



Scoping report discussed with representatives of target groups

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This document is developed within the SEABAS project platform to synthesising practices across multiple projects. It ensures a harmonised framework applicable in transboundary contexts, integrating outcomes from all contributing projects.

All members of the SEABAS project contributed to the preparation of the document by providing examples of best practices from the analysed projects or by submitting remarks. The project partners involved: Gdynia Maritime University, Institute of Oceanology Polish Academy of Science, Helsinki Commission, University of Tartu, Baltic Environmental Forum - Latvia, German Federal Maritime and Hydrographic Agency, Regional Council of Southwest Finland, Coalition Clean Baltic, Ministry of Smart Administration and Regional Development of Latvia and The Swedish Agency for Marine and Water Management.

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Introduction

The SEABAS project platform represents a critical step forward in the sustainable management of the Baltic Sea region. Its primary ambition is to establish a robust regional framework that seamlessly integrates Strategic Environmental Assessment (SEA) within Maritime Spatial Planning (MSP). Strategic Environmental Assessments, as required by the EU Directive 2001/42/EC, integrate environmental considerations into development plans and programmes, before they are adopted. The EU MSP Directive 2014/89/EU requires that the directive on Strategic Environmental Assessments is followed in situations where maritime spatial plans are likely to have significant effects on the environment. By building upon the successes of previous and ongoing initiatives, SEABAS champions an ecosystem-based approach designed to promote a sustainable blue economy while effectively managing human activities at sea. A central pillar of this overarching effort is the development of methodological recommendations in a transboundary context, directly addressing pressing regional challenges. The results will support the regional goals agreed upon in the HELCOM-VASAB Regional Maritime Spatial Planning Roadmap 2021 – 2030;

3.2 Develop a Baltic SEA-framework including themes, common data, assessment methods for impact evaluation, cross-border consultations, and

3.5 Promote the use of methods and tools in MSP for assessing cumulative environmental and other impacts of sea-based activities.

Within this framework Activity 1.1. serves as the foundational phase of the project, culminating in a detailed scoping report, presented in this document. The core purpose of this task is to compile, evaluate, and consolidate SEA practices, tools, and methodologies derived from recent projects addressing the environmental component in MSP and completed since 2019. By analysing key initiatives, this report systematically identifies best practices across essential domains to establish a coherent baseline for the list of good practices on SEA

This report is highly relevant and integral to the overarching goals of the SEABAS project platform. By synthesizing these practices into a comprehensive analysis, the task directly feeds into the objective of refining practical tools and establishing a harmonized SEA and Cumulative Impact Assessment (CIA) framework. The insights gathered here provide the actionable recommendations necessary to develop methodologies that are specifically tailored to the complex, transboundary realities of the Baltic Sea region. The scoping report ensures that the SEABAS project platform is grounded in validated, real-world applications rather than theoretical assumptions.

To ensure a comprehensive and robust foundation, this scoping report examines 13 European projects relevant to MSP and SEA. By drawing upon this extensive wealth of cross-regional experience, the deliverable carefully selects good practices. These practices are logically categorized into distinct themes, such as assessment scoping, data utilization, stakeholder participation, and interoperability, directly reflecting the primary purposes of the SEABAS project platform. This thematic organization not only makes the findings highly accessible but also provides clear, actionable pathways for integrating these diverse European insights into the harmonized framework tailored for the Baltic Sea region. This framework will also facilitate the regional work for coherent and ecosystem-based maritime spatial plans coordinated by the HELCOM-VASAB MSP Working Group.

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PART I

Review of Contributing Projects

PART I contains 13 European scientific projects taking into account the SEA and MSP, serving as the essential base for the good practices presented in this report. Together, these 13 projects represent a rich accumulation of experience and a vast base of knowledge that has been gathered since 2019. Before exploring specific practical insights, it is crucial to understand the frameworks and strategic objectives of these initiatives. This chapter establishes the necessary background to acknowledge how these methodologies emerged and why they are effective.

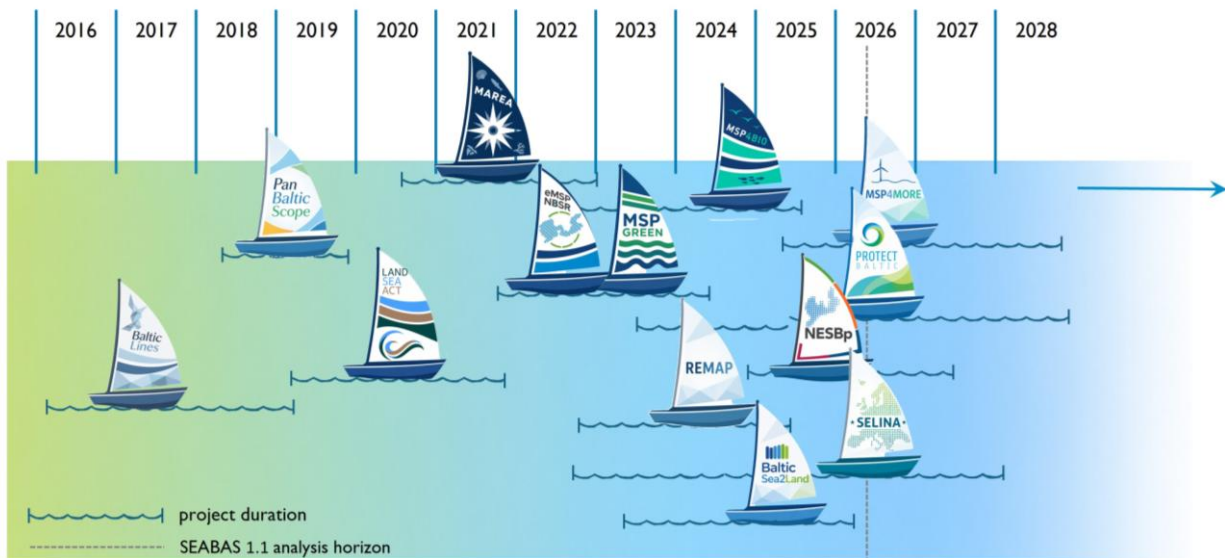


Fig. 1.1. Chronological order of the analysed projects (D.1.1.)

Source: own graphic prepared by Matczak M. (GMU)

1.1. Baltic LINES: Coherent Linear Infrastructures

Project Acronym: Baltic LINES

Funding Programme: Interreg Baltic Sea Region

Timeline: 2016 –2019

Baltic LINES addressed the specific challenge of transnational coherence for linear infrastructures—shipping routes and energy corridors. As the Baltic Sea becomes a hub for offshore wind, the need to coordinate grid connections and shipping lanes across borders became acute. The project aimed to prevent cross-border mismatches and secure connectivity to support Blue Growth. Key outputs included:



- **Energy Scenarios:** Development of future energy scenarios for 2030 and 2050 (low, central, high) to anticipate spatial needs for offshore wind and grid infrastructure. This forward-looking approach allows planners to reserve space for infrastructure that does not yet exist.
- **Data Infrastructure:** Harmonization of MSP data infrastructure for shipping and energy, contributing to the development of Marine Spatial Data Infrastructure (MSDI) prototypes. This ensures that a cable planned in one country "meets" the cable planned in the neighbours' waters.

1.2. Pan Baltic Scope: Coherent National MSP

Project Acronym: Pan Baltic Scope

Funding Programme: European Maritime and Fisheries Fund (EMFF)

Timeline: 2018 –2019

Pan Baltic Scope was a foundational project aimed at achieving coherent national MSP in the Baltic Sea region. It focused on building lasting macro-regional mechanisms for cross-border cooperation, laying the groundwork for many of the subsequent projects.

A key activity was the Planning Forum, which facilitated hands-on cross-border collaboration. The project also advanced the implementation of EBA and data sharing, including the development of an SEA inclusive EBA handbook, and methods for cumulative impact assessment and mapping of marine green infrastructure.



1.3. Land-Sea Act: Land-sea interactions advancing Blue Growth in Baltic Sea coastal areas

Project Acronym: Land-Sea-Act

Funding Programme: Interreg Baltic Sea Region

Timeline: 2019 – 2021

The Land-Sea-Act project focused on addressing the complex challenges involved in Maritime Spatial Planning (MSP) and "Blue Growth" around the Baltic Sea. Its primary goal was to bring together stakeholders involved in coastal management to find solutions that better integrate "Land-Sea Interactions" (LSI) into planning processes. By doing so, it aimed to balance the interests of preserving coastal ecosystems with the need for economic development in coastal areas. The solutions were tested in six case study areas around the Baltic Sea, including Sweden, Denmark, Germany, Poland, Latvia and Estonia. The results of all cases fed into the compendium of methodologies on how to address land-sea interaction and development trade-offs in coastal areas.

The project worked to improve transnational cooperation and facilitate knowledge exchange among national, regional, and local authorities. It produced practical outcomes such as the "Multi-level Governance Agenda on Blue Growth and Spatial Planning," which guides authorities on how to harmonize land and sea planning to foster sustainable development and resolve conflicts between different sectors.



1.4. MAREA: Marine Ecosystem Accounting

Project Acronym: MAREA

Funding Programme: Interreg Central Baltic

Timeline: 2020 –2022

MAREA (From marine ecosystem accounting to integrated governance for sustainable planning) focused on the practical implementation of the Ecosystem-Based Approach (EBA). It addressed the challenge that while EBA is a regulatory requirement, clear guidance on its implementation, specifically regarding the integration of ecology and economy, was lacking.

The project developed and tested novel assessment methodologies for Ecosystem Services (ES) mapping, environmental accounting, and sustainability assessment. Key outputs were the production of high-resolution maps for provisioning, regulating, and cultural ES, and the explicit integration of socio-economic models for valuation and accounting in coastal and marine ecosystems. The project presented cultural ecosystem services (CES), which by binding together elements from social and ecological concepts, showed that it is no longer an abstract concept. CES have changed into high-resolution maps showing the suitability and intensity of coastal use.

Main outcomes:

- **Geospatial Tools:** A synthetic decision-support geoportal was created to develop sustainable planning solutions explicitly integrating ES
- **Ecosystem Accounting:** The project advanced the development of a system for accounting for marine environments and the benefits they deliver (provisioning, regulating, and cultural services). This included quantitative modelling of marine ecosystem services.
- **Pilot Areas:** The methodologies were tested in transnational pilot areas: Finland-Estonia (Gulf of Finland) and Estonia-Latvia (Gulf of Riga), providing high-resolution maps for these zones.

1.5. eMSP NBSR: Emerging Ecosystem-Based Maritime Spatial Planning

Project Acronym: eMSP NBSR

Funding Programme: European Maritime and Fisheries Fund (EMFF)

Timeline: 2021 – 2024

The eMSP NBSR project represented a critical evolution in cross-basin cooperation, bridging the North Sea and Baltic Sea closer. The project operated on the premise that planners and policymakers require a mechanism to reflect on current practices and collectively identify solutions for emerging challenges, specifically those posed by the European Green Deal.



The heart of the project was the establishment of a Community of Practice (CoP) based on sharing analyses, information, and advice to each other and developing new practices. Rather than producing static reports, the project facilitated continuous dialogue among maritime authorities, policymakers, and researchers. The thematic strands were carefully selected to address the most pressing gaps in current governance:

- Ocean Governance: This strand explores solutions and best practices across the two sea basins, recognizing that administrative borders rarely align with ecological boundaries.
- Ecosystem-Based Approach (EBA): A core objective is enhancing the application of EBA in MSP through the development of international legal and policy frameworks.
- Sustainable Blue Economy: The project frames MSP as a solution provider for blue growth challenges, moving beyond conflict management to proactive facilitation.
- Monitoring and Evaluation: A critical gap in many national plans is the lack of robust monitoring. eMSP NBSR works on tracing coherence between maritime spatial plans and addressing climate change challenges.
- Data Sharing and information communication technology serving MSP: Evaluating the coherence of MSP data availability across borders to build further on existing regional maritime initiatives and project outputs related to the definition of MSP plans data models.

The legacy of eMSP NBSR lies in its transition mechanism—preparing the ground for its successor NESBp (look 1.12) and ensuring that the "collective memory" of the North and Baltic planners is not lost between project cycles.

1.6. MSP-GREEN: Maritime Spatial Planning as Enabler of the European Green Deal

Project Acronym: MSP-GREEN

Funding Programme: European Maritime, Fisheries and Aquaculture Fund (EMFAF)

Timeline: 2022 –2024

MSP-GREEN was explicitly aligned with the high-level political ambition of the European Green Deal (EGD). The project proceeded from the premise that MSP is not merely a passive regulatory tool, but a powerful cross-cutting instrument capable of *enabling* the EGD's objectives. This includes climate change mitigation, biodiversity protection, and the transition to a circular blue economy.

The project's central objective was to create a framework for plans to act as "marine enablers." This involved a systematic analysis of existing national maritime spatial plans to assess how EGD principles are integrated and identifying gaps where these ambitions are not yet met. The project operated across multiple sea basins (Mediterranean, Baltic, Black Sea, Atlantic), ensuring a comparative perspective.

Key strategic objectives of the project were:



- Assess whether and how MSP plans have considered the EGD objectives,
- Assess what are the major gaps, challenges and trade-offs in mainstreaming EGD into MSP,
- Identify and exchange valuable practices of incorporation of EGD elements in MSP plans,
- Identify, design and start implementing additional actions to strengthen the implementation of EGD-related objectives,
- Provide recommendations to EU countries on how to use MSP in fostering the achievement of the EGD goals,
- Engage regional sea communities – including non-EU countries – in a dialogue on the EGD ambition and the role of marine planning for a Sustainable Blue Economy.

1.7. MSP4BIO: Improved Science-Based MSP to Safeguard Biodiversity



Project Acronym: MSP4BIO

Funding Programme: Horizon Europe (Research and Innovation)

Timeline: 2022 –2025

MSP4BIO addressed the critical mismatch between MSP and the designation of Marine Protected Areas (MPAs). While theoretically linked under the Ecosystem-Based Approach, in practice, there is often little integration between the spatial planning of human uses and biodiversity conservation efforts at sea. The project was designed to close this gap by developing an integrated, modular Ecological-Socio-Economic (ESE) management framework.

The project strongly focused on the science-policy interface. It utilized "Science Policy Dialogue Think Tanks" to co-develop solutions with policy actors, ensuring that the scientific tools produced are usable by regulators. The project was built around four pillars:

- **Policy:** Developing solutions that support coherent policy implementation and effective mainstreaming of biodiversity.
- **Environment:** Improving the knowledge base and criteria for planning MPAs and Ecologically or Biologically Significant Areas (EBSAs), including climate change scenarios.
- **Socio-economic:** Integrating socio-economic considerations into MPA prioritization by using ecosystem services valuation approaches. This addresses the "Socio-economic considerations".
- **Integration:** Using trade-off analysis and scenario co-development to merge ecological and socio-economic data.

The framework was validated in six test sites. This pilot approach allows for the testing of "bottom-up" data integration, where local ecological data feeds into the broader regional framework.



1.8. ReMAP: Reviewing and Evaluating MSP Monitoring

Project Acronym: ReMAP

Funding Programme: EMFAF (European Maritime, Fisheries and Aquaculture Fund)

Timeline: 2022 –2025

ReMAP focused on the technical framework required to support the European MSP process, specifically the monitoring and revision of plans. The project aimed to provide Member States with innovative technical frameworks to review their maritime spatial plans, ensuring that planning is an iterative cycle rather than a one-off event.

Technical innovation was central to ReMAP. It was developing a suite of modular analytics and data tools build on the advances of the Technical Expert Group (TEG) on MSP data and EMODnet. These 10 modules covered:

- MSP “input data”
- MSP “output data”
- Cumulative Impact Assessment analytics
- Land-Sea Interactions analytics
- Marine Strategy Framework Directive and MSP relationships analytics
- Marine conservation & Maritime sectors (in)compatibility analytics
- Ecosystem services assessment analytics
- Socio-economic analytics
- Governance analytics
- Navigation Safety analytics

1.9. SELINA: Science for Evidence-based and sustainable decisions about NATural capital

Project Acronym: SELINA

Funding Programme: Horizon Europe

Timeline: 2022 – 2027

SELINA aims to reshape decision-making processes in both the public and private sectors by improving the uptake of information regarding biodiversity, ecosystem conditions, and ecosystem services. It seeks to move from scientific data collection to practical application, by providing guidance for evidence-based decision-making that supports the protection, restoration, and sustainable use of the environment. SELINA strives to spark a transformative societal change that halts biodiversity loss and supports the goals of the EU Biodiversity Strategy for 2030.



The project involves a collaboration of experts from 50 partner organizations across 27 EU member states and beyond. Such vast group includes leading experts on ecosystem services science, ecosystem accounting and science-policy business. The integrated ecosystem assessment framework developed by the project is examined within 15 real-world Demonstration Projects. SELINA will set new standards for international cooperation to promote ecosystem services and biodiversity conservation.

1.10. Baltic Sea2Land: Fostering integrated governance for the joint sustainable use of human and natural capital in the near shore zone



Project Acronym: Baltic Sea2Land

Funding Programme: Interreg Baltic Sea Region

Timeline: 2023–2025

Baltic Sea2Land focused on the complexity of Land-Sea Interactions (LSI) and the Multi-Level Governance (MLG) required to manage them. The project recognized that coastal management involves overlapping jurisdictions (municipal, regional, national) and complex environmental provisions that do not stop at the coastline.

The project developed the Sea2Land Navigator, a tool designed to help public authorities harmonize land and marine planning. This platform aids in balancing interests between the sustainable blue economy, local communities, and ecosystem preservation. It fosters integrated governance for the joint sustainable use of human and natural capital in the near-shore zone; a critical area often overlooked in purely "marine" or purely "terrestrial" planning.

1.11. PROTECT BALTIC: Enhancing Marine Protected Areas

Project Acronym: PROTECT BALTIC

Funding Programme: Horizon Europe (Mission Restore our Ocean and Waters)

Timeline: 2023 –2028

PROTECT BALTIC is a large-scale flagship initiative responding to the urgent need to expand strict protection in the Baltic Sea. With current coverage hovering between 14-17% and strict protection almost non-existent, the project aims to strategically enhance the network to reach the 30% protection target by 2030, as mandated by the EU Biodiversity Strategy.



The project is transboundary in nature, aiming to establish a regionally agreed protection framework and a data-driven evidence base. It aligns with HELCOM's Baltic Sea Action Plan (BSAP) and aims to redefine marine protection ensuring a sustainable future for unique biodiversity.

Key goals:

- “Spatial protection in the Baltic Sea results in tangible positive biodiversity outcomes and demonstrably contributes to a healthy and resilient Baltic Sea with diverse biological components functioning in balance.

- “The Baltic Sea spatial protection network is strategically planned from an ecological perspective and is resilient, coherent, ecologically representative and well connected.
- “The Baltic Sea marine protected area (MPA) network is effectively and equitably managed in an ecologically relevant way, enabling the potential of the network to provide biodiversity benefits to be realized”.

1.12. NESBp: Northern European Sea Basins Project

Project Acronym: NESBp

Funding Programme: EMFAF (2024-PIA-MSP)

Timeline: 2024 –2027

NESBp is the successor to the eMSP NBSR project, continuing the cooperation between the North Sea and Baltic Sea regions. It aims to institutionalize the Greater North Sea Basin Initiative (GNSBI) and link it with the HELCOM-VASAB MSP Working Group.

The project’s strategic goals include establishing a permanent structure for cross-border collaboration and learning, promoting integrated ecosystem-based governance, and providing practical solutions to enhance the multi-use of marine areas. By linking the two sea basins, NESBp acknowledges the interconnectivity of shipping, energy grids, and ecosystems across Northern Europe.



1.13. MSP4MORE: MSP tools for integrating Multiple sustainability objectives under expansion of Offshore Renewable Energy

Project Acronym: MSP4MORE

Funding Programme: Sustainable Blue Economy Partnership (SBEP) — co-funded by the European Union (Horizon Europe)

Timeline: 2025 – 2028

The project aims to develop strategic methods and data to support the effective integration of offshore wind in maritime spatial planning and its development while aligning with environmental policy targets, like expanding marine protected areas, promoting ecosystem restoration and minimizing competition for space with other sea uses.

MSP4MORE looks into enabling the sustainable coexistence of offshore wind park developments with various marine activities by identifying and addressing trade-offs and enhancing synergies. This project aims to develop tools that help planners optimize the location and design of offshore wind farms to minimize negative trade-offs with biodiversity and other marine sectors. Integrative research is carried out in seven study areas representing the Baltic, North, Mediterranean, and Barents Seas. Developed actions build on findings from various ongoing initiatives and foster innovation through collaboration with stakeholders from government, industry, academia, and the civil society.



PART II

Exhibition of SEA Good Practices and Guidance

Building upon the overview of the 13 European initiatives introduced in PART I, this section provides a systematic analysis of the good practices divided into thematic groups. These issues have been divided into: approaches or methods supporting the Strategic Environmental Assessment (SEA) scoping phase, assessment methods used to evaluate environmental impacts, tools supporting SEA, data essential to the SEA framework, knowledge gained through analysed projects and gaps identified during the implementation of these projects, and finally, mitigation measures. Each thematic group covers relevant topics and concludes with key considerations, highlighting best practices and lessons learned extracted from analysed projects to form the guide presented in PART II. Ultimately, this synthesis serves to establish a harmonized, ecosystem-based framework tailored to support the effective integration of SEA within Maritime Spatial Planning (MSP) across the Baltic Sea region.

2. Approaches or Methods Supporting the SEA Scoping Phase

This chapter examines how the projects contributed to the early stages of SEA development, particularly in identifying key issues, objectives, and conceptual approaches. In practice, SEA varies considerably in terms of scope and the range of topics to be addressed, resulting in diverse approaches and differences in defining the scoping phase. Although sometimes overlooked, the scoping phase plays a pivotal role in ensuring the effectiveness of SEA, as it involves critical strategic decisions regarding the themes to be included, linkages to relevant policy processes, and key practical aspects of the assessment.

The chapter identifies the good practices developed by the analysed projects and reviews methods that - whether specifically designed for or highly applicable to the SEA scoping phase - define the focus of the assessment. The following aspects were selected through discussions among project partners: inclusion of Land–Sea Integration (LSI), integration of Marine Strategy Framework Directive (MSFD) descriptors and indicators, approaches to ecosystem service mapping, identification of environmental objectives, incorporation of socio-economic and cultural considerations, and the definition of the content and level of detail during scoping. Table 2.1 provides a quantitative overview of these elements. In total, 42 good practices, guidelines or messages were identified, with socio-economic considerations and ecosystem service mapping emerging as the most frequently addressed. However, there are some overlaps between good practices, e.g., between cultural consideration and ecosystem services mapping since, in many cases, cultural consideration is related to cultural ecosystem services.

Table 2.1. Good practices identified for “approaches or methods supporting SEA scoping phase”

Project Acronym	Approaches or Methods Supporting the SEA Scoping Phase						
	LSI Land-Sea Integration	MSFD Descriptors and Indicators	Ecosystem Service Mapping	Environmental Objectives Identification	Defining the contents and level of detail during the scoping of the assessment	Socio-economic Considerations	Cultural Consideration
eMSP NBSR		x		x	x	x	
MSP-GREEN	x		x	x		x	
MSP4BIO			x	x	x	x	
PROTECT BALTIC			x	x	x	x	
MAREA			x			x	x
ReMAP							
BalticLINES							
Baltic Sea2Land	x		x		x	x	x
Land-Sea Act	x		x			x	x
SELINA		x	x	x			
MSP4More	x		x		x		x
NESBp						x	
Pan Baltic Scope	x	x	x		x	x	

Source: own analysis of information provided by project partners

Thus, it is difficult to assign specific good practices unambiguously to individual topics/themes, as project activities are inherently complex and thematic considerations often overlap. Therefore, the grouping presented does not aim to exhaustively resolve these overlaps, rather it is intended primarily to ensure that no important good practice is overlooked.

2.1. Land–Sea Integration (LSI)

Good practices related to Land-Sea Integration can be broadly classified into the following categories:

- a) conceptual and definitional approaches;
- b) implementation- and application-oriented documents, as well as relevant tools and instruments.

2.1.1. Land-Sea Integration definitions and conceptualization in relation to SEA

Fundamental work on inclusion of LSI into SEA was commenced under the **Pan Baltic Scope** project. The project has developed a clear definition of LSI, examined the evolution of the LSI concept within its policy context, and identified the key rationales for integrating LSI into MSP and/or Integrated Coastal Zone Management (ICZM). In addition, it has provided a synthesis of the principal enabling factors and challenges associated with addressing LSI within MSP processes at the national level.

A key finding of the project is that a more systematic consideration of LSI not only contributes to a more holistic understanding of spatial planning and SEA challenges but also supports more effective and proactive management approaches. This can lead to more coherent and integrated planning frameworks, potentially evolving towards a “one-space” planning approach. The outcome is a more balanced and forward-looking planning system, in which MSP and ICZM move beyond addressing only immediate or sector-specific pressures towards genuinely integrated planning across the land-sea interface. However, here the challenge is in the actual jurisdictions: i.e. governance mandates, routines and processes.

The project underscores the increasing development of cross-border and transboundary infrastructure, which requires a broader perspective on LSI that explicitly accounts for transboundary impacts, cumulative effects, and differences between planning systems. Incorporating LSI into MSP and SEA may therefore act as a catalyst for enhanced collaboration among planning authorities, as cross-border development impacts become better understood and integrated planning approaches gain prominence, not only within national planning processes but also at the regional and transnational levels.

In a similar manner the **MSP-GREEN** project underlines the need to integrate LSI into SEA highlighting the importance of terrestrial processes on intensity of traditional and emerging maritime activities. The project highlights that impact assessments should also consider impacts on the marine environment that are terrestrial in origin to understand the pressures more holistically. In relation to climate-change mitigation the project highlights that MSP should identify links to terrestrial and coastal planning related to the development and expansion of offshore renewables. The importance of land-sea connections and consideration of infrastructure other than wind turbines are stressed when assessing the impacts of offshore renewables¹.

¹Source: [Bridging Maritime Spatial Planning and the European Green Deal](#) (2024). Ramieri, E., Bocci, M., Gee, K., Capurso, G., et al.: (2024). Recommendations on how to strengthen the integration of EGD maritime components into MSP. MSPGREEN project]

Also, **MSP4MORE** project underlines the need of addressed LSI through assessing the socio-cultural effects of the offshore windfarms (OWF) development on coastal communities.

More detailed considerations are available in materials of other projects. For instance, the **Baltic Sea2Land** project identifies human terrestrial pressures and climate risks that should be considered under SEA:

- Erosion and sediment dynamics: port dredging, erosion protection structures, and construction in coastal dunes disturb natural sediment transport, accelerating coastal erosion.
- Pollution flows: agricultural runoff, waste, microplastics and “ghost nets” originate on land but damage marine ecosystems.
- Climate risks: storms, rising sea level, coastal flooding directly affect terrestrial settlements and infrastructure.

