

ECOLOGICAL OBSERVING SYSTEM IN THE ADRIATIC SEA: OCEANOGRAPHIC OBSERVATIONS FOR BIODIVERSITY

PRIORITY AXIS 3: ENVIRONMENT AND CULTURAL HERITAGE

SPECIFIC OBJECTIVE 3.2: CONTRIBUTE TO PROTECT AND RESTORE BIODIVERSITY

D5.3.1 Set of tools supporting ECOSSE case studies and activities

WP5 - Design and implementation of data infrastructure

A5.3 - Tools and Services to support the use cases

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1. INTRODUCTION

ECOSS Tools are part of the implementation work done in the framework of the Interreg Italy-Croatia project ECOSS by WP5 - “Design and implementation of data infrastructure”.

ECOSS Tools aims at providing interactive applications to respond to the needs of the sites involved in the ECOlogical observing system in the Adriatic Sea (ECOAdS) for the conservation strategies of the Natura 2000 sites and the contribution to the main EU directives. The ECOSS Tools provide graphical representations of monitoring activities at the sites, leveraging the information collected by the ECOSS project by means of their integration with other information sources already available on the internet.

ECOAdS includes two types of sites: Long Term Ecological Research (LTER) and Natura 2000 (N2K) sites, belonging to the LTER network and the Natura 2000 network, respectively.

During the ECOSS project, great effort was devoted both to identify the parameters to be monitored in order to accomplish the MSFD criteria needs and to recognize the variables that better contribute to conservation strategies. The results of this work are delivered in D3.3.1 “Report on the Key Oceanographic Processes and Performance Indicators for Natura 2000 Marine Sites” and in D4.4.1 “Report on the interactions, synergies and gaps among the WFD, MSFD and H&BD for an effective management of the marine ecosystems”.

The tools developed in the ECOSS project and deployed through ECOAdS web portal (<https://ecoads.eu>) are two: i. Directive contribution and ii. Conservation strategy. This document gives a description of the main tools functionalities also through the description of two use cases.

ECOSS Tools allow to:

- Evaluate the LTER-and-N2K sites’ contribution to the Marine Strategy Framework Directive (MSFD) monitoring activities (Directive contribution);
- Evaluate the N2K sites’ contribution to the conservation of the specific target species and habitats included in the site (Conservation strategy).

1.1 (Linked) Data sources

Some information needed for the tools was already available online, both in the form of site and dataset metadata and in the form of Linked Open Data (LOD)¹ and semantic data sources accessible via SPARQL. They are distributed by different authoritative sources and platforms, such as the European Long Term Ecological Research Network (LTER-Europe) Dynamic Ecological Information Management System - Site and Dataset Registry (DEIMS-SDR²), the European Environment Agency (EEA) Semantic Data Service, and the LTER-Europe Environmental Thesaurus (EnvThes).

The ECOSSE project identified sets of variables (ecological, oceanographic and pressure variables) to be monitored in order to assure the conservation of the target species and habitat at the N2K sites (see D3.3.1 for details).

We collected and formalized these variables and recommendations within an RDF graph, along with properties relating them with the sources previously presented.

Moreover, in the same RDF graph, we also formalized the Criteria Elements contained within Criteria for monitoring defined by MSFD, and we associated them to other entities.

The results of the app are obtained by the integration of all these sources, obtained at runtime through federated SPARQL queries and real-time lookups to the available site's metadata.

The detailed list of semantic sources is the following:

- ECOSSE task ontology (with instances)³: It is an RDF schema for several entities depicted in the tools. The schema provides classes for e.g. ECOSSE monitoring variables (Ecologic, Oceanographic and Pressure variables identified by the ECOSSE project with the aim to establish a reference for the monitoring tasks of the project sites); MSFD parameters

¹ <https://lod-cloud.net/>

² <https://deims.org/>

³ <http://rdfdata.get-it.it/ecoss/>

(these are atomic observable properties that ECOSS project extracted from MSFD documentation); EnvThes Parameters declared by the project sites within the LTER Europe DEIMS-SDR platform. The ECOSS task ontology models several relations among its entities so that it is possible to make semantic queries in order to investigate, for each site, its contribution to the MSFD directive given its actual monitoring status (represented by its current metadata provided by site managers in DEIMS-SDR).

