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“Fisheries in the AdriatIc Region - a Shared Ecosystem Approach”

D5.4.2 Guidelines for potential future implementation of the EAF using FAIRSEA products

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D5.4.2. Guidelines for potential future implementation of the EAF using FAIRSEA products

FAIRSEA – Fisheries in the Adriatic Region – a shared Ecosystem Approach

FAIRSEA is financed by Interreg V-A IT-HR CBC Programme (Priority Axis 1 – Blue innovation)

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Contents

List of Acronyms used

AIS	Automatic Identification System
CMEMS	Copernicus Marine Environment Monitoring Service
EAF	Ecosystem Approach to Fisheries
FAIRSEA	Fisheries in the AdrIatic Region – a Shared Ecosystem Approach
GSA	FAO Geographical Sub Areas
IP	Integrated Platform
LP	Lead Partner
LPUE	Landings Per Unit of Effort
MEDITS	Mediterranean International Trawl Survey
OTB	Bottom Otter Trawl
SOLEMON	Sole Monitoring
VMS	Vessel Monitoring System
WP	Work packages

About FAIRSEA Project

The FAIRSEA is a European Territory Cooperation project financed under the priority 1 "Blue innovation", Specific Objective 1.1 "Enhance the framework conditions for innovation in the relevant sectors of the blue economy within the cooperation area" of the INTERREG V-A Italy –Croatia Programme 2014-2020. The project focuses on the fisheries sector, key driver for the blue growth of the Adriatic communities, towards a sustainable co-management of resources and marine ecosystem protection. The transboundary nature of marine resources requires a cross-border cooperation and a shared "Vision" to properly tackle and address the different socio-economic and environmental challenges related to fisheries activities management. In this context, FAIRSEA Project aims at enhancing transnational capacity and cooperation in order to promote the sharing of knowledge and good practices between regional and transnational key actors in the sector of sustainable fisheries management in the Adriatic Sea as well as to implement innovative approaches adopting an ecosystem approach to fisheries (EAF). Coordinated by the OGS of Trieste (IT), the project involves a consortium of 12 strategic and operational partners from Italy and Croatia that will make to best use of their complementary expertise to address and support the application of the EAF ensuring a strong and interactive engagement of institutional, technical and socio-economic stakeholder in project activities.

The main result of the FAIRSEA Project is the development of an integrated platform for a quantitative ecosystem approach to fisheries that goes across territorial boundaries and across several disciplines, including oceanography, fishery socio-economy, trophic ecology, climatic changes, marine biology and ecology. This high technological and innovative platform was used as a planning tool to implement demonstrative testing of applicable fisheries policies both at local (subareas) and Adriatic scales. The platform applications done in FAIRSEA producing local scenario analysis (Pilot studies: Deliverable 5.2.1) and basin scenarios of climate and fisheries management (Scenario analysis: Deliverable 5.3.1) are just examples of applications and further developments can be done in the future. Updating and improving the platform will result in a tool that will provide a scientific basis for formulating and evaluating the shared management advice in the local and international participatory processes, involving management authorities, experts and stakeholders. Thanks to the experience done, the Project provides best practices (Deliverable 5.4.1) and guidelines (Deliverable 5.4.2, this deliverable) for the optimisation between ecological and socio-economical sustainability of fisheries in the Adriatic Sea.

1 Extended guidelines for potential future implementation of the EAF using FAIRSEA products

These guidelines are developed for describing the approach implemented in FAIRSEA for the EAF in the Adriatic Region, the platform developed, the data embedded, delineate capabilities and key elements of the tool, for its further use. The aim of the guidelines is to make the FAIRSEA approach useable and transferable.

The guidelines include also assumptions used in developing the platform and limitations for its accurate use.

The guidelines will highlight the impacts of potential management actions at the basin and local scale, as well as in the medium and short terms by considering ecosystem and technical interactions.

2 The FAIRSEA integrated platform in brief

The FAIRSEA IP integrate biological/ecological processes (i.e. considering water mass circulation, physical-chemical properties, plankton productivity, dynamics of resources including their interactions) and fisheries bio-economic dynamics (including fisheries displacement).

