data sets. Previous MSP studies using the impact assessment methods could provide knowledge and ideas of using them. Kidd and Shaw (2014) also encourage to adapt planning practises and knowledge of terrestrial planning to maritime planning. However, there needs to be a distinction between terrestrial and maritime planning since land-based activities are difficult to convert into maritime activities.

Temporal aspects

Another crucial aspect in spatial planning concerns time and temporal aspects. The EU MSPD states in Article 8 that "Member States shall set up maritime spatial plans which identify the spatial and temporal distribution of relevant existing and future activities and uses in their marine waters". For example, in assessing possible trade-offs between ecological and economic targets or synergies between them, it is important to note that some species distributions and human uses are seasonal, and it may be difficult to find seasonal spatially explicit data (Ban et al. 2013). Moreover, better consideration of long-term changes is needed. The questionnaires for planning authorities show that the economic impacts of long-term ecological changes are only considered in half of the BSR countries. Additionally, from the planning and management point of view, harmonized cross-boundary planning and assessment of impacts may prove difficult if the countries are in temporally different planning phases (Saunders et al. 2016). One of the objectives in the Pan Baltic Scope project is to even out the challenges in temporal differences in Baltic Sea countries' planning phases.

Development of aligned indicators and cooperation

There seem to be multiple challenges in economic and socio-cultural impact assessments in MSP. One solution to reduce these challenges could be the use of harmonized approaches and indicators for impact evaluations (Ivarsson et. al. 2017). Some indicators for maritime activities management were already created in the Baltic Sea Action Plan (HELCOM 2007) and HELCOM SPICE project has developed indicators for the use of marine waters (HELCOM 2018c). However, these indicators are not directly for MSP. The aligned indicators could help the cross-border cooperation that is called

for in the MSP data study (Cahill et.al. 2016). With the cooperation in decision making and planning practises coherent plans can be produced and conflicts can be avoided. The cooperation should be enhanced with common planning language and procedures.

Knowledge gaps related to impact assessments

One of the most crucial knowledge gaps in MSP are the data gaps related to socio-economic activities (Cahill et. al. 2016). This can be also noticed based on the response to the questionnaire in the BSR. Human activities on marine areas are often known but there is a lack of spatial and non-spatial economic and socio-cultural impact data. According to the MSP data study (Cahill et. al. 2016), some socio-economic data exist but are not useful for MSP since they are is related to terrestrial areas. There are also challenges related to the type of socio-cultural impact data. The data production is often based on the concept of cultural ecosystem services (Feltcher et. al. 2014). However, Scholte et. al. (2015) highlight that socio-cultural impacts include much more than only cultural ecosystem services and the material well-being that comes from provisioning and regulating services should also be included in the data sets. For economic and social impact data engagement of stakeholders is needed. Stakeholders can offer valuable information about values and meanings of marine areas. However, before engagement the stakeholders need to understand the meaning of maritime spatial planning.

The other data and knowledge gaps that arise from the survey responses are the lack of monetary data and challenges in the use of ecosystem service data. The questionnaire responses show that the share of monetary data is small, and the monetary aspects of socio-cultural end environmental impacts need more consideration in the planning process. Ecosystem services are often considered, but non-monetary and monetary valuation methods and results are missing. There is a need to add knowledge and resources, as well as create definitions and regulations for the integration of ecosystem services into the MSP process.

Development needs

An overarching assessment of the impacts of MSP is crucial for appropriately capturing how spatial planning affects the environment and human welfare and to follow the ecosystem-based approach. Many tools and methods have been developed to assess economic, social, cultural, environmental and ecosystem service aspects of MSP, and some results are also available that could support MSP processes in the Baltic Sea region. However, the tools and results are still rarely used, since it is the early phase of MSP process, and there are also knowledge gaps. In particular, approaches for the spatial assessment of economic, social-cultural and ecosystem service impacts should be

developed. Data are needed for assessing socio-cultural impacts, as well as valuing impacts in monetary terms.

Future assessments can build on the frameworks, approaches, data and results that have already been developed, for example within HELCOM HOLAS II, national assessments and research projects. The frameworks for integrated assessment of ecosystem and social and economic systems in MSP include ecosystem service cascade and DPSIR (drivers – pressures – state – impacts – response). The cascade model is often used in ecosystem service classification but the use of DPSIR is rarely mentioned in MSP literature. There are still many development needs related to impact assessments since impact assessment should include the assessment of multiple different impacts. Data on environmental aspects of the planning and sea area uses already exist. Still, economic impacts and ecosystem services are only rarely considered as a part of MSP. Also, data of impacts on human welfare need to be developed.