- EnvThes thesaurus⁴: Thesaurus for long term ecological research, monitoring, experiments. It is the controlled vocabulary of the LTER-Europe community. It is based on Simple Knowledge Organization System (SKOS) ontology. EnvThes is exploited by LTER Europe infrastructure, and in particular by DEIMS-SDR site metadata catalogue, as the basis for semantic interoperability. It is coordinated by Umweltbundesamt GmbH, Austria.
- EEA Eunis Habitat Types schema⁵: European Environment Agency RDF schema for information about the EUNIS habitat classification and the EU Habitats Directive Annex I habitat types
- EEA Eunis Sites schema⁶
- EEA Eunis Sites (instances)⁷: European Environment Agency information encoded in RDF (schema and instances) about protected and other designated sites relevant for fauna, flora and habitat protection in Europe
- EEA Eunis Species schema⁸
- EEA Eunis Species (instances)⁹: European Environmental Agencies information about species in Europe, particularly species mentioned in legal texts.

⁴ <http://vocabs.lter-europe.net/EnvThes/>

⁵ <http://eunis.eea.europa.eu/rdf/habitats-schema.rdf#>

⁶ <http://eunis.eea.europa.eu/rdf/sites-schema.rdf#>

⁷ <https://eunis.eea.europa.eu/sites>

⁸ <http://eunis.eea.europa.eu/rdf/species-schema.rdf#>

⁹ <http://eunis.eea.europa.eu/species/>

2. USING THE TOOLS

The tools are available within the ECOAdS portal, from each ECOAdS site-detail page (they are accessible from the home page by clicking points on the main map or by following ECOAdS-sites related textual links in the sidebar).

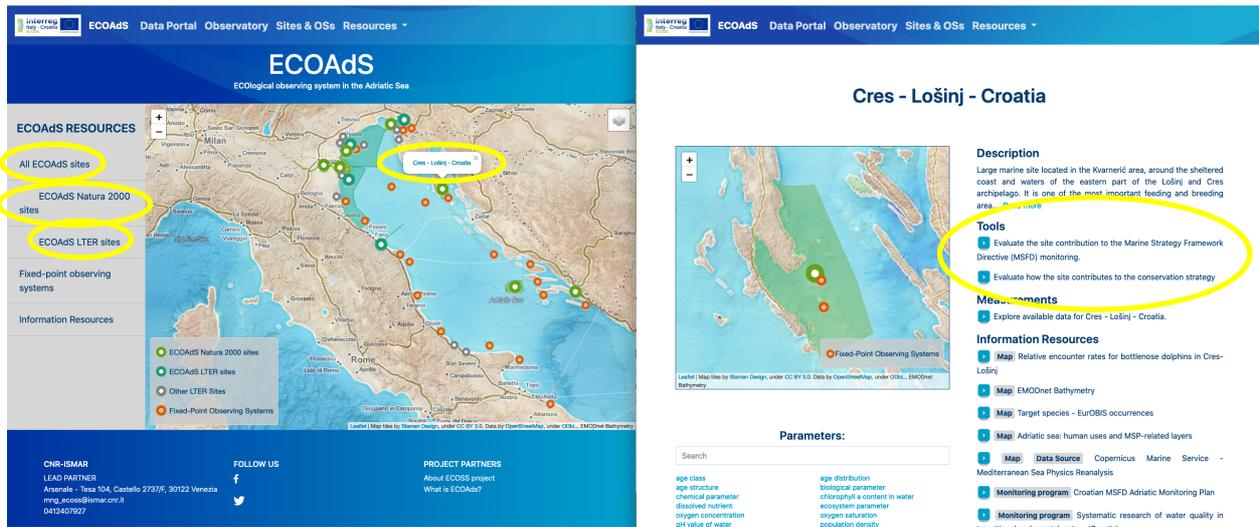


Figure 1. ECOAdS geoportal homepage and Cres-Lošinj site-detail page. The yellow circle highlights the main menu items or buttons for navigating to the tools.