The platform cornerstone elements are:

i) water masses circulation and connectivity (module HYDRO);

ii) biogeochemical planktonic processes and productions (module BGC);

iii) distribution of main resources using scientific surveys (module BSTAT);

iv) disaggregated catches and fleet capacity changes over time (module FSTAT);

v) spatial distribution of effort using scientific VMS/AIS data (module EFFORT);

vi) bioeconomic responses (BIOECO);

vii) food web dynamics (FWM);

viii) preference modelling (trough MCDA – Multicriteria Decision Analysis - methods).

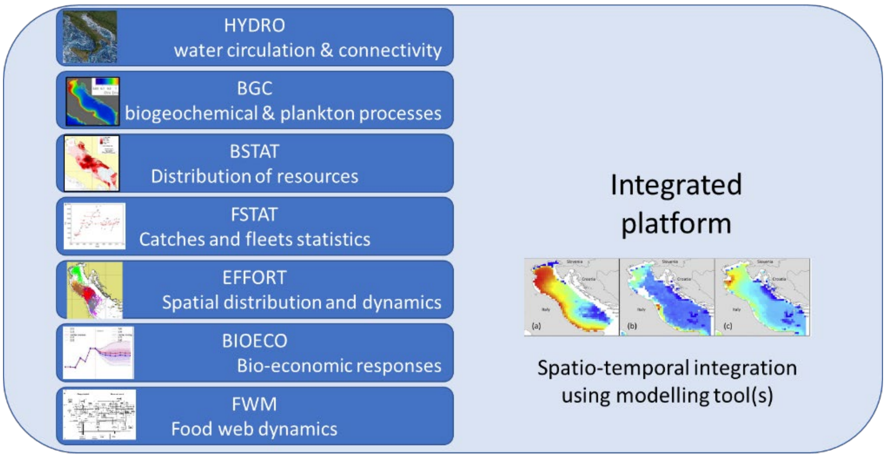

Figure 1: Scheme of the modules of the FAIRSEA Integrated platform

The information embedded in the FAIRSEA IP were used in an interdisciplinary and integrative quantitative analysis with the objectives to provide supportive science-based evidences useful for fisheries management. Open access to IP and data sharing will allow different stakeholders to model current and future scenarios by improving transparency in decision making process. Results and details for all the elements above mentioned can be found in the specific Deliverables produced during the project. A summary deliverable is also available to give a general structure of the Integrated Platform (D.4.8.2 Integrated platform and key elements).

2.1 Access to the FAIRSEA platform developed

FAIRSEA IP is a web-GIS application based on open source software. The software development of the IP is being entrusted to the external software development company INKODE (https://inkode.it/).

The platform is available online at the link: https://fairsea.inkode.it/#/login View only credentials are given to the public: username "***viewer***", password "***fairsea2020***".

Figure 2: Frontpage of the FAIRSEA integrated platform at the webpage: https://fairsea.inkode.it/#/login

Developer credential are available only for those who actively work on the platform (i.e., data entering, model development) and can be requested to the FAIRSEA project leader LP-OGS (slibralato@inogs.it) that will act on behalf of the partnership after having informed them.

The dissemination and enhancing of the FAIRSEA IP is one of the objectives of the FAIRSEA project. The project partners promote the public use and sharing of the data/outputs contained therein, both for scientific purposes (e.g. drafting of scientific papers, decision support tool for management) and for dissemination purposes (e.g. scientific dissemination). Please mention the FAIRSEA project as in the following:

"These data were produced and analyzed in the project FAIRSEA (Fisheries in the Adriatic Region – a Shared Ecosystem Approach) funded by the 2014–2020 Interreg V-A Italy – Croatia CBC Programme [Standard project ID 10046951]."

It is also suggested to include with the citation the link to the platform itself to take advantage of its products.

2.2 The data embedded

The data used for the developing of the IP were obtained thanks to data calls (mainly modules BSTAT, FSTAT, EFFORT) or downloaded from online repositories such as Copernicus Marine Environment Monitoring Service (hereafter CMEMS, http://marine.copernicus.eu/) (mainly modules HYDRO, BGC). All these data have been collected and elaborated to populate the layers of the modules. Then the layers have been used into the models used in the BIOECO and FWM modules (see the related Deliverables: Deliverable D4.6.1 - Calibrated BEMTOOL applications to the Adriatic Region for BIOECO and FWM).

Below is reported a summary table with the main information about the first five modules of the FAIRSEA IP. The list of the collected variables (with sources), the time frame, the spatial resolution and the aggregation level, is shown for each single module. More information on the data contained in the platform can be found in the individual FAIRSEA deliverables cited in the table itself.

