Supporting maritime spatial Planning in the Eastern Mediterranean (SUPREME)

Analysis of data, portals, tools and methods supporting MSP process

Deliverable Nr. 1.3.2 and 1.3.3

Co-funded by the European Maritime and Fisheries Fund of the European Union.
Agreement EASME/EMFF/2015/1.2.1.3/01/S12.742087 - SUPREME

ACKNOWLEDGEMENT

The work described in this report was supported by the European Maritime and Fisheries Fund of the European Union- through the Grant Agreement EASME/EMFF/2015/1.2.1.3/01/S12.742087 - SUPREME*, corresponding to the Call for proposal* EASME/EMFF/2015/1.2.1.3 for Projects on Maritime Spatial Planning (MSP).

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Project Full title	Supporting maritime spatial Planning in the Eastern Mediterranean (SUPREME)
Project Acronym	SUPREME
Grant Agreement No.	Agreement EASME/EMFF/2015/1.2.1.3/01/S12.742087 - SUPREME
Coordinator	Dr. Pierpaolo Campostrini
Project start date and duration	01/01/2017 – 31/12/2018
Project website	http://www.msp-supreme.eu/

Deliverable Nr.	1.3.2, 1.3.3	**Deliverable Date**	
Status: Final (F) / Draft (D) / Revised draft (RV)	Final		
Task number	C 1.3.2 and 1.3.3		
Task number Title	Analysis and testing of data, portals, tools and methods supporting MSP process		
Responsible Institute (acronym)	CORILA		
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Acronyms

ADRIPLAN: ADRiatic Ionian maritime spatial PLANning

CKAN: Comprehensive Knowledge Archive Network

CORILA: Consorzio per il coordinamento delle ricerche inerenti il sistema lagunare di Venezia

DG Mare: Directorate General for Maritime Affairs and Fisheries

EEA: European Environment Agency

EMODnet: European Marine Observation and Data Network

IEC: International Electrotechnical Commission

IHO: International Hydrographic Organization

INSPIRE: Infrastructure for Spatial Information in Europe

ISO: International Organization for Standardization

MSFD: Marine strategy framework Directive

MSP: Maritime Spatial Planning

MSPKC: MSP Knowledge Catalogue

OGC: Open Geospatial Consortium

SIMWESTMED: Supporting Implementation of Maritime Spatial Planning in the Western Mediterranean region

WCS: Web Coverage Service

WFS: Web Feature Service

WMS: Web Map Service

WMTS: Web Map Tile Service

PART I - Context

1. Introduction

1.1. About SUPREME project

The objective of the SUPREME (SUpporting maritime spatial Planning in the Eastern MEditerranean) project is to support Member States in establishing and developing Maritime Spatial Plans in the Eastern Mediterranean and to implement cooperation on cross-border planning in this sea basin. The action seeks to stimulate the development of a cross-border, ecosystem-based approach towards MSP, based on the requirements of the Directive on Maritime Spatial Planning 2014/89/EU.

More in details, SUPREME project involves public authorities in charge of MSP, as designated by the Governors of four MS (GR, HR, IT and SL), and the UNEP/MAP Barcelona Convention.

SUPREME has focused on two key objectives, stated in the call for proposals:

1. to support the implementation of Maritime Spatial Planning in EU Member States;
2. to launch and carry out concrete and cross-border MSP initiatives between Member States.

SUPREME will address these two key objectives through a variety of tools and considering the ecosystem based approach.

The project is structured in “components”, “tasks” and “sub-tasks”, where the Component 1 (Implementation of MSP) is the project’s core.

Inside the task C1.3, dealing with “*Support for Member States' implementation of Maritime Spatial Planning*”, the sub-tasks C1.3.2 (Data and information requirements for MSP) and C1.3.3 (Tools and methods supporting MSP process) are two connected activities that build on each other to support the access and use of maritime spatial data.

Due to the strong connection and interaction between the sub-tasks, we have adopted a joint approach to their implementation in order to optimize the execution of activities and to achieve more integrated and useful outcomes for the MSP implementation.

Both sub-tasks have been coordinated by CORILA and have required the participation of other partners in various phases of the activity.

1.2. Task 1.3.2: Data and information requirements for MSP

The objective of this task is to support access to and use of maritime spatial data, carrying out an analysis of data needs and existing data gaps and weaknesses. This action has considered the data and information requirements for MSP, specifically the challenges in cross-border integration and transboundary interoperability. The action has considered existing data availability, platforms and infrastructures, which can be extended and optimized within the Eastern Mediterranean. Data availability, data collection obligations and activities under the Integrated Monitoring and Assessment programme of the Barcelona Convention and data exchange represent a key aspect to support the setting and implementation of MSP processes, even in relation to monitoring and evaluation.

1.3. Task 1.3.3: Tools and methods supporting MSP process

The objective of this task is to investigate and test tools that are designed to effectively support maritime spatial planning processes. Existing tools have been investigated considering their capability in supporting the ecosystem-based approach, in understanding the interactions between different maritime activities and between the maritime activities and the marine environment, in supporting the planning and optimal location of uses and in improving stakeholders and planners understanding of the MSP process outcomes.

1.4. Data and tools group establishment

The partners of SUPREME project have been involved during different phases and with different levels of iteration. To better collaborate among partners and coordinate with other related tasks in the project, a "Data and tools group" has been set up. This group is composed by representatives of the partners directly working in the sub-tasks C1.3.2 and C1.3.3, plus representatives of other tasks connected with activities related to data and tools, especially from C1.1 *Initial assessment*, C1.3.1 *Spatial demands, future trends* and C.1.3.8 *Addressing MSP Implementation in Case Study Areas*. Moreover, efforts have been dedicated to the connection and exchange of information and experiences between the SUPREME “Data and tools group” and the SIMWESTMED “Task group on data”, which has very similar objectives and procedures.

The role of the Data and tools group participants has been to:

- share information, knowledge and experiences in relation to the activities of sub-tasks C1.3.2 and C1.3.3;
- act as a reference point at national level for the activities of review and survey of relevant stakeholders;
- discuss technical issues related to data collection and management, interoperability of data, portals and tools;

- connect and keep updated all SUPREME activities that are dealing with data and tools supporting the implementation of MSP at national level.

1.5. Context

In the recent years many initiatives have analyzed how data, portals and tools may support MSP process. The MSP Data Study (European Commission 2016) presents a complete overview of what data and knowledge are needed by Member States for MSP decision making, taking into account different scales and different points in the MSP cycle.

Pan-European initiatives have a strategic role to foster effective data sharing to support transboundary MSP. The European Marine Observation and Data Network (EMODnet 2018a) data portals (EMODnet 2018a) provide access to European marine data across seven discipline-based themes (bathymetry, geology, seabed habitats, chemistry, biology, physics, human activities (EMODnet 2018b). EMODnet data portals and Sea Basin Checkpoints have the potential to support transboundary MSP data exchange needs by providing access to a range of harmonised data sets across European Sea Basins and testing the availability and adequacy of existing data sets to meet commercial and policy challenges (European Commission 2016).

The Pan-European infrastructure for marine and ocean data management (SeaDataNet) (Schaap and Lowry 2010; “SeaDataNet” 2018) is actively implementing an interoperable infrastructure for managing, indexing and sharing online comprehensive sets of multi-disciplinary, in situ and remote sensing marine data, metadata and products. SeaDataNet has qualified itself as the leading infrastructure for the EMODNet data management component, it is driving several thematic portals (chemistry, physics, bathymetry, etc.) and provides practical and standard solutions for support interoperable data(Schaap 2017).

The INSPIRE Directive (Infrastructure for Spatial Information in the European Community) aims to create a European Union spatial data infrastructure “for the purposes of Community environmental policies and policies or activities which may have an impact on the environment” (European Union 2007; Craglia and Annoni 2007). INSPIRE is in line with the expectation of the EU MSP Directive to cooperate and share data across borders. According to Maritime Spatial Planning Directive (EC (European Council) 2014): “With a view to ensuring that maritime spatial plans are based on reliable data and to avoid additional administrative burdens, it is essential that Member States make use of the best available data and information by encouraging the relevant stakeholders to share information and by making use of existing instruments and tools for data collection, such as those developed in the context of the Marine Knowledge 2020 initiative and Directive 2007/2/EC of the European Parliament and of the Council (18)” (European Union 2007). In addition to the INSPIRE implementation, many other Spatial Data Infrastructures and geoportals can provide a valuable support to MSP process. Marine-driven geoportals, responding to the international quality protocols, are the key asset to support data management and exchange. They are intended to support data sharing to inform transboundary cooperation as well as national efforts in relation to MSP, to integrate analysis and planning activities on different selected areas. Moreover, they

represent the interoperability platforms to share information with the public and with all interested parties, as well as to recollect required information in order to inform decision making.

On the other end, several publications have reviewed and investigated how practical software tools may support the various stages of the MSP process (Stelzenmüller et al. 2013; Kannen et al. 2016; Pınarbaşı et al. 2017). The EU MSP Platform (European Commission 2018) provides an up-to-date collection of MSP-related practices including tools, studies, methodologies, guidances.

1.6. Overall aim and main structure

This report proposes an integrated analysis on data, portals and tools to support transboundary and ecosystem-based MSP in the Eastern Mediterranean region. The analysis of the three subjects (data, portals, tools) has been carried out following a three-steps parallel approach: i) current state analysis; ii) gaps and weakness identification; iii) proposed actions. Mutual interactions between available datasets (data), effective infrastructure for data sharing (portals) and tools have been investigated as well.

Part II (Method) is organized as follows: chapter 2 gives a description of the recursive approach adopted for the inventory and analysis stages; chapter 3 provides an overview of the SUPREME study area in relation with the MSP scales, defining the spatial framework for the transboundary perspective; chapter 4 provides an overview of data and information needs as starting point for the subsequent analysis; chapter 5 then gives a detailed description of the multi-objective data inventory approach, including the description of inventory templates for the data, portal and tools. In the same chapter, the open source software MSP Knowledge Catalogue is presented.

The analysis results are presented in Part III. The analyses have been organized as follow:

- Data (Chapter 6):
    - Current state: identifies the available datasets (especially at transnational scale) for the area;
    - Gaps and weaknesses: detects existing data gaps and weaknesses in relation with transboundary perspective;
    - Actions: identifies a series of actions to be taken to overcome data gaps including considerations on data policies to improve data exchange and reuse;
- Portals (Chapter 7):
    - Current state: identifies best practices and ICT infrastructure (e.g. geoportals, Spatial Data Infrastructures) for effective data exchange and sharing;
    - Gaps and weaknesses: identifies strengths, weaknesses, opportunities and threats (SWOT analysis) for implementing interoperability;
    - Actions: produces guidelines for data management and interoperability;

- Tools (Chapter 8):
    - Current state: reviews of practical software tools to support MSP process;
    - Gaps and weaknesses: recognizes barriers, opportunities and integration challenges in MSP tools;
    - Actions: proposes a tool-based approach to support ecosystem-based MSP at transboundary scale.

PART II - Method

2. General approach

The general approach was organized into six main phases, through a recursive refinement of the inventory and analysis (see Figure 1):

1. Identification of data and information needs represents the starting phase. The activity was based on SUPREME initial assessment and other deliverables, on a review of MSP plans and/or relevant strategy reports from EU initiatives and MSP-related projects.
2. An initial collection of data, portals and tools was carried out by the "Task group on Data and Tools". The collected information was directly inserted into MSP Knowledge Catalogue and straightway made ready for consultation and analysis.
   The multi-objective inventory was carried out as a multi-steps process involving the project partners and making use of other SUPREME tasks outcomes. The different contributions and their sequence is highlighted in Figure 2. In details, the inventory activity was divided in the following phases: i) the review of the Initial Assessment and the other SUPREME tasks outcomes; ii) the data, portals and tools review by the task partners; iii) data and tools required for the Case Studies implementation; iv) an extended review by all the SUPREME partners (including Case studies requirements).
3. A preliminary analysis was performed for identifying issues contained into the collected information. Some examples are as follows:
   a. recognize variant terms and synonyms in free-text tags (e.g domain area);
   b. discover possible inconsistencies and mismatching between multiple metadata fields (e.g. in the data-portal form, fields like "presentation form", "spatial representation", "web services" and "features" must have coherent answers);
   c. identify gaps (e.g. high number of missed answers for some fields like license and data accessibility).
4. Guided by the preliminary analysis outcomes, the MSP Knowledge Catalogue was fixed and improved (e.g. adding new metadata fields) and the collected information was cleaned up.
5. Final analysis was performed on the data, portals and tools inventory in order to outline the current state, identify the gaps and propose actions and guidelines.
6. An example to test interoperability and datasets, portals and tools for supporting transboundary MSP question was finally set-up.

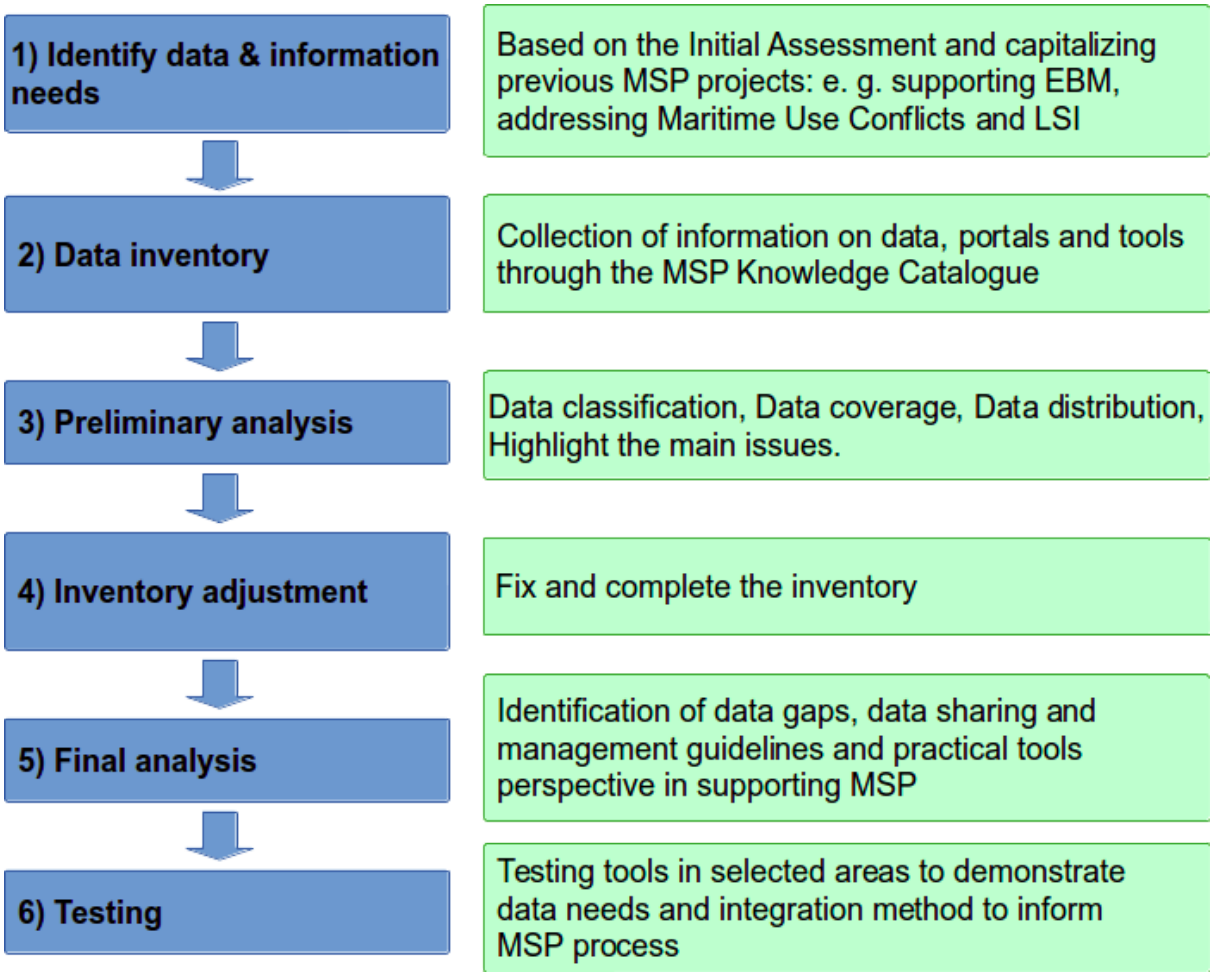

Figure 1: overview of the analysis process.

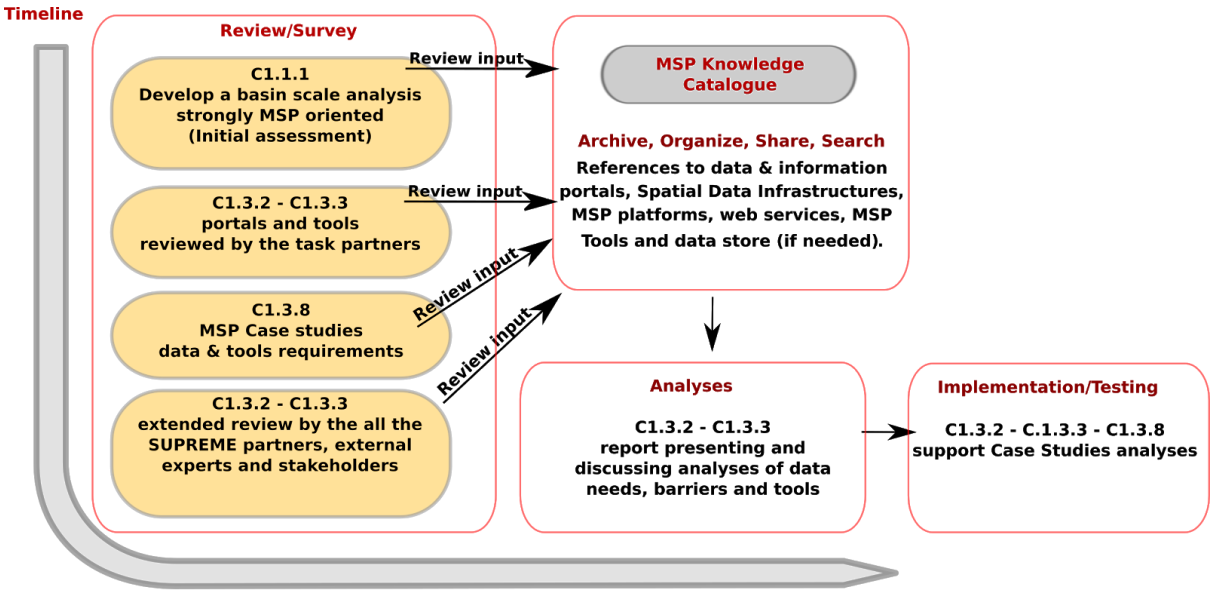

Figure 2: inventory workflow

3. Study area and MSP scales

According to the International Hydrographic Organization (IHO; Flandern Marine Institute, 2018), the SUPREME area is subdivided into four main sea areas: the Adriatic Sea (139 454 km^2), Ionian Sea (171 778 km^2), Aegean Sea (191 305 km^2) and the Eastern Mediterranean Basin - EU part (510 192 km^2), Eastern Mediterranean Basin - non EU part (663 021 km^2) (Figure 3).