Due to the spatial nature of economic and socio-cultural impacts, the spatial data is crucial for assessments. Some tools for producing spatial data already exist and some economic activities and impacts have been mapped. However, there is a lack of spatial ecosystem service and socio-cultural impact data. Even though ecologically and culturally important sites are mapped, the MSP impacts related to these locations are not often considered. Some tools to spatial impact assessments have been developed in recent years.

As mentioned, many tools for economic and socio-cultural impact assessment have already been developed. However, countries have faced challenges in executing the impact assessments. Many countries lack sufficient resources or knowledge to do impact assessments. Based on the literature review most impact assessments have been made on regional scale. Cross-border and international impact assessments and other MSP studies are lacking. Therefore, common indicators and international cooperation are needed improve the coherence of MSP across countries.

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Annex I. Surveys to collect information from the BSR on economic, social and cultural impacts and ecosystem services in MSP

Survey 1 (first stage)

Introduction

This survey gathers information on how marine spatial planning (MSP) is implemented nationally in the Baltic Sea Region, with focus on the assessments of economic, social and cultural impacts and ecosystem services. The responses will be used to inform about the current situation and planned work in MSP in the region, and as input for developing regional approaches for economic and social analyses in MSP. You are among the few experts selected to respond to this survey, and your response would be highly appreciated.

Consideration of environmental, economic and social aspects of MSP is required in the EU Maritime Spatial Planning Directive. Regional cooperation and approaches would improve the comparability and coherence of methods and outputs across countries and support national MSP processes.

The survey is part of the Pan Baltic Scope project, co-funded by the European Union. Click the button below to start the survey. Completing the questionnaire takes about 30 minutes.

Thank you for your participation!

Questionnaire

Page 1

Q1. What is your role in maritime spatial planning? [Radio button]

- Planner
- Regional developer
- Researcher
- Policy maker
- Other [OPEN FIELD]

Q2. What is your educational background?

Page 2

Q3. Which country (or geographic area) do you primarily present? [Radio button]

- Estonia
- Denmark
- Finland
- Germany
- Latvia
- Lithuania
- Sweden
- Poland
- Russia
- Other (please specify) [OPEN FIELD]

Q4. How are marine spatial plans made in your country (or geographic area)

- At the national level
- At the sub-national level with national coordination
- Other

Comment box

Q5. What is the primary geographic scale of your responsibility or experience with MSP?*

- Municipal
- Sub-national region
- National
- Multi-national geographic area
- Other (please specify) [OPEN FIELD]

Q6. What are your tasks in the MSP process in your country (or geographic area)? Please list the main tasks briefly. [OPEN FIELD]

Page 3

Please answer the remainder of the survey based on the MSP practices of the area you indicated in Question 5: What is the primary geographic scale of your responsibility or experience with MSP?

Q7. Of all the data used to inform your area's MSP, what is the approximate mix of qualitative and quantitative (including monetary) data?

- Qualitative
- Quantitative
- Monetary
- Other

Q8. Comment box, Go to P5

Page 4

Q9. If sectoral interests are not considered in the national MSP, please indicate 1-3 main obstacles to it: [List of open fields]

Page 5

Q10. In one of the previous surveys conducted under BALTIC SCOPE project (2015-2017), most of the countries replied that the assessment and mapping of ecosystem services was only partly included or not included in MSP, while Latvia had conducted a biophysical mapping of the ecosystem services. Is the assessment of ecosystem services included in maritime spatial planning in your country or region at the moment? [YES/NO]

Q11 Comment box

Page 6

Q12. If the ecosystem services assessment is not included in MSP, please list 1-3 main obstacles for including the assessment: [List of open fields] Go to P9

Page 7

Q13. If the ecosystem service assessment is included in the national MSP, have you conducted ecosystem services mapping in order to collect spatial data? [YES/NO]

Q14. Comment box

Page 8

Q15. If ecosystem services mapping to collect spatial data in not conducted, please list 1-3 main obstacles for the mapping: [List of open fields]

Page 9

Q16. Are there existing tools, methods or approaches to assess economic impacts within your national MSP? [YES -> P9 /NO]