Modules **(and Deliverables) name**	**Variable included**	**Time-frame**	**Resolution**	**Aggregation level**
4.1 HYDRO – Hydrodynamic circulation and connectivity *D 4.1.1- Connectivity and main circulation patterns in the Adriatic Sea*	Temperature, salinity and meridional and zonal component of the currents. Source: CMEMS MED-PHY http://marine.copernicus.eu/documents/QUID/CMEMS-MED-QUID-006-004.pdf	1999-2018; Seasonal division: Spring = April-May-June (AMJ), Summer = July-August-September (JAS), Fall = October-November-December (OND).	spatial resolution of 1/16 (ca. 6-7 km); 5 depth vertical levels (0-50 m, 50-100 m, 100-200 m, 200-500 m and 500-800 m)	Annual and seasonal averages over the period by depth level.

4.2 BGC – Biogeochemical processes and dynamics *D 4.2.1 – Production patterns in the Adriatic Sea*	chlorophyll-a, nitrate (NO3), phosphate (PO4), dissolved oxygen, phytoplankton carbon biomass, pCO2, alkalinity, pH and net primary production. Source: CMEMS MED-BGC http://marine.copernicus.eu /documents/QUID/CMEMS-MED-QUID- 006-008.pdf	1999-2018; Seasonal division: Spring = April-May-June (AMJ), Summer = July-August-September (JAS), Fall = October-November-December (OND).	spatial resolution of 1/16 (ca. 6-7 km); 5 depth vertical levels (0-50 m, 50-100 m, 100-200 m, 200-500 m and 500-800 m)	Annual and seasonal averages over the period by depth level.
4.3 BSTAT – Spatial distribution of marine resources *D 4.3.1-Spatio-temporal distribution of marine species*	*BioIndex folders*: Bathymetric distribution, number of positive hauls to the species, mean biomass index (kg/km2), mean abundance index (number/km2), inverse of mean abundance Coefficient of Variation (CV), mean individual weight (MIW), sex-ratio, index of recruits (number/km2), index of spawners (number/km2), length at 95° percentile (L0.95) *BioStand folders*: Standardized biomass index (kg/km2), Standardized abundance index (number/km2), Various model diagnostic plots, Maps of predicted spatial distribution. Source: EU DCF via official project data call.	MEDITS: time series 1994-2018; SOLEMON: time series 2005-2018.	For distribution maps: spatial resolution of 1/16 (ca. 6-7 km);	By species (see Del.4.3.1) and GSAs (GSA17, GSA18, GSA19)

4.4 FSTAT – Fisheries production and capacity *D 4.4.1 – Catches and fishing capacity by fleet segment*	*Catches*: landings and discards (both quantities and price), length frequency distribution (LFD); *Fleet capacity:* Days at sea, Fishing day, Hours at sea, Fishing effort in kW, fishing effort in gross tonnage, Number of vessels. Source: EU-JRC FDI via official project data call; STECF AER (STECF, 2019), Albania and Montenegro MARE 27 project data (Spedicato et al., 2016).	*Catches:* 2002-2018 *LFD*: 2002-2018 *Fleet capacity*: 2015-2018	-	By species, year, country, GSAs, fleet segment, vessel length.
4.5 EFFORT – Effort distribution and fleet displacement *D4.5.1 - Fishing effort map distribution*	Fishing effort (fishing hours) Source: ITA & HRV VMS and AIS datasets via official project data call.	2009-2018	For maps: spatial resolution 5x5 km square reference grid);	By gears OTB (Bottom Otter Trawl) effort, LL (Longline), PS (Purse seine), PTM (Pelagic Pair Trawl), TBB (Beam Trawl) and 3 LOA classes (12-18 m, 18-24 m, 24-40 m)

2.3 Modelling approaches integrating IP layers

The data made available in the modules of the platform were used and integrated in different approaches to constitute a Decision Support System. These approaches were a set of Species Distribution Models (SDM), the bioeconomic model BEMTOOL, the SMART approach based on VMS/AIS data and the Ecospace model. Below is a brief description of their main features and limitations.