The project also conceptualized LSI via ecosystem services making use of the ecosystem-services logic (the CICES classification). This conceptualization allows to demonstrate that:

- Marine ecosystems are the basis of coastal tourism.
- Coastal habitats affect fish stocks - coastal dunes, forests, wetlands influence water quality, biodiversity and ecosystem services at sea and marine habitats (reefs, sandy shoals) support fish nurseries that affect coastal fisheries.
- Terrestrial landscapes shape cultural identity and recreation value.

2.1.2. Guiding documents how to include LSI into SEA

The **Land-Sea-Act project** has developed a “Compendium of methodologies on how to address land-sea interaction and development trade-offs in coastal areas”. The compendium gives a brief overview on available methodological frameworks for addressing land-sea interactions, as well as collates the various methods tested by the Land-Sea-Act case studies for operationalising of LSI within planning and governance of coastal and marine spaces. The Compendium illustrates how LSI and different development trade-offs in coastal areas can be addressed within the process of spatial planning at different planning stages, levels and contexts².

MSP4MORE project provides an insight on practical inclusion of socio-cultural effects of the offshore windfarm (OWF) developments on coastal communities under SEA. This will include surveys on acceptance of OWF by coastal communities and stakeholder engagement for addressing the sociocultural implications and trade-offs between OWF developments and other uses of the sea and coastal areas.

The **Baltic Sea2Land** project emphasizes multi-level governance to manage complex land–sea interactions: coastal areas are impacted by many overlapping authorities and competing interests in tourism, energy, fisheries,

²Source: Ruskule A., Veidemane K., Pikner T., Printsman A., Palang H., Arikas D., Siegel P., Costa L., Burrow B., Piowarczyk J., Zielinski T., Romancewicz K., Koroza A., (2021). Compendium of Methodologies on How to Address Land-Sea Interactions and Development Trade-offs in Coastal Areas. Land-Sea-Act Project Output, pp. 47

conservation, and local communities. Through the Latvian pilot, the project demonstrated how LSI can be operationalised in national coastal planning, providing evidence on how land-based activities, marine processes, and climate risks mutually shape coastal development. The pilot's coastal landscape and accessibility assessment further adds spatially comparable data on visitor pressure, landscape vulnerability and access to the sea, illustrating how human mobility and coastal use patterns connect land and sea. Together, these outputs support coherent, multi-level coastal governance and highlight the need for an integrated coastal and marine planning framework. The project has developed important tools facilitating integration of LSI into Sea such as Sea2Land Navigator, coastal assessment framework for collecting comparable data on visitor coastal pressure, and coastal landscape and accessibility mapping. All of these will be analysed more in depth under tool and data chapters in this report (Chapter 4: SEA Tools and Chapter 5: Common data and usage of data).

The **Pan Baltic Scope** project has also developed still relevant and very important recommendations on inclusion of LSI into MSP. They emphasize the importance of raising early and continuous awareness of LSI among planners, authorities, and stakeholders throughout the planning process. They highlight the need for a systems-based perspective that considers social-ecological processes, governance frameworks, stakeholder involvement, and knowledge development in an integrated manner. Effective institutional coordination and stakeholder communication are also essential, particularly through aligning planning systems across land and sea and ensuring inclusive participation. Furthermore, the development and sharing of reliable, comprehensive knowledge on LSI, combining spatial, social, economic, and ecological data, are identified as critical for informed decision-making. The recommendations also stress the importance of identifying knowledge gaps and improving data coordination across sectors and institutions. Finally, adequate resources, capacity building, and networking are necessary to support LSI integration, especially at regional and local levels, alongside the dissemination of good practices³.

³Source: Morf, A., (ed) Cedergren, E., Gee, K., Kull, M., Eliassen, S. (2019) Lessons, stories and ideas on how to integrate Land-Sea Interactions into MSP. Nordregio, Stockholm. Available at <https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope> (Accessed 12eb 2026)

Key considerations of Land-Sea Interaction for BSR SEA FRAMEWORK

1. The critical body of knowledge required for the inclusion of LSI in SEA exists and continues to grow, albeit without significant acceleration (the findings of Pan Baltic Scope remain relevant and foundational).
2. The drivers for incorporating LSI into SEA are strong (e.g. the development of cross-border linear infrastructure, offshore renewable energy, coastal recreation) and are further reinforcing such integration.
3. New aspects related to the inclusion of LSI in SEA have recently been identified, including socio-cultural considerations, trade-offs between key terrestrial and maritime development objectives, and climate-related risks.
4. Relevant detailed guidelines, pilot test results, and supporting tools and frameworks (e.g. the Navigator) are available.
5. Key constraints include the limited availability of integrating spatial, social, economic, and ecological dimensions, as well as fragmented governance frameworks and deficiencies in governance capacity.

2.2. Integrating MSFD descriptors into SEA

Despite consistent interest in MSFD descriptors' integration into SEA, the topic has not gained much attention in the projects analysed. Only few projects explored this link and even then, most did so indirectly by using Maritime Spatial Planning as a bridge between MSFD and SEA.

The most comprehensive analysis is provided by **Pan Baltic Scope**. The project explores mechanisms for integrating the MSFD into SEA and MSP. Two principal entry points for integration were identified:

1. Identification of information derived from MSFD that can inform the SEA process.
2. Alignment of the overarching objectives of SEA with the indicators established under the MSFD.

The first entry point emphasizes the relevance of Good Environmental Status (GES) descriptors and associated indicators under the MSFD for consideration during the SEA scoping phase. These descriptors and their relevance to MSP are summarized below. (table 2.2):

Table 2.2. Scoping SEA in line with MSFD ambitions

Qualitative descriptor	Aspects relevant for MSP (most prominent examples)
D1 Biological diversity	Environmental protection, offshore renewable energy, cables and pipelines, oil and gas exploitation, sand and gravel extraction, benthic trawling
D4 Marine food webs	See biological diversity; important for cumulative impact assessments Dredging and dumping by their release of contaminants, which can accumulate in the food web and this way alter food web structure, shipping by introduction of contaminants, oil spills by direct mortality, fisheries (no take areas) because fishing alters the food web structure, any activity leading to habitat loss and population effects and disturbance as this could affect species distributions and this species composition at certain areas
D6 Seafloor integrity	Benthic trawling, maintenance of shipping lanes, cables and pipelines, oil and gas extraction, offshore renewable energy, sand and gravel extraction
D7 Hydrographical conditions	Maintenance of shipping lanes, offshore renewable energy, other infrastructure substances
D8 and D9 Hazardous substances	Oil spills, shipping, dredging, dumping
D10 Marine litter	Shipping
D11 Energy and underwater noise	Shipping, surveying, offshore wind energy, among others; however, large variety of sources

Source: D.Langlet and A. Westholm Synthesis Report on the Ecosystem Approach to Maritime Spatial Planning. Pan Baltic Scope project available at <https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope> (retrieved 20.02.26)

Of the eleven GES descriptors, three are inherently place-based and can be directly influenced through maritime spatial planning:

- a. D6 (Seafloor integrity)
- b. D7 (Hydrographical conditions)
- c. D11 (Energy, including underwater noise)

With the exception of D4 (Marine food webs), the listed descriptors are fully or partially spatially explicit:

- a. Descriptor D1 (Biological diversity) is partially place-based, particularly with respect to benthic species and habitats, as well as commercially exploited fish and shellfish species, due to their dependence on specific habitat conditions.
- b. Descriptors D1, D4, and D6 represent aggregate ecosystem properties. Trends in these state descriptors may reflect cumulative impacts; however, they do not necessarily allow for clear attribution of observed changes to specific pressures or activities. Descriptor D10 (Marine litter) currently has limited spatial attributes directly relevant to MSP, although waste generation associated with planned maritime activities requires regulatory consideration.

Further options for linking MSFD and MSP Directive's aims exist through:

- a. Designing monitoring programmes that measure MSFD indicators, assess predominant pressures and impacts, and evaluate environmental status in marine waters.
- b. Systematic evaluation of pressures and impacts generated by maritime activities, including cumulative impact assessments.
- c. Establishment of measurable environmental management targets aligned with GES objectives.
- d. Application of ecosystem-based management principles by considering ecological rather than administrative boundaries.
- e. Recognition of ecosystem carrying capacity limits in planning decisions.
- f. Conducting regular environmental assessments and adopting a holistic systems approach that acknowledges humans as integral components of marine ecosystems⁴.

The **eMSP** project finds that MSP can support the achievement of Good Environmental Status (GES) under the MSFD by managing and redistributing human pressures and promoting sustainable, multi-use marine areas. However, demonstrating direct impacts of MSP on GES remains difficult, particularly where pressures originate outside MSP's scope (e.g. terrestrial pressures) or are governed by other policies. All this calls for integrating LSI into SEA as discussed above. While MSFD indicators can in principle support MSP and SEA, their practical application is limited by challenges in attributing effects, mismatches in spatial and temporal scales, and difficulties in isolating individual impacts. Instead, the underlying data from these indicators is more effectively used in cumulative impact assessment tools. The project concludes that there is no straightforward method to directly link MSP implementation to GES outcomes, and assessments should focus on expected changes resulting from planning decisions. A key recommendation is to strengthen alignment between MSP/SEA objectives and MSFD goals by developing spatially explicit GES targets that can be operationalised through ecosystem-based planning.

The **SELINA** project has worked on ecosystem condition indicators that determine the values of ecosystem services. The MSFD descriptors and indicators have served as basis for developing a list of indicators. Furthermore, the

⁴Source Langlet and A. Westholm Synthesis Report on the Ecosystem Approach to Maritime Spatial Planning. Pan Baltic Scope project available at <https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope> (retrieved 20.02.26)

project has developed potential minimum indicators for describing marine ecosystem condition and pressure, respectively⁵.

Key considerations of Integrating MSFD descriptors into SEA for BSR SEA FRAMEWORK

1. The body of knowledge required for the inclusion of MSFD indicators in SEA has not yet reached a critical level of application.
2. Although the drivers for incorporating MSFD into SEA are strong (notably the focus of EU policies, including MSP, on achieving Good Environmental Status), the outcomes achieved to date remain limited, mainly due to challenges in attribution and mismatches in temporal scales.
3. The integration of MSFD into the BSR SEA Framework would require additional effort.
4. The data underpinning MSFD indicators appears useful for SEA and MSP in quantifying and scoping pressures and environmental conditions as background information; however, this largely reflects a traditional approach.
5. A noteworthy innovation is the potential to relate these data to ecosystem services, which could provide an additional dimension for SEA.

2.3. Ecosystem Service Mapping as the SEA element

This is a very popular topic with several good practices. Since ES has not been properly incorporated in many MSP efforts in the BSR during the first round of planning, this growth of good practices should be noted with satisfaction. The good practices can be grouped in three categories: (1) what ES should be included, (2) how it should be done (methodology) and (3) practical application (testing, arrangement of background data collection, etc.). Interestingly, there is a noticeable Latvian leadership in this field.

2.3.1. Model approaches to ES mapping

The **PROTECT BALTIC** project advances ES mapping in the Baltic Sea region through the BALM cascade model, which links biodiversity to societal benefits. The approach connects species to their functional traits, ecological functions, and ultimately to the ecosystem services they provide. This enables a more transparent and ecologically grounded understanding of how marine biodiversity supports services such as nutrient regulation, carbon sequestration, and cultural values.

Species traits, such as feeding behaviour, mobility, and trophic level, determine their role in ecosystem functions like nutrient cycling, habitat formation, and sediment stabilization. These functions underpin key ecosystem services, for example, water quality regulation, coastal protection, and fisheries support. The model also highlights

⁵Source https://project-selina.eu/storage/app/uploads/public/693/1a0/ce4/6931a0ce49cf7777813089.pdf#file_name=SELINA_Deliverable%20D3.2_v2.pdf

the importance of ecosystem condition, showing how changes in biodiversity and habitat quality can affect ecosystem functions and the delivery of services, and helping to identify areas vulnerable to environmental pressures.

A central element of the approach is spatial mapping, which combines habitat data, species distribution models, and trait-based information to identify where ecosystem functions and services are likely to occur. This allows planners to visualise the distribution of ecosystem services and their interaction with human activities and pressures. Ecosystem service valuation complements this by assessing the societal importance of services through economic, social, or multi-criteria methods. Together, mapping and valuation support marine spatial planning by identifying priority areas, evaluating trade-offs, and improving decision-making.

The **MSP4BIO** project developed methodologies to identify, rank, and visualise key ES in relation to human activities and planning priorities, making ES part of decision-making rather than an afterthought (Fig.2.1).

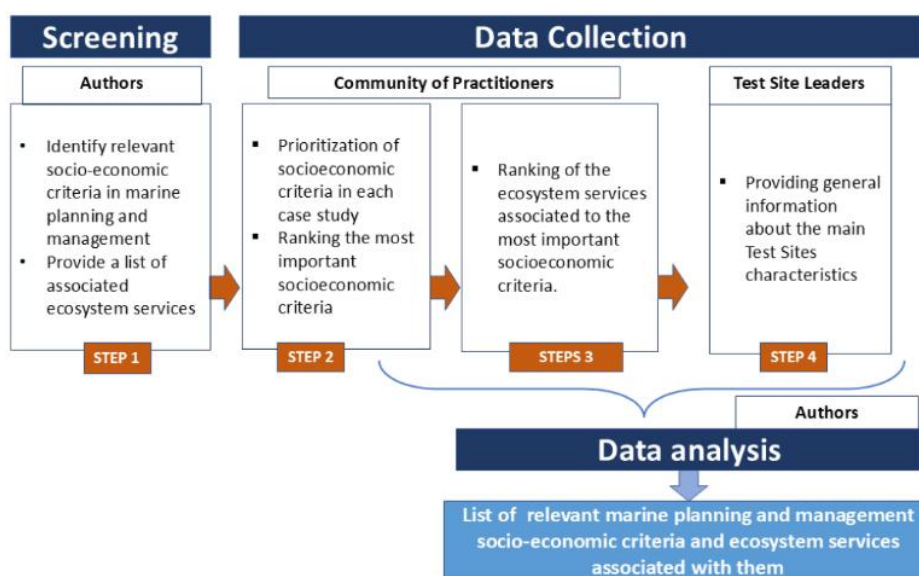


Fig. 2.1 Methodology for collecting and analyzing socioeconomic data in the MSP4Bio project.

Source: Pegorelli C, De Andres M, Garcia-Onetti J, Rayo S and Garcia-Sanabria J (2024) Marineprotected areas as socio-economic systems: a method for defining socio-economic criteria in marine planning. *Front. Mar. Sci.* 11:1358950. doi: 10.3389/fmars.2024.1358950

The proposed framework is grounded in stakeholders’ perceptions, enabling the ranking of both relevant ES and associated socio-economic criteria. The participatory mapping approach has been used to identify spatial overlaps between multiple ecosystem services and social and economic interests, thereby supporting planners in achieving balanced and informed planning outcomes. Stakeholder perception analysis was conducted using the Rapid Ecosystem Services Participatory Appraisal (RESPA) method, which assesses ES through perception-based surveys.

Members of the Communities of Practice established in different case studies within the project ranked ES according to their perceived importance. Qualitative responses from the prioritization process were subsequently converted into numerical values, classified into five levels: “High priority” (4), “Priority” (3), “Neutral” (2), “Low priority” (1), and “Not a priority” (0).

The results indicate significant regional variations in ES prioritization across different marine areas. Ecosystem services with the highest perceived social value were predominantly regulatory services that support human well-being. Moreover, cultural services were found to be equally, or in some cases more, important than provisioning services⁶.

Also **Pan Baltic Scope** project developed a model for E mapping in the BSR. It was carried out as one of the pillars in the mapping of marine green infrastructure (GI). A cross-national expert team developed a concept for marine GI applicable in maritime spatial planning and tested it on the Baltic Sea scale. This involved collating the available regional datasets from the HELCOM Data services covering a broad range of ecosystem elements for the identification of the areas of high ecological value and associated supply of ES, and aggregating this information into a synthetic map of the Baltic Sea marine GI. More than 30 data layers of the marine ecosystem components were included in the analysis covering following broader groups:

- pelagic habitats and species (represented by one data layer – productive surface waters);
- benthic habitats and species (including marine landscapes based on geology; EU protected benthic habitat types; and key benthic species);
- essential fish habitats (spawning, nursery and recruitment areas of commercially important fish species);
- bird habitats (wintering and breeding seabird colonies).

The expert-based matrix approach was used, drawing on the expert knowledge and the results of previous studies. The potential contribution of each ecosystem component to the supply of each ecosystem service was scored using a binary scale where value 0 was assigned in case of no or negligible contribution and 1 - when the ecosystem component was considered to contribute to the service. The scores were obtained through an iterative process, involving experts from Estonia, Latvia, Sweden, Finland, Germany and HELCOM. Further on, a hierarchical data aggregation approach was applied to avoid domination in the assessment results the ecosystem features that were represented by many data layers. First the assessments results were compiled on the level of ecosystem component sub-group (marine landscapes, Natura 2000 habitats, key benthic species, essential fish habitats and bird habitats) and finally aggregated in one map of the ecosystem service supply potential⁷.

⁶Source: : Pegorelli C., De Andres M., Garcí'a-Onetti J., Rayo S. and Garcí'a-Sanabria J. (2024) Marine protected areas as socio-economic systems: a method for defining socio-economic criteria in marine planning. *Front. Mar. Sci.* 11:1358950. doi: 10.3389/fmars.2024.1358950

⁷Source: Ruskule, A., Kotta, J., Saha, C.R., Arndt, P., Ustups, D., Strāķe, S., Bergström, L., 2023. Testing the Concept of Green Infrastructure at the Baltic Sea Scale to Support an Ecosystem-Based Approach to Management of Marine Areas. *Marine Policy*, 147, 105374, <https://doi.org/10.1016/j.marpol.2022.105374>

The **SELINA** project is working on refinement of the ecosystem service knowledge base that is available from prior EU Actions, such as MAES, ESERALDA, MAIA, and INCA, by diagnosing, developing and testing the capabilities of existing ES assessment approaches models, and indicators, aiming to increase the likelihood of their uptake in the decision-making processes. The project also explores interrelation between ecosystem condition and ecosystem service supply and testing how assessment of this interrelation can be applied in different decision-making contexts.

One of the subtasks on diagnosing and testing of the ecosystem service models is devoted to mapping of marine provisioning services, including fisheries, aquaculture and marine harvest. This subtask has developed a logical chain model for assessment of fish provisioning ES integration into MSP as well as marine environmental, nature conservation and fisheries policies. The model links indicators for assessing ecosystem extent (e.g. fish distribution and abundance, essential fish habitats for recruitment) with indicators for assessing condition (fish stock status), ES supply (fish landings) and benefits to society. This analysis offers an empirically grounded framework for ES, thereby enhancing the scientific validity of subsequent MSP and SEA implementations. A similar logical chain model was developed to assess the interrelations among coastal ecosystem condition and landscape qualities to cultural ES and related well-being benefits.

In addition, for the **MSP-GREEN project**, partners shared valuable practices and new actions from their countries that can contribute to furthering the EGD objectives in marine areas through the means of MSP.

A valuable Latvian practice was highlighted in the project materials. This practice implies the assessment of multiple values of landscapes and seascapes by applying an ES approach. The particular actions were taken to implement the **Land-Sea-Act project** (highlighted in the next sub-section)⁸.

Finally, the **MSP4MORE** project will quantify potential offshore windfarm (OWF) effects on ES, focusing on provisioning (e.g., fish production), regulation and maintenance services (e.g., carbon sequestration), as well as the underlying ecosystem functions that support biodiversity enhancement. Environmental economic methods, such as contingent valuation or cost-benefit analysis, will be applied to estimate the monetary value of benefits derived from OWFs with and without co-uses, for example nature-inclusive designs (NIDs), aquaculture, and passive fisheries. In addition, the cultural ecosystem service framework will be used to assess the sociocultural implications of OWF. This will include the non-material, and normally non-consumptive consequences of ecosystem effects, such as impacts on cultural heritage, aesthetic values, knowledge systems, sense of place and recreational practices. Furthermore, advanced spatial and dynamic modelling will be applied to produce detailed maps of species, communities, ecosystem functioning, and other processes that underpin provisioning and regulating ecosystem services. The generated maps of ecosystem assets and services along with the information on human activities and pressures will be used in cumulative effect assessment of OWF and MSP scenarios within the project case study areas.

⁸Source: Description of the valuable practice can be found here: <https://mospgreen.eu/wp-content/uploads/2024/05/VP-Latvia-Balancing-social-economic-and-environment-interests-in-offshore-wind-park-development.pdf>

2.3.2. Scope and range of ecosystem service mapping

The **Pan Baltic Scope project** has assessed 30 ecosystem components regarding their potential contribution to each of the selected ecosystem services (Tab 2.2). Also, **the MAREA project** has developed a quantitative modelling of marine ecosystem services. Finally, **BalticSea2Land project** scoped the ES for mapping. The ES identified by the aforementioned projects are presented in Table 2.3. (based on the Common International Classification of Ecosystem Services (CICES) Version 5.1):

Tab. 2.3. Ecosystem services selected/applied by the analysed projects

Project/ES	Pan Baltic Scope	MAREA	Baltic Sea2Land
Regulating and maintenance	2.1.1.2. Filtration/sequestration/storage/ accumulation by microorganisms, algae, plants, and animals 2.2.1.1. Control of erosion rates 2.2.2.3. Maintaining nursery populations and habitats (Including gene pool protection) 2.2.3.1. Pest control (including invasive species) 2.2.6.1. Regulation of chemical composition of atmosphere and oceans	2.2.2.3 Maintaining nursery populations and habitats 2.1.1.1 Bioremediation of wastes by algae and plants 2.1.1.2 Filtration/sequestration/storage/accumulation by algae and plants for both harmful substances and nutrients 2.2.1.1 Control of erosion rates 2.2.1.3 Flood control and coastal protection 2.2.5.2 Regulation of the chemical condition of salt waters by living processes (only net oxygen production) 2.2.6.1 Regulation of chemical composition of atmosphere and oceans (i.e. carbon sequestration and storage).	2.1.1.1 - Bio-remediation by micro-organisms, algae, plants, and animals 2.1.1.2 - Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals 2.1.2.1 - Smell reduction 2.1.2.2 - Noise attenuation 2.2.1.3 - Hydrological cycle and water flow regulation (Including flood control, and coastal protection) 2.2.2.1 - Pollination 2.2.2.3 - Maintaining nursery populations and habitats (Including gene pool protection) 2.2.6.1 - Regulation of chemical composition of atmosphere and oceans 2.2.6.2 - Regulation of temperature and humidity, including ventilation and transpiration
Cultural	3.1.1.1. Characteristics of living systems that enable	3.1.1.1 Characteristics of living systems that that enable	

	<p>activities promoting health, recuperation or enjoyment through active or immersive interactions</p> <p>3.1.1.2. Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions</p>	<p>activities promoting health, recuperation or enjoyment through active or immersive interactions.</p> <p>3.1.1.2 Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions.</p> <p>3.1.2.1 Characteristics of living systems that enable scientific investigation or the creation of traditional ecological knowledge.</p> <p>3.1.2.2 Characteristics of living systems that enable education and training</p> <p>3.1.2.3 Characteristics of living systems that are resonant in terms of culture or heritage</p> <p>3.1.2.4 Characteristics of living systems that enable aesthetic experiences</p> <p>3.2.1.1 Elements of living systems that have symbolic meaning</p> <p>3.2.1.2 Elements of living systems that have sacred or religious meaning</p> <p>3.2.1.3 Elements of living systems used for entertainment or representation</p>	
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Source	<p>Pan Baltic Scope. 2019. Green Infrastructure concept for MSP and its application within Pan Baltic Scope project. Final Report. http://www.panbalticscope.eu/wp-content/uploads/2019/12/PBS_project_greeninfrastructure_report_FINAL.pdf</p> <p>Ruskule, A.; Kotta, J.; Saha, C.R.; Arndt, P.; Ustups, D.; Strāķe, S.; Bergström, L. Testing the Concept of Green Infrastructure at the Baltic Sea Scale to Support an Ecosystem-Based Approach to Management of Marine Areas. Mar. Policy 2023, 147, 105374. https://doi.org/10.1016/j.marpol.2022.105374</p>	[Source (Output O.T1.1., Deliverable D.T1.1.1)]	
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Source: own elaboration

The selection was limited to regulating and maintenance as well as cultural ecosystem services which is justified given the methodological challenges associated with their measurement and mapping. The ecosystem services most frequently mapped include the following:

- Filtration, sequestration, storage, and accumulation by microorganisms, algae, plants, and animals; (2.1.1.2);
- Maintenance of nursery populations and habitats, including gene pool protection; (2.2.2.3);
- Regulation of the chemical composition of the atmosphere and oceans. (2.2.6.1).

2.3.3. Application and testing

The pioneering testing took place under the **Pan Baltic Scope project** that has mapped ES at the BSR scale for verifying its model of the ES mapping in relation to Green Infrastructure as described under chapter 2.3.1⁹.

The Latvian case study under the **Land-Sea-Act** project utilized biophysical mapping for assessing the ecosystem services supply in the Southwest Kurzeme coastal area. This included the terrestrial part up to 10 kilometres inland, shoreline, as well as the marine part, comprising the adjacent territorial waters and exclusive economic zone. The specific focus of the assessment was on cultural ecosystem services (for detail see chapter 2.7.2) although the provisioning and regulating services were also assessed. The assessment results were applied in discussing alternative scenarios or pathways for achievement of ambitious goals for offshore wind energy production by 2050, which would be in balance with sustainable tourism development and preserving coastal landscape and nature assets¹⁰. This effort was continued in the **Baltic Sea2Land project** under which regulating and cultural ecosystem services were mapped for whole Latvian coastline (up to 5 km inland from the shore). The assessment was conducted on the scale of landscape areas identified in Coastal landscape study (described in more detail under Cultural considerations in chapter 2.7.2). Assessment results and more details on methodology are available on Sea2Land Navigator¹¹.

Also, **MAREA** project mapped and, where feasible quantified, the potential supply of provisioning, regulating, and cultural ecosystem services within the marine areas of Estonia, Finland, and Latvia. The project has integrated multiple data streams and complementary methodological approaches, for ES as described above. For the mapping of these services, information from national monitoring programs, European data infrastructures (including Copernicus and the HELCOM Map and Data Service), and observational and experimental studies and scientific literature was compiled and integrated. These heterogeneous inputs were harmonized (e.g., across spatial resolution, temporal coverage, and variable definitions) and used to parameterize and validate distribution models and process-based models applied for mapping and quantifying provisioning and regulating services. For the mapping of cultural ecosystem services and their contribution to human well-being, participatory GIS approach was implemented to capture place-based preferences for practicing different recreational activities. The resulting data

⁹Source: Ruskule, A., Kotta, J., Saha, C.R., Arndt, P., Ustups, D., Strāķe, S., Bergström, L., (2023). Testing the Concept of Green Infrastructure at the Baltic Sea Scale to Support an Ecosystem-Based Approach to Management of Marine Areas. *Marine Policy*, 147, 105374, <https://doi.org/10.1016/j.marpol.2022.105374>

¹⁰Sources: https://land-sea.eu/wp-content/uploads/2022/01/LSA_Case_Study_Latvia.pdf

Ecosystem service approach: an example" section. It was originally published as a part of: Ruskule, A., Veidemane, K., Pikner, T., Printsman, A., Palang, H., Arikas, D., Siegel, P., Costa, L., Burow, B., Piwowarczyk, J., Zielinski, T., Romancewicz, K. & Koroza, A. (2021) Compendium of methodologies on how to address land-sea interactions and development trade-offs in coastal areas. Interreg Baltic Sea Region Programme funded project "Land-sea interactions advancing Blue Growth in Baltic Sea coastal areas" (R098 Land-Sea-Act)

Veidemane, K., Reke, A., Ruskule, A., & Vinogradovs, I., (2024) Assessment of coastal cultural ecosystem services and well-being for integrating stakeholder values into coastal planning. *Land*, 13(3), 362. <https://doi.org/10.3390/land13030362>

Armoškaitė, A., Puriņa, I., Aigars, J., Strāķe, S., Pakalniēte, K., Frederiksen, P., Schröder, L. & Hansen, H.S. (2020) Establishing the links between marine ecosystem components, functions and services: an ecosystem service assessment tool. *Ocean & Coastal Management* 193: 105229. DOI: <https://doi.org/10.1016/j.ocecoaman.2020.105229>

¹¹Source: <https://experience.arcgis.com/experience/a76b9295da7a4b11a33aec58d770da52/page/ENG>

supported the identification of environmental conditions preferred for practicing different cultural ecosystem service-related recreational activities in coastal areas¹².