Q17. Comment box

Page 10

Q18. If there are existing tools, methods or approaches to assess economic impacts within the national MSP, please indicate what kind of tools are used to assess the economic impacts: [CHECKBOXES]

- Cost-benefit analysis
- Cost-effectiveness analysis
- Environmental-economic accounting
- Environmental impact assessment
- None of the above
- Other: OPEN FIELD

Q19. Comment box

Page 11

Q20. If you chose none of the listed options are used, is there a tool, method or approach under development to assess the economic impacts in MSP? [YES/NO]

Page 12

Q21. If there is a tool, method or approach for assessing the economic impacts in MSP under development, please describe it: [OPEN FIELD LONG]

Page 13

Q22. Is the non-market valuation of ecosystem services familiar to you? [Extremely familiar – not at all familiar]

Q23. Are the monetary values of ecosystem services considered in planning? [YES ->P14/NO -> P15]

Page 14

Q24. If the monetary values of ecosystem services are considered, please specify what kind of method is used for valuation: [OPEN FIELD]

Q25. If the monetary values of ecosystem services are taken into account in the national MSP, what are the main sources of economic values of ecosystem services used? Please provide sources of the information below. [OPEN FIELD] Go to P16

Page 15

Q26. If the monetary values of ecosystem services are not considered in MSP, please list 1-3 main obstacles for considering them [List of open fields]

Page 16

Q27. What is included in the marine and coastal socially and culturally important objects and sites in your national MSP? [OPEN FIELD LONG]

Q28. Are the marine and coastal socially and culturally important objects and sites mapped? [YES -> P17 / NO -> P18]

Page 17

Q29. If the marine and coastal socially and culturally important objects and sites are mapped, please indicate the mapping tools used:

- Questionnaires and personal interviews
- Generic feature mapping
- Participatory mapping (i.e. specific place mapping)
- Observation approaches
- Document research: E.g. Viewshed analysis
- Expert based approach
- Other: [OPEN FIELD SHORT] Go to P19

Page 18

Q30. If marine and coastal socially and culturally important objects and sites are not mapped, please indicate 1-3 main obstacles for mapping [List of open fields]

Page 19

Q31. Are the areas of high ecological value mapped in the national marine and coastal areas? [YES -> P20 / NO -> 21]

Page 20

Q32. If the areas of high ecological value are mapped, are they used in connection with the national economic, social and cultural impact assessments? [YES / NO]

Page 21

Q33. Is there any spatial economic data available for example regarding shipping routes, fishing or tourism? [YES -> P23 / NO -> P24]

Page 22

Q34. If there are spatial economic data available, please specify what kind of data are available: [OPEN FIELD], Go to P26

Page 23

Q35. If there is no spatial economic data, please list 1-3 main obstacles for acquiring the data [List of open fields], Go to P26

Page 24

Q36. If there are any national public reports available on the economic, social or cultural impacts of MSP, please provide the name of the publication and possibly a hyperlink to online material: [OPEN FIELD]

Q37. Please list any a) concerns and b) suggestions that stem from your work on the economic, social or cultural impacts of MSP you would like to share with us. [OPEN FIELD]

Q38. Do you have any comments or concerns you wish to share with us? [OPEN FIELD]

Q39. If you would be available for a follow-up interview, please write your name here: [OPEN FIELD]

Survey 2 (second stage)

Economic and social analyses questionnaire - Pan Baltic Scope 2019

Introduction

This survey gathers information on how marine spatial planning (MSP) is implemented nationally in the Baltic Sea Region, with focus on the assessments of economic, social and cultural impacts and ecosystem services. The responses will be used to inform about the current situation and planned work in MSP in the region, and as input for developing regional approaches for economic and social analyses in MSP. You are among the few experts selected to respond to this survey, and your response would be highly appreciated.

Consideration of environmental, economic and social aspects of MSP is required in the EU Maritime Spatial Planning Directive. Regional cooperation and approaches would improve the comparability and coherence of methods and outputs across countries and support national MSP processes.

The survey is part of the Pan Baltic Scope project, co-funded by the European Union. Click the button below to start the survey. Completing the questionnaire takes about 30 minutes.

Thank you for your participation!

