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

Co-funded by the European Union

MSP data sharing systems in the North and Baltic Sea regions as means for stakeholders' involvement

eMSP NBSR project

co-funded by the European Union

2024

Contents

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DISCLAIMER

The work described in the Synthesis report on data sharing in the North and Baltic Seas was supported by the European Maritime and Fisheries Fund of the European Union - through the Grant Agreement number 101035797 – eMSP NBSR - EMFF-MSP-2020, corresponding to the Call EMFF-MSP-2020 (Maritime Spatial Planning).

Introduction

Maritime Spatial Planning is an integrative and inclusive process which highly depends on knowledge and data. For example, insufficient knowledge and scarcity of data were recognized as one of the major obstacles for the implementation of the ecosystem-based approach in MSP (Gap analysis of international framework for application of EBA in MSP). It concerns various knowledge areas marine environment, human activities, environmental pressures etc. However, the insufficiency of data is not the only difficulty which planners and policy makers faced at the first round of producing national maritime spatial plans. Many of them recognized difficulties in cross-sectoral and cross-border communication due to diversity of methodological approaches to data processing and analyzing as well as incompatibility of data in scale and time resolution. It hampered integration of required knowledge in the plans.

Data sharing systems are designed for data distribution and promotion ensuring data compatibility and interoperability. All that guarantees not only smooth transfer of required knowledge but also support involvement of various stakeholders in the planning process. Data sharing systems not only compile data but also ensure their quality and validity. They might provide access to data in accordance with the profile of specific user and offer interfaces for data visualization. However, development of this functionality requires application of the most modern technological solutions as well as remarkable effort aimed at data harmonization, identification of user needs and development of methodological approaches for the data interpretation, analysis and visualization.

This document is an attempt to contribute to this effort. It systematizes some specific features of existing MSP related data sharing systems, analyses end-users' views on the data needs and provides recommendations on end-user tools.

Key features of MSP data

Before considering data architecture, visualization tools and data sharing platforms in general, the nature of MSP related data is to be discussed. It includes the content of data, in other words a subject which data describe, and technical characteristics of the used data.

MSP data content.

Thematically, data used in MSP can be aggregated in five groups: administrative division, environmental data, data on human activities, data on environmental pressures and socio-economic data. In this study we do not intend to provide an exhaustive list of data used in MSP. However, we'd like to consider data describing various subjects to highlight the diversity of their technical characteristics and, subsequently, methods of their processing and visualization.

Data on administrative division primarily describes borders of various administrative units and zones. Environmental data covers a wide spectrum of information on physical, chemical, and biological parameters of planning areas. This group includes geological and hydrological parameters, distribution of species and biotopes and other data required for comprehensive understanding of natural conditions of the planning areas.

Data on human activities represents information on existing installations, underwater infrastructure, areas designated for various economic activities (fishing fisheries, tourism, offshore energy etc) as well as areas licensed for geological exploitation, reserved for nature conservation and cultural heritage. Another type of data on human activities describes functional zones designated for the development of human activities in future.

Human activities potentially exert environmental pressures. They result in physical disturbance or destruction of the ecosystem components, physical and chemical inputs to the environment and extraction of living organisms. The data describes their distribution and in combination with data on distribution of various ecosystem components serve as a basis for the assessment of environmental impacts.

Socio-economic data is a large massif of auxiliary information characterizing stakeholder groups and societal needs. It includes such parameters as population density and distribution, cultural and social groups, employment etc.

MSP data types.

Data used in MSP processes characterizes spatial distribution of parameters and characteristics of planned areas. However, assuming that spatial planning is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas, the data used in the process should demonstrate temporal changes in the planned area. Finally, since MSP is a strategic and participatory process it involves the use of descriptive textual information for policy narratives and communicating planning decisions with stakeholders.

Technically it means that the data supporting MSP process should integrate three major

types: georeferenced data reflecting spatial distribution of natural and anthropogenic parameters; tabular timeseries or diagrams illustrating temporal changes and textual data describing planning process and its goals. Integration of social and economic consideration into MSP process increases the use of non-georeferenced data characterizing planning area such as population density, health and living conditions, income, economic and goods flows, security and sovereignty and other.

Various aspects and parameters considered in the MSP process require the development of rules and procedures for interaction between various data. Spatial data used to be aggregated into thematic layers which are arranged in a tree-like structure (e.g. HELCOM Basemaps). However, correct use of multi-layered spatial data also requires establishing of respective rules. These rules should include description of geographical parameters of the data including geographical projections, precision and topological rules identifying interaction between data layers. Rules for the use of tabular data and diagrams, numerically describing temporal characteristic of the territory include primarily unification of data units and statistical procedures for data processing, including also identification of respective uncertainties. Textual data is the most freely used type, however, efficient use of such information requires the use of unified terminology. Also, the use of pre-defined key words eases data searchability.

Relations between different data types and their combined analysis are the most complicated elements of MSP data organization and handling. Spatial objects are characterized by numerically or textually described parameters. These parameters are to be attributed to spatial objects utilizing either attributive or related table. Linking different types of data involves the use of codes and glossaries of terms and key words, which have to be harmonized for the entire region and continuously maintained.

Finally, metadata as a specific type of information used for data defining and description is one of the vital elements of regional MSP data sharing systems. Metadata enriches the data with information, which makes it easier to discover, use and manage. It's crucial that metadata includes not only the description of technical parameters of various data but also provide links to the data source, legal information about the data origin justifying data reliability and contact information of data providers.

MSP data provided by third parties.

MSP as a participatory process requires compilation of extensive array of data, originating from various sources. Key requirements for the data are validity and scientific justification ("best available data", according to the MSPD). To supply MSP process with the data satisfying the above-mentioned criteria the pool of the data used in the planning process integrates various data sources with various updating periods.

