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Emerging Ecosystem-based Maritime Spatial Planning Topics in the North and Baltic Sea Regions

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Emerging Ecosystem-based Maritime Spatial Planning Topics in the North and Baltic Sea Regions

Reference Data Lists on EBA&SBE and Maritime Surveillance

Community of Practice on Data Sharing, Information and Communication Technologies serving MSP

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DISCLAIMER

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Glossary

BASEMAPS	Map service to access Baltic Sea maritime spatial planning
CC	Climate change
CoP	Community of Practice
EBA	Ecosystem Based Approach
eMSP NBSR	Emerging-based Ecosystems Maritime Spatial Planning in the North and Baltic Sea Regions
EU	European Union
FAIR	Findable, Accessible, Interoperable, and Reusable
HELCOM	Helsinki Convention - Protection of the Baltic Sea
AI	Artificial Intelligence
LS	Learning Strand
MSFD	Maritime Strategy Framework Directive
MSP-OR	Maritime Spatial Planning in the Outermost Regions
MSP	Maritime Spatial Planning
MSP MED	Maritime Spatial Planning in the Mediterranean Sea
TEG	European Union Technical Expert Group on Data for Maritime Spatial Planning
MSPD	Maritime Spatial Planning Directive
REMAP	Reviewing and Evaluating the Monitoring and Assessment of Maritime Spatial Planning
Shom	French National Hydrographic and Oceanographic Office
SBE	Sustainable Blue Economy
SIMAtlantic	Supporting Implementation of Maritime Spatial Planning in the Atlantic region
SIMCelt	Supporting Implementation of Maritime Spatial Planning in the Celtic Seas
SIMNORAT	Supporting the Implementation of Maritime Spatial Planning in the North Atlantic Region
VASAB	Vision and Strategies Around the Baltic Sea

Introduction

The Emerging ecosystem-based Maritime Spatial Planning in the North and Baltic Sea Regions project (eMSP-NBSR - https://www.emspproject.eu/) focuses on enabling policymakers and maritime spatial planners from the North and Baltic Sea regions to (i) reflect on current Maritime Spatial Planning (MSP) practices, (ii) learn effectively from each other, and (iii) collectively identify problems and solutions in order to support better informed decisions, facilitate exchanges and improve coordination.

The project pays particular attention to emerging topics defined as (i) **ocean governance**, (ii) **monitoring and evaluation**, (iii) **data sharing, information and communication technologies**, (iv) **ecosystem-based approaches** and (v) **sustainable blue economy**. The project uses a Community of Practice (CoP) based method to facilitate continuous learning on the five emerging topics, as a long-term way to 'future proof' MSP.

The CoP on Data sharing, information and communication technologies serving MSP, led by the French National Hydrographic and Oceanographic Service (Shom), aims at evaluating the **coherence of the MSP data and information available across borders**. The CoP targets to provide recommendations to authorities and data users in charge of the implementation of MSP, regarding MSP plans dissemination and data interoperability. As defined by its members, a key learning focus of this CoP should be the common understanding of data and data models needed for supporting MSP with regards to Green Deal, climate change and sustainable blue growth.

In this context, Shom, in collaboration with the other members of the Data sharing CoP, designed these Reference Data Lists Deliverable on Ecosystem Based Approach & Sustainable Blue Economy and on Maritime Surveillance. Both lists focuses are in accordance with Article 6b of MSPD[1] "*Member States shall […] consider […] environmental, economic and social aspects, as well as safety aspects*" and in line with two of the goals of the Data CoP[2]: (i) understand the process of MSP from data perspective and (ii) share MSP plans to the authorities responsible of their implementation, and connect this with activities to ensure maritime surveillance.

The objectives of these Reference Data Lists are to:

- **Analyse standardisation and consistency** of the data format, spatial continuity aspects (cross-border, spatialization, scale and symbology) and terminology.
- List the currently available (or used) data on the topic and come up with a proposal of **a Reference Data List**, from data perspective for the benefits of the other eMSP-NBSR project 's Communities of Practice.
- Investigate the linkages between MSP plans and maritime surveillance.
- Allow national MSP authorities to strengthen the MSP process, regarding the data challenges.

