# A fine scale spatial infrastructure for implementing networks of Marine Protected Areas: The AMAre Geoportal

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## The AMAre Project

AMAre (Actions for Marine Protected Areas) is an ongoing Interreg MED Programme project with the aim to develop shared methodologies and geospatial tools for multiple stressors assessment, coordinated environmental monitoring, multi-criteria analyses and stakeholders' engagements. The final aim is to scale up strategies and recommendations at transnational level adopting an ecosystem-based approach considering the goals of the Marine Strategy Framework Directive (MSFD) across MPAs. In this framework we collected and examined available spatial data for the 5 Marine Protected Areas (MPAs) involved in the project. Starting from these data and from MPA needs, we built a common data model based on the INSPIRE Data Specification and we developed a geodatabase. The geodatabase has been populated for the 5 MPAs and published on the AMAre Geoportal that organizes and integrates the principal themes available for MPAs.

## 1. MPAs world and needs
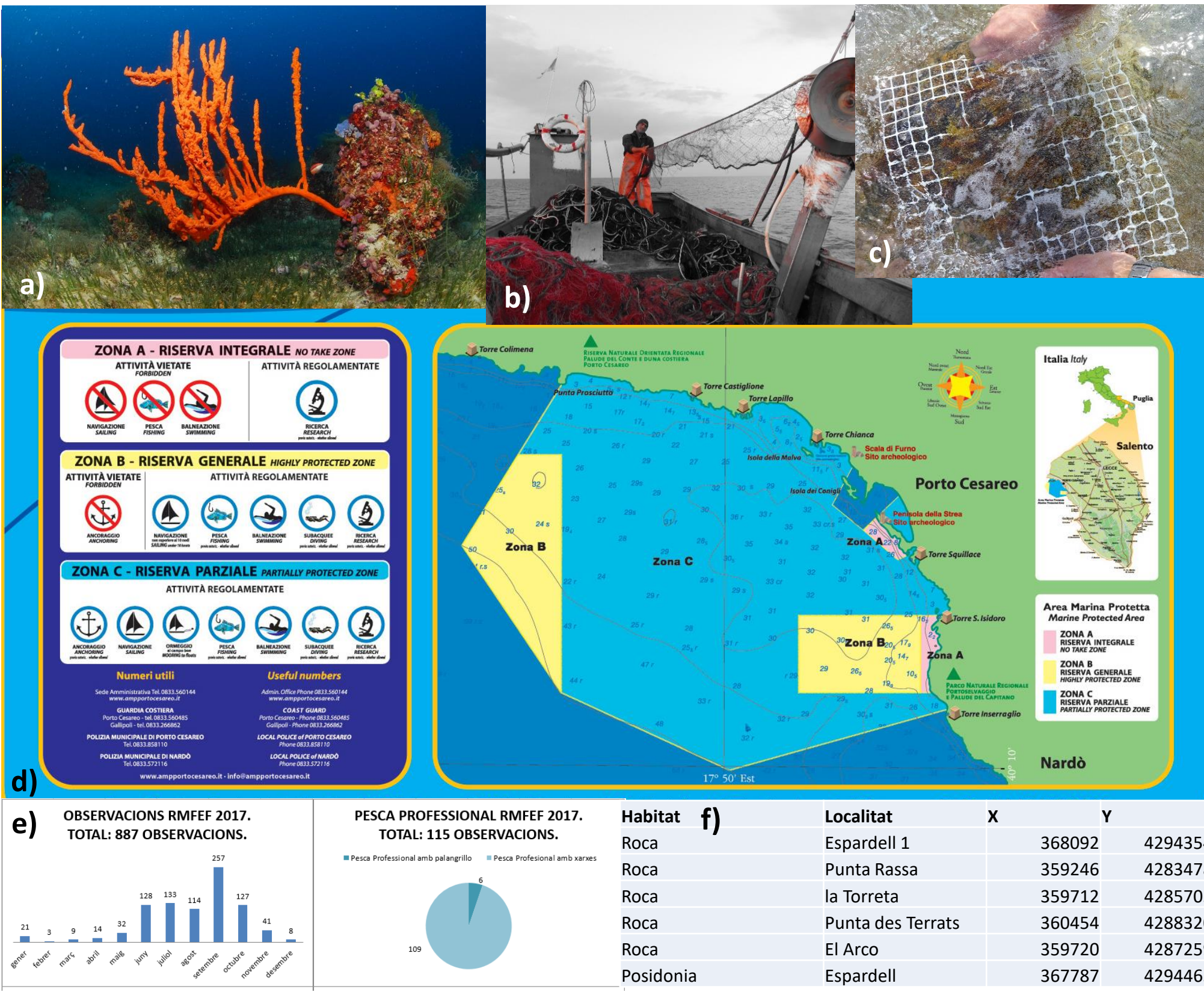


The MPAs data are multidisciplinary, ranging from habitat distribution (**Fig. 1a**) to human activities (**Fig. 1b**), monitoring (**Fig. 1c, 1e, 1f**) and management (**Fig. 1d**). The data and the architecture of the geodatabase were validated by the MPAs managers through dedicated meetings and by GIS experts making the AMAre products reliable for management purposes in a long term perspective and answering to fine scale specific needs.

