REVIEWING AND EVALUATING THE MONITORING AND ASSESSMENT OF MARITIME SPATIAL PLANNING

ReMAP

D3.4 BEST PRACTICE BASED ON DATA ANALYSIS COMPLETENESS AND QUALITY NEEDED FOR MSP

Recommendations on data analysis completeness and quality needed for MSP

Report for D3.4, Project: 101081304 — ReMAP — EMFAF-2021-PIA-MSP

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Author(s)	Emilie Delaroche – Shom; Adeline Souf – Shom; Isabel M. Moreno – CEDEX; Andrej Abramic – ULPGC; Alessandro Sarretta – CNR; Pascal Derrick – Netkit; Yannick Leroy - Shom		
Reviewed by	Yannick Leroy - Shom	Date	25/06/2025
	Andrej Abramic - ULPGC	Date	02/07/2025
	Alessandro Sarretta - CNR	Date	09/07/2025
	Isabel M. Moreno - CEDEX	Date	14/07/2025
	Adeline Souf - Shom	Date	18/07/2025
	Pascal Dericke - Netkit	Date	07/08/2025
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LIST OF ACRONYMS

AI: Artificial Intelligence

AUV: Autonomous Underwater Vehicule

BASEMAPS: map service to access Baltic Sea maritime spatial planning (MSP) relevant data from the original source where it is stored. Developed by HELCOM in cooperation with national experts from HELCOM-VASAB MSP data expert sub-group and with support from INTERREG BSR project BalticLINes (2016-2019) and EASME funded project Pan Baltic Scope (2019-2020).

CEDEX: Centre of Studies and Experimentation in Public Works - *Centro de Estudios y Experimentación de Obras Públicas*

CETMAR: Sea Technology Center - *Centro Tecnolóxico do Mar*

CNR: National Research Council - *Consiglio Nazionale delle Ricerche*

EMFAF: European Maritime, Fisheries and Aquaculture Fund

eMSP-NBSR: Emerging ecosystem-based Maritime Spatial Planning topics in North and Baltic Sea Regions

EMODnet: European Maritime Observation Data network

ENC: Electronic Navigational Charts

EU: European Union

EEZ: Exclusive Economic Zone

FAIR: Findable, Accessible, Interoperable, Reusable

GDPR: General Data Protection Regulation

GES: Good Environmental Status

GIS: Geographic Information System

HELCOM: Helsinki Commission; intergovernmental organization (IGO) and regional sea convention in the Baltic Sea area, regional platform for environmental policy making

IENWG: IHO - EU Network Working Group

IMO: International Maritime Organization

INSPIRE: Infrastructure for Spatial Information in Europe

IUAV: Venice University - *Università IUAV di Venezia*

IHO: International Hydrographic Organization

IMO: International Maritime Organization

MPA: Marine Protected Area

MS: Member State

MSFD: Marine Strategy Framework Directive

MSP: Maritime Spatial Planning

MSPdF: Maritime Spatial Planning Data Framework from TEG on data for MSP

NGO: Non-governmental organizations

OGC: Open Geospatial Consortium

PSSA: Particularly Sensitive Sea Area

ReMAP: Reviewing and Evaluating the Monitoring and Assessment of Maritime Spatial Planning

SDQF: Spatial Data Quality Framework

Shom: French Hydrographic and Oceanographic Service – *Service Hydrographique et Océanographique de la Marine*

TEG on data for MSP: Technical Expert Group on data for MSP

ULPGC: University of Las Palmas of Gran Canaria - *Universidad de Las Palmas de Gran Canaria*

WFS: Web Feature Service

WMS: Web Mapping Service

WP: WorkPackage

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INTRODUCTION

1.1. WP3 DESCRIPTION

The aim of WP3 is to gather and update input data used for national and regional Maritime Spatial Planning (MSP) initiatives/processes. The collected data will adhere to the Maritime Spatial Planning Data Framework (MSPdF) from TEG on data for MSP [1] and be harmonized following the specification of the conceptual design of the analytical models developed in WP2 for each of the 9 modules of the project (1). The harmonized input data will then be utilized in assessing the current MSP status in WP4 to run the modules developed for the project. The data collection phase is a crucial aspect of the MSP process – covering all its stages – and will be conducted by WP3 in conjunction with WP2's development of the analytical module.

1.2. OBJECTIVES OF DELIVERABLE 3.4

This deliverable aims to provide comprehensive recommendations on the completeness and quality of data necessary for effective MSP. This report outlines the key data requirements for MSP, covering both environmental and human aspects (5), while also addressing data sources and collection methods, such as remote sensing, in-situ observations, and national repositories. A major focus is on the completeness and harmonization of data used in ReMAP modules, emphasizing interoperability, standardization, and strategies to overcome data gaps. Additionally, the deliverable assesses critical dimensions of data quality, including accuracy, consistency, timeliness, and accessibility, while identifying common challenges such as inconsistent formats, overlapping datasets and outdated datasets. Through case studies in the Baltic Sea, North-Western Mediterranean Sea and Galician regions, the report showcases applications of data-driven MSP and highlights lessons learned. Finally, it offers policy recommendations for data governance, explores emerging technologies to enhance data quality and underscores the need for continuous improvement and cross-sectoral collaboration in MSP data management.

[1] https://maritime-spatial-planning.ec.europa.eu/msp-resources/technical-expert-group-teg-data-msp

1.3. KEY POLICY RECOMMENDATIONS

Here are the key recommendations highlighted in this report to be considered for MSP policy-making dimension:

☐ **Recommendation 1: ReMAP project as a foundation**

MSP projects, whether in the EU or abroad, should use the structured technical framework developed by ReMAP. To ensure the good visibility of the framework, it is recommended to promote it through the EU TEG on Data for MSP and MSP EU platform.

☐ **Recommendation 2: FAIR & INSPIRE to follow**

MSP projects, whether in the EU or abroad, should be compliant with FAIR concept and the INSPIRE principles and Open Data Directives as stated in the EU Data Act (Reg 2023/2854) (14), to support their application at national level with a view to strengthening strategic coordination at sea basin level and to align MSP data governance with the EU's broader framework for cross-sectoral data sharing and interoperability.
Considering the creation of an MSP Data Quality Label to certify datasets that meet agreed standards for accuracy, timeliness, consistency, and compliance with FAIR principles.

☐ **Recommendation 3: EMODnet MSP spatial plan requirements and updates**

MSP projects should update national spatial plans by integrating the EMODnet MSP data model and producing harmonised ontology data models for the key datasets listed by the MSPD. The aim is to provide a common, machine-readable vocabulary to enable automated data harmonisation and improve interoperability with other European data spaces.
Additionally, several attributes can be added in this "EMODnet MSP input data model" to better reference activities at sea with spatial data:

- *Sea Use Development Status (SeaUseDev)* attribute: which can reference the status of development of activities at sea. Test site/studied, approved, planned, construction, operation, decommission.
- *Site* attribute: an attribute to give the name of the activity site.

☐ **Recommendation 4: Strengthen the data harmonisation process**

Advocate for better data collection policies, encourage institutions to update their datasets more frequently and explore new technologies, such as Autonomous Underwater Vehicules (AUVs), and continue the work on automated data collection to generate more current (accurate and updated) and comprehensive datasets. In this process, the TEG on Data for MSP and the IENWG will provide support to institutions, helping them to adapt and implement these changes effectively.

☐ **Recommendation 5: Advance pan-European harmonisation and data collection**

Leverage European projects supported by the EMFAF (European Maritime, Fisheries and Aquaculture Fund) to provide financial and technical resources. These initiatives can strengthen the work of the TEG on Data for MSP and the IENWG, helping institutions across Europe contribute to more consistent and comparable datasets and improving the coherence of MSP efforts.

1.4. DATA REQUIREMENTS FOR MSP

1.4.1. DATA CATEGORISATION AND USED IN MSP

Effective MSP initiatives catalysed through a maritime development plan for the geographical area under consideration, relies on a diverse range of thematic data to ensure sustainable and well-informed decision-making. To this end, the TEG on Data for MSP has proposed a conceptual framework for identifying the input data required for producing MSP information layers to implement, monitor or revise such spatial plans (2).

The MSPdF provides the architecture for organising spatial data and the resulting geographic information into a logical structure composed by seven thematic groups (or data clusters) covering rationally and exhaustively all aspects, sectors, activities, marine/maritime analytical issues necessary to integrate for the holistic MSP processes (see *Figure 1* and *2* - at the end of this document see technical information part from Shom on data harmonization for MSP and *Appendix 1* for more details):

Figure 1. Seven clusters of the MSP data framework.

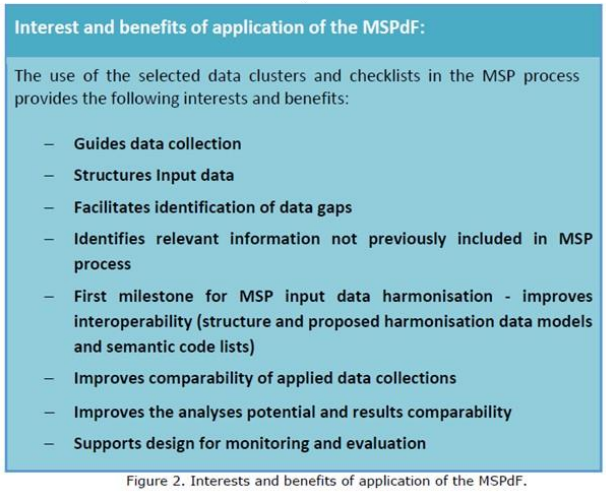


Figure 2. Interests and benefits of application of the MSPdF.

1.4.2. MSP SPATIAL PLAN DATA CREATION

MSP is a strategic process that organizes human activities in marine areas to achieve ecological, economic and social objectives. Across the European Union, coastal Member States develop MSP spatial plans to manage their maritime zones effectively. These plans delineate specific areas, known as Zoning Elements, designated for particular uses such as shipping, fishing, energy production and conservation. Developing MSP spatial plans requires a combination of spatial analysis, stakeholder engagement and adherence to standardized data practices. Utilizing tools like geographical information system (GIS) facilitates the accurate delineation of Zoning Elements, while adopting models like the EMODnet MSP data model (see *Figure 3*) ensures consistency and interoperability across European maritime regions. This deliverable is the presentation of the creation of MSP spatial plan with a methodological and pan-european technical guide.

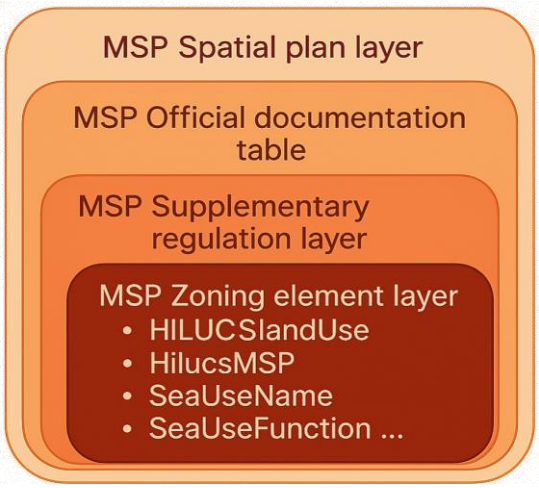


Figure 3: layered Structure: EMODnet MSP Data Model

2. DATA COLLECTION AND HARMONIZATION COMPLETENESS FOR REMAP MODULES

2.1. DEFINITION AND IMPORTANCE OF DATA WHOLENESS AND HARMONIZATION IN MSP

As stated in the report on MSP Input Data Harmonisation Recommendations from *Baltic Sea2Land* European project (3), effective MSP relies heavily on high-quality, accessible, and well-structured data. Two primary data categories exist within MSP:

- **Input data**: data used in the development of the MSP plans, including existing environmental and information on human activities data;
- **Output data**: represents the results of an MSP process, in the form of a plan defining existing and/or future sea-use alignments and preconditions.

A major challenge in MSP is the fragmented nature of input data - often scattered across multiple data providers, each using distinct formats and structures with disparities in spatial and temporal coverage - due to a lack of homogenised and comprehensive data management process. One of the useful recent case studies for

understanding this complexity has been highlighted by Shom in the eMSP NBSR project about blue corridors and maritime surveillance stakes in the North Sea [2].

This inconsistency necessitates extensive data processing and harmonization efforts before meaningful analysis can be conducted.

Harmonizing input data is especially critical at the regional level, where MSP initiatives involve multiple governance actors with diverse data management practices. Inconsistent data structures can hinder effective cross-border analysis, limiting the ability to develop coherent maritime spatial plans. To address this, data providers should adopt standardized data models for the data input information on environment, economy, governance, navigation safety, human activities at sea featuring uniform attributes and structures. Achieving data harmonization offers several advantages:

- **Reduced data processing time**: MSP practitioners can focus on analysis rather than format conversions;
- **Improved data comparability:** a common structure enhances the ability to compare datasets across different regions and governance entities;
- **Enhanced cross-border collaboration**: standardized data facilitates seamless cooperation among multiple stakeholders.
- **Improved data reusability:** harmonised datasets are ready-to-use "products" that can be directly applied in analyses, modelling, and decision-making without further transformation, supporting the reusability principle of FAIR.

2.2. CHALLENGES RELATED TO DATA GAPS AND HARMONIZATION

Despite these benefits, achieving widespread data harmonization remains challenging due to the sheer variety of data types, the transboundary nature of MSP datasets and the involvement of numerous data providers. Establishing common standards requires continuous collaboration and effort across institutional and national boundaries.

Improving data completeness and harmonization in MSP requires a multi-faceted approach, involving cross-sectoral collaboration, standardized data frameworks and the integration of diverse data sources. Key strategies include:

[2] https://www.emspproject.eu/wp-content/uploads/2024/01/Report-on-two-case-studies-Maritime-surveillance-Blue-Corridors_Final.pdf

- **Cross-sectoral collaboration and data-sharing agreements**: strengthening cooperation between European countries to ensure seamless data exchange and consistency across borders;
- **Use of standardized data models and categorization**: establishing uniform data structures to fill gaps and enhance the reliability and accessibility of input data;
- **Integration of historical and real-time data**: combining past records with live updates to provide a comprehensive and dynamic dataset for MSP decision-making.

By implementing these strategies, MSP practitioners can enhance the quality and interoperability of data, leading to more effective MSP and improved cross-border cooperation for a pan-European decision-making collaboration.

2.3. STRATEGIES TO IMPROVE DATA COMPLETENESS AND HARMONIZATION

The nine modules of the ReMAP project using input data, have significantly enhanced our understanding of data requirements for MSP. By analysing a wide range of topics — including governance, economics, the cumulative impact of human activities on ecosystems, navigation safety and the interaction between coastal activities and MSP — the project has highlighted the critical need for comprehensive and diverse data sources. As a result, we have developed a catalog of essential data for MSP following the principles of INSPIRE, FAIR and Open Data.

Data harmonization involves not only the standardization of spatial data attributes but also ensuring consistency across countries, including the alignment of spatial boundaries. In this regard, we have incorporated here some recommendations from the *Baltic Sea2Land* European project (3), which provides introducing guidelines to harmonize key MSP data. Below, we present the proposed harmonization model at the attribute level:

Offshore wind farms points

Geometry: point

Wind energy represents a vital renewable energy source and planning for wind farm development is a crucial aspect of MSP. These datasets capture information on the specific location of wind turbines (points) in each wind farm (see *Table 1*).

Attributes	Data type	Description
Country	Text	Country that reported the data
Name of wind farm	Text	Name of winds farm where the turbine belongs
Type	Text	Fixed support or floating
Status	Text	Application submitted / approved / denied / under construction / in use / out of use
Date	Date	Date of status
Power	Numeric	Planned or operational capacity of the turbine in megawatts (MW)
Height	Numeric	Height of turbine in meters

Table 1: reference table to specify harmonization attributes needed for wind farm points location

Offshore wind farms polygons

Geometry: polygon

Datasets can also represent the area covered by the wind farms. They utilize polygons to represent the spatial extent of wind farm areas (see *Table 2*).

Attributes	Data type	Description
Country	Text	Country that reported the data
Type	Text	Fixed support, floating or mix of both
Number of turbines	Number	Planned or operative number of turbines
Multiuse	Text	Yes (it includes possibility of multiuse) No (it does not include the possibility of multiuse)
Distance from coast	Number	Distance from coast in meters
Developer	Text	Name of company responsible for the management of the wind farm
Status	Text	Application submitted / approved / denied / under construction / in use / out of use
Date	Date	Date of status
Height	Number	Maximum height allowed according to the MSP plan
Power	Number	Planned or operative capacity of the whole wind farm in megawatts (MW)

Table 2: reference table to specify harmonization attributes needed for wind farm polygons spatial location

Cultural heritage points

Geometry: point

The maritime space holds a wealth of cultural heritage, including shipwrecks and archaeological sites. These datasets focus on shipwrecks, represented as points, to inform MSP decisions and ensure the protection of these sensitive areas (see *Table 3*).

Attributes	Data type	Description
Name	Text	Name of the object
Country	Text	Country that reported the data
Type of object	Text	Type of object (fishing boat, warship, …)
Object description	Text	Short description of object
Responsible authority	Text	Authority with main responsibility for its protection or management
Protection status	Text	Protection status if available
Distance to coast	Numeric	Distance to coast in meters
Depth	Numeric	Depth in meters
Date	Date	Date when protection started if available
Related info	Text	Additional info if available

Table 3: reference table to specify harmonization attributes needed for cultural heritage points spatial location

Cultural heritage sites polygons

Geometry: polygon

Cultural heritage encompasses a broader range of features beyond shipwrecks. This kind of dataset utilizes polygons to represent the spatial extent of cultural heritage sites, such as archaeological sites or underwater settlements (see *Table 4*).

Attributes	Data type	Description
Name	Text	Name of area
Protection status	Text	Protection status if available
Responsible authority	Text	Responsible authority for its protection
Habitat	Text	Type of main habitat

Table 4: reference table to specify harmonization attributes needed for cultural heritage polygons spatial location

Cables lines

Geometry: line

Underwater cables play a crucial role in infrastructure development. These datasets use lines to represent the routes of existing and planned or active cables, allowing planners to consider potential conflicts with other maritime activities (see *Table 5*).

Attributes	Data type	Description
Name	Text	Name of cable
Country	Text	Country that reported the data
Type	Text	Cable type (telecommunication, power, other)
Status	Text	Application submitted / approved / denied / under construction / in use / out of use
Date	Date	Date of status
Unit	Text	Capacity unit (kV or GB)
Capacity	Numeric	Capacity: Potential capacity of the cable or amount of data
Developer	Text	Name of company responsible for the management of the cable
Length	Numeric	Length of cable

Table 5: reference table to specify harmonization attributes needed for cables lines spatial location

To align with these recommendations on data harmonization at the attributes level coming for *Baltic Sea 2 Land* projet and to continue to ensure consistency and interoperability in data integration, a standardized approach to data input is essential.

In Appendix 2 of this deliverable is presented the complete data model for ReMAP modules data input harmonization, providing a structured approach to harmonize datasets, which can also serve as a foundation for MSP in a broader context. This model facilitates the organization, validation and exchange of diverse datasets, enabling seamless integration across various MSP applications. By adopting this minimum harmonized framework, data-driven decision-making processes can be improved, supporting more efficient spatial planning and management of maritime resources. Mostly all the attributes specified in the table in *Appendix 3* comes from EMODnet data attributes as the reference for pan-European maritime datasets.

Recommendation 1 →

MSP projects, whether in the EU or abroad, should use the structured technical framework developed by ReMAP. To ensure the good visibility of the framework, it is recommended to promote it through the EU TEG on Data for MSP and MSP EU platform.

3. DATA QUALITY IN MSP

3.1. KEY DIMENSIONS OF DATA QUALITY

Data quality is essential to ensure reliable and meaningful insights. It is defined by several key dimensions (see *Figure 4*):

- **Accuracy**: data must correctly represent real-world values and be free from errors;
- **Consistency**: information should be uniform across different datasets and systems, avoiding contradictions;
- **Timeliness**: data should be up-to-date and available when needed to support decision-making processes;
- **Accessibility**: users must be able to easily retrieve and use the data without unnecessary restrictions;
- **Relevance**: the data must be suitable for its intended purpose, providing valuable and applicable insights.

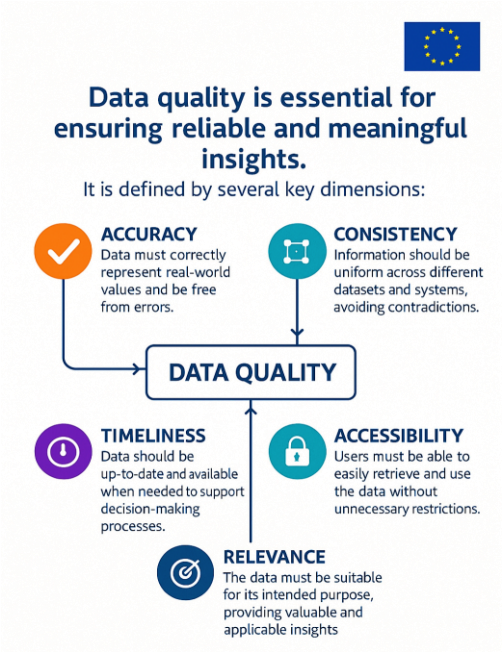


Figure 4: MSP data quality needs

Ensuring high data quality across these dimensions enhances reliability, improves decision-making and maximizes the value of information.

Data must comply with INSPIRE standards (10) and follow FAIR principles (17) to ensure high-quality, interoperable, and accessible information for MSP. INSPIRE (Infrastructure for Spatial Information in Europe) is a European directive that establishes a framework to share environmental and geographic data across EU countries. It promotes standardization, interoperability and harmonization of spatial datasets to support policy-making and cross-border cooperation. Meanwhile, FAIR principles ensure that data can be easily located, retrieved, integrated with other datasets and effectively reused by different stakeholders. Applying both INSPIRE and FAIR principles enhances data consistency, accessibility and usability, facilitating better decision-making in MSP and environmental management.