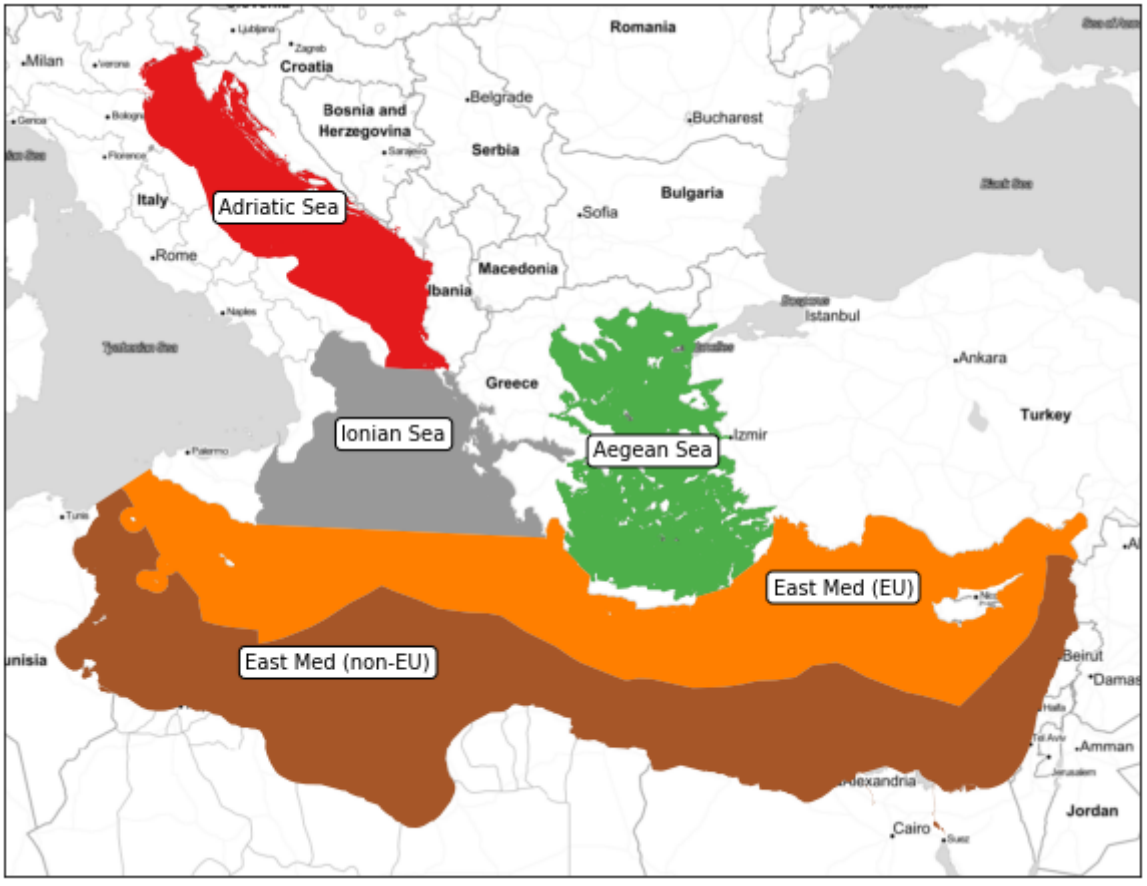

Figure 3: IHO sea areas for Eastern Mediterranean: Adriatic Sea, Ionian Sea, Aegean Sea and Mediterranean Sea - Eastern Basin.

All sea areas are of transboundary interest as they border with two or more countries from EU and extra-EU states and two continents (Europe and Africa).

The initial assessment of MSP relevant scales includes four levels:

(1) local: internal waters, regions, countries, and local jurisdiction;

(2) national: national coasts and territorial waters (e.g. continental shelf and contiguous zones);

(3) transnational: sea basins according to IHO;

(4) global: SUPREME area of study.

In SUPREME, particular focus was given to the analysis of the transboundary scale (level 3 and 4) due to time and resource constraints. For SUPREME Case Studies, the local scale of analysis was used to test SUPREME inventory and knowledge catalogue as supporting instruments. This was tested for the Northern Adriatic.

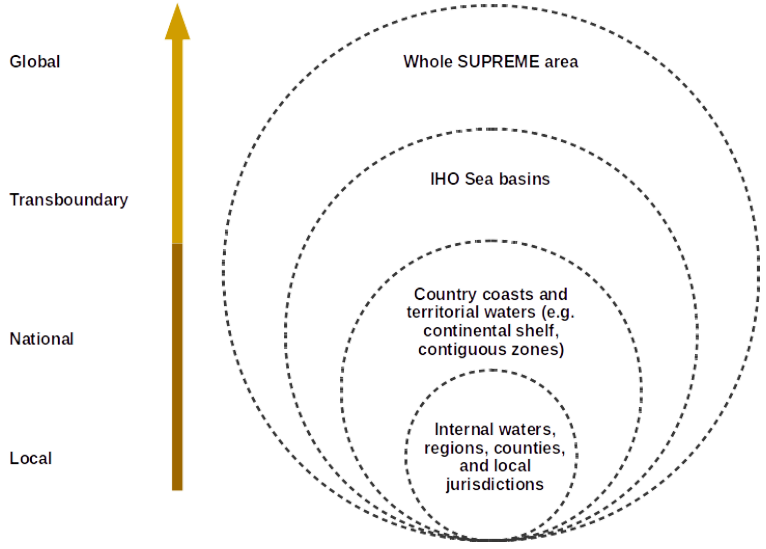

Figure 4: Scales of analysis

4. Data and information needs

In order to properly identify data and information needs, the main outcomes from other task activities were considered. The SUPREME deliverable D1.2.1 reports an overview on common objectives at sea basin level, taking into account a common view of the ecosystem-based approach.

The objectives were identified in order to support cross-border cooperation, on the basis of existing legal and policy documents at European, Mediterranean, Macro-regional and national scales. Moreover, the objectives took into account the three dimensions of sustainability: environmental/ecological, economic and socio-cultural and should reflect a common understanding of ecosystem based approach. A conceptual methodology for including ecosystem-based approach cross-border MSP was investigated also in the Deliverable 1.1.3 (C1.1.3 Develop and propose a conceptual methodology for transboundary MSP aspects). Finally, the spatial demands and future trends for maritime sectors was specifically investigate in Deliverable 1.3.1. Such deliverable also proposes a methodology for the cumulative impact assessment in a "Blue Growth Scenario".

4.1 Data requirements

The data requirements to effectively support the MSP process at different stages can be summarized as follows:

- Geo-awareness: spatially-explicit datasets should be preferable.
- Data categories: the datasets should cover multiple topics and support heterogeneous questions and analyses. Four macro categories can be identified:
    a. Administrative and maritime boundaries;
    b. Description and quantification of the geophysical environment and biological/ecological features;
    c. Description and quantification of human activities and sectors;
    d. Description and quantification of socio-economic and policy-related data.
- Coherence and harmonisation across boundaries.
- Spatial and temporal harmonization.
- Accessibility: the datasets should be freely accessible through the web.
- Usability: the datasets should be directly usable by the end-users making it available as structured data (e.g., shapefile instead of reports and papers) and making it available in a non-proprietary open format (e.g., CSV instead of Excel) (Berners-Lee 2010).

4.2 Portal requirements

- Discoverability: information resources should be easily detected through Graphical User Interfaces (GUI) including "geo-aware" access and filtering.
- Identifiability and traceability: the resources should be accompanied with relevant metadata in order to easily identify the significance, the genealogy, the ownership and the use licenses.
- Portal and data accessibility: the portals should foster public access to contained resource and to the portal itself.

4.3 Tool requirements

The tool requirements to effectively support the MSP process at different stages can be summarized as follows:

- Sustain one or more MSP stages or the entire process.
- Provide user-friendly interfaces appropriate for the different users groups involved in the MSP process (e.g. decision-makers, regional authorities, academics and stakeholders).
- Foster and encourage the users interaction and collaboration.
- Allow the information and knowledge integration from different disciplines and providers.
- Support the interaction with existing marine spatial data portals or with interoperable geoportals.
- Support spatially-explicit analysis.
- Incorporate ecosystem-based awareness.

5. Data inventory

5.1. Inventory design: general criterias

This activity aimed at designing a collaborative methodology to effectively collect information on existing data, portals and tools. Especially, the inventory has been focused on two main points: the data, portals and tools already available and the ones required and expected for the project with a special focus on the Case Studies requirements.

The inventory was designed to support the subsequent analyses (e.g. gaps identification, draft the guidelines) and is based on a preliminary assessment of MSP data and information needs. The needs as well as the analysis guiding questions are specifics and characteristics for data, portals and tools. In this sense, three different metadata schemas and collection processes were planned and adopted.

Moreover, in order to support the inventory activities, a collaborative web catalogue named “MSP Knowledge Catalogue” has been developed and implemented.

5.1.1 Data

Overall, the main data requirement in the scope of SUPREME project is to support a transboundary and ecosystem-based MSP process among Eastern Mediterranean Member States. In order to address this objective, the effective sharing of harmonized datasets is essential at all stages of the process.

Based on initial assessment of data requirements and needs, the inventory was specifically designed to:

- address data availability and gaps in relation with complementary projects and initiatives to support interaction and data exchange;
- identify barriers to data access and exchange (e.g. in relation to data ownership or data protection) and analyse existing data policies;

For each relevant dataset, the following informative features have been investigated:

1. Domain area/spatial scale
2. Topic category
3. License and data policy
4. Validation level
5. Accessibility and reusability
6. Spatial representation
7. Presentation form
8. Availability of related web services

A complete description of investigate features is reported in Appendix A.1.

5.1.2 Portal

The portals' inventory has been specifically designed to:

- catalogue available geoportals for supporting MSP in the Eastern Mediterranean Sea;
- address harmonization and transboundary issues in data integration and sharing;
- address accessibility gaps in relation to discoverability, thematic and spatial coverage, interoperable services and data policies;
- consider the integration between geoportals and MSP-related tools (e.g. cumulative impacts and coexistence between uses at basin scale).

For each MSP-related portal, the following informative metadata have been investigated:

- Portal type
- Topic categories
- Domain area
- Presentation forms
- Implemented web services
- License and data policy

- Additional features

The complete list of metadata and additional details is reported in Appendix A.1.2

5.1.3. Tools

The Mediterranean region shows specificities regarding both maritime activities and environmental features. These include: important tourism and recreational boating sectors; presence of valuable ecosystem components, such as posidonia meadows; presence of regulatory measures, e.g. related to marine mammals protection. A better understanding of interactions that could occur between these features is crucial to support the planning process. Existing tools for MSP deriving from other projects, as i) the one for the analysis of coexistence between uses and ii) to cumulative impacts related to maritime sectors, have been revised and acknowledged in SUPREME, to put in evidence strengths and weaknesses, as well as data gaps and opportunities to be effectively adopted to support the MSP process at different scales and on different geographical domains. Alongside, other tools have been considered as well as their integration as support in a decision process.

The terms "Tools" is widely used in different MSP context to identify a thing in order to assist and support the implementation of the MSP process. However, the term has been used arbitrarily to identify various set of things. Frequently, especially in the review analysis, the term tools may include web portal (basic functionalities), maps, approaches, methods, case study applications and best practices (Kannen et al. 2016; Stelzenmüller et al. 2013; Pınarbaşı et al. 2017; Furlan et al. 2018).

Following the definition present in Kannen et al. 2016, we distinguish between tool and approach where "*an approach as the broader of the two terms, namely a framework for thinking about a problem (in this case an integration challenge) and then working towards a solution. A tool is a - thing used to help perform a job - (Oxford English Dictionary, online), in other words a more specific technique. The distinction between approach and tool is arbitrary and may not always be clear-cut. Tools in MSP are typically programmes or applications that have helped to implement one or more approaches. At the same time, an approach may use one or several tools to come to a defined end result. Both tools and approaches may be general or problem-specific and more or less adaptable to different scales and MSP contexts*" (Kannen et al. 2016).

In summary, the tools inventory includes exclusively the software tools, leaving out approaches, methods and practices. In addition, we have excluded from the "Tools" group web portal implementations and other platforms and infrastructures specifically designated for data sharing and providing basic and common end-users functionalities (e.g. discovering, web mapping). Such portals have been investigated separately (see previous section).

Selection workflow and criterias:

- An initial review of already existing MSP tool catalogues and analysis (e.g. papers, reports) was carried-out as initial stage in order to extract a first list of software tools.

- Then, following an initial screening, the list was filtered in order to exclude abandoned software and software that is no longer maintained.
- Inaccessible software and software without a minimal documentation was excluded as well.
- Then, for each selected MSP-related tool, the following metadata were collected:
    -
    - Title
    - Abstract
    - Portal type
    - Tool category
    - MSP stages
    - MSP users
    - Type of software
    - Compatible OS
    - Input data
    - Output data
    - Organization
    - Code accessibility
    - Software license
    - Documentation
    - Tool community facilities
    - Additional information

The complete list of metadata and additional details is reported in Appendix A.1.3

5.2. MSP Knowledge Catalogue

In order to effectively support the survey activity, a dedicated web and collaborative catalogue was developed and implemented. The catalogue, named MSP Knowledge Catalogue (MSPKC), allowed to collect and share metadata for MSP-relevant datasets, portals and tools through three dedicated forms. The proposed web solution allows to improve the engagement of contributors, avoiding duplications and fostering a collaborative approach for the catalogue filling-up and maintenance. Moreover, the MSPKC was implemented over an open-source technological stack. The main core software is provided by CKAN (Comprehensive Knowledge Archive Network) (Open Knowledge International 2018) and the MSKC CKAN extension/plugin has been developed during the SUPREME project and released as open-source software (Menegon [2018] 2018). A screenshot of the MSPKC discovery and search interface is presented in Figure 5.

Additional details about the MSPCK CKAN extension software are reported in Appendix C.

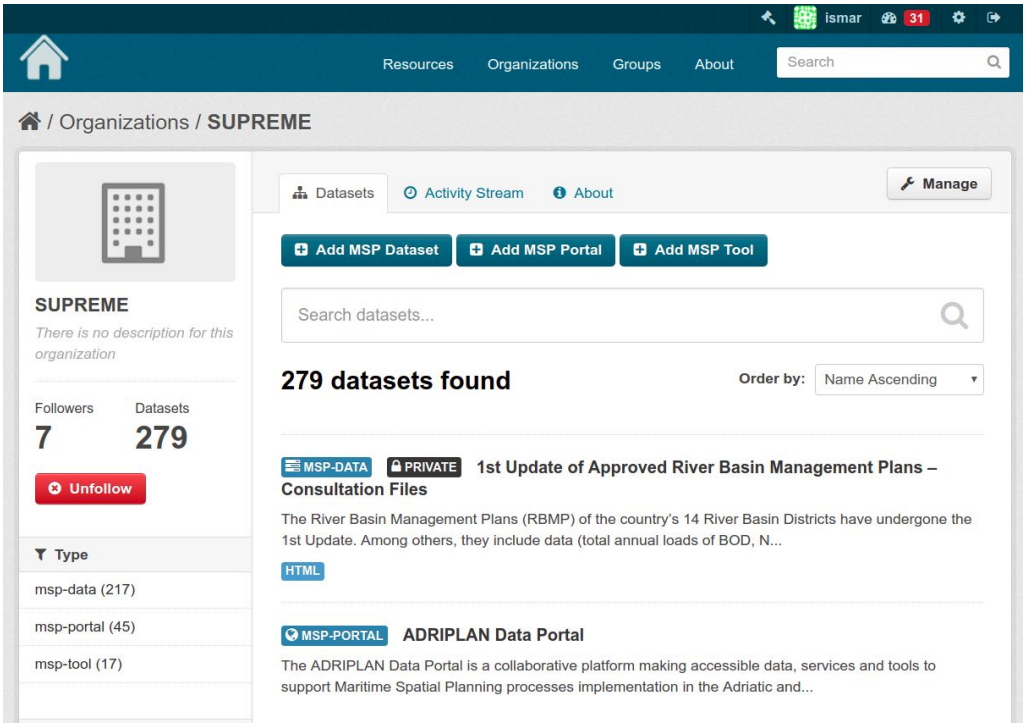

Figure 5: SUPREME MSP Knowledge Catalogue discovery and search interface. Source: http://catalogue.msp-supreme.eu