[1] Article 6b of the Maritime Spatial Planning Directive, 2014: *Member States shall establish procedural steps to contribute to the objectives by considering relevant activities and uses in marine waters such as environmental, economic and social aspects, as well as safety aspects*

[2] The Goals are defined in the Termes of references of the Data CoP, 2022

1. Reference Data List for an ecosystem-based approach to MSP within a sustainable blue economy

Aims

Related to the eMSP-NBSR project's key thematic, the present list focuses on the "Ecosystem-based approach" and "Sustainable Blue Economy" aspects of MSP. The List considers both environmental and socio-economic[3] aspects (Table 1).

To summarize, the Reference EBA-SBE Data List aims to list the current available (or used) data on the topics and provide a guideline on data needed for dealing with these aspects in MSP. The list is built on:

- Synthesis of different sources
- Less details in datasets: keep it "simple"
- Focus on Baltic and North Seas, but can be tweaked for application in other regions
- Includes both SBE- and EBA-related data

Methodology

This EBA-SBE Reference Data List were obtained from:

1. A desktop study including review of previous MSP projects (SIMAtlantic, SIMNORAT, SIMCelt) deliverables regarding data,
2. An in-depth analysis of environmental data categories used in the French Sea Basin Document (DSF)[4]
3. Suggestions and inputs from several countries (Belgium, Denmark, Latvia, Sweden, Poland, France, the Netherlands, Finland) from various events[5]:
    - Ecosystem Based Approached CoP's 4th Workshop on the 30/03/2023
    - HELCOM VASAB on Data for MSP meeting on the 07/03/2023
    - Ecosystem Based Approached CoP's 5th Workshop on the 14/06/2023
4. The social impact assessments regarding Data knowledge[6], from the MSP-OR (https://msp-or.eu/) project.
5. The MSP Data Framework and Relevant Data Report[7], from the REMAP project.
6. The work carried out within the Data Use and Information Survey, elaborated by the Data Community[8].

[3] Tools for monitoring, evaluation and revision of MSP, Technical Expert Group, 2022
[4] The Sea Basin Strategy Document, Eastern Channel – North Sea, 2021
[5] Memo of the informal consultation session of the Baltic Sea Region Maritime Spatial Planning Data Expert Sub-group, 2023.
[6] The Social Impact Assessments – Data Knowledge. MSP-OR project, 2023
[7] The MSP Data Framework and Relevant Data Report. REMAP project, 2023
[8] Data Use and Information Survey, eMSP-NBSR project, 2022

Following replies from the reviewers, a choice was made to combine some species to a more generic category (e.g. "Marine mammals", which replaces and combines "Grey Seals", "Harbor Seals", "Delphinids", "Other cetaceans", etc.). This is acknowledged by the CoP in order to seek clarity of the list and ensure some homogeneity as not all Member-States are encountering the same species in their waters.

Analysis

This Reference Data List focused on the "Ecosystem-based approach" and "Sustainable Blue Economy" aspects of MSP considering both environmental and socio-economic aspects constitute a data basis for MSP planners and stakeholders.

First, this inventory lists the data needed as inputs for the MSP process with regards to EBA-SBE aspects. The datasets needed for MSP, stored by categories and subcategories, provide a guideline for coherence and standardisation at transnational level.

The Data CoP encourages MSP auhorities to use this List as a Reference for Data needed for implementing EBA-SBE in MSP.

The responsibility then lies with each supplier/user to ensure the data is named following an appropriate terminology. To support the transboundary consultations and cooperation, Baltic Sea MSP Data group has compiled a 'Glossary' of most important sea uses from planners' perspective ("sea use code list")[9], indicating the possible sea use themes in national languages. Also, use a common data format (european format such as INSPIRE Directive, EMODnet, BASEMAPS) is key in data harmonisation.

Finally, FAIR principles[10] should be consistently used for working with MSP data. FAIR stands for Findable, Accessible, Interoperable, and Reusable. The FAIR principles were developed to address challenges related to data sharing, reuse, and collaboration.