Validity of the data which is used to build the content of marine spatial plans is provided by receiving required data from the original source. These datasets have been identified as MSP input data. In most cases the data originates from respective competent authorities. It concerns data on:

- administrative borders,

- biological and physical parameters of the ecosystem,
- maritime transport and safety of navigation,
- underwater installations and infrastructure,
- exploitation of mineral resources,
- aquaculture,
- tourism and recreation,
- nature conservation,
- defense,
- fishing areas,
- underwater cultural heritage and other.

Since almost all data used in MSP is produced under other policies, their producers follow the rules and practices that are set in respective sectors. These rules and practices can hardly be changed to serve MSP needs. The same concerns the data updating periods, which might vary greatly depending on respective sectorial procedures. That's why the only way to maintain an up-to-date state of data originating from external data providers in MSP data sharing systems is decentralization of such system. It implies harvesting data services from data sources and maintaining only respective metadata records in the centralized database. In fact, in relation to MSP input data supplied by third parties sharing system can be utilized as a platform providing information about the data used in the MSP process but not the data themselves. However, such a platform might be useful facilitating cross-sectoral cooperation.

Data resulting from MSP process.

On the other hand, data resulting from maritime spatial planning process can be structured and harmonized. This kind of data has been called MSP output data. An attempt to harmonize MSP data for the purposes of transboundary consultations was undertaken in the Baltic Sea region, where the Guidelines on transboundary MSP output data structure in the Baltic Sea (Guidelines on transboundary MSP output data structure in the Baltic Sea) was produced by Baltic Sea Region MSP Data Expert Sub-group (BSR MSP Data ESG), under the remit of the HELCOM-VASAB MSP Working Group and adopted for regional use. This document sets out technical requirements (data specification) for the interoperability and harmonization of spatial data sets corresponding to the transboundary/cross-border output data. It also provides an exhaustive list of sea uses and functionality of planning areas.

An example of MSP data sharing system in the Baltic Sea Region (BASEMAPS)

The Regional MSP Roadmap 2013-2020 set the goal to draw up and apply maritime spatial plans throughout the Baltic Sea Region by 2020 which are coherent across borders and apply the ecosystem approach. Thus, the coherence of MSPs became one

of the regional MSP objectives, which requires transboundary consultations and stakeholder's involvement. A regional document - Guidelines on transboundary consultations, public participation and co-operation – was developed and adopted to facilitate this process. However, transboundary consultations and stakeholder's engagement in the planning process required fluent exchange of information. To support MSP data exchange in the Baltic Sea region, a regional MSP data sharing system was established and is currently maintained by HELCOM. Since most of the data used in maritime spatial planning, and especially, data originating from the planning process are georeferenced the system was identified as a map service.

Basemaps is a map service hosted by HELCOM to access Baltic Sea maritime spatial planning (MSP) data. The service was developed to enhance transboundary consultations and ensure coherence of MSP across the Baltic Sea. For MSP output data, the service utilizes harmonized data structure in accordance with HELCOM-VASAB guidelines on transboundary MSP output data structure.

MSP data architecture and functionality.

Basemaps provides user access to input and output MSP data as well as to relevant metadata. For the purposes of Basemaps service and in line with HELCOM-VASAB guidelines on transboundary MSP output data structure, the following definitions were used.

Input data - data, information or evidence that is used for preparation a maritime spatial plan, such as environmental data, information about existing sea uses, social economic data, as well as other maritime spatial plans.

Output data – spatial data originating from MSP process and reflecting approved national maritime spatial plans.

BASEMAPS is built utilizing a combination of centralized and decentralized data architecture. It means that certain types of data are reported and deposited in the centrally maintained database, while others remain at their original source and the system just provides a description of the data and a link to respective resources.

Input data for MSP is primarily provided by competent organizations/authorities. This data is not collected and stored in the BASEMAPS's centralized database but available via links to online services provided by data owners to ensure data validity. BASEMAPS provides respective metadata which includes:

- Type of service (WMS, WFS, AGS or DLD),
- Data provider,
- Any kind of rights restrictions,
- Possible fees to access data,
- Name of layer as published by data provider,
- Title of layer,

- A short description of layer,
- Supported languages,
- Link to the data provider's metadata,
- Link to the provider's data service.

Items in the Basemaps' input data list display icons indicating a type of service used by data provider: WMS (Web Map Service), WFS (Web Feature Services), AGS (ArcGIS REST services), DLD (Downloadable services). Descriptions of input data layers are given in pop-up windows emerging when the data layers are activated. Since data is often provided in national languages, an instrument for on-the-fly translation of provider's metadata is inbuilt in Basemaps. Functionality of input data viewers depends on the service used by the data provider. The same concerns visualization tools and data downloading functions.

Output data reported by national data reporters is stored in centralized database and visualized in harmonized way in accordance with HELCOM-VASAB guidelines on transboundary MSP output data structure. However, the service provides access to the original data at its source, which is in most cases published national MSP and related documents.

Output MSP data in the Basemaps demonstrates status of plan areas and planned sea uses. Status of plan area reflects the state of MSP for each Baltic Sea country. The status has four categories:

- In force: The plan is adopted and active.
- Elaboration phase: The decision on the launching of MSP process has been announced.
- Preparation for elaboration: Respective legislation is in place and/or preparatory work for MSP has been launched.
- Obsolete: The plan has been superseded or is not in force any longer.

Planned sea uses visualizes areas designated for specific sea use according to classification given in the HELCOM-VASAB guidelines on transboundary MSP output data structure. These sea uses are also categorized according to their prioritization: priority, reserved, allowed, restricted and forbidden.