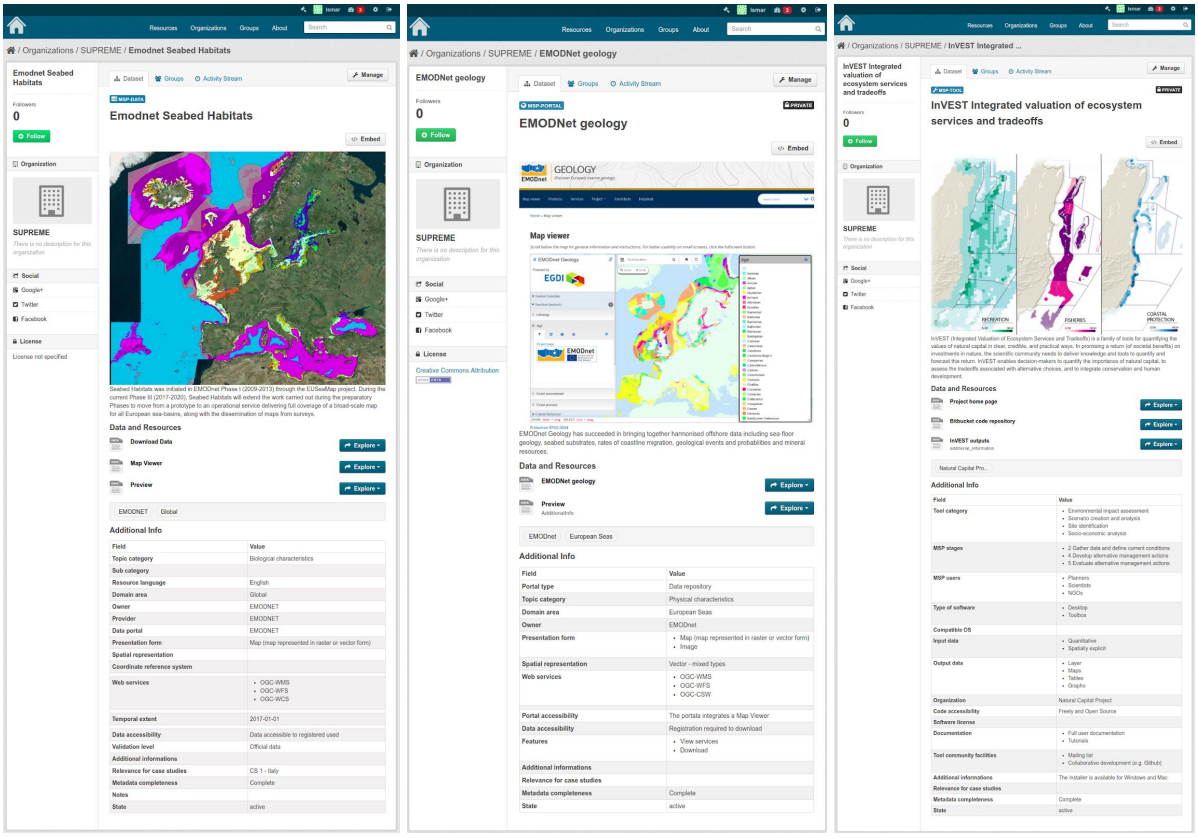

Figure 6: SUPREME MSP Knowledge Catalogue: example of information forms for data, portal and tool.

PART III - Analyses results and discussions

In this section of the report, information collected in the MSP Knowledge Catalogue for the three types of resources (data, portals, tools) is described and analysed in order to present the current state of knowledge, possible gaps and weaknesses, and actions to be activated to overcome those gaps and weaknesses.

Numbers and graphs here presented refer to the content of the MSPKC as it was described by partners during the collection phase and cleaned up during the preliminary analysis phase (as described in the section 2. General approach). Anyway some inconsistencies could still remain in some of the metadata regarding the harmonization of categories, classes and terminology, or in the completion of some specific metadata fields. The inherent dynamic and collaborative nature of the MSPKC tool will allow a continuous improvement of the catalogue both through the correction of inconsistencies and through the update and/or upload of new information, when it becomes available.

6. Data analysis

6.1. Current state

This section describes the content of the MSPKC related to the resource described in the catalogue as "*msp-data*". The datasets currently described in the catalogue are 168.

At the time of writing, 233 "msp-data" records have been inserted into the catalogue including the related metadata information and the references to online resources (e.g. link to downloadable files or web services). However, after an initial check, 58 records has been temporarily marked as invalid because they do not meet the initial requirements. The lack of requirements may be due to:

- the record doesn't refer to explicit datasets (e.g. it refers to papers or reports);
- the record is not significant for the MSP process;
- the record refers to no longer available resources.

In the end, 175 records has been considered for the final analysis. The spatial distribution of records, according to "Domain areas" metadata is presented in Figure 7.

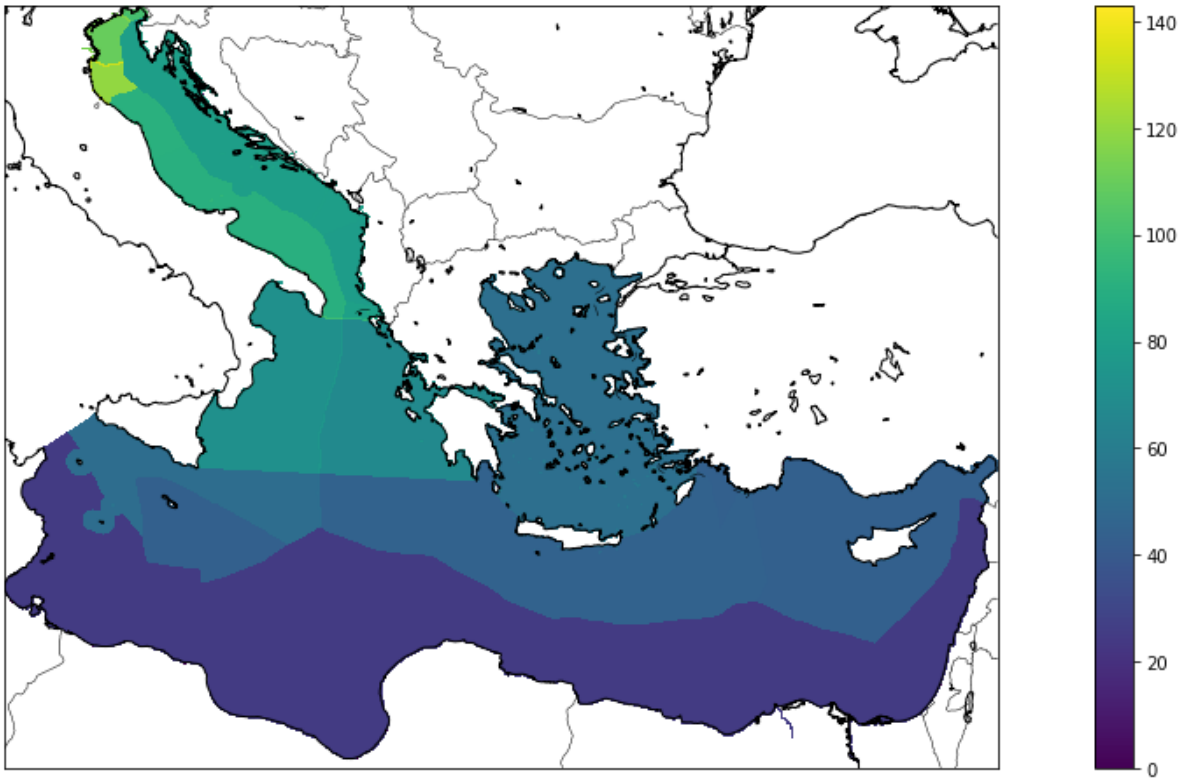

Figure 7: Spatial distribution of dataset availability.

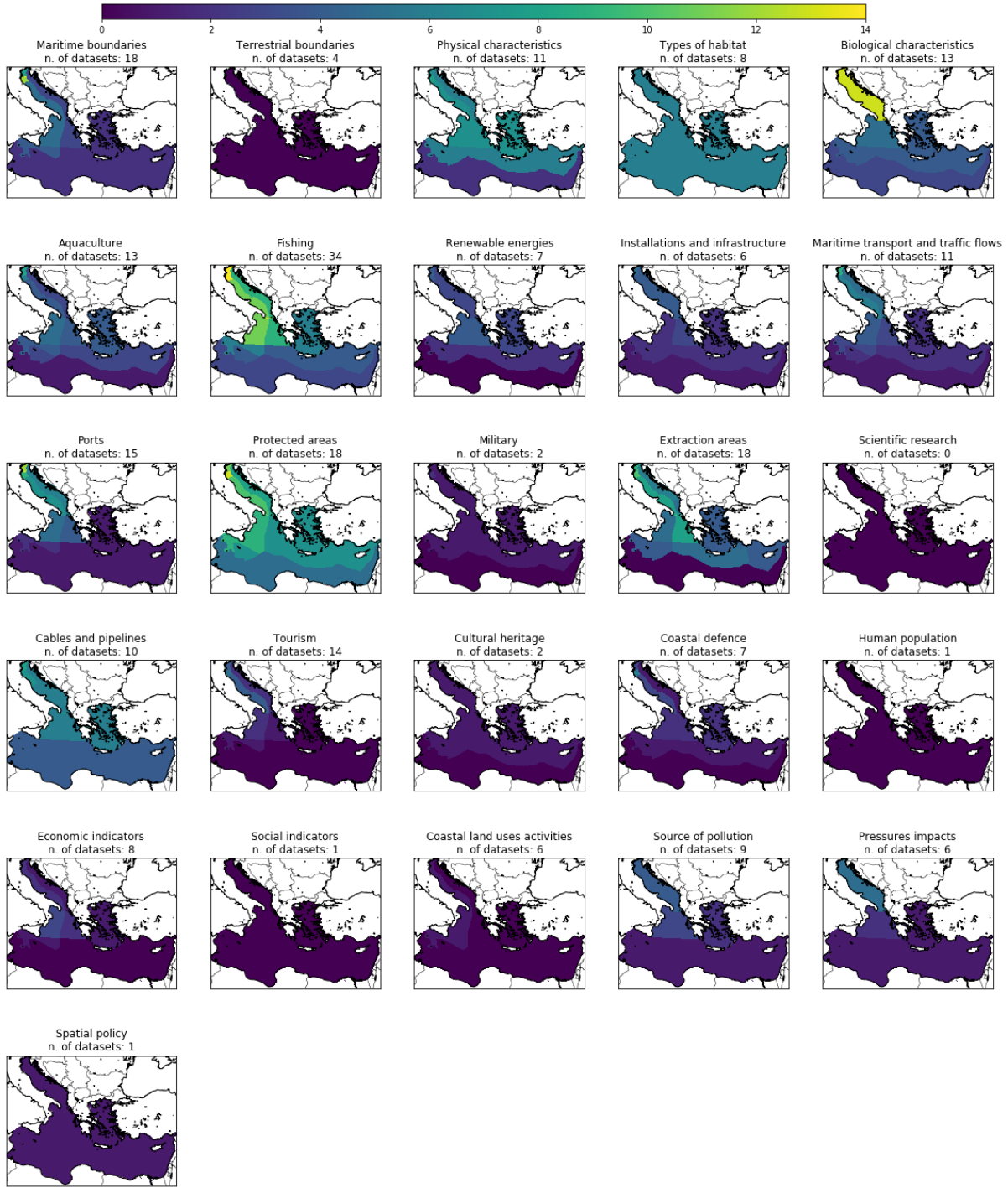

Figure 8: Spatial distribution of dataset availability for each topic category.

6.1.1 Transboundary analysis

In the figure 9 datasets are grouped per *Domain areas*, where the main domain areas refer to the subdivision described in section 3. Study area and MSP scales.

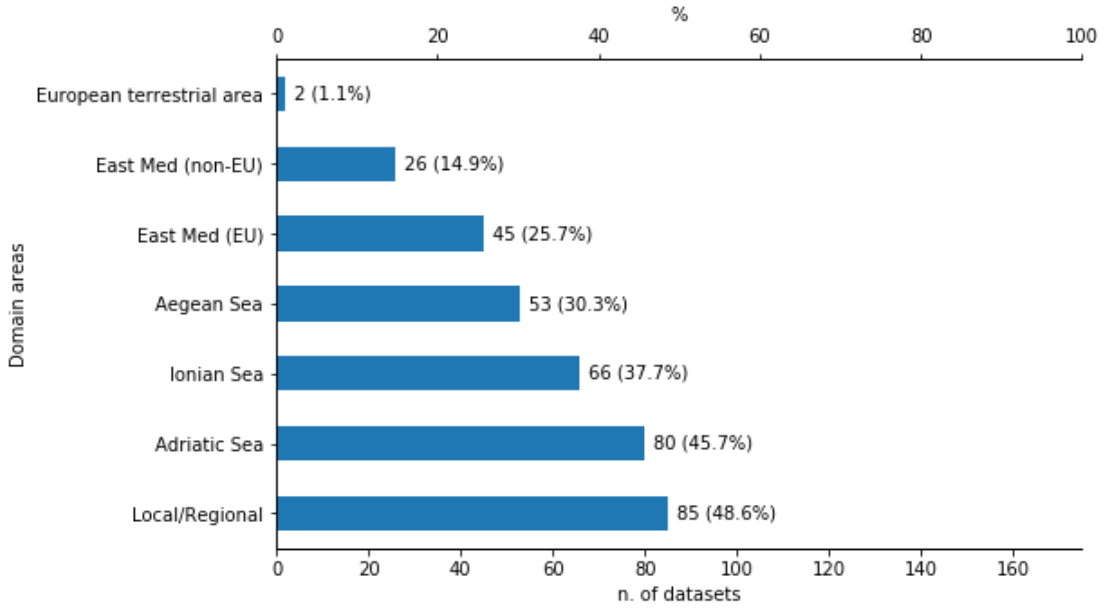

Figure 9: Number of datasets per domain area.

The Adriatic Sea is described by 8 datasets (45,7 %), while slightly fewer datasets are related to Ionian (66 i.e. 37,7 %) and Aegean (53 i.e. 30,3%)) Seas. The whole EU eastern Mediterranean Sea is described by 45 datasets (25,7%), while 85 datatests (48,6 %) are instead related to more local/regional areas (e.g. marine/coastal areas of Emilia-Romagna region, Veneto region, Istria county, ...).

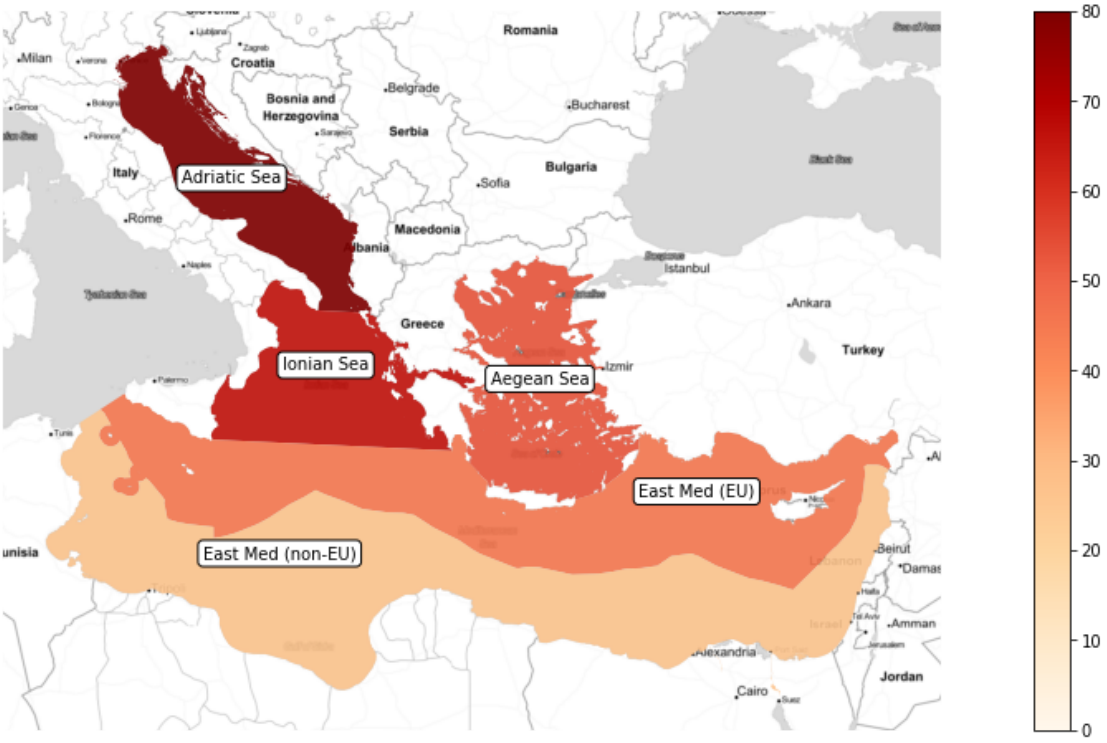

Figure 10: Map of the IHO sea basins, categorised based on number of datasets.

Figure 11 shows the distribution of datasets as classified per *Topic category*, as defined during the design of the inventory and described in details in the table available in the Appendix A, section A 1. MSP Dataset type.