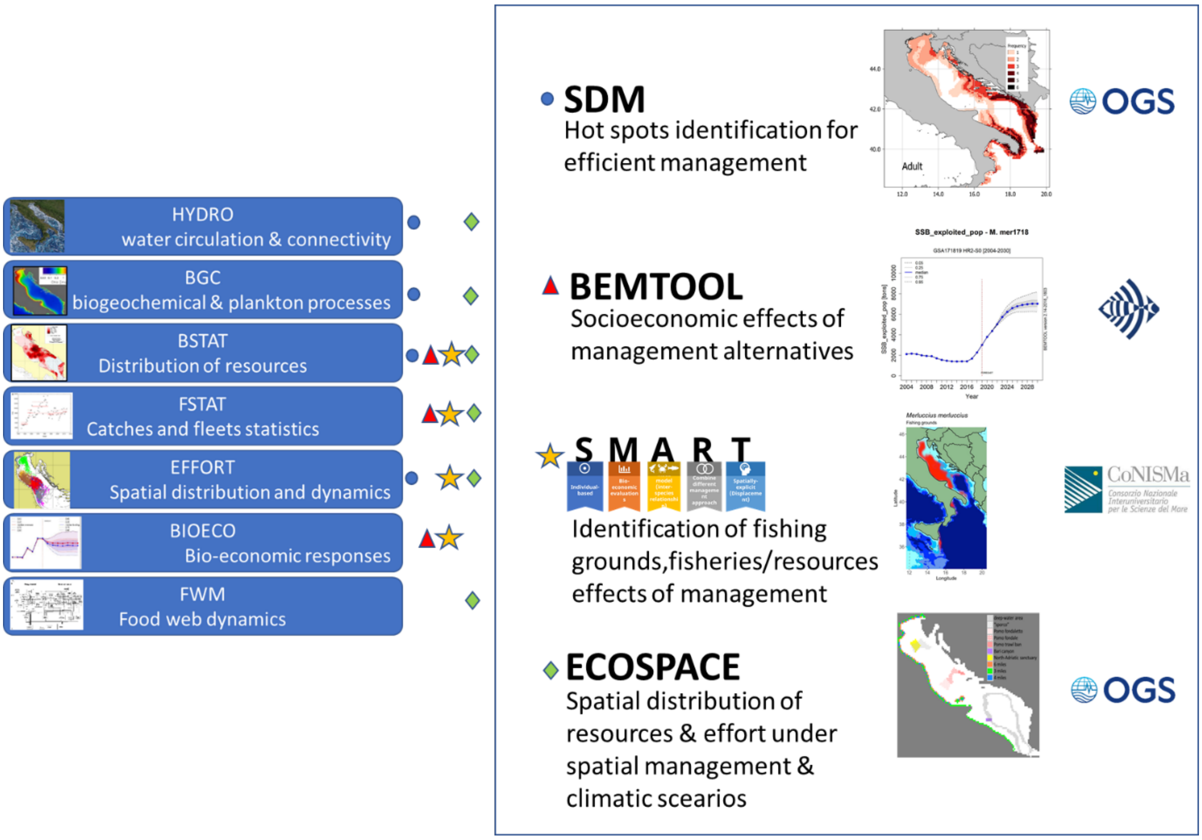

Figure 3: Decision Support System tools (on the right) and the IP layers used in them. Note that results of the models were also included in the platform

E-SDM: Ensamble Species Distribution Model

Marine species distribution models are largely used in ecology and fishery science to support the management of marine exploited resources. The ensemble SDM model was obtained by combining 5 different modelling approaches that use abundances and/or biomasses from trawl survey (module BSTAT), explaining data using geopositional covariates (coordinates and depth), plus a series of oceanographic variables from module HYDRO and BGC, and data from module EFFORT . A robust procedure is applied to best represent data allowing their interpolation and extrapolation of trawl survey indices to the domain of the GSA17-18 and 19. The approach is used to identify hot spots of aggregation of juveniles and adults, as a tool for planning future fisheries spatial management regulations. The approach is presented in the deliverable "*D.4.8.1 First analysis of layers of information*".

BIOECO – A multi- fleet and multi-stock platform for mixed fisheries

The main goal of this module in the FAIRSEA platform is to investigate the consequences of alternative scenarios, using BEMTOOL bio-economic model (Spedicato et al. 2016; Rossetto et al., 2014), to evaluate how changes/shifts in population traits (e.g. natural mortality, growth), fishery-driven impacts (e.g. fishing mortality, gear and fleet selectivity) and management or fishing strategies (e.g. closed season, changes in fishing opportunity), affect stock and fisheries dynamics in terms of landings, discards and economic performance.