The mapping effort currently informs Latvian MSP revision. This happens under Latvian Demonstration Project in **SELINA** enabling the uptake of the latest ecosystem service assessment results (including outputs of MAREA and Baltic Sea2Land projects) in the interim evaluation and update of the Latvian MSP and coastal planning. The ecosystem services addressed in marine part includes the provisioning services - catch of commercially important fish species and areas suitable for marine aquaculture as well as regulating services - the contribution of aquatic vegetation to bioremediation, nutrient storage, erosion control, and water flow regulation; the contribution of aquatic animals, such as mussels, to bio-deposition, nutrient flows, and sequestration. In coastal part the assessment focuses on coastal landscape qualities (e.g. aesthetic value, landscape diversity and naturalness, recreational potential, and accessibility), which are linked to coastal ecosystem condition and the potential supply of cultural ecosystem services, as well as to the use of coastal areas for recreation and other cultural services. Latvian efforts cover entire policy loop from modelling through mapping till policy orientation.

Key considerations of Ecosystem Service Mapping for BSR SEA FRAMEWORK

1. The experience of the Pan Baltic Scope project and MAREA project can provide valuable guidance for the preparation of the Baltic Sea Region SEA Framework, as they represents comprehensive BSR-wide attempts at ES mapping.
2. Given that the range of ecosystem services assessed to date remains relatively limited in scope, the application of ES prioritisation methods, such as those developed in various projects, will be necessary for the purposes of the BSR SEA Framework.
3. The projects have already tested a range of approaches for compiling the data required for ES mapping, as well as for harmonising available information. This experience should help in preparation of the Baltic Sea Region SEA Framework
4. An important task concerns linking the spatial distribution of ecosystem services with their interactions with human activities and pressures, as proposed, for example, in the Protect Baltic project.
5. The ecosystem services knowledge base accumulated across several projects can provide a valuable foundation for the effective development of the BSR SEA Framework.

2.4. Identification of Environmental Objectives

¹²Source: Output O.T1.1, Deliverable D.T1.1.1, <https://marea.balticseaportal.net/outputs/>

Reke, A., Ruskule, A., Lees, L., Kotta, J., Veidemane, K., Kõivupuu, A., ... & Barboza, F. R. (2025). Linking coastal cultural ecosystem services to human well-being and leisure preferences: insights from the Baltic Sea region. *Ecosystems and People*, 21(1), 2530103

The good practices highlighted under this Theme are related to the identification of environmental objectives, to the framing of the SEA process and finally to supporting it with relevant information, data, tools and frameworks.

2.4.1. Environmental objectives refinement

This objective found that traditional environmental objectives were insufficient for modern spatial planning and must be developed using a specific 5-component framework to ensure they cover the full scope of the ecosystem.

- inclusion of nature - objectives must go beyond protection and identify the carrying capacity of the ecosystem to limit human activities to levels that do not exceed the ecosystem's ability to regenerate
- integrative governance - objectives must identify institutional alignments to not go in conflict with other policies. Identification involves mapping who manages what and setting objectives for governance cooperation
- social & economic considerations - objectives must identify nature-inclusive opportunities, the concept of identifying "win-win" objectives where economic use actively restores nature
- comprehensiveness & coherence - objectives must be identified across borders, because the objective is invalid if it contradicts the neighbour's objective. Identification requires a cross-border coherence check
- adaptive management - objectives must be testable, including constant changes, not to be static

The **eMSP NBSR** pointed out that SEAs must now identify new types of environmental objectives that were previously overlooked:

- Climate Refugia Objectives - identifying and protecting specific areas that will serve as safe havens for species migrating
- Blue Carbon Objectives - identifying areas for carbon sequestration as climate assets to be protected from disturbance
- Multi-Use Objectives - setting objectives for co-location where one activity is required to support another environmental goal.

Additionally, **MSP4BIO** project identified some relevant for environmental objectives included: the identification of ecosystem services and ecosystem functionality; protection of bird migratory routes; enhancement of ecological connectivity through blue corridors and green infrastructure; long-term protection of sensitive species and habitats, consideration of climate change impacts¹³.

¹³Source: Calado H., et al., (2024). Strategic Guidance for the Integration of MPA and MSP Processes on Multiple Governance and Ecosystem Levels (Deliverable – D4.4., under the WP4 of MSP4BIO project (GA n° 101060707)).

2.4.2. Analysing SEA processes

The **MSP4BIO** Project analysed the extent to which environmental considerations are integrated into marine decision-making across five EU sea basins. The project identified and assessed the environmental issues most commonly addressed through SEA in each EU sea basin. In the BSR, the following elements were identified as key components of SEA practice:

- (a) compliance with the applicable legal and policy frameworks for SEA;
- (b) review and scoping procedures for the establishment of a sustainability baseline;
- (c) assessment of cumulative impacts within SEA;
- (d) consideration of uncertainties related to ecosystem impacts;
- (e) evaluation of environmental performance;
- (f) sustainability-oriented impact assessment;
- (g) assessment of long-term ecological, economic, and social effects;
- (h) monitoring to support and update the sustainability baseline;
- (i) public participation in SEA procedures;
- (j) stakeholder involvement throughout the SEA process; and
- (k) transparency and accessibility of SEA-related information¹⁴.

2.4.3. SEA process recommendations

The **MSPGREEN** project formulated several recommendations on the SEA scope. The project underlined the need:

- to keep environmental pressures within ecosystem capacity limits and reinforce biodiversity conservation.
- to conduct early and careful assessments of single and cumulative impacts and to develop alternative planning solutions and mitigation measures.
- to foster the availability, accessibility, and usability of marine environmental data, in particular data and knowledge on the pressures and impacts of climate change on marine ecosystems.
- to map and quantify ecosystem services.
- to evaluate the climate impacts of planning designations, also as a part of the SEA process. This evaluation can be based on calculating the carbon footprint of planning options and decisions along with greenhouse gas emissions likely to be produced by the different maritime sectors.
- to map blue carbon habitats (e.g. seagrass meadows and salt marshes), evaluating their climate change mitigation potential, assessing other co-benefits and improving their conservation, protection, and restoration through specific MSP objectives, zoning designations, and/or measures¹⁵.

¹⁴Source: Calado H., et al., (2024). Strategic Guidance for the Integration of MPA and MSP Processes on Multiple Governance and Ecosystem Levels (Deliverable – D4.4., under the WP4 of MSP4BIO project (GA n° 101060707)).

¹⁵Source: Recommendations: [Bridging Maritime Spatial Planning and the European Green Deal](#) (2024) Ramieri, E., Bocci, M., Gee, K., Capurso, G., et al., 2024. Recommendations on how to strengthen the integration of EGD maritime components into MSP. MSPGREEN project.

The **MSP4BIO** project formulated recommendations to strengthen the integration of environmental considerations into MSP. For the Baltic Sea Region, the recommendations include: strengthening legal frameworks and enforcement mechanisms; improving cross-border coordination and harmonisation of MSP processes; enhancing stakeholder coordination and engagement; systematically integrating climate change considerations and cumulative impact assessments into MSP; and reinforcing adaptive management approaches, including regular review and update cycles, as well as focusing on connectivity, and addressing monitoring gaps¹⁶.

The **Protect Baltic** project supports the operationalisation of environmental objectives by reviewing existing monitoring programmes and developing guidance for harmonized monitoring of ecological conditions and management effectiveness across Baltic Sea MPAs.

2.4.4. Practical support to SEA (tools, frameworks indicators)

The **PROTECT BALTIC** project supports the identification and operationalisation of conservation objectives within marine protected areas, by integrating ecological knowledge with governance structures, particularly through the development of indicators, targets, and decision-support tools. Conservation objectives are embedded within broader governance processes rather than treated as isolated ecological goals, thereby strengthening their role in marine management. A key outcome is the Baltic Sea Protection Optimization Framework, which translates ecological knowledge into practical targets and strategies for planning and policy implementation for marine protection.

Within this framework, targets are developed collaboratively with countries to monitor progress towards agreed environmental outcomes. The project also introduces a transparent methodology for setting ecological targets, based on the ecological importance of habitats and the extent to which they should be protected. These targets support the identification of priorities for spatial protection and guide the implementation of management measures.

Progress is assessed through measurable indicators linked to spatial ecological data, such as habitat maps and species distribution models, enabling region-specific analysis. This spatially explicit approach helps identify gaps where conservation objectives are not being met. Additionally, management performance is evaluated using tools such as MANEA and AMMEA, which assess effectiveness at both individual protected area and regional network levels. Together, these approaches provide a comprehensive basis for improving marine protection and achieving ecosystem-based management in the Baltic Sea region¹⁷.

¹⁶Source: Calado H., et al., (2024). Strategic Guidance for the Integration of MPA and MSP Processes on Multiple Governance and Ecosystem Levels (Deliverable – D4.4., under the WP4 of MSP4BIO project (GA n° 101060707)).

¹⁷Source: <https://protectbaltic.eu/our-framework>
<https://protectbaltic.eu/governance>
<https://protectbaltic.eu/management-1>
<https://protectbaltic.eu/monitoring-1>

One of the working strands of the **SELINA** project is dedicated to the development of the core set of indicators and their reference values for assessing the ecosystem condition as well as exploring its interrelation with ecosystem service supply. Furthermore, the integration of this information with the regulatory design and policy uptake is explored. The indicators and methodology have been defined by the Water Framework Directive and the MSFD (see chapter 2.2) for describing good environmental status. Environmental objectives are also addressed through a model of the Driving Force-Pressure-State-Impact-Response (DPSIR). The model integrates aspects of responses or actions which are closely linked to the environmental objectives set by policies and legislative acts. A DPSIR model has been showcased for the marine ecosystem at the Baltic Sea level. The report will be available in Autumn 2026¹⁸.

Key considerations of Identification of Environmental Objectives for BSR SEA FRAMEWORK

1. While preparing BSR SEA Framework particular attention should be paid to “new” environmental objectives such as Climate Refugia Objectives, Blue Carbon Objectives and Multi-Use Objectives.
2. Important ambition should be achieving BSR agreement on relevant targets related to these objectives. Baltic Sea Protection Optimization Framework can serve as an inspiration.
3. Climate impacts of planning designations, should be integrated into SEA process as well.
4. While designing the BSR SEA Framework a particular attention should be paid to identified by the projects key components of the SEA practice in BSR

2.5. Defining the contents and level of detail during the scoping of the assessment

These practices primarily focus on scoping the SEA and defining its required level of detail.

2.5.1. Scoping process

Based on the **eMSP NBSR project** outcomes, the "scoping" phase is not treated as a static administrative step. Instead, the project reframes scoping as a transboundary and adaptive exercise designed to overcome the fragmentation often found in traditional Strategic Environmental Assessments (SEA). eMSP NBSR defined the contents and level of detail during scoping, organized by its key Learning Strands. The eMSP NBSR rejected the idea that the scope is defined solely by the competent authority. Instead, it has to use the Community of Practice (CoP) to "co-scope" the assessment. A CoP is a group of people who share their knowledge and experience for something they do and learn how to do it better as they interact regularly. Stakeholders are involved before the assessment

¹⁸Source: Deliverable D3.3 [“Report on definition of reference conditions that describe good ecosystem condition”](#)

begins to define what level of detail is good enough for them to accept the plan. In addition, instead of hiding low levels of detail, the project encourages explicitly listing what cannot be assessed due to data limitations, which directly informs the monitoring plan.

Also, **MSP4MORE** promotes the use of CoP for scoping the SEA details. Based on systematic literature reviews, the analysis of existing and planned OWF projects and interactions with stakeholders through the Communities of Practice, workshops and surveys, the MSP4MORE is collating information on various effects related to OWF development as well as supporting data and tools for assessing these effects.

The **Baltic Sea2Land** project has developed a Tool for Multi-level Governance, which can assist scoping of SEA detail. The tool might be helpful in defining the scope of the assessment if needed. (The tool is described more in detail in subchapter 4.3)¹⁹.

2.5.2. Criteria to be considered

This subtopic is logically related to the refinement of the environmental objectives (chapter 2.4.1).

The **eMSP NBSR** project determined that the scope of an assessment must extend beyond standard environmental impacts. The project identified that the SEA must explicitly include following criteria:

- Ecological Carrying Capacity – to define the hard limits of the ecosystem.
- Climate-Smart Elements - to include climate refugia and blue carbon storage. If an SEA does not assess the impact on potential future migration routes, the scope is considered insufficient.
- Cumulative Effects via Coherence - to include transboundary cumulative effects. The assessment cannot stop at the national border

Also, the **MSP4BIO** Project identified a set of functional ecological criteria that support the effective designation and implementation of area-based management tools (ABMTs) and their ecologically coherent networks in marine environments. These criteria contribute to maintaining the integrity and functioning of marine ecosystems and are therefore highly relevant to SEA. In particular, they provide a robust basis for defining the scope of SEA, determining an appropriate level of assessment detail, identifying significant effects, and informing mitigation and monitoring measures.

To date, marine spatial protection and planning have largely relied on criteria addressing the structural components of ecosystems, such as habitat types and species presence. Criteria related to ecosystem functioning and ecological processes have been less frequently integrated into the design, assessment, and management of area-based protection measures, as well as into SEA mitigation strategies. The MSP4BIO Project addresses this gap by proposing functional criteria: biological traits, functional diversity, trophic ecology, and ecological connectivity for the

¹⁹Source: [Multi-Level Governance | Baltic Sea2Land Navigator](#)

prioritization, designation, and management of ABMTs and their networks. These criteria are equally applicable and highly valuable in the context of SEA scoping.

Finally, the MSP4BIO Project illustrates how these functional criteria can be operationalised in practice²⁰.

The **MSP4MORE** project will create a generic framework for integrating OWF developments into strategic environmental assessments and create novel applications for more comprehensive exploration of OWF effects on marine ecosystem structure and functioning, including:

- Ecosystem benefits provided by different OWF designs, including contributions to provisioning, regulating and supporting services and synergies with conservation and restoration targets.
- Sociocultural effects of OWFs for example in relation to aesthetic values, cultural heritage, sense of place, recreational practices, etc.
- Ecological preconditions that support sustainable multi-use within OWFs.
- Environmental parameters and ecological data (e.g. models for distribution of species, communities, ecosystem productivity and other processes) as well as human activities and pressures to be used for assessing cumulative effects of OWFs
- Data and methods for assessing the potential wide-scale effects of OWFs on ocean circulation, primary and secondary production and early life stages of species.
- Data, assessment frameworks and tools for spatial prioritization of suitable locations for OWFs as well as assessing risks and opportunities of OWF expansion.

While discussing criteria to be taken into consideration when deciding on SEA level of detail one should also refer to the two already describe good practices: the **PROTECT Baltic** effort related to providing a link to traits, functions and ecosystem services (see chapter 2.3.1) and **Pan Baltic Scope** proposals on integrating MSFD and GES into SEA (see chapter 2.2).

Key considerations of defining the contents and level of scoping for BSR SEA FRAMEWORK

1. In the preparation of the BSR SEA FRAMEWORK, particular attention should be given to dynamic scoping conceived as a transboundary and adaptive process aimed at overcoming fragmentation.
2. The BSR SEA FRAMEWORK should incorporate criteria related to ecosystem functioning, such as ecological carrying capacity and cumulative transboundary effects.
3. The BSR SEA FRAMEWORK should enable a more comprehensive assessment of the impacts of offshore wind farms on marine ecosystems.

²⁰Source: Bongiorno L., Bekaert M., Jusufovski D., Bocci M., Gissi E., Magaldi M., Sciascia R., Rombouts I., Costa A., Barbanti A., Pınarbaşı K., Withouck I., Kotta J., Whatley L., Barboza F.R. (2023) Portfolio of improved ecological criteria to be applied in biodiversity protection and restoration for project testing sites. Deliverable – D3.2., under the WP3 of MSP4BIO project (GA n° 101060707)

2.6. Integration of Socio-economic Considerations into SEA

The good practices identified under this theme are very diverse. They concern the following: methods and approaches for monetization of environmental values, policy guidelines how to handle socio-economic considerations under MSP and SEA and solving trade-offs between various developmental goals and targets, as well as administrative vehicles and tools for combination of socio-economic development and environmental requirements.

2.6.1. Recommendations, guidelines, basic assumptions, conceptualizations

The **Pan Baltic Scope** Project has proposed some assessment methods for integration of socio-economic considerations into SEA and MSP. According to the project the existing conceptual models such as the ecosystem services cascade and DPSIR (Drivers–Pressures–State–Impacts–Responses) should be used as a foundation and adapted for MSP and SEA purposes. A strong emphasis is placed on spatially explicit analysis, particularly for ecosystem service provision and welfare impacts, where data gaps remain significant. Coordinated, spatially explicit valuation studies across countries are recommended to improve comparability and enable regional-level assessments, including analysis of the spatial distribution of costs and benefits. In order to address the spatial distribution of benefits and costs the project asks to develop approaches, data and results to support spatial analyses of the components of the aforesaid frameworks. This is particularly needed for the provision of ecosystem services and effects on human welfare from changes in the environmental state/ecosystem services, for which spatially explicit information is often lacking.

- a. New spatially explicit and internationally coordinated valuation studies on selected environmental themes/ecosystem services would improve the knowledge base for assessing welfare impacts in connection to spatial planning. These could be implemented in all coastal countries or in selected countries representing the diverse conditions of the Baltic Sea countries, which would allow results to be transferred to other countries for regional estimates.
- b. Spatially explicit research on the value of ecosystem service and environmental impacts relevant to MSP should be promoted.

The **eMSP NBSR project** comprehensively integrated the Socio-economic Considerations into the Ecosystem-Based Approach (EBA) framework. The project argues that humans are part of the ecosystem, not external users of it. Therefore, socio-economic objectives must be defined by their ability to coexist with and restore the natural environment.

The **MSP-GREEN** project recommends using the EGD to work towards a fair and just sustainability transition at sea; blue circular economy; sustainable seafood production. The recommendations highlight the need to evaluate which marine and coastal areas, maritime sectors, communities, and segments of the population will mostly benefit or will be negatively affected by the implementation of EGD-aligned MSP across space and time (strong focus on blue

justice). By the same token, the recommendations also highlight the need for socio-economic impact analyses of circular blue economy on society. However, it is mentioned that more methods and approaches are still needed to assess the socio-economic effects of maritime development, so that a fair distribution of costs and benefits of MSP can be ensured. Inclusion of socio-economic analysis into SEA also requires specific type of data and data sharing e.g. information about recreational fisheries, including their impact on the environment or/and small-scale fisheries-related data (including, for instance, the distribution of fishing activities)²¹.

The **MSP4BIO** Project produced practical guidance, for the *Trade-off Negotiation* phase, in participatory contexts for MPA and MSP processes. Several types of trade-offs are identified: between conservation and economic development; between short- and long-term benefits; between exclusive and shared uses; between specific stakeholder interests; and between local, regional, or national interests. For SEABAS, the most relevant trade-off is between conservation and economic development, although it may encompass aspects of the other trade-offs, as SEA necessarily focuses on long-term and supralocal, often sea-basin, benefits. The guidelines provide a practical methodology for trade-off negotiation, structured in three phases: (I) preparation, (II) collaborative stakeholder engagement, and (III) post-meeting consolidation:

- **Preparation.** Based on conservation objectives and existing solutions, this phase involves identifying, collecting, and harmonizing spatially explicit data on ecological, environmental, and human activities. A set of ecological, environmental, and socio-economic criteria, as well as relevant ecosystem services, is then compiled for the area under study and for future prioritization under engagement phase. An appropriate participatory tool for trade-off analysis is selected to reflect both process requirements and local context. The final preparatory step is the development of a project within a participatory mapping tool, including a site-specific survey to identify locally relevant issues and priorities.
- **Engagement.** This is the core phase and requires the establishment of Communities of Practice (CoP) to support discussion and agreement on trade-offs. CoP activities start from introducing trade-offs, ecological values, and objectives; and continues with applying surveys and participatory tools; conducting trade-off analyses; supporting decision-making; and documenting outcomes using standardized templates.
- **Post-meeting consolidation.** This phase includes preparing a meeting report summarizing key discussions, identified trade-offs, and any preliminary agreements, as well as providing feedback to stakeholders to ensure transparency and build trust²².

²¹Source: Recommendations: [Bridging Maritime Spatial Planning and the European Green Deal](#) (2024) Ramieri, E., Bocci, M., Gee, K., Capurso, G., et al., 2024. Recommendations on how to strengthen the integration of EGD maritime components into MSP.

²²Source: Gutierrez, D., Calado, H., Barboza, F.R. et al. Sustainable solutions: exploring trade-offs in marine protected areas from six European case sites.npj Ocean Sustain (2025). <https://doi.org/10.1038/s44183-025-00167-w>

2.6.2. Monetization of environmental benefits

The **PROTECT BALTIC** project integrates socio-economic considerations into ecosystem-based management by assessing the value of ecosystem services provided by Baltic Sea ecosystems. By applying ecosystem service valuation approaches, PROTECT BALTIC helps make these benefits more visible and measurable. Valuation approaches used in the project include both qualitative and quantitative assessments. These may involve estimating the economic value of services such as fisheries productivity or recreational use, as well as assessing broader societal benefits associated with biodiversity conservation and ecosystem health. The results will help illustrate the potential economic consequences of ecosystem degradation and the benefits associated with conservation and restoration actions. Integrating ecosystem service valuation with spatial data further strengthens its relevance for planning processes and SEA. By linking service values with spatial ecosystem service maps, the project will enable decision-makers to identify areas where ecosystems provide particularly high socio-economic benefits. This information can be used to support the prioritization of conservation measures, restoration initiatives, and sustainable use strategies.

The **MAREA project** has developed a detailed methodology for the economic valuation of key marine ecosystem services, focusing on blue mussel farming and blue carbon, by formulating service-specific economic functions based on pre-existing models and published expressions. For blue mussel farming, the methodology relied on calculating the annual resource rents generated by blue mussel cultivation in the area of interest. For blue carbon, the total value was estimated as the sum of the values of carbon sequestration and carbon stock. The value of carbon sequestration was calculated as the product of (i) the area of the relevant ecosystem component (e.g., seagrass habitats, mussel beds), (ii) the carbon sequestration rate of that component in a given year, and (iii) the carbon price applied in that year. The value of carbon stock was calculated as the product of (i) the area of the relevant ecosystem component, (ii) the carbon stock level of that component in a given year, (iii) the carbon price applied in that year, and (iv) the rate of return used to annualize the carbon stock value to a yearly value. The resulting functions provided the basis for estimating the economic effects of alternative human-use scenarios on the selected ecosystem services²³.

2.6.3. Administrative vehicles, conceptual approaches and practical tools for integration socio-economic considerations into governance practices at sea

The **eMSP NBSR project** challenged the traditional SEA approach where economic projects are assessed merely for their negative impacts. Instead, there was proposed a method where socio-economic activities are identified as drivers for restoration. The project developed the concept of a "MariPark"—a business area at sea designed to be nature-positive. Next, it was identified that Multi-Use is the primary method for resolving space conflicts in crowded basins. For an SEA practitioner, this changes how you scope the assessment. Under the eMSP NBSR there was found that single-use zoning is no longer viable. The SEA must assess the efficiency of space use. The concept was further

²³Source: A full description of the methods and underlying models is presented in Output O.T2.1.1 and Deliverable D.T2.2.1 (<https://marea.balticseaportal.net/outputs/>).

developed under the **NESBp project**. Special considerations are given to new type of SEA (mezzo environmental assessment) that should secure environmentally friendly functioning of the MariPark (i.e., positive environmental effect) while providing business safety and security for the investors. The MariParks approach is seeking to balance ecological, economic, and social objectives. By concentrating activities within clearly defined areas, the concept aims to reduce spatial conflicts between different maritime users while supporting ecosystem-based management. The clustering of activities may also facilitate shared infrastructure, including grid connections, monitoring systems, and maintenance logistics, thereby increasing operational efficiency and reducing costs. Environmental considerations play a central role in the MariParks concept. The approach encourages the incorporation of nature-inclusive design and measures that support marine biodiversity, such as artificial reef structures, habitat enhancement, and adaptive management practices. In this way, MariParks can contribute to the development of marine green infrastructure by strengthening ecological connectivity and supporting ecosystem services alongside economic activities

The **PROTECT BALTIC** project is developing tools that support the evaluation of measures from a socio-economic and policy implementation perspective. The project has developed an automated tool for analysing the sufficiency of measures within marine protected areas, allowing users to assess whether it is likely that existing measures adequately address the multiple pressures affecting valuable marine ecosystems. This tool facilitates systematic analysis of management responses across different sectors and policy frameworks.

The **PROTECT BALTIC** project is also developing a hierarchical typological classification scheme for management measures in the BSR. This scheme organizes measures across different levels of governance and management types, helping to improve consistency in how MPA measures are described, which, in turn, enables measures to be analysed, and compared across countries and marine regions. This scheme is then used to classify measures collected from over 1,500 MPAs across the Baltic Sea. Together, these developments strengthen the ability of decision-makers to evaluate the effectiveness and sufficiency of policy measures in addressing environmental pressures while balancing ecological and socio-economic considerations.

The **Land-Sea Act** project has worked on blue economy aspects with indicator approach. The elements of this approach could be transferred to the SEA needs to some extent²⁴.

The **Baltic Sea2Land** project addressed development of maritime strategies, wind energy development through regional and local pilot cases. The methods and indicators applied at these pilots could provide some inputs in identifying relevant economic and social aspects to be considered during SEA²⁵.