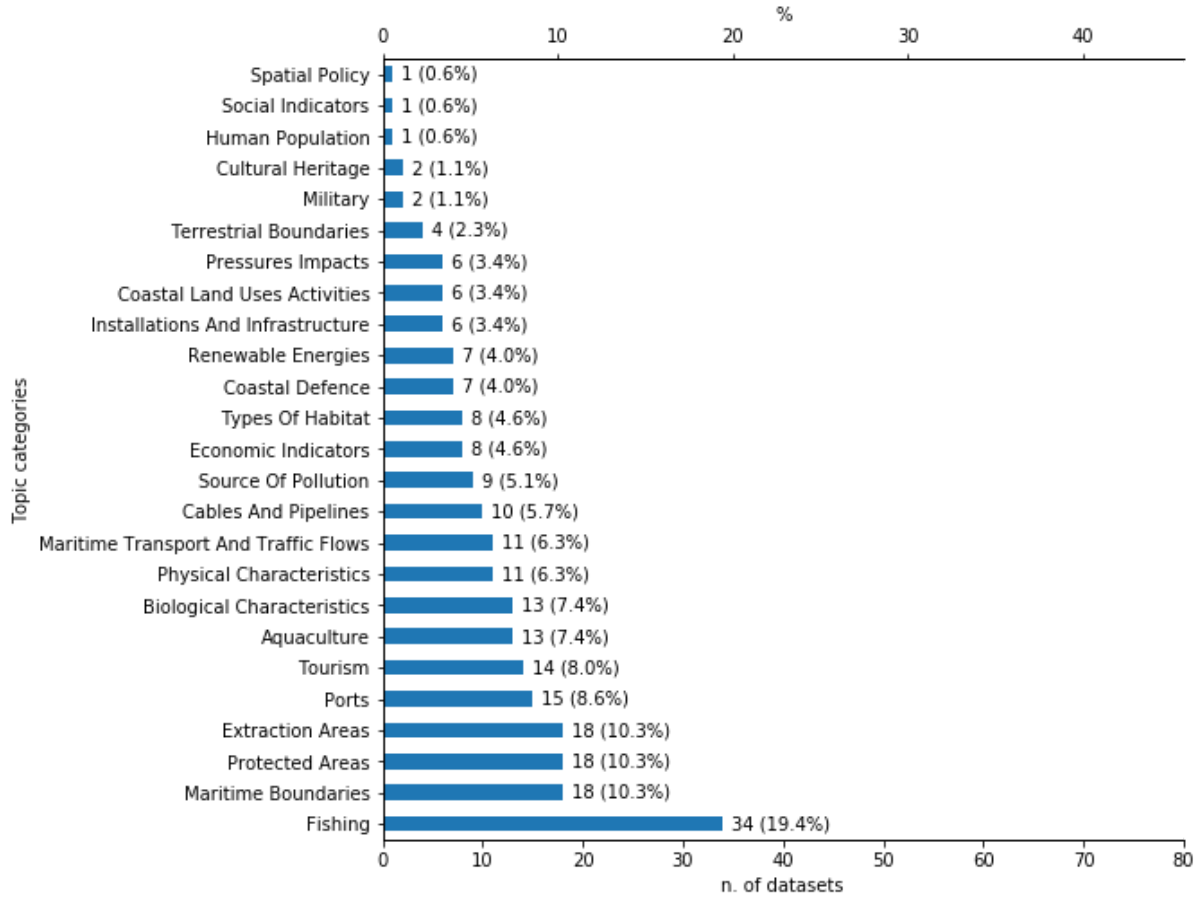

Figure 11: Number of datasets per topic category

Datasets describing activities/uses are the most represented, with 139 (79,4 %) resources, while physical/chemical/biological characteristics are described by 36 (20,6%) datasets (see figure 12); information related to socio/economic aspect is much less represented (only 9 datasets - i.e. 5,1%).

This distribution of information is quite common in most of the catalogues, portals, and spatial data infrastructures related with the marine environment, showing a difficulty to provide aggregated information on human population, social and economic indicators at a broad scales.

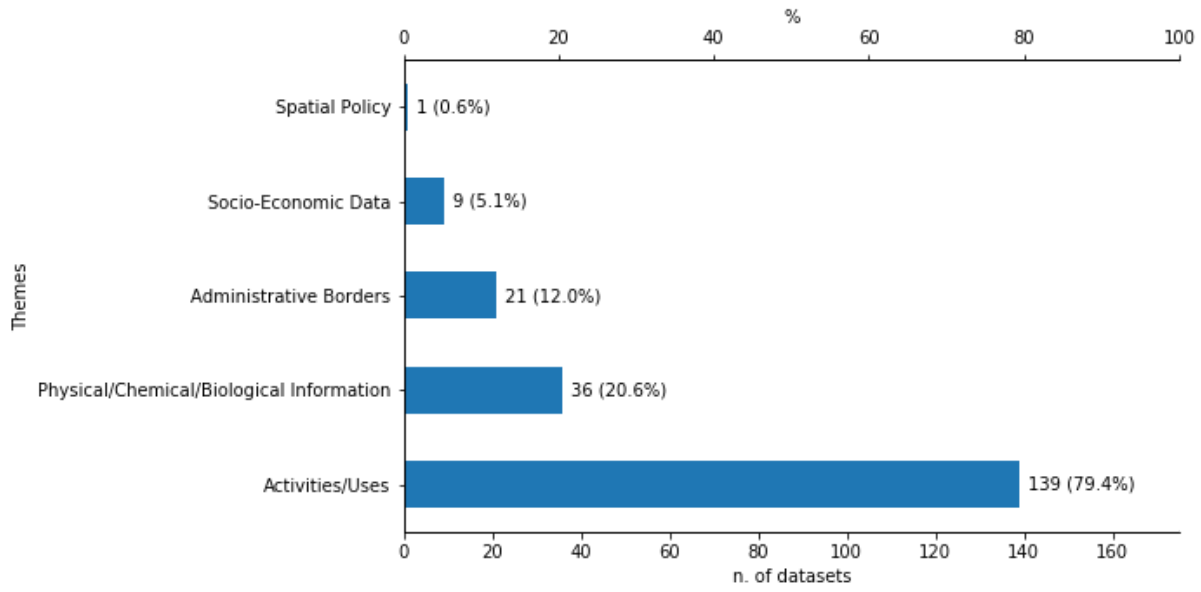

Figure 12: Number of datasets per theme (aggregation of topic categories, as per Appendix A, section A 1. MSP Dataset type).

Among human activities, *Fishery* is the most represented activity, with 34 datasets (19,4%) describing its distribution and characteristics, followed by *Extraction areas* (oil and gas areas, sand deposits), *Tourism*, *Transport* and *Aquaculture* activities. All main human activities in the area are represented in the catalogue, with a clear predominance of marine-related activities compared to coastal-related ones.

Looking in more detail the relation between the topic categories classification and the geographic availability (see figure 13) we can identify a few other patterns better describing the distribution of datasets in the area. The relative distribution of dataset topic categories is quite homogeneous among the basins, but a peculiar behaviour can be identified specifically for *Pressures and Impacts*, *Maritime transport* and *Biological characteristics*. For these topic categories, the Adriatic area shows a much higher availability of data: this could be due to the work carried out in the area by the two previous European-funded projects Adriplan and SHAPE, which collected and harmonised many datasets in these domains, providing a wider basis of knowledge compared to the other basins.

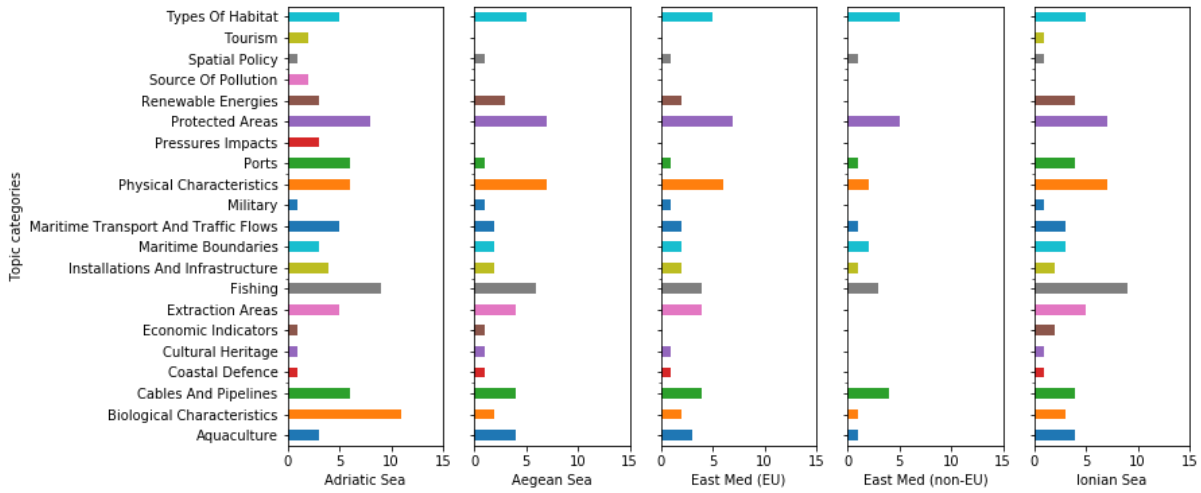

Figure 13: Number of datasets within each topic categories in the main domain areas.

Among the metadata used for the classification of datasets, the *Validation level* (see figure 14) was explicitly required by some partners to keep track of the official character level of the data, that was set to:

- Official
- Research
- Business
- VGI
- Draft
- Not classified

Planning visions, measures, decision, ideally should be always the based on and guided by official data, as the preferred type of resource. Official data anyway have the "inconvenience" that its validation need efforts and time to be done and agreed by responsible bodies. In the MSPKC, 48% of the datasets are described as official data.

Frequently, other type of information, even if not official, have the pros to be more update and more specific, so it can be used immediately (or with a short delay) after the collection. Research information have in addition the guarantee that rigorous scientific protocols and procedures have been undertaken to obtain the data and that a validation has been provided from the scientific community. Research-driven data contributes for the 46,3% of the resources of the catalogue, providing an important contribution to the knowledge in the area.

Other types of contributions, like Volunteered Geographical Information (VGI), can provide additional input, but only for a minimum amount (in the case of MSPKC only 1 dataset).

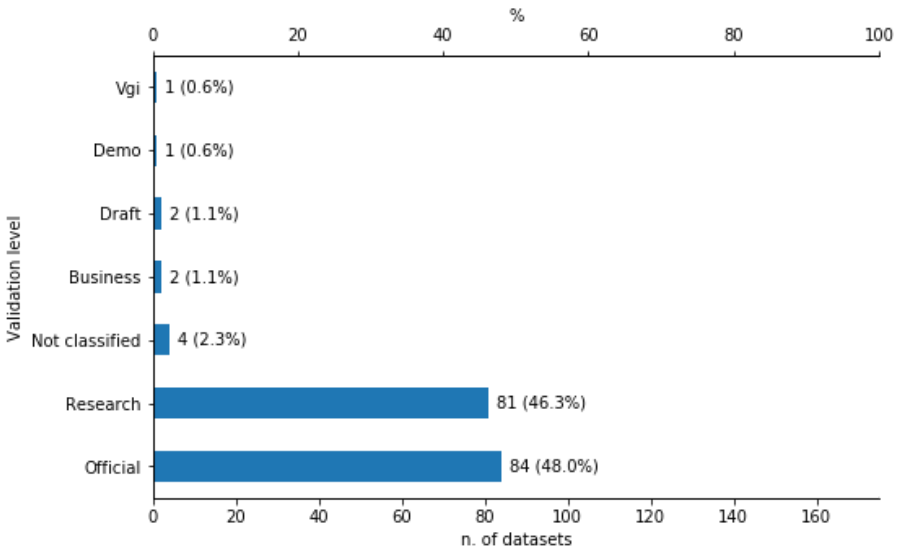

Figure 14: Number of datasets per validation level.

Figure 15 shows how many datasets are already available through standard interoperable services (OGC WMS/WFS/WCS). As expected, WMS services—that allow visualization of data but not the direct download—are the most frequent services, followed by WFS services (providing access and download functionalities for vector datasets) and WCS services (for raster-based datasets). The fact that only 33 (18,9%) datasets are not available through web services is a good indicator that many data portals are providing spatial information in a interoperable way, allowing an easier exchange of information among partners, initiatives and projects.

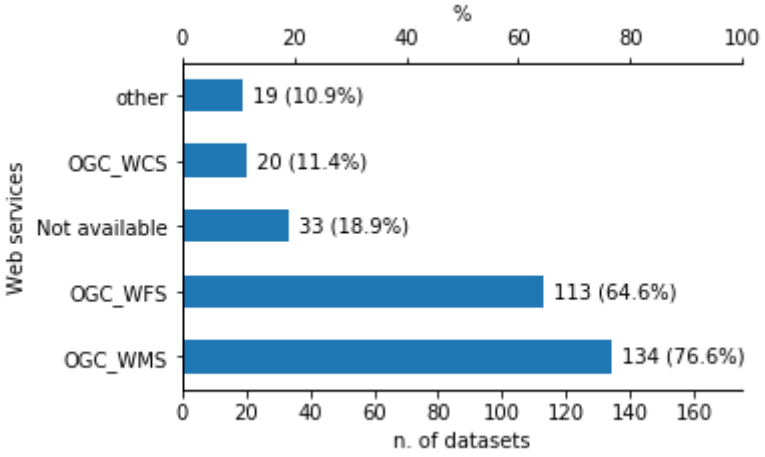

Figure 15: Number of datasets available through web services.

6.1.2 Review of dataset of transboundary interest

In the following a synthesis of the analysed datasets is reported for each topic category. A list of dataset is reported in Appendix B. More details on each dataset is available on the online knowledge catalogue, whose filters allow to perform targeted selections. Hyperlinks in the tables reported in Appendix B allow to directly access the catalogue records.

Maritime boundaries

Datasets on maritime boundaries are available at transboundary level, although they are not official. Moreover, several maritime claims among states make these dataset quite uncertain in some areas.
The various datasets provided by marineregions.org managed by the Flanders Marine Institute are the most used datasets to identify maritime borders in the SUPREME area, although they are not official data.
Gaps: No official dataset are available.

Terrestrial boundaries

Terrestrial transboundary borders dataset are available throughout Europe up to NUTS 3 level and are provided by Eurostat. The borders at the municipal level are rather uneven and are officially provided by the individual states. In some cases, as in Italy, the most updated official municipal borders are managed by Regions and provided through their own geoportals. The data and the data structure still differ between the different administrations.
Gaps: heterogeneous datasets for fine-scale data (e.g. municipal level).

Physical characteristics

This category includes many important sub-categories: coast, bathymetry, physical and chemical oceanography. An abundant amount of data is collected and is available through European data portals (eg SeaDataNet, Copernicus) for these categories, although not always directly usable for planning purposes.
Dataset are available on a cross-border scale for the project area, mainly provided by EMODNet Bathymetry, EMODNet Physics, EMODNet Chemistry and EMODNet Geology. EMODNet Bathymetry provides a 100 metres resolution DTM of all European seas.
Gaps: difficulty to find synoptic maps for planning purpose.

Types of habitat

At a broad scale EMODNet Seabed habitats provides useful information on type of habitats for the area of interest. Transboundary fine-scale homogeneous habitat maps from surveys are not available in the area.
Gaps: low availability of medium to fine scale habitat maps from surveys.

Biological characteristics

Several dataset are available at Adriatic transboundary scale in this category, mainly accessible through the Adriplan data portal. Among them a selection of dataset with modelled species distributions (phanerogams, coralligenous and mäerl formations, small pelagic species distribution)

produced within the MEDISEH project are available, while full dataset are available upon request from EMODNet Biology. EMODNet Biology portal provides datasets on broad worldwide distribution of several species of Algae, Zooplankton, Benthos, Birds, Fish and marine Mammals.
Gaps: lack on distribution medium to fine-scale maps of sensitive habitats (ie nursery and spawning areas) of key marine species at broad scale.

Aquaculture
Aquaculture data (finfish production) are available at transboundary level, provided by EMODNet Human Activities, although they are not complete in the project area: farms from Slovenia, Croatia, Montenegro and Albania are not provided so far.
Gaps: full coverage of aquaculture farms is missing in the project area.

Fishing
Transboundary fisheries datasets are available for what concern fishing areas (FRAs, FAO Major areas and GFCM geographical sub-areas. Concerning localisation of the actual activities, only trawling fishing intensity data at project area scale data are available, provided by JRC.
Gaps: lack of updated dataset at project area scale. Lack of small-scale fishery spatial data.

Renewable energies
Renewable energy plants are not present yet in the area. EMODNet Human activities provides datasets with planned windfarms and Ocean energy projects covering the project area. However planned windfarm datasets are incomplete or with obsolete data.
Gaps: actual planned windfarm locations need to be updated.
Installations & infrastructure
Localisation of hydrocarbon extraction platforms are provided by EMODNet Human activities and Adriplan data portal.
Gaps:

Maritime transport and traffic flows
Datasets of this topic category available at project area scale are marine traffic density map (2015 – only viewable in the European Atlas of the Sea) and motorways of the seas. Shipping routes and traffic lanes are available for the Adriatic-Ionian Region only.
Gaps: updated marine traffic density maps, subdivided in vessel categories are so far missing.

Ports
Main Ports spatial layer, with associated traffic statistics (referred to goods, vessels and passengers) covers the whole project area and it is updated until 2017.
Gaps: Minor ports and marinas are not available at transboundary level.

Nature and species conservation sites & protected areas
Main protected areas are officially provided at European scale: Natura 2000 sites are provided by European Environmental Agency and is updated regularly while Nationally designated Marine Protected Areas are provided by EMODNet Human activities. MPAs are also provided upon request by MAPAMED.

Specially Protected Areas of Mediterranean Importance (SPAMI) are provided by MAPAMED trhough Adriplan data portal.
Gaps: presently available MPAs dataset are not updated

Military
No spatial layers are available on this topic category with the exception of Dumped Munitions provide by Emodnet Human Activities.
Gaps: Datasets on military training areas are missing at transboundary level.

Raw material extraction areas
Hydrocarbon extraction - Active Licenses, Hydrocarbon Extraction – Boreholes and Hydrocarbon Extraction - Offshore Installations are provided in the project area by EMODnet Human activities
Gaps: Sand and gravel extraction areas (existing, potential) are missing at transboundary scale

Submarine cable & pipeline routes
Submarine Telecommunication Cables are available at the projects scale from more than one provider
Gaps: Pipelines are not available at transboundary level.

Tourism & recreation
Distribution of tourists is provided by Eurostat at transboundary scale and is accessible as a map trough Adriplan for the Adriatic-Ionic region only.
Gaps: Leisure/sporting activity sites, marinas, distribution of activities/sports, and seascapes are not available at transboundary level.

Underwater cultural heritage
Submerged Prehistoric Archaeology and Landscapes is the only spatial layer of this category available at project scale, provided by EMODnet Human activities.
Gaps: World Heritage sites, wrecks and listed marine monuments are missing at transboundary scale.