Basemaps provides access to data for unlimited users with relatively simple functionality. The data sharing system allows: viewing maps, viewing legends using legend widget, identify features visualizing their attributes, querying and downloading sea use data and viewing metadata. For authorized data users (national data reporters and administrators) the service includes functions which enable data uploading and editing.

MSP-related data sharing platforms in the North Sea Region and beyond

The MSP Directive 2014/89/EU (MSPD) requires countries to use the best available maritime spatial data and information. Articles 9.2, 10.1 and 11.1 of the MSPD, despite not mentioning MSP input data specifically, also require member states to organise data sharing and ensure the availability of maritime spatial plans while cooperating across borders with neighbouring member states. In general, in order to facilitate international cooperation and information exchange, data sharing is essential. For these reasons, MSP planners and data providers in the European Union have taken measures to make MSP data (both input and output data as defined previously) available through spatial data infrastructures dedicated to maritime data, as these structures facilitate access to information and data.

These efforts have taken different forms depending on the sea basin. In the North Sea, data sharing and coordination of maritime space uses are currently not coordinated under a general, comprehensive organization, agreement, or guideline. However, in this sea basin, data sharing and international cooperation tends to be organized sectorally. As such, there are several international data sharing, governance, research, and management entities focused on the North Sea. Beyond this, the North Sea is a densely frequented sea basin in the North Atlantic area, with a high concentration of activities and industries. For this reason, interest groups in the North Atlantic area also tend to have a particular focus on this zone.

For instance, the International Council For the Exploration of the Sea (ICES, https://www.ices.dk) is an international initiative aiming at being a leading marine science international organization with goals to providing scientific understanding of marine ecosystems and expert advice on sustainable use of the ocean. Among other topics of interests, the ICES focuses in particular on the sustainability of fishing and the management of fish stocks. The ICES is active not just in the North Sea, but in the whole North Atlantic area, focuses on the North Sea as one of the most active areas in fishing, and most industrialized with offshore infrastructures. The ICES maintains a data sharing platform (https://gis.ices.dk/sf/) organized by topic and area.

On this platform, several types of validated data can be visualized and downloaded, most of which can be used as MSP input data. A catalog lets users browse the datasets' associated metadata for a better understanding of the data itself.

Beyond the provided data and metadata, the ICES platform also provides users with a wide array of resources to enable stakeholder engagement in many ways. For instance, users can submit their own datasets, not just for personal visualization and comparison with the platform's own data, but for full integration into the data catalog. This provides stakeholders with the opportunity to participate in management processes by adding their own data for public use. In parallel, in order to facilitate the management of maritime space, several decision support tools are provided to the users, such as impact assessment tools, fish stock assessment tools, calculators, and so on. Other measures to facilitate management are provided, such as situational overviews in the form of regular reports on several topics (e.g. ecosystem overview, fisheries overview, and so

on), as well as scientific advice from experts for an effective ecosystem-based management.

On the topic of the interactions between science and policy, the ICES, itself is mainly a scientific community, which involves expert groups and scientific working groups dedicated to various topics of sea exploration and exploitation. There are in particular two working groups dedicated to MSP, including one focused on the effects and the mitigation of climate change in MSP. Finally, the ICES platform provides an access to a library of scientific publications, especially articles published by the community. This intense scientific activity is the base on which the advice provided to managers and policymakers is built, as the ICES is working to create better interaction between science and policy.

However, despite providing access to several datasets used in the MSP process, and despite its efforts to enable a scientifically sound, sustainable and ecosystem-based management of marine resources, the ICES itself is not dedicated to MSP, nor is it specifically focused on the North Sea.

In parallel, the SEANSE project, a European-funded MSP project running from 2018 to 2020, investigated data needs and data sharing in the North Sea. This initiative brought together partners from several countries bordering the North Sea: France, the Netherlands, the United Kingdom, Denmark and Germany. This project aimed at "developing a coherent approach to Strategic Environmental Assessments (SEAs) with a focus on renewable energy in support of the development and effective implementation of national MSPs", as defined by the project website (https://northseaportal.eu/). As such, it was mostly centered on two topics, marine renewable energy and existing pressures and impacts on the environment.

One of the objectives of the SEANSE project was to identify and address technical issues and gaps in transboundary data and knowledge sharing relevant to Maritime Spatial Planning. To tackle this task, the SEANSE data portal was developed. This portal was created as a data sharing platform, aiming at displaying and providing access to all relevant MSP input data for the North Sea, while focusing at first on marine renewable energies and environmental data. But beyond facilitating access to maritime spatial data in the North Sea, the main purpose of the platform was to become a tool to assess data interoperability across borders. It was therefore built with a focus on data sharing compatible with the concepts of FAIR data (findable, accessible, interoperable and reusable data) and compliant with INSPIRE principles (interoperability of data, availability of metadata, use of webservices).

In order to maximize interoperability and reusability, as well as data accuracy, the platform was built from open source elements and harvested data from webservices (e.g. WMS or WFS). In a similar way to the BASEMAPS portal, using such webservices allowed the users to visualize and access the most recent, up-to-date version of the data while reducing storage needs of the SEANSE platform.

The SEANSE portal displayed several datasets related to MSP, primarily through their use as MSP input data. Such data included: administrative divisions (regions, maritime boundaries, etc.), environmental data (biological, physical and chemical characteristics such as salinity, but also grey seal pupping sites, etc.), human activities (underwater cultural heritage, military training areas, etc.), as well as pressures and impacts on the environment (fishing impacts): four of the five categories of MSP data defined in the previous chapters of this document. Taking into account the primary focus of the portal on marine renewable energies and environmental assessment, this demonstrates the overarching character of data in MSP: despite focusing on specific issues, the SEANSE portal included data from most of the categories.