3.2. COMMON ISSUES AFFECTING DATA QUALITY

Several factors can compromise data quality, limiting its reliability and usability:

- Inconsistent formats across datasets can create integration challenges, making it difficult to compare or analyse information effectively.

- Outdated datasets reduce the accuracy of decision-making, as they may not reflect current conditions or changes over time. For instance, the MSFD assessment for GES is only available for 2018 (WISE portal), with no updated version yet published for 2024. As a result, these estimations are based on data that is now significantly outdated, reducing their relevance and applicability to current environmental conditions.
- Lack of metadata further complicates data interpretation, as users may struggle to understand its source, structure, or relevance.
- Non-adherence to INSPIRE recommendations (10) and FAIR principles (17) bring a lack of data standardization, making cross-border cooperation and interoperability more complex.
- Another critical issue is that spatial data across different countries do not always share the same reference polygons for spatial data, leading to inconsistencies and overlapping information. These discrepancies can create conflicts in MSP and decision making, as areas may appear duplicated or misaligned, complicating international coordination. Standardizing spatial reference frameworks and ensuring alignment between datasets can help minimize these overlaps and improve data harmonization across borders.

Addressing these issues is essential to ensure high-quality, reliable data for MSP and other critical applications.

3.3. BEST PRACTICES TO ENSURE HIGH-QUALITY DATA

Ensuring high data quality requires a structured approach based on standardization, validation and transparency. The standardization of data formats and collection protocols is essential to improve interoperability and facilitate seamless data integration across systems and countries. Implementing quality control and validation processes helps detect and correct errors, ensuring data accuracy and reliability. Additionally, comprehensive metadata documentation enhances transparency by providing essential information about the data's source, structure, and relevance. By applying these best practices, organizations can improve data consistency, facilitate cross-border collaboration, and support more effective decision-making in spatial planning and environmental management.

Recommendation 2 →

MSP projects, whether in the EU or abroad, should be compliant with FAIR concept and the INSPIRE principles and Open Data Directives as stated in the EU Data Act (Reg 2023/2854) (14), to support their application at national level with a view to strengthening strategic coordination at sea basin level and to align MSP data governance with the EU's broader framework for cross-sectoral data sharing and interoperability.

Considering the creation of an MSP Data Quality Label to certify datasets that meet agreed standards for accuracy, timeliness, consistency, relevance and compliance with FAIR principles.

4. CASE STUDIES AND PRACTICAL APPLICATIONS IN REMAP MODULES

4.1. SUCCESSFUL IMPLEMENTATION OF DATA-DRIVEN MSP

A clear illustration of how harmonized MSP Spatial Plans enhance project modules analyses can be found in the ReMAP initiative. In the case presented in this paragraph, the navigation safety is analysed with ingested MSP datasets—sourced from EMODnet and Tools4MSP general metadata catalog, filled in during the project replying to the need from module developers of ReMAP project to run their module move forward during ReMAP data collection and harmonization meetings —relying on MSP Zoning Element and its two key attributes: seaUseFunction, which categorizes the intended use of each zone, and seaUseDescription, which provides a human-readable explanation of planned.

By standardizing these simple attributes across all participating EU Member States MSP Spatial Plan Zoning Element data, it is possible with a simple GIS to compute where different maritime activities occur or are planned, without spending extra effort reconciling divergent coding schemes to specify if there is conflict with navigation safety for example.

In the Baltic Sea case study, vessel density data from EMODnet was overlaid on harmonized MSP zones (see *Figure 5*). The resulting analysis exposed several high-traffic sea lanes intersecting zones allocated to large-scale infrastructure or military operations (see *Figure 6*). Thanks to the unified seaUseFunction and seaUseDescription fields, planners could instantly spot potential conflicts between planned activities and marine traffic and evaluate navigation safety risks alongside future development plans—demonstrating how harmonized zoning attributes enable rapid and accurate assessments.

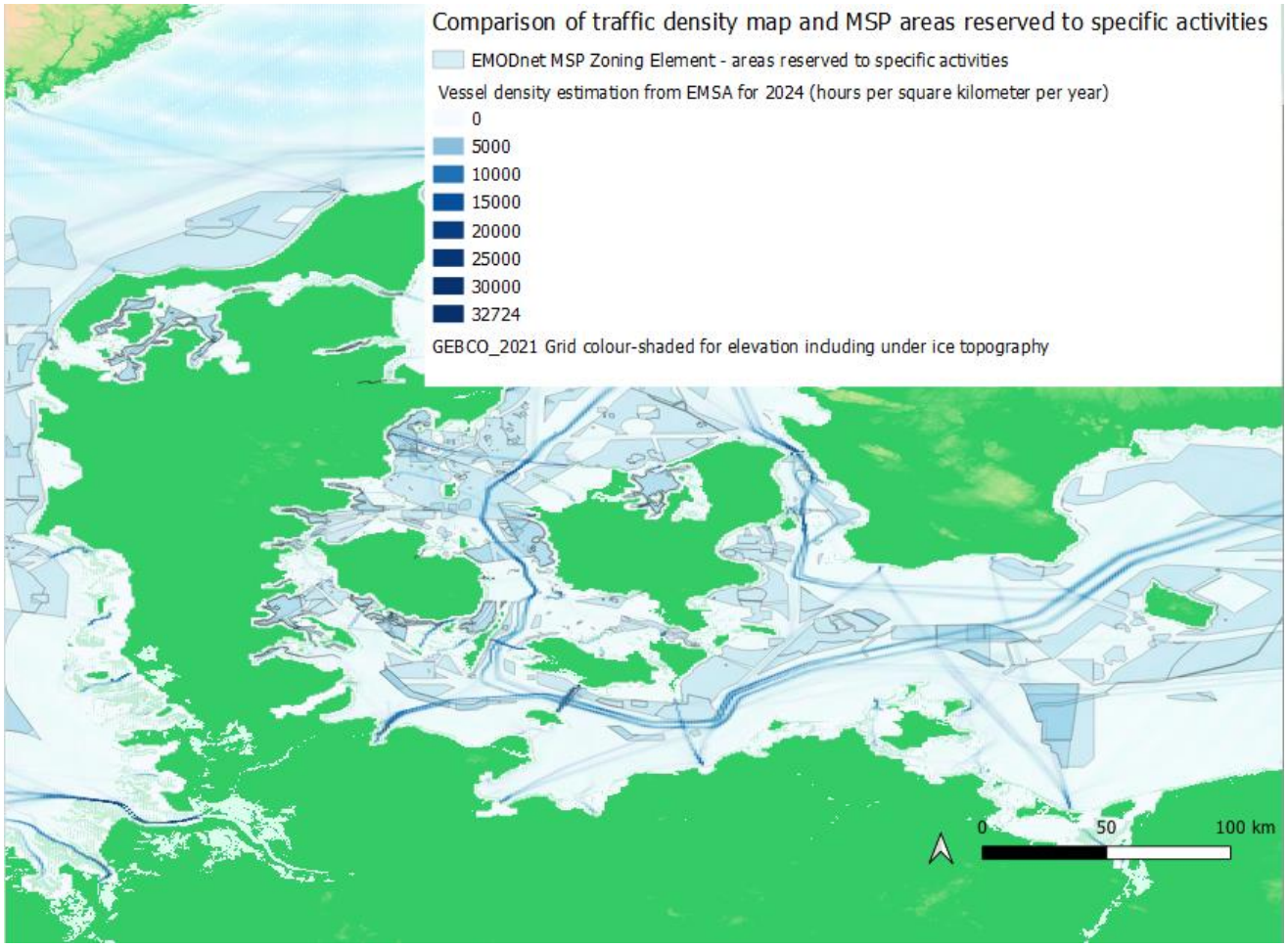


Figure 5: Map coming from a GIS representing MSP areas reserved for specific activities from MSP spatial plan zoning element data layer of HELCOM Map and data service and the superposition with route density from EMSA on EMODnet for the specific area between Sweden and Denmark in the Baltic sea.

Importantly, this approach is not unique to navigation safety. Every ReMAP module—from environmental impact assessment tools to energy infrastructure planners—depends on the same consistent spatial dataset. By aligning MSP Zoning Elements across EMODnet and Tools4MSP and ensuring each zone carries precise seaUseFunction and seaUseDescription information, the ReMAP project delivers reliable, sector-specific insights within a single, coherent MSP framework. This harmonization ultimately underpins better-informed decisions and smoother cross-border collaboration, whether the focus is on navigation safety, ecological protection, or offshore development.

By integrating diverse datasets already harmonized through ReMAP modules, planners will more effectively identify potential conflicts between existing sea uses and future development or restricted zones. Here we exemplify how data-driven approaches can support more informed and sustainable MSP decisions, enhancing both safety and operational efficiency at sea with harmonized data.

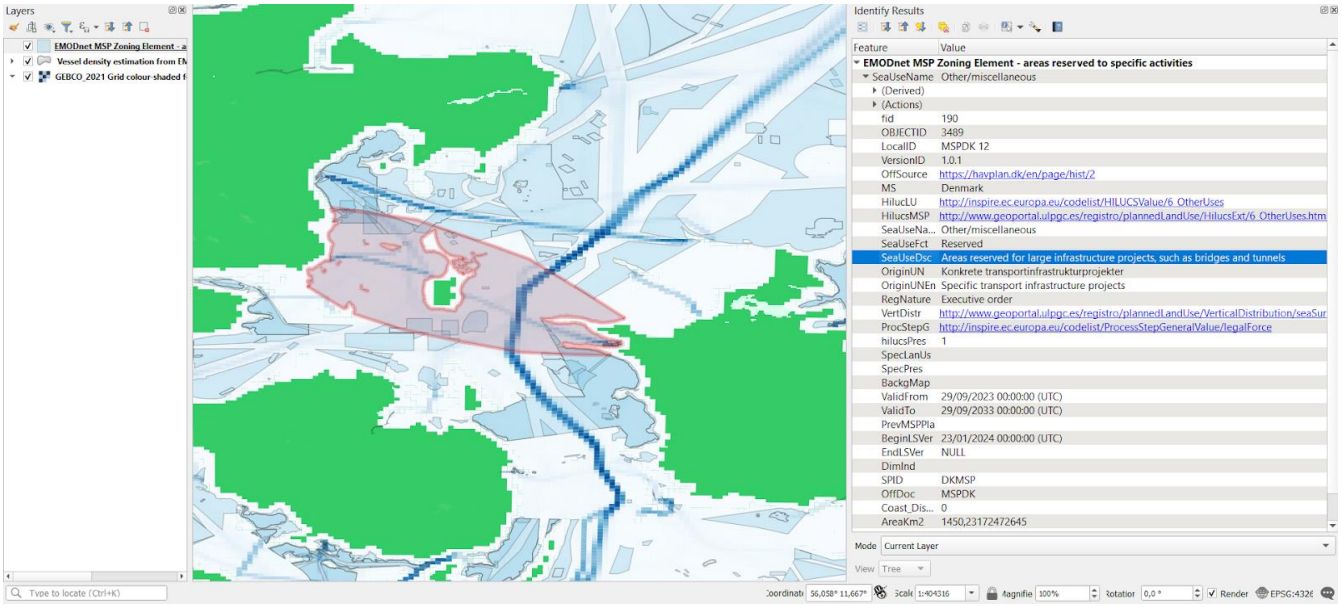


Figure 6: Map coming from a GIS representing a specific MSP zoning element area with sea use function reserved and sea use description areas reserved for large infrastructure projects, such as bridges and tunnels and route density layer from EMSA on EMODnet below.

Recommendation 3 →

MSP projects should update national spatial plans by integrating the EMODnet MSP data model and producing harmonised ontology data models for the key datasets listed by the MSPD. The aim is to provide a common, machine-readable vocabulary to enable automated data harmonisation and improve interoperability with other European data spaces.
Additionally, several attributes can be added in this "EMODnet MSP input data model" to better reference activities at sea with spatial data:

- *Sea Use Development Status (SeaUseDev)* attribute: which can reference the status of development of activities at sea. Test site/studied, approved, planned, construction, operation, decommission.
- *Site* attribute: an attribute to give the name of the activity site.

4.2 Input data module output analyses

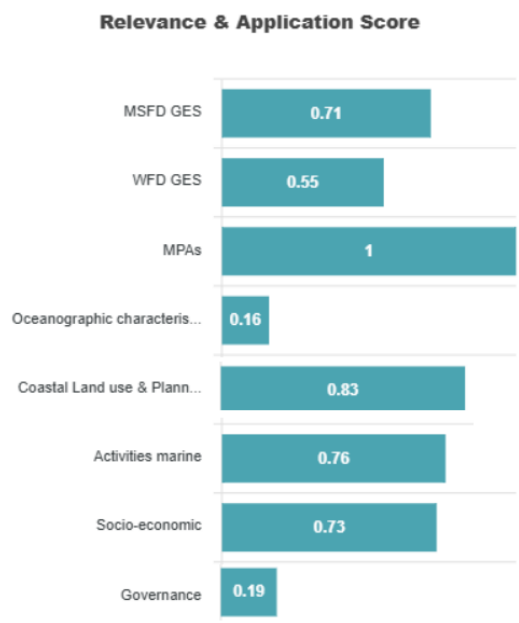
In this paragraph is presented the input data module output for French Mediterranean Sea made for MSP plans coming from Input Data Module developed by ReMAP project (see *Figure 7*). More explanations on the different scores presented in the figures are given in *Annex 3*.

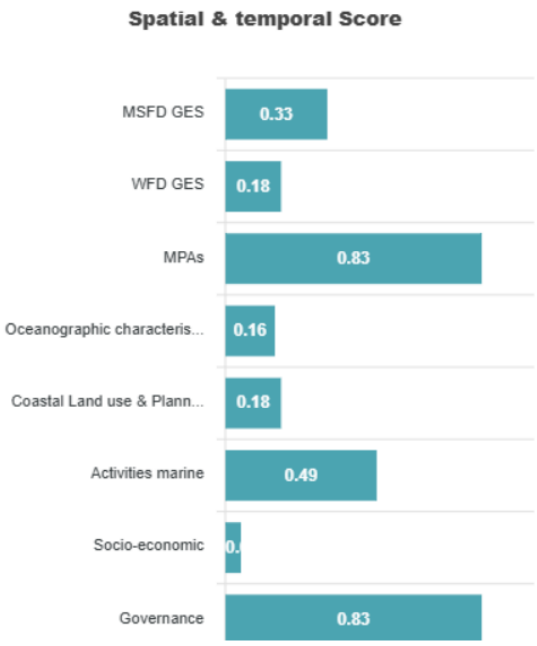
MPAs are particularly important, as they represent zones that should be protected from pollution, intensive fishing, and other forms of intense maritime exploitation. These areas are a central focus of MSP, which must ensure their proper consideration in the planning process.

Coastal land use is also a key element, given its direct interaction with the marine environment. It can contribute to nutrient inflows and pollution, thereby affecting marine ecosystems.

Maritime activities have a direct impact on benthic habitats, hydrological conditions, and marine wildlife. The marine environment is sensitive to human presence and actions at sea. Consequently, MSP must serve as the guiding framework for regulating these activities to ensure they do not harm marine ecosystems.

The data input for MSP that most respect FAIR transparency principles are the governance data (EEZ limits, maritime borders, territorial sea, jurisdiction limit, etc). Followed by the socio-economic data presented mainly in Eurostat portal.





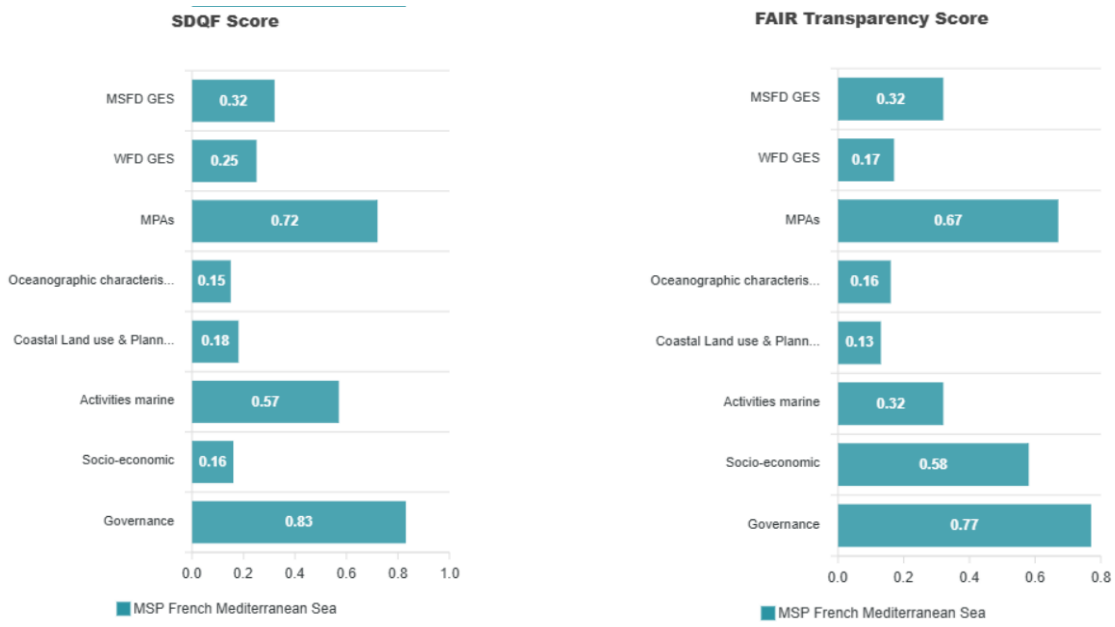


Figure 7: Input data module output on MSP spatial plan for French Mediterranean Sea summary. On the left upper side: relevance and application score of each data input category on actual MSP plan, on the right upper side: FAIR transparency score of the input data in MSP plan, on the left bottom side: spatial and temporal score of input data in MSP plan and spatial data qualify framework for actual MSP plan for French Mediterranean sea area.

4.3. LESSONS LEARNED FROM MODULES APPLICATIONS

One of the main challenges encountered in the modules was dealing with large datasets, making it difficult to harmonize all the data required for the different ReMAP use cases. Each dataset contained a vast amount of information, often coming from various sources, which increased the complexity of standardization. Ensuring consistency across all data while maintaining its integrity required significant effort. Emerging generative Artificial Intelligence (AI) and AI-assisted tools can help automate metadata creation, schema mapping, and also data cleaning. It will help reducing the manual workload of harmonising large, multi-source MSP datasets.

Another major issue was the difficulty in spatial harmonization, as the spatial polygons used for each use case do not have the same boundaries or limits. These differences created inconsistencies when trying to align datasets for comparative analysis or integrated assessments. Addressing these spatial discrepancies required additional processing and methodological adjustments from national maritime spatial planning decision makers.

Furthermore, filling in all the necessary attributes in the datasets was a key challenge, as not all data sources provided the same level of detail or completeness. To overcome this, it became essential to specify the most important attributes to focus on, ensuring that the data remained relevant and useful for the intended analyses.

Identifying these priority attributes helped streamline data processing and improved the overall efficiency of data integration within the ReMAP framework.

Another critical challenge was the lack of up-to-date data. In many cases, the available datasets were outdated, sometimes dating back to the early 2010s, whereas the ReMAP framework required more recent information, ideally from 2020 or later. The reliance on old data introduced uncertainties and potential inaccuracies in the analysis, as environmental, economic and social conditions have evolved significantly over the past decade. This issue was particularly problematic for dynamic sectors where changes occur rapidly, such as land use, climate patterns, or socio-economic indicators.

To address this issue, it is essential to advocate for better data collection policies, encourage institutions to update their datasets more frequently, and explore new technologies, such as remote sensing and continue the work on automated data collection began by Shom in ReMAP project, to generate more current and comprehensive datasets. Establishing collaborations with relevant stakeholders and data providers could also help improve access to fresher data and ensure that the analyses remain as relevant and precise as possible. Using the Input data module and developing reports on what data is missing, what data needs an update regarding the transparency (FAIR), coverage, resolution and quality, include well structured and comparable information on current data MSP requirements and updates.

Recommendation 4 →

Advocate for better data collection policies, encourage institutions to update their datasets more frequently, and explore new technologies, such as remote sensing and continue the work on automated data collection to generate more current (accurate and updated datasets) and comprehensive datasets. In this process, the TEG on Data for MSP and the IENWG will provide support to institutions, helping them to adapt and implement these changes effectively.

4.4. CONCLUSIONS ON EACH USE CASES OF THE PROJECT

4.4.1. BALTIC SEA USE CASE

The Baltic Sea use case within the ReMAP project served as a critical regional application of the developed framework, demonstrating the potential for cross-border integration of marine spatial data. Despite the involvement of nine countries bordering the Baltic Sea, the data was relatively easy to access thanks to well-established regional structures, particularly the Helsinki Commission (HELCOM). HELCOM, an intergovernmental organization dedicated to protecting the marine environment of the Baltic Sea, maintains the HELCOM Map and Data Service (MADS), a centralized Spatial Data Infrastructure (SDI) that consolidates data from all Baltic countries. This platform provides standardized datasets compiled through national reporting under joint regional agreements.

The data, especially those related to MSP, were already harmonized to a large extent, which facilitated their integration into the ReMAP framework. Where necessary, additional harmonization was conducted to ensure full alignment with ReMAP standards. A key challenge remained: variability in data availability and formats across national systems, particularly for modules requiring standards not yet implemented.

These gaps were addressed through collaborative efforts with module developers and targeted data processing. Overall, the Baltic Sea use case highlighted the effectiveness of regional cooperation mechanisms, such as HELCOM, in supporting structured data collection and harmonization across jurisdictions. The success of this case illustrates the importance of mature, centralized data infrastructures in enabling interoperable and scalable marine data management.

→ See the complete dataset compilation for this area in Milestone 3.2.1 of ReMAP project.