As presented and discussed in the deliverable *4.6.2 - Management scenarios of policy using BEMTOOL outputs* three main management scenarios were tested in the BIOECO module.

These scenarios resulted in a vast number of results considering the stocks, the number of fleets and the numerous indicators for the different components: biological, economic, and pressure/impact that the bioeconomic model uses to synthetize the effect of each management measure in the predictions.

The scenarios are then compared and ranked by considering a) the utility functions associated to the different indicators and b) the weights provided by the stakeholders. These weights are representing the relative importance of each indicator (i.e. GVA, RBER, WAGE, EMPL, SSB, F, Y, D see Deliverable 4.6.2 for further details), to the overall utility.

SMART - Spatial MAnagement of demersal Resources for Trawl fisheries)

As extensively described in the D5.3.1- Report on the results from the application of scenarios for fisheries management in the Adriatic Region, the SMART model (D'Andrea et al., 2020) was used to explore the potential effects of different management scenarios. SMART is an individual-based model (the basic entity represented is the single vessel) that allows simulating the individual adaptation of each fishing vessel to different management rules including spatial closures, temporal closures, regulation of the fleet size, etc.). SMART is also a bio-economic model, since it works optimizing the effort pattern of each fishing vessel through a profit maximization. Hence, using SMART, it is possible to forecast the effort displacement, that is the re-allocation of the fishing effort determined by the different scenarios.

Thus, the SMART model was used to assess the potential effect of different management scenarios including some "extreme" management measures such as the closure of the 6 nautical miles zone (coastal area). The outputs returned a set of indexes related to the status of different stocks and the economic performance of the fleet according to the different scenarios.

ECOSPACE – a spatially explicit ecosystem model

Another modelling approach considered one of the most suitable tools for evaluating the direct and indirect effects of anthropogenic pressures on spatial scale ecosystem dynamics is those built in the Ecopath with Ecosim and Ecospace (EwE) (Adebola and Mutsert, 2019; Couce Montero et al., 2021; Puts et al., 2020; Serpetti et al., 2021; Steenbeek et al., 2020). The environmental variables from HYDRO, BGC modules were used to drive the species distributions in relation of their habitat preferences (niches) by species or groups of species (see details in "*Deliverable 5.3.1 Report on the results from the application of scenarios for fisheries management in the Adriatic Region*") in the domain of the model which is the GSA17 and 18 at a resolution of 1/16 degree. Other than the spatiotemporal dynamics of 73 species or groups of species interacting each other as prey-predators, the fisheries were described in this model using the information collected in module FSTA (see also "*D 4.4.1 – Catches and fishing capacity by fleet segment*"). This modelling approach represents explicitly the technical interactions among fisheries and the interactions among species thus allowing characterizing cascading effects of spatial management measures.

2.4 Scenarios tested

The e-SDM modelling approach was implementing two climatic scenarios:

- IPCC scenario RPC4.5
- IPCC scenario RPC8.5

The environmental forcings derived from HYDRO and BGC under climatic conditions were used for simulating the changes in the center of gravity for the hot spot of the models, i.e., the changes in the distribution of species over time and space as a consequence of the climate change variables. See "Deliverable 5.3.1 Report on the results from the application of scenarios for fisheries management in the Adriatic Region".

A recap of the management scenarios tested in BIOECO is summarised below.

1. (S0) Status quo (no variations compared to 2021).

2. (S1) Linear reduction of 40% in fishing days until 2026, for trawlers and "rapido", toward an F_{MSY} combined (0.35 value). We used a combined reference point of the target species included in the GFCM Recommendation (GFCM/43/2019/5), instead the one of European hake F_{MSY} (0.18 value), in order to avoid the risk of underutilisation for the less exploited stocks.

3. (S2) based on the GFCM Recommendation and implemented through a combination of measures selected by stakeholders and based on:
   a) spatial closure areas (within 6 nautical miles, until December),
   b) taking into account the presence of nurseries of the main target species in the areas,
   c) considering 2 months of fishing bans for other gears (PGP 17-18 and DFN Croatia fishing ban in Feb and May; HOK GSA 18 March and May),
   d) a linear reduction of 25% in fishing days for trawlers and "rapido" fleets.