In the site-detail page, the "Tools" section contains two bullet points, dedicated to the 2 tools: i. Evaluate the site contribution to the MSFD monitoring and ii. Evaluate how the site contributes to the conservation strategy.

The first point leads to the tool for the assessment of the site contribution to MSFD. By this tool it is possible to visualize the measured parameters and their relation with MSFD criteria elements. The site contribution is evaluated by the number of observed parameters, corresponding to the parameters suitable for assessing a MSFD criteria.

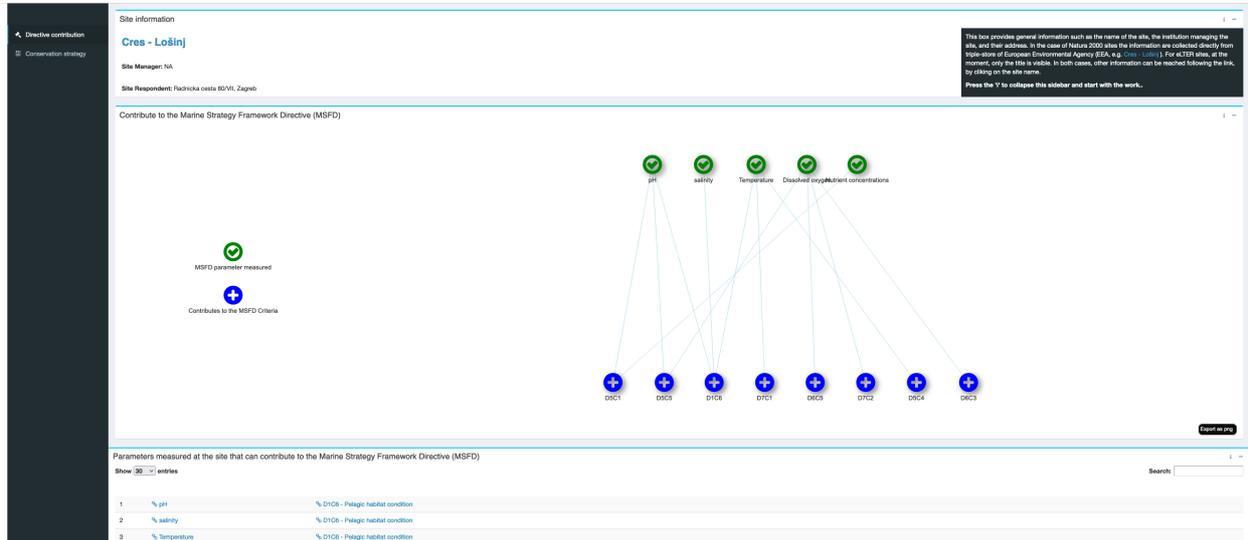


Figure 2. "Directive contribution" tool web interface.

The second point, dedicated to the conservation strategy, leads to the tool for evaluating the contribution of N2K site to the conservation of target species and habitats. The conservation strategy contribution is evaluated by comparing the number of ecological, oceanographic, and pressure variables measured at the site with the variables indicated by ECOSSE as fundamental for assessing the state of conservation of the specific target species/habitat.