Q1. What is your role in maritime spatial planning? * [Radio button]

- Planner
- Regional developer
- Researcher
- Policy maker
- Other (please specify) [OPEN FIELD]
- Q2. What is your educational background? [OPEN FIELD]

Page 2

Q3. Which country (or geographic area) do you primarily represent? * [Radio button]

- Baltic Sea Region
- Estonia

- Denmark
- Finland
- Germany
- Latvia
- Lithuania
- Poland
- Sweden
- Russia
- Åland
- Other (please specify) [OPEN FIELD]

Comments

Q4. How are marine spatial plans made in your country (or geographic area)? * [Radio button]

- At the national level
- At the sub-national level with national coordination
- Other

Q5. What is the primary geographic scale of your responsibility or experience with MSP? * [Radio button]

- Municipal
- Sub-national region
- National
- Multi-national geographic area
- Other (please specify) [OPEN FIELD]

Q6. What are your tasks in the MSP process in your country (or geographic area)? Please list the main tasks briefly.

Page 3

Please answer the remainder of the survey based on the MSP practices of the area you indicated in Question 5: What is the primary geographic scale of your responsibility or experience with MSP?

Q7. Of all the data used to inform your area's MSP, what is the approximate mix of qualitative and quantitative (including monetary) data? [QUANTITATIVE–QUALITATIVE]

Q8. Of the quantitative data used to inform your area's MSP, approximately what percentage is monetary data? [0%– 100%]

Q9. Of all the data used to inform your area's MSP, approximately what percentage is environmental data? [0%– 100%]

Comments

Q10. Are competing interests between sectors/activities (e.g. tourism versus wind energy production or shipping versus environmental concerns) considered in your area's MSP? * [Radio button]

- Yes
- Not currently, but under active development
- No

Comments

Page 4

Q11. What tools or methods are used/under active development to evaluate competing interests in your area's MSP (e.g. compatibility matrix, mapping of overlapping activities/expressed interests, cumulative impact assessment, cost-benefit analysis, participatory GIS tools, expert assessment, stakeholder dialogue, etc.)? [OPEN FIELD]

Q12. In your estimation, what is the approximate mix of qualitative and quantitative (including monetary) data used to evaluate competing interests in your area's MSP? [QUANTITATIVE–QUALITATIVE]

Q13. Of the quantitative data used to evaluate competing interests in your area's MSP, approximately what percentage is monetary data? [0%– 100%]

Q14. Of all the data used to evaluate competing interests in your area's MSP, approximately what percentage is environmental data? [0%– 100%]

Q15. If competing interests are not considered in your area's MSP, what are 1-3 main obstacles to it?

- Obstacle 1 [OPEN FIELD]
- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Page 5

Q16. Are economic impacts (e.g. impacts on gross value added, employment) of planning decisions considered within your area's MSP? *[Radio button]

- Yes
- Not currently, but under active development
- No

Comments

Q17. What tools or methods are used/under active development to assess economic impacts in your area's MSP (e.g. cost-benefit analysis scenario analysis, etc.)? [OPEN FIELD]

Q18. In your estimation, what is the approximate mix of qualitative and quantitative (including monetary) data used to evaluate economic impacts in your area's MSP? [QUANTITATIVE–QUALITATIVE]

Q19. Of the quantitative data used to evaluate economic impacts in your area's MSP, approximately what percentage is monetary data? [0%– 100%]

Page 6

20. Are there any spatial data on economic impacts in your area's MSP (e.g. regarding shipping routes, fishing, tourism, etc.)? * [Radio button]

- Yes
- Not currently, but under active development
- No

Comment

Q21. If there are no spatial economic data, what are 1-3 main obstacles to acquiring the data?

- Obstacle 1
- Obstacle 2
- Obstacle 3

Economic and social analyses questionnaire - Pan Baltic Scope 2019

Q22. If economic impacts are not considered in your area's MSP, what are 1-3 main obstacles to it?

- Obstacle 1 [OPEN FIELD]

- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Page 7

Q23. Are socially and culturally important objects and sites mapped in your area's MSP? *

- Yes
- No

Comments

Q24. If marine and coastal socially and culturally important objects and sites are mapped, what tools are used to identify these areas? [OPEN FIELD]

Q25. If the marine and coastal socially and culturally important objects and sites are not mapped, what are 1-3 main obstacles for mapping?