4.4.2. North-Western Mediterranean use case

The North-Western Mediterranean use case, involving France, Spain, and Italy, illustrated the challenges and progress associated with harmonizing MSP data across multiple national frameworks. Both France and Spain have made significant strides by providing their MSP plans for the Mediterranean region, although only Spain has currently made its data fully available through EMODnet.

France is expected to publish its updated spatial plans on EMODnet by early 2026, following the upcoming revision of the *Documents Stratégiques de Façade* (15) for the moment in public consultation phase. At present, French MSP data is organized into broad vocation areas ("zones de vocation") — extensive areas where certain maritime activities, such as fishing or aquaculture, are permitted or prioritized. However, these zones lack detailed categorization; they do not define reserved, restricted, or prohibited areas, nor do they outline zones for potential activity development. This coarse spatial information complicates precise harmonization with other national datasets.

Italy, meanwhile, has made its MSP plans viewable via its national maritime portal SID, but these datasets are not yet available for download or integrated into EMODnet's pan-European catalogue (process in progress). The spatial data developed during ReMAP Project by CNR for Italy's maritime spatial planning is available on the portal already used for the MSPMed project, within the Tools4MSP catalogue, in a downloadable format.

Harmonizing data from the three countries remains a complex task due to differences in data structure, terminology, and availability. The lack of fully standardized, accessible datasets at the European level presents significant barriers to seamless integration into the ReMAP framework. Despite these difficulties, ongoing national

efforts and upcoming updates to MSP documentation offer a promising path toward a more unified and interoperable data landscape for the North-Western Mediterranean Sea.

→ See the complete dataset compilation for this area in Milestone 3.2.3 of ReMAP project.

4.4.3. GALICIAN USE CASE

The Galician use case represents a valuable local-level contribution to Spain's national MSP process, offering a bottom-up perspective not directly addressed by national MSP authority. This regional initiative provided rich and detailed data that complemented the broader planning framework by integrating local maritime realities. Galicia focused its efforts on collecting and harmonizing spatial data for marinas, ports and diving areas — all contributing to the Cumulative Impact Assessment module; conservation zones, including Natura 2000 sites and other specially protected areas — supporting the Conservation module and land-based activities influencing marine areas — informing the Land-Sea Interaction module of ReMAP. This locally driven approach enabled the inclusion of up-to-date, fine-scale knowledge. However, several challenges emerged due to the spatial scope of the analysis. One key difficulty was the limited availability of economic and MSFD-related data at the regional level, as most of the geoportals harvested during the project provide data primarily at national or international scales. Additionally, disparities in data formats, spatial resolutions, and thematic classifications necessitated significant harmonization efforts to ensure interoperability with national datasets and compatibility with the ReMAP framework's analytical tools. Despite these hurdles, the Galician case highlighted the added value of regional initiatives in enriching national MSP processes and underscored the importance of developing stronger links between regional data providers and centralized data infrastructures.

→ See the complete dataset compilation for this area in Milestone 3.2.2 of ReMAP project.

5. FUTURE DIRECTIONS AND TECHNICAL RECOMMENDATIONS

5.1. EMERGING TECHNOLOGIES TO ENHANCE DATA QUALITY AND COMPLETENESS

Emerging technologies play a pivotal role in enhancing the quality and completeness of data used in MSP and environmental monitoring. Advancements in remote sensing technologies, such as high-resolution satellites and drones, allow for more accurate and timely data collection from marine and coastal environments. These technologies enable the monitoring of dynamic oceanographic variables, including sea surface temperatures, currents, and ecosystem health indicators, with unprecedented precision.

The use of underwater vehicles (AUVs) further expands the scope of in-situ data collection, making it possible to gather real-time data from previously hard-to-reach areas as Shom did by recently acquiring AUVs to notably carry out hydrographic surveys (paper link, see *Figure 8*).

Figure 8: image of testing for the IXblue AUV operated by Shom marine hydrographers.

Moreover, blockchain technology is being explored to ensure the integrity and traceability of data, promoting transparency in data sharing and reducing the risk of manipulation or errors. By leveraging these cutting-edge technologies, the quality, resolution and accessibility of marine data can be significantly improved, enabling more informed decision-making for sustainable marine management.

The digital turn in MSP is also reflected in the deployment of Digital Twin of the Oceans (DTO). Initiatives like European DTO (EDITO), through their both projects (Infra and Model-lab) [3] could ensure data quality and completeness in providing a technological environment which requires a data management rationalisation. DTO also raises the question of the integration of decision-support tools (e.g. ReMAP tools), whose role in providing well-informed data for decision making is becoming important for MSP practitioners.

5.2 NEED FOR CONTINUOUS IMPROVEMENT AND CAPACITY BUILDING

To ensure that data sharing, collaboration, and MSP remain effective in the face of evolving challenges, there is a critical need for continuous improvement and capacity building within the relevant stakeholders. One relevant approach is the Community of Practice (COP) approach developed as part of the eMSP NBSR project to manage specific issues, like data sharing [4]. Another approach is to implement MSP Library | The European Maritime Spatial Planning Platform, the European MSP Literacy Platform to provide ongoing, accessible training, tutorials, and resources on MSP data standards, tools, and best practices.

[3] https://edito-infra.eu/european-digital-twin-ocean-introducing-edito-infra/

[4] https://www.emspproject.eu/project-activities/community-of-practice/data-sharing/

This could be coupled with the work of the TEG, in an architecture of European governance of MSP reference data to be developed.

Recommendation 5 →

Leverage European projects to provide financial and technical resources. These initiatives can strengthen the work of the TEG on Data for MSP and the IENWG, helping institutions across Europe contribute to more consistent and comparable datasets and improving the coherence of MSP efforts.

Training and education are vital in equipping personnel from governmental bodies, research institutions and private entities with the necessary skills to use emerging technologies, analyse complex datasets and apply the results to practical policy decisions. Capacity building should extend beyond technical training to include developing a strong understanding of data ethics, governance and the legal frameworks required for cross-border collaboration. Establishing specialized programs, workshops and certifications that focus on data management, climate change impacts and marine ecosystem monitoring can ensure that professionals are always prepared to handle the evolving landscape of marine data. Moreover, fostering collaboration between universities, research centres, and industry stakeholders can help advance innovation in the field, while ensuring that best practices are shared and widely adopted. Continuous improvement also involves adapting to the fast-paced advancements in technology and incorporating feedback from data users to refine systems and tools. This dynamic, capacity-building approach will be essential in enhancing data stewardship, ensuring the long-term effectiveness and sustainability of marine data initiation.

5.3. TECHNICAL RECOMMENDATIONS FOR DATA MANAGEMENT

❖ **Standardization of data formats and frameworks:**

- To address the fragmentation of datasets, the adoption of standardized data formats and frameworks across Member States should be promoted. This includes the widespread implementation of the **INSPIRE directive** (10) for spatial data interoperability and **FAIR principles** (Findable, Accessible, Interoperable, Reusable) (17) for data management. An harmonized approach to data formats will reduce processing time, improve data comparability and foster seamless cross-border collaboration. These efforts could be strengthened by setting **mandatory guidelines for data standards**, as outlined in this report, ensuring all EU member states follow uniform protocols for data collection, processing and sharing.
- Data harmonization is not only about standardizing spatial data formats but also ensuring consistency across countries, including the alignment of spatial boundaries as the Exclusive Economic Zone (EEZ) of each EU countries is not clearly defined at each maritime border between states. The **MSP Data**

Framework (MSPdF) from the **TEG on Data for MSP** (2) emphasises the importance of aligning datasets to facilitate interoperability. In this regard, the EU should prioritize **attribute-level harmonization**. For example, **the *Baltic Sea2Land* European project** (3) has provided key guidelines for harmonizing data across regions, especially for critical MSP data such as offshore windfarms, cultural heritage sites and subsea cables. The recommendations from **HELCOM Vasab** in this project offer valuable insights into how these datasets should be harmonized, ensuring that spatial data attributes are aligned across Member States for more effective MSP.

- Another key report coming from EU project is the one from REGINA-MSP project (2022-2024), which gives important insight on how to harmonized data sharing processes in marine geoportals (6, https://www.regina-msp.eu/sites/regina/files/inline-files/Deliverable%203.2%20-%20Data%20Report.pdf).
- The report also highlights the importance of harmonizing the **specific attributes** required for MSP, particularly those necessary to run **ReMAP's modules**. These modules, which address various aspects of MSP, rely on a consistent set of attributes for data related to human activities, marine ecosystems and spatial boundaries. The dataset attributes outlined in this report, such as those for offshore windfarms, cultural heritage and underwater cables should serve as **standardized guidelines** for dataset harmonization, ensuring that data is consistent, comparable and accessible across regions.
- By integrating these attributes into national and EU-wide datasets, the EU can ensure a **coherent, standardized approach** to MSP that meets the requirements of all stakeholders and improves cross-border collaboration. Following these recommendations will lead to better data quality, enhanced interoperability and a more efficient approach to MSP across EU.

❖ **Enhanced data sharing and collaboration between Member States:**

- Given the transboundary nature of marine environments, fostering data-sharing agreements between European countries is crucial. A comprehensive framework that facilitates the seamless exchange of MSP data, including environmental, socio-economic and legal data should be push forward with the implementation of all data harmonized and presented in this deliverable and collected in *deliverable 3.2* (7) of ReMAP project in **EMODnet data catalogue**. This should include better integration of **cross-border data** and **simplification of data sharing process in the platform** where public and private stakeholders, including national authorities, researchers and NGOs, can access relevant datasets with for example formation accessible freely in visioconference format to do so easily.
- Specifically, **climate-related data** such as sea surface temperatures, ocean salinity, currents and atmospheric pressure are essential for assessing the impacts of climate change on marine ecosystems and can be found in Copernicus data base. Furthermore, incorporating data on extreme weather events, such

as storms and heatwaves, as well as long-term trends like sea-level rise, will enable more effective decision-making in MSP. Collaboration should also extend to the integration of climate models that predict future environmental changes, offering valuable insights for the development of adaptation strategies. By pooling these data resources, the EU can enhance its capacity to manage marine and coastal areas, promote sustainability and mitigate the impacts of climate change on the marine environment.

❖ **Updating and modernizing data collection:**

- **Regular update of data** used in MSP should be prioritized. Currently, many datasets are outdated, some dating back to the 2010s, which affects the quality and relevance of the analysis. National authorities and data providers should be encouraged to invest in technologies that enable **real-time data collection** and **automated data systems**, such as remote sensing and satellite-based technologies. Moreover, **EU funding programs** should be directed towards the development of state-of-the-art technologies for **continuous monitoring** and the generation of up-to-date environmental and socio-economic datasets.

❖ **Support for national data infrastructure and capacity building:**

- In many cases, local and regional authorities struggle to manage and harmonize large datasets due to limited technical expertise and resources.
- A key component of this initiative should involve aligning national data infrastructures with EU-wide standards for spatial data, following the recommendations provided by the **Technical Expert Group (TEG) on Data for MSP**. The **MSP Data Framework (MSPdF)** (2) categorization, which is linked to the **Marine Strategy Framework Directive (MSFD)**, offers a robust approach to ensure that environmental, socio-economic and legal data are harmonized across regions and sectors. By adopting the MSPdF and its categorization for data collection, countries will ensure consistency and compatibility, improving data accessibility and usability across borders.
- Furthermore, the EU should consider for the integration of **IHO's S-100 standard in MSP**, which is widely used in **Electronic Navigational Charts (ENCs)** and provides a modern, comprehensive framework for maritime data categorization. The S-100 standard covers essential maritime data, including bathymetric surfaces, marine traffic management and under keel clearance management, which can serve as a strong foundation for MSP and navigation, especially when harmonizing spatial datasets for marine planning.
- By combining these standards — MSPdF (2), MSFD and S-100 — national data repositories can be upgraded to be more accessible, efficient and aligned with EU-wide requirements. The EU should allocate resources to ensure that national systems are not only harmonized but also equipped with the tools to manage and integrate data effectively. This holistic approach will enable better cross-border collaboration, enhance data quality and accessibility, and ultimately improve the management of marine spaces in line with sustainability goals.

- **Incentivizing the collection of specific data for MSP:**
  - Collection of **specific, targeted data** critical for MSP should be encouraged. The work of a **dedicated EU data collection program** could continue to incentivize national authorities and industry stakeholders to fill data gaps by providing funding, guidance and technical support based on the *Deliverable 3.3* of ReMAP (8). These datasets would be essential to balance **economic development** and **environmental sustainability** in MSP.

- **Encouraging stakeholder engagement and citizen science:**
  - Local knowledge plays a critical role in data collection, particularly for scientific, socio-economic and cultural datasets. The EU should actively promote **public involvement in data collection** initiatives, providing financial and technical incentives for **crowd-sourced data**. Local communities, fishermen and other maritime stakeholders can provide invaluable insights into regional conditions, which can help fill data gaps. By involving **citizens and local stakeholders** in the data collection process, the EU can ensure more **inclusive** and **locally relevant** datasets for MSP.

- **Legislative framework for data governance and protection:**
  - With the increasing volume of data being collected and shared across borders, it is essential to establish robust **data governance policies** that ensure data security, privacy and ethical considerations are respected. The EU should encourage the use of INSPIRE and Open Data directives as a **comprehensive data governance framework** that ensures **transparency** and **accountability** in the use of marine data. This framework should include clear policies on data **ownership**, **access** and **sharing** and establish guidelines for **data protection**.

- **Long-term data sustainability:**
  - Data collection and management should not only focus on short-term needs but also prioritize the **long-term sustainability** of data repositories. **Maintenance** and **updating** of long-term datasets and financial incentives should be provided and fund to ensure the continuous operation of marine data infrastructure. Special attention should be given to ensure that the collected data is accessible to all stakeholders involved in **sustainable ocean management** for the long haul.

CONCLUSION

In this report D3.4 we underscore the vital importance of data harmonization to support effective MSP across Europe. Current fragmentation of data between EU Member States significantly challenges the comparability and coherence necessary for transnational MSP initiatives. To address this, the report emphasizes establishing standardized frameworks and practices to ensure data interoperability, transparency and consistency, thus enabling informed decision-making and efficient planning. A central recommendation is to build upon **ReMAP project** as a foundation for harmonizing MSP datasets. The structured model developed by ReMAP can serve both EU and international MSP projects, supporting standardized data integration. To enhance its impact, the report advises promoting ReMAP database via the EU TEG on Data for MSP and the EU MSP platform. Moreover, the report recommends that all MSP projects adhere to **FAIR principles** (17) (Findable, Accessible, Interoperable and Reusable) and **INSPIRE Directive** (10), alongside Open Data Directives. This compliance would significantly improve data accessibility, reduce processing time, and ensure datasets are comparable across borders. To further refine harmonization, the report proposes updates to **EMODnet MSP data model**, including new attributes like *Sea Use Development Status* —capturing phases such as planned, under construction, or operational—and a *Site* attribute to name activity sites. These additions would enable more precise referencing of maritime activities. Strengthening the data harmonization process also requires **improved data collection policies**, encouraging more frequent updates and exploring technologies like remote sensing and automated data collection. Here, the TEG on Data for MSP and the IENWG can guide institutions to implement these practices effectively. To advance **pan-European harmonization**, the report calls for leveraging financial and technical resources from EU projects. This approach will support consistent, high-quality datasets across Member States, bolstering the coherence of MSP initiatives. Beyond technical solutions, the report highlights the critical need for **transnational collaboration**. As marine and coastal areas often span multiple jurisdictions, effective MSP depends on close cooperation among national authorities, regional bodies, research institutions, civil society and the private sector. Sharing knowledge, tools, and best practices can help develop harmonized data systems and address common challenges. The EU is well-placed to foster this collaboration by facilitating dedicated platforms and networks such as EMODnet, WISE marine, Copernicus and EUROSTAT. These platforms not only provide technical guidance but also encourage collective problem-solving and knowledge exchange, supporting countries at different stages of MSP maturity. In conclusion, successfully harmonizing and managing data for MSP in Europe requires a multi-layered strategy: adopting standardized data formats and frameworks, aligning data attributes with international and EU standards, modernizing data collection, and strengthening national capacities. These efforts, supported by European projects and funding, will create a robust and interoperable data infrastructure that ensures MSP is coherent, efficient and sustainable—serving both local and transnational governance objectives.

BIBLIOGRAPHY

(1) Abramic, A.; Menegon, S.; Sottiriva, S.; Ricon, Y.I.; Santiago, J.L.; Ballesteros, M.; Vallejo, Y.F.-P.; Delaroche, E.; Shinoda, D.; Carella, F.; et al. Towards Sustainable Seas: ReMAP's Contribution to Monitoring and Evaluating Maritime Spatial Plans.

(2) Abramic, A., Norton, D., Sarretta, A., Menegon, S., Katsika, M., Gekas, V., Rybka, K., Fernández-Palacios, Y. (2023). Maritime Spatial Planning Data Framework (MSPdF). How to structure input data for MSP process, monitoring & evaluation. Produced by Technical Expert Group (TEG) on Data for MSP. Supported by CINEA and DG MARE (EC). 45p. Doi: 10.2926/440667

(3) Baltic Sea2Land Project. (2023). MSP input data harmonisation recommendations. VASAB Secretariat. (Baltic Sea2Land project deliverable)

(4) Committee on Spatial Planning and Development of the Baltic Sea Region (CSPD/BSR) & Helsinki Commission (HELCOM). (2019). Guidelines on transboundary MSP output data structure in the Baltic Sea (Adopted at the 80th meeting of VASAB CSPD/BSR, 23 January 2019, Schwerin, Germany; and at the 40th meeting of HELCOM, 6–7 March 2019, Helsinki, Finland).

(5) Ehler C. et Douvere F., 2009. Marine Spatial Planning: a step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission (IOC) and Man and the Biosphere Programme (MAB), IOC Manual & Guides, N° 53, Paris: UNESCO, 99 p

(6) Delaroche, E., Esquerré, A., Souf, A., Ramieri, E., Papageorgiou, M., Campillos, M., Bocci, M., Carella, F., Brigolin, D., Châles, F., Changeant, A., Porporato, E., Kyvelou, S., Sakellariou, S., Menegon, S., Leroy, Y. 2024. Data report: analysis on regional data and geoportal of interest for national MSP. REGINA-MSP project, European Climate, Infrastructure and Environment Executive Agency.

(7) Delaroche, E., Leroy, Y., Shinoda, D., Santiago, J. L., Sarretta, A., & Abramic, A. (2025). D3.2 Catalogue of the ReMAP collected and harmonized datasets: Report for D3.2, Project: 101081304 — ReMAP — EMFAF-2021-PIA-MSP. European Union.

(8) Delaroche, E., Ortiz de Zarate, Y., Leroy, Y., Abramic, A., & Sarretta, A. (2025). Recommendations toward the collection and integration from non-public actors data for MSP consideration: Analysis and methodological guidance on sharing non-official data and information (Deliverable D3.3). Project: 101081304 — ReMAP — EMFAF-2021-PIA-MSP. European Union.

(9) Delaroche E., Souf A., Shinoda D., Abramic A., Santiago Castro-Rial J.L., Ballesteros M. (2023). MS3.1 ReMAP report: MSP data framework and relevant data. Project: 101081304 — ReMAP — EMFAF-2021-PIA-MSP. European Union.

(10) European Parliament and Council of the European Union. (2007). Directive 2007/2/EC of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE). Official Journal L 108, 25 April 2007, 1–14. Retrieved from https://data.europa.eu/eli/dir/2007/2/oj

(11) European Parliament and Council of the European Union. (2014). Directive 2014/89/EU of 23 July 2014 establishing a framework for maritime spatial planning. Official Journal L 257, 28 August 2014, 135–145. Retrieved from https://data.europa.eu/eli/dir/2014/89/oj

(12) European Parliament and Council of the European Union. (2019). Directive (EU) 2019/1024 of 20 June 2019 on open data and the re-use of public sector information (recast). Official Journal L 172, 26 June 2019, 56–83. Retrieved from https://data.europa.eu/eli/dir/2019/1024/oj

(13) European Parliament and Council of the European Union. (2022). Regulation (EU) 2022/868 of 30 May 2022 on European data governance (Data Governance Act). Official Journal L 152, 3 June 2022, 1–44. Retrieved from https://data.europa.eu/eli/reg/2022/868/oj

(14) European Parliament and Council of the European Union. (2023). *Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data (Data Act).* Official Journal of the European Union, L 202, 22.12.2023, p. 1–64.

(15) Ministère de la Transition écologique et solidaire. (2018, August 17). Note technique – Documents stratégiques de façade maritime. Légifrance. Retrieved from https://www.legifrance.gouv.fr/circulaire/id/43970

(16) Technical Expert Group on MSP Data. (2021). Proposal for making harmonized MSP plan data available across Europe: Results of the work of the Technical Expert Group (TEG) on MSP data.

(17) Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., … & Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data, 3, 160018. https://doi.org/10.1038/sdata.2016.18

TECHNICAL INFORMATION FROM SHOM FOR DATA HARMONIZATION

Each data cluster is structured by a categorisation, at a first level, and mainly based on already established frameworks, the digital resources available for managing the lifecycle of input data, as well as potential sources of data. However, the MSPdF does not provide a detailed categorisation architecture for each data cluster, i.e. all the sub-categories attached and a classification system, or an inventory of the reference data to be considered. MSPdF includes check-lists per each cluster, with data topics with a certain level of details (e.g. for Marine and coastal environment we use the GES and GEcS (WFD), for Coastal uses - it is used HILUCS, for marine uses - it is applied in extended eHILUCS. To complement this, based on the MSPdF, Shom is proposing a standard architecture with a hierarchy of five scalable strata as an "umbrella" [1], using part of data cluster 5 as a concrete example here (in *Figure 1*).

Under this "umbrella", from the 3rd strata (here CATc5.3), it is possible to identify potential datasets relevant for the implementation, monitoring of revising phase of the MSP process. So, this standard architecture must be adaptative according the national MSP context, meaning the data management resources established by the administrative and institutional MSP framework, and the geographical area under consideration (e.g. European overseas region).