²⁴Source: <https://land-sea.eu/wp-content/uploads/2022/01/Blue-Growth-Checks-Mapping-the-Blue-economy-in-the-case-study-regions.pdf>

²⁵Source: The project results are presented in the Baltic Sea2Land Navigator. [Baltic Sea2Land Navigator](#)

Key considerations of Integration of Socio-economic Considerations for BSR SEA FRAMEWORK

1. The knowledge and experience related to the integration of socio-economic considerations into MSP and SEA appear to be sufficient for the design of the BSR SEA Framework. The theoretical foundations in this field have been established through projects such as Pan Baltic Scope and MSP-GREEN.
2. Several tools and approaches have been developed and tested, demonstrating promising potential for scalability to the Baltic Sea Region level.
3. Of particular importance is the experience gained in MSP4BIO project, especially in relation to the design and implementation of trade-off negotiation processes, as well as the MariPark concept of eMSP and NESbp, which may require a novel approach to SEA and its reconceptualisation
4. Significant progress has also been made in the monetisation of ecosystem services through the work of several projects; however, these approaches remain largely experimental and require broader societal and governance acceptance.

2.7. Integration of Cultural Considerations into SEA

Good practices relate to two main aspects: methodological advancements in addressing cultural values in both coastal and marine contexts, and the practical mapping and assessment of these values, with a particular focus on cultural ecosystem services. However, a key limitation lies in the relatively indirect linkage of these efforts to SEA.

2.7.1. Methodological advancement in measuring marine cultural values

The **MSP4MORE** project will develop an analytical framework and test various methods for addressing the sociocultural effects of the OWF development within the case study areas. Based on extensive literature review as well as experience gained for testing of the analytical framework, the project will explore how can cultural ecosystem service assessment methods be applied and adapted to evaluate the sociocultural impacts of OWF developments across diverse socio-ecological contexts. The sociocultural values will be addressed through cultural ecosystem service perspective by applying the following types of indicators and methods:

- Quantitative indicators: willingness-to-pay, frequency of recreational use, tourism revenue.
- Qualitative indicators: narratives of place attachment, perceived fairness, trust in institutions.
- Spatial indicators: participatory mapping of culturally significant seascapes.

2.7.2. Mapping, identifying and assessing marine and coastal cultural values

The **MAREA** project has mapped cultural ecosystem services (CES) in order to determine which recreational activities take place along the coasts of Estonia and Latvia, which of these activities are most preferred, and which aesthetic and environmental conditions are considered desirable for practicing them. The assessed activities

encompassed both passive and active forms of engagement with coastal and marine environments and were linked to the selected CES. Details are available under chapters 2.3.2 and 2.3.3.

Also, in the **Land-Sea-Act** project, a Polish case study has been conducted with focus on identification of marine cultural values. The case study used semi-structured interviews and interactive stakeholder workshops with various groups of selected stakeholders and local communities to learn about their relations/perceptions with/of the sea and to determine sites of cultural, historical, and social importance. As a result, places and features were mapped to identify which parts of the region represent the highest concentration of culturally significant areas²⁶.

Within the **Land-Sea-Act** project, the Latvian case study carried out a comprehensive integrated assessment of coastal cultural ecosystem services in the southwestern Kurzeme coastal region of Latvia. The assessment was based on a scientific study examining how coastal landscapes support cultural values, recreational uses, and perceived well-being benefits, and how these values can be incorporated into coastal planning processes. The study area encompassed the terrestrial coastal zone from the shoreline up to 10 km inland, covering approximately 120 km of coastline. This area represents a functional land–sea interface where interactions between society and coastal ecosystems are particularly significant. Cultural ecosystem services were assessed using a landscape-based approach, with landscape areas serving as the primary spatial units of analysis. The methodology combined expert-based biophysical mapping with social science methods to capture both the physical characteristics of coastal landscapes and the associated cultural values. Experts evaluated ecosystem service supply within each landscape area on a scale from 1 to 5, based on a set of indicators with defined quantitative values. The assessment drew on available spatial datasets (e.g. land cover, forestry, and tourism data) as well as field survey results, particularly for evaluating landscape qualities. The assessment of seascape areas was informed by results from the BONUS BASMATI project (Armoškaitė et al., 2020). Landscape characterisation and quality assessment were used to identify features relevant to cultural ecosystem service provision, including landscape structure, visual qualities, accessibility, and degree of naturalness.

Stakeholder perspectives were integrated through participatory and survey-based methods, including stakeholder engagement events, participatory mapping of recreational uses and valued locations, and a nationwide survey on perceived well-being benefits derived from coastal environments. This mixed-method approach enabled the assessment to capture diverse perspectives of local residents, visitors, and sectoral stakeholders, and to identify variations in cultural values and priorities²⁷.

The effort has been further developed within the **Baltic Sea2Land** project. As part of this initiative, coastal landscape mapping (previously referenced in chapter 2.3.3) was conducted along the entire Latvian coastline at the landscape-area level. The approach combined systematic field surveys with the analysis of available geospatial datasets, with the aim of generating data to support the integration of cultural considerations into planning and decision-making

²⁶Source: Ruskule, A. et al. 2021. *Compendium of Methodologies on How to Address Land-Sea Interactions and Development Trade-offs in Coastal Areas*. (Output of Activity 2.5.)

²⁷Source: Veidemane, K.; Reke, A.; Ruskule, A.; Vinogradovs, I. *Assessment of Coastal Cultural Ecosystem Services and Well-Being for Integrating Stakeholder Values into Coastal Planning*. *Land* 2024, 13, 362. <https://doi.org/10.3390/land13030362>

processes. The assessment of landscape areas was based on the following key characteristics: landscape aesthetics, uniqueness, diversity, naturalness, cultural heritage, and recreation and tourism potential, including public accessibility. In the first stage, the Latvian coastline, extending up to 5 km inland, was divided into preliminary landscape areas using multiple spatial data layers. Beach and inland landscapes were assessed separately. In the second stage, extensive fieldwork was carried out to evaluate characteristics that cannot be reliably derived from existing datasets, such as aesthetic quality and accessibility. Based on the field survey results, the boundaries of landscape areas were refined. In the third stage, geospatial analysis was conducted for all landscape areas according to defined criteria, including the proportion of EU-protected habitats, designated nature protection areas, and visitor intensity. The outcome of the assessment consisted of landscape quality maps, developed both for individual criteria and as composite indicators that can be used further to assess cultural ecosystem service potential.

The **Baltic Sea2Land** project also addressed coastal visitation, environmental pressures, and public infrastructure. The study evaluated visitor flows, infrastructure quality, and human impacts on coastal vegetation along the entire Latvian coastline. The results were compared with analogous studies conducted in 2015 and 2019, using a harmonised methodology, thereby enabling the analysis of trends related to anthropogenic pressures on the coastal environment as well as patterns of coastal development.

In addition, the coastal geodatabase was updated to include detailed information on access points, parking areas, tourist accommodation, and other relevant infrastructure. Visitor intensity and vegetation pressure were systematically mapped in 100-metre segments along the full length of the coastline.

Key considerations of Integration of Cultural Considerations for BSR SEA FRAMEWORK

1. The knowledge and experience related to the integration of cultural considerations into MSP, including the mapping and assessment of cultural values in both marine and coastal areas, appear to have reached a critical mass in terms of conceptual development and practical testing.
2. In particular, the Latvian experience is highly advanced; however, it would require appropriate upscaling to be applicable at the Baltic Sea Region (BSR) level.
3. A key limitation remains the translation of this experience into the SEA context, which has not yet been fully addressed by the projects to date.

3. Assessment methods

In the context of SEA, methods refer to the structured analytical approaches or conceptual procedures used to evaluate environmental impacts, such as impact matrices, or multi-criteria decision analysis, which define *how* the assessment is conducted. In contrast, tools denote the practical instruments or technologies that support the application of these methods, including software platforms (e.g., GIS), modelling systems, databases, or visualization applications, which determine *with what means* the methods are implemented. Therefore, good practices concerning SEA methods that provide the methodological framework guiding analysis and interpretation are analysed in this chapter, whereas SEA tools will be examined in the following chapter.

The chapter identifies the principal good practices developed by the analysed projects and reviews methods that were designed or tested to support the selected aspects of SEA. The following aspects were selected through discussions among project partners: CIA - Cumulative Impact Assessment (CIA), Mapping of nature values, Evaluating significance of adverse effects, Sustainability assessment (socio-economic in SEA). Table 3.1 provides a quantitative overview of these elements. In total, 15 good practices were identified, with CIA emerging as the most frequently addressed.

Table 3.1. Good practices identified for “Assessment methods”.

Project Acronym	Assessment Methods			
	CIA - Cumulative Impact Assessment	Mapping of nature values	Evaluating significance of adverse effects	Sustainability assessment (socio-economic in SEA)
eMSP NBSR				
MSP-GREEN				
MSP4BIO	x	x		x
PROTECT BALTIC	x	x	x	x
MAREA	x	x	x	
ReMAP	x			
BalticLInes				
Baltic Sea2Land				
Land-Sea Act				
SELINA				
MSP4More				
NESBp				
Pan Baltic Scope	x	x	x	x

Source: own analysis of project partners

3.1. Cumulative Impact Assessment (CIA)

Good practices related to CIA can be broadly classified into the following categories:

- a) conceptual approaches and recommendations
- b) data related advancements.

3.1.1. Conceptual approaches

Under **Pan-Baltic Scope** a document entitled „Cumulative Impact Assessment for Maritime Spatial Planning in the Baltic Sea Region” was elaborated, published in November 2019 and widely disseminated(<https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope>). The document is mainly related to MSP, but some observations and proposals are relevant for CIA as a part of SEA.

A) Conclusions

- Evaluating cumulative impacts is central for implementing the ecosystem-based approach.
- Most issues relating to MSP and strategic environmental assessment in the Baltic Sea are of transboundary importance.
- Work to assess cumulative impacts has made good progress in the past years. However, many data gaps and knowledge gaps in underlying ecosystem processes remain, and still, it is a challenge on how to implement the cumulative impact assessment practically.
- As many types of analyses are possible, it is of high importance to define clear questions at the beginning of the analyses, for the results to be useful in practice. It is also important to create an understanding among the involved parties on how the results can be used. For example, in addition to presenting the results, the limitations relating to underlying assumptions, methodology and data must be clearly formulated.

B) Recommendations

- Countries should integrate CIA in key steps of their planning process to support and implement an EBA.
- Data availability and knowledge on the interactions between human activities and the ecosystem need to be continuously and systematically improved to further support spatially referenced CIA. Suggested ways to achieve this include:
 - A regular process among countries to obtain more fine-scaled spatial data on ecosystem components and nature values at the regional scale, to enable incremental improvement of shared data.
 - Dedicated activities to support knowledge sharing and developing a more holistic understanding of linkages between pressures and nature assets, for example considering synergistic effects and ecosystem feedbacks.
- It would be beneficial to make room for the combined use of qualitative and quantitative approaches in the further development, to meet the reality for implementation in different national and local settings and support linkages to economic and social analyses.

- Countries should ensure that their assessment approaches are coherent within the Baltic Sea, especially considering the advantage of a transboundary perspective to enhance cooperation and mutual understanding. Such co-development is effectively enabled under a regional umbrella, such as HELCOM, the key aim being to join forces and share development progress to support a scientifically sound and efficient management²⁸.

Under the **ReMAP** project, a CIA module has been developed. The module primarily aims to evaluate the cumulative burden that multiple and simultaneous activities may impose on the environment. It builds on HELCOM Spatial distribution of Pressures and Impacts Assessment (SPIA) developed under the HELCOM Holistic Assessment of the Baltic Sea (HOLAS 3). The primary outputs will consist of maps representing the corresponding pressure and impact distribution. A key added value of the module is in the conceptual approach to CIA providing clear link between input data, tools and processes and outputs (Fig 3.1)

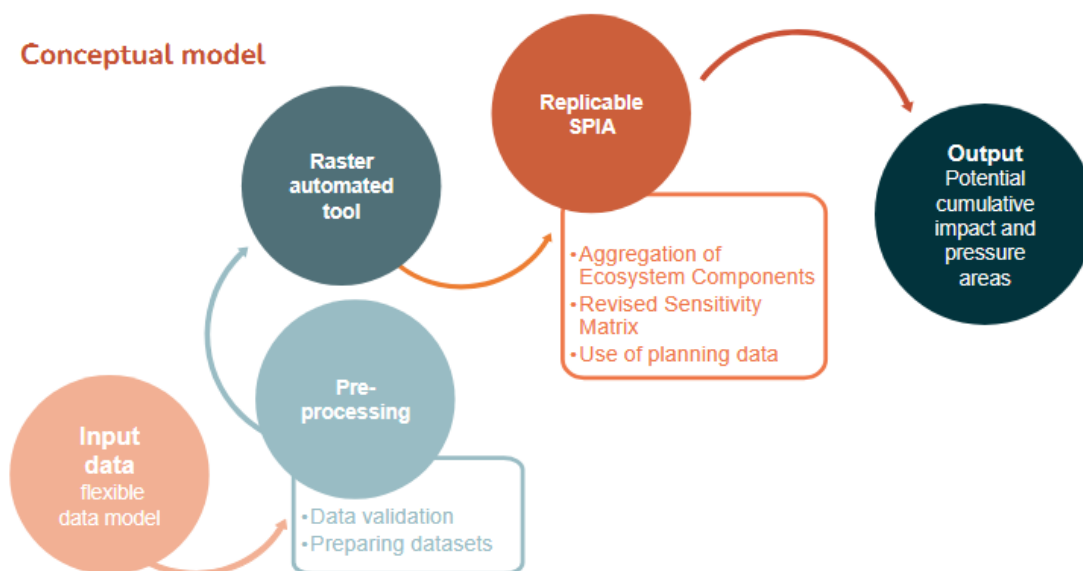


Fig. 3.1. CIA Conceptual model

Source: ReMAP: Input data for the Cumulative Effects Assessment Analytical Module on ReMAP project, created in 2024 and compiled from different data sources is provided. Below is further information on datasets applied for the module and original metadata. More information about the module and the project can be found at <http://www.geoportal.ulpgc.es/remap/>

²⁸Source: Lena Bergström, Andžej Miloš, Juuso Haapaniemi, Champa Rani Saha, Philipp Arndt, Jan Schmidtbauer-Crona, Jonne Kotta, Joni Kaitaranta, Stefan Husa, Jonas Palsson, Mari Pohja-Mykrä, Anda Ruskule, Magda Matczak, Solvita Strake, Andrzej Zych, Anne Nummela, Magdalena Wesolowska, Goncalo Carneiro (2019) Cumulative Impact Assessment for Maritime Spatial Planning in the Baltic Sea Region. Pan Baltic Scope

The **MSP4BIO** project has considered CIA as a key approach for information the design and management of area-based conservation measures. Within MSP4BIO's Ecological Toolkit (ESE1) for MPA prioritization and networking the systematic application of CIA was explicitly promoted as a cornerstone for the effective design and management of area-based conservation measures. By embedding CIA within ESE1, the toolkit recognizes that conservation outcomes depend not only on ecological values, but also on the spatial distribution and combined intensity of human pressures acting on marine ecosystems. Implementation of ESE1 across the different Test Sites—particularly its CIA component provides an essential evidence base for identifying where and why cumulative pressures are greatest, how these pressures overlap with sensitive habitats and conservation features, and which areas offer the strongest potential for conservation action to support coherent MPA network design²⁹.

The **PROTECT BALTIC** project has developed analytical frameworks that help evaluate the combined effects of multiple human pressures on marine ecosystems. A key contribution of the project is the further development of the Baltic Sea-wide cumulative impact assessment approach, known as the Spatial Pressure Impact Assessment (SPIA). Central to this development is the expansion and refinement of the threat matrix³⁰, which describes the relationships between human activities and the pressures they exert on the marine environment. The threat matrix has been extended to include additional activities and pressures, as well as improved links between activities and the pressures they generate. The project has also introduced scoring systems that evaluate the strength of the relationship between different activities and pressures, allowing for a more nuanced understanding of how human uses contribute to environmental impacts. To further improve analytical consistency, both human activities and pressures are being organized within a hierarchical structure. This hierarchical classification enables assessments to be conducted at different levels of detail while maintaining coherence across datasets and analytical frameworks. The project also distinguishes between activities that cause direct or local pressures and those that contribute to more diffuse pressures. Direct pressures occur primarily in the immediate vicinity of the activity, such as seabed disturbance from bottom trawling. Diffuse pressures occur at some distance from the original activity, such as nutrient inputs from agricultural activities that contribute to eutrophication in marine environments. Recognizing these different pressure pathways helps improve the realism of cumulative impact assessments.

3.1.2. Data related advancements

The **PROTECT BALTIC** project provides important inputs for CIA by developing not only analytical frameworks but also spatial datasets. The project contributes to CIA by compiling and harmonizing pressure layers that represent the spatial distribution and intensity of different human activities, such as fisheries, shipping, coastal development, and offshore infrastructure. These pressure layers provide a foundation for analysing how multiple human uses interact within marine ecosystems. Habitat maps and species distribution models produced within the project also

²⁹Source:Kotta, et al. (2024) Ecological toolkit (ESE1) for MPAs prioritization and networking. Deliverable – D3.4., under the WP3 of MSP4BIO project (GA n° 101060707)

Stancheva, M., et al., (2025). Site specific solutions for accelerating biodiversity protection and restoration in MSP Deliverable – D5.3., under the WP5 of MSP4BIO project (GA n° 101060707).

³⁰ mock up available at: <https://protectbaltic.github.io/Threat-matrix/>

play a key role in CIA by identifying where sensitive habitats and species occur. These spatial datasets allow impact assessments to focus on areas where ecological vulnerability is highest. The sensitivity scores used in CIA are also being further refined to improve the representation of species and habitat responses to different pressures. To support more detailed spatial analyses, the spatial resolution of cumulative impact assessments is being improved to 250 × 250 metres across the Baltic Sea. This enhanced resolution allows for more precise identification of pressure hotspots and areas of ecological vulnerability.

An important advance in **MAREA** project was not only the development of new maps of provisioning, regulating, and cultural ES for the northeastern Baltic Sea, but also their explicit integration as ES assets within PlanWise4Blue, enabling the assessment of how these services may change under alternative human-use scenarios³¹. Today, a key set of ES layers is an integral part of the input layers available in PlanWise4Blue³².

Key considerations of Cumulative Impact Assessment for BSR SEA FRAMEWORK

1. Evaluating cumulative impacts must be a central component of implementing the ecosystem-based approach. Countries should integrate CIA directly into key steps of their spatial planning and assessment processes.
2. Ensure transboundary coherence because most issues relating to the Baltic Sea are of transboundary importance, countries must ensure their assessment approaches are coherent across the region. Co-development under a regional umbrella, such as HELCOM, is highly recommended to join forces and share development progress.
3. Define clear objectives and acknowledge limitations so the results are practically useful. Planners must also transparently communicate the limitations related to underlying assumptions, methodology, and data gaps.
4. Refine threat matrices and hierarchical structures to utilize a comprehensive threat matrix that explicitly links human activities to the specific pressures they generate. Organizing these activities and pressures into a hierarchical structure allows assessments to be conducted at various levels of detail while maintaining coherence.
5. Distinguish between direct and diffuse pressures to improve the realism of the SEA, the framework must differentiate between direct/local pressures and diffuse pressures.
6. Evaluate simultaneous burdens and synergistic effects because the SEA framework cannot look at sectors in isolation; it must evaluate the cumulative burden that multiple, simultaneous human activities impose on the environment. This requires a holistic understanding of synergistic effects and ecosystem feedbacks.

³¹Source:Output O.T1.1, Deliverable D.T1.1.1 (<https://marea.balticseaportal.net/outputs/>).

³²<https://gis.sea.ee/bluebiosites/>

3.2. Mapping of nature values

Good practices related to mapping of nature values can be grouped into following categories:

- a) Mapping of Green Infrastructure physical components
- b) Mapping of ecosystem services as a Green Infrastructure products
- c) Modelling of nature values
- d) Implementing the results of mapping and modelling

In line with the objectives and tasks defined by the EU Biodiversity Strategy 2020 and the GI Strategy, several initiatives on GI mapping and strategic planning have been launched, ranging from local-scale projects to EU-level studies. Best-practice examples of GI mapping at the European, national, regional, and local levels were analysed by the Joint Research Centre (JRC), the European Environment Agency (EEA), and the Directorate-General for Environment of the European Commission in a joint report published in 2019.

The JRC report presents a conceptual framework for strategic GI planning and highlights two complementary approaches to GI mapping:

- Physical mapping of existing GI components, including protected areas, ecological networks, and other valuable natural areas;
- Ecosystem service-based mapping, including provisioning, regulating, and cultural services.

These two approaches are presented as interconnected and complementary perspectives, as GI consists of biodiversity-rich habitats that provide multiple ecosystem services.

3.2.1. Green Infrastructure complex mapping

The **Pan Baltic Scope** project has undertaken testing of the application of the GI concept and the methodology for mapping marine GI at the Baltic Sea scale using available data. The Pan Baltic Scope approach to GI mapping included the following steps:

1. Identification of the components constituting marine GI and selection of appropriate datasets for GI mapping;
2. Mapping areas of high ecological value, including:
 - selection of relevant assessment criteria,
 - assessment of marine ecosystem components against the selected criteria,
 - development of an aggregated ecological value map;
3. Mapping ecosystem service supply potential, including:
 - selection of ecosystem services relevant to marine GI,
 - assessment of marine ecosystem components against the selected ecosystem services,

- development of an aggregated ecosystem services map;
4. Development of a GI map through integration of the ecological value and ecosystem services mapping results.

As a result, the following maps were produced:

- a) Synthetic ecological value maps accompanied by aggregated ecological value maps for four different marine habitats and species groups in the Baltic Sea;
- b) Aggregated maps of ecosystem service supply potential accompanied by aggregated maps of ecosystem services provided by four different marine habitats and species groups in the Baltic Sea³³.

3.2.2. Mapping of nature values

Under the **MSP4BIO** project nature value layers were integrated and harmonized for the application of CEA tools within the framework of the Horizon Europe project MSP4BIO (and related parallel projects), a comprehensive suite of nature-value and human activity/pressure layers was updated and newly integrated into PlanWise4Blue, expanding the tool's capacity to assess impacts at the Baltic Sea scale. In particular, the PlanWise4Blue layers were revised to incorporate the most recent information available from relevant European data infrastructure repositories—most notably the HELCOM Map and Data Service³⁴.

3.2.3. Modelling of nature values

The **PROTECT BALTIC** project has advanced spatial modelling to improve the understanding of biodiversity patterns and habitat distributions in the Baltic Sea. This work builds on a wide range of ecological data sources, including species occurrence records, environmental variables, and monitoring datasets. These data are combined using statistical and machine-learning approaches to produce predictive species distribution models (SDMs) across the region. By extending ecological knowledge beyond surveyed areas, these models help fill important spatial data gaps, allow countries with less data to benefit from mapping efforts in other countries, and provide more comprehensive coverage of biodiversity patterns. The modelling is conducted at a spatial resolution of 250 × 250 m, significantly improving the spatial resolution of existing Baltic-wide models, and allowing for a detailed representation of biodiversity patterns and habitat distributions across the Baltic Sea.

The modelling effort covers a large number of species and taxonomic groups, reflecting the project's aim to provide a comprehensive assessment of marine biodiversity. In total, spatial models have been prepared for more than 600 species across multiple ecological groups. These include benthic invertebrates, macrophytes, fish species, as well

³³Source:: Ruskule A., Bergström L., SchmidtbauerCrona J., Jonne Kotta J., Arnd P., (2019) Mapping of Marine Green Infrastructure: Pan Baltic Scope Approach Pan Baltic Scope available at <https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope>

³⁴Source:An up-to-date list of the nature value and human activity/pressure layers currently available in PlanWise4Blue can be consulted by accessing the tool via the Blue Bio Sites repository (<https://gis.sea.ee/bluebiosites/>).

as birds and marine mammals. Together, these models provide an extensive spatial representation of species distributions and habitat suitability across the Baltic Sea.

A particular focus of the modelling work is the identification of areas of high ecological value. These include biodiversity hotspot areas, locations supporting high ecological functioning, areas of importance for connectivity, and habitats that are particularly important for species persistence and ecosystem processes. By analysing species distributions together with environmental drivers such as depth, substrate type, salinity, and temperature, the models help identify where favourable ecological conditions occur and where sensitive or valuable habitats are likely to be located.

The resulting spatial outputs include predictive maps of species and habitat distributions that allow biodiversity patterns to be assessed across the Baltic Sea basin. These spatial datasets become particularly valuable when combined with information on human activities and environmental pressures. By overlaying biodiversity maps with pressure layers and management boundaries, **PROTECT BALTIC** enables the identification of areas where important nature values may be exposed to significant pressures and where conservation measures could be most effective³⁵.

The set of ecosystem services models and layers produced in the frame of **MAREA** and integrated into PlanWise4Blue have been already described in this report. Here the important aspect is their integration into PlanWise4Blue tool³⁶.

3.2.4. Implementing mapping results

In addition to mapping biodiversity patterns, the **PROTECT BALTIC** project is also developing spatial models for optimizing spatial protection and to identify areas that should be prioritized for protection. These optimization analyses consider both ecological targets and the overall biodiversity benefits of protecting specific areas. By integrating species distribution models, habitat information, and conservation targets, the project will produce spatially explicit guidance on where conservation efforts could achieve the greatest ecological benefits. The project is also developing ecological protection targets for Baltic Sea habitats. This process includes mapping the range, spatial extent, and condition of each habitat type, as well as assessing their diversity, ecological function, resilience, and importance for the life-history stages of other species. Additional attention is given to habitats that are particularly important for species of special conservation concern. By analysing these ecological characteristics, the project aims to provide a robust basis for defining habitat-specific protection targets. Importantly, this approach helps explain not only which habitats are valuable, but also why they are important for maintaining biodiversity and ecosystem functioning. Finally, these project analyses contribute to assessments of the ecological coherence and

³⁵Source:<https://protectbaltic.eu/wp3%3A-spatial-modelling>
<https://protectbaltic.eu/wp5%3A-ecological-coherence-1>

³⁶Source:Output O.T1.1 and Deliverable D.T1.1.1 (<https://marea.balticseaportal.net/outputs/>), and in the catalogue of the PlanWise4Blue tool in the Blue Bio Sites portal (<https://gis.sea.ee/bluebiosites/>).

functionality of the Baltic Sea MPA network. In doing so, they help identify areas where existing protection may be insufficient to safeguard biodiversity and ecosystem processes.

Key considerations of Mapping of nature values for BSR SEA FRAMEWORK

1. Adopt a dual mapping approach, it should integrate two complementary perspectives.
2. Implement a structured marine Green Infrastructure methodology. Assessments should follow a systematic approach to map marine GI. This involves identifying GI components, mapping areas of high ecological value, mapping ecosystem service supply potential, and integrating these into aggregated, pan-Baltic GI maps.
3. Utilize advanced predictive modelling to fill data gaps. Where survey data is limited, the framework should rely on predictive species distribution models built using statistical and machine-learning approaches.
4. Modelling efforts must be extensive, capturing multiple ecological groups to provide a true representation of marine biodiversity. This includes generating models for benthic invertebrates, macrophytes, fish species, birds, and marine mammals.
5. Target ecological hotspots and connectivity mapping to focus on identifying areas of high ecological value. This means pinpointing biodiversity hotspots, areas crucial for ecological connectivity, and habitats that are vital for species persistence and maintaining ecosystem processes.
6. Nature values become most effective for SEA when combined with information on human activities. The framework must overlay predictive biodiversity maps with pressure layers and management boundaries to identify where important nature values are exposed to significant threats.
7. Define habitat protection targets mapping results to establish robust ecological protection targets. This requires assessing habitats based on their spatial extent, condition, diversity, ecological function, resilience, and their importance for the life-history stages of species of special conservation concern.