All the results at a detailed level were implemented in the platform, thus giving the possibility to any end user or stakeholder to explore the trajectories of each scenario, following three main criteria: i.e. state of the stocks, impact/pressure, state of the fleet. Once the criteria is selected then it is possible from a drop down menu to select the stocks and then compare the scenarios (Fig. 1) through a suite of biological indicators related to the simulated exploited and unexploited populations (the latter with only the natural mortality acting). Eight biological indicators are implemented for the comparisons.

The SMART model was used to assess the potential effect of different management scenarios including:

- Scenario #1: *Status quo* (including the presence of the Pomo Fisheries Restricted Area);
- Scenario #2: Scenario #1 + closure of the 6 nautical miles zone (coastal area);
- Scenario #3: Scenario #1 + effort reduction up to 30% in 3 years;
- Scenario #4: Scenario #1 + Extended late summer ban (total stop in September/October, -40% of the normal effort in November).

The ECOSPACE model was used to test the following scenarios:

- S0) Baseline scenario with effort constant after 2021
- S1) coastal closure: up to 4 nautical miles from Italy coastline (active from 2021), restricted all year for OTBs, PTMs, TBBs and up to 6 nautical miles from Italy coastline restricted from August to November for OTB_VL24++, PTM_VL24++, TBBs (active from 2021).
- S2) Implementation of a gradual five-years (2022-2026) further effort reduction for OTB and TBB as foreseen in the Multiannual Management Plan. Each year, on the basis of SAC advice, the GFCM shall establish yearly effort quotas that contribute on reaching Fmsy for selected species
- S3) Effort reduction as applied in S2 and implementation of new FRAs. Thus, other than Pomo Pit as in the baseline, also the Bari Canyon and the North Adriatic sanctuary were activated.
- S4) Climate changes: driven by changes of primary productivity simulated as changes of biomasses of small and large zooplankton derived by the biogeochemical model outputs for the RPC 8.5.

Furthermore, in order to test effects of different FRAs, a sensitivity test scenario was applied for each FRA:

- A1) Pomo Pit all sub-regions (active from 2017) therefore to assess theirs impacts these areas were deactivated when comparing to the baseline;
- A2) Bari canyon (active from 2021): restricted all year for all fleets;
- A3) North Adriatic sanctuary (active from 2021): restricted for all OTBs and TTBs

2.5 Utility function applied to scenarios implemented (BEMTOOL)

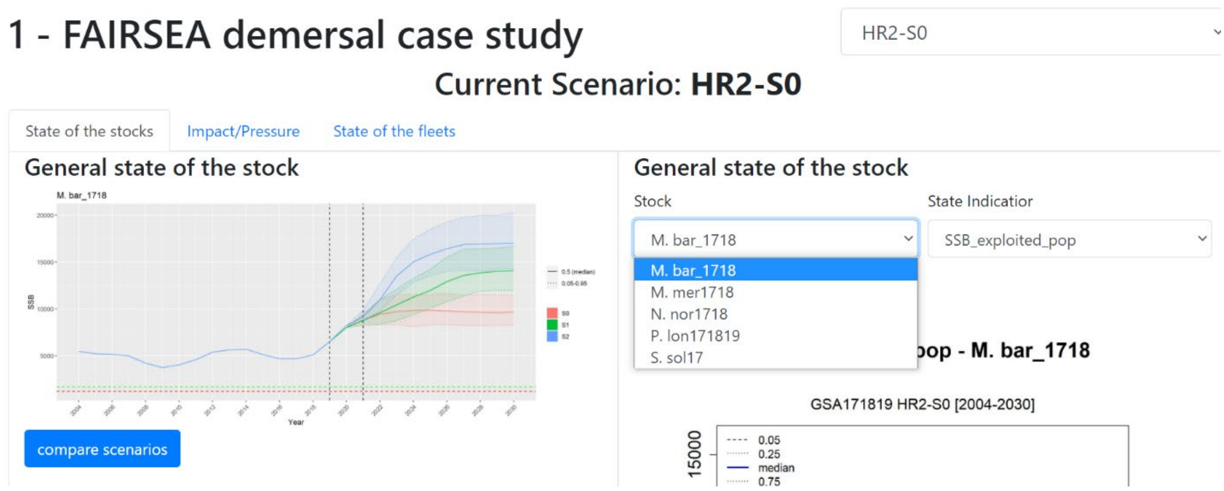

Fig. 4 FAIRSEA platform. BIOECO. Screenshot with an example of comparison of scenario results for the state of the stocks.