- Obstacle 1 [OPEN FIELD]
- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Page 8

Q26. Are the areas of high ecological value mapped in your area's MSP?* [Radio button]

- Yes
- No

Comments

Q27. If the areas of high ecological value are mapped, how are they used in connection with economic, social and cultural impact assessments? (e.g., not at all, to inform stakeholder discussions, as part of an integrated analysis; please explain) [OPEN FIELD]

Q28. Are the economic consequences (i.e. monetary benefits or damages) of ecological changes considered in your area's MSP? [Radio button]

- Yes
- No
- Other (please specify) [OPEN FIELD]

Page 9

Q29. Are impacts on ecosystem services considered within your area's MSP?* [Radio button]

- Yes
- Not currently, but under active development
- No

Comments

Q30. What tools or methods are used to assess ecosystem services in your area's MSP (e.g. expert evaluation, cost-benefit analysis, mapping, monetary valuation, etc.)? [OPEN FIELD]

Q31. In your estimation, what is the approximate mix of qualitative and quantitative (including monetary) data used to evaluate ecosystem services in your area's MSP. [QUANTITATIVE–QUALITATIVE]

Q32. Of the quantitative data used to evaluate ecosystem services in your area's MSP, what percentage is monetary data? [0%– 100%]

Page 10

Q33. If ecosystem service assessment is included in your MSP, has ecosystem services mapping been conducted in your area in order to collect spatial data?* [Radio button]

- Yes
- No, but under active development
- No

Comments

Q34. If ecosystem services mapping to collect spatial data is not conducted, what are 1-3 main obstacles to the mapping?

- Obstacle 1 [OPEN FIELD]
- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Q35. If ecosystem services assessment is not included in your area's MSP, what are 1-3 main obstacles to including the assessment?

- Obstacle 1 [OPEN FIELD]

- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Page 11

Q36. How familiar are you with the non-market valuation of ecosystem services? [Radio button]

- Very familiar
- Moderately familiar
- Somewhat familiar
- Not at all familiar

Comments

Q37. Are economic (monetary) values of ecosystem services considered in your area's MSP?* [Radio button]

- Yes
- No

Comments

Q38. If the economic values of ecosystem services are considered in your area's MSP, what are the main sources of the economic values?

- Source 1 [OPEN FIELD]
- Source 2 [OPEN FIELD]
- Source 3 [OPEN FIELD]

Page 12

Q39. If the economic values of ecosystem services are not considered in your area's MSP, what are 1-3 main obstacles for considering them?

- Obstacle 1 [OPEN FIELD]
- Obstacle 2 [OPEN FIELD]
- Obstacle 3 [OPEN FIELD]

Q40. As part of your area's MSP, are alternative spatial plans developed or under active development in addition to the primary plan?* [Radio button]

- Yes, single alternative plan
- Yes, multiple alternative plans
- No

Q41. On average, how well developed is the alternative plan(s) compared to the primary spatial plan? [Radio button]

- Much less developed
- Less developed
- Similarly developed

Comments

- Q42. If alternative spatial plans are constructed, how are they used? [OPEN FIELD]

Page 13

43. Many national management/research agencies have conducted background case studies on MSP including covering topics such as climate change, blue economy and mapping of nature values or ecosystem services. Are you familiar with such studies within your area? [Radio button]

- I am familiar with such studies
- I am not familiar with such studies

Q44. If you are familiar with such studies, how are background case studies used in the actual planning process in your area? [OPEN FIELD]

Q45. Do you have any comments you wish to share with us in regard to the survey or MSP? [OPEN FIELD]

Q46. We are seeking a diverse group of respondents to this survey. If you could recommend other MSP professionals to approach, particularly from a different area, background, or job description than yourself, that would be greatly appreciated. [OPEN FIELD]

Thank you very much for your time in answering to this survey. Your answers will form an important contribution to the Pan Baltic Scope project.

Annex II: Existing models and assessments

Based on the brief introduction of approaches presented above, here we list the existing models, frameworks and assessments that have been developed in the Baltic Sea area and could be useful for the economic and social analyses in maritime spatial planning (Table 8). Other sea areas are covered in Table 9. Socioeconomic impacts of human activities associated with the sea are closely connected to the cumulative impact assessments, thus a column for cumulative impact assessment is included in Table 8.

Table 8. Existing spatial models, frameworks and assessments developed in the Baltic Sea area.