Coastal defence
Coastal migration is the only dataset of this category available at transboundary scale, provided by EMODnet Geology.
Gaps: Areas used for dredging, Managed realignment schemes, Coastal protection schemes are not available in the project area.

Human population
Human population data are available through Eurostat, but have not been analysed in this report.

Economic indicators
Economic indicators data are available through Eurostat, but have not been analysed in this report.

Social indicators

Social indicators are not available/have not been found at transboundary level.

Coastal land uses/activities
Broad land use (Corine Land Cover 2012) coverage is available at the project scale and provide by Environmental European Agency trough land.copernicus.eu.
Gaps: Spatial data on localisation of coastal activities are not available at transboundary level.

Source of pollution
Little information is available at transboundary scale for this category. Adriplan data portal provides a model of nutrients and organic matter distribution in the Adriatic.
Gasp: few datasets available at transboundary scale. For example maps are missing at transboundary scale on marine litter, (e.g. maps of areas affected by litter), introduction of synthetics and heavy metals, Pollution caused by ships (carbon Dioxide), introduction of radionuclides, chemical effects from the dumping of dredged material, introduction of microbial pathogens (e.g. maps of point sources), introduction of non-indigenous.

Pressures and impacts
Few datataset are available at transboundary scale for these categories. Adriplan data portal provides a model of cumulative impact in the Adriatic Sea.
Gasp: very little spatial datasets available at transboundary scale. For instance are missing maps on: physical destruction from dredging/extraction/dumping, eutrophication and algae blooms, underwater noise, selective extraction of species and bycatch (e.g. maps of areas most Affected), biological disturbance as a result of sand extraction/dumping of dredged material

Spatial policy
No MSP plans are available yet in the project area.

6.2. Gaps and weaknesses

- **Spatial coverage**: as shown in the diagrams above, datasets are unevenly distributed in the study area, with higher number available for the Adriatic Sea and Ionian Sea, while informative gaps are present in the Aegean Sea and to a higher extent in the remaining Mediterranean Eastern Basin. This unbalanced distribution of the information was already observed in previous projects in the Mediterranean area, e.g. in the Adriplan project, where data availability was greater in the Italian Adriatic sea, compared with the Slovenian and Croatian seas. Reasons for this can be due to differences in the real existence of data (i.e. not collected), but also for different levels of accessibility (not publicly available, restricted) or organizational issues (not organised or shared through standard web portal).

- **Categories coverages**: concerning the categories used by MSP planner, a lack of data related to the socioeconomic aspects and coastal defence has been found, especially in the Aegean Sea and the rest of the Eastern Mediterranean.

- **Map format**: in some cases spatial information are provided through maps contained in documents and not as spatial layers ready to be used in GIS.

- **Data accessibility and licences**: many datasets don't have explicit standard licenses (e.g. Creative Commons), while frequently having custom licenses assigned but only roughly described. Many datasets have absolutely no information related to access and reuse, making almost impossible for the users to clearly understand what they can do with the available data.

6.3. Actions

- Promote **joint data collection** programs, at the wider spatial domain possible.
- Define **guidelines for standardised joint data monitoring**, integrated as far as possible to the monitoring programs of environmental characteristics, pressures and impacts foreseen by MSFD.
- Basin, sub-basin and regional-based portals should promote the **aggregation and the standardization of data** in their spatial domain, facilitating the creation of harmonised datasets. This local process could also support the enrichment of EMODnet Data Ingestion Portal, that aims at facilitating the inclusion of additional marine datasets to EMODnet, "for further processing, publishing as open data and contributing to applications for society"[1] at EU level.
- Concerning the Adriatic-Ionian region, this actions should be addressed within the PORTODIMARE Interreg ADRION project, in which many SUPREME partners are participating.
- Define a **set of spatial layers** which are absolutely essential as a basis for Maritime Spatial Plans at national/transboundary level.

[1] https://emodnet-ingestion.eu/

- Define a minimum **common data structure** on each essential spatial layer in order to harmonise data created by different producers and for different geographic areas and to facilitate their combination for transboundary analysis and planning.
- Support the **availability** of spatial datasets through standard web services in the cases they are not yet organised in interoperable infrastructures.
- Support and disseminate a better awareness of the issues related to **data policies and accessibility**, so that data managers can improve and make clearer how data can be accessed and reuse, preferably using standard open licenses (e.g. Creative Commons Attribution CC-BY).

7. Portal Analysis

7.1. Current State

This section describes the content of the MSPKC related to the resource “msp-portal”. The datasets currently described in the catalogue are 52.

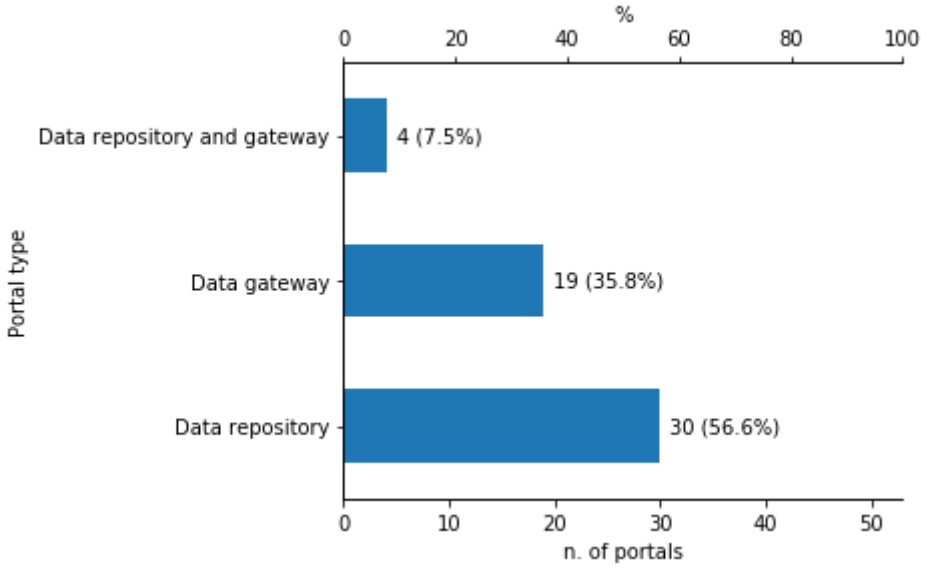

Figure 16: Portal types

As shown in the above graph (Figure 16) nearly half of the portals are data repository only, one third are data gateways only and 2 share both functions. Given the different structure and organization of the portals may not be clear if the data are present on the same server or from other sources.

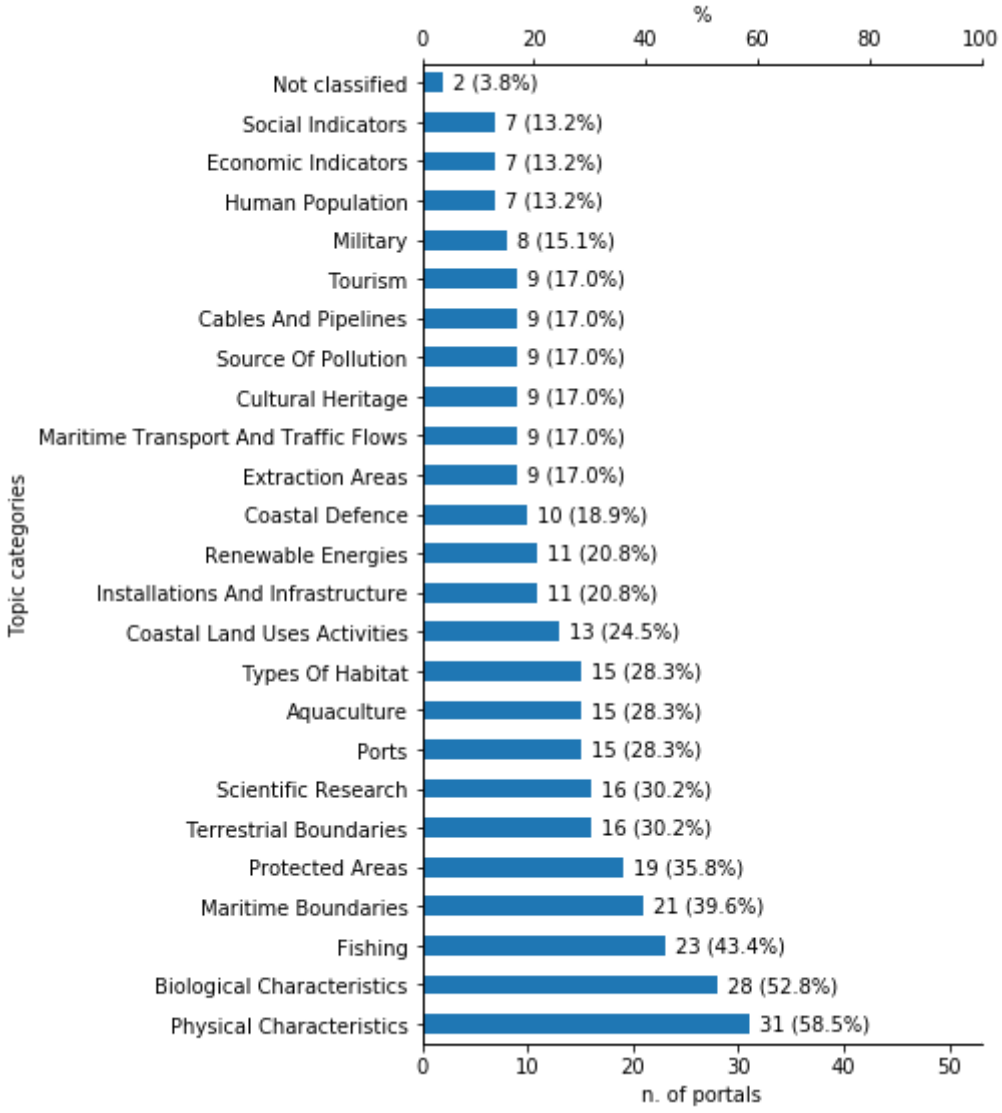

Figure 17: Number of portals for each topic category

Physical and biological characteristics are the predominant typology of data available on the analysed portals. However, also all the other topic categories are well represented in the analyzed portals, as shown in the above graph.

The graph below shows the the distribution of the typology of data presentation form other than maps.

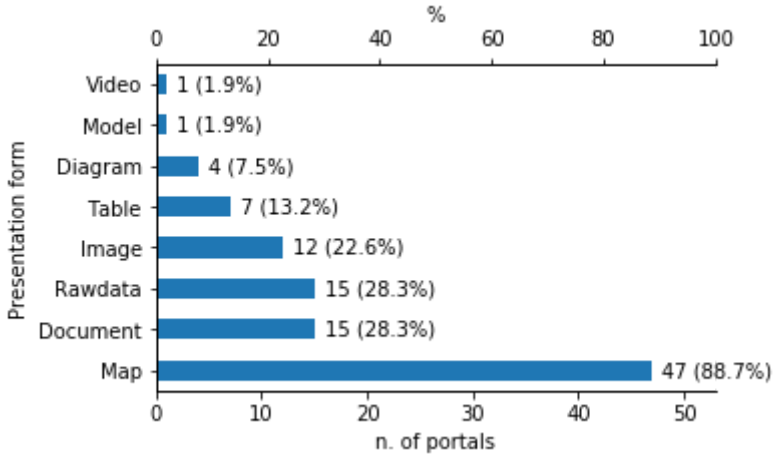

Figure 18: Count of data presentation form in the portals examined

AS shown in the graph below, WMS is the most common web service provided (26 out of 52 portals), followed by WFS services. WPS services are provided in 3 portals while SOS services are provided only in one 1 portal. Web services are absent in 22 out of 52 portals.

Among the "other" standard must be cited the Common Data Index - CDI metadata standard that is used by all SeaDataNet data centers.

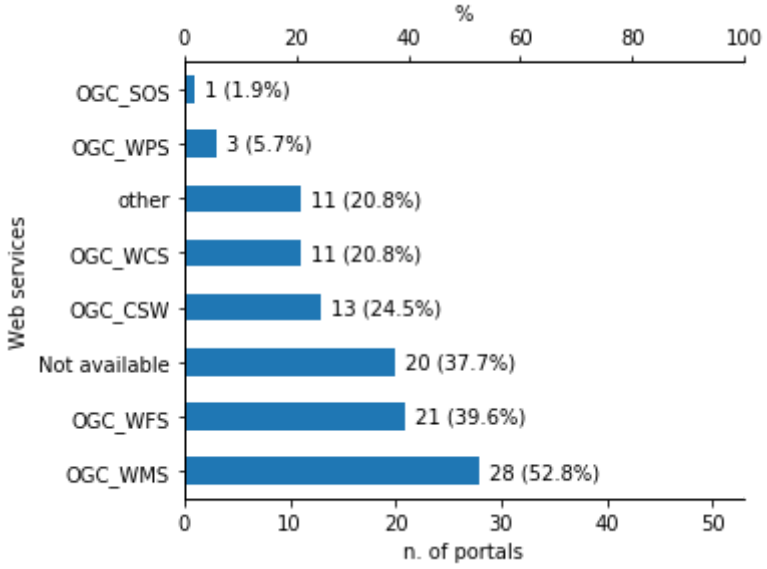

Figure 19: Count of Web services type in the portals examined

Among the available features (figure 20) the map viewer is present in almost all the portals, the download of data sometimes requires registration or is achievable through the catalogue research, where metadata form redirects to the original source of data. Many catalogue services are based on Open Source software Geonetwork that is natively capable to publish a CSW endpoint, but part of these portals have the feature disabled or not advertised.

Virtual research environment seems to be a feature recently introduced, this give to registered users the chance to view, combine data and make analysis inside the portal without download the entire datasets. Maybe this kind of implementation could help to avoid licensing problems, on the other hand these processes use hardware resource on the server and can be slower than normal analysis with desktop software.

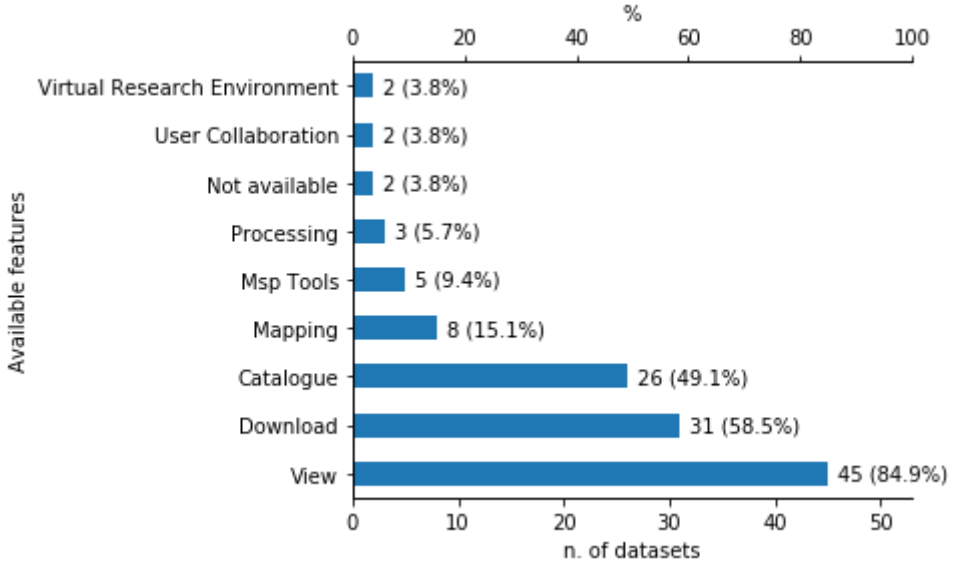

Figure 18: Count of available features in portals examined

7.2. Gaps

The current state of the portal list has been analyzed using SWOT analysis framework focused on MSP needs. Although the Strengths are evident and clear, it seems that is quite difficult to resolve the weaknesses and the great uncertainty about Opportunities and Threats make difficult to forecast how the state of the portals will evolve.

7.2.1 Strengths

- Accessibility: the aim of a geoportal with metadata catalogue is to collect all available data related to Maritime Spatial Planning in a region or at least for the domain of interest and to make them accessible through standard protocols. The planning processes should be based on the most reliable and recent data available.
- Comparison: listing all datasets available about a theme in the same area or similar contexts can improve overall data quality and allow the comparison data from different sources, choosing the one that fits better for the case study or action involved.
- Interoperability: standard CSW catalogues can be accessed by other software and harvested by other servers without human intervention. In this way huge amount of data can be managed and indexed.

- Preview: almost every geoportal provide a map viewer that can be used either to search the data by region or to view the layer in a map. This is useful the end users that can save time to evaluate the dataset before to register and download it.
- Flexibility: data organized in standard catalogue and web services can be accessed and used in different way and from different devices (web browser, mobile devices, IOT etc..)

7.2.2 Weaknesses

- Licensing: there are many different types of licensing model and in some cases the data must be requested directly to the owner.
- Complexity: the relevant data for MSP are related to many fields of knowledge, different sources and collecting methods. Huge catalogs of metadata that cannot be explored without a search filter: in some cases the query mask requires domain-specific competences thus restricting the number of potential users.
- Transboundary data: the data and the portals often refers to different type of marine regions while the area of interest of the user could be not completely covered.

7.2.3 Opportunities

- Growth: new data can be added at every time, especially for gateway portals.
- Data quality: access and compare different kind of datasets can improve the overall data quality filling gaps and validating existing data.
- User interaction: web portals can collect user's feedback and interact with other web resources through API.

7.2.4 Threats

- Unavailability: the source server where data are published or available for download is not managed by the portal manager and may be discontinued in the future.
- Obsolescence: most of portals are results of a research project or related to specific cruises/vessels and could disappear over years.
- Overload: lack of completeness in the metadata compilation can lead to an information overload, were an excessive quantity of data is produced and can't be effectively managed anda decoded.

