Implementation of the MSFD to the Deep Mediterranean Sea

IDEM

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Deliverable 2.3 Report on habitat/ecosystems/pressure mapping in GIS.

Leader: CNR
Participants: CSIC, DFMR, ENEA, IFREMER, TAU, UB, UM, UNIVPM

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1. INTRODUCTION

In the framework of Task 2.3, Habitat/ecosystems/pressure GIS maps were reproduced to integrate the current knowledge on the spatial coverage of the descriptors/criteria/indicators as well as human stressors on the Mediterranean deep-sea ecosystems and provide the first evaluation of the environmental status in the Mediterranean Sea.

All available data from previous projects, initiatives and European infrastructures related to habitats/ecosystem distribution and human pressures for the deep sea (where deep sea is intended below the 200 m water depth) were collected and integrated in a Geodatabase. We also integrated data coming from IDEM partners, following the established project data policy and data management workflow.

The Geodatabase architecture was adapted from the CoCoNet project - Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential (https://cordis.europa.eu/project/rcn/101654_en.html) and implemented following the INSPIRE Directive (https://inspire.ec.europa.eu/), in order to be the most possible compliant to the European standards for data management. The Geodatabase was populated integrating all collected datasets.

All available data are used to produce maps showing the habitat distribution including both the biotic and abiotic components such as geomorphology, substrate and biological occurrences for the entire Mediterranean Sea under the 200 m and the human pressures.

A spatial geoportal for the IDEM project was implemented to show and retrieve all stored data to IDEM partners and to general public, giving downloading credentials only after data policy acceptance. The geoportal has several GIS functions described in this deliverable.

This document describes in detail all methodological steps and includes the GIS maps produced.

2. DATA COLLECTION

In order to obtain an exhaustive overview of the existing spatial data about deep sea in the Mediterranean basin, we revised the following databases:

Database number: 1
Database name: CoCoNet WebGIS
Database link: http://coconetgis.ismar.cnr.it/
Database description: CoCoNet is a 4 year FP7 European project aiming at designing network of marine protected areas and off shore wind farms. Within the CoCoNet project CNR-ISMAR lead the data management WP and created a WebGIS integrating data coming from partners (WPI, ISMAR-CNR, HCNR, IFREMER, CONISMA, University of Malta, CNRS, IBER-BAS, IO-BAS, GEOECOMAR, INAT, HCMR-IOO, UKRSCES, IBMK) and previous projects (BIOMAP project, Mediseh marea project).

Database number: 2
Database name: EMODnet portals
Database link: http://www.emodnet.eu/portals
Database description: EMODnet (European Marine Observation and Data Network) is a network of organizations supported by the EU's integrated maritime policy. These organizations work together to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers and data products. Data comes from a multitude of public and private data sources at EU, international, national, and local level.

Database number: 3
Database name: FAO, European Environment Agency (EEA) and ETC-UMA Data Portal
Database link: https://www.eionet.europa.eu, http://www.fao.org/geonetwork/srv/en/main.home#
Database description: FAO, European Environment Agency (EEA) and ETC-UMA Data Portal. The FAO GeoNetWork provides Internet access to interactive maps, satellite imagery and related spatial databases maintained by FAO and its partners. FAO and WFP, UNEP and more recently OCHA, have combined their research and mapping expertise to develop GeoNetWork open source as a common strategy to effectively share their spatial databases including digital maps, satellite images and related statistics.

Database number: 4
Database name: UNEP
Database link: http://data.unep-wcmc.org/
Database description: The Ocean Data Viewer offers users the opportunity to view and download a range of spatial datasets that are useful for informing decisions regarding the conservation of marine and coastal biodiversity. These data come from internationally respected scientific institutions and other organisations that have agreed to make their data available to the global community, with the hope that these data will support and encourage informed decision-making that sustains global biodiversity and ecosystem services (http://data.unep-wcmc.org/about).

Database number: 5
Database name: PANGAEA

Database link: https://www.pangaea.de/

Database description: PANGAEA is an Open Access library operated by a team of data editors, project managers, IT specialists and scientists with expertise in all fields of earth and environmental science and have a profound knowledge for the review and processing of scientific data. The information system PANGAEA aims at archiving, publishing and distributing georeferenced data from earth system research. Most of the data are freely available and can be used under the terms of the license mentioned on the data set description. A few password protected data sets are under moratorium from ongoing projects (https://www.pangaea.de).

Database number: 6
Database name: LITTERBASE
Database link: http://litterbase.awi.de/

Database description: The database collects litter occurrences in the world taken from publications. LITTERBASE currently comprises 821 scientific publications on the amount, distribution and composition of litter in the ocean and other watercourses (http://litterbase.awi.de/litter_detail).

We downloaded data as shapefile (.shp), raster file and OCG services in order to integrate all spatial information within the IDEM geodatabase that will be available through the IDEM spatial geoportal.

The table below shows the list of downloaded and examined data:

Database	Data	Data format
CoCoNet	Punctual habitat type	shapefile
CoCoNet	Linear habitats	shapefile
CoCoNet	Areal habitats	shapefile
CoCoNet	Species occurrences	shapefile
CoCoNet	Shipping Lane	shapefile
CoCoNet	Discharges	shapefile
CoCoNet	Ports	shapefile
CoCoNet	IndustrialAndCommercialArea	shapefile
CoCoNet	MarineMacroLitter	shapefile
CoCoNet	WaterCourses	shapefile
CoCoNet	Marine mammals and turtles diversity	tif
EMODnet/EurOBIS	Animalia occurrences	csv
EMODnet/EurOBIS	Plantae occurrences	csv
EMODnet	Seabed habitats	shapefile
EMODnet	UtilityAndServiceLines	shapefile
UNEP	CWC distribution	shapefile
UNEP	Saltmarsh distribution	shapefile
UNEP	Octocorals distribution	shapefile
UNEP	Seamount distribution	shapefile
UNEP	Biodiversity patterns	shapefile
UNEP	Critical Habitat	shapefile

PANGAEA	Cold Seeps Ionian Sea	tif
PANGAEA	Marine litter, chemicals in water column	csv
LITTERBASE	Seabed marine litter (<-200m)	shapefile
ISMAR-CNR	Fish catch in Mediterranean Sea from 1990 to 2004	csv
CISIC	Dissolved organic/inorganic	shapefile
CISIC	Chemicals in water column	Csv
IDEM partners	Canyons	shapefile
IDEM partners	Seamounts	shapefile
IDEM partners	Deep basins	shapefile
IDEM partners	Hellenic trench	shapefile
IDEM partners	Trawling areas La Fonera Canyon (from Puig et al. 2012)	shapefile
IDEM partners	Coal fly ash disposal (from Kress et al. 1998)	shapefile
IDEM partners	Gas deep wells	shapefile
IDEM partners	Industrial waste disposal Gulf of Corinth (from Poulos et al. 1996)	shapefile
IDEM partners	Industrial waste disposal Cassidaigne Canyon (from Dauvin et al. 2010)	shapefile
IDEM partners	Sulphide deposits	shapefile
IDEM partners	Chemosynthetic Ecosystems	shapefile
IDEM partners	Mud volcanoes	shapefile
IDEM partners	POP monitoring sites	shapefile
IDEM partners	PAH and other organics sites	shapefile

Table 1: Data potentially fitting the MSFD Descriptors.

3. IDEM GEODATABASE ARCHITECTURE

The IDEM Geodatabase architecture comes from the CoCoNet project (http://coconetgis.ismar.cnr.it/), representing a multi-disciplinary spatial database including several thematic layers such as habitat distribution, biodiversity and threats occurrences. The CoCoNet Geodatabase was updated and the thematic layers grouped following the MSFD Descriptors. The idea was to evaluate the dataset type better fitting the aim of the MSFD Descriptors.

The CoCoNet Geodatabase included the entire Mediterranean and Black sea basins, while the IDEM Geodatabase is storing only Mediterranean data below the 200 water depth linked to MSFD Descriptors. The following table shows the list of thematic layers included in the IDEM Geodatabase:

Group layer	Layer
	MSFD subregion
	IDEM area of interest
D1	**Biodiversity is maintained**
	Species occurrences
	Habitat point
	Seamounts, knolls and mud volcanoes
	Seabed substrate
	Seabed habitat EUNIS

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	Seabed habitat MSFD
	Mammals and turtles diversity
	Critical habitats
D2	**Non-indigenous species do not adversely alter the ecosystem**
	Number of multicellular non indigenous species
D3	**The population of commercial fish species is healthy**
	Potential fishing pressure along the Mediterranean Sea coast
D4	**Elements of food webs ensure long-term abundance and reproduction**
D5	**Eutrophication is minimised**
	Aquaculture production: fish farms influence
D6	**The sea floor integrity ensures functioning of the ecosystem**
	Utility and service line
	Mining and extraction activity
	Impact of fisheries on the bottom from AIS data combined with habitat vulnerability
	Sulphide deposits
	Dumping zones
	Exploration and extraction of oil and gas
	Trawling areas
D7	**Permanent alteration of hydrographical conditions does not adversely affect the ecosystem**
D8	**Concentrations of contaminants give no effects**
	Contaminants monitoring stations
	Pollution point source
	Dumping zone
	Intensity of pollution by maritime transport in Mediterranean Sea
D9	**Contaminants in seafood are below safe levels**
D10	**Marine litter does not cause harm**
	Marine litter
	Shipping lanes
	Marine litter by population influence
D11	**Introduction of energy (including underwater noise) does not adversely affect the ecosystem**
Other	
	Cumulative Human Impact

Table 2: IDEM Geodatabase layer list grouped by MSFD Descriptors.