Climate change has been factored in identifying the data

needed for an EBA and SBE in MSP. Some data are directly connected to climate change, such as air temperature and atmospheric CO2 concentration, and are essential in evaluating the impacts of climate change. Other data are associated with climate change as a causal factor (e.g., human activities, pollution, etc.), while some are connected as consequences that need to be addressed in confronting this challenge (e.g., marine renewable energy, marine protected areas).

[9] Glossary of possible sea uses in national languages, VASAB.
[10] Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016)

The Reference List for an EBA-SBE

Table 1: Reference Data List for an ecosystem-based approach MSP with a sustainable blue economy, sorted by category and sub-category and its link with CC.

Category	Sub-category	Dataset	Climate change related data
Ecosystems and ecology	Benthic substrate	Biogenic environments (Reefs, mussel reefs, haploops reefs, etc...)	x
		Rocky substrate (bedrock, etc.)	
		Sedimentary substrate (Mud, sand, gravel, rocks and boulders)	x
		Mixed substrate	
	Pelagic habitats	Deep environments (Deep waters)	x
		River plumes	x
	Other habitats	Reedbeds	x
		Artificial reefs	
	Halieutic fauna	List of observed fish species	x
		Endangered species colonies	x
		Functional areas and corridors (Nursery, spawning, feeding, breeding zones)	x
		Fish migration routes and significant areas	x
	Marine mammals	List of observed marine mammals (Include conservation status)	x
		Sedentary marine mammal colonies	x
		Functional areas and corridors (Resting, moulting, breeding zones)	x
		Marine mammal migration routes and significant areas	x
		Areas of seasonal high marine mammal density	x
		Areas of permanent high marine mammal density	x
	Avifauna	List of observed bird species	x
		Seabird colonies (Coastal and offshore)	x
		Functional areas and corridors (Nesting/roosting, feeding)	x
		Seabird migration routes and significant areas (Stopover sites)	x
		High density areas – Breeding season	x
		High density areas – Wintering	x
	Other fauna	Zooplankton and neuston	x
		Macro- and microzoobenthos	x
		Terrestrial animals	x
		Chiropterae migration routes and functional areas	x
		Chelonioidea functional areas and migration routes	x
	Flora	Phytoplankton (Flow cytometry recorders)	x
		Terrestrial flora	x
		Aquatic plant species (Algae, charophytes, water moss, angiosperms, etc.)	x
		Species of ecological or environmental interest (Posidonia oceanica, Laminaria hyperborea)	x
	Ecosystem processes	Other marine ecosystem processes	x
		Land-sea interactions	x
Zonal assessment and/or protection	Marine and coastal protected areas	Underwater cultural heritage	
		Reserves	x
		Natura 2000	x
		Other international MPAs	x
		Other MPAs	x
	Coastal erosion	Coastal erosion risk areas	x
	Ecological status assessment	Eutrophication and hypoxia	x
		Nutrient and oxygen backgrounds	x
		Ecological status and Biodiversity assessment	x
		Lost seabed surface area	x
		Chemical background	x
		Investigation of natural value	