Model (M), assessment (A) and/or framework (F)	**Title**	**Type**	**Geographic scope**	**Output**	**Source**
M	Bioeconomic model for cod, herring and sprat fisheries	Economic	Baltic Sea (aggregated from Polish fishing data)	Natural capital asset measurement for cod, herring and sprat fisheries	Do Yun et al. 2017
M	Ecosystem accounts for marine ecosystems and fish provisioning services for herring, sprat and cod	Economic	Finland	Asset accounts of Finnish marine ecosystems and ecosystem services supply and use account for herring, sprat and cod provisioning services.	Lai et al. 2018
M	Holistic modelling tool ATLANTIS - Baltic bio-economic multi-stock-multi-fleet fisheries management evaluation model coupled to a multi-species stock	Economic	Greifswald Bay, the western Baltic Sea	Benefits of Maritime Spatial Planning (MSP) in relation to herring management. Revenues, profits and catch per metier in cod, sprat and herring fisheries.	Eero et al. 2014

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Source
	assessment model (VECTORS project)				
M	Spatial ecosystem model, forced by a coupled physical-biogeochemical model Ecospace in Ecopath with Ecosim	Economic	Baltic Proper, Central Baltic Sea	Cod, flounder, herring and sprat fishing efforts under three scenarios (Baltic Sea Action Plan, Reference and business-as-usual (BAU)	Bauer et al. 2018
M	Bioeconomic model combining catchment model with a marine model to assess cost-effectiveness of nutrient abatement measures	Economic	Baltic Sea	Spatially optimal allocation of phosphorus load reductions targets and effectiveness and costs of agricultural measures and improvements in the capacity of waste water treatment	Ahlvik et al. 2014
M	Cost-benefit analysis of improved water quality, using spatially explicit bioeconomic model	Economic	Baltic Sea	Comparison of the costs of nutrient abatement and the benefits of improved water quality to solve for the optimal level of water protection	Hyytiäinen et al. 2015
A	Mapping of socially and culturally significant objects	Social, cultural	Estonian coast covering an area 500 m inland	Spatial distribution of socially and culturally significant objects	Metspalu & Ideon 2017

Model (M), assessment (A) and/or framework (F)	**Title**	**Type**	**Geographic scope**	**Output**	**Source**
M	Economic benefits from the marine resource use	Economic	Estonian marine area, patches of 1 x 1 km	Sector level spatial values for fishing, aquaculture, energy production and marine transport and conflict analysis among the sectors	Pihor et al. 2017
F	The economic impact on the provision and quality of ecosystem services resulting from different planning scenarios	Economic	Generic	Monetized values of changes in the provision of the affected ecosystem service. Changes in wellbeing can also be described with semi-quantitative, quantitative or qualitative estimates.	Ivarsson et al. 2017
A	Spatial analyses to identify suitable wind power sites with decision support tool Marxan	Economic, cultural	Arkona Basin and Pomeranian Bight, western Baltic Sea. Planning area covers 14 100 km^2 territorial waters and EEZs of Denmark, Sweden, Poland and Germany subdivided into 1 x 1 km hexagonal units	Selection of most suitable wind park sites with respect to ship traffic and scenic view protection	Göke et al. 2018

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Source
F	Societal cost-benefit analysis of the Finnish MSFD Programme of Measures	Economic	Finnish marine waters	Costs and benefits of the Finnish programme of measures	Börger et al. 2016
A	Mapping of potential sites for underwater natural and cultural trails and parks	Cultural	Finnish, Swedish and Danish marine waters	Spatial distribution of underwater natural and cultural trails	O'Brien et al. 2011
A	Mapping of underwater cultural heritage sites	Cultural	Finnish marine waters	Spatial distribution of underwater cultural heritage sites	Kaituri et al. 2017
A	Categorization of cultural ecosystem services	Cultural	Baltic Sea	Regional applications of CES categorization	BONUS BALTICAPP 2016
A	Mapping of valuable cultural heritage sites	Cultural	Swedish coast and marine waters	Preliminary spatial mapping of cultural heritage sites	Naturvärdsverket 2007
M	Viewshed analysis on coastal and marine landscapes of the Baltic Sea using cumulative threat analysis	Cultural	Area covering a visibility zone of 223,641 km^2 (54 % of the entire Baltic Sea space), with 63,672 observation points	Cumulative visual impacts for shipping activity, existing and planned offshore wind energy prospects, offshore oil platforms and nature protected areas using HELCOM Data and Maps Service	Depellegrin 2016

Table 9. Examples of existing models, frameworks and assessments developed in other sea areas.