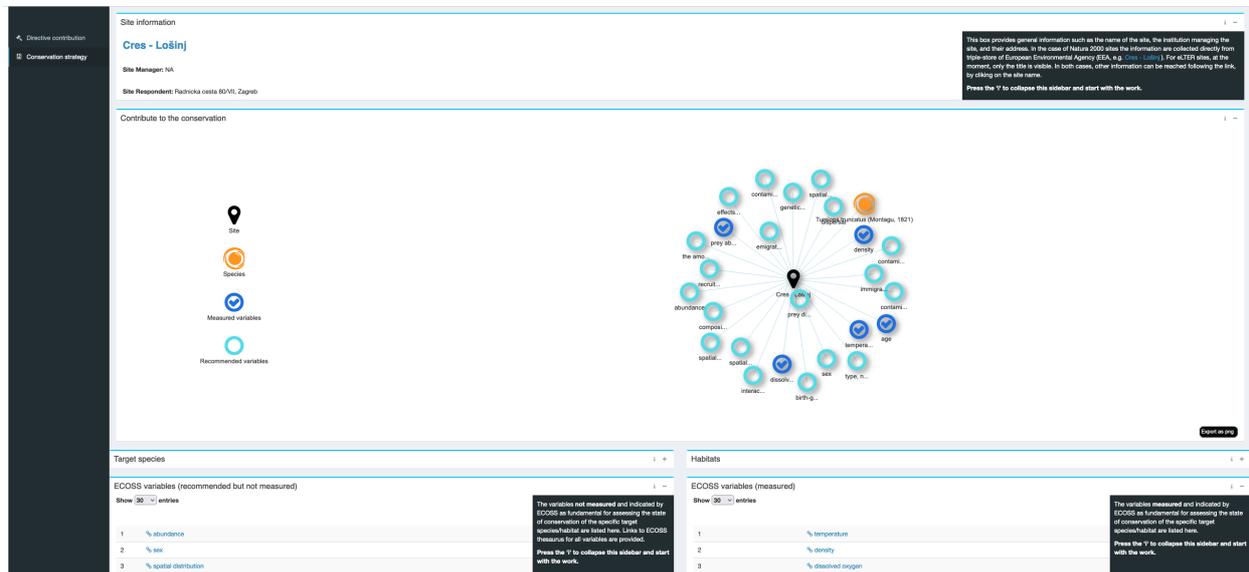


Figure 3. "Directive contribution" tool web interface.

2.1 Use cases

In order to better describe the functionalities of the tools, we've identified two use cases:

- the first is designed for policy makers or researchers that want to assess the contribution of a monitoring site (e.g. LTER) to the MSFD;
- The second is designed for those managers of the N2K network site who want to assess the contribution of the site, to the species- or habitat-conservation strategy in order to implement and/or build a Management Plan.

Following the instructions described in the previous paragraphs, the user interface of the two tools can be accessed. Both the tools appear divided in different boxes with title, on the top left corner, and, on the right corner, 2 buttons: the one with the "i" allows you to open a dropdown menu that provides some additional information on the content of the box, while the other simply serves to shrink the selected box and obtain more space for the other boxes on the screen.

The first box for both tools provides general information, such as the name of the site, the institution managing the site, and addresses. In the case of N2K sites, the information are collected directly from the triple-store of the European Environmental Agency (EEA, e.g. Cres - Lošinj), while for LTER sites, at the moment, only the title is visible. In both cases, other information can be reached following the link, by clicking on the site name.

The contents of the other boxes depend on the selected tool.

In the case of the “Directive contribution” tool, the graph shows the site contribution to the MSFD. The parameters listed with the green checked circle represent the parameters already monitored in the site that match with those deemed necessary to contribute to the MSFD criteria. The dark blue circles, at the lower part of the graph, are all the MSFD criteria to which the parameters can contribute. The lines are meant to represent the connections between the parameters and the criteria. The table in the bottom box reproduces the information provided in the graph: the parameters monitored and the MSFD criteria. Links to the ECOSSE thesaurus for parameters and MSFD criteria are provided.

Using the same representation type, the graph in the second tool shows the site contribution to the conservation strategy. Checked circles represent the recommended variables monitored in the site, while the light-blue symbols represent variables that are not yet measured. The target species protected in the site are represented by the orange icon. Finally, also the protected habitats are shown. Target species and habitat list are retrieved in real time from the European Environmental Agency (EEA) Linked Data repository.

The graphs can be downloaded as images. This functionality aims to provide a picture of the site status both with respect to the number of measured parameters compared with the parameters listed for the monitoring activity of the MSFD, and to the measured variables among the ones indicated by ECOSSE project as fundamental for assessing the state of conservation of the specific target species or habitat.