**Fig. 1.** Examples of data coming from the AMAre Marine Protected Areas.

## 2. The data model

The AMAre data model is based on the INSPIRE Data Specification we simplified in order to better fit the project needs and to obtain a unique integrated structure. We modeled the logical schema with Enterprise Architect software, a standards-based modeling environment who defines mappings between UML 2 and ArcGIS concepts, and prototypes an automated import and export capability for ArcGIS geodatabase schemas represented in UML. The model consists of 17 feature datasets, 76 feature classes, 59 relationship classes, 39 tables and 13 raster catalogs organized by 10 thematic groups:

- Administration;
- Biodiversity;
- Elevation;
- Geology;
- Habitats and Biotopes;
- Hydrography;
- Monitoring;
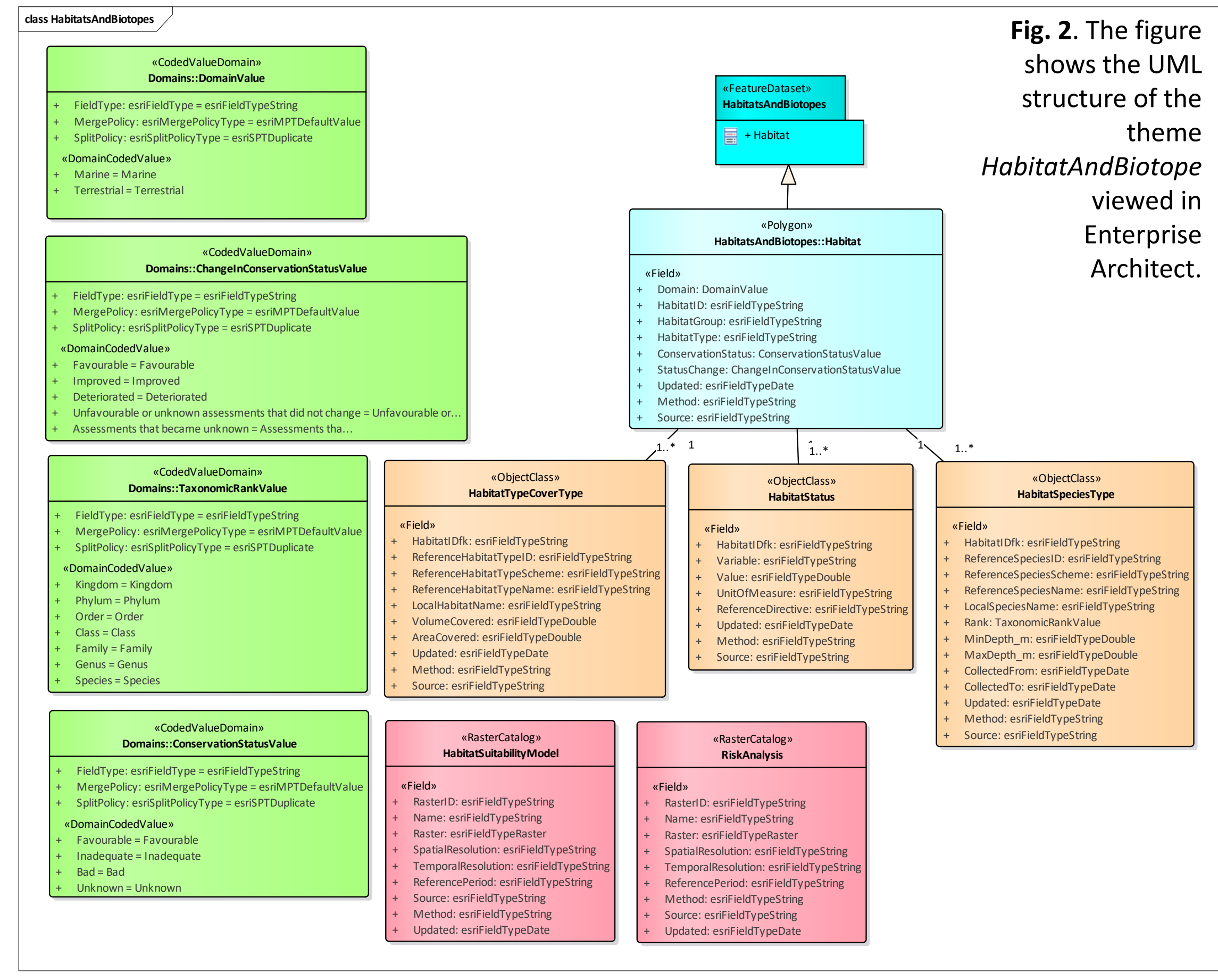- Oceanography;
- Socioeconomics;
- Threats.