MSPdF detailed proposal can ensure fine correspondences between this data categorisation and the extended Hierarchical Inspire Land Use Classifications (eHILUCS) register based on the INSPIRE Directive [2]. It is fundamental for detailing, the link between human activities per key MSP sectors (finfish production à aquaculture) and the sea-use category for the MSP zoning area (eHILUCS value: 1_4_1_1), for analysing for instance, the weight of each sector in the European Green Deal (EGD) objectives, or for a muti-use development, still in an MSP digitalisation and sea-basin coordination perspective.

CATp.5.1	Parent category - 1st level
CATp5.2	Parent category - 2nd level
CATc5.3	Child category
CLAc5.3.1	CLAss child - 1st rank
CLAc5.3.2	CLAss child - 2nd rank

[1] https://msp-or.eu/wp-content/uploads/2022/05/shom-technical-report-feasibility-study-fr-msp-or-extension-vf.pdf

[2] http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt

OPERATIVE MARITIME ACTIVITIES & PLANNING					DATA MODEL	
					INSPIRE LAND USE	MSP INSPIRE MODEL
CATp5.1	CATp5.2	CATc5.3	CLA5.3.1	CLA5.3.2	HILUCS value	eHILUCS* value
PRIMARY PRODUCTION					1_	
	Aquaculture (syn: fish farming)				1_4_1	
		Marine farm/culture				1_4_1_1*
			Finfish production			1_4_1_2*
			Shellfish/mollucs production			
				Mussels production		
				Hollow oyster production		
				Flat oyster production		
				Clam production		
			Algae production			
				Microalgae production		
				Macroalgae production		
			Seaweed production			1_4_1_3*
			Freshwater finfish production			
			Farming of new species			
		Regulatory marine farm zone (syn: aquaculture concession)				

Figure 1: Standard architecture proposed by Shom for detailed the MSPdF

In addition, MSPdF detailed makes also possible for identifying potential combination, overlapping and gaps between referent datasets for MSP and the Marine Strategy Framework Directive (MSFD) descriptors, which focus on achieving Good Environmental Status (GES) in European marine waters with Programmes of Measures (PoMs), and also the Water Framework Directive (WFD) (*Appendix 1*). According the national MSP strategies and the phasing processes, MSPD can be the MSFD "implementer" for supporting Ecosystem-Based Approach (EBA) as keystone of the MSP plans, or its "master" for calling EBA as frame of particular domains of the MSP plans. To enhance marine management, integrating MSFD environmental assessments with MSP's broader spatial planning considerations seems to be essential for balancing GES, economic development and security concerns.

The data requirements for MSP rely on diverse sources, including remote sensing, in-situ observations, crowd-sourced data, national and international data repositories. These sources provide essential information across multiple data categories, aligning with the MSP Data Framework (MSPdF, (2)) recommended by the TEG on data for MSP.

The data collection methods span 7 primary clusters. Marine and coastal environment data are categorized under the Marine Strategy Framework Directive (MSFD) and the Water Framework Directive (WFD), covering biodiversity, non-indigenous species, commercial species, eutrophication, contaminants, marine litter and noise. Marine and coastal conservation data focus on marine and coastal protected areas, designated sites and related regulations. Oceanographic characteristics and climate data include ocean physics, biochemistry, ecosystem variables (as per GOOS), datasets from EMODnet and Copernicus Ocean Monitoring. Coastal land use and planning capture current and planned coastal land use, structured according to the INSPIRE classification system follwing the HILUCS (10). Operative maritime activities and planning incorporate data on MSP and activity categorization within the eHILUCS.

Socio-economic information encompasses demographic, economic and governance-related datasets on maritime activities, regulations and administrative competences.

Additionally, standardized datasets from the International Hydrographic Organization (IHO) S-100 framework, including Electronic Navigational Charts (ENCs), bathymetric surfaces, navigational warnings and marine traffic management, further support MSP by providing already harmonized and internationally recognized geospatial data. These comprehensive data sources and methods ensure the effective integration of spatial and environmental information for informed maritime decision-making.

MSP data collection can strengthen its attributeis attribute data catalogue by using IHO standards object classes and attributes, which have provided a structured framework for maritime data since 1992 with the S-57 standard—the foundation of the ENCs. In 2024, the IHO introduced the S-100 standard, an evolution of S-57 that expands and modernizes maritime data categorization. This standard includes a comprehensive list of categories essential for MSP, ensuring internationally harmonized and standardized geospatial data. The key S-100 data categories include:

- ENC data categories (S-101)
- Bathymetric surface
- Surface current forecast
- Water level forecast
- Maritime limits and boundaries
- Marine radio services
- Navigational warnings
- Marine traffic management
- Catalogue of nautical products
- Under keel clearance management
- Polygonal demarcations of global sea areas
- Marine harbor infrastructure
- Aids to navigation information
- Wave and weather hazards
- Marine protected areas
- Marine radio services

The full list of S-101 ENC categories can be found in the IHO Geospatial Information Registry in xml file document *101_Feature_Catalogue_2.0.0.xml.signature.zip (see Figure 2).*

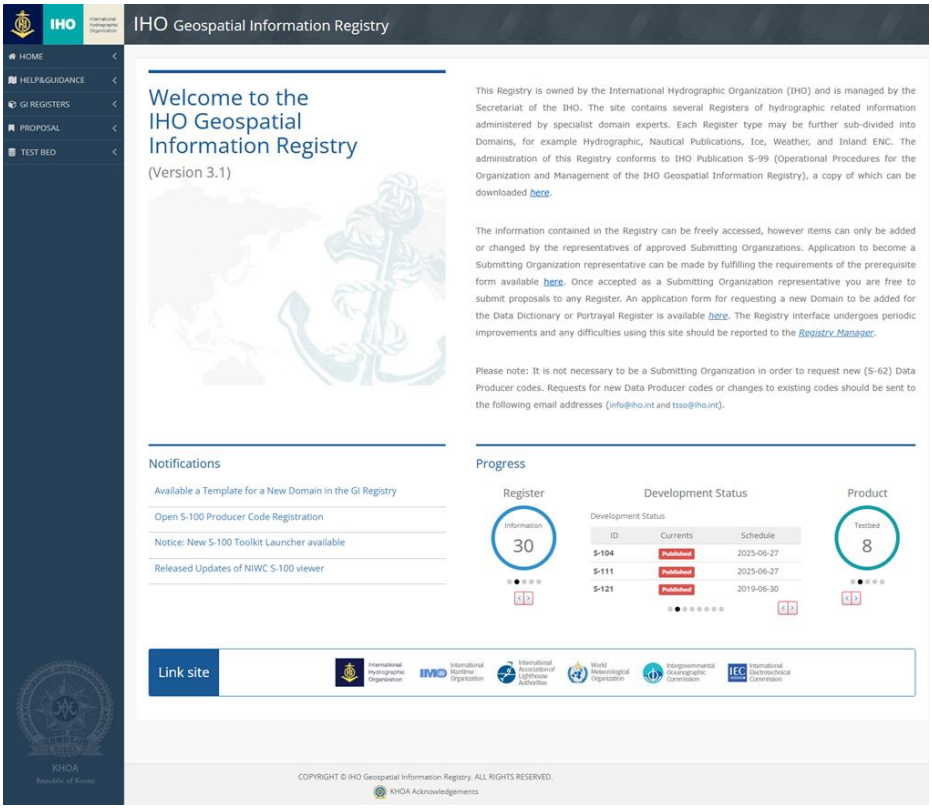


Figure 2: IHO Geospatial Information Registry

By integrating IHO's maritime data standard with broader environmental, oceanographic and socio-economic datasets, MSP ensures comprehensive and well-informed spatial planning for sustainable ocean management. However, despite the fact that it is operational and is used daily by maritime operators, there is still work to be done to acculturate the MSP world so that it fully integrates these standards, and does "not reinvent the wheel".

Conceptual framework of MSP Spatial Plans: EMODnet MSP data standard model components

To ensure interoperability, MSP spatial plans should conform to standardized data models like the EMODnet MSP data model. This model defines the structure and semantics to represent maritime spatial data.

- **MSP Spatial Plan**: metadata about the plan, including title, scope, and responsible authority.
- **MSP Zoning Element**: spatial features representing designated zones with associated attributes (see *Figure 3*).
- **MSP Supplementary Regulation**: legal instruments and regulations applicable to the zones.
- **MSP Official Documentation**: references to official documents supporting the plan.

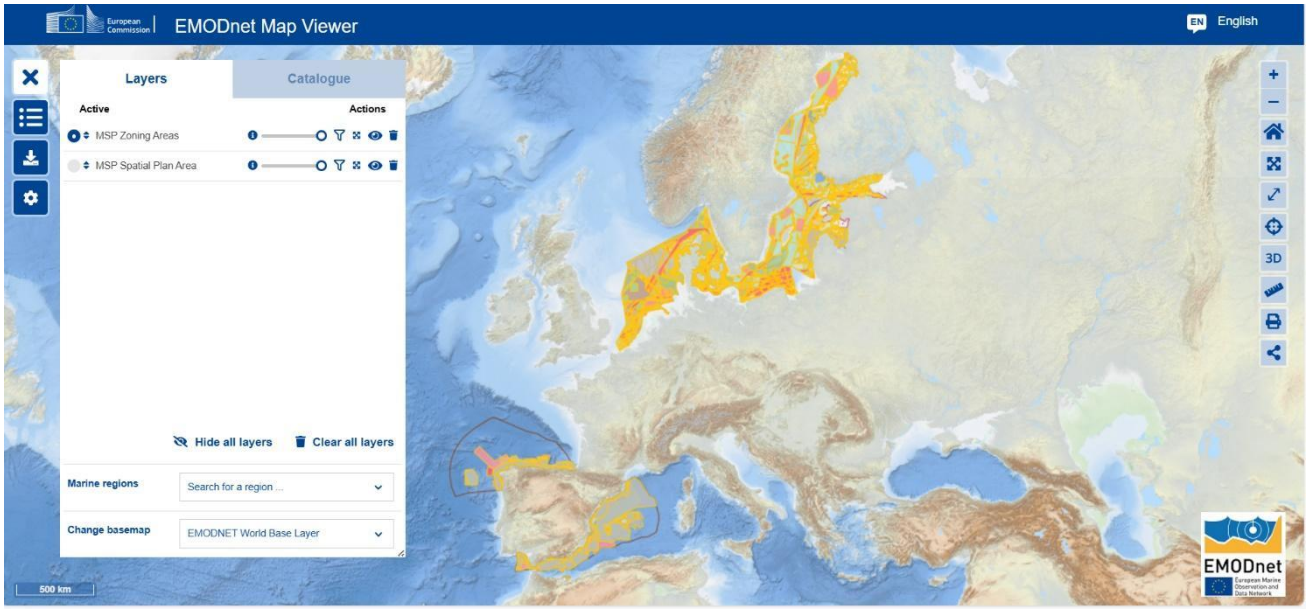


Figure 3: MSP Spatial plan representation in EMODnet map viewer

Data standards and interoperability

The conceptual framework for MSP spatial plans is founded interoperable data architecture that promotes coherent decision-making across borders. At its core lies the EMODnet MSP data model, which defines a common structure to capture and exchange spatial information. By aligning with this model, MSP authorities ensure that datasets from different jurisdictions share consistent schemas and semantics, thereby reducing ambiguities and streamlining collaborative efforts. The UML depiction of the data model (*Annex 1*) and its detailed description (*Table 1*) serve as essential references for implementers seeking to adopt these standards.

	MSP Spatial Plan Area	MSP Zoning Element	MSP Supplementary Regulation	MSP Official Documentation
Definition	Gathers general information at the supra-national scale.	Defines the maritime use to a vocation area. For each use and for each function, a geographical element will be developed.	Reports on additional legislation associated with the use.	Reports on the documentation of the legislation in force.
Main components	Identifier, country, spatial level (regiona, local, …).	Maritime use, priority of use, vertical distribution.	Type of legislation	Link to the legislation

Stakes	Simple. Most informations available	Complex. At present, the use area covers several uses. It will therefore be necessary to prioritise one activity across the zone. Zones may overlap.	Simple. Most information are already available	Simple. Most information are already available

Table 1: structuring data model from a single layer to a 4-layer model

MSP Zoning Elements

MSP Zoning elements form the spatial backbone of MSP plans, delineating areas assigned to specific maritime uses or protected statuses. Each zoning element comprises a precise geometry—defining its spatial boundaries—and a set of attributes detailing permitted activities, regulatory constraints and legal references. These attributes not only clarify the intended use of each zone but also embed traceable links to national legislation and international agreements. Consistent representation of zoning attributes is critical for both visualisation in GIS platforms and automated policy compliance checks.

To enhance data integrity and reduce manual workload, an automated attribute-management system has been developed, leveraging the synergy between the TEG on MSP Data Recommendations (16) and MSP-MED initiatives.

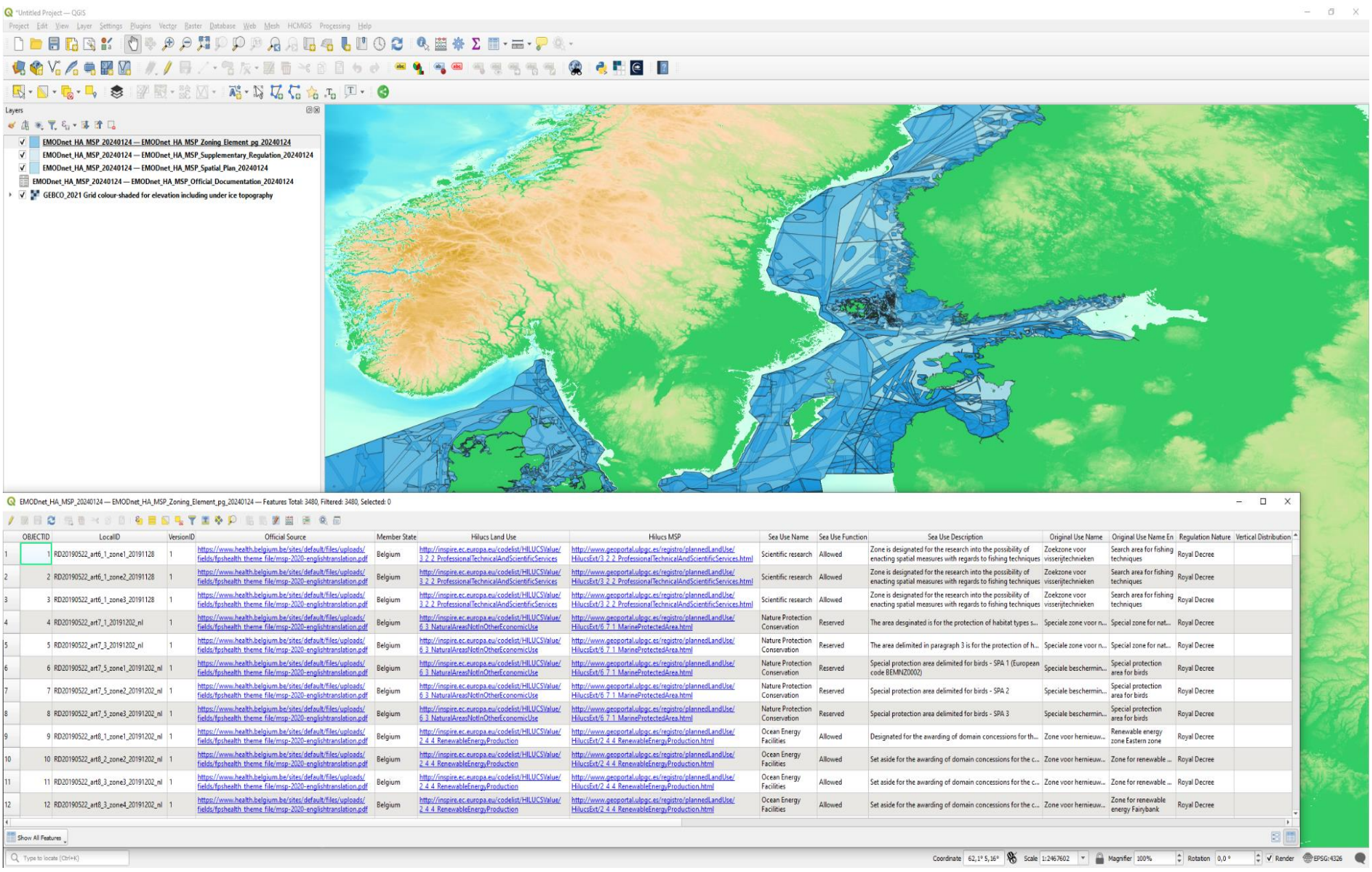
Central to this system is a codelist crosswalk (*Annex 2*) that maps values across three attribute systems:

- HilucsLandUse (INSPIRE)
- HilucsMSP (INSPIRE data model, (16) description is given here www.geoportal.ulpgc.es)
- SeaUseName (BASEMAPS (4))

This semantic mapping guarantees that when a user selects a HilucsLandUse code, the corresponding SeaUseName is populated automatically and only the relevant HilucsMSP options remain available. Such an autofill mechanism not only accelerates data entry but also enforces logical consistency, preventing contradictory activity codes from being assigned to the same spatial entity. Through these automated controls, the MSP spatial plan framework achieves higher-quality, interoperable data that supports informed maritime governance. By controlling the relationships between attributes, the system prevents inconsistencies such as conflicting activity codes within the same spatial entity (see *Table 2*: attributes match examples for MSP Zoning Element).

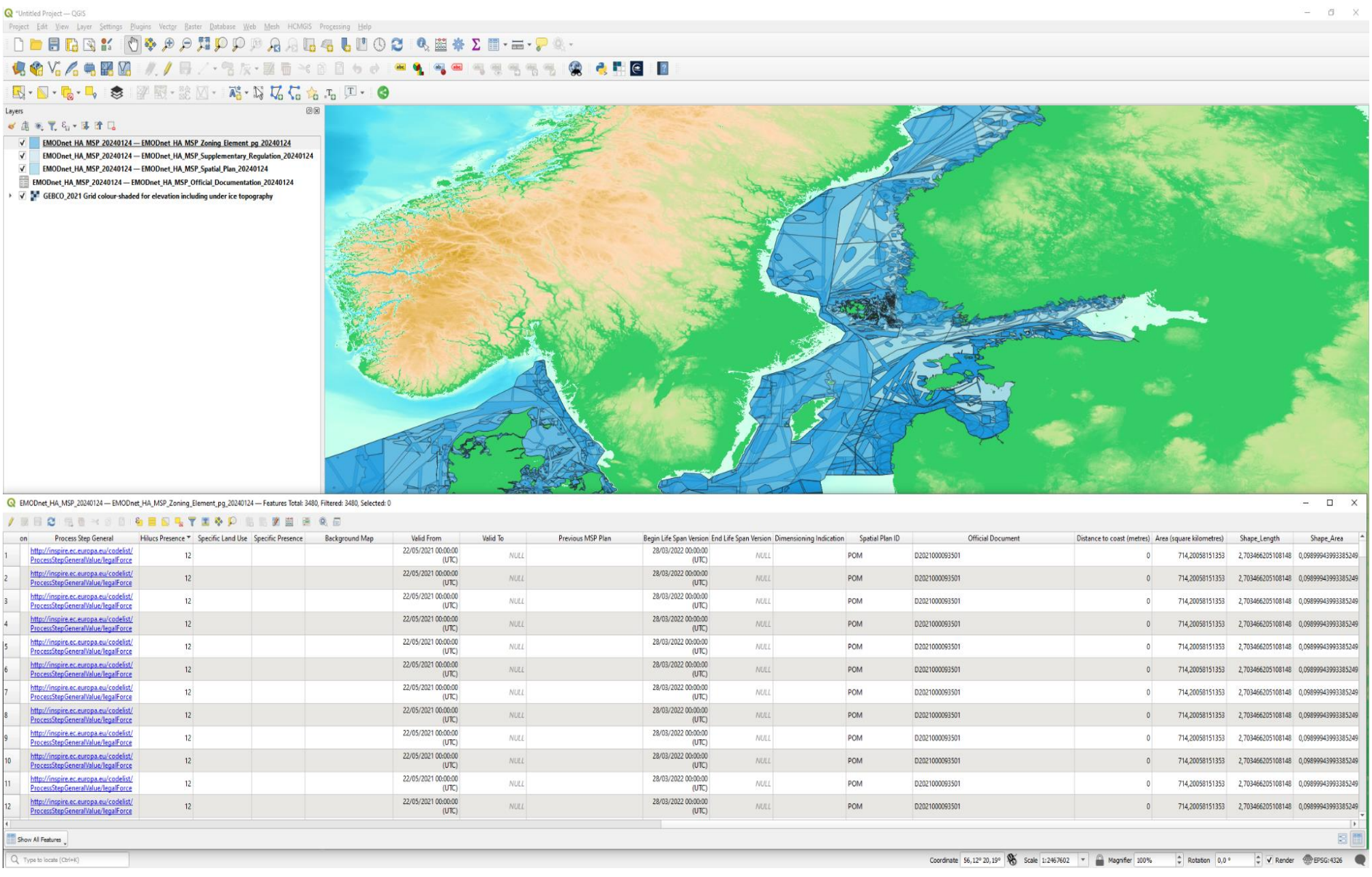
Since 2019, the MSP INSPIRE data model has evolved by applying the data management principles of the 2007/2/EC INSPIRE Directive to marine planning (12). Early trials assessed whether the terrestrial “Planned Land Use” model from INSPIRE could serve MSP purposes. Although this baseline model proved robust, it lacked the granularity needed to capture marine-specific activities. To address these gaps, we extended the INSPIRE schema in implementing an expanding INSPIRE register with a dedicated maritime-use vocabulary—one that can be updated

dynamically at the request of data providers—to eliminate ambiguity and ensure full coverage of marine activities. These enhancements make the INSPIRE data model fully fit for purpose in MSP contexts, here in *Figure 4* and *Figure 5* is presented the MSP Spatial Plan from EMODnet and more specifically the MSP Zoning Element attributes following EMODnet MSP data model.