As described in the introduction, all the terms, ECOSSE variables or parameters, the MSFD criteria elements and target species or habitats are collected and formalized within an RDF graph. In the tools, the boxes with tables list these terms, providing also, for each one, the link to the corresponding semantic resource. Figures 4 and 5 show the LodView interface of ECOSSE

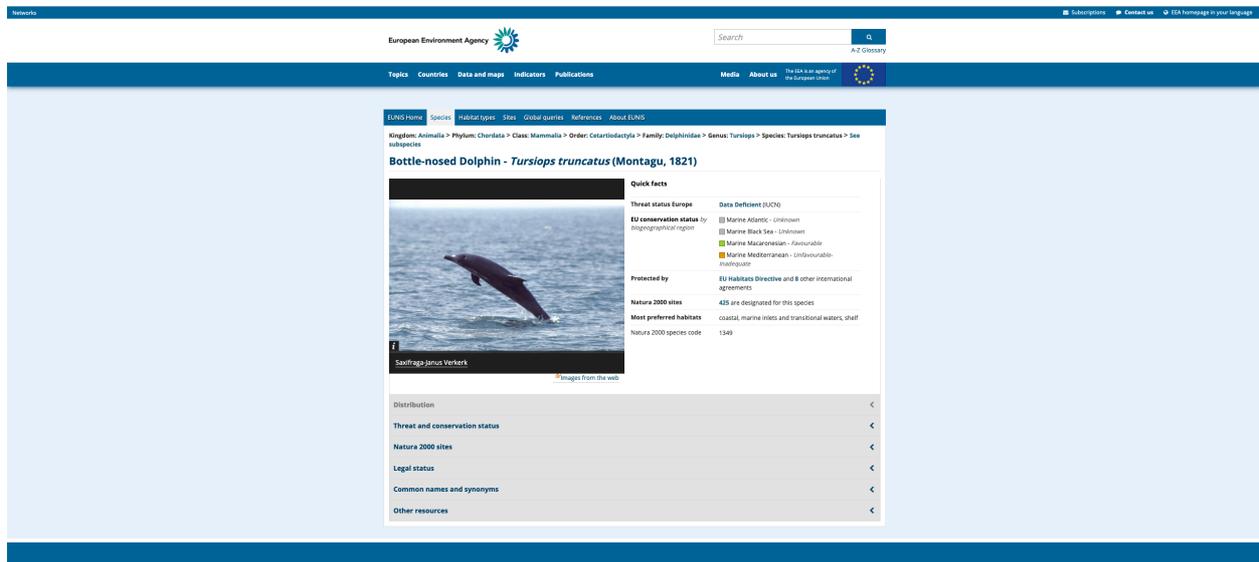
Thesaurus and the EEA website respectively, reachable by following the link for the different terms.



The screenshot shows the LodView interface for the concept 'abundance'. The URL is `http://rdfdata.get-it.it/ecoss/var.1`. The interface displays various RDF properties and their values:

- skos:prefLabel:** abundance
- rdfs:type:** skos:Concept
- skos:inScheme:** `http://rdfdata.get-it.it/ecoss/ecoss/variables` and `ecoss/variables`
- ecoss:recommendedForSite:** A list of URIs including `http://eunis.eea.europa.eu/sites/HR300161`, `http://eunis.eea.europa.eu/sites/HR300469`, `http://eunis.eea.europa.eu/sites/HR400015`, `http://eunis.eea.europa.eu/sites/IT3270023`, `http://eunis.eea.europa.eu/sites/IT330009`, and `http://eunis.eea.europa.eu/sites/IT3250047`.
- ecoss:variableClass:** `http://rdfdata.get-it.it/ecoss/class/EnvironmentalVariable`
- skos:closeMatch:** `http://vocabs.her-europe.net/EnvThes21541`
- skos:relatedMatch:** A list of URIs including `http://rdfdata.get-it.it/ecoss/mofc_param.49` (Representative specie abundance), `http://rdfdata.get-it.it/ecoss/mofc_param.41` (Macrophyte abundance), `http://rdfdata.get-it.it/ecoss/mofc_param.9` (Benthic species abundance), and `http://rdfdata.get-it.it/ecoss/mofc_param.20` (commercially exploited species abundance).

Figure 4. RDF representation of ECOSSE variable (e.g. abundance) through the LodView interface.