At this stage, there are no thematic layers fitting the Descriptor 4, 7, 9 and 11 due both to lack of spatial data for some specific information, such as for hydrological conditions Descriptor 7, or to gap of knowledge.

4. GIS MAPS

This paragraph shows some example of dynamic maps available within the IDEM Geoportal for each MSFD Descriptor.

D1 – BIODIVERSITY IS MAINTAINED

The maps below show all spatial data representing Descriptor 1 (Fig.1-6). The Marine Directive aspires to ensure that biodiversity is maintained in line with the natural state of a specific area, also considering the ongoing climatic changes. The first aim is to identify components of biodiversity, with particular attention at those playing a crucial role in the ecosystems, that might potentially be harmed by human pressure. This first Descriptor takes into account not only species-related indices, such as distributional range, population abundance or biomass and reproductive capacity, but also habitats distribution, extent and condition. We decide to consider the distribution of species by major Phyla, the distribution of habitats, and type of seabed substrate (Fig. 1). We also consider the distribution of geomorphologic features, such as seamounts, knolls, mud volcanoes, and trenches, Fig. 2) and the modelled distribution of EUNIS (Fig. 3) and MSFD (Fig. 4) habitat types; In the Atlantic and Arctic, the MSFD classification subdivides the Bathyal zone into "upper", "mid" and "lower", while in the Mediterranean Sea this subdivision is missing. For this reason, the classes "Upper bathyal sediment" and "Lower bathyal sediment", as well as the "Upper bathyal rock and biogenic reef" and the "Lower bathyal rock and biogenic reef" cannot be distinguished in the basins. This simplification in the MSFD classification for the bathyal zone contributes to a lack of information about the type of seabed habitat, making it difficult to distinguish two habitats with very different characteristics.

IFC's Environmental and Social Performance Standards define IFC responsibilities in managing the environmental and social risks. The Performance Standards provides guidelines on how to identify risks and impacts, on how to avoid, mitigate, and manage risks and impacts to promote sustainable business. This includes stakeholder engagement and disclosure obligations about the activities.

Performance Standard 6 is focused on biodiversity and the resources provided by the earth's ecosystems, which contribute to economic prosperity and human development. IFC PS6 recognizes that i) protecting and conserving biodiversity, ii) maintaining the benefits from ecosystem services, and iii) promoting the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities, are fundamental to sustainable development. It defines the spatial distribution of likely or potential Critical Habitat (Fig. 5):(i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

We also report a map representing the marine mammals and turtles diversity in the deep Mediterranean Sea (Fig. 6).
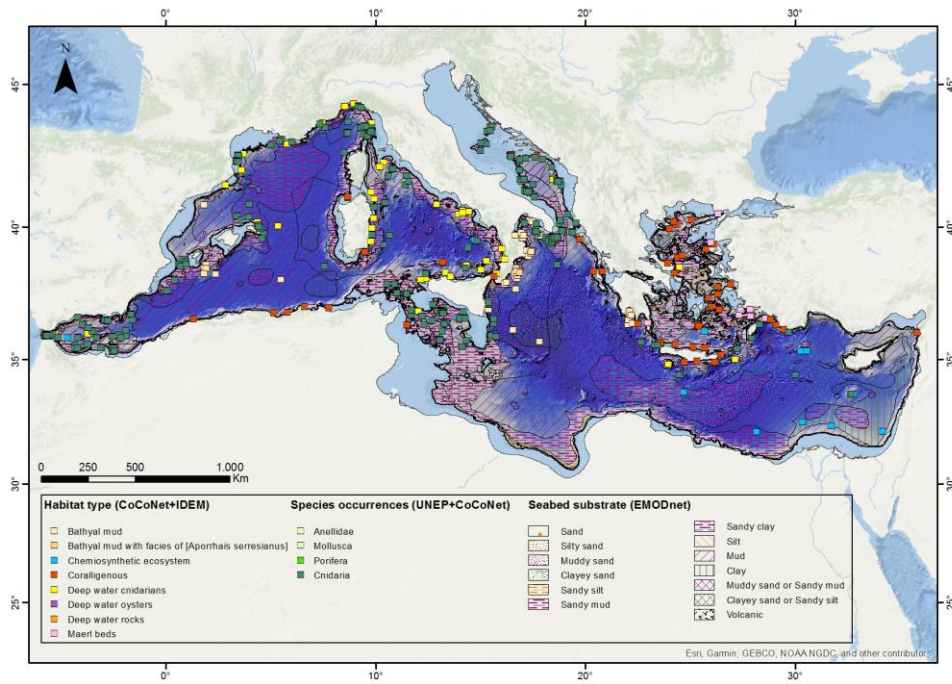
Fig. 1. The map shows the distribution of some major Phyla occurrences, the distribution of punctual habitat (i.e. coralligenous formations, deep sea coral habitats), and the predictive extent/distribution of different classes of seabed substrate.
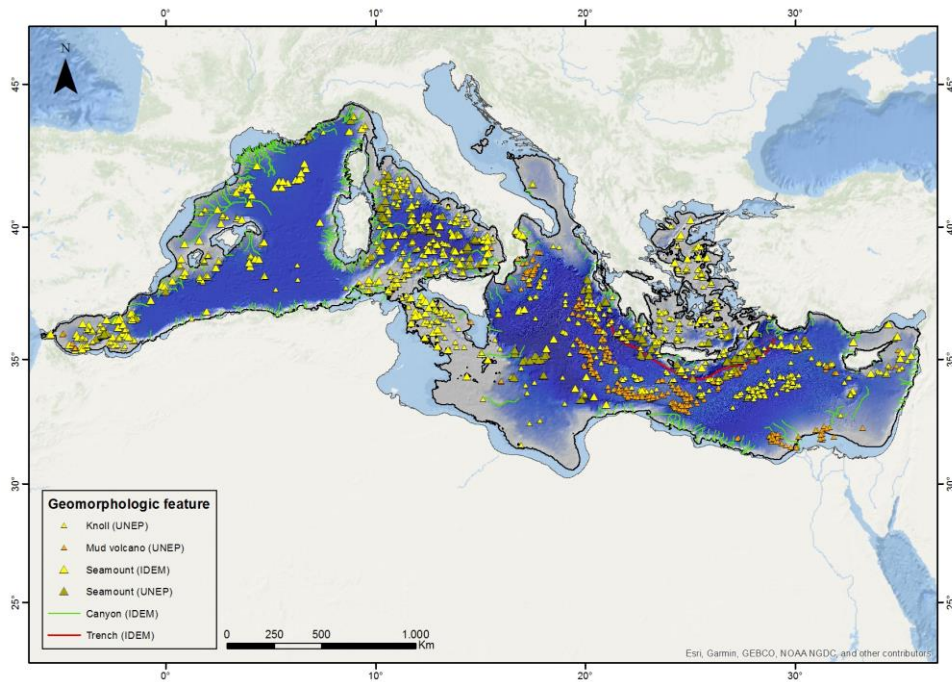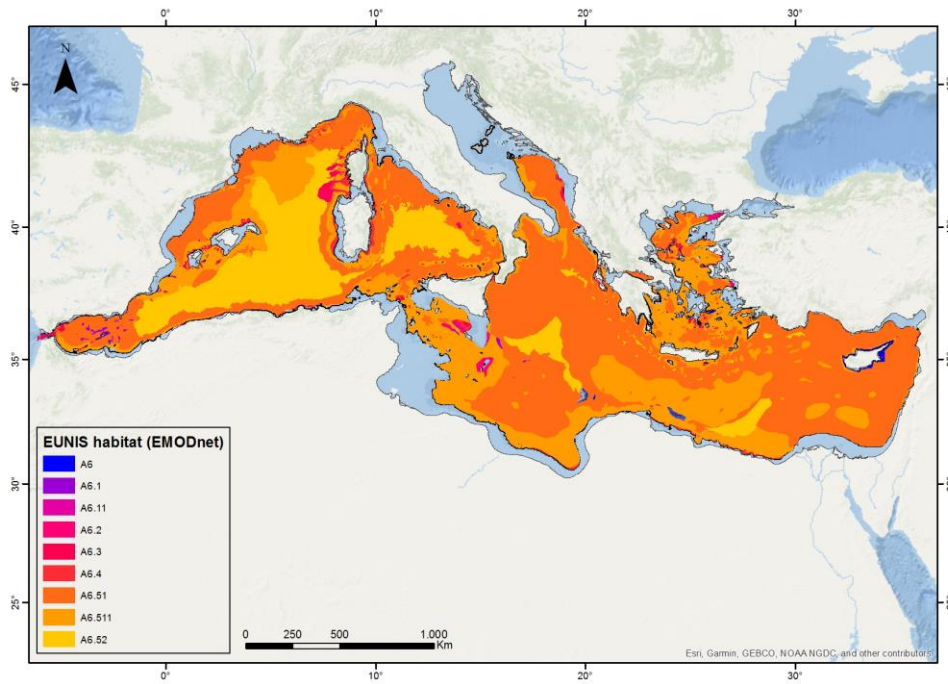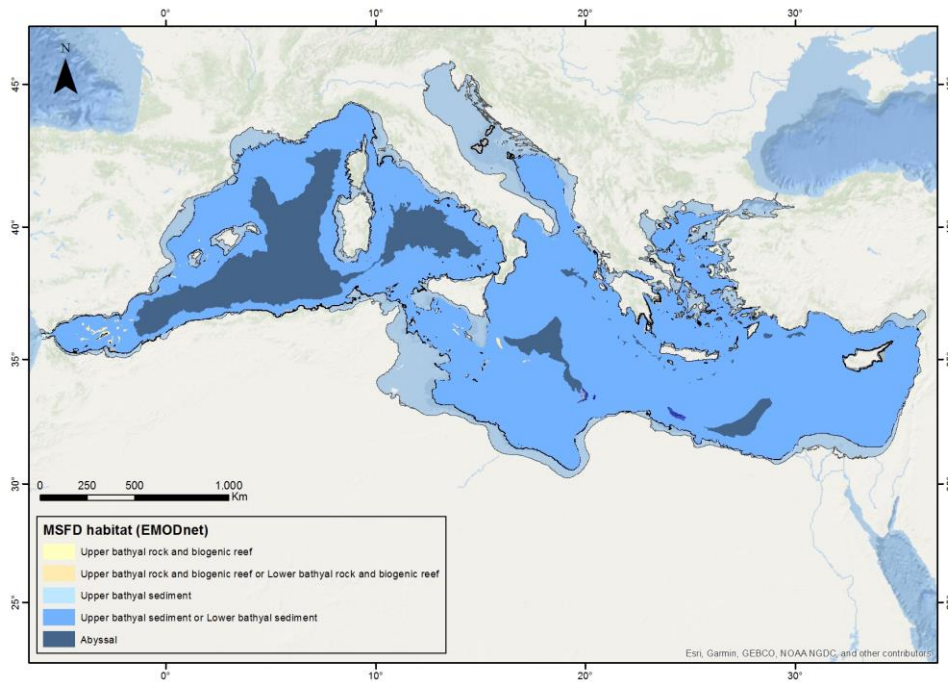