**Fig. 2.** The figure shows the UML structure of the theme *HabitatAndBiotope* viewed in Enterprise Architect.

## 3. The geodatabase

We imported the UML model in a ArcGIS File geodatabase (**Fig. 3**) and we populated 5 distinct geodatabases, one for each MPA with the aim to provide a tool supporting management for private use (**Fig. 4**). At the same time we organized all the geodatabases in a Oracle database and we published them through an unique web application.
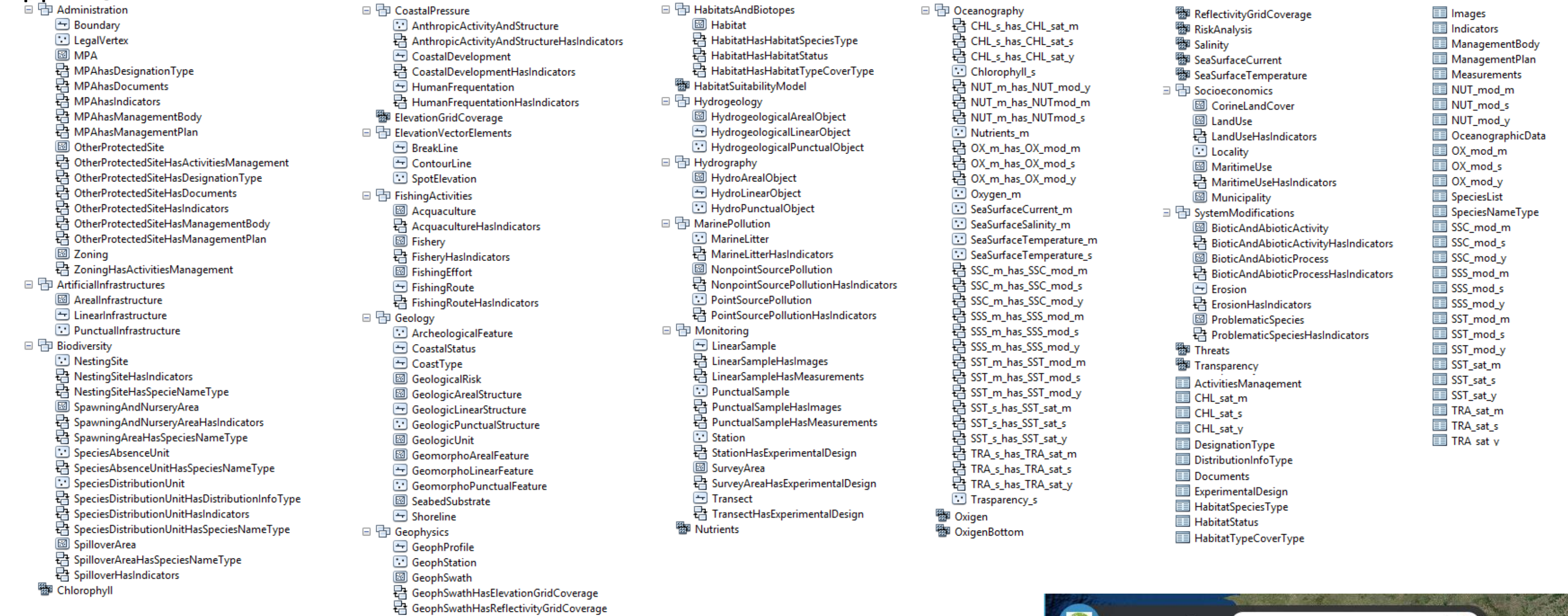