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
M	Marine integrated valuation of ESs and tradeoffs provided by corals, mangroves, and seagrasses (InVEST)	Economic, social	The coast of Belize, Central America. Planning process and ESs cover an area 3 km inland and 18 000 km^2 territorial sea.	Annual production of lobster, tourism, and coastal protection for year 2010 and three future scenarios until year 2025		Arkema et al. 2015
M	Spatial wind energy value model compared to cumulative viewshed maps where visibility is measured in viewer days (InVEST Wind Energy and Scenic Quality model)	Economic, cultural	Block Island, Rhode Island, U.S. east coast. The model covers Block Island and 60 x 60 km^2 area surrounding the island.	Spatially explicit net present value of wind farm configuration, visual impact index of wind farm, and efficiency frontier representing optimal combinations of visibility and wind NPV		Griffin et al. 2015

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
M	Spatial model for the human welfare effects of salmon aquaculture (InVEST Aesthetic Quality Model)	Economic, social, cultural	Chiloe region, Southern Chile	Spatially explicit impacts of salmon aquaculture on ecosystem services and human wellbeing: Poverty reduction, corporate and tax benefits,	Human disease control, waste processing, biological regulation	Outeiro and Villasante 2013
M	Bioeconomic model using heuristic algorithm in the assessment of multi-sector ecosystem-based management strategies	Economic, cultural	Massachusetts Bay, U.S. east coast. Model covers 868 patches of 2 x 2 km.	Spatially explicit impacts of wind farm installations on commercial lobster and flounder fisheries as well as whale-watching tourism and conservation in the form of efficiency frontiers		White et al. 2012
F	Framework for analysing ecosystem services tradeoffs in MSP	Economic	Generic	Optimal delivery of two or more ecosystem services		Lester et al. 2013

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
M	Spatially heterogenous model to evaluate the tradeoff between biomass conservation (fish biomass remaining in the sea) and sustainable fishery profits	Economic	The central coast of California, U.S. covering 48 patches	Spatial patch-level harvest, fishery profit and fish abundance	Fish abundance	Lester et al. 2013
M	Interactions among offshore wave energy production, crab fishery and the coastal viewshed	Economic, cultural	Coast of Oregon, U.S.	Monetary annual value per km of coastline of wave energy, profits of crab fishery and value of coastal property as modified by the placement of a wave energy facility		Lester et al. 2013

Model (M), assessment (A) and/or framework (F)	**Title**	**Type**	**Geographic scope**	**Output**	**Cumulative impacts assessed**	**Source**
M	Qualitative mathematical Ecopath/Ecosim-model using Bayesian networks to assess the reef-effect of offshore wind farms	Social	Courseulles-sur-Mer, English channel, France	Qualitative fisheries responses to offshore wind farm installations under different scenarios of cumulative impacts	Increase in benthic organisms (reef-effect), decrease in fishing pressure, and the climate effects on distribution of *Solea solea*, *Gadus morhua* and *Pecten maximus*	Raoux et al. 2018
F	Assessment of social capital as an ecosystem service	Social	Malagasy locally managed marine area, Madagaskar	Assessment and importance of social capital: Trust, community involvement and social cohesion		Barnes-Mauthe et al. 2015
A	Economic valuation and mapping of recreational scuba-diving, sea-kayaking, wildlife viewing trips and seabird watching	Economic, cultural	Coastal area of Wales, UK covering patches of 10 x 10 km within 12 nautical miles off the coast	The average spend per person per day for each activity, estimates for the total number of activity days for each user-group		Ruiz-Frau et al. 2013

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
M	Estimation of marine economic values-in-use (use of marine waters) using systematic costs assessment (SCA) to assess opportunity costs (cost of degradtion)	Economic	Gulf of Naples, Tyrrhenian sea, Italy. Cost units cover an area of 10,454 hexagons of 10 ha each.	Monetary values of large scale and small scale fishing, aquaculture, beach resorts, yachting, diving and commercial shipping expressed in €/ha		Appolloni et al. 2018
A	Spatial analyses to identify overlaping areas of high conservation value and areas important to human use with decision support tool Marxan	Social	Pacific coast, Canada covering patches of 2 x 2 km for a total of 120 499 planning units	Non-monetary Marxan analyses for the six human use sectors: (1) commercial fisheries, (2) sport fishing, (3) ocean energy, (4) tourism and recreation, (5) tenures, and (6) shipping and transportation		Ban et al. 2013
M	Estimation of the value of non-market benefits associated with the	Economic	Republic of Ireland	Willingness to pay values for Irish population from the primary valuation		Norton & Hynes 2018