3.3. Evaluating significance of adverse effects

Under **Pan-Baltic Scope** project a document entitled “Cumulative Impact Assessment for Maritime Spatial Planning the Baltic Sea Region” was elaborated, published in November 2019, and widely disseminated³⁷. The following approach has been used for measuring the significance of BSR pressures. First, an overview table (Table 3.2) of potential relationships between human sea uses and pressures in the Baltic Sea has been developed. The columns show principal pressures and the rows - principal human activities as referred to in the MSFD. The cells indicate

³⁷<https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope>

which pressures can potentially be associated with each of the listed human activities. Then Baltic Sea Pressure Index tool (BSPI tool) has been applied to calculate the Baltic Sea Pressure Index (BSPI grid layer as an output).

Table 3.2. Pressures matrix

Theme	Activity	Physical pressures			Input energy		Input of substances				Biological pressures			
		Change of seabed	Disturbance to seabed	Hydrological conditions	Sound (cont./impulsive)	Oth. energy (heat/EMF (N))	Hazardous substances	Litter (N)	Nutrients	Organic matter (N)	Disturbance of species	Extraction/mortality/injury	Genetic modification (N)	Microbial pathogens (N)
Cultivation of living resources	Aquaculture – marine	X	X	p				p	p	p	p	p	p	p
Production of energy	Renewable energy (wind farms)	X	X	X	p						p	p		p
	Non-renewable energy (fossil fuel energy production)		p			X	p				p			p
	Transmission (cables)	X	X											p
Extraction of living resources	Fish and shellfish harvesting		X		p			p			p	X		
	Marine plant harvesting		X		p			p			p	p		
	Other hunting and collecting										p	X		
Extraction of non-living resources	Extraction of minerals	X	X		p		p				p			
	Extraction of oil and gas	X	p	X	p		p				p			
Physical restructuring of rivers, coastline or seabed	Land claim	X	p	p										
	Watercourse modification	X	p	X						p	p			
	Coastal defence	X	X	p							p			
	Offshore structures	p	p								p			p
	Restructuring of seabed	p	p	p			p	p	p	p				
Tourism and leisure	Tourism and leisure infrastructure (marinas and leisure harbours)	X	p					p		p	p			
	Tourism and leisure activities (recreational boating)		X				p	p	p		X			
Transport	Transport infrastructure (harbours, oil terminals)	X	X	p	p		p	p			p			p
	Transport – shipping		X		p		p	p	p		p			p
	Transport - land	p	p	p	p		p		p		p			
Urban and industrial uses	Urban uses	p	p	p	p	p	p	p	p	p	X			p
	Industrial uses (oil and gas refineries)	X	p	p	p	p	p	p	p	p	p			p
	Waste treatment and disposal	p	p			p	p	p	p	p				p

Security/defence	Military operations		p		p		p	p	p		p	p			
Education and research	Research, survey and educational activities		p		p						p	p			
Heritage															
Nature															
Other - multiuse		p	p	p	p	p	p	p	p	p	p	p	p	p	p

Explanation: Cases where a data layer on human activity was directly used when creating the pressure layer in HOLAS II (HELCOM 2018a-b) are marked "X". Other probable or potential combinations are marked "p". These pressures were not explicitly linked to human activities data in HOLAS II, as the pressure was rather estimated based on monitoring and measurements at sea, but they may need to be considered when evaluating planning scenarios. Pressures marked (N) were not used in the HOLAS II Baltic Sea Impact Index, as they were considered to have a relatively minor impact, and in the case of marine litter due to lack of data.

The focus of this approach is on the relationship between pressures and ecosystem components rather than on impacts from human activities directly. Underlying assumption is that species will respond to the total (cumulative) level of a certain pressure independently on how many or what type of human activities caused this. Hence, in the assessment, the intensity and distribution of a certain pressure represents the combined pressure from all human activities that give rise to it at the assessed scale. This approach gives a balance as it avoids the risk that pressures which are caused by several human activities are unduly over-estimated³⁸.

The threat matrix has been developed in the **PROTECT BALTIC** project. They provide a structured framework for assessing how different activities may affect habitats and species and for estimating the relative importance of these impacts.

Within the matrix, human activities are linked to the environmental pressures they generate, providing a structured representation of how different uses of the marine environment translate into specific types of impact. By assigning a relative strength to each activity–pressure relationship, the matrix helps indicate which activities are likely to be the most significant contributors to particular environmental pressures. This structured representation clarifies the pathways through which human uses of the marine environment generate pressures and provides a useful basis for subsequent analyses, such as evaluating how these pressures may affect sensitive habitats and species or contribute to cumulative impacts.

The threat matrix can be used in combination with spatial pressure layers and ecological distribution data to identify areas where sensitive habitats and species are exposed to multiple pressures. This approach can help to identify locations where adverse effects may be particularly significant and where management measures may be required³⁹.

³⁸Source: Lena Bergström, Andžej Miloš, Juuso Haapaniemi, Champa Rani Saha, Philipp Arndt, Jan Schmidbauer-Crona, Jonne Kotta, Joni Kaitaranta, Stefan Husa, Jonas Palsson, Mari Pohja-Mykrä, Anda Ruskule, Magda Matczak, Solvita Strake, Andrzej Zych, Anne Nummela, Magdalena Wesolowska, Goncalo Carneiro (2019) Cumulative Impact Assessment for Maritime Spatial Planning in the Baltic Sea Region. Pan Baltic Scope.

³⁹Source: Linking human activities to Baltic Sea environmental pressures

A major effort initiated under the **MAREA** project has been the assessment of the magnitude of the effects of different human activities and pressures on a wide range of nature values. This has been based on the best available observational and experimental evidence in the specialist literature. Key information, including effect sizes, measures of uncertainty/precision, sample sizes, and contextual variables (among others) was extracted and used to estimate aggregated effects using well-established meta-analytical approaches. This process generated quantitative estimates of the single effects of human activities and pressures, as well as their synergistic and antagonistic interactions, across diverse nature values. Where empirical evidence was insufficient or unavailable, the methodology was complemented with expert-based approaches. Substantial additional work was therefore required to harmonize quantitative estimates derived from the literature with those obtained through expert elicitation, ensuring consistency and comparability across evidence sources.

The results have been further advanced through subsequent initiatives (particularly the Horizon Europe projects MSP4BIO, Blue4all, and MARBEFES)⁴⁰.

Key considerations of Evaluating significance of adverse effects for BSR SEA FRAMEWORK

1. The framework must go beyond calculating the single, isolated effects of human activities. It must also generate quantitative estimates of how different pressures interact with one another (synergistic and antagonistic interactions) across diverse nature values.
2. It is required to harmonize diverse evidence sources. Every effort should be made to harmonize quantitative estimates derived from the scientific literature with qualitative or semi-quantitative data obtained through expert consultation.
3. The framework should leverage established regional tools, such as the Baltic Sea Pressure Index (BSPI) tool, to calculate and visualize standardized pressure grid layers as a clear, actionable output for planners.

3.4. Sustainability assessment (socio-economic in SEA)

Good practices related to sustainability assessment can be grouped into following categories:

- a) recommendations
- b) implementation actions

3.4.1. Recommendations on sustainability assessment

The **Pan Baltic Scope** project calls for unification of approaches used for assessing the economic and social aspects of maritime spatial development in the Baltic Sea region. For that reason, the project has formulated recommendations. The recommendations emphasise the need to develop an integrated assessment framework

⁴⁰Source: dedicated guidelines prepared for the cumulative impact assessment tool PlanWise4Blue **Linking human activities to Baltic Sea environmental pressures**(<https://gis.sea.ee/bluebiosites/>).

capable of capturing the combined economic, social, cultural, environmental, and ecosystem service impacts of maritime spatial plans. Such a framework should provide a comprehensive understanding of how spatial planning decisions affect marine ecosystems and human welfare over both short and long-time horizons. Such framework would integrate analysis of ecological systems alongside social and economic systems, explicitly addressing linkages between human activities, environmental pressures, ecosystem state, and societal benefits. It should assess the economic contribution of all maritime activities—including non-market values such as recreation—alongside their environmental pressures, impacts on ecosystem services, and resulting effects on human welfare. Where feasible, impacts on welfare, costs, and benefits should be quantified in monetary terms, including long-term economic and social implications of spatial plans. To ensure relevance and usability, the framework should be developed through international collaboration involving all Baltic Sea coastal countries and integrating environmental and social science expertise. Active engagement of planners, policymakers, and stakeholders is essential to ensure that the framework addresses decision-making needs. Long-term implementation requires investment in expertise, resources, common terminology, and institutional memory, as well as alignment with other marine and environmental policies where economic and social aspects are addressed. Flexibility must be ensured to accommodate geographic and governance diversity.

3.4.2. Implementation actions

The **MSP4BIO** project has prepared a detailed protocol and guidelines for the effective implementation of trade-off analyses in the design and management of the area-based conservation measures and maritime spatial planning processes. The resulting document guides the design of the scenarios to assess the effects of developing alternative actions on the overall sustainability of marine ecosystems. In this context, the document provides a methodological pathway to understand how different human activities and their pressures affect and are affected by changes in ecosystem services and finding solutions to minimize socio-economic and environmental impacts. The proposed methodology is implemented through the following steps and sub-steps⁴¹:

- Preparation: (a) Geographic Information System (GIS) Data Collection, (b) Ecosystem Services Criteria and Prioritization, (c) Environmental Models and Tool Information Summary, (d) Conservation and Protection Goals Identification, (e) Tool selection, (f) Building a project in Participatory Mapping Tool.
- Collaborative Engagement with Stakeholders: (a) Introduction Trade-Offs, (b) ecological Values and Goals, (c) Applying Survey in participatory tool and results, (d) Analysis and decision-making, (e) Documentation.
- Feedback to Stakeholders.

Also **PROTECT BALTIC** project has proposed a multi-use methodology combining ES and sustainability appraisal. Ecosystem services inherently involve socio-economic aspects, In particular this is visible while conducting their

⁴¹Source: Gutierrez D., Calado H., De Bruyn A., et al., (2024). Trade-offs method for protection and restoration in MSP – ESE3 Deliverable – D4.3., under the WP4 of MSP4BIO project (GA n° 101060707).

monetary valuation to assess value of ES to certain maritime activities. This is important while conducting SEA for instance for areas of mineral extraction in order to calculate "gains" or "losses" for ES.

Key considerations of Sustainability assessment for BSR SEA FRAMEWORK

1. The SEA framework must move beyond purely ecological measures to adopt an integrated approach that captures the combined economic, social, cultural, environmental, and ecosystem service impacts of spatial plans.
2. To effectively balance conservation goals with maritime development, planners should utilize a detailed protocol for trade-off analyses.
3. For the sustainability assessment to be relevant and usable, it must be co-developed through international collaboration involving all Baltic Sea coastal countries, accommodating geographic and governance diversity.

4. Tools

This chapter analyses detailed inventory of the tools developed across various maritime projects to support the SEA process. Technical instruments are essential for transforming vast amounts of complex data into actionable planning decisions. Their primary purpose is to ensure that human activities at sea do not exceed the environment's ability to regenerate. The tools identified in this chapter are designed to handle the complexity of the marine environment by translating raw data into actionable planning insights.

The chapter serves to systematize these digital and methodological solutions to provide a robust evidence base for the regional SEA framework. By employing scenarios and mapping functionalities, planners can visualize potential conflicts between human activities—such as offshore wind expansion—and sensitive ecosystems before they occur. This enables the identification of Environmental Objectives, the assessment of Cumulative Impacts, and the development of Mitigation Measures that are essential for a legally compliant and effective SEA. Ultimately, these tools aim to identify the ecological carrying capacity of the sea, ensuring that blue growth does not exceed the environment's ability to regenerate.

The chapter identifies the principal good practices developed by the analysed projects to support the SEA scoping phase, by using vast amount of available data to make it easier to understand and visualize the available options so that the right decision can be made. Table 4.1 provides a quantitative overview of these elements. In total, 12 good practices or guidelines or messages were identified.

Table 4.1 Good practices identified for “SEA tools”.

Project Acronym	Tools		
	Alternatives or Scenarios	Mapping Tools	Other
eMSP NBSR			
MSP-GREEN			
MSP4BIO	x	x	
PROTECT BALTIC	x	x	
MAREA	x	x	
ReMAP			
Baltic LINes			
Baltic Sea2Land		x	x
Land-Sea Act	x		
SELINA			
MSP4More	x		x
NESBp			
Pan Baltic Scope			x

Source: own analysis of project partners

4.1. Alternatives or Scenarios

Good practices regarding alternatives or scenarios involves development of forward-looking planning options and the assessment of future environmental states. Purpose of such is To evaluate how different human-use developments or climate change will impact marine ecosystems over time. It involves creating "what-if" situations to understand their potential environmental and socio-economic consequences before a plan is finalized.

One of the crucial tools presented in this theme is PlanWise4Blue, so a tool that is used in many projects, was introduced by the **MAREA** project as its primary technical output, serving as a comprehensive decision support tool that translates the project's scientific findings into a user-friendly digital interface. This tool integrates complex modelled data layers—such as natural values, socio-economic systems, and human activities—into specific functional modules. The PlanWise4Blue is an online GIS-based tool developed by scientists at the University of Tartu that aims to provide science-based support for assessing the impacts of human activities on the marine ecosystem and the services it provides. The work carried out in **MAREA**, together with several follow-up projects (e.g., the Horizon Europe project MSP4BIO, Blue4aLL, and MARBEFES), enabled the operationalisation and further improvement of tool PlanWise4Blue. It supports the assessment of the effects of alternative human-use scenarios on nature values.

Another project implementing the cumulative impact assessment tools, particularly PlanWise4Blue, was the **MSP4BIO** project. The project required defining alternative human-use development scenarios for evaluation at its test sites to use such a tool. These scenarios were developed through an ongoing dialogue with local experts. For example, in the Bulgarian and Romanian EEZs, alternative scenarios were designed to assess the cumulative impacts of different human activities and their potential future development on selected key marine mammal species. Accordingly, the scenarios focused primarily on current and projected trends in human activities within the areas of interest, rather than on ecological changes in the targeted natural values or on the implementation of management measures⁴². In addition, the project produced detailed practical guidance for incorporating climate change into spatial planning and the design and management of area-based conservation measures at sea. The document provides a step-by-step workflow that walks users through the needed methodological steps and sub-steps:

- Setting the assessment: (1) Select a management question, (2) Choose the management approach: conservative or selective, (3) Define the spatio-temporal scales of concerns, (4) Define the ecological levels (targets and criteria), (5) Define and prioritize the targets of conservation including social concerns.
- Risk identification: (1) Background analysis about current species/communities/areas, (2) Assessing exposure using climate scenarios, (3) Sensitivity, (4) Feasibility.

⁴²The detailed description of the scenarios considered and the implementation of PlanWise4Blue in selected test sites are described in: Stancheva, M., et al., (2025). Site specific solutions for accelerating biodiversity protection and restoration in MSP Deliverable – D5.3., under the WP5 of MSP4BIO project (GA n° 101060707).

- Risk analysis: (1) Choice of Trait-based Vulnerability Method, (2) The Vulnerability assessment: defining Vulnerability thresholds and calculating Climate Risk, (3) Uncertainty and Verification process.
- Risk assessment: (1) Reading Trait-based Vulnerability Method outputs, (2) Criteria for prioritization: Prioritization of management concerns regarding actual knowledge on climate-smart MPA, (3) Assessment and ranking among pathways, (4) Uncertainty analysis.
- Informed management and monitoring: (1) Insights for management: Designing climate-smart MPA and MPA networks, (2) The trade-off exercise: propose a consensus-building final MPA network, (3) Insight for monitoring, (4) Future research and tools needed.

In addition to the steps, the guidance provides a dedicated section showing how the introduced approach could be applied to answer relevant questions in the integration of marine protected areas in maritime spatial planning⁴³.

Another project, **Land-Sea-Act**, carried out a study on scenario building for balanced use of land-sea resources at the coast of Southwestern Kurzeme, Latvia. It aimed to support sustainable coastal development by balancing national interests of renewable (wind) energy production at sea with local interests in development of coastal tourism, preservation of landscape value and environmental quality. The optimum solutions for locating offshore wind parks and tourism development within the case study area were developed, including the following steps:

- mapping and assessment of the coastal landscapes and ecosystem services,
- stakeholder engagement in formulating coastal development challenges, values, interests of local communities, as well as in participatory scenario building,
- assessing impact of the proposed scenarios to coastal ecosystems, services and land-/ seascape.

Therefore, in the **Land-Sea-Act** the participatory scenario building was carried out during an interactive face-to-face workshop in 2020 by applying target-seeking scenario method to explore alternative pathways for achievement of the policy objectives of renewable energy and coastal tourism development. The area necessary for wind park development was calculated based on the estimated capacity for offshore wind energy production in Latvian marine waters by 2050, which was 2.9 GW according to the report from Wind Europe (2019). Participants were divided in four groups and each tasked to seek suitable locations for the offshore wind parks with total capacity of 2.9 GW, also considering the limitations and priorities for the sea use defined in the national MSP of Latvia and possible impacts on marine ecosystem and landscape. Each group also discussed scenarios for sustainable tourism development in the coastal area of the Southwestern Kurzeme. Information on marine and coastal ecosystem features and services, sea uses and thresholds of offshore wind park visibility from the coast were presented to stakeholders within an online map explorer developed using ArcGIS Online Map Explorer. The four alternatives proposed by the stakeholders for the offshore wind park locations were later assessed by experts,

⁴³The detailed description of the guidance and the steps can be found in: Cambra et al (2024). Guidance for including climate change scenarios in protection and prioritization strategies for Marine Protected Areas development. Deliverable D3.3, under the WP3 of MSP4BIO project (GA n° 101060707).

calculating the impacts on marine ecosystem components, coastal landscape qualities, ecosystem service supply and human well-being. Based on the assessment results, the experts proposed optimum solutions for offshore wind energy development by 2030 and 2050 and elaborated proposals for targeting tourism development. Solutions for sustainable tourism were elaborated by clustering of the inland landscape units by the dominant landscape qualities. Recommendations were proposed for adjusting/targeting tourism development to site specific values/landscape qualities⁴⁴.

In the similar manner, **MSP4MORE** aims to support OWF development in alignment with other sustainability targets including biodiversity conservation - expanding MPA networks and other effective conservation measures (OECM) and the delivery of ecosystem services. For this purpose, the project will explore and expand the use of the tools and existing spatial prioritization frameworks as well as stakeholder engagement processes for optimizing OWF planning in MSP. This will include development of planning alternatives that optimise OWF profitability, conservation targets, biodiversity, other sea uses and socio-cultural effects, by applying the SpOWED Optimization Framework. The applied approach will enable a rigorous and systematic exploration of alternatives for minimal-impact site-prospecting, employing analysis at high resolution for CEAs and investigation of spatial interactions with other uses by applying weighted spatial optimization under various constraints while ensuring the compactness and continuity of optimal solutions.

Next, **PROTECT BALTIC** contributes to the exploration of future environmental scenarios through spatial modelling of climate-driven changes in abiotic conditions and their implications for species and habitat distributions in the Baltic Sea. This work provides a forward-looking perspective on how marine ecosystems and biodiversity patterns may change under climate change. A key component of modelling is the development of estimates for future abiotic conditions, including variables such as temperature, salinity, and oxygen conditions that strongly influence marine ecosystems. These projections provide the environmental basis for understanding how suitable conditions for species and habitats may shift over time. Building on these projections, **PROTECT BALTIC** develops species and habitat distribution models to estimate how the spatial distribution of biodiversity may change under future climate scenarios. By linking species occurrence data with environmental drivers, the models identify suitable habitat conditions and project how these may shift as environmental conditions change. The modelling work also enables the identification of potential biodiversity hotspots under both present and future conditions. By analysing spatial patterns of species and habitat distributions, the project highlights areas that currently support high biodiversity as well as areas that may become increasingly important in the future. Together, these outputs provide valuable spatial information on how biodiversity patterns in the Baltic Sea may evolve under climate change, supporting

⁴⁴a) Land-Sea-Act case study report “Balancing coastal tourism and use of off-shore wind energy in Southwestern Kurzeme”, available at: <https://land-sea.eu/results/>

b) Ruskule & Veidemane, 2021. Baltic Sea cross-border case study on operationalising the green infrastructure concept and addressing land-sea interactions in MSP. In: “Study on Integrating an Ecosystem-based Approach into Maritime Spatial Planning: Project case-study reports”. European Commission, 2021, <https://data.europa.eu/doi/10.2926/181540>

c) Pikner, T., Piwowarczyk, J., Ruskule, A., Printsman, A., Veidemane, K., Zaucha, J., Vinogradovs, I., Palang, H., 2022. Sociocultural Dimension of Land–Sea Interactions in Maritime Spatial Planning: Three Case Studies in the Baltic Sea Region. *Sustainability*, 14, 2194. <https://doi.org/10.3390/su14042194>

d) Visualization and method description available at the Land-Sea Act Online Map Explorer

forward-looking conservation planning and ecosystem-based management. The spatial optimization modelling for protection, i.e. modelling aimed at identifying where and what to protect to achieve targets at minimum cost, also includes a large number of different scenarios, representing both how best to achieves individual targets, multiple targets at once, and the most biodiversity benefit overall.

Key considerations of Alternatives or Scenarios for BSR SEA FRAMEWORK

1. Projections must be integrated with Climate Change, by inclusion of variables like salinity, temperature and oxygen, identification of current hotspots and ecologically significant areas under future climate scenarios.
2. There is a need for a stakeholder-driven discussion developing scenarios or alternatives, where there is an ongoing dialogue with local experts and stakeholders. Such workshops exploring pathways to achieve policy objectives expand the criteria for conducting scenarios.
3. The framework should identify locations that achieve conservation targets at the "minimum cost" or maximum biodiversity benefit.
4. Use high-resolution analysis to understand how multiple human activities combine to affect specific marine species
5. Utilize tools like PlanWise4Blue to provide science-based evidence that is easily accessible for decision-makers. Mapping functionalities are necessary to visualize potential conflicts between investment and ecosystems before they even occur.

4.2. Mapping Tools

Mapping tools are technical instruments and geospatial platforms designed. These significantly impact the Strategic Environmental Assessment (SEA) process by moving it from a static administrative procedure to a dynamic, evidence-based analysis. It enables Cumulative Impact Assessments by overlaying nature value layers with pressure layers to pinpoint exactly where environmental carrying capacities might be exceeded. Furthermore, these tools facilitate transboundary cooperation by harmonizing incompatible national datasets into regional portals to transform vast ecological and human-activity datasets into spatially explicit visual outputs.

An interesting tool here is the Sea2Land Navigator⁴⁵. The project **Baltic Sea2Land** developed an online platform that aims to support marine and coastal planning by allowing planners to map and assess connectivity across land and sea, identify synergies and conflicts between coastal uses, strategize inclusive stakeholder engagement and governance responses. The tool consists of three main sections, one of them being Data Hub. It is a collection of

⁴⁵<https://navigator-helcom.hub.arcgis.com/pages/data-hub>

geodata, including interactive and intuitive tools for exploration through maps and dashboards. The Data Hub section consists of three main parts:

- Geodata - this section functions as a one-stop tool for exploring and interacting with maritime spatial data. The Geodata section allows users to access and explore spatial datasets provided by the project partners, as well as to upload and view their own geospatial data directly in the browser. Users can add locally stored data in various supported formats (such as SHP, GeoJSON, KML, and CSV) or connect to external open-data services, including WMS, WFS, and similar sources. This section provides a flexible environment for interacting with diverse datasets related to marine uses and values - such as nature, landscape, and other environmental information - while ensuring that any uploaded data remains stored locally in the user's browser for private use.
- Dashboards - includes dashboards with economic data. Similarly to the Interactive maps section, these dashboards can provide insights to planners and stakeholders.
- Interactive maps - contains Baltic Sea2Land project partner-provided maps that serve as a communication tool for both stakeholders and policymakers. This section provides spatial context information on different themes that are of potential use for planners. There is a total of seven sub-sections – Regional plans, Nature protection and ecosystem services, Stakeholder involvement, Energy maps, Tourism, Fishing activities and Landscapes.

For all sections, users have the ability to submit their own materials. Therefore, in the case of interactive maps, users can not only view (and interact with) maps but also provide their own. **Baltic Sea2Land**-supported 2024 coastal landscape and accessibility mapping is used to show where access to the sea is blocked, where coastal landscapes are vulnerable and how tourism flows travel from inland settlements to the shore. There were two pilot projects there – national and regional. National centred on the National Coastal Plan and the regional on developing a Coastal Thematic Plan for the Kurzeme region. Such mapping enabled to identify spatial obstacles in terms of physical access to particular area. The national pilot provided valuable insights for future spatial planning strategies, and regional facilitated justification and advocacy for the investments and coastal development solutions.

Next, project **MSP4BIO** analysed a tailored set of tools capable of producing spatially explicit outputs to inform maritime spatial planning, as well as the design and management of area-based conservation measures at sea. It introduced the toolkit to support the design, establishment and management of Marine Protected Areas (MPAs) by improving decision-making processes. Thanks to this, it allowed to focus on prioritization of areas, integration of connectivity processes and assessment of human impacts on marine ecosystems. The project tested the technical base for implementing the guidance and operational approaches. Cumulative impact assessment tools such as SPIA, Tools4MSP, and PlanWise4Blue, together with the ABC planner tool for prioritizing and optimizing area-based protection measures, generate spatially explicit outputs through the application of their underlying algorithms.

Tools such as PlanWise4Blue and ABC planner also offer advanced mapping functionalities, enabling users to tailor map products and present information in alternative ways to meet different reporting needs⁴⁶.

In the ongoing project, **PROTECT BALTIC**, spatial mapping and modelling tools are a central component supporting the analysis and visualization of ecological patterns across the Baltic Sea. These tools will help transform large and diverse environmental and biodiversity datasets into spatially explicit information that can guide conservation planning, marine spatial planning, and the design of effective Marine Protected Areas (MPAs). Within the project, spatial modelling approaches are used to combine environmental data, species observations, and information on human pressures into integrated mapping frameworks. By bringing together these different data sources, the tools can generate detailed maps showing where species and habitats occur, how biodiversity is distributed across the Baltic Sea, and how human activities may affect marine ecosystems. The modelling framework produces spatial outputs such as maps of predicted species presence, probability of occurrence, and associated uncertainty. These outputs allow researchers and decision-makers to identify biodiversity hotspots, understand ecological patterns, and assess areas where conservation actions may be most effective. By considering potential environmental changes and human pressures, the models can estimate how species distributions and habitats may shift over time. These forward-looking analyses help identify areas that may remain ecologically resilient and highlight regions that may require additional protection in the future.

Under the **MAREA** project, PlanWise4Blue tool now gained an extensive set of ecosystem services maps that can be used as nature-value inputs for cumulative impact assessments⁴⁷.