Despite MSP in the North Sea is not coordinated in a centralized fashion, sectoral efforts, as well as other similar cooperation groups (such as the North Seas Energy Cooperation group focusing on the energy sector, the CPMR North Sea Commission, and OSPAR) are promoting international cooperation and data sharing. Through these initiatives MSP in the North Sea facilitates stakeholder engagement. They support decisions related to the application of an ecosystem-based approach advised by scientific experts through intense science-policy interactions. FAIR data are being promoted across the entire sea basin. While a complete MSP data hub has yet to be established, these sectoral efforts ensure a high degree of cross-border cooperation within the North Sea and even beyond.

MSP stakeholders mapping

Maritime spatial planning is a participatory process. The quality of planning, political adoption and public acceptance of the plan is guaranteed by accounting for the needs and views of various stakeholder groups and resolving potential clashes of sea users' interests. Interaction and communication with stakeholders are to be arranged throughout the entire planning process starting from very early stages when planning goals are set and continuing up to MSP adoption and following up its implementation and revision. In many countries interaction and communication process in MSP is regulated by national legislation, which identifies bodies and institutions to be involved in the planning process. A framework for consultation procedures is also to a large extent given in national or international legal and policy framework.

Maritime spatial planning is one of the ocean governance processes. Ocean governance can be seen as the entirety of formal and informal institutions (organizations, rules, responsibilities, instruments, processes) used by human societies to plan and manage our seas in terms of human uses and maintenance of their good environmental status. Decentralization to the lowest appropriate level is mentioned in the Malawi principles of ecosystem-based approach, which assumes multi-level governance as a basic approach for the EBA based ocean governance.

For multi-level governance to succeed, the right groups of stakeholders need to be involved, and they should be used properly in effective work groups. To ensure effective multi-level governance, the different levels need to cooperate, communicate, and ensure participation and strategic planning, while monitoring the results and being cost effective. Regional intergovernmental organizations (e.g. Regional Sea Conventions (RSCs)) play essential role being focused on mid- and long-term planning horizons, delivering policy coherence, linking local planning to national policies, and providing adequate information and guides to stakeholders.

The intention of this section is to map stakeholders' groups which are potentially engaged in maritime spatial planning process to cater for cross-sectorial cooperation and multi-level governance. It also makes an attempt to cluster them into groups to develop recommendations for efficient sharing of MSP related data.

As it's been already announced in the introductory part to this section active involvement of stakeholders' groups enables both cross-sectoral cooperation and multi-level governance in the MSP process. Cross-sectoral cooperation provides accounting for various development goals and thus allocation for sea space required for their achievement including multi-use of marine areas. In this respect national competent authorities responsible for the development of respective sectors are to be engaged. Interests of various economic sectors and industries are also represented by professional communities either national or international. Environmental aspects of planning process are covered by both national and international competent authorities and environmental Non-Governmental Organizations (NGOs). The same concerns protection of cultural heritage. And finally, civil society is represented by local, national and international NGOs and interest groups.

Multi-level governance is provided through active involvement and interaction of managerial entities at different levels. It depends on specific feature of national governance system, but in general includes national (federal) competent authorities, sub-national (regional) authorities, municipal level and intergovernmental organizations with respective mandate.

Scientific community is one of the specific stakeholders which provide scientific knowledge and data for decision making for both sectorial organizations and managerial ones. Scientific community is represented by respective national institutions as well as international scientific organizations and expert communities.

Summarising all above mentioned notions for the purposes of data sharing all stakeholders can be clustered to the following stakeholders' groups: intergovernmental organizations, national authorities, regional authorities, municipalities, business communities, environmental communities, scientific community and civil society. Table 1 provides a non-exhaustive list exemplifying organizations representing these stakeholders' groups in the North and Baltic Sea regions.

Stakeholder group	Organization
Intergovernmental	UN, IMO, IUCN, HELCOM, OSPAR, VASAB, EUSBSR, UNESCO, etc
Competent authorities	National competent authorities for environment, transport, energy, fisheries, exploitation of natural resources, culture, defence etc. Respective authorities for federal states or sub-national administrations.
Municipalities	Coastal municipalities and their organizations such as KIMO International, Union of Baltic Cities etc.
Civil society	CPMR-NSC, CPMR-BALTIC, Baltic Sea Advisory Council, North Sea Advisory Council, etc.
Environmental	OCEANA, WWF, Baltic Environmental Forum, Coalition Clean Baltic, GREENPEACE etc
Business	Association of national organizations of fishing enterprises in the European Union, The Federation of European Aquaculture Producers, Baltic energy market interconnection plan, etc
Scientific	International Council for the Exploration of the Sea, national research institutes, Baltic Earth, etc

Basemaps end-user survey

The BASEMAPS end-user survey is intended to harvest feedback from various groups of data end-users on the content and functionality of HELCOM Basemaps service.

Participants of the survey

The survey was arranged by HELCOM-VASAB MSP DATA expert sub-group with intention to collect views on the content and functionality of the system from all Baltic Sea countries. As a result, 35 responses were received MSP data experts across the Baltic Sea region. However, not all questions were answered by all respondents. Respondents from Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Poland, Sweden and European Union represented the following major user groups: competent authorities, scientific organizations, civil society and business community. Distribution of responds shown on Figure 1 demonstrates domination of the users representing competent authorities. The prevailing of competent authorities among the Basemaps' end-users is explainable as the system was designed to facilitate MSP data sharing for transboundary consultations.