OBJECTID	LocalID	VersionID	Official Source	Member State	Hilucs Land Use	Hilucs MSP	Sea Use Name	Sea Use Function	Sea Use Description	Original Use Name	Original Use Name En	Regulation Nature	Vertical Distribution
1	RD20190522_art6_1_zone1_20191128	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/3_2_2_ProfessionalTechnicalAndScientificServices	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/3_2_2_ProfessionalTechnicalAndScientificServices.html	Scientific research	Allowed	Zone is designated for the research into the possibility of enacting spatial measures with regards to fishing techniques	Zoekzone voor visserijtechnieken	Search area for fishing techniques	Royal Decree	
2	RD20190522_art6_1_zone2_20191128	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/3_2_2_ProfessionalTechnicalAndScientificServices	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/3_2_2_ProfessionalTechnicalAndScientificServices.html	Scientific research	Allowed	Zone is designated for the research into the possibility of enacting spatial measures with regards to fishing techniques	Zoekzone voor visserijtechnieken	Search area for fishing techniques	Royal Decree	
3	RD20190522_art6_1_zone3_20191128	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/3_2_2_ProfessionalTechnicalAndScientificServices	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/3_2_2_ProfessionalTechnicalAndScientificServices.html	Scientific research	Allowed	Zone is designated for the research into the possibility of enacting spatial measures with regards to fishing techniques	Zoekzone voor visserijtechnieken	Search area for fishing techniques	Royal Decree	
4	RD20190522_art7_1_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/6_3_NaturalAreasNotInOtherEconomicUse	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/6_7_1_MarineProtectedArea.html	Nature Protection Conservation	Reserved	The area designated is for the protection of habitat types s...	Speciale zone voor n...	Special zone for nat...	Royal Decree	
5	RD20190522_art7_3_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/6_3_NaturalAreasNotInOtherEconomicUse	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/6_7_1_MarineProtectedArea.html	Nature Protection Conservation	Reserved	The area delimited in paragraph 3 is for the protection of h...	Speciale zone voor n...	Special zone for nat...	Royal Decree	
6	RD20190522_art7_5_zone1_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/6_3_NaturalAreasNotInOtherEconomicUse	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/6_7_1_MarineProtectedArea.html	Nature Protection Conservation	Reserved	Special protection area delimited for birds - SPA 1 (European code BEMNZ0002)	Speciale beschermin...	Special protection area for birds	Royal Decree	
7	RD20190522_art7_5_zone2_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/6_3_NaturalAreasNotInOtherEconomicUse	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/6_7_1_MarineProtectedArea.html	Nature Protection Conservation	Reserved	Special protection area delimited for birds - SPA 2	Speciale beschermin...	Special protection area for birds	Royal Decree	
8	RD20190522_art7_5_zone3_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/6_3_NaturalAreasNotInOtherEconomicUse	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/6_7_1_MarineProtectedArea.html	Nature Protection Conservation	Reserved	Special protection area delimited for birds - SPA 3	Speciale beschermin...	Special protection area for birds	Royal Decree	
9	RD20190522_art8_1_zone1_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/2_4_4_RenewableEnergyProduction	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/2_4_4_RenewableEnergyProduction.html	Ocean Energy Facilities	Allowed	Designated for the awarding of domain concessions for th...	Zone voor hernieuw...	Renewable energy zone Eastern zone	Royal Decree	
10	RD20190522_art8_2_zone2_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/2_4_4_RenewableEnergyProduction	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/2_4_4_RenewableEnergyProduction.html	Ocean Energy Facilities	Allowed	Set aside for the awarding of domain concessions for the c...	Zone voor hernieuw...	Zone for renewable ...	Royal Decree	
11	RD20190522_art8_3_zone3_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/2_4_4_RenewableEnergyProduction	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/2_4_4_RenewableEnergyProduction.html	Ocean Energy Facilities	Allowed	Set aside for the awarding of domain concessions for the c...	Zone voor hernieuw...	Zone for renewable ...	Royal Decree	
12	RD20190522_art8_3_zone4_20191202_nl	1	https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/msp-2020-englishtranslation.pdf	Belgium	http://inspire.ec.europa.eu/codelist/HILUCSValue/2_4_4_RenewableEnergyProduction	http://www.geoportal.ulpgc.es/registro/plannedLandUse/HilucsExt/2_4_4_RenewableEnergyProduction.html	Ocean Energy Facilities	Allowed	Set aside for the awarding of domain concessions for the c...	Zone voor hernieuw...	Zone for renewable energy Fairybank	Royal Decree	

Figure 5: EMODnet MSP Spatial Data model presentation in QGIS map and specific attributes of MSP Zoning Element



on	Process Step General	Hilucs Presence	Specific Land Use	Specific Presence	Background Map	Valid From	Valid To	Previous MSP Plan	Begin Life Span Version	End Life Span Version	Dimensioning Indication	Spatial Plan ID	Official Document	Distance to coast (metres)	Area (square kilometres)	Shape_Length	Shape_Area
1	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
2	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
3	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
4	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
5	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
6	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
7	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
8	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
9	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
10	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
11	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249
12	http://inspire.ec.europa.eu/codelist/ProcessStepGeneralValue/legalForce	12				22/05/2021 00:00:00 (UTC)	NULL		28/03/2022 00:00:00 (UTC)	NULL		POM	D2021000093501	0	714,20058151353	2,703466205108148	0,0989994399385249

Figure 6: EMODnet MSP Spatial Data model presentation in QGIS map and specific attributes of MSP Zoning Element

Schematically, extension of the MSP data structures can be described as follows: within each Zoning Element, the *SeaUseFct* field can be populated with values that represent specific maritime uses or functions, as defined in the classification system. These values allow for a standardized and interoperable description of intended sea uses across different planning zones. The table below (*Table 2*) illustrates the possible entries for the *SeaUseFct* field, detailing how each function is coded and categorized to ensure consistency within the MSP schema.

Identified geometry in MSP data structure	priority [SeaUse CodeList] [multiple options possible - 0…*, separated with comma]	reserved [SeaUse CodeList] [multiple options possible - 0…*, separated with comma]	allowed [SeaUse CodeList] [multiple options possible - 0…*, separated with comma]	restricted [SeaUse CodeList] [multiple options possible - 0…*, separated with comma]	forbidden [SeaUse CodeList] [multiple options possible - 0…*, separated with comma]	seaUseDsc [CharacterString]	Spatial PlanID Permanent identifier of maritime spatial pla, unique at internation level - the country code (eg. DE, FI, LT) followed by unique identifierat national level; Identifier will help to link geometries from different countries
xxx	Selection from *seaUse* code list		Selection from *seaUse* code list	Selection from *seaUse* code list	Selection from *seaUse* code list	Requirements restrictions within sea use area	
	Examples						
	installations-owf		aquaculture-mussel		transport, fishing	Areas suitable for OWF development. Aquaculture might be considered after additional investigation.	
			fishing- bottom trawling		installations	Areas important for sea bottom trawling. No permanent installations or infrastructure allowed.	
					transport	Areas prohibited for navigations.	

Table 2: MSP Zoning Element: SeaUseFct and SeaUseDsc field description classification system

Technical implementation using QGIS

QGIS is an open-source Geographic Information System (GIS) that provides tools to create, edit, and analyse spatial data. It is widely used to develop MSP spatial plans due to its flexibility and support for various data formats.

There are three primary methods presented in this chapter to delineate Zoning Elements in QGIS:

Using existing shapefiles of Designated Areas (recommended method)

The most efficient and accurate method to define MSP Zoning Elements in MSP spatial plans is to utilize existing shapefiles of officially designated areas (see *Figure 6*). These may include Marine Protected Areas (MPAs),

International Maritime Organization (IMO)-recommended shipping lanes, or legally recognized fishing zones. This approach ensures spatial consistency with existing governance frameworks and minimizes duplication of effort.

Steps:

1. Obtain relevant shapefiles:
    - collect spatial datasets from authoritative sources such as national marine spatial data infrastructures, environmental agencies, or international organizations (e.g., IMO).
    - ensure all shapefiles are in a compatible Coordinate Reference System (CRS: EPSG4326).
2. Load shapefiles into QGIS:
    - go to Layer > Add Layer > Add Vector Layer.
    - browse and select the desired shapefiles (e.g., MPAs, shipping routes).
3. Review and clip to study area (Optional):
    - use the Clip tool in Processing Toolbox to restrict layers to your area of interest.
4. Standardize attribute fields:
    - open the attribute table of each layer and, if needed, add or rename fields (e.g., inspireID, seaUseName, hilucsMSP, etc) for integration with your MSP zoning schema.
5. Merge or consolidate layers (if needed):
    - use the Merge Vector Layers tool to combine various zone types into a single planning layer.
    - assign a consistent zoning classification to each feature.

Benefits:

- Reduces manual work and errors
- Ensures alignment with existing spatial regulations
- Facilitates stakeholder acceptance by incorporating recognized boundaries

Figure 6: mini-portal created by Shom for MSP data in the framework of MSP-MED https://mspmed.eu/project/, geospatial Overview of MPAs in the Southern European Marine Region.

Manual digitization

This method involves drawing polygons directly on the map canvas to represent zoning elements (see *Figure 7*).

Steps:

1. Create a new polygon layer:
    - go to Layer > create Layer > new shapefile layer.
    - choose polygon as the geometry type.
    - define the Coordinate Reference System (CRS: EPSG:4326)
    - add necessary attribute fields (e.g., inspireID, seaUseName, hilucsMSP, etc).
2. Start editing:
    - right-click on the new layer and select Toggle Editing.
3. Add features:
    - use the Add Polygon Feature tool to draw the zone boundaries by clicking on the map canvas.
    - right-click to finish drawing the polygon.
    - enter attribute information in the prompted form.
4. Save edits:
    - click on Save Edits to store the changes.

- toggle off editing mode.

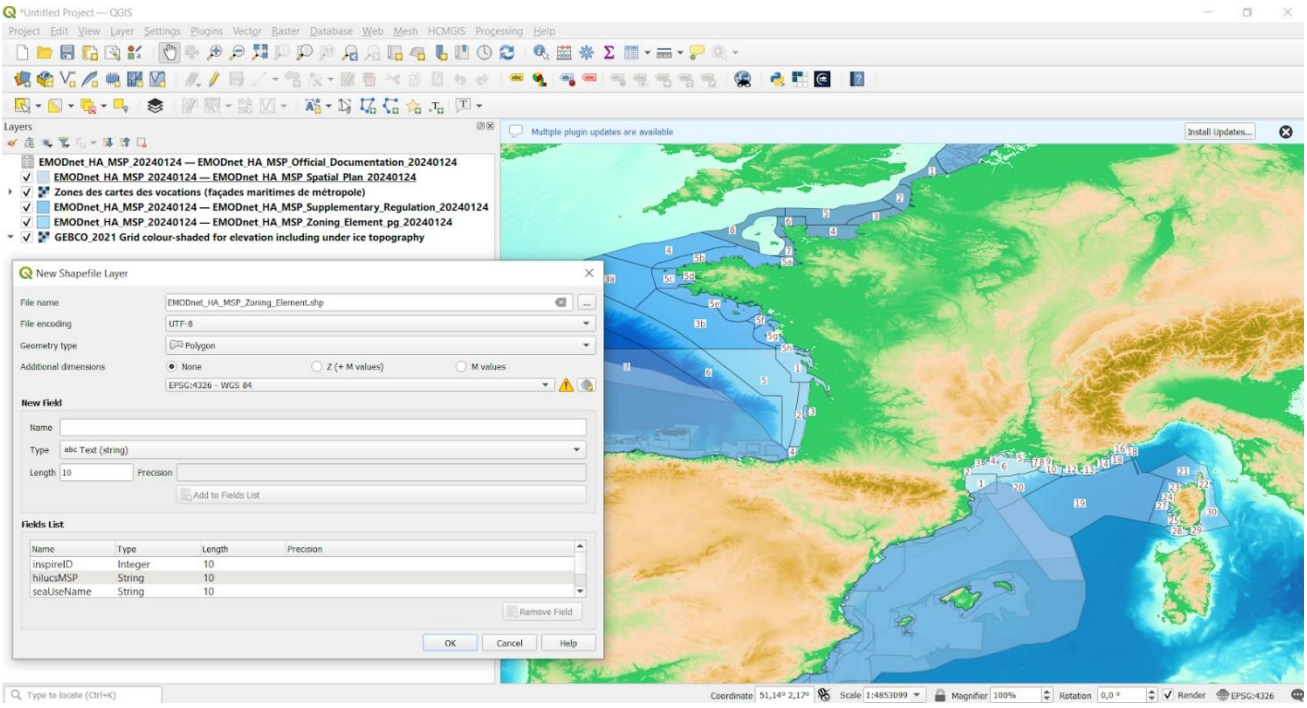


Figure 7: manual digitization of MSP Zoning Element in QGis

Importing coordinates

If the coordinates of zoning elements are available (e.g., from surveys or legal descriptions), they can be imported into QGIS to create polygons.

Steps:

1. Prepare coordinate data:
    - organize the coordinates in a CSV file with fields for Latitude, Longitude and an identifier for each zone.
2. Import CSV as point layer:
    - go to layer > add Layer > add delimited text layer.
    - select the CSV file and specify the X (Longitude) and Y (Latitude) fields.
    - choose the appropriate CRS (CRS: EPSG:4326).
3. Convert points to polygon:
    - use the points to path tool to connect points in the correct order.
    - then, apply the Lines to Polygons tool to create polygon features.

Metadata and data sharing

Proper metadata documentation is crucial for data discovery and reuse. Metadata should include information on data provenance, quality and usage constraints (see *Figure 8*). Adhering to the FAIR principles (Findable, Accessible, Interoperable, Reusable) (18) and INSPIRE principles (10) enhances the utility of MSP spatial plans.

Metadata fields		Content
Title	Title of the dataset	[NAME]
Abstract	Short description of dataset (including e.g. modelling approach, if applicable)	This dataset contains [Short description of the dataset]
Keywords	Keywords relevant for the dataset	[Keywords relevant for the dataset]
Inspire	Inspire category	
eHILUCS	Extended HILUCS category level 2 code	
Data owner	Organisation name	
	Contact person name	
	Contact person email	
Data provider information	Organisation name	
	Contact person name	
	Contact person email	
Data disseminator	Organisation name	
	Contact person name	
	Contact person email	

Lineage	Lineage (history and/or overall quality of the spatial data set. Where appropriate it may include a statement whether the data set has been validated or quality assured)	Data model used for the harmonization: [DATA MODEL USED]
URL	URL of the downloadable resource in case it is available	
Spatial data information	Data format (ESRI shapefile, MapInfo TAB, GML, Excel)	
	Data type (point / line / polygon / raster)	
	Coordinate reference system (EPSG: code)	WGS84 (EPSG: 4326)
	Minimum scale range	1:5,000
	Maximum scale range	1:150,000,000
Temporal extent	Start date (DD.MM.YYYY)	01.01.2024
	End date (DD.MM.YYYY)	31.12.2030
Access and use	Conditions applying to access and use	Data can be used freely given that the source is cited (following creative commons license CC-BY). The source should be cited as: "Organisation: Name of dataset (Year)".
	Limitations on public access (Yes/No/Partly)	No

Figure: metadata template fo MSP data harmonization based on Helcom metadata catalog template

ANNEXES

Annex 1

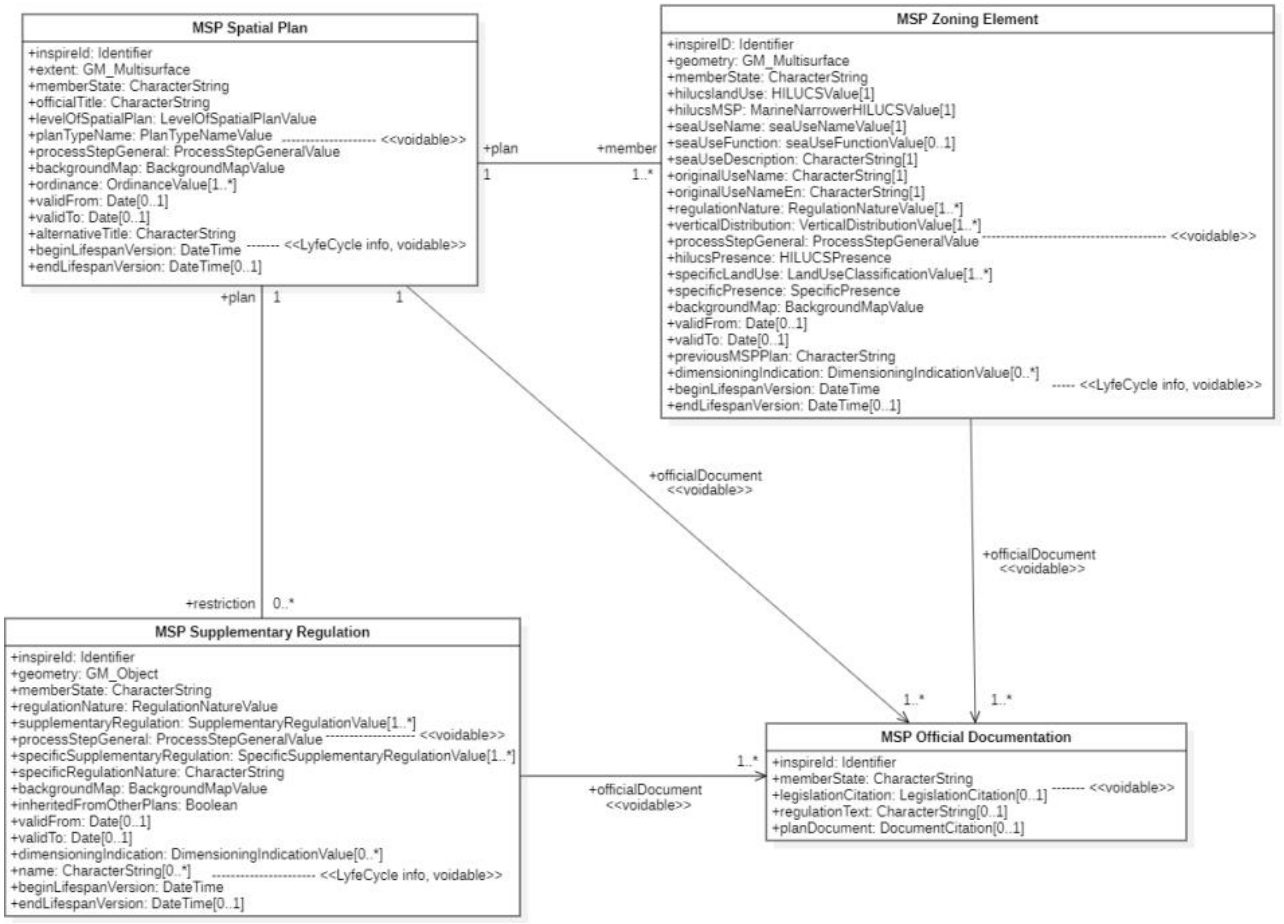


Figure: UML diagram of the EMODNet MSP data model

Annex 2

SeaUseName	HilucsLandUse	HilucsMSP
Aquaculture (including algae)	1_4_AquacultureAndFishing	1_4_AquacultureAndFishing
Aquaculture (including algae)	1_4_1_Aquaculture	1_4_1_Aquaculture
Aquaculture (including algae)	1_4_1_Aquaculture	1_4_1_1_AquacultureSeaWater
Aquaculture (including algae)	1_4_1_Aquaculture	1_4_1_2_AquacultureBrackishWater
Aquaculture (including algae)	1_4_1_Aquaculture	1_4_1_3_AquacultureFreshWater
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_ProfessionalFishing
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_1_FishingLine
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_1_FishingLine
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_2_HandLine
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_3_Trap
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_4_BeachTrawl
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_5_MorayTrap
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_6_TrammelNet
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_7_LiveBait
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_8_PoleLine
Fishing areas	1_4_2_ProfessionalFishing	1_4_2_9_JiggerFishing

Fishing areas	1_4_2_ProfessionalFishing	1_4_2_10_Others

Table: codelist mapping table example for fishing and aquaculture activities, between the HilucsLandUse, HilucsMSP (INSPIRE) and the SeaUseName (BASEMAPS). Present a simplify filling of different maritime activities attributes in MSP Spatial Plan which gives a definition of the HilucsLandUse attribute automatically to define the corresponding SeaUseName and reduce the choice for HilucsMSP to the related possibilities. There is different activities code in the same entity.

Annex 3

Spatial Data Quality Framework (SDQF)

The Spatial Data Quality Framework (SDQF), defined based on scientific literature (e.g. Wan et al. 2015, Spencer & Wilkes 2019, Yaman et al. 2020), was applied to systematically evaluate the quality of spatial datasets used in the project. The framework assesses data quality through four key components: Accuracy, Consistency, Completeness, and Timeliness.

– **Accuracy** reflects how close data is to true values, with scores from 0 to 3:

- *Score 3*: High accuracy data, typically derived from direct monitoring, observations, or surveys.
- *Score 2*: Medium accuracy data, usually based on modelling.
- *Score 1*: Low accuracy data, such as data obtained by proxy.
- *Score 0*: Accuracy information not available or difficult to assess.

– **Consistency** measures the logical coherence of a dataset with other MSP input data, also scored from 0 to 3, where a higher score means fewer contradictions or discrepancies:

- *Score 3*: High consistency – strong alignment with other datasets.
- *Score 2*: Medium consistency – minor discrepancies.
- *Score 1*: Low consistency – significant contradictions.
- *Score 0*: Consistency information not available.

– **Completeness and Timeliness** capture the extent to which datasets are spatially and temporally comprehensive; these are automatically calculated based on the information entered under the Category Spatial & Temporal Characteristics.

By using the SDQF and explicitly scoring datasets from 0 (lowest quality or unknown) to 3 (highest quality), the project ensures a transparent, standardized, and comparable assessment of data quality, supporting better harmonization and interoperability in MSP. The original score (ranging from 0 to 3) is normalized to a scale between 0 and 1.