Table 1:

	+	-
Int.	**Accessibility** **Comparison** **Interoperability** **Preview** **Flexibility**	**Licensing** **Complexity** **Transboundary data**
Ext.	**Growth** **Data quality** **User Interaction**	**Unavailability** **Obsolescence** **Information overload**

7.3 Actions

- The potential for EMODnet sea basin portals to help coordination of MSP at a regional level and options for realising marine spatial data infrastructures to implement MSP.
- Potential revisions to be made concerning INSPIRE specifications for MSP purposes or import of some features fro CDI /SeaDataNet standard.
- Evaluate the opportunity to create standard datasets on local repository at sub-basin scale for a subsequent ingestion inside one of the EMODnet data portal.
- Extension of the EMODnet portal network to cover all the topic categories: currently the eight active portals (bathymetry, geology, biology, chemistry, physics, seabed habitats, coastal mapping and human activities) don't provide information about socio-economic factors and tourism/recreation.
- Harmonization of data policy in a short list of standard licenses that are recommended. The standard license can be clearly stated in the metadata form and used as a filter type and a compatibility matrix can be modeled for guide the reuse of data.
- Improve interoperability promoting the use of webservices like CSW that consent machine to machine operations in discovery, filter and load data and maps.
- Implement a versioning system to track the evolution of data and portals with the purpose of aggregate time series and visualize changes.

8. Tools Analysis

8.1. Current state

Table 2 reports the list of the 17 reviewed software tools including a subset of the collected attributes (Tool category, MSP stages, MSP users and Owner).

Table 2: reviewed software tools and main characteristics

	Tool category	MSP stages	MPS users	Owner
ARIES	Ecosystem services assessment Socio-economic analysis	2 gather data and define current conditions 5 evaluate alternative management actions 6 monitor and evaluate management actions	Ngos Planners Scientists	k.LAB
AquaSpace	Site identification Socio-economic analysis Uses conflict analysis	5 evaluate alternative management actions	Planners Scientists	THUNEN
BowTieXP	Environmental impact assessment	3 identify issues, constraints, and future conditions	Planners Scientists	CGE
DISPLACE	Environmental impact assessment Socio-economic analysis Uses conflict analysis	5 evaluate alternative management actions	Scientists	DTU-Aqua
EcoImactMapper	Environmental impact assessment	5 evaluate alternative management actions	Planners Scientists	Stanford University
EwE - Ecopath with Ecosim	Environmental impact assessment Scenario creation and analysis	3 identify issues, constraints, and future conditions 5 evaluate alternative management actions 6 monitor and evaluate management actions	Scientists	Ecopath International Initiative
GRID	Data gathering-management Uses conflict analysis	2 gather data and define current conditions 3 identify issues, constraints, and future conditions 5 evaluate alternative management actions	Authorities Marine users Scientists	CNR-ISMAR
GeoNode	Data gathering/management	2 gather data and define current conditions	Planners Scientists Authorities General public Marine users NGOs	GeoNode Developer Team

InVEST	Ecosystem services assessment Socio-economic analysis	3 identify issues, constraints, and future conditions 5 evaluate alternative management actions 6 monitor and evaluate management actions	Ngos Planners Scientists	Natural Capital Project
InaSAFE	Scenario creation and analysis	2 gather data and define current conditions 3 identify issues, constraints, and future conditions	Ngos Authorities Planners Scientists	World Bank-GFDRR Indonesian Government-BNPB Australian Government
MIRADI	Governance assistance Management plan proposal	1 define goals and objectives 2 gather data and define current conditions 3 identify issues, constraints, and future conditions 4 develop alternative management actions 5 evaluate alternative management actions 6 monitor and evaluate management actions 7 refine goals, objectives and management actions	Ngos Planners Scientists	Conservation Measures Partnership
Marxan	Site identification	4 develop alternative management actions	Ngos Planners Scientists	University of Queensland
Maxent	Habitat modelling	2 gather data and define current conditions 3 identify issues, constraints, and future conditions 5 evaluate alternative management actions 6 monitor and evaluate management actions	Scientists	
SeaSketch	Communication Data gathering-management Environmental impact assessment Management plan proposal	2 gather data and define current conditions 3 identify issues, constraints, and future conditions 4 develop alternative management actions 5 evaluate alternative management actions	Ngos Authorities General public Marine users Planners Scientists	UCSB
Tools4MSP	Environmental impact assessment Uses conflict analysis	2 gather data and define current conditions 3 identify issues, constraints, and future conditions 5 evaluate alternative management actions 6 monitor and evaluate management actions	Planners Scientists	CNR-ISMAR
Zonation	Environmental impact assessment Site identification	4 develop alternative management actions 5 evaluate alternative management actions	Authorities Planners Scientists	C-BIG

seeOcean	Data gathering-management	2 gather data and define current conditions 3 identify issues, constraints, and future conditions	Planners Scientists	navama

The "tool category" attribute identifies the scope of the tool. A tool may be connected to one or more tool category and the distribution of tool for each tool category is presented in Figure 21. The most covered categories are *Environmental impact assessment* (7 tools), *Use conflict analysis* (5 tools) and, with 4 tools, *Socio-economic analysis* and *Data gathering/management*. Differently, the less covered categories (with one tool each) are *Habitat modelling (MAXENT), Governance assistance* (MIRADI) and *Communication (SeaSketch)*.

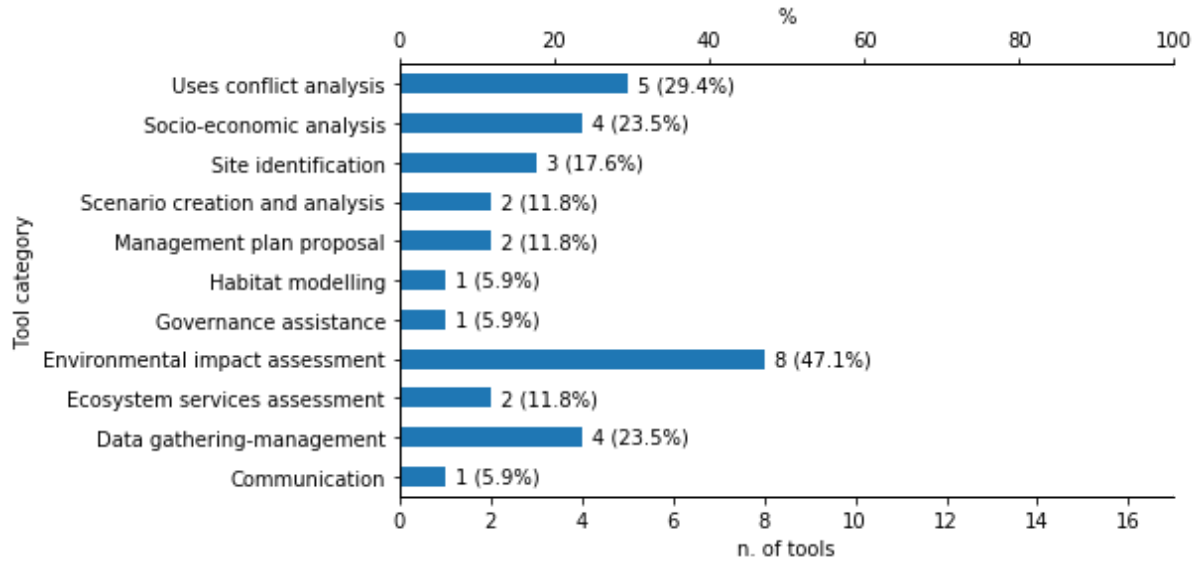

Figure 21: Distribution of tools by tool category. A tool may be connected with one or more categories.

In FIgure 22, the distribution of tools per MSP stage is presented. Each software tools can support different stages of the MSP process. The most covered stage is "5 Evaluate alternative management actions", with 12 tools, followed by "3 Identify issues, constraints and future conditions" (10 tools) and "2 Gather data and define current condition" (9 tools). The less covered stages are "1 Define goals and objectives" and " 7 Refine goals, objectives and management actions", both supported by one software tool (MIRADI).

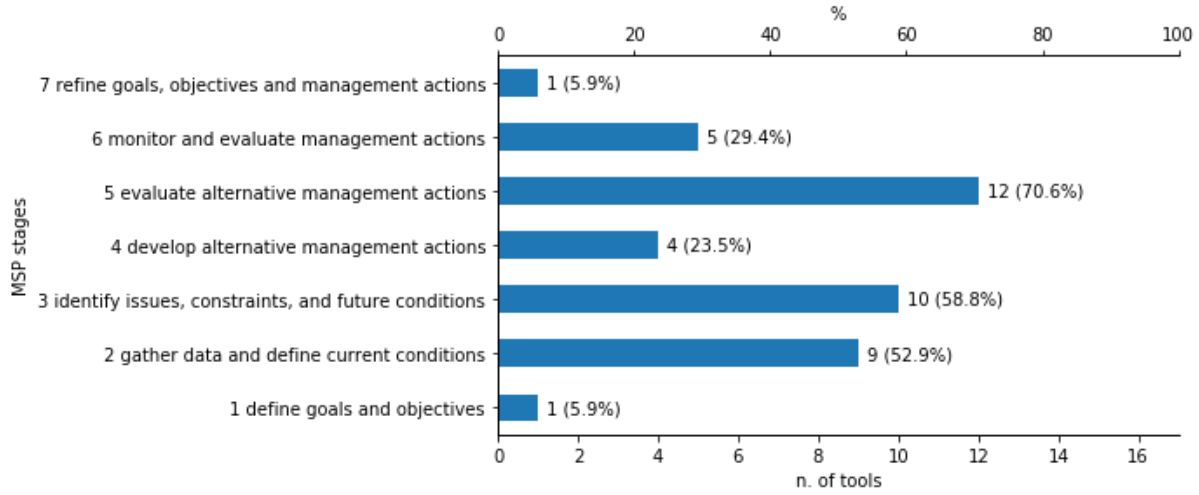

Figure 22: Distribution of tools by MSP stage. Each tool may be connected to one or more MSP stages.

MSP is a multi-actor process involving multiple users at different process stage. The *MSP users* attribute has been filled up taking into account the tool scope, the usability of the GUI (Graphical User Interface) and the learning curve. Figure 23 shows the number of tools connected to each end-user group. Scientists are the most supported group with 17 (all software tools) followed by the planners (13 tools). On the contrary, the General public is the less supported user group with one tools (SeaSketch).

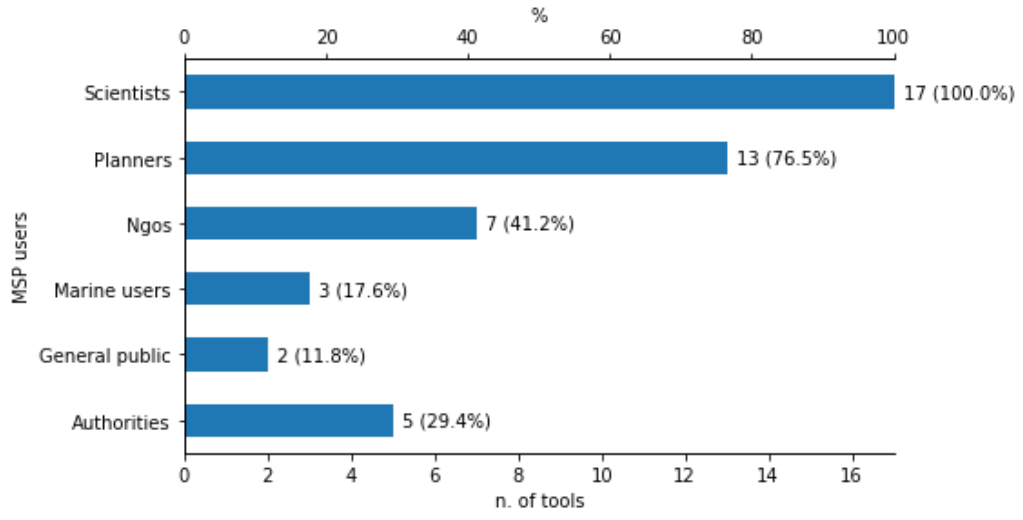

Figure 23: Distribution of tools by MSP user. Each tool may support one or more MSP users.

The distribution of input and output data types is shown in Figure 24. Spatially explicit input data as well as Quantitative information are required by almost all the tools (15 tools), instead temporally explicit input datasets are required by 2 tools (DISPLACE, seaOcean). Analysis of Type of outputs data

shows coherent results, where the tools generating layers are maps are respectively 15 and 10. On the contrary, Reports is the less covered category with 4 tools.

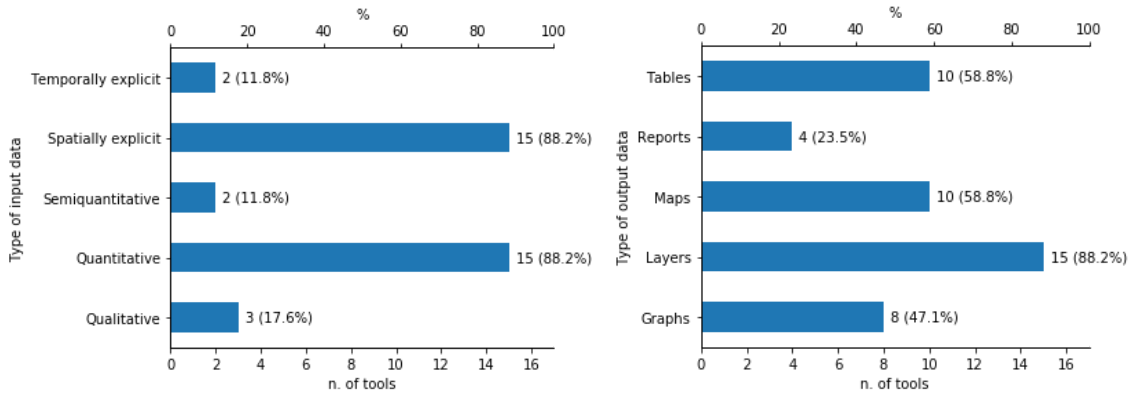

Figure 24: Distribution of tools by Type of input data (left) and Type of output data (right). For each tool, multiple data types are allowed.

Last analyzed attributes are related to software characteristics. In Figure 25 the distribution for the Type of software, License, and Community facilities are presented. Most of the tools are Desktop software (9 tools) followed by Web-based software (7 tools), Toolbox (2 tools) and QGIS plugin, library and ArcGIS plugin (1 tool each).

Most of the softwares (9 tools) are released under open-source licenses (MIT, GPL, Affero GPL, BSD), Commercial softwares are 6 (4 without fees and 2 with fee) and for 2 softwares (GRID, seaOcean) the license is not clearly defined.

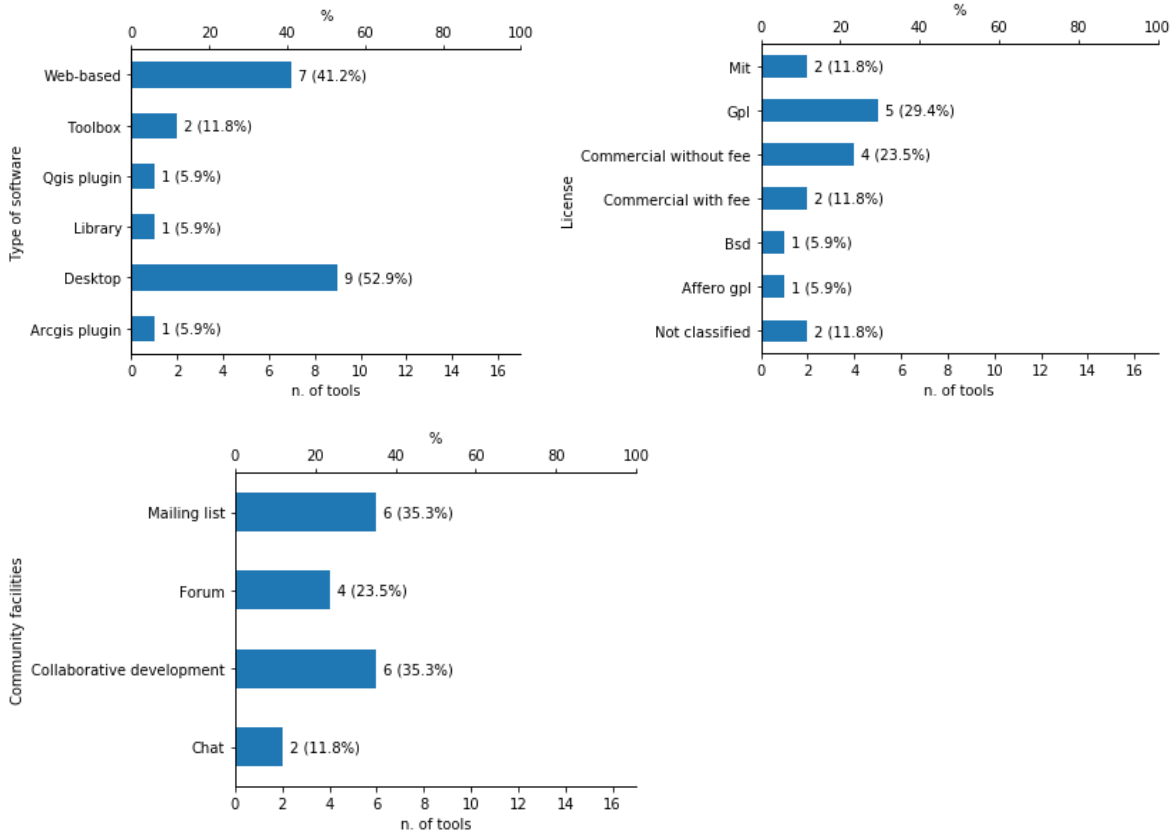

Figure 25: Software related attributes. Distribution of tools by Type of software (top-left), License (top-right) and Community facilities (bottom-left). For each tool, multiple choices are allowed.

8.2. Gaps and weaknesses

L

- Lack of a single tool for the whole MSP as a multi-actor and multi-stages process: despite the previous analysis shows that the different available tools can support the MSP planners in the various phases of the whole planning process, at present there are no suitable tools that can be used by a single user because of the different levels of complexity present in the various tools). Furthermore, it is not possible to integrate and concatenate multiple tools in order to support and harmonised workflow analysis, due to technological and semantic limitations, since this tools had been developed in different times and often for specific projects-related objectives.