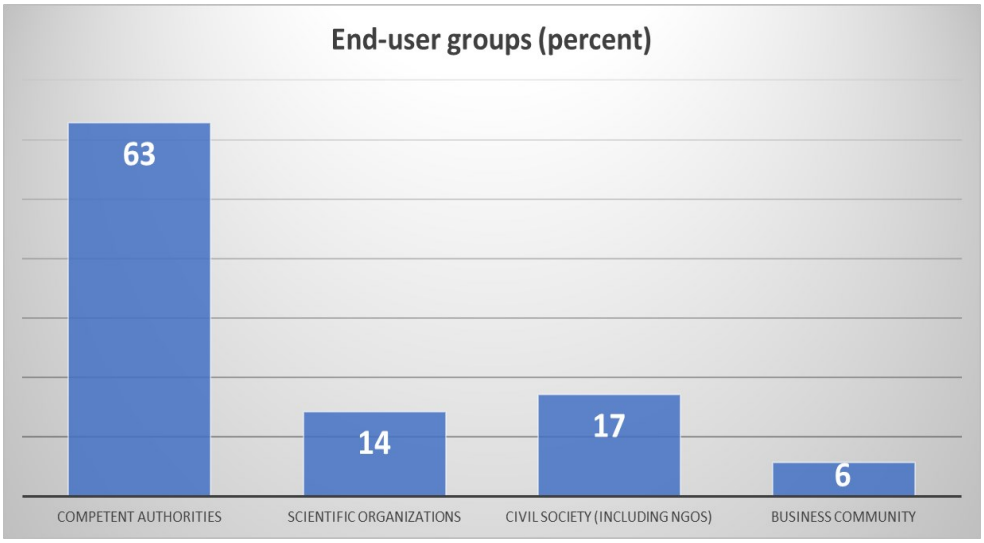

Figure 1. Number of responds received from various groups of BASEMAPS end-users.

Purposes and frequency of BASEMAPS' use.

Regional MSP data sharing system BASEMAPS was originally designed to facilitate transboundary MSP consultations and thus ensure coherence of MSPs across the Baltic Sea region. However, the survey demonstrated that the system attracts end-users with other purposes and goals. Primarily, the system is used to support decision making process related to national maritime spatial planning processes. It involves management and drawing up the plans. But the survey demonstrated that the system is also used for scientific and communication purposes which attracts additional stakeholder's groups. Distribution of responds is shown on Figure 2.

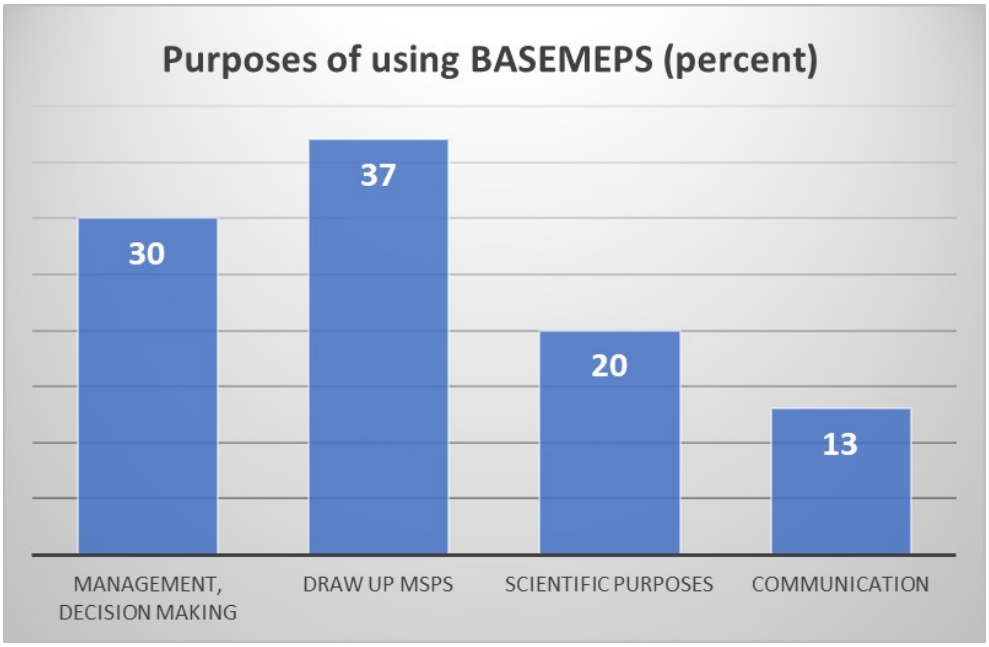

Figure 2. Purposes of the use of BASEMAP MSP data sharing system.

MSP data sharing system is characterised by relatively static content. It explains most of end-users use BASEMAPS a few times a year. However, some respondents are using the system on weekly and even daily basis. It's likely that these respondents are primarily data managers responsible for the validity of national data presented in the system. Frequency of using BASEMAPS is shown on Figure 3.