Relevance and application within the MSP process

This assessment aims to evaluate the suitability and actual use of spatial datasets within each of the seven data clusters of the MSPdF, as well as their potential impact on decision-making in the Maritime Spatial Planning (MSP) process. The evaluation is based on two criteria, each scored from 0 to 3:

– **Relevance for the national MSP process**, where:

- *Score 3*: Highly relevant – the dataset directly supports key MSP objectives and requirements.
- *Score 2*: Moderately relevant – the dataset contributes to some aspects of planning and decision-making.
- *Score 1*: Low relevance – the dataset provides only supplementary information, with minimal impact.
- *Score 0*: Not relevant – the dataset offers no substantial contribution to the MSP process.

– **Considered/used within the MSP process**, where:

- *Score 3*: Properly applied – the dataset is fully integrated and effectively informs decisions.
- *Score 2*: Used, but not properly applied – the dataset is included but outdated or incompletely applied.
- *Score 1*: Considered, but not used – acknowledged during planning, but not actively used in decisions.
- *Score 0*: Not considered – excluded from the MSP process, lacking relevance or applicability.

Through this scoring approach, the analysis highlights both the perceived importance of each dataset and its actual role and integration into the MSP process, helping to identify gaps and opportunities for improving data use in maritime spatial planning. The original score (ranging from 0 to 3) is normalized to a scale between 0 and 1.

FAIR

The FAIR data principles (Wilkinson et al. 2016) were applied to assess and improve the transparency, usability, and overall quality of spatial datasets in the MSP context. These principles ensure that data is **Findable, Accessible, Interoperable,** and **Reusable**, each evaluated through specific criteria and scores ranging from 0 (lowest compliance) to 3 (highest compliance).

– **Findable data** assesses the existence and quality of metadata, and whether datasets are registered in searchable catalogues:

- *Score 3*: Described with metadata, registered and indexed in international catalogues (e.g., INSPIRE, EU Open Data Portal, EMODnet).
- *Score 2*: Described with metadata and findable through national or local catalogues.
- *Score 1*: Metadata exists but data is not indexed in searchable catalogues.
- *Score 0*: No metadata; data is not discoverable.

– **Accessible data** evaluates the degree to which datasets can be retrieved and used:

- *Score 3*: Publicly accessible through open protocols.
- *Score 2*: Accessible on request, but not through open protocols.
- *Score 1*: Existing but locked and not available.
- *Score 0*: Not available.

– **Interoperable data** measures how well data can be integrated with other sources, based on adherence to standards and harmonization:

- *Score 3*: Harmonized according to international standards (e.g., INSPIRE, S-56, OGC).
- *Score 2*: Not harmonized, but uses international standardized semantics (e.g., INSPIRE code lists, CORINE classes).
- *Score 1*: Uses national standards.
- *Score 0*: Not harmonized at all.

– **Reusable data** is automatically calculated based on the combined results of the Findable, Accessible, and Interoperable criteria, reflecting the overall potential for data to be effectively reused in MSP processes.

This structured approach supports transparent data management and helps identify concrete actions to improve data availability and quality in maritime spatial planning. The original score (ranging from 0 to 3) is normalized to a scale between 0 and 1.

Spatial and temporal coverage & resolution - spatial and temporal characteristics

Within the MSP process, it is essential to assess both the **spatial** and **temporal** characteristics of datasets to ensure they are suitable for planning and decision-making. Four specific criteria are evaluated, each scored from 0 (lowest suitability) to 3 (highest suitability):

– **Spatial coverage (extension)** measures whether a dataset fully covers the relevant planning area (e.g., coastal waters or EEZ):

• *Score 3*: Complete coverage; *Score 2*: Partial coverage; *Score 1*: Sporadic coverage; *Score 0*: No spatial component.

– **Spatial resolution** assesses the level of spatial detail provided:

• *Score 3*: Adequate for MSP; *Score 2*: Medium-level, partially adequate; *Score 1*: Coarse but still usable; *Score 0*: Too coarse to be applied.

– **Temporal coverage** evaluates the extent of the period represented by the dataset:

• *Score 3*: Fully adequate; *Score 2*: Medium-level, partially adequate; *Score 1*: Limited but still usable; *Score 0*: Inadequate for MSP needs.

– **Temporal resolution** assesses how frequently data is collected or updated:

• *Score 3*: Fully adequate; *Score 2*: Medium-level; *Score 1*: Coarse; *Score 0*: Inadequate.

In parallel, data quality is systematically evaluated using the **Spatial Data Quality Framework (SDQF)**, based on scientific literature (Wan et al. 2015; Spencer & Wilkes 2019; Yaman et al. 2020). This framework covers four main aspects:

– **Accuracy**: from *Score 3* (high accuracy from monitoring/surveys) to *Score 0* (unknown accuracy).

– **Consistency**: from *Score 3* (high consistency with other MSP data) to *Score 0* (data presents significant contradictions).

– **Completeness and Timeliness**: automatically derived from the spatial and temporal characteristics previously scored.

Together, these criteria provide a structured and transparent approach to evaluating whether spatial datasets are fit for purpose in maritime spatial planning, helping to identify strengths, weaknesses, and priorities for improvement. The original score (ranging from 0 to 3) is normalized to a scale between 0 and 1.

APPENDIXES

APPENDIX 1:

Data cluster	Description
Marine & Coastal Environment – Data cluster 1	• Information on the marine environment is considered essential within the MSP methodology, as part of the necessary assessment of environmental sustainability of the maritime activities considered under the MSP process. • Impacts related to pressures of the maritime sectors on the environment and the potential for the mitigation and sensitivity of ecosystems need to be evaluated. • This complex assessment requires the management of complex information on the state of the environment, ecosystems' carrying capacity, and pressures of the maritime activities governed by the MSP plans.
Marine & Coastal Conservation and Designated sites – Data cluster 2	• Conservation data is required to be considered and analysed within the MSP process. It is necessary to assess the potential (in)compatibilities of specific uses and activities with marine and coastal protected areas, with any other type of conservation figures, or even with designation with maritime sectors that are managed by MSP. • To consider (in)compatibilities with current and future maritime uses and activities, it is necessary to understand the conservation objectives related to each designated area. • Within this cluster, it is necessary to have spatial information on the area where marine conservation/designation is applied; further, we need to understand what type of management is applied and, if possible, what types of maritime activities are incompatible.
Oceanographic characteristics and Climate – Data cluster 3	• Within the process of MSP, it is essential to consider and collect data on the oceanographic and climatic conditions. • A variety of different parameters are considered under this data cluster, incorporating issues related to physical aspects (e.g., sea temperature and salinity, atmospheric pressure, bathymetry, winds, currents, waves, etc.), and chemical aspects (oxygen, nutrients, dissolved organic carbon, etc.), among others. • By monitoring the oceanographic conditions, the local climate can be understood, and parameter variations and current trends identified. • Oceanographic conditions are relevant for understanding how current climate change is affecting the MSP, including modification of the natural potential or even limiting factors.
Coastal Land use and Planning – Data cluster 4	• Within the process of MSP, it is key to deliver land-sea interaction analysis, a review of potential conflicts, and synergies between maritime sectors and coastal human activities. This type of study requires data collection of coastal land use (anthropogenic activities within the coastal belt). • Thus, it is necessary to understand and consider the distribution of the current operative activities, but also the planned activities in the coastal areas, as these can have significant links and effects on maritime sector distribution. • Coastal land use and planning (e.g., coastal zone management plans) need to be considered and integrated within the MSP process.
Operative maritime activities and planning	• To understand the current distribution of the maritime sectors it is necessary to collect spatial data on human activities within the marine areas that are included in the planning area.

– Data cluster 5	• Data on the distribution of the fisheries, maritime transport, nautical activities, aquaculture, renewable energy, mineral extraction, maritime tourism, etc., are necessary to assess potential spatial conflicts, but also synergies between maritime and coastal sectors. • Data on the distribution of maritime activities and uses are a base point to understand the need for spatial planning, managing conflicts and applying possible multi-use and co-use solutions. • Beyond data on operative maritime activities, within this cluster, we need to consider the spatial data on maritime planning, zoning of marine areas and other possible designated types of maritime sector distribution.
Socio-economic information – Data cluster 6	• The application of an ecosystem-based approach within the MSP process contributes to finding the balance between the conservation of the marine environment and the use of the marine and coastal resources, while promoting the sustainable development and growth of the marine and coastal economies, as presented within the Integrated Maritime Policy for the European Union and in the Directive 2014/89/EU establishing a framework for maritime spatial planning. It is necessary to understand the needs for development of the maritime sectors and identify how to incorporate the environmental trade-offs in the MSP equation. • Information on the coastal population, unemployment, number of jobs and income of current and planned coastal and maritime sectors, is necessary and needs to be understood prior to the planning process. Further, the same type of information should be monitored once the plans are operational, serving the identification of trends in employment, maritime/coastal sectors development and related income.
Governance information – Data cluster 7	• The incorporation of the Governance information cluster is key as it includes the information and data of two key elements. • The first component is related to the need to understand and consider within the MSP process the competences distribution of the different levels of the public administration within the area of planning. This component of the cluster provides understanding of which administration has the competence for the different areas on the sea, including the coastal zone. EEZ and Continental shelf usually have a national competence (e.g., Ministry of Maritime Affairs), but Territorial waters or/and Internal waters can be administered by departments of the local or regional governments. In particular, within the planning, monitoring and evaluation process, it is relevant to have information on the competences distribution of the various maritime sectors and uses including fisheries, energy, maritime transport, but also connected coastal sectors and uses, primarily ports and terrestrial transport, but also other including recreational use. • The second component of the Governance cluster refers to the varied regulation that applies to the area of planning, including the marine, but also coastal areas. We should consider the incorporation of the current regional, national and international regulation that applies to the marine and coastal areas. Regulation that applies to the planning area needs to be considered, as it can support but also constrain the planning process and implementation. It should also be considered if two or more policies that apply in the same area can have synergies or incompatibilities, e.g., in the assessment process. The implementation of the environmental laws and the EU directives such as the MSFD can support the ecosystem approach with the MSP process. However, the environmental policies, such as those related to the conservation of marine birds or habitats, need to be considered as they can incorporate limits to the development of the maritime sectors in certain areas. It is necessary to consider this aspect and identify the potential compatibilities can support the planning process.

Data cluster	Structural framework	Details
Marine & Coastal Environment – Data cluster 1	MSFD – Good Environmental Status	Descriptor 1: Biodiversity (seabirds, marine mammals, marine fish, cephalopods, pelagic habitats, benthic habitats)
		Descriptor 2: Non-indigenous species
		Descriptor 3: Commercial species
		Descriptor 4: Marine food webs
		Descriptor 5: Human-induced eutrophication
		Descriptor 6: Sea floor integrity
		Descriptor 7: Hydrological conditions
		Descriptor 8: Contaminants
		Descriptor 9: Contamination of fish and seafood
		Descriptor 10: Marine litter
		Descriptor 11: Energy and noise
	WFD – Good Ecological Status	Biological quality elements: phytoplankton, phytobenthos, benthic invertebrates, fish, macrophytes
		Physico-chemical elements: nutrients, organic pollution, acidification, specific pollutants
		Hydromorphological elements: hydrology, morphology
Marine & Coastal Conservation and Designated sites – Data cluster 2		Management, restrictions and regulation
		Marine Protected Areas
		Coastal Protected Areas
		Designated sites (conservation, safety, security, risk control)
Oceanographic characteristics and Climate – Data cluster 3	Ocean Variables (GOOS)	Physical: sea state, surface stress, surface height, temperature, currents, salinity
		Biogeochemistry: oxygen, nutrients, inorganic carbon, tracers, particulate matter, nitrous oxide, stable carbon isotopes, dissolved organic carbon
		Biology & Ecosystems: phytoplankton/zooplankton biomass and diversity, fish, turtles, birds, mammals, corals, mangroves, microbes, invertebrates
		Cross-disciplinary: ocean colour, marine debris, ocean sound
	EMODnet Physics Parameters	Waves, water temperature, salinity, currents, optical properties, sea level, atmospheric pressure, wind, conductivity, BioGeoChemical
		Bathymetry
	Copernicus Ocean Monitoring Indicators	Ocean circulation: heat/volume transport, boundary currents, wind-driven circulation, gyres, upwelling, overturning circulation
		Ocean climate: temperature, carbon uptake, freshwater, heat uptake, sea ice, sea level rise
		Ocean variability/extremes: climate variability, cold spells, extreme sea levels, marine heatwaves, storm/cyclone potential, sea state
		Ocean health: chlorophyll, primary production, acidification, deoxygenation, eutrophication, bloom, oligotrophication, coral health
Coastal Land use and Planning – Data cluster 4		Current activities and coastal planning
		Current and planned land use following INSPIRE Land Use

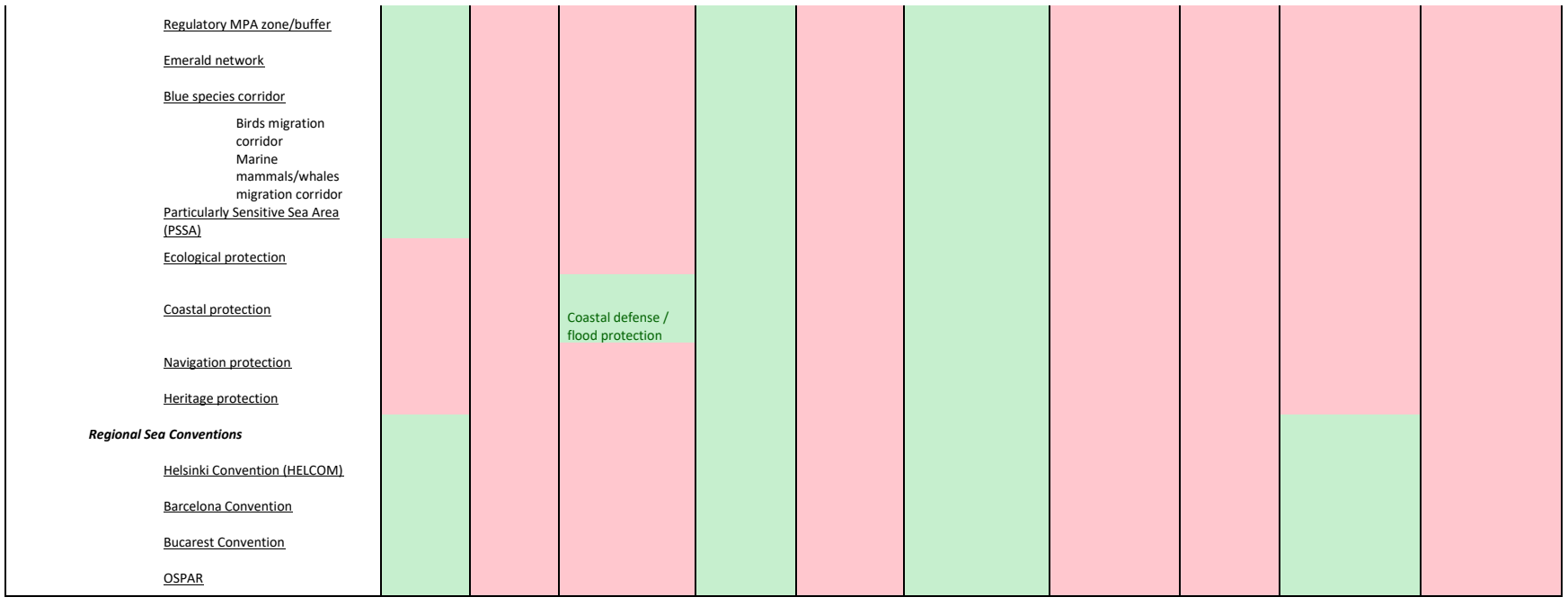
		Classification: primary/secondary/tertiary production, transport/logistics/utilities, residential, other uses
Operative maritime activities and planning – Data cluster 5		Current maritime uses and Maritime Spatial Planning
		Current and planned uses following extended INSPIRE classification for maritime activities: primary/secondary/tertiary production, transport/logistics/utilities, other uses
Socio-economic information – Data cluster 6	Socio-demographic and Economic Data	Socio-demographic: population characteristics
		Economic: coastal and ocean economy, jobs and income in coastal and maritime sectors
Governance information – Data cluster 7		Competence and legislation
		Administrative competence: planning areas, maritime and coastal activities
		(Inter)national regulations: conventions, legislation, policies

APPENDIX 2:

MARINE & COASTAL ENVIRONMENT					ReMAP modules									
CATp1.1	*CATp1.2*	CATc1.3	CLA1.3.1	*CLA1.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
MARINE BIODIVERSITY														
	Flora life													
		Phytoplankton												
			Phytobenthos											
			Mixoplankton											
		Algae												
			Macrophytes											
			Macroalgae (syn: seaweed)											
		Seagrass												
			Posidonie											
	Fauna life													
		Zooplankton												
		Coral species												
		Marine fish and shellfish												
			Benthic fish											
			Demersal fish											
			Pelagic fish											
			Shellfish											
			Commercial species											
		Invertebrate												
			Cephalopods											
			Benthic invertebrate											
		Marine mammals					Extraction							
			Cetacean											
				Dolphins										
				Wales										
			Seals											
			Other marine mammals											
		Marine reptile					Extraction							
		Seabirds					Extraction / wintering area for bird							
			Migratory species											
			Sedentary species											
	Habitats													
		Coastal habitats												
		Nursery habitats												
		Seabed habitats												
			Biogenic structure											
			Calcaerous habitats											
		Benthic habitats												
		Pelagic habitats												
		Essential fish habitats												
		Reefs												
			Artifical reefs											
			Natural reefs											
	Ecosystems													
		Phytoplankton ecosystem												
		Zooplankton eocsystem												
		Fish ecosystem												
		Invertebrate ecosystem												
		Benthic invertebrate ecosystem												
		Hard coral cover					Extraction							
		Seagrass ecosystem												
		Macroalgal canopy ecosystem												
		Mangrove ecosystem												
		Microbe ecosystem												
ANTHROPOGENIC PRESSURES														
	Ocean health													

Chlorophyll										
Ocean acidification										
Ocean deoxygenation			Bottom-water habitats not influenced by permanent anoxia							
Euthrophication and bloom										
Eutrophication										
Bloom										
Oligotrophication										
Coral health										
Non-indigeneous species										
Food webs										
Habitats integrity										
OSPAR threatened and/or declining habitat s in NE Atlantic										
Ecosystems integrity										
Vulnerable marine ecosystems in the North Atlantic										
Seabed integrity										
Hydrographical Conditions (CC)										
Physical seascapes										
Contaminants										
Contaminants measurement counts										
Contaminants median values										
Contamination of fish and seafoods										
Contaminant of fish										
Contaminant of seafood										
Marine litter										
Beach litter										
Seafloor litter										
Micro litter										
Plastic continent										
Energy and underwater noise										
Ocean sound										
Ocean colour										
Microbe										
Pollution										
Chemical pollution			Radioactive substance							
Oil pollution										
Plastic pollution										
Solid pollution										
Organic pollution										
Noise pollution										
Light pollution										
Specific pollution			Polluting ship accident							

MARINE & COASTAL CONSERVATION/DESIGNATED SITES	ReMAP modules									
CATp2.1 / *CATp2.2* / CATc2.3 / CLA2.3.1 / *CLA2.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
PROTECTED AREA										
Coastal/Marine Protected Area (syn: MPA, marine protected site)										
Potential MPA site										
Planned MPA site										
Approuved MPA site										
Managed MPA										
Ia - Strict nature reserve										
Ib - Wilderness area										
II - National park										
III - Natural monument or feature										
IV - Habitats/species management area										
V - Protected seascape										
VI - Protected areas with sustainable use of natural resources										
Natural 2000 network (ICUN category IV)										
SCIs/SACs, Habitats Directive										
SPAs, Birds Directive										