Likewise, it is possible to select the pressure/impact or the state of fleet criteria. An example for the latter is reported in the Figure 5. In this example a fleet among the 28 contemplated in the simulations is selected and scenarios compared for a suite of socio-economic indicators. Nine economic indicators are implemented for comparison and three pressure/impact indicators.

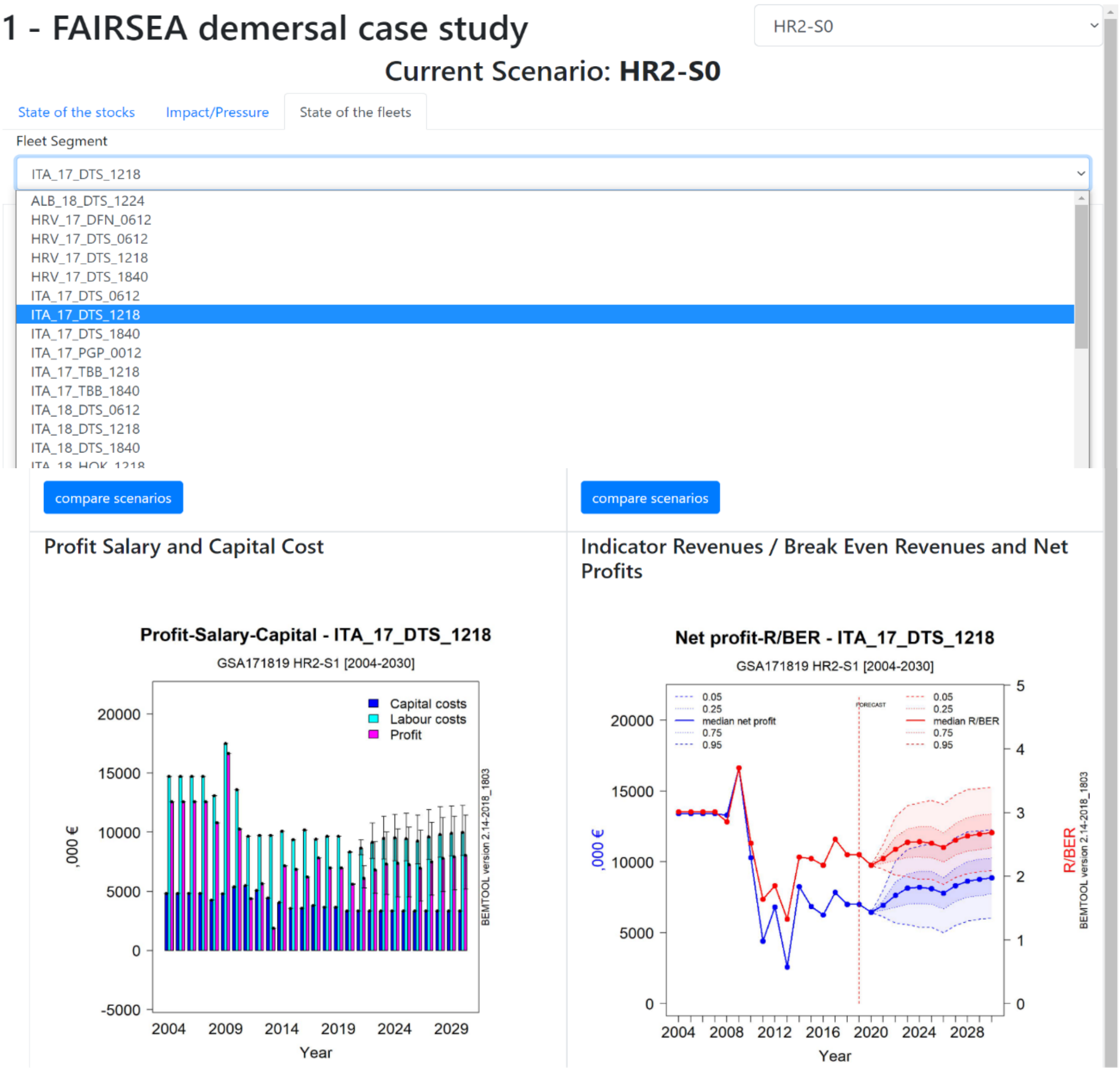

Fig. 5 FAIRSEA platform. BIOECO. Screenshot with an example of comparison of scenario results for the state of the fleets.