Fig. 2. The map shows the distribution of geomorphologic features in deep Mediterranean Sea: seamounts, knolls, mud volcanoes, canyon and trenches.

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Fig. 3. *Predictive extent of deep-sea habitat type, according to EUNIS classification (for more information see http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/02a444c8-bd2d-4e15-8e69-806059103760).*

Fig. 4. *The map shows the modelled extent of different deep-sea habitat, according to MSFD classification. For further information see http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/d23d0516-6ff4-4fb8-bf78-c11991cef78b.*

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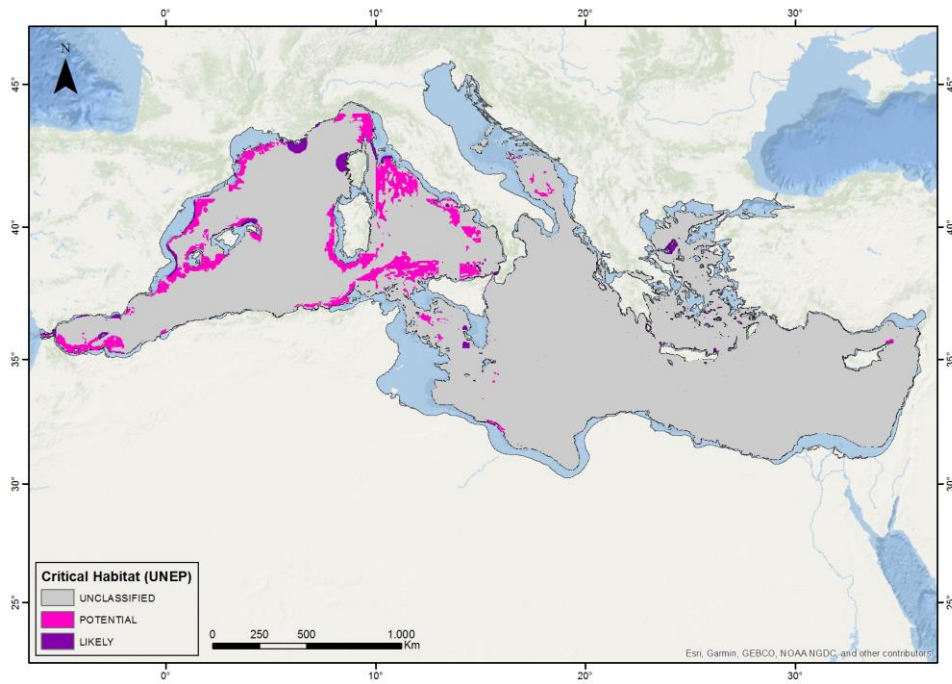
Fig. 5 Map showing the modelled distribution of critical habitats for deep Mediterranean Sea according to IFC PS6 criteria (http://data.unep-wcmc.org/datasets/44).
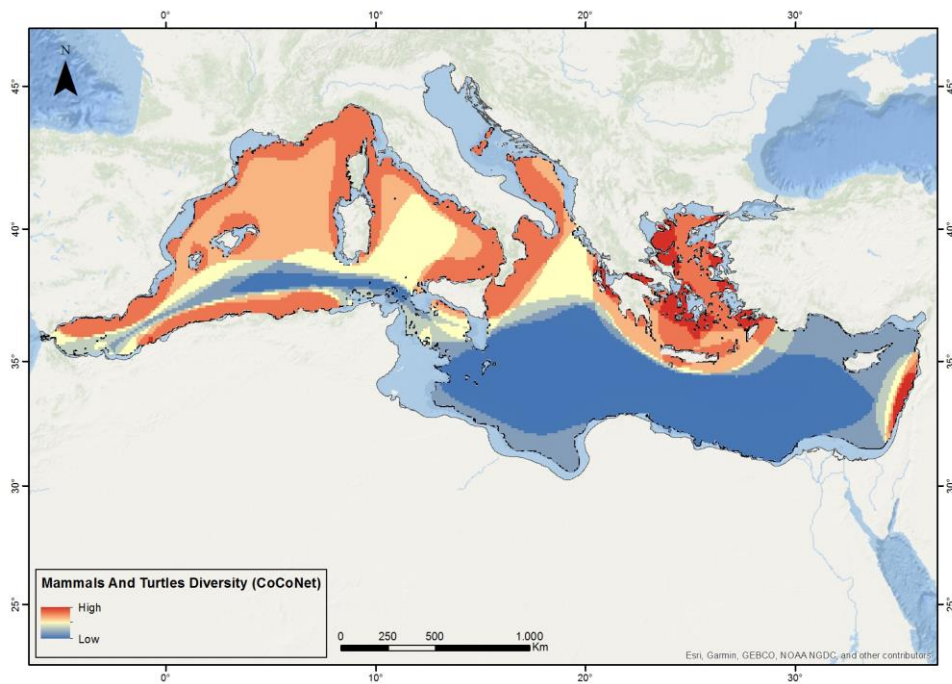
Fig. 6 Marine mammals and turtle's diversity hot spot and cold spot for Mediterranean deep sea.