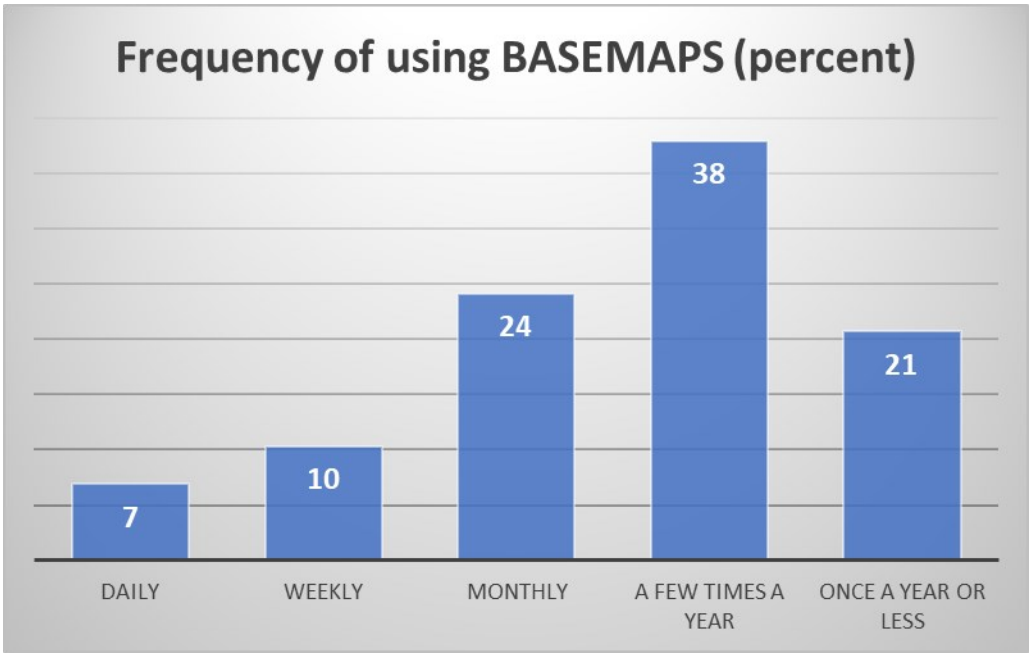

Figure 3. Frequency of using BASEMAPS by end-users.

The most useful content of BASEMAPS.

Respondents were invited to evaluate the importance of the data available through BASEMAPS service for their professional activity. For the survey all data shared by BASEMAP were divided to four groups: harmonized MSP output data, MSP output data at source, MSP input data at source and harmonized MSP input data. Evaluation of the data usefulness for end-users was based on four categories: very important, important, somewhat important and not at all important. To calculate the evaluation score, the categories were weighted as 3, 2, 1 and -1 respectively. The scoring was computed by plain sum of given evaluations multiplied by their weights.

The survey clearly demonstrated that output MSP data is of primary end-users' interest. Regionally harmonized MSP output data was of the highest relevance while harmonization of input data is of the lowest. Scores received by MSP data groups in the end-user survey is illustrated by Figure 4.

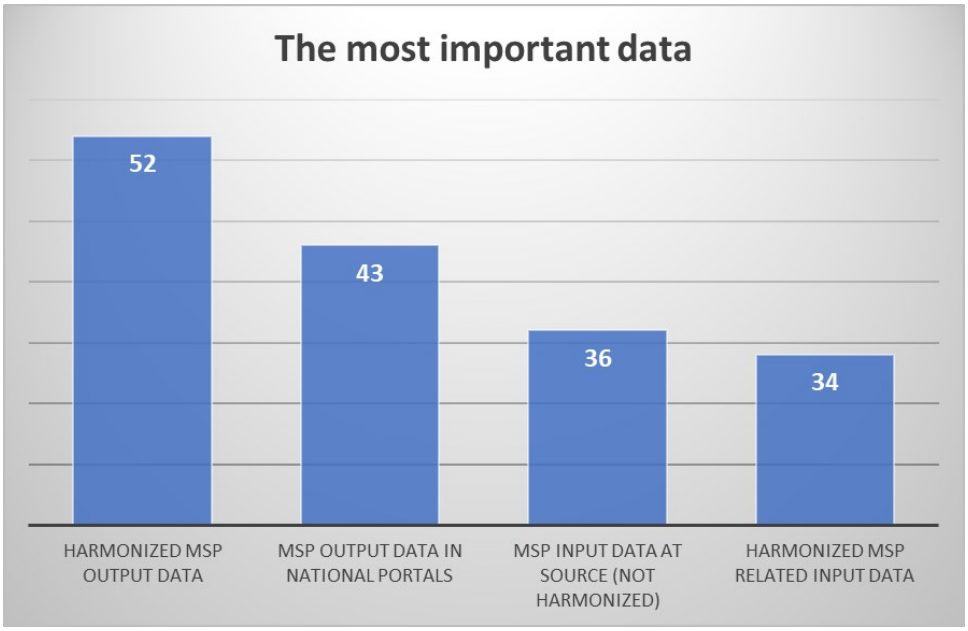

Figure 4. Prioritization of MSP data sharing system content by end-users.

The most useful functionality of BASEMAPS

Respondents were invited to evaluate the relevance of BASEMEPS's functionality for their professional activity. Four major functions out of five provided by BASEMAPS were included in the survey: viewing maps, viewing legends using legend widget, identify features visualize their attributes and querying sea use data. The function of viewing metadata was not included. The functionality had to be evaluated according to five categories: extremely important, very important, somewhat important, not so important not at all important. To calculate the evaluation score categories were weighted as 3, 2, 1, -1 and -2 respectively. The scoring was computed by plain sum of given evaluations multiplied by their weights.

In general end-users primarily use BASEMAPS to view attributes of various features and view maps. Exploring legend widgets is of a secondary significance, while querying data is of list interest. The results of assessment are shown on Figure 5.