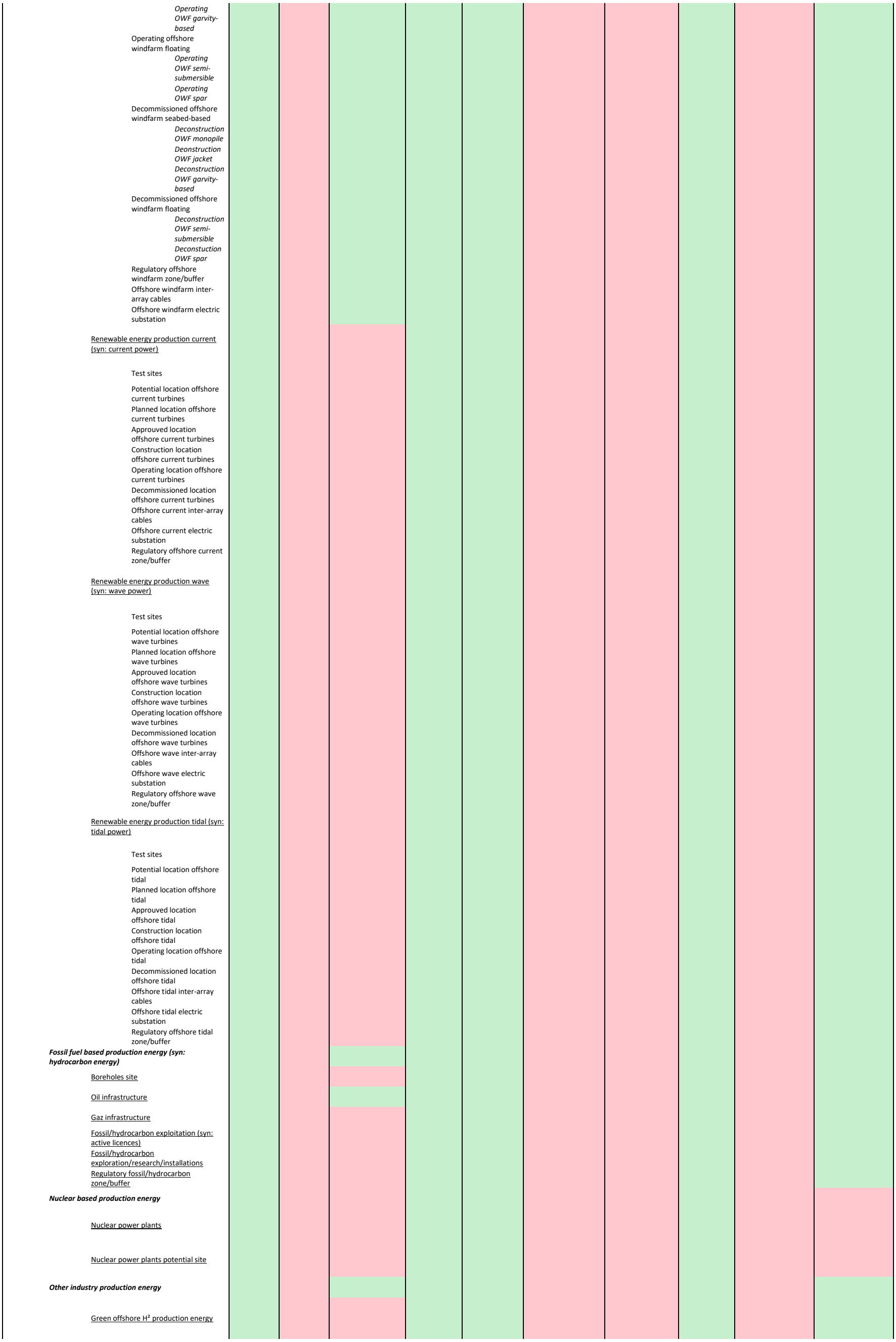
OCEANOGRAPHIC CHARACTERISTICS & CLIMATE					ReMAP modules									
CATp3.1	*CATp3.2*	CATc3.3	CLA3.3.1	*CLA3.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
GEOLOGY														
	Coastal morphology													
		Rocky coastline												
			Cliff											
				Low cliff (1 to 5m)										
				Medium cliff (5 to 10m)										
				High cliff (>10m)										
			Rocky beach											
				Galet beach										
		Sandy coast												
			Sandy beach											
				Estuary beach										
				Pocket beach										
			Sandy arrow											
			Dune											
				Sand dunes										
				Submarine dune										
			Laguna											
			Coastal ponds											
			Sand / vase / mud bank											
		Interbank zones												
		Estuary												
		Delta												
		Other coastal morphology												
			Chenier											
			Mangrove											
	Coastal behavior													
		Erosion												
		Aggradation												
	Geological events and probabilities													
	Marine minerals													
	Seabed substrate													
	Seafloor geology													
	Submerged landscapes													
BATHYMETRY														
	Coastlines													
		Lowest Astronomical Tide (LAT)												
		Mean High Water (MHW)												
		Mean Sea Level (MSL)												
	Depth													
		Bathymetric contours												
		Mean depth												
	Topography and digital elevation model													
		GEBCO Undersea Features												
		Land topography												
		Names on land												
		Names on sea												
		Digital elevation model												
OCEAN VARIABLE AND PARAMETERS														

Ocean physics and circulation											
Ocean heat transport											
Ocean volume transport											
Currents											
Boundary currents											
Surface currents											
Deep currents											
Wind											
Wind driven circulation											
Wind fileds											
Ocean gyres and upwelling											
Meridonial overturning circulation											
Waves											
Swell											
Optical properties											
Turbidity											
River outflow											
Ocean climate											
Sea water temperature (syn: sea temperature)											
Ocean carbon uptake											
Ocean freshwater											
Ocean heat uptake											
Ice cover											
Fast ice											
Glacier											
Polar ice											
Sea ice change											
Sea level rise											
Ocean variability and extremes											
Climate variability											
Cold spells											
Extreme sea level											
Marine heat waves											
Storm and cyclone potential											
Sea state											
Ocean surface stress											
BIOCHEMISTRY											
Oxygen											
Acidity											
pCO2											
Nutrients											
Salinity											
Alkalinity											
Carbon											
Inorganic carbon											
Stable carbon isotopes											
Dissolved organic carbon											
Hydrocarbon											
Transient tracers											
Particulate matter											
Nitrus oxide											
Nitrate											
Phosphate											

COASTAL LAND USE & PLANNING					**ReMAP modules**									
CATp4.1	***CATp4.2***	CATc4.3	CLA4.3.1	*CLA4.3.2*	**D2.1_MSP "input" data**	**D2.2_MSP "output" data**	**D2.3_Cumulative Environmental Assessment**	**D2.4_Land-Sea Interactions**	**D2.5_Marine Strategy Framework Directive**	**D2.6_MSP/marine conservation compatibility**	**D2.7_Ecosystem Services Assessment**	**D2.8_Socio-Econnomic**	**D2.9_Governance**	**D2.10_Navigation Safety**
PRIMARY PRODUCTION														
SECONDARY PRODUCTION														
TERTIARY PRODUCTION														
TRANSPORT NETWORKS LOGISTICS AND UTILITIES														
RESIDENTIAL USE														
OTHER USES														

OPERATIVE MARITIME ACTIVITIES & PLANNING					ReMAP modules									
CATp5.1	*CATp5.2*	CATc5.3	CLA5.3.1	*CLA5.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
PRIMARY PRODUCTION														
Aquaculture (syn: fish farming)														
Marine farm/culture														
Finfish production														
Shellfish/mollucs production														
Mussels production														
Hollow oyster production														
Flat oyster production														
Clam production														
Algae production														
Microalgae production														
Macroalgae production														
Seaweed production														
Freshwater finfish production														
Farming of new species														
Regulatory marine farm zone (syn: aquaculture concession)														
Fisheries (syn: fishing)														
Professionnal fisheries/fishing (syn: commercial)														
Fishing area														
Regulatory fishing zone (syn: fishing restriction)														
Fishing effort														
Fishing intensity (EMODnet)														
Beam trawls (EMODnet)														
Bottom otter trawls (EMODnet)														
Bottom seines (EMODnet)														
Dredges (EMODnet)														
Pelagic trawls and seines (EMODnet)														
Static gears (EMODnet)														
Average subsurface swept area ratio (EMODnet)														
Average surface swept area ratio (EMODnet)														
Fishing gears														
Dredges														
Trawling														
Beam trawls (EMODnet)														
Bottom otter trawls														
Pelagic trawls (syn: midwater)														
Beach trawl														
Seines														
Pelagic seines														
Bottom seines														
Beam trap														
Trap														
Moray trap														
Trammel net														
Live bait														
Fishing line														
Hand line														
Pole line														
Long line														
Jigger fishing														
Fishing dynamic gear														
SSF dynamic pelagic gear														
SSF dynamic benthic gear														
Coastal dynamic pelagic gear														
Coastal dynamic benthic gear														
Deep-sea dynamic pelagic gear														

Deep-sea dynamic benthic gear											
Fishing static/passive gear											
SSF static/passive pelagic gear											
SSF static/passive benthic gear											
Coastal static/passive pelagic gear											
Coastal static/passive benthic gear											
Deep-sea static/passive pelagic gear											
Deep-sea static/passive benthic gear											
Recreationnal fisheries/fishing											
Other living primary production											
Hunting											
Regulatory hunting zone											
Management of migratory animals											
Picking of natural products											
Regulatory picking of natural products zone											
Mining and quarrying											
Mining of energy products materials											
Mining of ores											
Aggregate/sand extraction area											
Raw material extraction area											
Other mining and quarrying											
Regulatory mining zone (syn: mining concession)											
Carbon capture and storage											
Dredging											
Regulatory dredging zone											
SECONDARY PRODUCTION											
Renewable production energy											
Renewable energy production wind (syn: wind power)											
Test sites offshore windfarm seabed-based											
Test sites OWF monopile											
Test sites OWF jacket											
Test sites OWF gravity-based											
Test sites offshore windfarm floating											
Test sites OWF semi-submersible											
Test sites OWF spar											
Planned offshore windfarm seabed-based											
Planned OWF monopile											
Planned sites OWF jacket											
Planned sites OWF gravity-based											
Planned offshore windfarm floating											
Planned OWF semi-submersible											
Planned OWF spar											
Approuved offshore windfarm seabed-based											
Approuved OWF monopile											
Approuved OWF jacket											
Approuved OWF gravity-based											
Approuved offshore windfarm floating											
Approuved OWF semi-submersible											
Approuved OWF spar											
Construction offshore windfarm seabed-based											
Construction OWF monopile											
Construction OWF jacket											
Construction OWF garvity-based											
Construction offshore windfarm floating											
Construction OWF semi-submersible											
Constuction OWF spar											
Operating offshore windfarm seabed-based											
Operating OWF monopile											
Operating OWF jacket											


Operating OWF garvity-based
Operating offshore windfarm floating
Operating OWF semi-submersible
Operating OWF spar
Decommissioned offshore windfarm seabed-based
Deconstruction OWF monopile
Deonstruction OWF jacket
Deconstruction OWF garvity-based
Decommissioned offshore windfarm floating
Deconstruction OWF semi-submersible
Deconstuction OWF spar
Regulatory offshore windfarm zone/buffer
Offshore windfarm inter-array cables
Offshore windfarm electric substation
Renewable energy production current (syn: current power)
Test sites
Potential location offshore current turbines
Planned location offshore current turbines
Approuved location offshore current turbines
Construction location offshore current turbines
Operating location offshore current turbines
Decommissioned location offshore current turbines
Offshore current inter-array cables
Offshore current electric substation
Regulatory offshore current zone/buffer
Renewable energy production wave (syn: wave power)
Test sites
Potential location offshore wave turbines
Planned location offshore wave turbines
Approuved location offshore wave turbines
Construction location offshore wave turbines
Operating location offshore wave turbines
Decommissioned location offshore wave turbines
Offshore wave inter-array cables
Offshore wave electric substation
Regulatory offshore wave zone/buffer
Renewable energy production tidal (syn: tidal power)
Test sites
Potential location offshore tidal
Planned location offshore tidal
Approuved location offshore tidal
Construction location offshore tidal
Operating location offshore tidal
Decommissioned location offshore tidal
Offshore tidal inter-array cables
Offshore tidal electric substation
Regulatory offshore tidal zone/buffer
Fossil fuel based production energy (syn: hydrocarbon energy)
Boreholes site
Oil infrastructure
Gaz infrastructure
Fossil/hydrocarbon exploitation (syn: active licences)
Fossil/hydrocarbon exploration/research/installations
Regulatory fossil/hydrocarbon zone/buffer
Nuclear based production energy
Nuclear power plants
Nuclear power plants potential site
Other industry production energy
Green offshore H² production energy

Offshore green ammonia/methanol production energy											
Solar production energy											
Solar production energy seabed-based Solar production energy floating											
Thermal/hydropower production energy											
Salitnity production energy											
Heavy and product industry											
Manufacturing of vehicles and transport equipment											
Shipyards											
Other industry											
Blue BioTech											
Desalination											
TERTIARY PRODUCTION											
Maritime services											
Yachting area											
Regulatory yachting zone											
Nautical sports area											
Regulatory nautical sports zone											
Nautical sports											
Surf											
Windsurf											
Kitrsurf											
Regatta											
Other nautical sport											
Beaches (syn: bathin waters)											
Coastal tourism area											
Regulatory coastal tourism zone											
Coastal tourism											
Whale watching site											
Scuba diving site				Diving							
Underwater cultural heritage area											
Regulatory underwater cultural heritage zone											
Underwater cultural heritage (syn: heritage site)											
Natural											
Wreck											
Archeological											
Others											
TRANSPORT NETWORKS LOGISTICS AND UTILITIES											
Water transport											
Harbour (syn: port)											
Main ports											
Fish port											
Commercial/goods port											
Cruises/ferries port											
Recreational port (syn: marina)											
Regulatory harbour zone											
Anchorage area											
Mooring berth											
Regulatory anchorage zone											
Navigation aids											
Maritime buoyage system (syn: buoy)											
Beacon towers											
Cairns											
Active lightouses											
Non-activie disused lighthouses											

	Other nautical signals
Restricted area/area to be avoided	
Cargo transhipment area	
Regulatory cargo transhipment zone	
Vessel/ship holding area	
Regulatory vessel/ship holding zone	
Maritime and river regulation area	
Marine/maritime traffic safety zone (syn: vessel safety zone)	
Marine/maritime traffic lanes (syn: traffic route/corridor)	
	Approach channel (syn: fairway)
	Traffic separation schemes (syn: TSS)
Route density (EMSA)	
	All vessels (EMSA)
	Cargo vessels (EMSA)
	Fishing vessels (EMSA)
	Other vessels (EMSA)
	Passenger vessels (EMSA)
	Tanker (EMSA)
Regulatory seaplane landing zone	
Vessel density (EMODnet)	
All type (EMODnet)	
Sailing (EMODnet)	
Pleasure craft	
Fishing (EMODnet)	
High speed craft (EMODnet)	
Passenger vessel (EMODnet)	
Cargo (EMODnet)	
Tanker (EMODnet)	
Military and law enforcement (EMODnet)	
Service (EMODnet)	
Dredging or underwater ops (EMODnet)	
Tug and towing (EMODnet)	
Other ships (EMODnet)	
Unknown (e.g. dark fleets) (EMODnet)	
Other maritimes transport network	Bridges
Logistical and storage services	
Offshore supply	
	Green power stations
	Blue carbon/eco service
	Bio-based phosphorus and nitrogen recycling
Offshore technical infrastructures	
	Hybrid interconnector
	Subsea data center
Utilities	
Power distribution services (syn: pipeline)	
	Oil line/pipeline
	Gas line/pipeline
	Regulatory underwater line/pipeline zone
Water and sewage infrastructure	
	Submarine outfall
Waste treatment/disposal	
	Solid waste treatment
	Water waste treatment
	Waste at ports
	Regulatory waste treatment zone
	Marine litter location

Marine discharge												
Marine oil discharge												
Marine waste dumping												
Dredge spoil dumping			Deposit of dredged materials									
Submarine cables												
Submarine power cable (syn: energy cable) Submarine telecom cable (syn: communication cable)												
Submarine cables zone												
Land reclamation												
Intention land reclamation												
Approved land reclamation												
Other utilities												
Artificial reefs												
MILITARY AREA												
Military exercice zone												
Military firing exercise zone												
Military naval exercise zone												
Military dumping zone												
World War II dumped munitions												
Explosives dumped munitions												
Non-explosives dumped munitions												
Regulatory dumping zone/buffer												

SOCIO-ECONOMIC INFORMATION					ReMAP modules									
CATp6.1	***CATp6.2***	CATc6.3	CLA6.3.1	*CLA6.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
SOCIO-DEMOGRAPHIC														
	Population characteristics													
	Employment													
ECONOMIC INFORMATION														
	Coastal economy													
	Ocean economy													
	Maritime economy													
	Coastal & maritime sectors jobs and income													
	Characteristics of business and economy interacting in the coastal economy Characteristics of business and economy interacting in the ocean economy													

GOVERNANCE INFORMATION					ReMAP modules									
CATp7.1	***CATp7.2***	CATc7.3	CLA7.3.1	*CLA7.3.2*	D2.1_MSP "input" data	D2.2_MSP "output" data	D2.3_Cumulative Environmental Assessment	D2.4_Land-Sea Interactions	D2.5_Marine Strategy Framework Directive	D2.6_MSP/marine conservation compatibility	D2.7_Ecosystem Services Assessment	D2.8_Socio-Econnomic	D2.9_Governance	D2.10_Navigation Safety
ADMINISTRATIVE/REGULATORY LIMITS														
	Maritime boundaries													
		Territorial sea (syn: national waters)												
		Contiguous zone												
		Exclusive Economic Zone (EEZ)												
		Other boundaries												
	Land boundaries													
		National land boundaries												
		Regional land boundaries												
		Departmental land boundaries												
		Local land boundaries												
	Administrative limits													
		National jurisdictional limits												
		Regional jurisdictional limits												
		Departmental jurisdictional limits												
		Local jurisdictional limits												
		Other jurisdictional limits												
			Harbour limits											

Land-sea limit										
ADMINISTRATIVE/REGULATORY UNIT										
MSP area/zone										
MSP spatial plan area										
MSP zoning area										
Allowed										
Potential										
Reserved										
Restricted										
Priority										
Forbidden										
National planning										
Regional planning										
Local planning										
Other planning zone/area										
ICZM area/zone										
Sea basin strategy area/zone										
Large marine ecosystems of the world										
Marine ecoregions of the world										
ICES ecoregions										
Navigation area										
I - United Kingdom										
II - France										
III - Spain										
IV - USA										
V - Brazil										
VI - Argentina										
VII - South Africa										
VIII - India										
IX - Pakistan										
X - Australia										
XI - Japan										
XII - USA										
XIII - Russian Federation										
XIV - New Zealand										
XV - Chile										
XVI - Peru										
XVII - Canada										
XVIII - Canada										
XIX - Norway										
XX - Russian Federation										
XXI - Russian Federation										
Offshore meteo zone										

APPENDIX 3:

Data	Attributes / content	Details
MSP spatial plan	LocalId	Identifier
	extent	GM_Multisurface
	VersionID	Class version
	OffSource	Official Source
	MS	Member state
	OffTitle	Official Title
	LevelSpPla	Level of Spatial Plan value
	PlanTyName	Plan Type Name value
	ProcStepG	Process Step General value
	ValidFrom	Validity from : Date [0..1]
	ValidTo	Validity to : Date [0..1]
	AltTitle	Alternative Title
	BeginLSVer	Begin Life Span Version : Date time
	EndLSVer	End Life Span Version : Date time
	OffDoc	Official Document
	Coast_Dist	Distance from the coast
	AreaKm2	Area km²
	Shape_Leng	Shape length
	Shape_Area	Shape area
	HilucLU	hilucslandUse - Hilucs value
	HilucsMSP	Marine Narrower HILUCS value
	SeaUseName	Sea Use Name value
	SeaUseFct	Sea Use Function value
	SeaUseDsc	Sea Use Description value
	OriginUN	Original Use Name value
	OriginUNEn	Original Use Name English
	RegNature	Regulation Nature value
	hilucsPres	HILUCS presence
	PrevMSPPlan	Previous MSP Plan
	SPID	Specific identity of plan
MSP official documentation	OBJECTID	Object identity
	LocalID	Local identity
	VersionID	Version identity
	OffSource	Official source
	MS	Member State
	LegCit	Legislation Ciation
	RegText	Regulation text
	PlanDoc	Plan document - document citation
MSP Zoning Element	OBJECTID	Object identity
	LocalID	Local identity
	VersionID	Version identity
	OffSource	Official source
	MS	Member state
	HilucLU	hilucslandUse - Hilucs value
	HilucsMSP	Marine Narrower HILUCS value
	SeaUseName	Sea Use Name value
	SeaUseFct	Sea Use Function value
	SeaUseDsc	Sea Use Description value
	OriginUN	Original Use Name value
	OriginUNEn	Original Use Name English
	RegNature	Regulation Nature value
	ProcStepG	Process Step General value
	hilucsPres	HILUCS presence
	ValidFrom	Validity from : Date [0..1]
	ValidTo	Validity to : Date [0..1]
	PrevMSPPla	Previous MSP Plan
	BeginLSver	Begin Life Span Version : Date time
	EndLSVer	End Life Span Version : Date time
	SPID	Specific identity of plan
	OffDoc	Official Document
	Coast_Dist	Distance from the coast
	AreaKm2	Area km²
	Shape_Leng	Shape length
	Shape_Area	Shape area
Administrative units	Administrative boundary	Administrative boundary
	Administrative hierarchical level	Administrative hierarchical level
	Administrative level	Administrative level
	Condominium	Condominium
	LegalStatusValue	Legal Status Value
	ResidenceOfAuthority	Residence Of Authority
	TechnicalStatusValue	Technical Status Value
	Maritime Units	Maritime Units
	Baseline	Baseline
	BaselineSegment	Baseline Segment
	BaselineSegmentTypeValue	Baseline Segment Type Value
	ContiguousZone	Contiguous Zone
	ContinentalShelf	Continental Shelf
	ExclusiveEconomicZone	Exclusive Economic Zone
	InternalWaters	Internal Waters
	MaritimeBoundary	Maritime Boundary
	MaritimeZone	Maritime Zone
	TerritorialSea	Territorial Sea
Legislation and competent authority	N/A	Document - no spatial attribute
Benthic Habitat	inspireID	Identity INSPIRE
	geometry	Geometry
	habitat	Habitat
	habitatSpecies (optional)	Habitat species
	habitatVegetation (optional)	Habitat vegetation
	referenceSpeciesId (optional)	Reference species identity
	referenceSpeciesScheme (optional)	Reference species scheme
	localSpeciesName (optional)	Local species name
	referenceHabitatTypeId	Reference habitat type identity
	referenceHabitatTypeScheme	Reference habitat type scheme
	referenceHabitatTypeName (optional)	Reference habitat type name
	localHabitatName (optional)	Local habitat name
	areaCovered (optional)	Area covered
	lengthCovered (optional)	Length covered
	volumeCovered (optional)	Volume covered
	localScheme (optional)	Local scheme
	localNameCode (optional)	Local name code
	localName (optional)	Local name
	qualifierLocalName (optional)	Qualifier local name
	localVegetationName (optional)	Local vegetation name
MSFD status class ART8_GES	CountryCode	Country code