The screenshot shows the EEA website factsheet for the Bottlenose Dolphin (*Tursiops truncatus*). The page includes the following information:

- Classification:** Kingdom: Animalia > Phylum: Chordata > Class: Mammalia > Order: Cetartiodactyla > Family: Delphinidae > Genus: Tursiops > Species: Tursiops truncatus > Sea subspecies
- Quick facts:**
 - Threat status Europe:** Data Deficient (EU28)
 - EU conservation status by biogeographic/real region:**
 - Marine Atlantic - Unknown
 - Marine Black Sea - Unknown
 - Marine Macaronesian - Favourable
 - Marine Mediterranean - Unfavourable-Inconclusive
 - Protected by:** EU Habitats Directive and 8 other international agreements
 - Natura 2000 sites:** 425 are designated for this species
 - Most preferred habitats:** coastal, marine inlets and transitional waters, shelf
 - Natura 2000 species code:** 1349
- Image:** A photograph of a bottlenose dolphin leaping from the water, credited to Saifraga Janus Verkerk.
- Navigation menu:** Distribution, Threat and conservation status, Natura 2000 sites, Legal status, Common names and synonyms, Other resources.

Figure 5. Bottlenose Dolphin factsheet on EEA website.

A presentation of the two use cases is available at this link: <https://ecoads.eu/static/toolsDoc/>

3. LICENSING

The ECOSSE Tools are distributed as Free and Open Source Software under GNU GPL 3 license.

The code is available online at the GitHub repository URL <https://github.com/oggioniale/ECOSSE-parametersDirectives>.

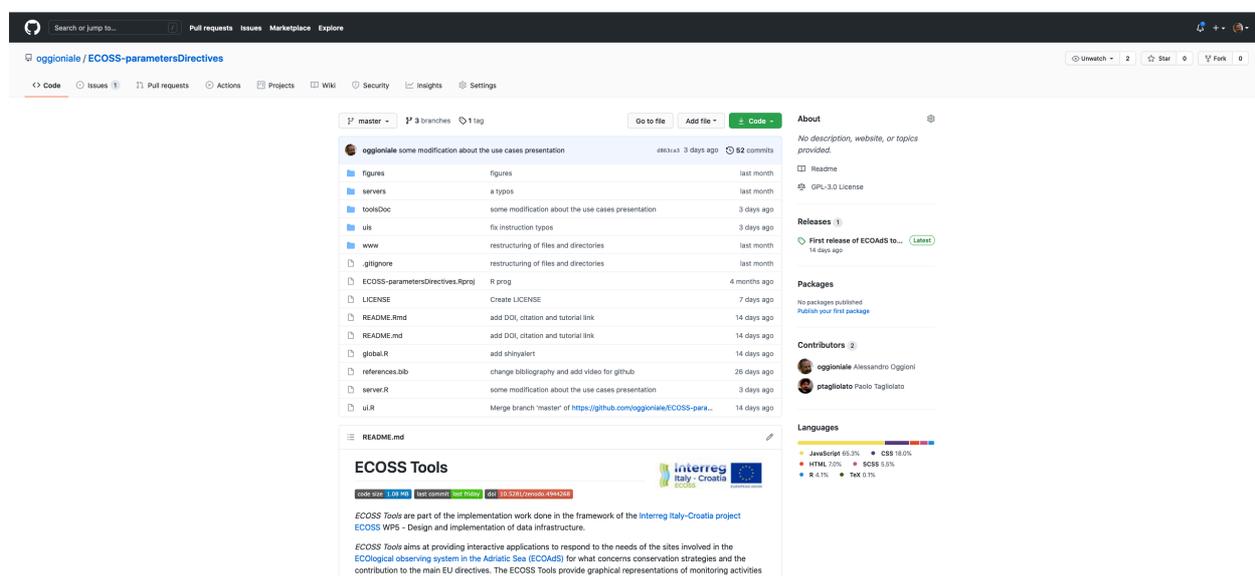


Figure 6. Tools GitHub repository.

The ECOSSE tools are citable as:

Alessandro Oggioni & Paolo Tagliolato. (2021). oggioniale/ECOSSE-parametersDirectives: First release of ECOADS tools (Version v1.0). Zenodo. DOI: 10.5281/zenodo.4944267

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