Key considerations of Mapping Tools for BSR SEA FRAMEWORK

1. **The framework should prioritize tools that connect to external open-data services (WMS, WFS) to ensure data remains current without manual updates.**
2. **While regional portals promote sharing, the framework must support local browser storage for private user data to encourage sensitive data exploration without immediate public disclosure.**
3. **Modelling should not just show current statuses but estimate how species distributions and habitats may shift over time due to environmental changes and human pressures.**
4. **Maps should not just be for experts. The use of Dashboards and themed Interactive Maps (Energy, Tourism, Fishing) serves as a vital communication tool between stakeholders and policymakers to reach consensus.**

⁴⁶Descriptions of these tools and their capabilities can be found in: Kotta, et al. (2024) Ecological toolkit (ESE1) for MPAs prioritization and networking. Deliverable – D3.4., under the WP3 of MSP4BIO project (GA n° 101060707)

⁴⁷See further MAREA project details in Output O.T1.1 and Deliverable D.T1.1.1 <https://marea.balticseaportal.net/outputs/>

4.3. Other

Beyond standard mapping and scenario-building platforms, the Strategic Environmental Assessment framework for the Baltic Sea Region is enriched by a suite of specialized tools that focus on governance, methodological consistency, and the refinement of cumulative impact calculations. While these instruments may not always be categorized as primary mapping interfaces, they are indispensable for translating vast datasets into actionable policy and managing the inherent complexities of marine planning. By functioning with data and knowledge hubs, these other tools move the SEA process from a purely technical exercise to a structured management workflow that ensures decisions are both informed by data and socially and administratively coherent.

First, the most important here is the **Baltic Sea2Land** project's Multi-level governance tool⁴⁸ enabling users to identify and engage stakeholders as well as refine objectives, explore resources and timelines, and monitor and evaluate plans while considering stakeholder needs. This interactive tool is designed to tackle governance complexity in marine and coastal planning. It is primarily intended for planners and policymakers at national, regional and local level who often face challenges like:

1. Overlapping responsibilities between local, regional, and national authorities;
2. Poor coordination between sectors or governance levels;
3. Conflicting goals between stakeholders;
4. Difficulty linking planning processes to real spatial and governance data.

Multi-Level Governance Tool serves as one of three pillars of the Sea2Land Navigator platform alongside the Knowledge Hub (catalogue of documents, methods, tools etc.) and Data Hub (collection of spatial data, maps and quantitative data; already detailed in the Mapping Tools section). The Tool references and links to materials in the Knowledge Hub and Data Hub and works in tandem with them. At all points the Tool encourages to make informed decisions about what activities to engage with within the Tool and during the policymaking/planning process in general.

Next, under **Pan-Baltic Scope** an aforementioned document entitled „Cumulative Impact Assessment for Maritime Spatial Planning in the Baltic Sea Region”⁴⁹ was elaborated, published in November 2019 and widely disseminated⁵⁰. The added value of this document is threefold:

1. bring available cumulative impact assessment (CIA) tools and approaches to the planners' table;
2. identify possible further development options for CIA;

⁴⁸The Multi-level governance tool: <https://navigator-helcom.hub.arcgis.com/pages/multi-level-governance>
Its implementation plan: https://interreg-baltic.eu/wp-content/uploads/2023/12/MLG_Implementation_Plan_D1.1-1.pdf

⁴⁹Lena Bergström, Andžej Miloš, Juuso Haapaniemi, Champa Rani Saha, Philipp Arndt, Jan Schmidtbauer-Crona, Jonne Kotta, Joni Kaitaranta, Stefan Husa, Jonas Palsson, Mari Pohja-Mykrä, Anda Ruskule, MagdaMatczak, Solvita Strake, Andrzej Zych, Anne Nummela, Magdalena Wesolowska, Goncalo Carneiro (2019) Cumulative Impact Assessment for Maritime Spatial Planning in the Baltic Sea Region. Pan Baltic Scope

⁵⁰<https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope>

3. validating CIA in the case studies.

The following tools are worthy to be mentioned in this context:

- **A BSII Cumulative impact Assessment Toolbox (BSII CAT)** aims at supporting sea-basin coherent assessments of cumulative impacts. It allows calculating the described below two indexes as well as identification of areas with high ecological values or high potential provision of ecosystem services (ES). To support MSP, the toolbox enables batch impact assessments and impacts assessments targeting ecosystem components important for green infrastructure in a balanced way. The tool makes use of Baltic data, but it can also be applied using other data layers. The Toolbox includes the following⁵¹:
 - **“Baltic Sea Impact Index tool (BSII tool)** – calculates the Baltic Sea Impact Index. It uses data layers on ecosystem components and pressures (grid layers), as well as a sensitivity scores matrix as input, and creates a BSII grid layer as output. The tool also creates a BSII statistics matrix, which shows how much each ecosystem component and pressure combination contributes to total impact.
 - **Baltic Sea Pressure Index tool (BSPI tool)** – calculates the Baltic Sea Pressure Index. It uses data layers on pressures (grid layers), as well as a sensitivity scores matrix as an input, and creates a BSPI grid layer as output.
 - **Ecological Value tool (EV tool)** – supports the identification of areas with high ecological value. It uses data layers on ecosystem components (grid layers) and an ecological value matrix as input. The assessment is performed for each selected ecological value criterion and ecosystem component group, as identified by the matrix. The grid layers are further aggregated to create results for each combination of criterion and group, for all criteria within each group, and as a total ecological value grid layer.
 - **Ecosystem Service tool (ES tool)** – supports the identification of areas with high potential provision of ecosystem services. It uses data layers on ecosystem components (grid layers) and an ecosystem services matrix as input. The assessment is performed for each selected ecosystem service and ecosystem component sub-group, as identified by the matrix. Output grid layers are created for: each combination of ecosystem service and ecosystem component sub-group, as an aggregated result for each ecosystem component sub-group, and as a total ecosystem service grid layer.
 - **Baltic Sea Impact Index Batch tool for Ecological Values or Ecosystem Services (BSII Batch tool)** – calculates the Baltic Sea Impact Index with respect to areas important for ecological value or for the provision of ecosystem services, referring to the matrix approaches of the EV and ES tools. Upon selection, it addresses either each combination of ecological value criteria and ecosystem component group or each combination of ecosystem service and ecosystem component sub-group, following the same structure as in the EV and ES tools, respectively. As input, the tool uses data layers on ecosystem components and

⁵¹Direct quotation from the document

pressures (grid layers), as well as specific sensitivity scores matrices. It creates BSII grid layers for each matrix as output. Optionally, the tool also creates BSII statistics matrices. The sensitivity scores matrices needed for input to this tool can be created with the Sensitivity score matrices for BSII Batch Tool.

- **Sensitivity score matrices for BSII Batch Tool** – creates new sensitivity score matrices by combining existing matrices. Using the BSII sensitivity scores matrix and either the ecological value or ecosystem services coefficients matrices as input, the tool creates one specific sensitivity score matrix for each combination of ecological value criteria and ecosystem component group, or for each combination of ecosystem service and ecosystem component sub-group”.

The ongoing **MSP4MORE** project aims to advance tools for CIA of various OWF designs and for optimizing OWF planning at the sea basin scale. The work on CIA will start with scoping of how OWFs have been technically integrated in CIA across Europe identifying common approaches and key differences. The project will depart from the established tools like the PlanWise4Blue from Estonia and Norwegian CEA tools and evaluate the work against other tools applied in different study areas, such as Netica, Symphony, HELCOM SPIA for testing different scenarios for OWF expansion and different nature-inclusive and multi-use designs. Based on analysis of existing tools the project will consolidate this information into an operational, step-by-step, reproducible framework for the realistic integration of OWFs into CEA, offering digital solutions that enable the realistic and consistent integration of OWF projects into decision-making processes. Further on the project will explore the methods and tools applied for spatial prioritization and optimizing OWF planning under different data availabilities and management settings. The usability of modelling approaches such as SpOWNED, Zonation and others will be evaluated to support OWF development under multiple planning objectives.

Key considerations for BSR SEA FRAMEWORK

1. **Governance tools should work in tandem with Knowledge Hubs (catalogues of documents, methods, and tools) and Data Hubs (spatial and quantitative data). This interlinked approach encourages planners to make informed decisions about specific activities throughout the policymaking and planning process.**
2. **Consolidate existing tools into an operational, step-by-step approach for realistic integration of new industries into decision-making.**
3. **The framework should evaluate the usability of advanced modelling approaches to support development under multiple planning objectives. This allows for spatial prioritization under different data availabilities and management settings. The framework should not just suggest tools but focus on bringing available CIA approaches to the planners table through validation in real-world case studies**
4. **Use sensitivity score matrices to quantify how specific combinations of ecosystem components and pressures contribute to total environmental impact.**

5. Data

The primary purpose of this chapter is to systematize the digital solutions required to transform vast, complex marine data into actionable planning insights. It is fundamental to the SEA framework, because an effective assessment is impossible without a robust evidence base. SEA relies on accurate data to evaluate how plans interact with the environment across national borders. Common data allows for the quick assessment of data collection to see if it is granular enough for monitoring and assessing the plans. This provides several specific functional outputs that enhance the quality of the SEA, allowing planners to visualize potential conflicts between human activities and sensitive ecosystems.

This chapter identifies the specific technical solutions and platforms necessary to manage the complexities of the marine environment. It highlights good practices for the effective use of data in the SEA process. The chapter is divided into three distinct themes Data Harmonization, Data Portals and New data generated. Table 5.1 provides a quantitative overview of these elements. In total, 17 good practices or guidelines or messages were identified.

Table 5.1. Good practices identified for “SEA common data”.

Project Acronym	Common data/usage of data		
	Data Harmonisation	Data Portals	New data generated
eMSP NBSR			
MSP-GREEN			
MSP4BIO		x	x
PROTECT BALTIC	x	x	x
MAREA	x	x	x
ReMAP	x		
Baltic LINES		x	
Baltic Sea2Land		x	x
Land-Sea Act			x
SELINA			
MSP4More			x
NESBp	x	x	
Pan Baltic Scope			x

Source: own analysis of project partners

5.1. Data Harmonisation

Data harmonization in the Baltic Sea Region is the technical process of collecting, standardizing, and integrating fragmented datasets from multiple sources into a unified framework. It involves moving away from incompatible formats anchoring them in shared analytical standards. A core component of this process is the transition of diverse spatial models to a common analytical grid. This ensures that information originating from different countries, is interoperable and can be compared consistently across the entire sea basin.

The primary purpose of harmonization for the Strategic Environmental Assessment is to provide a robust, transboundary evidence base required to evaluate the environmental effects of large-scale maritime plans. By systematizing digital and methodological solutions, it transforms vast amounts of complex raw data into spatially explicit visual outputs that help planners identify ecological carrying capacities and visualize potential conflicts before they occur. It effectively moves the SEA from a static administrative procedure to a dynamic, evidence-based analysis that can pinpoint exactly where environmental limits might be exceeded.

First, The **ReMAP**⁵² project facilitates Strategic Environmental Assessment (SEA) by providing a Modular Interoperability Framework, so the architectural approach to ensure that diverse maritime data can be processed by different tools without manual conversion. Rather than requiring SEA practitioners to harmonize raw national data manually, ReMAP automates this process by prioritizing EMODnet and Copernicus data streams. The project addresses the challenge of data harmonization by anchoring its technical framework in the established standards of the Technical Expert Group (TEG) on MSP data and EMODnet, specifically utilizing the harmonized EU MSP layer as the primary baseline for all assessments. To overcome the complexity of integrating heterogeneous national datasets, the project employs a modular data architecture consisting of 10 analytical modules. These modules are categorized to cover environmental, economic, social, governance, and safety aspects of Maritime Spatial Planning:

- Input data module – conceptualizes and executes an exploratory data analysis (EDA) on the datasets considered and used for the development of Maritime Spatial Plans. Its primary function is to "auto-assess" the data collection to determine if the available data has a suitable granularity level for monitoring and assessing the plans. The tool evaluates the input data based on four key topics: Relevance for MSP, compliance with FAIR Principles (Findable, Accessible, Interoperable, Reusable), Spatial & Temporal Coverage, and the Spatial Data Quality Framework.
- MSP & MSFD module – explores and analyses the relationships and interactions between MSP output data and spatially explicit Marine Strategy Framework Directive (MSFD) reporting. It operates on a conceptual model that connects planned uses in MSP with spatial data produced within MSFD assessments to inform both processes reciprocally. The tool automatically identifies spatial relationships and statistics between

⁵²website: <https://remap.cetmar.org/>

these datasets, specifically addressing multiscale analysis based on MSFD subdivisions of marine waters (such as Marine Reporting Units). It generates output data including geospatial layers and summary statistics—such as "Uses/GES maps" and spatial coherence data.

- Marine Conservation & Maritime Sectors (In)compatibility module – referred to as also the MSP CONS software tool, aims to analyse how marine environment conservation is integrated within current EU spatial plans. It specifically examines how MSP addresses potential conflicts between maritime activities and conservation objectives, focusing particularly on Marine Protected Areas (MPAs). The tool assesses whether the spatial planning includes trade-offs with conservation or if the planning is delivered in line with conservation targets.
- Navigation safety module – implemented through the NaviSafe software tool, uses safety of navigation information (such as Electronic Navigational Charts and related databases) to analyse the compliance between safety data and the activities included in MSP scenarios.
- Socio-economic module – quantifies the socioeconomic sectors included in the MSP. It focuses on comparing the economic impact of emergent activities with current ones. Input data combines Blue Economy indicators with qualitative assessments from the industries involved or affected by MSP. If significant variations between current and planned activities are identified, the module estimates the total effects on related industries.
- Output module – performs Exploratory Data Analysis (EDA) on Maritime Spatial Plans to summarize their main characteristics. It enables comparative analysis among Member States (MSs), multi-use analysis, and spatial pattern identification (such as connectivity, adjacent zoning elements, or diversity). It utilizes well-established European-wide geospatial layers (e.g., marine transport, bathymetry) giving opportunity for a comparative analysis by comparing established plans.
- Cumulative Impact Assessment module – evaluate the cumulative burden that multiple and simultaneous activities may impose on the environment. It builds upon the HELCOM Spatial distribution of Pressures and Impacts Assessment (SPIA), which was developed under the HELCOM Holistic Assessment of the Baltic Sea (HOLAS 3). The module explores the use of the SPIA tool to support MSP by utilizing planning data based on the MSP data model.
- Ecosystem services Assessment module – referred to as the Ecosystem Services supply (ESS) potential module, aims to assess the capacity of marine ecosystems to provide multiple ecosystem services. It utilizes standardized and widely accepted classifications, specifically using the European Nature Information System (EUNIS) for benthic habitats and the Common International Classification of Ecosystem Services (CICES) for ecosystem services. The tool assesses the rarity of ecosystem services in terms of the number of benthic habitats capable of providing them and considers ES capacity as an approximation of the vulnerability of losing ES supply

- Land-Sea Interactions module –explores the mechanism for analysing interactions between coastal land use and maritime activities included in Maritime Spatial Planning (MSP). The objective is to deliver this analysis at the national level, applying national plans and data on coastal land use. The module performs spatial analysis by defining buffer areas around designated uses based on specific interaction distances. It identifies marine areas with potential conflicts or compatibilities between coastal and maritime uses. The output data model includes geometry, classifications of marine and coastal use, the type of interaction (Conflict/Compatibility).
- Government conceptual module – assesses the performance of the governance system in supporting the implementation of the MSP plan. Recognizing that the governance system is the only fully designable element in the complex setting of MSP, the module evaluates whether existing coordination—or the lack thereof—hampers, enables, or enhances the implementation of the Plans. It acknowledges that while coordination provides a useful understanding of the governance dimension, it is limited, and this tool represents a first step toward integrating governance using a data approach.

Next, **PROTECT BALTIC**⁵³ addressed, through the project’s work on data collation, management plan analysis and spatial data integration. Given the transboundary nature of the Baltic Sea and the diversity of national management approaches, compiling and harmonising information across countries is essential for enabling consistent regional assessments of marine protection and management effectiveness. Within the project, data from multiple sources have been collected and standardized, including information on marine protected areas (MPAs), protection measures, and management plans from Baltic Sea countries. This work ensures that information originating from different national systems can be compared and analysed within a shared framework. By structuring datasets in a consistent and interoperable format, **PROTECT BALTIC** enables the integration of protection-related information across the region and supports analyses at the Baltic Sea scale. To support this work, the project is developing a classification scheme for harmonizing measures across the Baltic Sea. This scheme provides a structured typology of measures used within MPAs and other conservation areas, allowing measures implemented in different countries to be compared and assessed consistently. The classification supports regional analyses of management effectiveness and helps clarify how different types of protection contribute to biodiversity conservation. In parallel, the project is establishing a structured classification of human activities and pressures affecting the Baltic Sea ecosystem. This classification aligns with terminology used in relevant EU policy frameworks and directives, enabling better interoperability with existing European datasets and assessment processes. By harmonising the description of activities and pressures across countries, the project facilitates integrated analyses of how human

⁵³website: <https://protectbaltic.eu/wp2%3A-data-collation>

<https://protectbaltic.eu/news/f/baltic-sea-protection-at-209%25-over-twice-the-global-average>

<https://protectbaltic.eu/glossary>

uses interact with biodiversity and protected areas. These efforts are complemented by the development of structured databases that integrate information on protected areas, ecosystem components, human pressures, and socio-economic factors. Bringing these datasets together allows the project to analyse relationships between biodiversity values, management measures, and pressures affecting marine ecosystems, thereby supporting regional assessments of marine protection.

PROTECT BALTIC is converting most Baltic-wide spatial models– including species distributions, habitat maps, human activities, pressures, cumulative impacts, and future scenarios– to a shared 250 × 250 metre grid resolution. Moving datasets from different original resolutions to a common spatial framework greatly improves their comparability and allows integrated spatial analyses across the entire Baltic Sea region. A key outcome of this work is an improved understanding of the extent and effectiveness of marine protection in the Baltic Sea. Analyses carried out within the project show that the region has designated a large proportion of its marine area as protected, with coverage reaching more than twice the global average. At the same time, the harmonized dataset reveals important differences in protection levels, management measures, and implementation across countries and sites, highlighting that the designation of protected areas alone does not necessarily guarantee effective biodiversity protection. The harmonized data also enables a gap analysis of management plans and protection measures. By compiling and analysing management information from across the region, the project identifies where management plans are missing, incomplete, or insufficiently linked to conservation objectives. Such gaps may include limited information on measures, unclear conservation targets, or insufficient monitoring provisions. Identifying these gaps provides valuable guidance for improving the consistency and effectiveness of marine conservation efforts in the Baltic Sea. The harmonized datasets and associated analyses help highlight where additional management planning, improved data collection, or stronger coordination between countries may be needed. To further support comparability across Baltic Sea countries, the project also contributes to the development of common terminology and definitions related to protection measures and MPA management, supporting a shared understanding of conservation actions across the region.

Within the **MAREA** project, cultural ecosystem services (CES) were mapped using a participatory GIS approach in the coastal areas of Estonia and Latvia. The assessed activities encompassed both passive and active forms of engagement with coastal and marine environments and were linked to the following CES (classified according to the Common International Classification of Ecosystem Services (CICES) V. 5.1.):

- Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions.
- Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions.
- Characteristics of living systems that enable scientific investigation or the creation of traditional ecological knowledge.
- Characteristics of living systems that enable education and training

- Characteristics of living systems that are resonant in terms of culture or heritage
- Characteristics of living systems that enable aesthetic experiences
- Elements of living systems that have symbolic meaning⁵⁴.

The **NESB** project is intended to support international cooperation in the field of Maritime Spatial Planning (MSP) within the North Sea and Baltic Sea basins. Due to the spatial, legal and environmental diversity of both regions, a holistic approach to planning processes is required, leveraging a broad range of knowledge based on geographic information derived from processed datasets. Preliminary analyses conducted under the NESBp project, based on published national MSP datasets, identified a number of challenges of varying scale. These include limited data transparency, the lack of standardized metadata and a harmonized data model, as well as significant discrepancies in compliance with the INSPIRE Directive. This period was characterized by intensive cooperation, including meetings and active information exchange with GNSBI, the HELCOM-VASAB MSP Working Group, EMODnet, the NSEC Shipping Group and several other EU initiatives. Joint activities are planned to enhance transparency, informational value and, in particular, the coherence of MSP within an international context. From the perspective of harmonizing spatial planning, particular emphasis will be placed on maritime safety and navigation safety, which constitute key elements to be integrated into operational MSP initiatives through the effective implementation of the national MSP. Navigation safety is most often considered at a sectoral level, for instance within maritime traffic analyses or in the planning of offshore wind farm projects. Extending this dimension within the context of a digital European MSP, coordinated at the sea basin level, is becoming essential. Research is currently underway to evaluate national MSP plans and related geoportals with regard to the integration of navigation safety, which is presently considered at the national level. The objective of this research is to determine whether specific types of plans facilitate the integration of navigation safety and to assess whether reference interoperable and harmonized input datasets may effectively support the development of navigation safety plans in accordance with the requirements defined under NESB. Identifying effective mechanisms for the structured dissemination of knowledge related to MSP processes among various stakeholder groups remains a significant challenge.

⁵⁴See also Tab. 2.3.

Key considerations of Data Harmonisation for BSR SEA FRAMEWORK

- 1. The framework must integrate fragmented datasets from multiple sources into a unified structure by moving away from incompatible formats. A core component of this is converting diverse spatial models to a common analytical grid, which ensures data interoperability and comparability across the entire sea basin.**
- 2. The system should utilize an input data module to auto-assess datasets to ensure they have suitable granularity for monitoring and assessing plans. This evaluation should be based on relevance for Maritime Spatial Planning (MSP) and compliance with FAIR Principles (Findable, Accessible, Interoperable, Reusable).**
- 3. Establishing structured typologies for protection measures, human activities, and environmental pressures is essential for consistent transboundary analysis. Aligning this terminology with existing EU policy frameworks ensures interoperability with European datasets and facilitates integrated regional assessments of biodiversity and human use.**
- 4. There is a need to connect planned uses in MSP with spatially explicit Marine Strategy Framework Directive (MSFD) reporting to reciprocally inform both processes.**
- 5. It should automatically identify spatial relationships and perform multiscale analysis to generate outputs like spatial coherence data and uses maps or GES maps.**

5.2. Data Portals

Data portals serve as centralized, web-based platforms or meta-portals designed to compile, harmonize, and share vast amounts of spatial data and knowledge. These digital infrastructures act as dynamic knowledge repositories that integrate diverse datasets, ranging from marine natural resources, species, and habitats to human activities, climate change, and maritime spatial planning. By utilizing interactive tools such as map viewers, interactive governance tools, and storytelling applications, data portals transform complex, geographically diverse data into accessible visual presentations. Furthermore, they often connect directly to official national data services to ensure that the information displayed is always the most current version provided by national authorities.

For a Strategic Environmental Assessment to be effective, it fundamentally requires a comprehensive, harmonized spatial evidence base to accurately evaluate transboundary environmental effects. Data portals are absolutely necessary for SEAs because they provide reliable, accurate data needed to assess how proposed spatial plans will interact with various elements of the marine environment. By integrating cumulative impact assessments, future development scenarios, and thematic knowledge hubs, these platforms enable planners to effectively model and visualize potential conflicts between human activities and sensitive ecosystems. Ultimately, data portals equip planning practitioners with the structured knowledge and analytical capabilities required to deliver rigorous, evidence-based environmental assessments.

Under the **BalticLINES** project the BASEMAPS⁵⁵ data portal was established as the operational Baltic data infrastructure for Maritime Spatial Planning. The primary purpose of BASEMAPS was to overcome the technical fragmentation that hindered transboundary cooperation. Previously data on shipping routes and energy corridors existed only in incompatible national formats. Now, by harmonizing this data into a single web-based portal, BASEMAPS created a unified catalogue of existing and planned linear infrastructure, enabling planners to visualize and align their sectorial plans across borders for the first time. It connects directly to the official national data services (WMS/WFS) of the Baltic Sea countries. This ensures that the data displayed is always the most current version provided by the national authorities. Also, it can visualize transboundary data layers on a single map. The interface allows for zooming, planning to see how infrastructures line relate across national borders. Creating such common baseline, standards, the BASEMAPS made a step forward towards supporting the Strategic Environmental Assessment process by providing the comprehensive, harmonized spatial evidence base required to assess transboundary environmental effects. SEAs rely on accurate data to evaluate how the proposed plans (such as the expansion of offshore wind farms or new shipping lanes) interact with marine environment elements. By integrating future development scenarios, BASEMAPS allowed to model and visualize potential conflicts between human activities and sensitive ecosystems.

The aforementioned tool - Sea2Land Navigator⁵⁶- developed as part of the **Baltic Sea2Land** project is designed mainly for coastal and maritime spatial planning practitioners seeking to address Multi-Level Governance (MLG) complexities. It consists of three main sections:

- Multi-level Governance tool – an interactive tool that is designed to tackle governance complexity in marine and coastal planning. It helps to design the planning process step-by-step, especially focusing on work with stakeholders.
- Data Hub – contains various geospatial data layers relevant to coastal planning and MSP, including geographical and economic data. User can also add data from other sources.
- Knowledge Hub – contains collection of thematic knowledge on various aspects of MLG and coastal and maritime planning. It includes diverse types of information, starting from gray literature to scientific publications and good practice examples. A separate section of Knowledge Hub is dedicated to Methods that can be used to tackle different tasks related to coastal and maritime planning.

The Data Hub serves as the central data library specifically designed for coastal and marine spatial planning. It centralizes both geographical and economic information in one place, allowing planners to easily find what they need. The hub contains a vast collection of marine and coastal geodata and includes an interactive maps section

⁵⁵<https://basemaps.helcom.fi/>

⁵⁶<https://navigator-helcom.hub.arcgis.com/>

that functions as a communication tool to display spatial context information for planners. The platform guides planners through the entire process, from analysing the initial situation and identifying stakeholders to creating solutions and tracking progress. By offering structured approaches and comprehensive data, the portal improves both decision-making and stakeholder engagement.

Next, within the **MSP4BIO** project, a highly practical product was developed - the MSP4BIO Data Compilation⁵⁷. It is a meta-portal serving as a knowledge base of existing portals related to marine natural resources, including species, habitats, their protection and human activities in marine areas. The catalogue also includes resources concerning climate change, as well as portals describing maritime spatial planning. The described portals cover all six sites in five European sea basins addressed in the MSP4BIO project - the North and South Atlantic, the North Sea, the Baltic Sea, the Western Black Sea and the Northwest Mediterranean Sea. In addition, the resulting data and the main outcomes of the MSP4BIO project have been compiled and made available in the form of ArcGIS StoryMaps⁵⁸. These interactive resources allow users to view, in one place, the results of spatial analyses for geographically diverse case studies developed within the MSP4BIO project. At the same time, they provide an excellent way of combining descriptive content with visual presentations.

Moreover, the PlanWise4Blue cumulative impact assessment tool, whose development was advanced by the **MAREA** project, is available at the Blue Bio Sites⁵⁹. This portal centralizes PlanWise4Blue and other relevant planning tools and serves as a data repository for a diverse range of spatial data layers.