	ContactMail	Contact mail
	ContactName	Contact name
	ContactOrganisation	Contact organisation
	ReportingDate	Reporting date
	MarineReportingUnit	Marine reporting unit
	GEScomponent	Good Environmental Status component
	Feature	Feature
	GESextendAchieved	Good Environmental Status extend achieved
	GESextendUnit	Good Environmental Status extend unit
	GESextendThreshold	Good Environmental Status extend threshold
	AssessmentPeriod	Assessment period
	GESachieved	Good Environmental Status achieved
	RelatedTargets	Related targets
	RelatedPressures	Related pressures
	DescriptionOverallStatus	Description overall status
	IntegrationRuleTypeCriteria	Integration rule type criteria
	IntegrationRuleTypeParameter	Integration rule type parameter
	Element	Element
	Element2	Second element (if needed)
	ElementSource	Element source
	ElementCode	Element code
	Element2Code	Second element code
	ElementCodeSource	Element code source
	Element2CodeSource	Second element code source
	DescriptionElement	Element description
	ElementStatus	Element status
	Criteria	Criteria
	CriteriaStatus	Status criteria
	DescriptionCriteria	Description criteria
	Parameter	Parameter
	ParameterOther	Other parameter
	ThresholdValueUpper	Upper threshold value
	ThresholdValueLower	Lower threshold value
	ThresholdQualitative	Qualitative threshold
	ThresholdValueSource	Value source threshold
	ThresholdValueSourceOther	Other value source threshold
	ValueAchievedUpper	Upper value achieved
	ValueAchievedLower	Lower value achieved
	ValueUnit	Value unit
	ValueUnitOther	Other value unit
	ProportionThresholdValue	Threshold value proportion
	ProportionThresholdValueUnit	Threshold value proportion unit
	ProportionValueAchieved	Value achieved proportion
	Trend	Trend
	ParameterAchieved	Achieved parameter
	DescriptionParameter	Description parameter
	RelatedIndicator	Related indicator
	Reference	Reference
	Description	Description
MSFD status class ART9_GES	CountryCode	Country code
	ContactMail	Contact mail
	ContactName	Contact name
	ContactOrganisation	Contact organisation
	ReportingDate	Reporting date
	GEScomponent	Good Environmental Status component
	JustificationDelay	Delay justification
	JustificationNonUse	Non-use justification
	GESdescription	Good Environmental Status description
	DeterminationDate	Determination date
	UpdateType	Update type
	Feature	Feature
	MarineReportingUnit	Marine reporting unit
MPA	geometry	Geometry
	inspireID	Identity INSPIRE
	legalFoundationDate	Legal foundation date
	legalFoundationDocument	Legal foundation document
	siteDesignation	Site designation
	Designat_1 (IUCN classification)	Designation with IUCN classification
	Percentage Under Designation	Percentage of site under designation
	siteName	Site name
	SiteProtectionClassification	Site protection classification
	DesignationSchemeValue	Designation scheme value
	ProtectionClassificationValue	Protection classification value
	DesignationType	Designation type
	constraints	Constraints associated
Restricted area Navigational (RestrictedAreaNavigational)*	CategoryOfRestrictedArea	Category of restricted area
	status	Status
	restriction	Restriction
Seabed area (SeabedArea)*	waterLevelEffect	Water level effect
	natureOfSurfaceQualifyingTerms	Nature of surface - Qualifying terms
	natureOfSurface	Nature of surface
Seaplane landing area (SeaplaneLandingArea)*	restriction	Restriction
	status	Status
Ferry route*	status	Status
	trafficFlow	Traffic flow
	depthRangeMinimumValue	Depth range value 1
	categorieOfFerry	Category of ferry
Recommended Track (RecommendedTrack)*	status	Status
	trafficFlow	Traffic flow
	depthRangeMinimumValue	Depth range value minimum
	qualityOfVerticalMeasurement	Quality of Vertical measurement
Recommended route centerline (RecommendedRouteCentreLine)*	status	Status
	trafficFlow	Traffic flow
	depthRangeMinimumValue	Depth range value minimum
	qualityOfVerticalMeasurement	Quality of Vertical measurement
Cable (Cable)*	restriction	Restriction
	categoryOfCable	Category of cable
	buriedDepth	Buried depth
	condition	Condition
	status	Status
Pipeline Submarine/On Land (PipelineSubmarineOnland)*	categroyOfPipelinePipe	Category of pipeline
	product	Product
	restriction	Restriction
	buriedDepth	Buried depth
	condition	Condition
	status	Status
	depthRangeMinimumValue	Depth range value minimum
	depthRangeMaximumValue	Depth range value maximum
Depth Contour (DepthContour)*	valueOfDepthContour	Value of depth contour
	depthRangeMinimumValue	Depth range value minimum

Depth area (DepthArea)*	depthRangeMaximumValue	Depth range value maximum
	valueOfDepthContour	Value of depth contour
Offshore platform, Offshore Safety Zone, Offshore Production area (OffshorePlatform, OffshoreProductionArea, CatgeoryOfOffshorePlatform)*	categoryOfOffshoreProductionArea	Category of Offshore production area
	condition	Condition
	product	Product
	restriction	Restriction
	categoryOfOffshorePlatform	Category of offshore platform
	status	Status
Marine traffic management: navigation line, recommended traffic lane part, two-way route, precautionary areas localisation, caution area (NavigationLine, RecommendedTrafficLanePart, PrecautionaryArea, TwoWayRoutePart, PrecautionaryArea, CautionArea)*	categoryOfNavigationLine	Category of navigation line
	status	Status
	depthRangeMinimumValue	Depth range value minimum
	trafficFlow	Traffic flow
	restriction	Restriction
Wreck (Wreck)*	categoryOfWreck	Category of wreck
	expositionOfSounding	Exposition of sounding
	qualityOfVerticalMeasurement	Quality of Vertical measurement
	valueOfSounding	Value of Sounding
	status	Status
	waterLevelEffect	Water level effect
Marine Pollution Regulations Area*	depthRangeMinimumValue	Depth range value minimum
	restriction	Restriction
	status	Status
	trafficFlow	Traffic flow
Harbour Area (HarbourAreaAdministrative)*	status	Status
Fishing zone (FishingGround)*	status	Status
Anchorage area (AnchorageArea)*	categoryOfAnchorage	Category of anchorage
	restriction	Restriction
	status	status
Beacon cardinal (BeaconCardinal)*	condition	Condition
	status	Status
	natureOfConstruction	Nature of construction
Beacon isolated danger (BeaconIsolatedDanger)*	condition	Condition
	status	Status
	natureOfConstruction	Nature of construction
Beacon lateral (BeaconLateral)*	condition	Condition
	status	Status
	natureOfConstruction	Nature of construction
Beacon safe water (BeaconSafeWater)*	condition	Condition
	status	Status
	natureOfConstruction	Nature of construction
Beacon special purpose or general (BeaconSpecialPurposeGeneral)*	condition	Condition
	status	Status
	categoryOfSpecialPuroposeMark	Category of special purpose mark
	natureOfConstruction	Nature of construction
Light (LightAllAround)*	sectorLimitOne	Sector limit 1
	sectorLimitTwo	Sector limit 2
	status	Status
Submarine dune (SubmarineDune)*	verticalLength	Vertical length
Obstruction (Obstruction)*	categoryOfObstruction	Category of obstruction
	condition	Condition
	natureOfConstruction	Nature of construction
	natureOfSurfaceQualifyingTerms, natureIofSurface	Nature of surface
	status	Status
	waterLevelEffect	Water level effect
Military practice area (MilitaryPracticeArea)*	categoryOfMilitaryPracticeArea	Category of military practice area
	restriction	Restriction
	status	Status
Fairway (Fairway)*	depthRangeMinimumValue	Depth range value minimum
	restriction	Restriction
	status	Status
	trafficFlow	Traffic flow
Marine Farm/Culture (MarineFarmCulture)*	categoryOfMarineFarmCulture	Category of marine farm / culture
	restriction	Restriction
	status	Status
	waterLevelEffect	Water level effect
Separation Zone or Line (SeparationZoneOrLine)*	IMOAdopted	IMO Adopted
	status	Status
Traffic separation scheme boundary (TrafficSeparationSchemeBoundary)*	IMOAdopted	IMO Adopted
	status	Status
Traffic separation scheme crossing (TrafficSeparationSchemeCrossing)*	IMOAdopted	IMO Adopted
	restriction	Restriction
	status	Status
Traffic separation scheme lane part (TrafficSeparationSchemeLanePart)*	IMO Adopted	IMOAdopted
	restriction	Restriction
	status	Status
Traffic separation scheme roundabout (TrafficSeparationSchemeRoundabout)*	IMOAdopted	IMO Adopted
	restriction	Restriction
	status	Status
Separation Zone or Line (SeparationZoneOrLine)*	IMOAdopted	IMO Adopted
	status	Status
Inshore traffic zone (InshoreTrafficZone)*	IMOAdopted	IMO Adopted
	restriction	Restriction
	status	Status
Exclusive Economic zone (ExlusiveEconomicZone) and Vessel Traffic Service Area (VesselTrafficServiceArea)*	jurisdiction	Jurisdiction
Anchorage area (AnchorageArea)*	categoryOfAnchorage	Category of anchorage
	restriction	Restriction
	status	Status
Anchorage berth (AnchorBerth)*	categoryOfAnchorage	Category of anchorage
	radius	Radius
	status	Status
Territorial sea area (TerritorialSeaArea)*	restriction	Restriction
Ice area (IceArea)*	categoryOfIce	Category of ice
	status	Status
Dumping Ground (Dumping Ground)*	categoryOfDumpingGround	Category of dumping ground
	restriction	Restriction
	status	Status
Lighthouse	ARLHS_NUMB	Amateur Radio Lighthouse Society (ARLHS) dataset lighthouse indexed number
	Country	Country
	Name	Name
	status	Status
	Coast_dist	Distance to the coast
	Position_c	Center position
	Comment	Comment
Traffic boat density map	Traffic	Number of hours spent by boats in this area per square kilometer per year
Bathymetry	Elevation	Elevation

Mean sea level	FID	Feature identity
Marine mammal main corridor of migration	Status	Status (Presence/Absence)
Marine mammal reproduction site	Status	Status (Presence/Absence)
Marine mammal wintering site	Status	Status (Presence/Absence)
Turtles distribution	Status	Status (Presence/Absence)
Sea level rise (based on GIEC scenario)	Depth	Depth
Impulsive sound events	year	Year of the event
	source	Source event
Aggregate extraction	Code	Code
	Name	Name
	Id	Identity
	Material	Material
	Country	Country
	Site_type	Site type
	status	Status
	Year_start	Start year
	Year_end	End year
	Notes	Notes
	Sourcetype	Source type
	Sourcedata	Data source
	Service	Service
	Sourcelink	Source link
	Lastaccess	Last access
	Metadavail	Metadata availability
	Metalink	Metadata link
	SeaBasin	Sea basin
	Sea	Sea
	Centroid_x	Centroid x latitude
	Centroid_y	Centroid y longitude
	Coast_dist	Distance from the coast
Dredging area	ID_1	Identity
	Latitude	Latitude
	Longitude	Longitude
	Posinfo	Position information
	Country	Country
	Seabasin	Sea basin
	Sea	Sea
	Year	Year
	Extraction type	Extraction type
	Tonnes	Tonnes
	Notes_1	Notes
Aquaculture/mariculture site	ObjectID	Object identity
	Shape	Shape
	Country	Country
	Owner_name	Owner name
	status	Status
	Farm_type	Type of aquaculture or mariculture
	Production_method	Production method
	Production_stage	Production stage
	Purpose	Purpose
	Products_detail	Products detail
	Point_info	Point information
	Site_ID	Site identity
	Coast_dist	Distance from the coast
	Position_coastline	Position from the coastline
	Eurostat_species_group	EUROSTAT species group
	Eurostat_species_name	EUROSTAT species name
	Eurostat_code	EUROSTAT code
	Species_ID	Species identity
	Area_name	Area name
	year	year of construction
Main ports	Port_ID	Port identity
	Data_src_c	Data source code
	Port_coor_	Port coordinate
	Cntr_code	Country code
	Port_name	Port name
	Rep_mar_l	Maritime entity (reporting)
	Source	Source
	Point_x	Latitude point
	Point_y	Longitude point
	Traffic	Traffic
Offshore installation	Country	Country
	Code	Code
	status	Status
	Name	Name
	Category	Category
	Function	Function
	Operator	Operator
	Loc_block	Location block
	Prim_prod	Primary production
	Wt_sub_t	Sub-structure weight
	Wt_top_t	Topside weight
	Validfrom	Valid from
	Validto	Valid to
	Wd_m	Water depth in meter
	Dist_m	Distance to coast in meter
	Notes	Notes
Pipeline	ID	Identity
	Name	Name
	status	Status
	Medium	Medium
	Operator	Operator
	Size_in	Size (inch)
	Length_m	Length (meter)
	Year	Year
	From_loc	From locality
	To_loc	To locality
	Country_co	Country code
	Country	Country
	Notes	Notes
	Shape_leng	Shape length
Dumped munition	Object_ID	Object identity
	Mun_type	Munition type
	Mun_dsc	Munition description
	Info_prov	Information provenance
	Date	Date
	Coast_dist	Distance from the coast
	Shape_Leng	Shape length
	Shape_Area	Shape area
	fid	Feature identity

Coastal land use	Inspire_ID	Identity INSPIRE
	hilucsLandUse	hilucslandUse - Hilucs value
	hilucsMSP	Marine Narrower HILUCS value
	beginLifespanVersion	Begin life span version
	endLifespanVersion	End life span version
	hilucsPres	HILUCS presence
	SpecificLandUse	Specific land use
	specificPresence	Specific presence
	observationDate	Observation date
	ValidFrom	Valid from
	ValidTo	Valid to
Fisheries (production)	Rate of utilization of quotas	No spatial attribute
	Number of enterprises	No spatial attribute
	Energy consumption	No spatial attribute
	Fishing days	No spatial attribute
	Volume of landings	No spatial attribute
	Value of landings	No spatial attribute
	Repair and maintenance costs	No spatial attribute
	Variable costs	No spatial attribute
	Non-variable costs	No spatial attribute
Aquaculture (production)	Number of enterprises ≤ 5 employees	No spatial attribute
	Number of enterprises 6 - 10 employees	No spatial attribute
	Number of enterprises > 10 employees	No spatial attribute
	Volume of sales	No spatial attribute
	Value of sales	No spatial attribute
	Raw material costs	No spatial attribute
	Repair and maintenance costs	No spatial attribute
	Other operational costs	No spatial attribute
Fish, crustaceans and molluscs processing and preserving	Number of enterprises ≤ 10 employees	No spatial attribute
	Number of enterprises 11 - 49 employees	No spatial attribute
	Number of enterprises 50 - 249 employees	No spatial attribute
	Number of enterprises ≥ 250 employees	No spatial attribute
	Energy costs	No spatial attribute
	Raw material costs	No spatial attribute
	Other operational costs	No spatial attribute
	Self-sufficiency rate	No spatial attribute
Extraction of aggregates	Offshore production of oil	No spatial attribute
	Offshore production of gas	No spatial attribute
	Price of crude oil	No spatial attribute
	Price of natural gas	No spatial attribute
	Historical volatility of oil price	No spatial attribute
	Historical volatility of gas price	No spatial attribute
	Share of renewable energy	No spatial attribute
Maritime transport	Estimated production of marine aggregates	No spatial attribute
Port activities: construction of water project	N/A	Description not available yet
Port activities: warehousing and storage services	N/A	Description not available yet
Ports activities: service activities incidental to water transportation	N/A	Description not available yet
Port activities: cargo handling	N/A	Description not available yet
Shipbuilding (including leisure boating and water sport equipment)	Number of enterprises (includes ship repairs)	No spatial attribute
	Number of new orders	No spatial attribute
	Number of completions	No spatial attribute
	Turnover of naval shipbuilding	No spatial attribute
	GVA of naval shipbuilding	No spatial attribute
	Persons employed in naval shipbuilding	No spatial attribute
	FTE in naval shipbuilding	No spatial attribute
Ship repair	N/A	Description not available yet
Dismantling of wrecks	N/A	Description not available yet
Cruise tourism	Number of cruise passengers	No spatial attribute
	Direct expenditure	No spatial attribute
	Average cruise ticket value	No spatial attribute
	Turnover of cruise tourism	No spatial attribute
	GVA of cruise tourism	No spatial attribute
	Persons employed in cruise tourism	No spatial attribute
	FTE in cruise tourism	No spatial attribute
Wind energy production	Number of farms	No spatial attribute
	Number of turbines	No spatial attribute
	Capacity installed (MW)	No spatial attribute
	Investments	No spatial attribute
	Gross electricity generation main activity (main activity and autoproducer)	No spatial attribute
Public activities for environmental protection, research and marine and coastal security	N/A	Description not available yet
Fish consumption: prepared meals and dishes (based on fish or fish products)	N/A	Description not available yet
Coastal tourism	Nights spent at tourist accommodation establishments in coastal areas	No spatial attribute
	Number of establishments, bedrooms and bed-places in coastal areas	No spatial attribute
	Total tourist expenditure in coastal areas	No spatial attribute
Seabed mining	N/A	Description not available yet
Bathing sites/ beaches**	name	Name
Bridges and other constructions**	year	Year of construction
Coastal defence and flood protection**	status	Status of construction at the time of data collection
	year	Year of construction
	area	Area km²
Continuous anthropogenic noise**	N/A	Raster with sound pressure levels at one 1/3 octave band of 125 Hz exceeding background levels at least 50% of the time
Diving**	val_20**	Value of total dives for chosen year
Deposit of dredged materials**	year	Year of action or event
Discharge of warm water from nuclear power plants**	val_20**	Heat load (TWh per year) value for chosen year
Dredging area**	type	Type of dredging
	value	Dredged volume in cubic meters
	year	Year of action or event
Eutrophication (relative distribution of nutrient concentration)	status	Integrated assessments results for MSFD reporting (HEAT assessment)
	country	Country in which the assessment is locate
	ER	Overall eutrophication ration
	ER_1	Eutrophication ration for nutrients
	EQR	Overall ecological ratio for
	EQR_1	Ecological quality ratio for nutrients
	EQRS	Overall ecological quality ratio scaled
	EQRS_1	Ecological quality ration scaled for nutrients
	EQRS_Class	Overall effect
	EQRS_1_Class	nutrient effect
	Confidence.Overall_confidence	Overall confidence
	Confidence.C1_from_HEAT_	Confidence for nutrient effect
	Confidence.C_Class	Confidence class for overall confidence
	Confidence.C_1_class	Confidence class for confidence for nutrient effect
Extraction of target fish species in commercial fisheries**	ICESNAME	ICES statistical rectangles
	val_20**	Total landings (tonnes) per species per chosen year
Extraction of, or mortaly/injury to, wild species - seabirds**	value	Number of individuals extracted per species per year (for species, use 3 first letters of genus and 2 of specific, e.g. Sooty shearwater: soosh)

	species	Species name
	year	Year of collection
Extraction of, or mortality/injury to, wild species - mammals**	value	Number of individuals extracted per species per year (for species, use 3 first letters of genus and 2 of specific, e.g. Sooty shearwater: soosh)
	species	Species name
	year	Year of collection
Extraction of, or mortality/injury to, wild species - turtles**	val_20**	Number of individuals extracted per species per chosen year
	species	Species name
	area	Area of extraction km²
Extraction of, or mortality/injury to, wild species - corals**	val_20**	Number of individuals extracted per species per chosen year
	species	Species name
	area	Area of extraction km²
Extraction of minerals**	type	Type of sediment extracted
	area	Area of extraction in km²
	year	Year of action or event
Fishing intensity (based on VMS data, further specificities on this link)**	val_20**	Total swept area ratio per c-square per chosen year for all gear types
	ICESsq	ICES_C-squares
Fossil fuel energy production**	val_20**	Heat load (TWh per chosen year)
Hazardous substances**	value	Integrated assessments results for MSFD reporting (CHASE assessment)
Hydropower dam**	year	Year of construction
Illegal oil discharging**	s_vol	Spill volume (m3)
	s_area	Spill area (km²)
	year	Year of action or event
Land claim**	N/A	No attributes required
Marinas and leisure harbours**	type	Type of marina or leisure harbour
Oil platforms**	year	Year of construction
Occurrence of stablished Non-Indigenous Species**	value	Integrated assessments results for MSFD reporting
Polluting ship accidents**	s_vol	Spill volume (m3)
	year	Year of action or event
Radioactive substance	discharge	Discharge per isotope per year (name isotope by its short form, e.g. Caesium 137: CS137)
	isotope	Isotope name
Recreational boating and sports**	tot_fuel_c	Total fuel consumption of recreational boats
Rivers	N/A	
Seaweed harvesting and farming/cultivation**	val_20**	Tonnes per chosen year
Watercourse modification**	year	Year of construction
Broad habitat types **	N/A	
Sandbanks**	presence	Presence/absence
Estuaries**	presence	Presence/absence
Mudflats and sandflats**	presence	Presence/absence
Coastal lagoons**	presence	Presence/absence
Large shallow inlets and bays**	presence	Presence/absence
Reefs**	presence	Presence/absence
Submarine structures made by leaking gas	presence	Presence/absence
Islands, islets and small islands**	presence	Presence/absence
Posidonia beds**	presence	Presence/absence
Submerged or partially submerged sea caves**	presence	Presence/absence
Natura 2000 habitats**	year	Year of occurrence
	biotope	Biotope of Habitats Directive Annex 1 habitat types (Marine and coastal)
Benthic species**	species	Species name
	data_type	Data type
	year	Year of event
	presence	Presence/absence
	value	Count value
	unit	Unit of count value, e.g. individuals per m / other
Productive surface waters (Chl-a)**	value	Chl-a concentration (maximum monthly value)
Bottom-water habitats not influenced by permanent anoxia	H2S	H2S (modelled)
	year	Year of event
Fish abundance (list of species provided per sea area)**	ICES	ICES subdivision
	CPUE	CPUE values per ICES subdivision
	m_CPUE	Mean CPUE
	year	Year of occurrence
	species	Species name
Wintering areas for birds**	presence	Presence/absence
Breeding areas for birds**	presence	Presence/absence
Mammals distribution**	presence	Presence/absence
	Species	Species name
Coral distribution**	presence	Presence/absence

Table: reference table to specify harmonization attributes needed for ReMAP spatial data

* for the moment object attributes indexed in S-57 CARIS S-57 ENC Object Catalogue, will be used with S-101 format when available

** description of attributes needed for these datasets are coming from the ReMAP project dataset validation tool developed by HELCOM