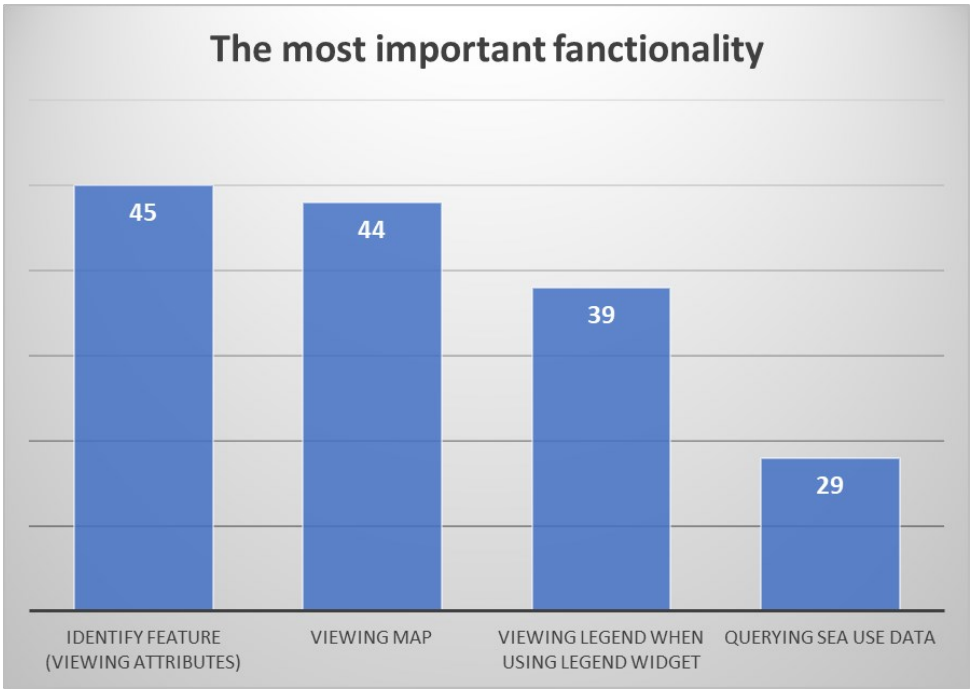

Figure 5. Prioritization of BASEMAPS' functionality.

Reflection on the data findability and Basemaps improvement

In general, a tree-like data structure was considered as relatively easy to use. About 50% of end-users responded that data are either easy or very easy to find. The rest found the usability of searching functional neither easy nor difficult. No responses indicated that required data is difficult to find.

Respondents of the Basemaps' end-user survey were invited to provide their recommendations on the improvement of the regional MSP data sharing system. They are summarized in the following list:

- Integrate a function for downloading selected spatial data.
- Provide links to national portals with detailed information about responsible national authority with respective contacts.
- Provide links to original MSP output data.
- Develop simple analytical instruments enabling data selection and comparison by e.g. size of various designated areas and zones with respective presentation of the results in tabular format.
- Consider further development of the data tree to further improve the findability of data.
- Consider opportunities for integration of the service with other existing systems.
- Further develop cartographical symbology and legend pattern to improve readability and interpretation of visualized maps.
- Further work on interface design to make it more attractive for end users.

Analytical tools for MSP data sharing systems.

MSP data sharing systems play remarkable role as a communication and coordination tool. Since MSP is a participatory and inclusive process, sharing data facilitates communication of planning solutions and decisions with stakeholders as well as their engagement in the planning process and the development of these solutions.

Using MSP data sharing systems as communication and stakeholder engagement tool requires thorough consideration of means for data visualization, access, and findability, which are discussed in other parts of the synthesis report. In addition to data searching and viewing MSP data sharing systems also might provide users with tools for data analysis. It's obvious that the use of free source GIS systems, which are now-a-days broadly available, enables expert performing their own analysis of downloaded data. However, certain types of analytical procedures integrated in user interface of online data sharing systems might be beneficial for their use as communication or decision-making support systems and engage various target groups to MSP process. Using online analytical tools helps to save time for downloading and compiling needed MSP data as the basic analytical procedures can be launched online. These tools also enable the use of predefined analytical algorithms designed for specific types of data and visualize outputs of the analysis utilizing map legends developed for these data.

Designing of the online analytical tools require thorough analysis of target groups and their needs. It should also consider availability of respective data, confidence of modelling algorithms and technical feasibility of the application development. Before the development of an analytical tool has been launched the developers should investigate basic preconditions for the analysis, which supposed to performed by the tool. These preconditions include answering the following basic questions:

- User groups for the analytical tool (e.g. politicians, authorities, science, business, public etc)
- Questions the analysis is to answer (e.g. What is the percent of water area designated for nature conservation in the Gulf of Riga?).
- Data deposited in the data sharing system to be utilized for the analysis (e.g. MSP output data in the HELCOM Basemaps).
- Auxiliary information needed for the analysis (e.g. data which can be uploaded by user or obtained from open source data depositories).
- User tools to be utilised for the analysis (e.g. data filters, tools for spatial selection, tools for output/selection etc)
- Desirable format for the output of the analysis (e.g. maps, tables, diagrams, plots etc).

Some examples of analytical tools and analysis which might be performed utilizing different types of MSP data are given below. These examples are inspired by existing

analytical tools or tools which are under development or investigation. The examples were jointly designed by MSP4BIO, ReMAP and eMSP project participants.

Examples of analytical tools:

1. Spatial analysis – computation of areas designated for various types of human activities at sea.
    a. Distribution of primary sea use (calculation of areas with specified priority sea use per country, sub-basin, Baltic Sea).
    b. Distribution of allowed sea use (calculation of areas based on combination of specific priority and allowed sea use per country, sub-basin, Baltic Sea).
    c. Distribution of prohibited sea use (calculation of areas where specific sea uses are restricted or not allowed per country, sub-basin, Baltic Sea).
    d. Free hand tool for spatial analysis identifying sea uses in a selected area and provides basic statistical analysis.
2. Thematic analysis – aggregation of areas designated for human activities at sea related to certain economic sector, with visualization in a form of thematic map utilizing predefined symbology.
    a. Energy
    b. Nature conservation
    c. Exploitation of natural resources
    d. Recreational activities and cultural heritage
    e. Professional transport (ferry and good shipping lines etc)
    f. Maritime safety (traffic separation schemes, reefs, racks, etc)
    g. Scientific research
    h. Other themes
3. Temporal analysis – analysis of changes in a certain time period, utilizing archived data (if available). As a minimum, this type of analysis requires information from a log file about all modifications and updates of the plan and archived MSP output data.