A central component of **PROTECT BALTIC's** work is the MPA Portal⁶⁰, an online platform developed within the project to provide managers, policymakers, scientists, and stakeholders with reliable, up-to-date, and accessible information on Marine Protected Areas (MPAs) across the Baltic Sea. Scheduled to be launched in 2028, the MPA Portal will function as a regional data platform and visualization tool. It will compile spatial datasets produced within PROTECT BALTIC together with relevant external data sources. These include information on species and habitat distributions, biodiversity patterns, environmental conditions, and other ecological datasets relevant to marine conservation and management. By bringing these datasets together in a single platform, the portal will allow users to explore spatial information in an integrated and user-friendly way. The portal is designed to support a wide range of users, including MPA managers, environmental authorities, researchers, planners, and policymakers. Through interactive maps and layered spatial data, users will be able to visualize ecological patterns, explore biodiversity information, and examine relationships between ecological features and protected areas. This functionality supports the integration of scientific data into planning processes, conservation assessments, and management decision-making. In addition, the Baltic Sea MPA Portal will contain comprehensive information on all MPAs in the

⁵⁷<https://msp4bio.vliz.be>

⁵⁸<https://storymaps.arcgis.com/stories/faf55224ffaa4fea893bc2f70ebf4b88>

⁵⁹<https://gis.sea.ee/bluebiosites/>

⁶⁰<https://protectbaltic.eu/wp8%3A-mpa-portal-1>

Baltic Sea, including their management status, governance frameworks, and relevant ecological data. The platform will also host the results of analyses produced within the project, provide access to spatial datasets generated by PROTECT BALTIC, and include tools to track progress towards the targets of the Baltic Sea Protection Optimization Framework. An important objective of the MPA Portal is to improve the accessibility and transparency of spatial data. By making project results and biodiversity datasets openly available through an online platform, PROTECT BALTIC ensures that the knowledge generated within the project can support stakeholders across the Baltic Sea region in advancing effective marine conservation.

Recently, the **NESBp** project, has established as a one of the project's objectives to develop a knowledge exchange platform for GNSBI/NESBp as an application for sharing maps, data and information, with the aim of facilitating integrated, cross-sectoral and cross-boundary cooperation in maritime spatial planning decision-making processes. The project is expected to deliver a prototype information service tool integrating existing modelling / digital twin solutions in the North Sea region. Where feasible, the tool will build upon data, information, and experience derived from EMODnet, HELCOM Basemaps, OSPAR, ICES and the proof-of-concept map viewer and information service developed within the GNSBI. The majority of existing portals only provide access to data and information. Within the GNSBI activities, a proof-of-concept platform has been developed for the sharing of data, information, and knowledge. It consists of a web-based map viewer and a separate online document (compendium) providing an overview of relevant knowledge. Although these components are fully functional, they currently contain only a limited scope of content. Further work is therefore ongoing to develop additional key functionalities and capabilities of the platform, ensuring that it is tailored to different user groups (decision-makers, MSP experts, sectoral stakeholders, and the general public) and that it effectively delivers various types of information, including input data, a structured knowledge base, and considerations related to MSP spatial planning. At its current preliminary stage, the platform comprises a user interface offering data input options depending on the user type and the category of information, linked to corresponding output maps and interpretative text. Next steps, planned for 2026, will include testing the portal and collecting feedback from the GNSBI community, alongside the continued expansion of the platform's advanced database.

Key considerations of Data Portals for BSR SEA FRAMEWORK

1. Knowledge exchange platforms must be designed with specific user interfaces that cater to decision-makers, MSP experts, sectoral stakeholders, and the general public, offering tailored data inputs and corresponding interpretive outputs. Therefore, there should be a tailored platform for a particular diverse user group.
2. These efforts should be based on online web-based platforms to integrate a wide array of spatial data, ranging from marine natural resources and habitats to human activities and climate change. It needs centralized diverse datasets.
3. The framework needs to integrate cumulative impact assessments and future development scenarios, allowing planners to effectively model and visualize potential conflicts between human activities and sensitive ecosystems.
4. To facilitate transboundary cooperation, the framework must overcome technical barriers by harmonizing previously incompatible national formats into unified catalogs.
5. Data portals must connect directly to official national data services to guarantee that the information displayed is always the most current version provided by authorities.

5.3. New Data Generated

The generation of new data refers to the process of creating novel datasets and knowledge resources that were previously unavailable, expanding the evidence base for environmental management and planning. Within the context of marine spatial planning and conservation, this involves producing new regional-scale data products through activities such as extensive field surveys, expert-based environmental surveys, and advanced spatial and dynamic modelling. These newly generated datasets encompass a wide range of critical information, including high-resolution maps of essential fish habitats, ecosystem services, landscape assessments, species distribution, human pressures, and cumulative impacts.

The primary purpose of generating this new data is to address critical knowledge gaps and provide a stronger scientific foundation for conservation planning and ecosystem-based management. Projects generate this data to identify areas of high environmental value, select candidates for strict protection and understand ecological connectivity and functions. Furthermore, these new data sets are purposed to evaluate potential conflicts by identifying main pressures from maritime sectors and to model future scenarios.

First, the **Pan Baltic Scope** project produced new data sets on essential fish habitats as well as for the first time combined the available data sets for mapping the marine green infrastructure at the pan-Baltic Sea scale. The essential fish habitat maps⁶¹ developed by the project include the spawning areas of cod, sprat, herring, European

⁶¹The results of mapping essential fish habitats published: L. Bergström, M. Erlandsson, I. Putnis, J. Gatt Støttrup, M. Kallasvuo, U. Bergström, H. Jokinen, M. Plikšs, I. Taal, A. Kokkali, E. Brown, S. Husa, L. Saks, T. Selnes, R. Svirgsden, L. Sundström, A.O. Yurtseva, D. Ustups, Essential fish habitats in the

flounder, Baltic flounder, as well as recruitment areas of perch, pikeperch, and flounder. The maps for each species were produced by applying or combining the following approaches, depending on availability of data:

- Species distribution models - spatial predictive modelling for producing maps with fuller spatial coverage, which describe the probable distribution of fish habitats. Direct data from inventories, or monitoring, were used as a basis for developing statistical models depicting the relationship between the key variable and environmental parameters.
- Environmental envelope approach – builds on similar principles as species distribution models but is not dependent on spatially referenced input data. The environmental envelope for a certain species and life stage was defined based on ecological knowledge on its limiting required environmental conditions.
- Habitat associations – applied in the case if information to support the environmental envelope approach was insufficient, the fish habitat may be depicted on an overarching level based on the distribution of benthic habitats that the focal species and life stage is mainly associated with.

The development of the maps was iterative process – first, researchers made an overview of current knowledge on essential fish habitats in the Baltic Sea and prepared initial proposals for those species and aspects that were considered feasible based on available information. The proposed maps and approach were discussed at a joint Pan Baltic Scope – HELCOM workshop resulting in recommendations on how to improve the maps. The mapping results were also presented and commented in several HELCOM meetings and comments taken into account in development of the final versions of the maps. Essential fish habitat maps were included among the ecosystem components (along with other data sets from the HELCOM Map and Data services) that were assessed in relation to the criteria of ecological value and ecosystem service supply for producing the aggregated map of the Baltic marine green infrastructure⁶².

Next, the **Land-Sea-Act** project carried out biophysical mapping of landscape qualities for assessing the coastal ecosystem services supply in the terrestrial part of the Latvian case study area - the Southwest Kurzeme coastal area (approximately 120 km along the coastline, up to 10 kilometers inland, and shoreline). The assessment was based on extensive field survey data combined with the analysis of existing geospatial data layers, including information on nature protection areas, cultural heritage sites and objects, and tourism-related data⁶³. Results are published in the Land-Sea-Act online map explorer⁶⁴.

Baltic Sea – Identification of potential spawning, recruitment and nursery areas, HELCOM, 2021, Available at: <https://helcom.fi/wp-content/uploads/2021/09/Essential-fish-habitats-in-the-Baltic-Sea.pdf>

⁶²The results of mapping marine green infrastructure published in: Ruskule, A., Kotta, J., Saha, C.R., Arndt, P., Ustups, D., Strāķe, S., Bergström, L., 2023. Testing the Concept of Green Infrastructure at the Baltic Sea Scale to Support an Ecosystem-Based Approach to Management of Marine Areas. *Marine Policy*, 147, 105374, <https://doi.org/10.1016/j.marpol.2022.105374>

⁶³For more details on the assessment see: Veidemane, K.; Reke, A.; Ruskule, A.; Vinogradovs, I. Assessment of Coastal Cultural Ecosystem Services and Well-Being for Integrating Stakeholder Values into Coastal Planning. *Land* 2024, 13, 362. <https://doi.org/10.3390/land13030362>

⁶⁴<https://experience.arcgis.com/experience/2447e76e306a4e68bf82323e33b72b26>

While Land-Sea-Act introduced methodology for assessing coastal ecosystem services and biophysical mapping of landscape qualities, the **Baltic Sea2Land** project recognized the success of this methodology and adopted it on the national level. The assessment is based on extensive field survey data combined with the analysis of existing geospatial data layers, including information on nature protection areas, cultural heritage sites and objects, and tourism-related data. The landscape assessment covers the coastal zone from the seashore up to 5 km inland. Beach and inland landscapes were assessed separately, reflecting their distinct physical characteristics, uses, and cultural values. Field data were collected during the summer of 2024, while spatial data analysis was carried out in autumn 2024. A total of 178 landscape areas were identified and assessed (106 – inland, 72 – beach). The resulting datasets are publicly available through the Latvian Landscape Atlas⁶⁵. Using the landscape areas identified, modelling of 9 regulating ecosystem services was carried out. The result is a geospatial data layer that covers whole Latvian coastline from the shore up to 5 km inland, demonstrating the provision of regulating ES on landscape area level⁶⁶. As part of the Baltic Sea2Land study “Assessment of Coastal Visitation, Environmental Pressure and Public Infrastructure Along the Baltic Sea Coast”, the coastal geodatabase was comprehensively updated⁶⁷. The updated dataset highlights coastal access points and driveto entries, public parking areas (including their capacity and quality), tourist accommodations and their capacity, as well as other refined spatial information. Across the entire coastline, visitation intensity, waste load, and anthropogenic pressure on vegetation were mapped and updated at a high spatial resolution of 100-meter segments.

Wider point of view introduced the **MSP4BIO** project, where six test areas were selected across five European sea basins, differing not only in spatial characteristics but also in ecological biodiversity and levels of socio-economic engagement. Each area was subject to an in-depth analysis. Using the participatory mapping tool SeaSketch⁶⁸, applied in the development of local case studies across six marine regions (North and South Atlantic, North Sea, Baltic Sea, Black Sea, and Mediterranean Sea), key existing and future conservation areas were identified. An expert-based environmental survey also enabled the identification of areas of the highest environmental value. The analysis of the collected data can support the selection of areas for strict protection to achieve the 10% target by 2030, as well as the identification of candidates for Other Effective Area-Based Conservation Measures (OECMs) or other types of Marine Conservation/Protected Areas (MCAs/MPAs). In addition, the data collected on potential

⁶⁵ **Inland landscapes:** <https://experience.arcgis.com/experience/6c0b5c1cfaaa4bffb3c44b79158cd93c/page/Piekrastes-nov%C4%93rt%C4%93jums?views=lek%C5%A1zemes-ainava>

Beach landscapes: <https://experience.arcgis.com/experience/6c0b5c1cfaaa4bffb3c44b79158cd93c/page/Piekrastes-nov%C4%93rt%C4%93jums?views=Pludmales-ainava>

⁶⁶ Results are available here: <https://experience.arcgis.com/experience/a76b9295da7a4b11a33aec58d770da52/page/ENG>

⁶⁷ **The datasets are publicly available through the Latvian Maritime and coastal spatial planning tool (interactive application for maritime and coastal spatial planning):**

Coastal assessment - access to the sea:

https://experience.arcgis.com/experience/dc0f3099465d46d680389717fd5dd536/page/Piek%C4%BCuves-j%C5%ABrai-un-publisk%C4%81-infrastrukt%C5%ABra_

Anthropogenic pressure and numbers of visitors:

<https://experience.arcgis.com/experience/dc0f3099465d46d680389717fd5dd536/page/Antropog%C4%93n%C4%81s-slodzes-un-apmekl%C4%93t%C4%ABbas-nov%C4%93rt%C4%93jums>

⁶⁸ <https://www.seasketch.org/>

conflicts made it possible to identify the main pressures on marine ecosystems arising from key maritime sectors and human activities. It should be noted that the data were collected separately for each of the six case studies and that there is no single, central project database. The datasets are stored locally by the project partners responsible for conducting the studies in each country.

The **MAREA** project mapped cultural ecosystem services (CES) in the whole coastline of Latvia and Estonia using a participatory GIS approach. New data were generated under the assessed activities, which encompassed a number of cultural ecosystem services (based on CICES V.5.1. classification):

3.1.1.1 Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions.

3.1.1.2 Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through passive or observational interactions.

3.1.2.1 Characteristics of living systems that enable scientific investigation or the creation of traditional ecological knowledge.

3.1.2.2 Characteristics of living systems that enable education and training

3.1.2.3 Characteristics of living systems that are resonant in terms of culture or heritage

3.1.2.4 Characteristics of living systems that enable aesthetic experiences

3.2.1.1 Elements of living systems that have symbolic meaning

3.2.1.2 Elements of living systems that have sacred or religious meaning⁶⁹.

Next, **PROTECT BALTIC** is generating a substantial amount of new data and knowledge to support improved conservation and management of the Baltic Sea. In addition to compiling and harmonising existing datasets, the project is producing a wide range of new regional-scale data products, many of which have not previously been available for the Baltic Sea as a whole. A major component of this work is the development of new biodiversity datasets, including extensive species distribution data and improved spatial models for numerous marine species. These datasets significantly expand the available information on the distribution and ecological requirements of Baltic Sea biodiversity and provide a stronger scientific basis for conservation planning. The project is also generating species community data, which describe patterns in species assemblages and biodiversity structure across the region. In addition, PROTECT BALTIC is producing new information on ecological functions and ecosystem processes. These datasets help identify areas that play important roles in maintaining ecosystem functioning, such as key feeding, nursery, or spawning areas. Complementing this work, the project is developing both active and

⁶⁹ See also Tab. 2.3.

passive dispersal models for a large number of multiple species, which improves the understanding or connectivity across the Baltic Sea, and helps describe ecological links between habitats and populations. Understanding connectivity is essential for designing effective networks of protected areas and ensuring that species can move between habitats throughout their life cycles. The project is also generating new data related to marine protected areas (MPAs). This includes detailed information on the number and location of protected areas, MPA boundaries, management frameworks, conservation objectives, and the specific protection measures implemented within sites. By compiling and standardising this information across the Baltic Sea region, PROTECT BALTIC provides an unprecedented overview of how MPAs are managed and what types of protection are in place. Beyond biodiversity and protection data, the project is producing new datasets on ecosystem services, helping to identify areas where marine ecosystems provide important benefits to society. This information supports more integrated assessments that consider both ecological values and human benefits. Together, these new datasets provide an important scientific foundation for improved marine spatial planning, conservation, and ecosystem-based management across the region.

Finally, the **MSP4MORE** project, as it is still under development, will include new data generation within the case study areas for assessing various ecological, economic, and sociocultural effects of OWF development. This will include:

- Economic valuation of potential offshore windfarm (OWF) contributions to ecosystem services, focusing on provisioning (e.g., fish production), regulating (e.g., carbon sequestration), and supporting services (e.g., biodiversity enhancement).
- Assessment of sociocultural implications of OWF development by using the cultural ecosystem service framework (e.g., public survey data on impacts on cultural heritage, aesthetic values, knowledge systems, sense of place, and recreational practices).
- Advanced spatial and dynamic modelling to produce detailed maps of species, communities, ecosystem functioning, and other processes that underpin provisioning and regulating ecosystem services.

The generated maps of ecosystem assets and services along with the information on human activities and pressures will be used in cumulative effect assessment of OWF and MSP scenarios within the project case study areas.

Key considerations of New Data Generated for BSR SEA FRAMEWORK

- 1. The framework must prioritize the generation of novel datasets to address critical knowledge gaps. This expands the evidence base and provides a much stronger scientific foundation for ecosystem-based management and conservation planning.**
- 2. Data preparation cannot happen in a silo. The process must be iterative, meaning initial mapping proposals and methodologies should be presented at joint workshops with regional governing bodies. This ensures the data preparation methods are peer-reviewed, refined, and accepted regionally before finalization.**
- 3. The measures should compile and standardize detailed information on MPAs across the entire region. This includes generating new comprehensive data on MPA boundaries, management frameworks, specific implemented protection measures, and conservation objectives. Even when preparing data for specific, localized case studies, the framework requires that the data be collected using standardized classifications.**

6. SEA Knowledge & Gaps

This section refers to the main knowledge gained through the analysed projects that is relevant for Strategic Environmental Assessment in Maritime Spatial Planning, including good practices, lessons learnt and gaps identified during project implementation. It also covers data limitations, methodological challenges and recommendations for further development where these were explicitly addressed by the projects.

According to the inventory, seven projects were marked as relevant for this topic. The strongest contributions come from eMSP NBSR, PROTECT BALTIC, MAREA and Pan Baltic Scope. Table 6.1 provides a quantitative overview of these elements. In total, 16 good practices or guidelines or messages were identified. Some projects like NESBp or Protect Baltic are still ongoing, and the more detailed information will be available later in 2026. This asymmetry should be kept in mind when interpreting the analysis below.

Table 6.1. Good practices identified for “SEA knowledge and gaps”.

Project Acronym	Knowledge&Gaps		
	New knowledge on SEA gained	Lessons learned / good practices	Gaps / needs for further development
eMSP NBSR	x	x	x
MSP-GREEN			
MSP4BIO		x	x
PROTECT BALTIC	x	x	x
MAREA	x	x	x
ReMAP			
Baltic LINes		x	
Baltic Sea2Land			
Land-Sea Act			
SELINA			
MSP4More			
NESBp	x		
Pan Baltic Scope	x	x	x

Source: own analysis of project partners

6.1. New Knowledge on SEA gained

The **eMSP NBSR** project contributed important new knowledge by reframing SEA as a more adaptive, cyclical and transboundary process. In particular, the project argued that SEA should not be treated only as a static approval procedure, but should be directly linked to monitoring and evaluation. Significant effects identified during the assessment should become indicators followed during implementation, so that monitoring results can trigger a renewed assessment cycle if thresholds are exceeded. The project also introduced the idea of climate-smart SEA scoping. According to the partner input, SEA should not only assess impacts on present habitats, but also consider future habitat shifts, species migration, climate refugia and blue carbon as protected environmental assets. Furthermore, eMSP NBSR proposed a 5-component Ecosystem-Based Approach framework to help define SEA content. This framework covers inclusion of nature, integrative governance, social and economic considerations, comprehensiveness and coherence, and adaptive management. In this sense, the project contributed not only specific recommendations, but also a broader conceptual shift in how SEA can be understood in the context of marine planning.

PROTECT BALTIC contributed new knowledge relevant for SEA by demonstrating how different types of ecological, spatial and governance information can be combined to support ecosystem-based environmental assessment. The project shows the value of structured frameworks that clarify the relationships between biodiversity, ecosystem functioning, human activities and environmental pressures. According to the partner description, one important insight is that linking species and their traits to ecosystem functions and services helps make more obvious how biodiversity underpins societal benefits. At the same time, distinguishing between activities and the pressures they generate provides a clearer basis for understanding impact pathways. The project also highlights the importance of spatially specific assessment and the need for harmonised regional datasets in a transboundary sea basin such as the Baltic Sea. In addition, it points to the value of forward-looking analysis, including the combination of biodiversity data and environmental modelling in order to consider future ecological change, including climate change. These elements strengthen the analytical basis of SEA and support more comprehensive ecosystem-based assessment.

MAREA contributed new knowledge mainly through its work on ecosystem services. The project produced early quantitative maps of provisioning, regulating and cultural ecosystem services and integrated these outputs into the cumulative impact assessment tool PlanWise4Blue. This is relevant for SEA because it represents one of the first efforts in the Baltic Sea to operationalise ecosystem services in planning practice rather than treat them only as a conceptual reference. The modelling approaches developed under MAREA provide practical methods for incorporating ecosystem services as relevant nature values in SEA and CIA processes.

Pan Baltic Scope contributed important new knowledge by strengthening the environmental evidence base for long-term and climate-aware SEA. The project explored the potential future state of the Baltic Sea by 2100 using climate modelling results from the Swedish Meteorological and Hydrological Institute (SMHI). These projections covered key ecological structuring factors such as salinity, temperature and nutrient conditions. Based on historical

reference data, the project modelled the present-day distribution of selected key species and estimated their possible future distributions under projected environmental conditions.

The analysis considered two climate scenarios: one assuming ambitious mitigation measures and another representing a high-emission, business-as-usual pathway. In both cases, most analysed species were projected to experience substantial distribution shifts by 2100. Species strongly constrained by salinity were expected to decline markedly in the northern and central Baltic Sea and in the Bothnian Sea. Hard-bottom habitats were identified as particularly vulnerable, with a likely significant loss of ecosystem functions.

The project also showed that these ecological shifts may have broader functional and socio-economic implications. A reduction in ecosystem functions linked to brackish-water conditions is expected, including food production associated with commercially important species such as cod, while some increase in functions related to more freshwater-like conditions may occur. The project further highlighted possible declines in ecosystem services provided by blue mussels, especially water filtration, as well as risks to habitat-forming macrophytes such as *Fucus* spp. and *Zostera marina*, which are important for many associated organisms, including juvenile fish.

In addition, habitat connectivity analysis showed that some areas play a particularly important role in maintaining ecological networks, functioning for example as core habitats, source areas or refugia. These areas were identified as deserving particular attention in MSP, SEA and nature conservation planning. Overall, Pan Baltic Scope contributed valuable knowledge on how climate-driven ecological change may affect species distributions, ecosystem functions, ecosystem services and spatial planning priorities in the Baltic Sea.

The material also indicates **NESBp** as relevant for this topic in the inventory. However, no substantive description was provided in the partner input at this stage, so the project cannot yet be discussed in analytical terms under this subsection.

The analysed projects show that new knowledge relevant for SEA has developed along several lines. eMSP NBSR contributed mainly to the conceptual and procedural understanding of adaptive, ecosystem-based and climate-smart SEA. PROTECT BALTIC and MAREA strengthened the ecological and analytical basis of assessment, particularly through integrating biodiversity, ecosystem functioning and ecosystem services. Pan Baltic Scope contributed important future-oriented environmental knowledge relevant for long-term strategic assessment. Taken together, these projects suggest that the knowledge base relevant for SEA is expanding, although not all projects have reached the same level of operational maturity.

Key considerations of New Knowledge for BSR SEA FRAMEWORK

1. SEA must evolve from a static, one-time approval procedure into a dynamic cycle where ongoing monitoring results can trigger new assessments if environmental thresholds are exceeded
2. Assessment frameworks must explicitly link species traits to ecosystem functions to show how biodiversity underpins societal benefits, clearly distinguishing between human activities and the environmental pressures they create.
3. Assessments must be flexible enough to accommodate continuous learning and incorporate integrative governance along with social and economic realities.
4. Assessments cannot only focus on present habitats. They must factor in future ecological changes.

6.2. Lessons learned / good practices

MSP4BIO provided one of the clearest practice-oriented lessons in the analysed material. The project showed that cumulative impact assessments benefit from an iterative process supported by continuous consultation with local stakeholders and experts from different but complementary backgrounds. According to the partner input, regular revisiting of assessment aims, validation and refinement of data, and joint review of model outputs improved both the technical robustness and the practical relevance of the results. This process also facilitated the upscaling of tools originally developed for specific regions to other areas across Europe. The main lesson here is that iterative and consultative assessment improves both methodological quality and transferability.

PROTECT BALTIC did not yet provide mature lessons learned or established good practices as the project is only halfway through implementation and many analytical and synthesis activities are still ongoing. For that reason, a full evaluation of lessons learned, and good practices will only be possible at a later stage, once the main outputs have been finalised.

MAREA contributed an important practical lesson regarding the integration of ecosystem services into spatial planning. The technical work carried out under the project demonstrated that a multi-source data approach can be used to generate quantitative estimates of the potential supply of ecosystem services and that these can be explicitly integrated into planning processes. The key good practice highlighted by the partner is therefore the move beyond purely expert-based assessments towards more explicit and quantitative ecosystem-service-based analysis. This is particularly relevant for SEA where ecosystem services are increasingly expected to be addressed, but practical methods remain limited.

Baltic LINES contributed several practical lessons relevant for transboundary MSP and, indirectly for SEA. The project emphasised the importance of coherent planning criteria for linear infrastructures, especially shipping routes and energy corridors, across the Baltic Sea. One practical output was the BASEMAPS portal, which makes it possible to view national maritime planning data from a pan-Baltic perspective while drawing on live data from national servers. This approach helps overcome incompatibility of data and supports more coherent discussion of planning visions and options. The project also recommended regular review of planning criteria, stronger

communication between planners and energy or shipping sectors, and more structured transboundary cooperation, including annual workshops and a technical Pan-Baltic offshore energy and grid stakeholder group. In addition, BalticLINes recommended that countries consult their neighbours not only on final products, but also on the data and criteria used, and that shared scenarios for 2030 or 2050 be used as reference points for national plan revisions. For SEA, these recommendations are relevant because they support more coherent assumptions and more comparable assessment of alternatives and future consequences.

The **eMSP NBSR** project contributed a number of good practices resulting from its Community of Practice model and its review of what already works in member states. A first important lesson concerns stakeholder involvement. The project found that passive consultation, for example simply making documents available online, is insufficient. More effective participation requires active capacity building before the formal process begins, including meetings in smaller coastal towns and direct invitations to specific local associations. A second lesson concerns the use of scenarios in stakeholder discussions. The project recommends presenting a scenario first, rather than a map, in order to shift discussion away from immediate conflict over spatial claims and towards broader visions and desired futures. A third lesson concerns data infrastructure. According to the project, building entirely new portals often fails, while compatibility with existing systems is a more realistic and effective solution. Finally, the project presents the Community of Practice itself as a useful format for voluntary, peer-to-peer and practice-oriented exchange among experts, offering an alternative to more consultant-driven processes

Pan Baltic Scope project is a source of practical lessons for SEA carried out under real planning constraints. One of its products - *EBA in MSP - a SEA inclusive handbook*⁷⁰ the national SEAs analyses were performed together with good practices on used SEA tools and methods. One of the methods shown as a good practice was the Polish heuristic forecasting method for conducting SEA, showing that heuristic forecasting based on expert knowledge and interdisciplinary cooperation can be a practical approach in MSP contexts where quantitative data are limited or uncertain. The project concluded that qualitative, expert-based input-output assessment can effectively support decision-making, provided that it is structured and supported by monitoring data and expert validation. Another important lesson was the importance of integrating the assessment with existing monitoring systems, including MSFD indicators, HELCOM monitoring programmes and national oceanographic data, in order to improve scientific credibility and consistency with broader environmental policy frameworks. The analysis also stressed the method's flexibility and multi-sector applicability, including fisheries, shipping and environmental protection, as well as its potential transferability to other contexts, while noting limitations related to its qualitative character and partial documentation.