- Transboundary data exchange: transboundary MSP data needs are different from national MSP data needs. The scope and level of detail of data needed is much simpler, usually dealing with issues such as where bathymetry, shipping lines or energy corridors cross

political boundaries. However, ensuring the coherence and harmonisation of these data across boundaries remains a challenge due to different data protocols and formats. Typically, this is complicated by a number of underlying issues: different languages between countries, the need for high level political agreement to share relevant data across boundaries and the need for good cooperation between local and regional interest groups. Here, cooperation between MSP authorities is essential (see Case Study "Putting transboundary MSP data policy into action: a history of MSP collaboration in the Baltic Sea Region").

8.3 Actions

One of the objectives of SUPREME Task 1.3.3 is to analyse the existing tools in order to consider opportunities and barriers in integration within existing data portals and possible integration to support MSP process. Considering the currently gaps and weakness in possible tools and portals integration, in Figure 26 we proposed a possible solution to integrate existing MSP-related users, software tools, and already existing interoperable portals.

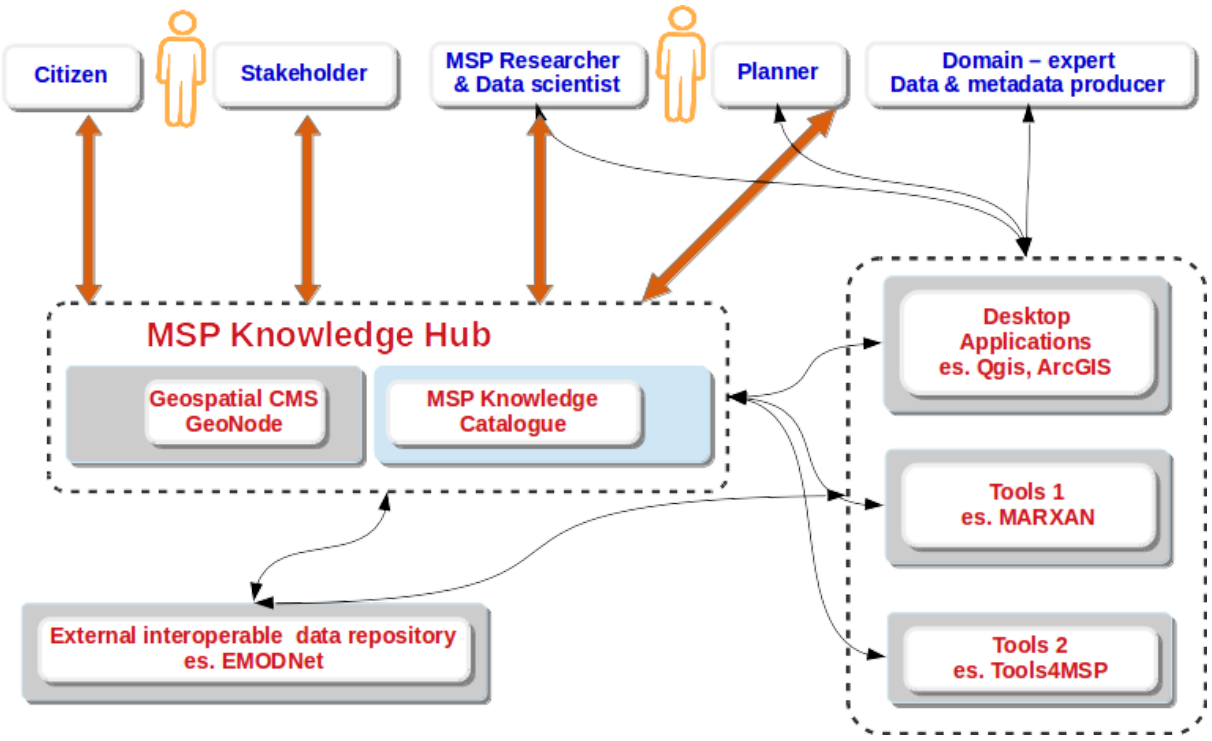

Figure 26: Proposal of interoperable tools and portals integration to support MSP process.

The heart of the proposal provides for implement a MSP Knowledge Hub where data, information, knowledge is made accessible to all types of users. Moreover, the Hub aims to facilitate the integration and concatenation between multiple tools sharing the datasets through standard and interoperable services. Straightforward connection between Hub and GIS desktop application (e.g. QGIS, ArcGIS) allows, on the one hand, to performs complex and highly supervised data-preparation

and analysis tasks and the other to easily share the results with other MSP users and make them available as input for the connected tools.

The MSP Knowledge Catalogue developed during task 1.3.2 and 1.3.3 may be used as a component of the above proposed Hub. A core functionality provided by the MSP Knowledge Catalogue is to collect and organize basic contributions (e.g. datasets, linkage to remote interoperable services, tables, reports, documents) by all MSP user categories.

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Appendix A - MSP Knowledge Catalogue Metadata specifications

A 1. MSP Dataset type

Resource title [text, mandatory]

This is a characteristic, and often unique, name by which the resource is known. The title is the most informative element of a metadata record and usually the highest priority as search engines go to this element.

References/relations: INSPIRE Resource title

Resource abstract [text, mandatory]:

This is a brief narrative summary of the content of the resource. The abstract provides a clear and concise statement that enables the reader to understand the content of the dataset.

References/relations: INSPIRE Resource abstract

Topic category [list multiple-choice, mandatory]:

High-level dataset thematic classification to assist in the grouping and search of available datasets. The classification has been derived from the EU MSP Data Study report (“Range of themes and categories of data and information used by MSP planners”) and then reviewed by the SUPREME Data and Tools working group.

SUPREME topic categories and EU "MSP Study" categories:

EU MSP Data Study themes	**SUPREME Catalogue topic categories** (*=reviewed by the SUPREME Data and Tools working group)	**EU MSP Data Study categories**
ADMINISTRATIVE BORDERS	Maritime boundaries*	Boundary data
	Terrestrial boundaries*	Boundary data
PHYSICAL/CHEMICAL /BIOLOGICAL INFORMATION	Physical characteristics	Physical characteristics
	Types of habitat	Types of habitat
	Biological characteristics	Biological characteristics
	Source of pollution*	Pressures and impacts
	Pressures and impacts	Pressures and impacts
ACTIVITIES/USES	Aquaculture	Aquaculture
	Fishing	Fishing
	Renewable energies	Renewable energies
	Installations & infrastructure	Installations & infrastructure
	Maritime transport and traffic flows	Maritime transport and traffic flows
	Ports	Ports
	Nature and species conservation sites & protected areas	Nature and species conservation sites & protected areas
	Military	Military
	Raw material extraction areas	Raw material extraction areas
	Scientific research	Scientific research
	Submarine cable & pipeline routes	Submarine cable & pipeline routes
	Tourism & recreation	Tourism & recreation
	Underwater cultural heritage	Underwater cultural heritage
	Coastal defence	Coastal defence
	Coastal land uses/activities*	-
SOCIO-ECONOMIC DATA	Human population	Human population

	Economic indicators	Economic indicators
	Social indicators	Social indicators
SPATIAL POLICY	Spatial policy	Spatial policy

Resource language [list, multiple-choice]

The language(s) used within the resource.

Domain area [tags, multiple-choices]

This is a list of geographical names to identify the spatial domain / coverage of the resource.

E. g. Mediterranean, Adriatic, Ionian, Aegean, Italy-Adriatic, Italy-Ionian, Italy-Veneto, Greece-Aegean, Italy, Greece, Croatia, Slovenia, Albania.

The domain area will be used to identify spatial gaps

Temporal extent [date or date range]

Time period covered by the content of the dataset. This could be an individual date (using only the begin date) or a time period (using both begin date and end date).

Owner [tags, multiple-choices]

This is a list of one or more names (e. g. Emodnet, EEA) identifying the ownership of the resource.

Provider [tags, multiple-choices]

This is a list of one or more names (e. g. Emodnet, EEA) identifying the provider of the resource. E. g. This could be the owner of the geo-portal or SDI through which the resource is available.

Presentation form [list, single-choice]

Mode in which the dataset is represented

- Map (map represented in raster or vector form)
- Image
- Document
- Table
- Model
- Profile
- Video
- Audio
- Diagram
- Multimedia
- Raw data

Spatial representation [list, single-choice]

Method used to represent geographic information in the dataset. The spatial representation could also highlight when textual or tabular data (or other no-Map datasets) are used to represent geographic data.

References/Relations: INSPIRE SpatialRepresentationType, ISO19139 SpatialRepresentationType.

A specific value has been added to explicitly identify the non geospatial datasets.

- Vector - point
- Vector - line (or polyline)
- Vector - polygon
- Vector - mixed types
- Raster (grid)
- Non geospatial dataset.

Coordinate reference system (TODO)

Identifier of the coordinate reference system(s) used in the data set. Only identifiers contained in the EPSG Geodetic Parameter Dataset shall be used (e.g. 4326). Refer to the following URLs for more info and to find the proper EPSG code:

https://epsg.io/

http://spatialreference.org/

If more than an EPSG code are available (e.g. download services supporting on-fly reprojection) you could specify just the most common EPSG codes.

Examples:

- 4326
- 4326, 3035

Web services [list, multiple-choices]

Available interoperable services to view or download the resource.

- OGC-WMS
- OGC-WFS
- OGC-WCS
- OGC-SOS
- ....

Accessibility [text]

A description of the level of resource accessibility.

License [list, single-choice]

- Creative Commons Attribution
- Creative Commons Attribution Share-Alike
- Creative Commons CC0
- Creative Commons Non-Commercial (Any)
- GNU Free Documentation License
- License not specified
- Open Data Commons Attribution License
- Open Data Commons Open Database License (ODbL)
- Open Data Commons Public Domain Dedication and License (PDDL)
- Other (Attribution)
- Other (Non-Commercial)
- Other (Not Open)
- Other (Open)
- Other (Public Domain)
- UK Open Government Licence (OGL)

Validation level [list, single-choice]

Level of validation.

- Draft
- Official data
- Research
- Business
- Demo

Note [text]

Additional information about the resource.

Case studies relevance [list, multiple-choices]

- Case study 1
- Case study 2
- ....

A 2. MSP Portal type

Portal title [text]

This is a characteristic, and often unique, name by which the portal is known. The title is the most informative element of a metadata record and usually the highest priority as search engines go to this element.

Portal abstract [text]:

This is a brief narrative summary of the content of the portal. The abstract provides a clear and concise statement that enables the reader to understand the content of the portal.

Topic categories [list, multiple-choices]:

High-level thematic classification of the datasets available through the portal.

- Maritime boundaries
- Terrestrial boundaries
- Physical characteristics
- Types of habitat
- Biological characteristics
- Aquaculture
- Fishing
- Renewable energies
- Installations & infrastructure
- Maritime transport and traffic flows
- Ports
- Nature and species conservation sites & protected areas
- Military
- Raw material extraction areas
- Scientific research
- Submarine cable & pipeline routes
- Tourism & recreation
- Underwater cultural heritage
- Coastal defence
- Human population
- Economic indicators
- Social indicators
- Coastal land uses/activities
- Source of pollution [TODO]

Portal language [list, multiple-choice]

The language(s) used within the resource.

Domain area [tags, multiple-choices]

This is a list of geographical names to identify the spatial domain / coverage of the portal.

E. g. Mediterranean, Adriatic, Ionian, Aegean, Italy-Adriatic, Italy-Ionian, Italy-Veneto, Greece-Aegean, Italy, Greece, Croatia, Slovenia, Albania.

The domain area will be used to identify spatial gaps

Owner [tags, multiple-choices]

This is a list of one or more names (usually organizations or institutes like Emodnet, EEA) identifying the owner of the portal.

Presentation form [list, multiple-choices]

This is the mode in which the available datasets/resources are represented

- Map (map represented in raster or vector form)
- Image
- Document
- Table
- Model
- Profile
- Video
- Audio
- Diagram
- Multimedia
- Raw data

Spatial representation [list, multiple-choices]

Method used to represent geographic information in the dataset. The spatial representation could also highlight when textual or tabular data (or other no-Map datasets) are used to represent geographic data.

References/Relations: INSPIRE SpatialRepresentationType, ISO19139 SpatialRepresentationType.

A specific value has been added to explicitly identify the non geospatial datasets.

- Vector - point
- Vector - line (or polyline)
- Vector - polygon
- Vector - mixed types
- Raster (grid) (TODO)
- Non geospatial dataset.

Coordinate reference system (TODO)

Identifier of the coordinate reference system(s) supported by the portal. Only identifiers contained in the EPSG Geodetic Parameter Dataset shall be used (e.g. 4326). Refer to the following URLs for more info and to find the proper EPSG code:

https://epsg.io/

http://spatialreference.org/

If more than an EPSG code are available (e.g. download services supporting on-fly reprojection) you could specify just the most common EPSG codes.

Examples:

- 4326
- 4326, 3035

Web services [list, multiple-choices]

Interoperable services implemented by the portal.

- OGC-WMS
- OGC-WFS
- OGC-WCS
- OGC-SOS
- OCG-CSW
- OGC-WPS
- ...

Portal accessibility [text]

Description of the level of portal accessibility.

Data accessibility [text]
Description of the level of resources accessibility.

Data license [list, multiple-choices]

- Creative Commons Attribution
- Creative Commons Attribution Share-Alike
- Creative Commons CC0
- Creative Commons Non-Commercial (Any)

- GNU Free Documentation License
- License not specified
- Open Data Commons Attribution License
- Open Data Commons Open Database License (ODbL)
- Open Data Commons Public Domain Dedication and License (PDDL)
- Other (Attribution)
- Other (Non-Commercial)
- Other (Not Open)
- Other (Open)
- Other (Public Domain)
- UK Open Government Licence (OGL)

Features [list, multiple-choices]

Main features implemented by the portal

- View services
- Download
- Processing
- Mapping
- MSP Tools
- User collaboration

Notes [text]

Additional information about the portal.

Case studies relevance [list, multiple-choices]

- Case study 1
- Case study 2
- ....

A 3. MSP tool type

Title [text]

This is a characteristic, and often unique, name by which the tool is known. The title is the most informative element of a metadata record and usually the highest priority as search engines go to this element.

Abstract [text]:

This is a brief narrative summary of the content of the resource. The abstract provides a clear and concise statement that enables the reader to understand the content of the tool.

Tool category [list, multiple-choices]:

High-level tool thematic classification to assist in the grouping and search of available tools.

- Environmental impact assessment
- Communication
- Data gathering/management
- Economic analysis
- Evaluation
- Governance assistance
- Management plan proposal
- Scenario creation and analysis
- Site identification
- Socio-economic analysis
- Uses conflict analysis

MSP stages [list, multiple-choices]

MSP stages for which the tool is designed.

- Define goals and objectives
- Gather data and define current conditions
- Identify issues, constraints, and future conditions
- Develop alternative management actions
- Evaluate alternative management actions
- Monitor and evaluate management actions
- Refine goals, objectives and management actions

MSP users [list, multiple-choices]

- Planners
- Scientists

- Authorities
- General public
- Marine users
- NGOs

Software type [list, single-choice] Type of software.

- Desktop
- Web-based
- Toolbox
- Plugin

Input data [list, multiple-choices]

Type of input data needed to run the tool.

- Qualitative
- Quantitative
- Spatially explicit
- Temporally explicit

Output data [list, multiple-choices]

Type of output resources.

- Layer
- Maps
- Reports
- Tables

Organization [tags, multiple-choices]

This is a list of one or more names (usually organizations or institutes e. g. Emodnet, EEA) identifying the main supporter of the tool development and implementation.

Code accessibility [text]

Description of the level of code accessibility.

Software licence [list, single-choice]

- GPL
- LGPL
- Apache license
- BSD
- MIT
- CPL
- MPL
- EUPL

Documentation [list, multiple-choices]

- Unavailable
- Draft user documentation
- Full user documentation
- Draft developer documentation
- Full developer documentation
- Tutorials
- Videos & presentations

Community facilities [list, multiple-choices]

- Mailing list
- Forum
- Chat (e.g. IRC, Gitter)
- Collaborative development (e.g. Github)
- ...

Notes [text]

- Additional information about the tool.