    - The analysis can be performed for planning area, sub-basins. Area for the analysis might be outlined by a free hand tool or identified by a mouse click on a certain spot.
    - Inter annual variation could be revealed with using this analytical tool (e.g. fishing effort, tourism or intensity of other activities).
    - Evolution of specific human activities in a defined time period can be displayed (e.g. offshore energy, aquaculture or nature conservation).

4. Combined analytical tool – performs thematic spatial analysis. This kind of tools is based on a modelling algorithm utilizing spatial MSP output data and other auxiliary information. Analysis performed by the tool depends on specific theme and related knowledge and rules. The tool can perform the following types of analytical procedures:
    a. Identification of areas suitable for a certain activity based on knowledge on co-existence of human activities and information on already planned uses,
    b. Identification of no-go areas for activities utilizing information on restricted and forbidden uses in combination with knowledge on co-existence of various activities and other natural parameters (data might be uploaded from open sources),
    c. Analysis of potential conflicts and overlaps for randomly selected sea areas. The analysis can utilize a predefined matrix of potentially conflicting sea uses. The tool can also include a feedback function (participatory GIS).
    d. Calculation of risks for navigation caused by various activities at sea. This calculation can be based on the data about natural conditions, already planned sea uses and existing regulations.
    e. Calculation of cumulative effect utilizing MSP output data on planned sea uses and existing information on environmental pressures caused by various human activities. If available, information on ecosystem components can be integrated to illustrate specific potential impact.

Conclusions of the survey

Representatives of all Baltic Sea countries, which had developed or were finalizing the development of national MSPs at the time of survey, took part in the survey.

The survey respondent's group was dominated by representatives of competent public authorities (more than 60%) which might affect the survey outputs. However, scientific and business communities as well as civil society were also represented.

The survey revealed that BASEMAPS service is primarily used for decision making purposes or drawing up national MSPs and majority of end-user visit the service few times a year.

The less frequently, BASEMAPS service is used for communication purposes, only in about 10% of cases. It indicates that most likely national authorities prefer to use national internet resources to communicate planning solutions.

MSP output data is of the highest interest for the respondents while input data is of minor importance. Respondents expressed specific interest in harmonized visualization of MSP output data for the whole Baltic Sea region.

Participants of the survey were also interested in contact information of competent authorities responsible for the development of national MSPs and input data providers.

The service is mainly used for visualization of data and exploring attributes of selected features.

An opportunity to download selected data is a desirable function. Also, a simple analytical instrument enabling selection and comparison of selected data is of interest.

The survey proves the effectiveness of combined centralized/decentralized approach to data sharing when the most demanded and permanent data is accessed through a centralized repository in harmonized way, while less important and more frequently updated information is made available via data owner's web services.

Final remarks and considerations

Maritime Spatial Planning is largely data driven process. Quality of the plans and their political impact largely depend on the quality of data used for planning, their relevance for various sectors and their availability. Thus, thematic, and cross-cutting discussion and knowledge sharing are needed for learning and for the identification of appropriate platforms and repositories for the data. Availability and appropriate presentation of the data also drive involvement of stakeholders in the planning process, providing transparency of the planning solutions, assuring accounting of interests of various marine user groups and, consequently, development of the most sustainable MSP solutions.

Mapping of stakeholders involved in the maritime spatial planning process was carried out in the frame of eMSP project and covers organizations acting it the North Sea and Baltic Sea. All stakeholders can be classified based on management level and sectorial interest. Effective multi-level governance and decentralization mentioned in the Malawi Principles, requires cooperation of intergovernmental, national, and sub-national or municipal levels. Cross-sectoral cooperation engages authorities and organization representing interests of various economic sectors and businesses. Scientific community and civil society are also key players in the MSP process.

Analysis of data flows in MSP process shows that all MSP related data could be roughly divided to two major types: Input data – primarily provided by various data producers and serving as the basis for planning solutions and output data – produced in the planning process.

Sharing of input data is a crucial component of stakeholders' involvement which largely drives cross-sectoral dialog and ensures comprehensiveness of MSP knowledge base. Being produced under different policies these data could be hardly harmonized. However, availability and interoperability of this data at the highest possible level in

combination with their confidence guarantee that planning solutions are accepted by all involved parties. Sharing of input data is primarily based on exchange of metainformation and information services provided by data producers.

MSP outputs data which is produced by competent authorities is a subject of harmonization. The Baltic Sea region with strong leadership of HELCOM-VASAB MSP Working Group has developed an advanced MSP data model which is implemented in the regional MSP data sharing system Basemaps. Exploitation of this system demonstrates effectiveness and sustainability of applied data architecture combining centralized data repository for MSP output data and decentralized platform for MSP input data.

At the same time, drawing on the example of the North Sea Region, where MSP is not centrally coordinated but involves sectoral efforts, it becomes evident that international cooperation and data sharing play a crucial role. Institutions such as the International Council for the Exploration of the Sea (ICES) and initiatives like SEANSE project exemplify successful data sharing platforms and sector-specific efforts that have significantly contributed to stakeholder engagement, decision-making, and the promotion of FAIR data principles. While a centralized data sharing system is yet to be established, these sectoral efforts have been proven effective in fostering a high degree of international cooperation, illustrating the potential of a mixed centralized/decentralized approach to MSP data sharing.

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Co-funded by the European Union

Thank you for reading!

This document is a result of a joint work of the eMSP NBSR project partners and invited contributors.

It is the very last page of the document, but not the end of the eMSP NBSR project - the whole scope of project results is coming gradually and to be complete in the beginning of 2024.

Meanwhile, real-time progress and more information on all activities and events can be found at www.eMSPproject.eu