**Fig. 3.** View of the AMAre Geodatabase in ArcCatalog.

## 4. The geoportal

The AMAre Geoportal is a web application (HTML5 technology) published by the software ArcGIS Server 10 and the Moka CMS (Content Management System). The Moka CMS GIS system is the core of the GIS infrastructure, it is a tool for creating GIS application using cartographic object organized in a catalogue. The AMAre Geoportal allows an interactive visualization of the spatial data organized in a common spatial infrastructure (**Fig. 5**). The portal combines intelligent web maps with graphs, charts, tables and text to unlock, make accessible and reusable the data in a coordinated manner. The user can navigate through the layers, download features and tables, customize its view and print maps.
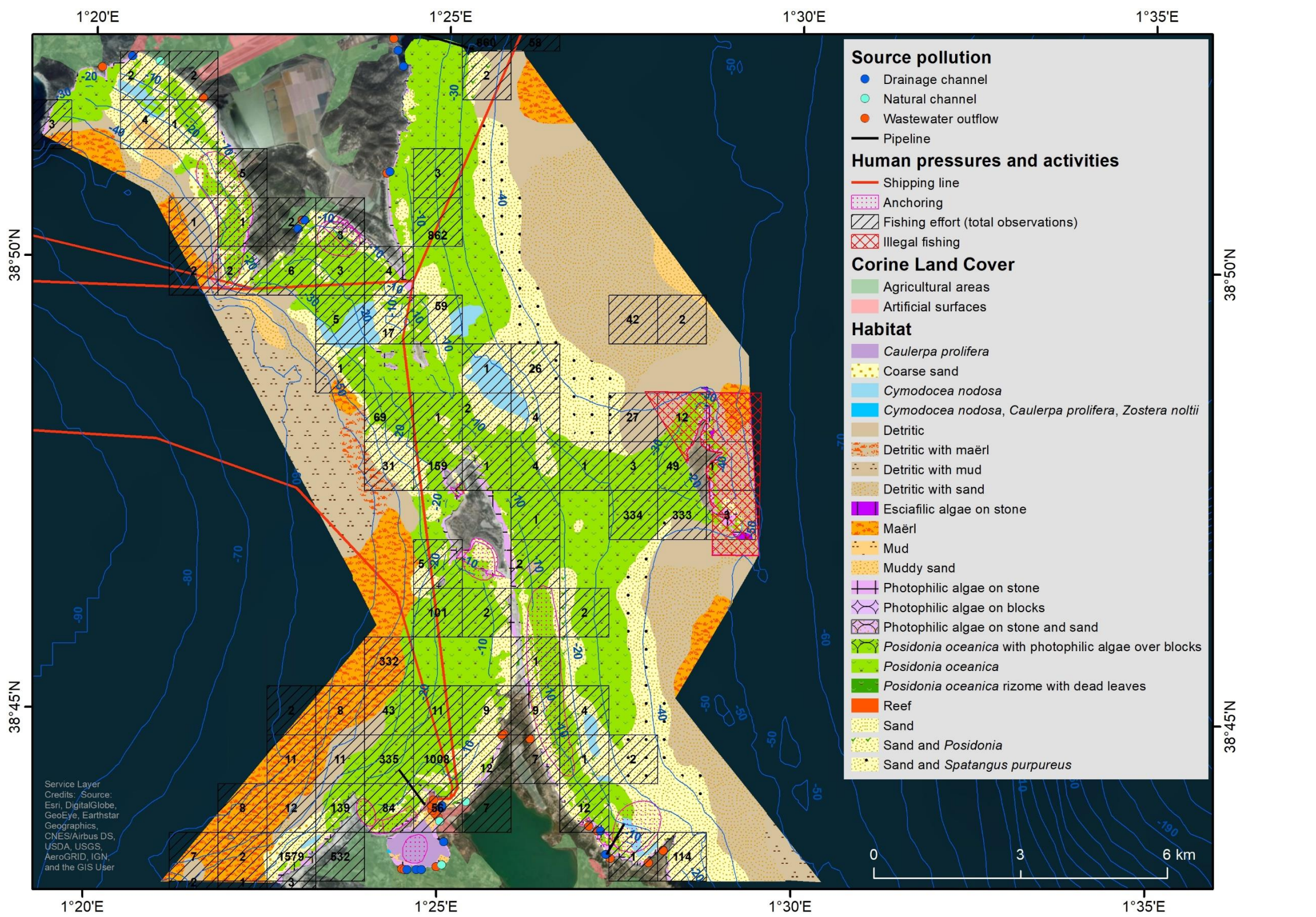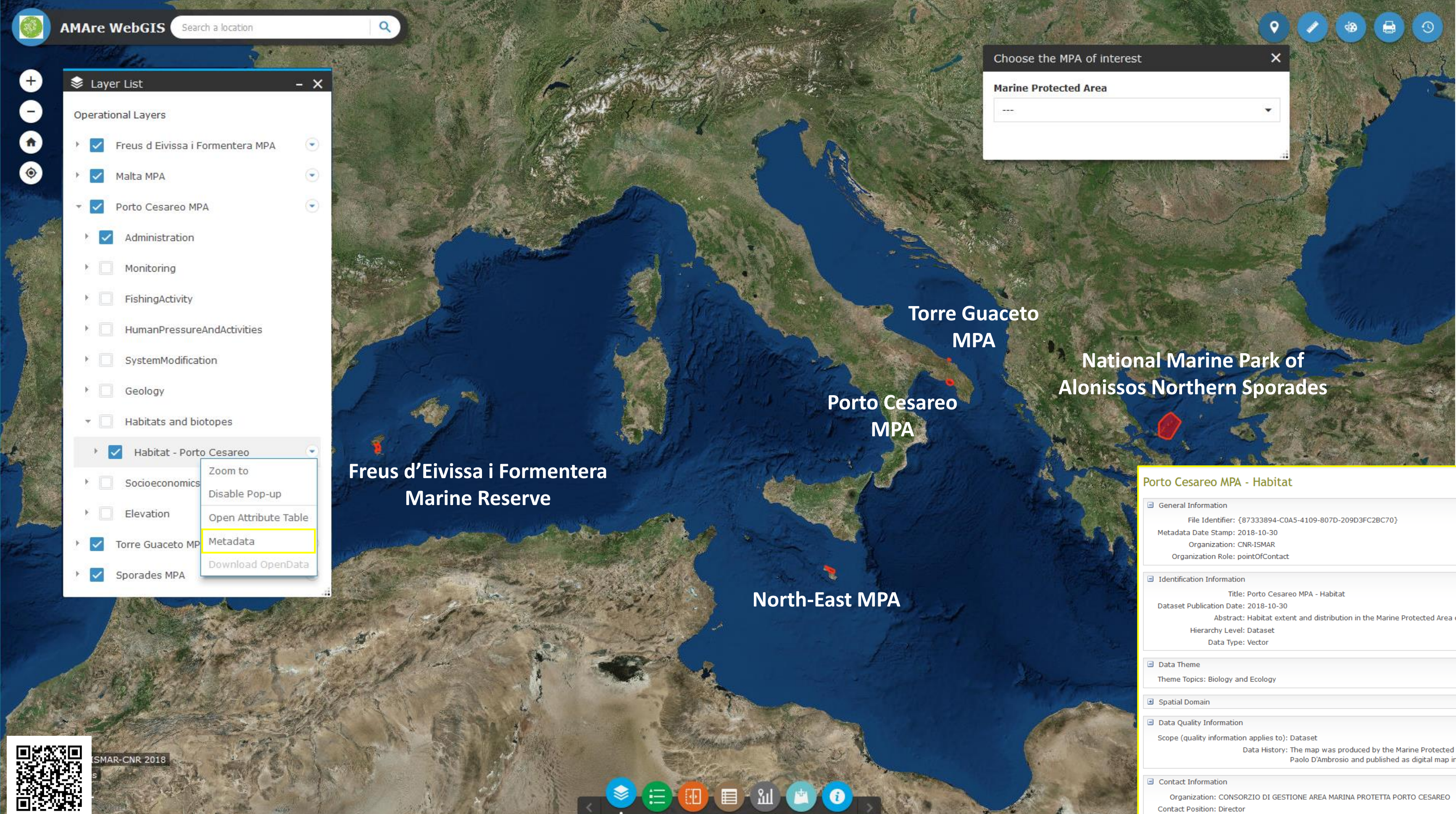


**Fig. 4.** Map of the distribution of habitats and human activities in the Freus d'Eivissa i Formentera MPA. This map is an example of how GIS tools can support the MPA management.



**Fig. 5.** View of the AMAre Geoportal.

**Fig. 6.** Example of metadata form (ISO19115) filled for the layer *Habitat*.

## Conclusion

The AMAre Geoportal is a critical tool to improve the management of MPAs with a coordinated approach, essential to introduce principles of maritime spatial planning. The main difference between the geoportals dealing with large scale datasets and the one we present is that this was specifically conceived for MPAs fine scale and tailored on their needs. The geodatabase is a common tool to facilitate the decision support system. It encourages the communication with stakeholders and improve the management within each MPA and the comparisons across MPAs on the distribution and the effects of human activities, biodiversity status and relevant management issues.

## 5. Metadata

Each layer of the geoportal has his metadata form (**Fig. 6**). 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. 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. The metadata contain also the links to OGC services, making maps and data available in an open, internationally recognized format.

AMAre Website    ESRI Geoportal    Enterprise Architect    INSPIRE Data Specification