Category	Sub-category	Dataset	Climate change related data
		eDNA autosampler	
	Natural resources and Ecosystem services	Total catch (tons)	x
		Occurrence of red algae (Furcellaria lumbricalis)	x
		Natural resources	x
		Other ecosystem services	x
Geomorphology	Bathymetry, geomorphology and landscapes	Isobathymetric lines (20m/30m/50m/100m)	x
		Coastal lagoons	x
		Estuaries and river deltas	x
		Bay areas (Narrow brackish water bay areas, Shallow marine bays)	x
		Flood meadows	x
		Fine sediment flats	x
		Sand or gravel formations (Sandbanks, dunes, etc.)	x
		Shoreline characteristics (Coastal erosion or accretion, type of coast)	x
		Other geomorphological structures	
Atmosphere parameters	Weather and wind	Wind speed (Median wind speed, vertical wind profile)	x
		Air temperature	x
		Dew point temperature	x
		Precipitations	x
	Climate and climate change related	Climate classification	x
		CO2 concentration in atmosphere	x
		Predicted climate change effects	x
Hydrodynamics and hydrography	Surface-level physical parameters	Total solar irradiation (sunlight)	x
		Water level	x
		Surface temperature	x
		Surface salinity	x
		Surface water reflectance spectrum	x
		Ice cover	x
		2D wave spectrum (wave buoy)	
	Water column description	Hydrographic structure (water layers)	x
		Thermoclines	x
		Haloclines	x
		Photic zone depth	
		Temperature vertical profile	x
		Salinity vertical profile	x
		Vertical profile of turbidity	x
		Vertical profile of fluorescence	
		Vertical profile of oxygen concentration	x
		Incident light vertical profile	
		Composition of suspended material	x
		Vertical profile of Carbon Variables (pH, Dissolved CO2)	x
		Nutrient concentration vertical profile	x
		Primary and secondary productivity	x
		Vertical current profile	x
Human activities	Impact and pressure	Underwater noise	
		Noise above surface	
		Turbidity caused by human activities	x
		Fuel and oil pollution	x
		Toxic metal pollution	x
		Synthetic chemical pollution	x
		Plastic pollution	
		Treatment plant pollution	
		Electromagnetic fields caused by cables	
		Military explosion sound pressure level	
		Military explosion debris	

Category	Sub-category	Dataset	Climate change related data
		Pathogens from aquaculture	
		Air pollution	x
	Antropogenic activities	Transport (Freight or passengers, both national and international)	x
		International uses (Cohabitation of cross-border users)	
		Export/Import by maritime routes	x
		Birdhunt	x
		Mineral and fossil resources prospection and extraction (Sand, gravel, oil...)	x
		Coastal nourishments and other measures	x
		Multifunctional economic development	x
		Fisheries	x
		Transformation of seafood	
		Sport, recreation	x
		Scientific research and education	x
		Aquaculture	x
		Unexploded Ordnance and military dumping grounds	
		Dumping grounds	x
		Forest and silviculture area	x
		Coastline farming production	x
	Infrastructures	Economic activities areas	x
		Technical infrastructures	x
		Coastal large urban areas	x
		Ports, and harbor activities	x
		Nautical and naval sectors	x
		Industrial areas	x
		Cables, oil pipelines and communication lines	
		Marine renewable energies	x
		Thermal or nuclear power plant	x
		Artificial islands and installations	x
	Managment restrictions and regulations (national security, defence, plans...)	Military restricted area	
		Search and Rescue Area	
		Maritime boundaries	
		Maritime surveillance systems	
		Areas reserved for future development	x
		On-land urban planning dedicated to maritime activities (Radar protection zone, devices etc.)	
		National maritime spatial plans (2 sets: delimitations and zoning)	x
		Regional and sub-national maritime spatial plans	x
		Cross-border and international maritime spatial plans and agreements	x
Socio-economic data	Social indicators	Health and living conditions	x
		Income	
		Local benefits of the blue economy	x
		Tourism	x
		Economic and goods flows (Coastal and marine economic flows (e.g. Input-output matrix for coastal and marine sectors))	x
	Demography caracteristics	Social situation	
		Employment	
		Socio-cultural values (security and sovereignty, health, equity and justice, and heritage, identity and stewardship)	

2. Reference Data List on Maritime Surveillance

Aim

Maritime surveillance is a key driver in addressing the MSP objectives as it guarantees the safety of navigation, therefore of human lives and safeguards the environment from disasters. It also needs to be ensured, regardless of the MSP planning scenarios and therefore need to be advertised to marine regional authorities for them to have a complete picture of the stakes at sea.

This is embedded within the MSP Directive Article 6b focusing on minimum requirements for maritime spatial planning, *"Member States shall establish procedural steps to contribute to the objectives by considering relevant activities and uses in marine waters such as environmental, economic and social aspects, as well as safety aspects"*[1].

This Reference Data List focuses on Maritime surveillance that covers:

- Maritime safety (protection and rescue from dangerous situations related to navigation)
- Maritime security (protection against deliberate, external threats and criminal activities)
- Border control
- Maritime pollution
- Enforcement of marine protected areas
- Fishery control
- Other specific local activities (spatial activities, etc.)