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D2 – NON-INDIGENOUS SPECIES DO NOT ADVERSELY ALTER THE ECOSYSTEM

The second Descriptor of MSFD is focused on the assessment of the scale of the pressure and impacts of marine non-indigenous species (NIS) introduced as a result of human activities. The main aim is to prevent new introductions of NIS and the increases in the abundance and spatial distribution of yet established NIS. Since the knowledge about the effects of the NIS on the marine ecosystem is still poor, the Descriptor implies additional scientific and technical development for the establishment of new potentially useful indicators. Large scale geo-referenced data about the distribution of NIS in deep Mediterranean Sea are still not available, so we focused our attention on data regarding occurrences of NIS (excluding unicellular organisms) recorded within the Exclusive Economic Zone of 19 Mediterranean countries (according to Galil et al., 2014 and Galil personal communications, Fig.7).
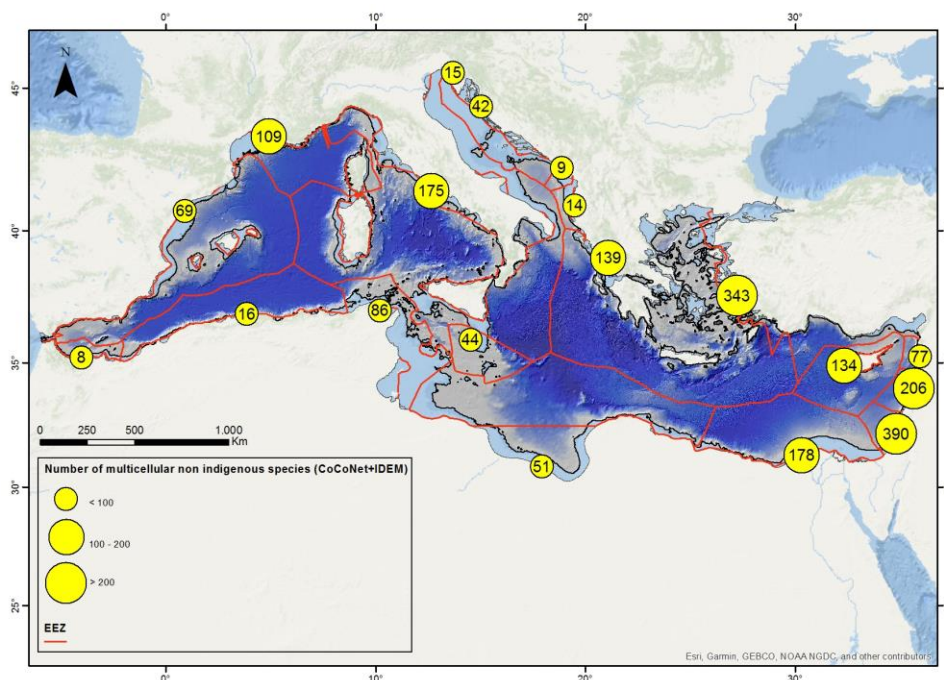

Fig. 7. Map showing the total number of observed occurrences of NIS within the Exclusive Economic Zone (EEZ). The yellow dots refer to both inshore and offshore records.

D3 - THE POPULATION OF COMMERCIAL FISH SPECIES IS HEALTHY

This Descriptor is focused on the state of the populations of all commercially-exploited fish and shellfish, which should be maintained within safe biological limits, exhibiting population age and size distribution indicative of a healthy stock. As for the Descriptor 2, geo-referenced quantitative data regarding populations of commercial fish and shellfish in the deep Mediterranean Sea have not been found, thus, we decided to consider the cumulative intensity of fishery activities operating in the deep sea, along the Mediterranean coasts (Fig. 8), which can contribute to identify areas where fish and shellfish populations are most exposed to fishing pressure.
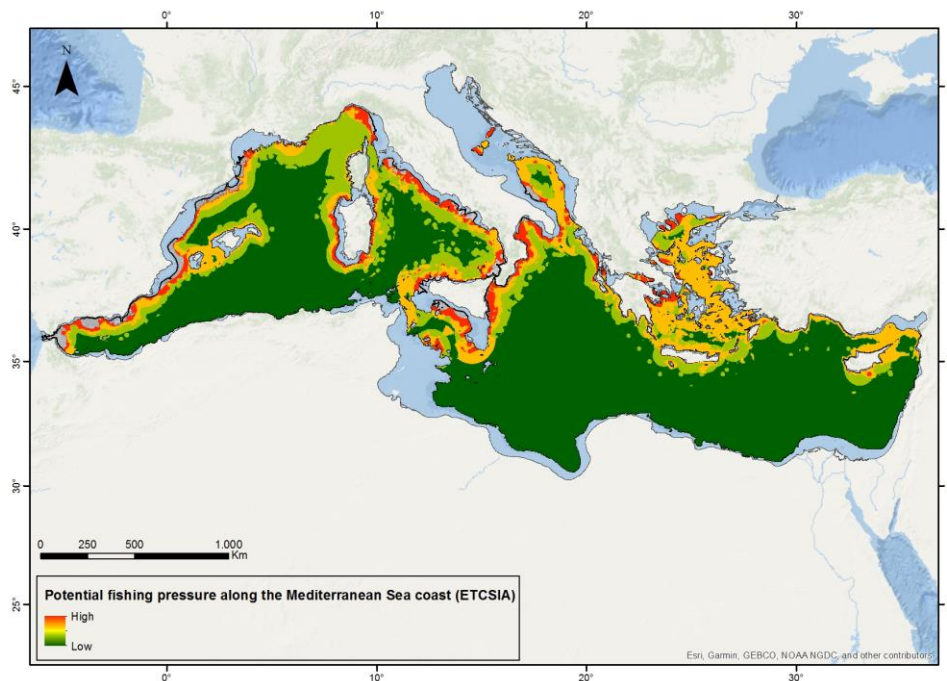
Fig. 8. *Map of the potential fishing activities pressure operating in areas with depth greater than 200 m.*

D5 – EUTROPHICATION IS MINIMISED

Descriptor 5 is defined in Annex I of the MSFD as "Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters". The main scope of the Descriptor is to ensure that nutrient concentrations and the photic limit (transparency) of the water column are not at levels that cause alterations in the abundances of opportunistic macroalgae, macrophyte, harmful algae, and macrofaunal communities which may lead to adverse eutrophication effects. Several difficulties have been encountered in mapping the distribution both of concentrations of nutrients, and the abundances of macroalgae, macrophyte and macrofaunal communities potentially causing eutrophication effects, as no geo-referenced data are available for deep waters. Thus, we considered the potential influence of fish farms on deep-sea habitat (Fig. 9), which pump high organic and nutrient loadings in the surrounding water column and on the sea bottom. The major impact is on the sea floor, where high sediment oxygen demand, anoxic sediments, production of toxic gases and a decrease in benthic diversity may result.
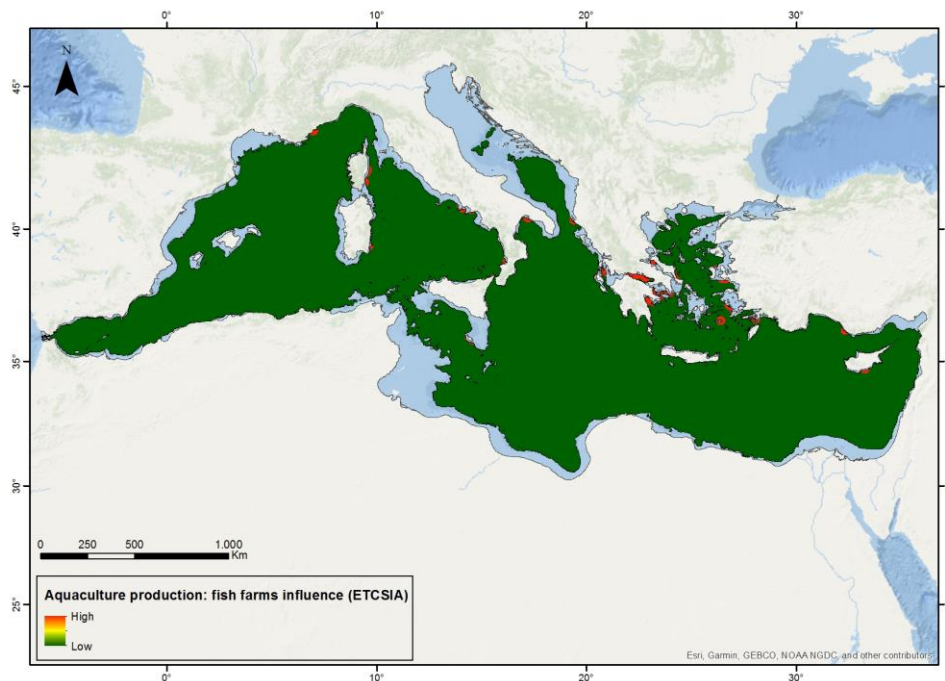
Fig. 9. Map showing the potential fish farms influence on deep layer of the water column and deep-sea benthic habitats. For more information see http://sdi.etcsia.uma.es:8080/geonetwork/srv/spa/catalog.search#/metadata/013014d9-6ac8-43a3-91f9-34f5ff3e07ad.