The lessons learned identified in the analysed projects are mainly procedural and practice oriented. MSP4BIO and eMSP NBSR highlight the value of iterative, consultative and well-designed assessment processes. BalticLINes shows the importance of common data, scenarios and transboundary consultation conditions. MAREA contributes a good

⁷⁰Altwater S., Lukic I., Eilers S. (2019) EBA in MSP – a SEA inclusive handbook. Pan Baltic Scope available at: <https://maritime-spatial-planning.ec.europa.eu/projects/pan-baltic-scope>

practice in moving ecosystem services assessment towards more explicit and quantitative forms, while Pan Baltic Scope demonstrates the continued usefulness of structured expert-based approaches where data remain limited. These good practices appear relevant for future regional SEA standards because they are largely transferable and not limited to one national system.

Key considerations of Lessons learned and good practices for BSR SEA FRAMEWORK

- 1. Consultation like posting documents online is insufficient. It should rely on an iterative process with developing potential, regular validation of data, and active consultation with local stakeholders and multidisciplinary experts to enhance the reliability and practical applicability of the results.**
- 2. While expert knowledge is valuable, SEA should increasingly utilize multi-source data to generate explicit, quantitative estimates of ecosystem services, moving away from purely expert-based assessments.**
- 3. To overcome data incompatibility across borders, countries should utilize interconnected data systems and share long-term scenarios. Hence, planners should consult neighbouring countries early on the data and criteria being used, not just on the final products.**
- 4. To foster more productive stakeholder engagement, planners should present broad future scenarios before showing specific spatial maps. This shifts the focus toward shared visions and desired futures, helping to avoid immediate conflicts over spatial claims.**

6.3. Gaps / needs for further development

MSP4BIO project identified a number of persisting challenges related to the implementation of cumulative impact assessments in different European areas. According to the partner input, these include the technical background required for the preparation and harmonisation of relevant spatially explicit information, as well as the overall lack of information in some areas. Although the description is brief, it clearly points to continuing data and technical capacity gaps that constrain more advanced application of cumulative impact assessment and related SEA work.

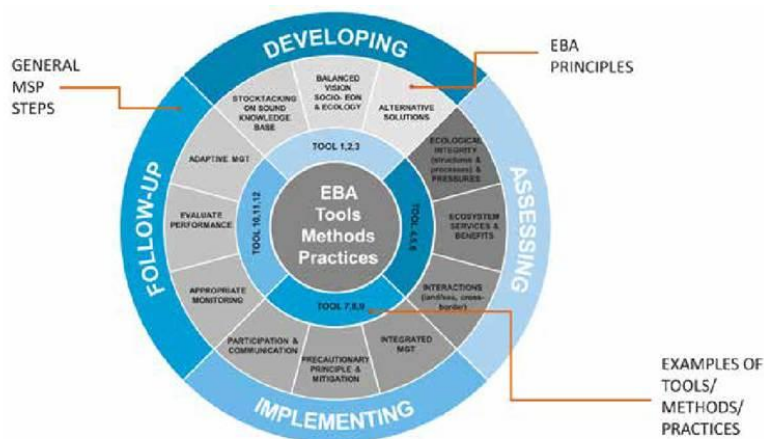
In case of **PROTECT BALTIC** project, it is still too early to draw comprehensive conclusions on lessons learned and remaining gaps, because the project is only halfway through implementation and many analytical and synthesis activities are still ongoing. However, the directions in which future gap analyses will proceed could be seen - these include datasets, methods and analytical approaches developed under the project, as well as broader issues such as data availability, cross-country harmonisation, management implementation and the effectiveness of protection measures. The project therefore does not yet provide a completed diagnosis of gaps, but it already identifies the fields where further development needs are expected to emerge.

MAREA project identified important gaps related to the availability of data for quantitative ecosystem service assessment. According to the partner input, although the project advanced modelling, quantification and mapping of ecosystem services and showed how these outputs can be operationally integrated into processes such as CIA, important knowledge and data limitations still constrained the range and resolution of products that could be

developed. In particular, the limited availability of harmonised and spatially explicit information on key nature values and ecological processes restricted the representation of some ecosystem services. This gap is highly relevant for SEA because it shows that methodological advances alone are insufficient without a stronger operational data basis.

The **eMSP NBSR** project provided one of the clearest and most developed diagnoses of persisting gaps. The project concluded that existing frameworks remain insufficient to meet the ambitions of the European Green Deal. Although eMSP NBSR defined principles for ecosystem-based MSP, it identified a critical lack of tools for actually assessing them, including the absence of a functional framework for transboundary CIA. The project also highlighted continued problems with data interoperability, noting that data sharing between member states remains non-automatic, labour-intensive and based on national versions of datasets rather than agreed common standards. A further gap concerns the lack of future-oriented dynamic spatial models that could support climate-smart MSP, for example by predicting species migration under different climate scenarios and helping planners identify future marine protected areas. Finally, the project pointed to fragmentation of ocean governance. Its Community of Practice proved useful, but remained voluntary and project-based; once funding ends, the model dissolves unless it is institutionally anchored. These gaps are not isolated technical problems but structural challenges for regional SEA and MSP.

Pan Baltic Scope project approached further development needs from a bit different angle. The project proposed a modular approach for integrating the EBA into MSP and indicated a wide range of tools relevant at different planning stages, including tools for carrying capacity assessment, scenarios, ecosystem services, geospatial analysis, impact assessment, stakeholder involvement, monitoring and adaptive planning.



The modular concept containing tools for the implementation of EBA in MSP.

Fig. 6.1. The modular concept containing tools for the implementation of EBA in MSP

Source: Altvater, Susanne & Lukic, Ivana. (2019). *EBA in MSP - a SEA inclusive handbook* EBA in MSP - a SEA inclusive handbook. 10.13140/RG.2.2.27416.55042.

At the same time, the project observed that although many such tools are already available, their practical application in MSP remains limited. According to the partner input, the main reasons are lack of resources and lack of data. This is an important conclusion for SEA as well, because it suggests that the current challenge is not only the absence of methods, but also the limited capacity to use existing methods effectively in practice.

The analysed projects identify a quite coherent set of gaps and further development needs. They concern limited availability and harmonisation of spatial data, methodological and technical barriers CIA, insufficient operational support for transboundary SEA, lack of future-oriented climate-smart assessment tools, and weak institutional continuity of cross-border cooperation. The material also suggests that an important challenge lies not only in developing new methods, but in creating the conditions needed to apply existing methods more consistently and effectively. A more dynamic reading of the identified gaps is also needed, as some projects, such as Pan Baltic Scope, were implemented earlier than the more recent initiatives reviewed in this report. This suggests that at least some of the limitations identified at that stage may have been partly addressed in subsequent projects. A useful next step would therefore be to assess to what extent later projects have actually reduced these gaps and, where progress remains limited, what barriers continue to hinder implementation.

Key considerations of Gaps and needs for further development for BSR SEA FRAMEWORK

- 1. Future development must focus on building a stronger operational data basis that is quickly updatable. It requires national datasets to be automated and harmonized in terms of spatial data sharing. Hence, there is a need for agreed-upon common standards across all member states.**
- 2. Future efforts must focus on structural continuity. Successful collaborative networks, like the Community of Practice, need to be transitioned from temporary, voluntary, project-funded models into permanently anchored institutional bodies.**
- 3. To meet the ambitions of the European Green Deal, developers need to overcome existing technical and methodological barriers by creating a dedicated, fully operational framework for cross-border Cumulative Impact Assessments.**

7. Mitigation

This section focuses on mitigation measures identified, developed or tested within the analysed projects. It examines how the projects addressed potential impacts and what mitigation concepts, guidelines or practical solutions were proposed, including cases where such measures were not yet implemented.

Compared with other chapters, project input under this theme is much more limited. According to the inventory, mitigation-related contributions were indicated for MSP4BIO, PROTECT BALTIC and NESBp.

PROTECT BALTIC provides the most developed contribution under this theme. The project addresses mitigation in a structured way and links it closely with restoration, recognising that in marine areas affected by long-term pressures and degradation, reducing pressures and restoring ecosystem functions are often complementary. A central element of the project is the development of a hierarchical typology and classification system for measures applicable across the Baltic Sea Region. This framework is not limited to Marine Protected Areas, but covers measures used in a broader range of marine management contexts. It links measures to the human activities that generate pressures and to the environmental pressures they are intended to address, thus creating a clearer basis for understanding how management actions relate to identified impacts. The project also compiles and analyses measures from available MPA management plans across the Baltic Sea. These measures are being classified according to the project typology, which will make it possible to compare approaches across sites and countries and to identify broader regional patterns.

Another important contribution is the attempt to assess not only the presence of mitigation measures, but also their adequacy in relation to cumulative pressures. By linking spatial data on human activities, pressures and impacts with information on implemented measures, the project is developing methodologies and tools to analyse whether existing measures are likely to be sufficient to reduce pressures affecting biodiversity and marine ecosystems. This is particularly relevant for SEA, where mitigation is often described in general terms without checking whether it corresponds to the actual pressure profile.

The project also links mitigation and restoration to ecological and spatial analyses. By combining restoration opportunities with spatial information on species and habitat distributions, biodiversity hotspots and environmental pressures, it helps identify areas where mitigation and restoration actions may deliver the greatest ecological benefits. An additional contribution concerns governance and implementation conditions. **PROTECT BALTIC** is carrying out legislative analyses, including mapping of the international legal landscape, preparation of national legislative profiles, and gap analysis of legal and policy frameworks relevant to protection measures. This broadens the discussion from ecological desirability to the legal and institutional conditions shaping implementation. Finally, the project is contributing to a regional restoration action plan and a restoration toolbox compiling methods, knowledge and case examples relevant for the Baltic Sea Region. Although some of these outputs are still in preparation, they already point towards a more systematic and regionally coordinated approach to mitigation and restoration.

The inventory also indicates **NESBp** as relevant for mitigation, but no substantive project description was provided under this theme at this stage. The first project results in this aspect are expected in mid-2026. MSP4BIO was also

marked as relevant in the inventory, yet no developed text on mitigation measures was included in the partner input. For this reason, these projects cannot yet be discussed analytically within this subsection.

Key observations

The analysed material shows that mitigation is one of the less developed themes in the current project inventory. At present, the strongest contribution comes from **PROTECT BALTIC**, which treats mitigation as a structured system linked to activities, pressures, ecological analysis and implementation conditions, while also connecting mitigation with restoration. This suggests an important direction for the BSR context: mitigation in SEA should be more systematic, spatially explicit and better connected to cumulative pressures and implementation conditions. At the same time, the present evidence base remains narrow and would benefit from later supplementation from other projects, expected later in 2026.

Key considerations of Mitigation for BSR SEA FRAMEWORK

- 1. The framework should closely link mitigation with active restoration, recognizing that in long-degraded marine areas, merely reducing new pressures is not enough; restoring ecosystem functions must be a complementary goal.**
- 2. It is not enough for mitigation measures to simply be ecologically desirable, they must be practically enforceable. The SEA framework must incorporate analyses of governance and implementation conditions.**

Summary

The presented guidelines and good practices signify a profound paradigm shift in marine environmental governance, transitioning from a reactive, compliance-driven framework to a proactive, adaptive, and predictive management model. It turns abstract ecological theory into spatially explicit, quantifiable parameters capable of guiding real-world zoning decisions. European marine planning community has successfully generated an extensive array of advanced methodologies, predictive models, and digital decision-support tools, the primary obstacle to achieving a sustainable blue economy is no longer theoretical or technical development. Instead, the urgent regional challenge lies in overcoming institutional fragmentation and data incompatibility across national borders.

The thematic categorization of these findings into seven thematic groups: approaches or methods supporting the SEA scoping phase, assessment methods, tools, data, knowledge with gaps, and mitigation provide a highly functional structure unpacking the complexities of transboundary maritime planning. Beginning with Chapter 2's focus on defining the initial approaches or methods of the assessment scoping phase, then report presents the analytical frameworks of Chapter 3. It then transitions into the practical application layers of Chapters 4 and 5 by detailing the specific data and tools required to manage the marine evidence base. Finally, PART II concludes with Chapters 6 and 7, which synthesize the gathered knowledge, noted gaps, and mitigation frameworks necessary to build a continuous, adaptive ecosystem management cycle across the Baltic Sea Region.

Chapter 2 Approaches or Methods Supporting the SA Scoping Phase focuses on transforming the early strategic phase of assessment from a static step into a dynamic, transboundary exercise. The eMSP NBSR project significantly impacts this chapter by shifting scoping to an adaptive, stakeholder-led process driven by Communities of Practice. PROTECT BALTIC, MAREA, and MSP4BIO heavily shape the sections on Ecosystem Service (ES) mapping. PROTECT BALTIC introduces the BALM model linking biodiversity to societal benefits, MAREA provides the baseline for quantitative ES modelling. Finally, Pan Baltic Scope and MSP-GREEN drive the inclusion of Land-Sea Integration (LSI), ensuring that terrestrial impacts on marine spaces are scoped holistically.

Chapter 3 Assessment methods presents the structured analytical approaches used to calculate environmental impacts, primarily guided by cumulative and ecological value frameworks. Pan Baltic Scope established the macro-regional baseline for Cumulative Impact Assessments (CIA) and Marine Green Infrastructure (GI) mapping. The PROTECT BALTIC project directly builds upon this by expanding the regional threat matrix to classify human pressures at a hyper-precise 250-meter spatial resolution. MSP4BIO introduces a comprehensive, multi-step protocol for trade-off negotiation between nature conservation and blue economy expansion.

Chapter 4 Tools shifts from abstract methods to the concrete digital instruments, software interfaces, and geospatial platforms used by planners. MAREA impacts this chapter through its primary technical output, PlanWise4Blue, an online decision-support tool that maps alternative human-use scenarios against nature values. The Baltic Sea2Land project introduces the Sea2Land Navigator, providing an active platform for planners to visualize coastal visitor pressure, landscape vulnerability, and spatial access blockers. Meanwhile, Baltic LINes delivers the foundational energy and shipping corridor scenarios for 2030 and 2050, and MSP4MORE introduces the SpOWED Optimization Framework to calculate minimal-impact site locations for offshore wind farms.

Chapter 5 Data defines the spatial evidence base of the assessment, detailing how projects generated new information and addressed transboundary dataset fragmentation. ReMAP showed the Modular Interoperability Framework – an designed approach used to ensure that diverse marine data can be processed by various tools without the need for manual conversion. PROTECT BALTIC standardizes regional databases into a unified classification scheme. In terms of new data generation, Pan Baltic Scope created essential fish habitat maps, MAREA generates high-resolution maps for cultural ecosystem services, and MSP4BIO utilizes the SeaSketch platform to map conservation zones.

Chapter 6 SEA knowledge and gaps acts as a critical synthesis of lessons learned and procedural vulnerabilities discovered during regional implementation. eMSP NBSR demonstrates that SEAs should function as cyclical processes where ongoing monitoring results actively trigger plan revisions. Also, it exposes key remaining vulnerabilities, such as the distinct lack of a fully operational framework for transboundary cumulative impact assessments and the lack of permanent funding for planner collaboration. MSP4BIO and Pan Baltic Scope contribute the principal lessons on stakeholder engagement, highlighting that passive online document publication is entirely insufficient compared to interactive future-scenario forecasting.

Chapter 7 Mitigation focuses on measures designed to actively reduce, or repair environmental degradation. Here, PROTECT BALTIC impacts the chapter by successfully linking mitigation measures directly to active restoration plans, asserting that simply minimizing human pressures is insufficient for long-degraded marine zones.



PART III

Combined Contribution to the Roadmap for the development of a Baltic Sea Region Strategic Environmental Assessment (BSR SEA Framework)

This section provides a summary that connects the earlier parts of this document. It illustrates how the projects reviewed in PART I, along with the presentation of good practices and findings created in PART II, shape the final thoughts and results presented in PART III. By bringing these pieces together, this section turns initial research and practical guidelines into a clear, overall picture of actual situation observed in reviewed projects.

PART III summarizes the knowledge gathered in this document and presents contributions that can serve as the knowledge foundation for future roadmap. Key input comes from the project analysis, feedbacks and conclusions gathered from SEBAS project partners during consultation meetings. This input gathered here led to the creation of a significant contribution based on the experiences and results of previous projects. It revealed important nuances inspired by the projects screened that should be considered when starting the work on the framework. PART III highlights gaps discovered along the PART II. While doing that it also takes into consideration the knowledge of the authors of the report and their planning experience. Hence, the purpose of PART III is to highlight the main shortcomings resulting from the current situation.

The biggest deficiency of Strategic Environmental Assessment in the Baltic Sea Region is a deep-seated fragmentation across borders, institutions, and datasets, which severely undermines the ability to manage a shared marine ecosystem. Although valuable tools, scientific data, and pilot studies exist, they remain trapped in national silos or temporary, project-based initiatives that lack long-term institutional continuity. This results in incompatible data formats and a deficit in harmonized transboundary methodologies. Current SEA frameworks struggle to assess complex, such as the cumulative pressures of expanding offshore wind farms or the long-term shifts caused by climate change.

Furthermore, the regional SEA framework suffers from a heavy reliance on static, bureaucratic theory over practical, everyday application. Existing planning routines fail to effectively operationalize critical data, like Marine Strategy Framework Directive indicators, cultural values, and ecosystem services, into enforceable legal contexts. This leaves the process unable to adapt dynamically to new monitoring data or continuous learning. Additionally, current approaches are overly restricted to passive damage mitigation, failing to integrate active ecosystem restoration or properly evaluate the governance feasibility and enforcement capacity of proposed mitigation measures.

8. Main gaps Identified for the development of the Baltic Sea Region SEA Framework

8.1. Insufficient Integration of existing knowledge into operational SEA practice

Even though systematized knowledge, tools, methodologies, pilot studies, and frameworks already exists, much of these experiences have to be even better operationally integrated into SEA systems and routine MSP practice across the BSR (both at regional and national level).

8.2. Fragmented governance and limited institutional continuity

Governance arrangements remain fragmented between countries, sectors, and institutions. Many successful cooperation structures and Communities of Practice are still project-based and temporary, calling for long-term continuity.

8.3. Deficit of harmonised transboundary methodologies

There is a deficit in terms of fully harmonised BSR approach for:

- a) cumulative impact assessment;
- b) ecosystem service assessment;
- c) trade-off analysis;
- d) climate integration;
- e) marine Green Infrastructure (GI) mapping;
- f) socio-cultural assessment within SEA.

Differences in applied methodologies limit transboundary coherence.

8.4. Insufficient integration of spatial, ecological, social, and economic dimensions

A major gap concerns the insufficient integration of:

- a) ecological data;
- b) socio-economic considerations;
- c) cultural values;
- d) ecosystem services;
- e) governance realities;
- f) spatial planning objectives.

Current approaches remain too fragmented and sector-specific. For instance good practices on assessing cultural aspects of sea use are scarce with exception of cultural ecosystem services but even in this case a key limitation remains the translation of this experience into the SEA context.

8.5. Weak operational integration of MSFD Indicators into SEA

While Marine Strategy Framework Directive (MSFD) related data and indicators are available, their practical integration into SEA remains limited due to:

- a) attribution challenges;
- b) temporal mismatches;
- c) insufficient operational methodologies;
- d) lack of application experience.

8.6. Insufficient treatment of cumulative and synergistic effects

Existing SEA practice still insufficiently addresses:

- a) cumulative impacts of Offshore Wind Farms (OWF) on marine ecosystems;
- b) synergistic and antagonistic interactions;
- c) ecological carrying capacity;
- d) transboundary cumulative impacts

8.7. Data Fragmentation and Incompatibility

Datasets across the Baltic Sea Region remain fragmented, incompatible, and uneven in quality and resolution. Important gaps include:

- a) incompatible national formats;
- b) lack of common analytical grids;
- c) insufficient interoperability;
- d) uneven accessibility of spatial datasets;
- e) limited automation of data sharing.

8.8. Limited availability of novel and high-resolution data

There remain some knowledge gaps regarding:

- a) species distributions;
- b) ecological connectivity;
- c) climate refugia;
- d) ecosystem functioning;
- e) cumulative pressures;
- f) future climate impacts.

In several areas, predictive modelling and new datasets are still insufficiently developed.

8.9. Incomplete integration of climate change into SEA

SEA systems still insufficiently incorporate:

- a) future climate projections;
- b) climate-related ecological shifts;
- c) climate refugia;
- d) blue carbon considerations;
- e) climate impacts of planning designations.

8.10. Insufficient operationalisation of ecosystem services approaches

Although ecosystem service methodologies have advanced significantly, some gaps remain regarding:

- a) prioritisation of ecosystem services;
- b) operational use in SEA;
- c) integration with pressures and human activities;
- d) governance acceptance of ES-based assessments.

8.11. Weak translation of cultural values into SEA practice

Experience in mapping cultural values exists, particularly in some countries, but translation of this knowledge into operational SEA procedures remains underdeveloped.

8.12. Insufficient dynamic and adaptive SEA processes

SEA practice remains largely static and procedural. Existing systems insufficiently support:

- a) adaptive management;
- b) dynamic scoping;
- c) monitoring-triggered reassessment;
- d) continuous learning processes;

8.13. Insufficient integration between SEA, restoration, and governance feasibility

Current SEA approaches often focus primarily on mitigation while insufficiently addressing:

- a) active ecosystem restoration;
- b) governance feasibility;
- c) enforceability of mitigation measures;
- d) implementation capacity.

8.14. Insufficient usability of decision-support tools

Although many advanced tools and platforms exist, important gaps remain in:

- a) usability for planners;
- b) accessibility for stakeholders;
- c) interactive communication tools;
- d) integration of tools into operational planning processes.

8.15. Insufficient validation through real-world applications

Many methodologies and tools remain experimental or pilot-based and still require:

- a) operational testing;
- b) validation in real planning cases;
- c) scalability assessment;
- d) institutional uptake.

8.16. Lack of common regional standards and agreed targets

The Baltic Sea Region still lacks commonly agreed:

- a) environmental objectives;
- b) protection targets;
- c) climate-related targets;
- d) cumulative impact thresholds;
- e) ecosystem-based assessment standards.

This limits consistency across national SEA systems.

Conclusion

The scoping report in the PART I establishes a robust regional baseline by evaluating 13 European projects completed or ongoing since 2019, identifying and categorizing a vast number of good practices across core thematic domains. From these initiatives, a detailed inventory of good practices was categorized into seven core thematic groups: approaches or methods supporting the Strategic Environmental Assessment (SEA), assessment methods, tools, data, SEA knowledge and gaps, mitigation. PART II is based on this knowledge. Ultimately, the overarching message is that while in Europe there was generated a substantial number of conceptual data, methodologies, and validated tools, the primary challenge is no longer theoretical development; rather, the urgent need in operational integration, governance coordination, harmonisation of methodologies, and institutional continuity.

The most important part of this report is PART II Exhibition of SEA Good Practices and Guidance. It reveals a profound paradigm shift in marine environmental governance, transitioning from a reactive, compliance-driven framework to a proactive, adaptive, and predictive management model. By using the collective outputs of the presented in PART I projects, these chapters under PART II indicate the projects' intention to turn abstract ecological theories into spatially explicit, proposing quantifiable parameters capable of guiding real-world zoning decisions. From the early scoping processes in Chapter 2 to the structured mitigation and restoration frameworks in Chapter 7, the document establishes a highly functional contribution to the roadmap that embeds human activities as an internal component of the marine ecosystem rather than an external disruption. A crucial finding running through these chapters is that the European marine planning community has generated a comprehensive set of advanced methodologies, models, and digital decision-support tools. Chapter 2 outlines 42 distinct good practices, heavily driven by multi-level land-sea integration (LSI) from projects like Pan Baltic Scope and Baltic Sea2Land, alongside trait-based ecosystem service mapping from PROTECT BALTIC. Chapters 3 and 4 operationalise these theories by demonstrating the scalability of automated tools like PlanWise4Blue. Chapter 5 introduces data harmonization architectures, such as ReMAP's Modular Interoperability Framework, which ensures that diverse maritime data can be processed by different tools without manual conversion. Despite these extensive technical advancements, the final synthesis in Chapters 6 and 7 exposes ongoing challenges regarding transboundary institutional fragmentation, data sharing that remains manual and labour-intensive, and a distinct lack of automated transboundary cumulative impact frameworks. Lessons compiled from projects like eMSP NBSR and MSP4BIO highlight that passive online stakeholder consultation is entirely insufficient compared to iterative, future-scenario forecasting. It was concluded that to prevent maritime activities from exceeding ecological carrying capacities, the region must abandon disjointed, project-based administrative habits and transition to a permanently anchored, transboundary framework that links strict regional data portal compliance with legally enforceable mitigation and active ecosystem restoration.

PART III serves as a summary of the practices gathered in PART II, along with the input and comments received from SEABAS project partners during meetings. It is a combined knowledge that is a contribution to the future roadmap that translates the good practices into a concrete input of crucial information necessary to build the Baltic Sea

Region (BSR) SEA Framework. Mostly based on the knowledge gained from Chapter 6, this section introduces by diagnosing sixteen critical structural and operational gaps currently hindering marine governance, such as insufficient integration of existing project knowledge, fragmented institutional continuity, and severe data incompatibility across national borders. The biggest deficiency of SEA in BSR is a deep fragmentation across borders, datasets, and institutions, which leaves valuable tools trapped in isolated, temporary projects rather than routine practice. This lack of standardization makes it incredibly difficult to assess complex, transboundary threats like climate change and cumulative offshore wind farm impacts. Ultimately, the current framework relies on static, bureaucratic theory that prioritizes passive damage mitigation over practical, real-world application and active ecosystem restoration. These findings emphasize that the primary bottleneck in the region is no longer a deficit of theoretical methodologies, but rather the absence of an integrated, regional operational standard. Hence, based on the knowledge gathered, the proposed BSR SEA Framework should be built on accumulated knowledge from projects while overcoming fragmentation between national systems, sectoral policies, data structures, and governance arrangements, as revealed by the project partners discussions. The framework should not merely harmonise existing SEA practices but should evolve SEA into a dynamic, adaptive, ecosystem-based, and transboundary governance instrument supporting sustainable development of the Baltic Sea Region.

The resulting BSR SEA Framework should be capable of supporting sustainable maritime development while securing the ecological integrity and resilience of the Baltic Sea ecosystem. The Baltic Sea Region already provides a substantial knowledge base for the creation of a comprehensive Strategic Environmental Assessment Framework. Regional cooperation under the HELCOM-VASAB MSP Working Group is essential for establishing coherence, since coordinated national implementation is necessary to ensure practical effectiveness and long-term sustainability. This paves the way for building a shared, open digital infrastructure driven by automated, web-based data portals connecting to external open-data services (WMS/WFS), which simultaneously guarantees data currency while protecting sensitive regional planning data through secure local browser storage. This is in accordance with the EU INSPIRE Directive, an EU legal initiative established to create a standardized Infrastructure for Spatial Information in Europe to support environmental policies.

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