The Table 2 focuses on Baltic and North Seas, but can be tweaked for application in other regions (ex: no sea ice in the Mediterranean…).

Methodology

The categories were obtained from:

1. Shom's expertise[11] and interviews in-house,
2. Desk-top study from the parallel work[12] carried out in the Maritime Spatial Planning in the Outer-most Regions project (MSP-OR)
3. Previous EU MSP projects (e.g. Cooperation among Member States – Production of datasets of transnational interest from the MSP MED project[13])
4. Feedbacks from the audience during two of the Data CoP workshops:
    - Paris (18/01/2023)[14]
    - Brest (23/05/2023) for recommendations and comments[15]

[11] Shom's missions include support to public policies implementation by providing reference maritime data and expertise on the marine physical environment and marine safety of navigation - https://www.shom.fr/en
[12] D3.14 French Guiana Maritime Safety of Navigation Dataset, MSP-OR project, 2022
[13] Cooperation among Member States – Production of datasets of transnational interest, MSP MED project, 2022
[14] Minutes of the 3rd Workshop of the Data CoP in Paris
[15] Minutes of the 4th Workshop of the Data CoP in Brest

5. Inputs from experts' presentations: Anne Lunde Hermansson[16], Clément Dupont[17]

Analysis

This Reference Data List for Maritime Surveillance meets the identified need to know which are the input data required in the MSP process. Although maritime surveillance is a key factor in the successful implementation of MSP, it appears that the MSP stakeholders tend to omit maritime surveillance data within the framework of their plans. This is due to several reasons including lack of knowledge of the full domains included in the concept of surveillance and the added value of those data for MSP. Technical limitations play also a role in the limited use of those data: lack of interoperability between current monitoring systems and MSP planning tools; limited accessibility of maritime surveillance data[17]…

This List constitutes a basis in identifying actors related to maritime surveillance and a guideline for coherence regarding classification of these type of data into appropriate categories and subcategories.

Complementary data information is provided in the Deliverable on the two study cases on Maritime Surveillance and Blue Corridors[18] like metadata, accessibility, privacy, link to the data etc.

Also, once data needed is identified in an MSP implementation process, a common data format (european format such as INSPIRE Directive, EMODnet, BASEMPAS) is recommended for improving harmonisation.

Once more, FAIR principles[19] should be strongly used for working with MSP data. The FAIR principles were developed to address challenges related to data sharing, reuse, and collaboration. FAIR stands for Findable, Accessible, Interoperable, and Reusable.

Several types of data essential for considering Maritime Surveillance in Maritime Spatial Planning (MSP) are interconnected with climate change, both directly (e.g., ice conditions, risks of marine submersion) and indirectly (e.g., maritime traffic, offshore wind farms). The data collected to support maritime surveillance play a crucial role in promoting sustainable and climate-resilient approaches to maritime management.

[16] Hermansson, E.L., PhD Thesis for the degree of Licentiate, Navigating towards environmental impact assessment of shipping, Chalmers University of Technology. 52 pages. 2022

[17] Dupont C., PhD Thesis, Contribution des données de surveillance maritime à la Planification de l'Espace Maritime français, Université de Bretagne Occidentale. 265 pages. 2021

[18] Foreseen for October 2023 - https://www.emspproject.eu/project-activities/community-of-practice/data-sharing/

[19] Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016)

The Reference Data List for Maritime Surveillance

Table 2: Reference List in data collection in maritime surveillance in MSP, sorted by category and sub-category and its link with CC