D6 – THE SEA FLOOR INTEGRITY ENSURES FUNCTIONING OF THE ECOSYSTEM

The different characteristics (physical, chemical and biological) of the sea bottom support the structure and functioning of marine ecosystems, especially for species and communities living on the sea floor. To preserve, or better, to avoid adverse alteration of the seafloor integrity is crucial for ensure natural structure and functioning of deep-sea benthic ecosystem. A great number of human activities may led to an alteration of the seafloor structure, such as mining operations, oil and gas extractions, dumping, trawling areas in La Fonera Canyon (from Puig et al. 2012) , and cable and service line branching off on the sea bottom (Fig. 10). Moreover, fishing activities, trawling in particular, may contribute to both alter the integrity of the sea bottom and reduce the extent of seafloor communities by acting directly on benthic species. This acquires particular importance for those habitats that are considered most vulnerable (i.e. deep-sea coral habitats) that provide important ecological functions. Here we report a modelled pressure map of fishery, for the year 2014, on habitats by combining the intensity of fishery activities, divided by months, with the vulnerability of habitats (Fig. 11).
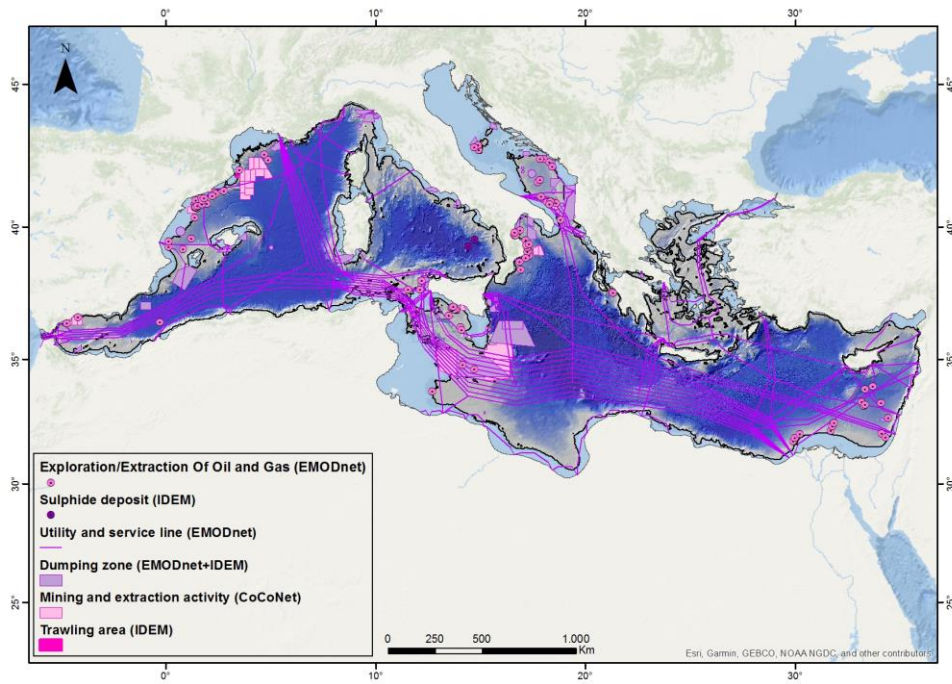
Fig. 10. *Location of human activities on the sea bottom over 200 m depth which may potentially alter the seafloor integrity.*
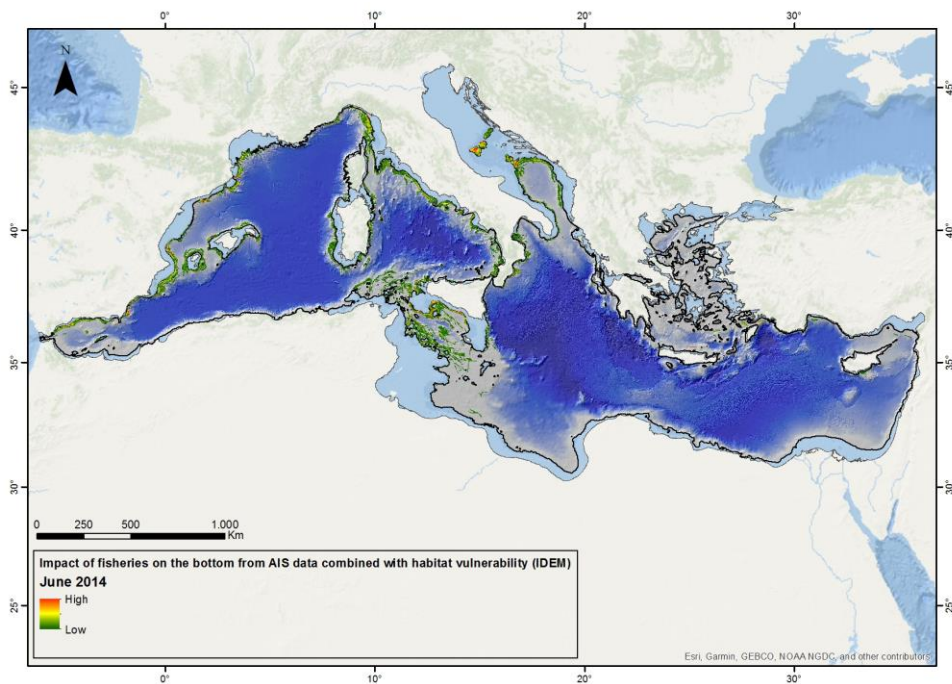

Fig. 11. *Impact of fishery activities in June 2014 on the sea bottom over 200 m depth obtained combining AIS data and habitat vulnerability. For more information see http://www.emodnet-mediterranean.eu/portfolio/fisheries/.*

D8 – CONCENTRATIONs OF CONTAMINANTS GIVE NO EFFECTS

The input of contaminants into the marine environment is considered under MSFD Descriptor 8 as one of the anthropogenic pressures which needs to be assessed by EU Member States. The release of chemical contaminants degrades the state of marine waters and can cause serious damage to its functioning. Contaminant inputs to marine waters may be much diluted and therefore consequences of the inputs may not become apparent immediately after release, but may result in delayed effects for chronic exposure. Examples of substances found in the marine environment include pesticides, anti-foulants, pharmaceuticals and heavy metals, among others. Mapping the potentially hazardous concentration of contaminants is difficult to achieve, thus, we documented the location of human activities which may cause contaminants inputs (Fig.12): borehole, offshore platforms, sulphide deposits, dumping areas, coal fly ash deposit areas (from Kress et al. 1998), waste disposal areas in Gulf of Corinth (from Poulos et al. 1996) and in Cassidaigne Canyon (from Dauvin et al. 2010). Moreover, we report a predictive map of the intensity of pollution by maritime transports , based on shipping tracks, port influence and oil spills (Fig. 13). The model provide an estimate of the amount of pollution produced by maritime transports (i.e. fuel leaks, oil discharge, waste disposal).
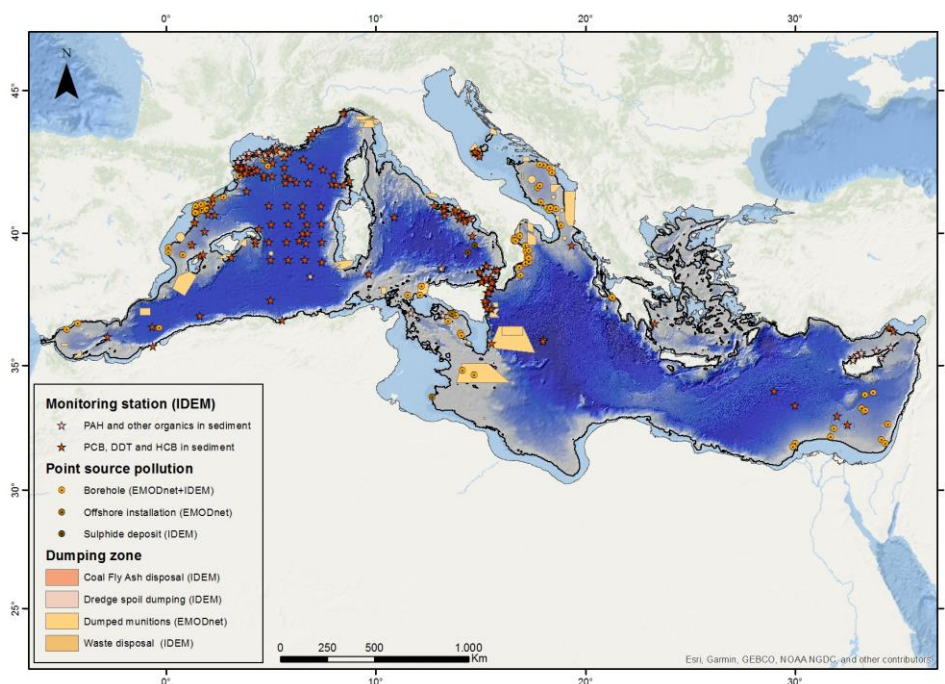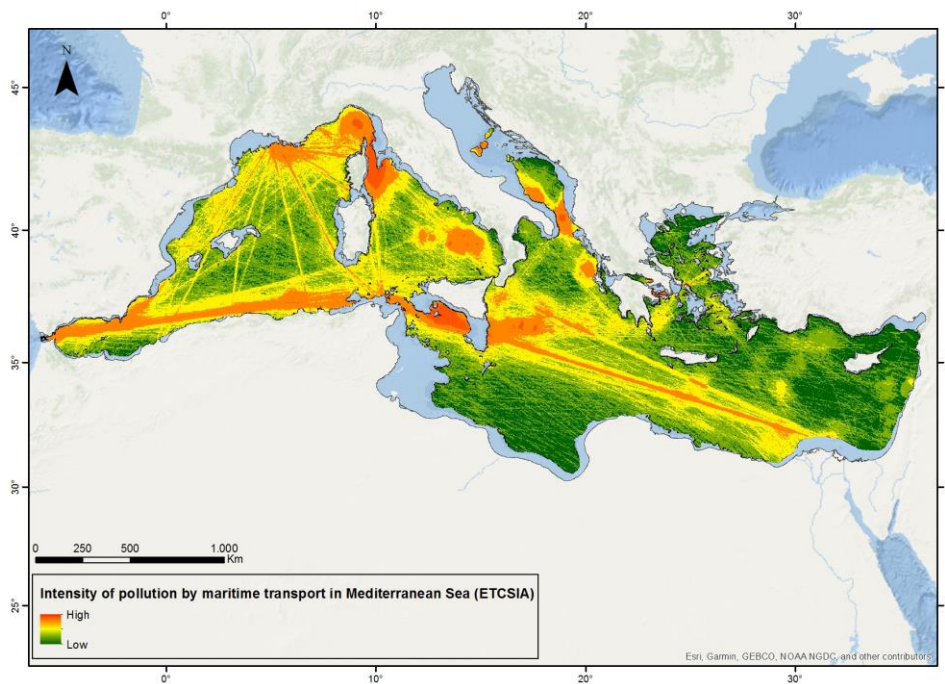