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
	achievement of good environmental status (GES) combining contingent valuation method and value transfer			study, which is used as the basis of value transfer for UK, France, Spain and Portugal		
A	Mapping of historical and archeological sites and analysis of pressures and conflicts between activities	Cultural	Cyprus	Cross-comparison of activities to identify compatibilities and conflicts between activities and uses with respect to the cultural sites		Agapiou et al. 2017
F	Multi-resolution scale-linked maritime spatial planning method combining 390 biodiversity elements and 38 human activities	(Social)	East cost of South Africa, province of KwaZulu-Natal, multi-resolution system of planning	Optimal allocation of conservation areas with respect to presence of human activities and ecological impact	Index of cumulative anthropogenic pressures	Lagabrielle et al. 2018

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
			units ranging from 0.2 to 10 km			
M	Bayesian belief network for analysing the reallocation of artisanal fishery from a non-take offshore aquaculture area	Social	Basque continental shelf	Effort allocation scenarios used to find best alternative fishing locations based on environmental suitability, past revenue and past fishing presence		Coccoli et al. 2018
M	Multi-factorial spatial model MaRS for planning wave, tidal and wind power	Social, cultural	Scottish waters	Socio-cultural impact of seascape and visual impact and presence of competing economic activities		Davies et al. 2014
A	Categorization of cultural ecosystem services	Cultural	Black Sea	Definitions of aesthetic, recreation and leisure, cultural heritage and		Fletcher et al. 2014

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
				identity related cultrual ecosystem services		
A	Analysis of economic, environmental, and social outcomes from the implementation of ocean plans	Economic, social	Massachusetts and Rhode Island (North America), North Sea (Belgium), Barents Sea (Norway), Great Barrier Reef (Australia)	Economic value created, current economic value, economic losses, government spending, stakeholder engagement, empowering native peoples, marine research arising from the implementation of MSP		Blau and Green 2015
A	Participatory mapping of cultural values	Economic, cultural	Regional District of Mount Waddington, Vancouver Island, Canada	Categorizations of most important ecosystem benefits, spatial distribution of monetary values, non-monetary values and threats		Klain and Chan 2012

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
A	In-person interviews and participatory mappingto assess cultural coastal values	Cultural	Falkland Islands, UK, coastal polygon extending 1 km inland and 1 km seawards of the coastaline was used	Identification of cultural coastal value hotspots in four categories: natural beauty, recreation, sense of place and cultural history		Blake et al. 2017
M	Spatial production function of ecosystem services and implications for location and extent of landscape conversion	Economic	Generic theoretical model and empirical application to a mangrove ecosystem in Thailand	Spatially distributed ecosystem benefits and the risk of ecological collapse in allocation of ecological landscape and development options.	Risk of ecological collapse with respect to the critical spatial width of the landscape	Barbier 2012
F	Integration of socio-cultural valuation methods into a decision-making context	Economic, cultural, social	Generic	Guide to avaliable socio-cultural valuation methods		Scholte et al. 2015
F	Community-based narrative on cultural	Cultural, social	Generic	Identification of culturally significant areas		Gee et al. 2017

Model (M), assessment (A) and/or framework (F)	Title	Type	Geographic scope	Output	Cumulative impacts assessed	Source
	values and 'spatialising' them for MSP purposes					
A	Spatial analysis using participatory GIS to validate and integrate local stakeholder knowledge in marine planning	Social, economic	California, US, north-central coast	Spatial extent and relative economic importance of commercial and recreational fishing, operating costs of fisheries, analysis of potential economic losses associated with planned marine protected areas		Scholz et al. 2011
A	Viewshed analysis of visual impacts of aquaculture	Social	Western Isles, North West coast of Scotland	Visual, seascape and landscape analysis to produce spatial models for new aquaculture development with minimal visual impact		Falconer et al. 2013

Model (M), assessment (A) and/or framework (F)	**Title**	**Type**	**Geographic scope**	**Output**	**Cumulative impacts assessed**	**Source**
F	Meta-analytical transfer of the value of recreational activities	Social, economic	Global	Global map of coastal recreation values and the methodology for integrating spatially explicit geo-referenced values		Ghermandi & Nunes 2012