Category	Sub-category	Dataset	Climate change related Data
Maritime boundaries	Geopolitical boundaries (legal status)	Maritime limits and boundaries	
	Administrative limits	Related to jurisdictional status (authorities in charge of enforcement)	
Physical characteristics	Bathymetry	Isobath lines (20m/30m/50m/100m)	x
		Sandbanks	x
		Muddy banks area	x
	Ocean chemistry	Halocline	x
Maritime transport and traffic flows	Maritime routes and areas	Ports access channels (fairways)	x
		Traffic Separation Scheme	x
	Maritime traffic	Recreational navigation	x
		Navigation by professional vessels	x
Ports & Infrastructures	Governance and planning	Harbour-master's office	
		Pilot office	
		Custom office	
	Infrastructures	Berth stations	
		Bridge	
		Ports	x
	Renewable Marine Energies	Offshore wind farms	x
		Other Renewable Marine Energies	x
	Mining infrastructures	Offshore oil and gas rigs	
Nature and species conservation sites & protected areas	Sub-national protected areas (marine and coastal)	National natural reserve	x
		Natura 2000 areas	x
		Other marine protected areas	x
Submarine cable & pipeline routes	Telecommunication and pipelines	Sub-marine cables and pipelines	
Surveillance and security	Obstructions and wrecks	Obstructions	
		Underwater Rocks	x
		Ice	x
		Wrecks	
	Aids to navigation	Landmarks	
		Beaconage	

		Buoyage	
	Search and rescue	Search and rescue (SAR) area	
Fishing and aquaculture	Fisheries	Limits related to fishery uses	x
	Aquaculture	Areas used for aquaculture	x
Pressures and impacts	Other impacts	Dumping ground	x
	Pollutions	Oil spills	
		Other pollutions	
	Extraction of mineral resources	Offshore sand or gravel mining	
Spatial policy	Governance of spatial planning on land and at sea	Anchoring area	
		Mooring area	
Military	Military areas	Permanently restricted areas	
		Military areas, temporary restrictions	
		Former designated areas for discarding military weapons	
		Unexploded Ordnance (UXO)	
Risks	Weather-related	Storms	x
	Climate-related	Risks of marine submersion	x

Conclusion

In conclusion, the Reference Data List on Maritime Surveillance and Ecosystem Based Approach & Sustainable Blue Economy was designed in the eMSP NBSR project, led by Shom in collaboration and with the support of the Data sharing CoP. It aims at ensuring coherence and consistency in MSP data across borders.

Establishing a prioritization order for considering these data at a transnational MSP scale is a challenging task due to the unique local and regional needs and specificities of each country. The variation in the priority order for these data is influenced by multiple factors, including the country's economic, social, environmental, and political context. Nevertheless, it is imperative to establish European-level connections to enhance coherence among Member States. The MSP Directive acknowledges the Marine Strategy Framework Directive (MSFD)[20] as a fundamental environmental component. The MSFD provides a comprehensive framework for defining ecosystem and activity typologies. Coordinating the implementation of these two Directives and seeking alignment or complementarity with MSFD typologies allows for the uniform utilization of data across Europe.

The Reference Data List not only itemizes the currently available and used data on the two topics but also proposes a set of reference data for other Communities of Practice within the eMSP-NBSR project and any stakeholders involved in the MSP process. This promotes harmonization and effective communication among stakeholders involved in MSP, fostering better-informed decision-making processes.

These two lists aim to provide an overview of data needed in MSP for each aspect. It constitutes a guideline for collecting the right data and an excellent basis for identifying the data needed. To categorize the data in the right categories and subcategories classification is the first essential step before using it.

The lists have to be completed with further information such as data suppliers, privacy of the data, format, data producer, date… The next Deliverable on the two study cases on Maritime Surveillance and Blue Corridors, produced by the Shom in the framework of the Data Community of Practice, aims to provide methodology and recommendations for collecting appropriate information and metadata.

For an optimal interoperability and accessibility of the available data, data collection for each dataset should be carried out regularly at a scientifically coherent frequency and must satisfy as closely as possible with the FAIR (Findable, Accessible, Interoperable, and Reusable) principles.

[20] European Union, Amending Directive 2008/56/EC of the European Parliament, 2017.

Special attention should be given to data related to climate change in the upcoming MSP plans. These may need to be adjusted and modified to ensure the proper consideration of this aspect in the plan and also to ensure that each country complies with the Green Deal directive. Technological tools and modeling (Artificial Intelligence, Digital Twin of the Ocean) can help predict these changes and better understand these climate challenges.

The present document is recommended to identify issues and challenges, and also support national MSP authorities to strengthen the MSP process in the upcoming reviews of plans, regarding the data challenges in the light of changing technologies, climate change and the increasing amount of data.