Fig. 12. *Map showing the location of human activities in the deep Mediterranean Sea which may represent potential source of contaminants inputs.*

Fig. 13. Predictive map of intensity of pollution by maritime transport operating areas with depth greater than 200 m. For further information see http://sdi.etcsia.uma.es:8080/geonetwork/srv/spa/catalog.search#/metadata/345ee326-4077-4233-a7cb-005e70285b03.

D10 – MARINE LITTER DOES NOT CAUSE HARM

Marine litter is any persistent, manufactured or processed solid material that is discarded, disposed of, or abandoned in the marine environment. The provisions of MSFD Descriptor 10 aim to protect the marine environment against harm caused by litter. Here, we show the documented location of marine litter in deep Mediterranean Sea. As for Descriptor 8, maritime transport may represent an important source of marine litter, thus, we decide to represent also the main shipping lanes. In addition, we considered the influence of human population in the release of litter which may reach deep ecosystems, revealing major values in the Eastern Mediterranean Sea (Fig. 14).
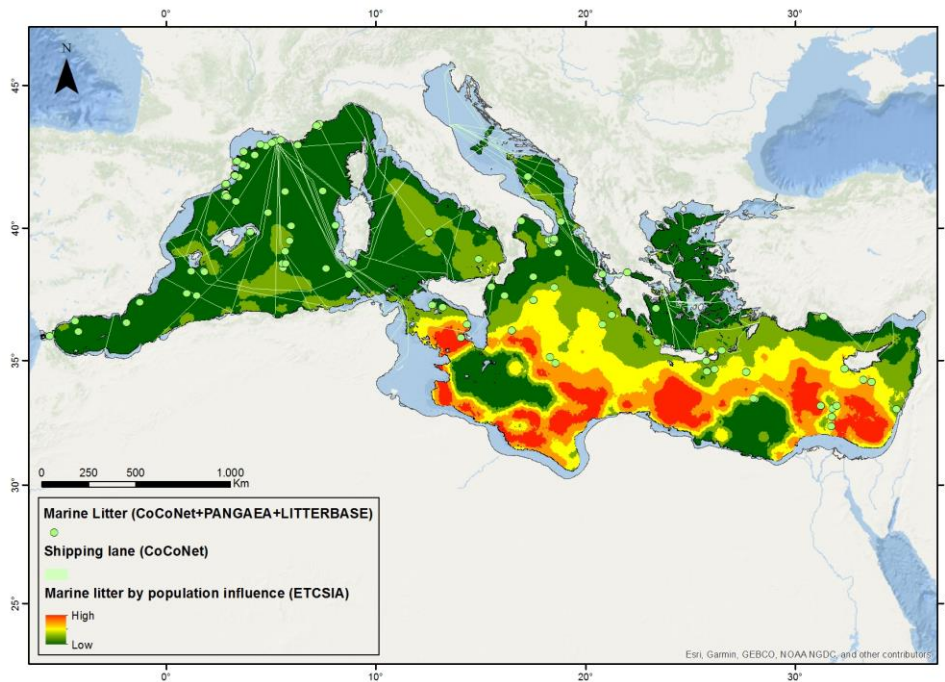
Fig. 14. *The map shows the documented location of marine litter in deep Mediterranean Sea and major shipping lane. In addition, we report the modelled potential influence of human population in the release of marine litter in deep sea are reported.*

The map of cumulative human impact, an ecosystem-specific multiscale spatial model which synthesize the effect of 38 categories of anthropogenic drivers of change on marine ecosystems (Fig. 15, Halpern et al., 2008), contributes to define the general distribution of the human impact at basin scale. It could be used for several MSFD Descriptors.
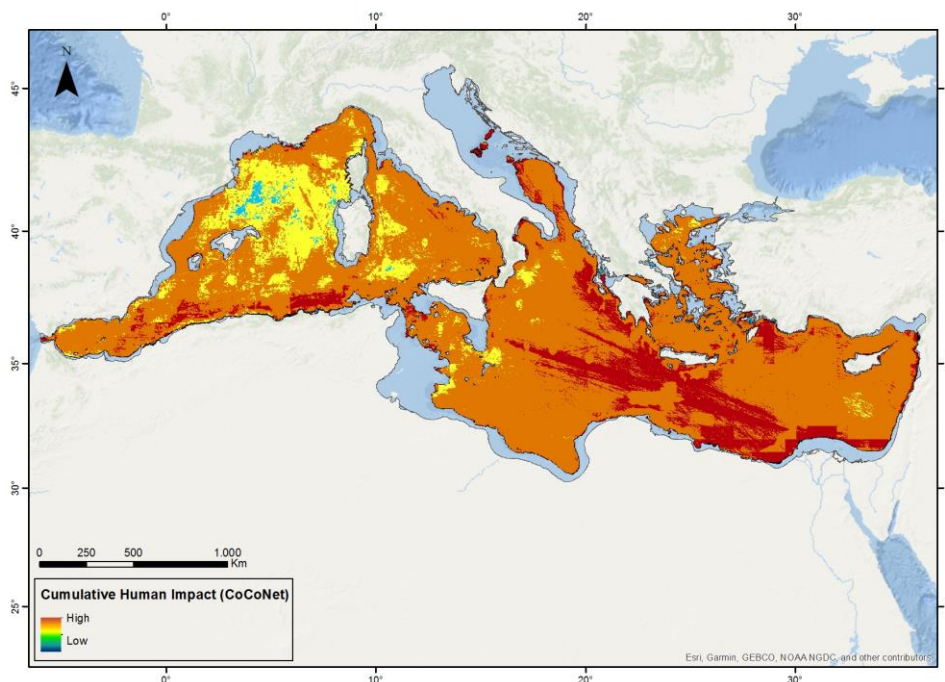
Fig. 15. *Map of the cumulative human impact from Halpern et al. 2008.*