Appendix B - Datasets of transboundary interest

Maritime boundaries

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Maritime Boundaries and Exclusive Economic Zones	Marineregions.org	Marineregions.org	other	Download after filling in a form	
12 nautical miles from the coast - terrestrial waters	Adriplan Data Portal	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan registered user	
GFCM Geographical Sub-Areas	FAO	Adriplan data Portal,FAO	OGC_WMS, OGC_WFS	Freely accessible	

Terrestrial boundaries

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Administrative or Statistical units	Eurostat	Eurostat	other	Data freely downloadable	

Physical characteristics

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Coastal migration	EMODnet Geology	EMODnet Geology	OGC_WMS, OGC_WFS, other	Freely accessible	
Seabed substrates (1:1 million)	EMODnet Geology	EMODnet Geology	OGC_WMS, OGC_WFS, other	Data freely accessible	
Bathymetry DTM	EMODnet Bathymetry Portal	EMODnet Bathymetry Portal	OGC_WMS, OGC_WCS, other	Data freely accessible after filling a form	
EEA coastline for analysis	EEA	EEA Data and Maps	other		
Bathymetry of the Greek Seas	Hellenic Navy Hydrographic Service HNHS	Hellenic Navy Hydrographic Service HNHS		free	
Hard and soft bottom shallow, shelf, slope, deep	CNR-ISMAR	Adriplan	OGC_WMS, OGC_WCS		

Coastal Erosion trends	EEA	Adriplan data Portal,EEA Data and Maps	OGC_WMS	Freely accessible	

Types of habitat

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Seabed Habitats	EMODnet Seabed Habitats	EMODnet Seabed Habitats	OGC_WMS, OGC_WFS, OGC_WCS	Data accessible to registered used	
Spatial Distributions of Posidonia oceanica Habitat (Modelled - MEDISEH project)	UNEP World Conservation Monitoring Centre	EMODnet Seabed Habitats	OGC_WMS	Open access (NO DOWNLOAD) according to terms and conditions	
Spatial Distributions of Coralligenous Habitat (Modelled - MEDISEH project)	UNEP World Conservation Monitoring Centre	EMODnet Seabed Habitats	OGC_WMS	Open access (NO DOWNLOAD) according to terms and conditions	
Spatial Distributions of Mäerl Habitat (Modelled - MEDISEH project)	UNEP World Conservation Monitoring Centre	EMODnet Seabed Habitats	OGC_WMS	Open access (NO DOWNLOAD) according to terms and conditions	
CCH - Cetacean Critical Habitats	MedPAN	Adriplan data Portal			

CIESM jellyfish blooms along Mediterranean coasts	CIESM-The Mediterranean Science Commission			free	

Biological characteristics

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Marine Mammals sightings (EMODnet)	EMODnet Biology	Adriplan,EMODnet Biology	OGC_WMS, OGC_WFS	Freely accessible	
Ecologically or Biologically Significant Areas (EBSAs)	CBD	CBD		freely available	
Seagrass meadows (Posidonia oceanica) distribution and trajectories of change	Telesca L.,Belluscio A.,Criscoli A.,Ardizzone G.,Apostolaki E. et al.			free	
Spawning areas	MEDISEH	ADRIPLAN	OGC_WMS, OGC_WFS	Data freely accessible	
Marine mammals	UNEP-MAP-RAC-SPA	ADRIPLAN	OGC_WMS, OGC_WFS	Data are freely accessible	

Nursery/Recruitment Habitats	MEDISEH	ADRIPLAN	OGC_WMS, OGC_WFS	Data are freely accessible	
Sightings of loggerhead turtles in the Adriatic Sea - density map	UNEP-MAP-RAC-SPA	ADRIPLAN		The layer is freely download from ADRIPLAN portal	
Gridded distribution of loggerhead turtles in the Ionian-Adriatic Sea	UNEP_MAP	Adriplan	OGC_WMS, OGC_WFS		
Gridded distribution of marine mammals in the Adriatic Sea	UNEP_MAP	Adriplan	OGC_WMS, OGC_WFS		
Seabirds Adriatic	UNEP_MAP	ADRIPLAN	OGC_WMS, OGC_WFS	The dataset is available only to ADRIPLAN users	
Surface nitrate concentration-total nitrate	OGS	NODC,Adriplan	OGC_WMS, OGC_WCS		

Seabirds	UNEP-MAP-RAC-SPA	ADRIPLAN	OGC_WMS, OGC_WCS	Data are freely accessible	
CIESM jellyfish blooms along Mediterranean coasts	CIESM-The Mediterranean Science Commission			free	

Aquaculture

Title	Owner	Data portal	Web services	Data accessibility	Domain area
FLAGs (Fisheries Local Action Groups) - Greece	HCMR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
GFCM Geographical Sub-Areas	FAO	Adriplan data Portal,FAO	OGC_WMS, OGC_WFS	Freely accessible	
Finfish Production	EMODnet Human activities	EMODnet Human activities	OGC_WMS, OGC_WFS	Data are free to access and download	
Shellfish Production	EMODnet Human activities	EMODnet Human activities	OGC_WMS, OGC_WFS	Data are free to access and download	

Fishing

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Fixed fishing gear (Regione Emilia Romagna)	SHAPE	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
FLAGs (Fisheries Local Action Groups) - Greece	HCMR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
6 nautical miles from the coast	Adriplan Data Portal	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan registered user	
4 nautical miles from the coast	Adriplan Data Portal	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	
3 nautical miles from the coast	Adriplan Data Portal	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan registered user	
Trawling Fishing Intensity - BlueHub	EEA	JRC BlueHub,Adriplan	OGC_WMS		

GFCM Geographical Sub-Areas	FAO	Adriplan data Portal,FAO	OGC_WMS, OGC_WFS	Freely accessible	
Pair pelagic trawl fishery	CNR-ISMAR	Adriplan	OGC_WMS, OGC_WFS		
FRAs - Fishering Restricted Areas	MedPAN,GFCM	Adriplan data Portal,GFCM data portal		Data may sent by email by MedPAN	
Bottom otter trawl fishery - 2013	CNR-ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS, OGC_WCS	Freely accessible	
Bottom otter trawl fishery GSA 20 - 2011	Adriplan	Adriplan data Portal	OGC_WMS, OGC_WFS, OGC_WCS	Freely accessible	
FAO Major Areas for Fishery Purposes	FAO	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Renewable energies

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Ocean Energy Projects	Emodnet Human Activities	Emodnet Human Activities	other	Freely available	
Wind Farms (Points)	EMODnet Human activities	EMODnet Human activities	OGC_WMS, OGC_WFS, OGC_WCS, other	Data are free to access and download	
Wind Power Stations in Greece	Greek Regulatory Authority for Energy	RAE Geoportal	OGC_WMS, OGC_WFS, OGC_WCS, other	Data, metadata and network services are provided for FREE.	
Offshore Wind Farms in project	OGS	Adriplan data Portal,4C Offshore	OGC_WMS, OGC_WFS		

Installations & infrastructure

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Telecommunication cables	Cablemap	Cablemap		Freely accessible	

Around offshore installation	SHAPE	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
Hydrocarbon extraction platform - Italy (Emodnet)	EMODnet Human activities	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	
Safety zones	Shape	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Maritime transport and traffic flows

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Marine traffic density map 2015	European Atlas of the Seas	European Atlas of the Seas		View only	
Motorways of the Seas - European Atlas of the Sea	European Atlas of the Seas	Adriplan data Portal,European Atlas of the Seas	OGC_WMS, OGC_WFS	Freely accessible	
Traffic lane	SHAPE	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Shipping routes	OGS	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely acessible	
Adriatic traffic density July 2014 - June 2015	Balmas,CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data freely accessible\r\n	

Ports

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Main Ports Statistics 2015-2016 -Emodnet	Emodnet Human Activities	ADRIPLAN,Emodnet Human Activities	OGC_WMS, OGC_WFS, other	Data freely accessible	
Ports and harbours	SHAPE	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
Ports planning	Università IUAV di Venezia		OGC_WMS, OGC_WFS	Freely accessible	
Ferry ports 2013	Adriplan	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Ferry ports and statistics (2011-2013)	Adriplan	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
Cruise ports 2013	Adriplan	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Nature and species conservation sites & protected areas

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Specially Protected Areas of Mediterranean Importance (SPAMI)	MAPAMED	Adriplan data Portal		freely accessible	
International Bird Areas	BirdLife International	BirdLife International		Data downloadable upon request	
Nationally Designated Areas	Emodnet Human Activities	Emodnet Human Activities	OGC_WMS, OGC_WFS, other	Freely accessibile	
Natura 2000 Sites	European Environmental Agency	EEA Data and Maps		Public	

Artificial reef	Atlas Shape	Atlas Shape			
FRAs - Fishering Restricted Areas	MedPAN,GFCM	Adriplan data Portal,GFCM data portal		Data may sent by email by MedPAN	
CCH - Cetacean Critical Habitats	MedPAN	Adriplan data Portal			
Marine Protected Areas	MedPAN	Adriplan data Portal	OGC_WMS, OGC_WFS		

Military

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Dumped Munitions	Emodnet Human Activities	Emodnet Human Activities	OGC_WMS, OGC_WFS, other	freely available	

Raw material extraction areas

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Oil and Gas research areas in Greece	Ministry of Environment Energy and Climate Change		other	free	
Offshore sand dredged	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Freely Accessible	
Hydrocarbon extraction platform - Italy (Emodnet)	EMODnet Human activities	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	
Hydrocarbon Extraction - Boreholes	EMODnet Human activities	EMODnet Human activities	OGC_WMS, OGC_WFS, other	Data are free to access and download	
Hydrocarbn Extraction - Offshore Installations	EMODnet Human activities	EMODnet Human activities			
Hydrocarbon extraction - Active Licenses	EMODnet Human activities	EMODnet Human activities	OGC_WMS, OGC_WFS, other	Data are free to access and download	

Hydrocarbon exploitation permits in Italy	Ministero dello sviluppo economico	Adriplan data Portal,Ministero dello sviluppo economico	OGC_WMS, OGC_WFS	Freely accessible	

Submarine cable & pipeline routes

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Telecommunication cables	Cablemap	Cablemap		Freely accessible	
Planned energy cable Italy-Slovenia	CNR-ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
Submarine Telecommunication Cables	EMODnet	ADRIPLAN	OGC_WMS, OGC_WFS	Data publicly accessible	
Underwater pipelines	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	
New natural gas pipeline Italy-Greece	Adriplan		OGC_WMS, OGC_WFS	Freely accessibl	

Proposed Trans Adriatic Pipeline route		Adriplan data Portal	OGC_WMS, OGC_WFS	Freely Accessible	
Telecommunication cables	Telegeography	Telegeography		free	
Submarine Energy Cables_Future planning	ADMIE S.A.			free	
Submarine Energy Cables	ADMIE S.A			available upon request	

Tourism & recreation

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Bathing waters	SHAPE		OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	
Accommodation establishments (2011)	Eurostat,CNR ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Underwater cultural heritage

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Submerged Prehistoric Archaeology and Landscapes	EMODnet Human activities	EMODnet Human activities	OGC_WMS		

Coastal defence

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Offshore sand dredged	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Freely Accessible	
Coastal migration	EMODnet Geology	EMODnet Geology	OGC_WMS, OGC_WFS, other	Freely accessible	
Coastal erosion in Greece	Taylor and Francis Group			upon request	

Economic indicators

Title	Owner	Data portal	Web services	Data accessibility	Domain area
FLAGs (Fisheries Local Action Groups) - Greece	HCMR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	
Accommodation establishments (2011)	Eurostat,CNR ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS	Freely accessible	

Coastal land uses/activities

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Corine Land Cover (CLC) 2012	EEA	land.copernicus.eu	other	Free download after registration	

Source of pollution

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Marine Litter Assessment in the Mediterranean - 2015	UNEP_MAP			free	

Marine Litter Assessment in The Adriatic & Ionian Seas 2017	MIO-ECSDE,HCMR,ISPRA			free	
LBA - SHYFEM 2016 - N-P total / Plume / Organic matter	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user	
TECHNICAL REPORT FOR THE PREPARATION STAGE OF ACTION PLAN FOR MARINE STRATEGIES IN GREECE, FOR THE IMPLEMENTATION OF MARINE STRATEGY FRAMEWORK DIRECTIVE 2008/56/EC	Ministry of Environment, Energy and Climate Change,			free	
Surface nitrate concentration-total nitrate	OGS	NODC,Adriplan	OGC_WMS, OGC_WCS		

Pressures and impacts

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Cumulative Impact Assessment for the Adriatic Sea (model)	CNR ISMAR	Adriplan data Portal	OGC_WMS, OGC_WCS, other	Freely accessible	

Marine Litter Assessment in the Mediterranean - 2015	UNEP_MAP			free	
Marine Litter Assessment in The Adriatic & Ionian Seas 2017	MIO-ECSDE,HCMR,ISPRA			free	
LBA - SHYFEM 2016 - N-P total / Plume / Organic matter	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user	
Surface nitrate concentration-total nitrate	OGS	NODC,Adriplan	OGC_WMS, OGC_WCS		

Spatial policy

Title	Owner	Data portal	Web services	Data accessibility	Domain area
MSFD Marine regions and sub-regions	EEA Dataset	EEA Dataset	other	Freely available	

Appendix C - Supporting case study activities

Types of habitat

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Seabed Habitats	EMODnet Seabed Habitats	EMODnet Seabed Habitats	OGC_WMS, OGC_WFS, OGC_WCS	Data accessible to registered used	

Biological characteristics

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Spawning areas	MEDISEH	ADRIPLAN	OGC_WMS, OGC_WFS	Data freely accessible	
Marine mammals	UNEP-MAP-RAC-SPA	ADRIPLAN	OGC_WMS, OGC_WFS	Data are freely accessible	

Nursery/Recruitment Habitats	MEDISEH	ADRIPLAN	OGC_WMS, OGC_WFS	Data are freely accessible	
Sightings of loggerhead turtles in the Adriatic Sea - density map	UNEP-MAP-RAC-SPA	ADRIPLAN		The layer is freely download from ADRIPLAN portal	
Seabirds Adriatic	UNEP_MAP	ADRIPLAN	OGC_WMS, OGC_WFS	The dataset is available only to ADRIPLAN users	
Seabirds	UNEP-MAP-RAC-SPA	ADRIPLAN	OGC_WMS, OGC_WCS	Data are freely accessible	

Aquaculture

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Aquaculture (Emilia-Romagna - 2014)	Emilia Romagna Region	ADRIPLAN	OGC_WMS, OGC_WFS		
Mussel farming vessels - 2015	CNR-ISMAR Ancona	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user. To be used only for SUPREME Case Study North Adriatic	
Aquaculture (Veneto - June 2014)	Regione Veneto	ADRIPLAN	OGC_WMS, OGC_WFS	The dataset is publicly available through the ADRIPLAN portal	
Aquaculture (Friuli Venezia Giulia - 2014)	SHAPE	ADRIPLAN	OGC_WMS, OGC_WFS	Data publicly accessible	

Fishing

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Pelagic pair trawl (PTM) "Volanti" (swept km) - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user. To be used only for SUPREME Case Study North Adriatic.	
Mussel farming vessels - 2015	CNR-ISMAR Ancona	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user. To be used only for SUPREME Case Study North Adriatic	
Small scale fisheries - Northern Adriatic (IT)	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and to be used only for SUPREME Case Study North Adriatic	
GNS - Reti a imbrocco - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and to be used only for SUPREME Case Study North Adriatic	

DRB - Draghe idrauliche - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and to be used only for SUPREME Case Study North Adriatic	
PS - Circuizione - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and To be used only for SUPREME Case Study North Adriatic	
TBB - Rapidi - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and To be used only for SUPREME Case Study North Adriatic	
OTB - Strascico - 2015	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user and to be used only for SUPREME Case Study North Adriatic	

Installations & infrastructure

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Hydrocarbon extraction platform - Italy (Emodnet)	EMODnet Human activities	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Maritime transport and traffic flows

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Adriatic traffic density July 2014 - June 2015	Balmas,CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data freely accessible\r\n	

Ports

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Main Ports Statistics 2015-2016 -Emodnet	Emodnet Human Activities	ADRIPLAN,Emodnet Human Activities	OGC_WMS, OGC_WFS, other	Data freely accessible	

Ports planning	Università IUAV di Venezia		OGC_WMS, OGC_WFS	Freely accessible	
Cruise Ports (Italy, 2015)	CNR ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS		

Military

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Military permanent	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Raw material extraction areas

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Offshore sand dredged	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Freely Accessible	

Hydrocarbon extraction platform - Italy (Emodnet)	EMODnet Human activities	Adriplan Data Portal	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Submarine cable & pipeline routes

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Submarine Telecommunication Cables	EMODnet	ADRIPLAN	OGC_WMS, OGC_WFS	Data publicly accessible	
Underwater pipelines	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Tourism & recreation

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Marinas - Adriatic Sea	pagine azzurre	ADRIPLAN	OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Cruise Ports (Italy, 2015)	CNR ISMAR	Adriplan data Portal	OGC_WMS, OGC_WFS		
Bathing waters	SHAPE		OGC_WMS, OGC_WFS	Data accessible only to Adriplan user	

Coastal defence

Title	Owner	Data portal	Web services	Data accessibility	Domain area
Offshore sand dredged	CNR-ISMAR	ADRIPLAN	OGC_WMS, OGC_WFS	Freely Accessible	
Opere difesa 2014 Regione Emilia Romagna	Regione Emilia Romagna	ADRIPLAN	OGC_WMS, OGC_WFS	Data publicly accessible	

Source of pollution

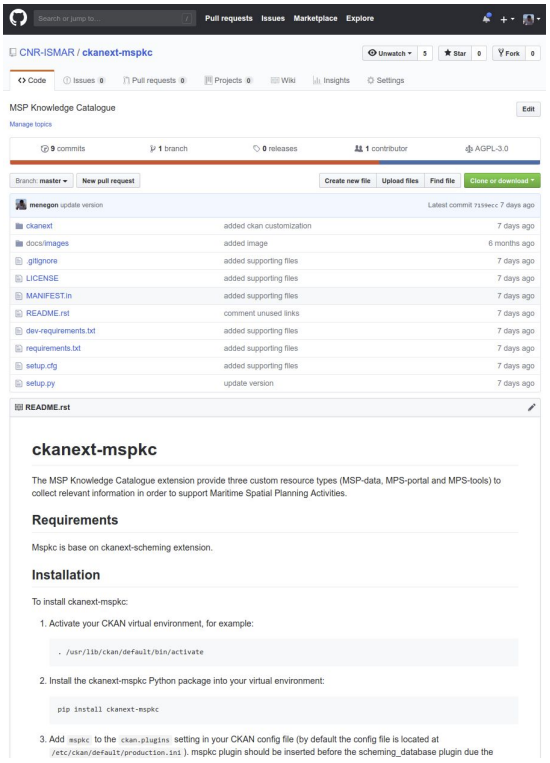
Title	Owner	Data portal	Web services	Data accessibility	Domain area
LBA - SHYFEM 2016 - N-P total / Plume / Organic matter	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user	

Pressures and impacts

Title	Owner	Data portal	Web services	Data accessibility	Domain area
LBA - SHYFEM 2016 - N-P total / Plume / Organic matter	CNR ISMAR	ADRIPLAN	OGC_WMS, OGC_WCS	Data accessible only to Adriplan user	

Appendix D - MSP Knowledge Catalogue Metadata server and client software

The MPS Knowledge Catalogue has been released as open-source software (under the GPL license) throughout the GitHub portal.



https://github.com/CNR-ISMAR/ckanext-mspkc