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5. IDEM GEOPORTAL

We created and published the IDEM WebGIS platform (HTML5 technology) through the software ArcGIS Server 10 and the Moka CMS (Content Management System GIS). The Moka CMS GIS system is the core of the GIS infrastructure. The CMS is a tool for creating GIS application using cartographic object organized in a catalogue (Fig. 16).
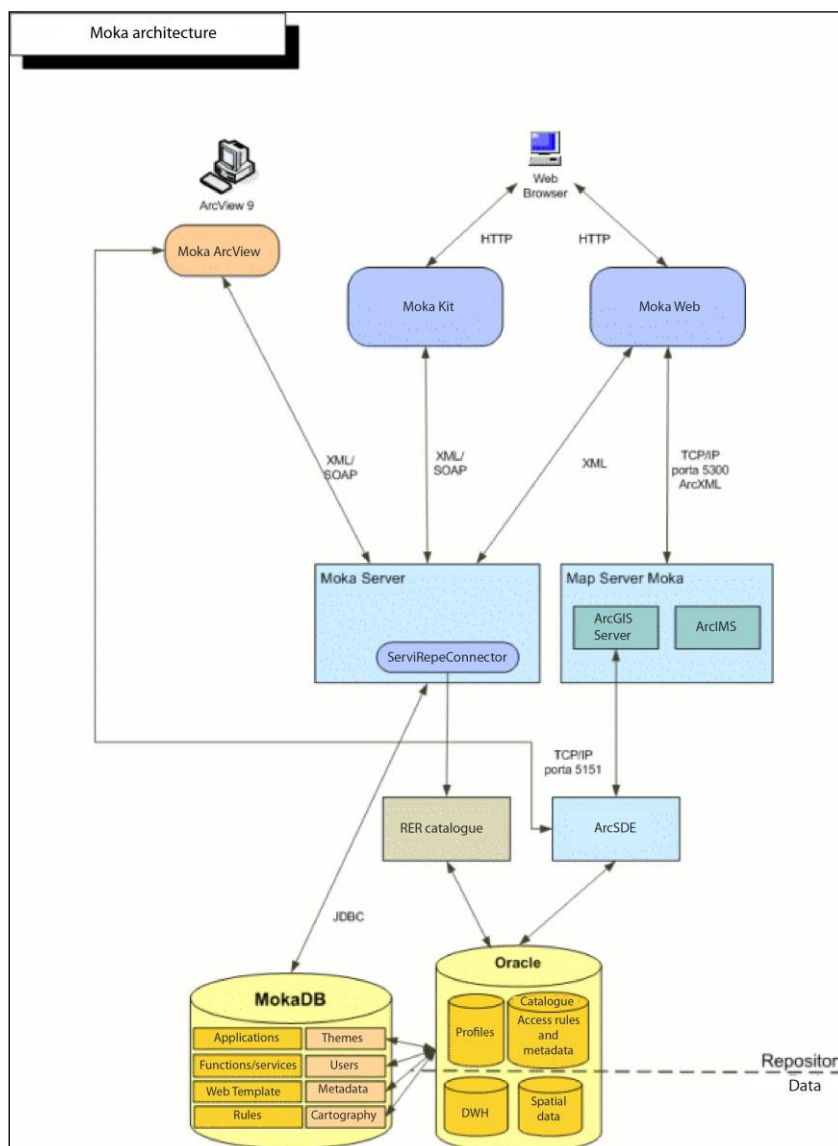

Fig. 16. *System architecture (Image from the Help of the Moka Web).*

The IDEM WebGIS is a web-based portal for interactive visualization of the spatial data collected in the Project and organized in a common spatial infrastructure. The portal combines Geographic Information Science (GIS) principles and tools to harmonize a relatively large and multi-dimensional datasets. The tool combines intelligent web maps with graphs, charts, tables, and text to unlock, make accessible and re-usable the data in a coordinated manner.

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The IDEM WebGIS platform is free accessible through the IDEM webpage and at the link (Fig. 17):

 http://gismarblack.bo.ismar.cnr.it:8080/mokaApp/apps/idem/index.html
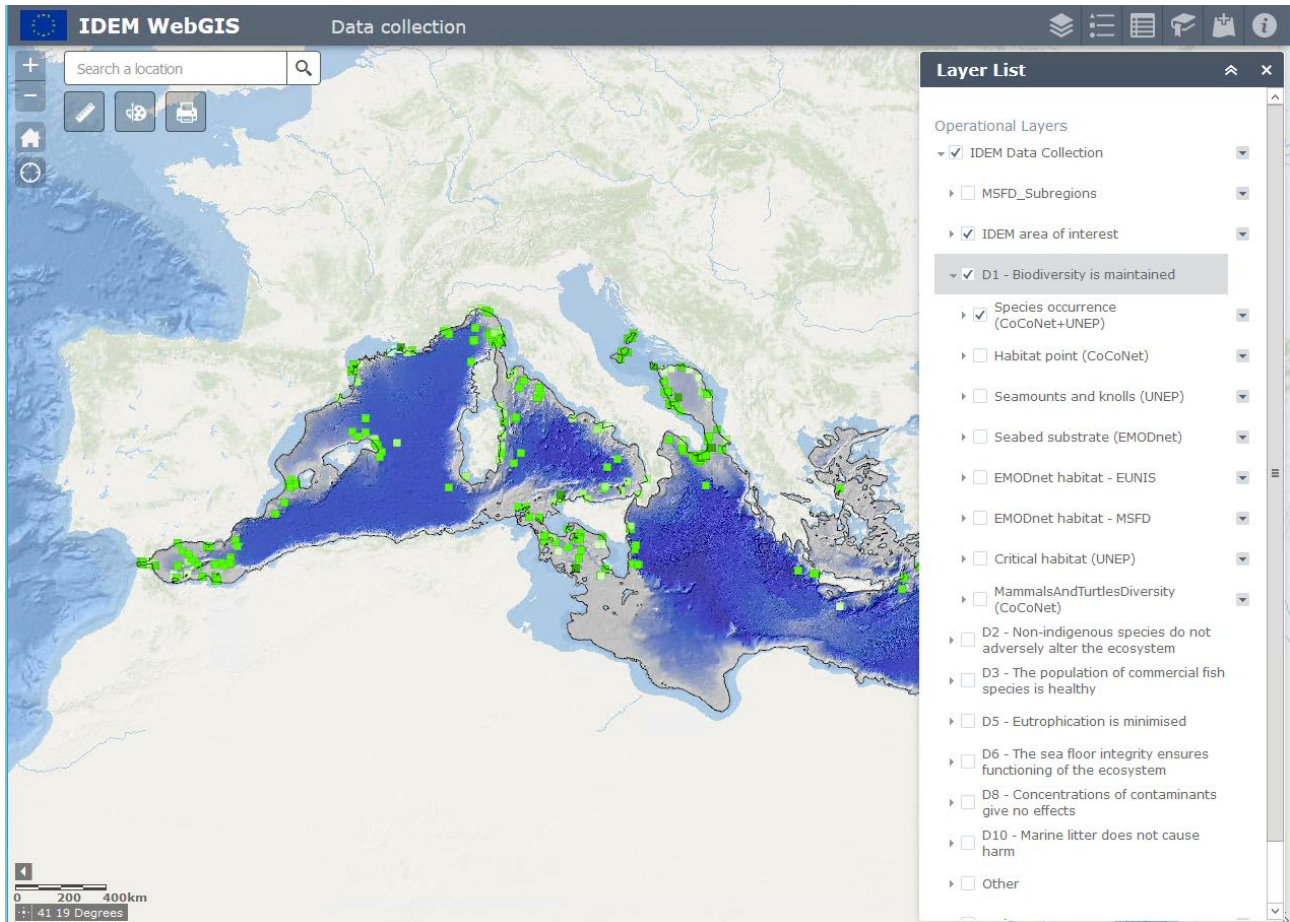
Fig. 17. *The IDEM WebGIS. General view and layer list of the IDEM WebGIS platform.*

The portal allows the users to visualize and to query data. The user can navigate through the layers, customize his view (for example adding external layers) and print maps. The following paragraphs show the list of functions available on the portal.

The off-panel functions are on the map (Fig. 18):

1. search a location (for searching toponyms)
2. zoom, home, overview (for moving on the maps)
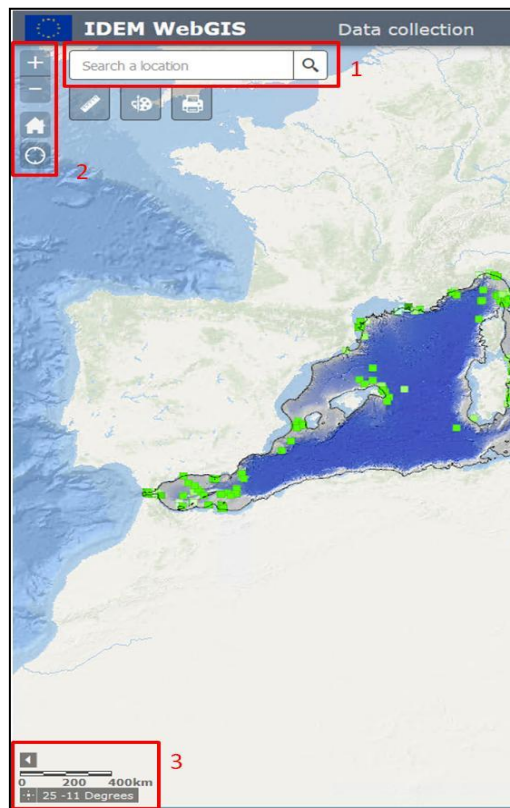3. coordinates, scale bar (to be informed about position and scale)

Fig. 18. *The off-panel functions of the IDEM WebGIS.*

The place holder contains in-panel functions (fig. 19):

1. Layer list (that is the Table Of Contents showing all the available layers)
2. Legend (showing the legends of the active layers)
3. Attribute Table (opening the tables related to the object)
4. Bookmarks (allows to add customized bookmarks)
5. Add data (allows to add external shapefile or Web Map Services)
6. Information (gives information about metadata, OGS services and data policy)
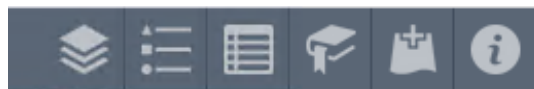

Fig. 19. *The functions in the place holder of the IDEM WebGIS.*

The toolbar contains in-panel functions (Fig. 20):

1. Measure (for take measure on the map)
2. Draw (for drawing on the maps)
3. Print (for printing maps .pdf, .jpeg, etc.)

Fig. 20. *The functions in the toolbar of the IDEM WebGIS.*

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6. METADATA AND OGC SERVICES

Each layer of the geoportal has its metadata, information that describes the content, quality, condition, origin, and other characteristics of data or other pieces of information. Metadata for spatial data may describe and document its subject matter; how, when, where, and by whom the data was collected; availability and distribution information; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard. Metadata consists of properties and documentation. Properties are derived from the data source (for example, the coordinate system and projection of the data), while documentation is entered by a person (ESRI definition).

Metadata are crucial for searching and sharing data, and the correct and rich description of the collected data is essential for the findability and reusability of the datasets. Metadata also provides information about the sources and the data quality.

The metadata are managed by the ESRI Geoportal server, a free, open source product that enables discovery and use of geospatial resources including datasets, rasters, and Web services. It helps organizations to manage and publish metadata for their geospatial resources to let users discover and connect to those resources. The Geoportal Server supports standards-based clearinghouse and metadata discovery applications. Geoportal inventories all the metadata of the registered geospatial resources in a geoportal catalog service, which is an Open Geospatial Consortium (OGC) compliant CS-W 2.0.2 service (https://www.esri.com/en-us/arcgis/products/geoportal-server/overview).

The spatial geoportal and the metadata catalogue are linked and integrated (see figure 21).
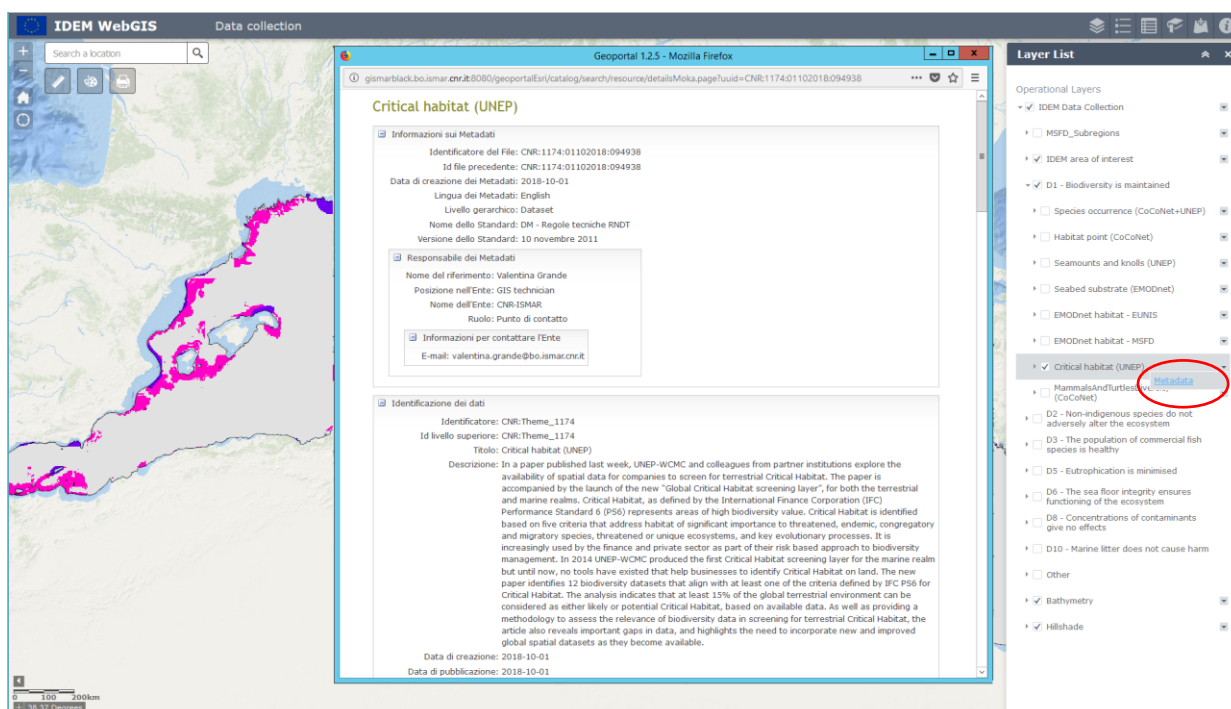

Fig 21. *The image comes from the IDEM geoportal and shows how to access the metadata of each layer thought the portal.*

The metadata contain also the links to OGC service, that is a web service making maps and data available in an open, internationally recognized format over the web to anyone with a supported client application. These OCG standards depend on a generalized architecture and serve specific needs for interoperable location and geospatial technology, including GIS.

The Web Map Service (WMS) of the IDEM data collection is:

http://gismarblack.bo.ismar.cnr.it:6080/arcgis/services/published_moka/IDEM_Data_Collection_77/MapServer/WmsServer
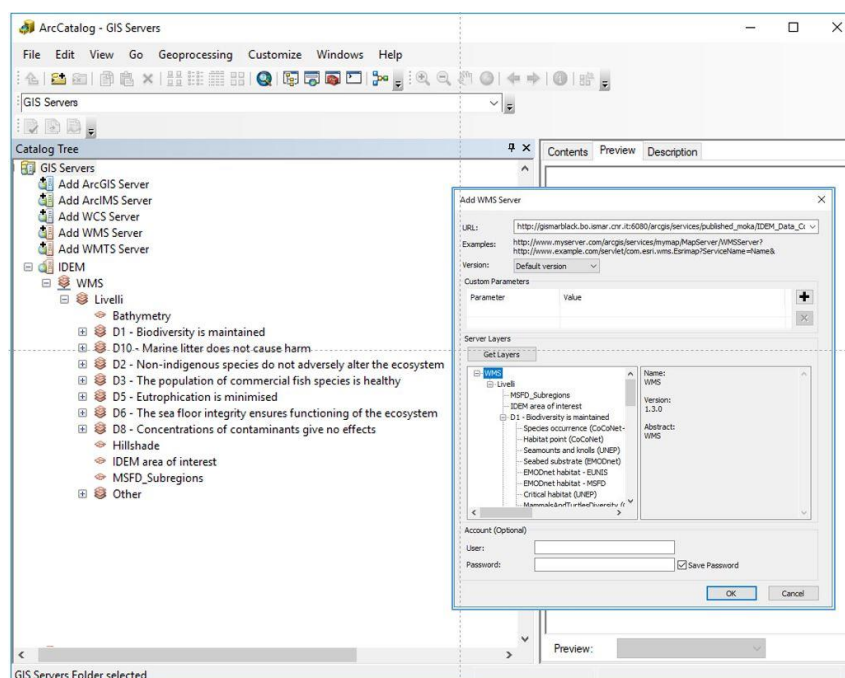

Fig. 22. *Web Map Service of IDEM project in ArcCatalog (ArcGIS 10.5.1 software).*

7. CONCLUSIONS AND FUTURE WORK

The Spatial Geoportal and the Geodatabase are extremely useful to all IDEM partners for gap analysis, for evaluation of actual information about MSFD Descriptors, for planning of future activities, for producing reports and deliverables using all the same database. For the general public the geoportal gives the opportunity to visualize and retrieve all available info from a unique entry point and also to follow the progress of IDEM project in relation to data analysis and data collection. The IDEM Geodatabase will be update constantly during the lifespan of the project also with data coming from IDEM partners that are not integrated yet. The Geoportal will be maintained active during the project and the administrator will manage the credentials for general public. The Geodatabase and the Geoportal will be maintained after the end of the project by CNR-ISMAR at least for one year and then they could be integrated and migrated to long term infrastructure, after technical analysis of compliance and established agreement.

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