The more complex point in the scenario evaluation, especially when different trade-offs are considered in the scenarios' settings, is the ranking of these scenarios using suitable indicators and reference points. The MCDA is a functionality of BEMTOOL that has been implemented in the platform. The approach allows comparing alternative management scenarios on the basis of their ability to achieve a set of biological and socio-economic goals. This functionality is peculiar of BEMTOOL and in this application can allow more active interactions (see also chapter 3.1 in this Deliverable) with stakeholders that can play with the different weights combined with utility functions in order to rank the different scenarios (see Deliverable 4.6.2 for more methodological details) (Fig. 6).

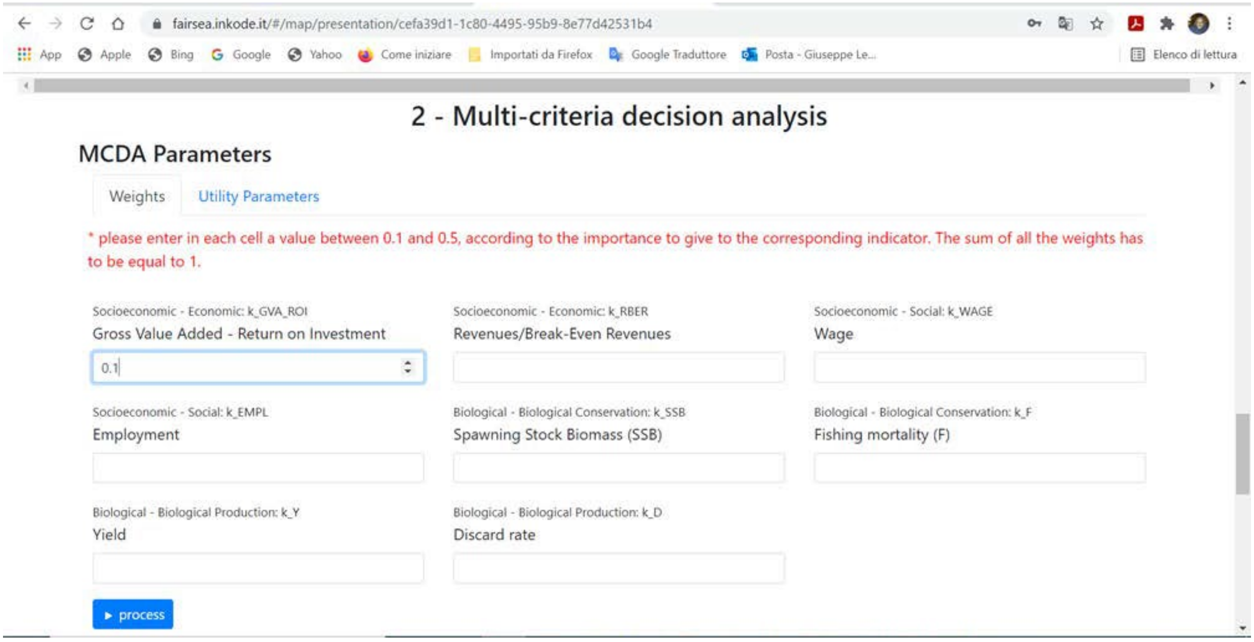

Fig. 6 – FAIRSEA integrated platform. Screenshot of the page in the MCDA menu, where stakeholders can introduce weights, which represent the relative importance of each indicator.

3 Capabilities and limitations of the FAIRSEA integrated platform

3.1 The interactive capabilities

The platform was designed and created with the intention of being user friendly and easily accessible even by non-expert users. For this reason, navigation within the FAIRSEA IP is often facilitated by drop-down menus (HYDRO, BGC, BSTAT, EFFORT, BIOECO) and interactive dashboard (FSTAT). Georeferenced outputs can be easily mapped through different layers that can be activated or not thanks to interactive legends. Outputs of BIOECO can be easily compared between different scenarios via "*compare scenario*" mode, as illustrated in the chapter 2.

3.2 How to download data

All information uploaded in the platform can be downloaded in the form of csv, NetCDF, shapefile or zipped folders according to the module of interest:

- HYDRO & BGC: csv and NetCDF by variable
- BSTAT: csv and jpeg by variable and species
- FSTAT: xlsx database
- EFFORT: csv and shapefile by gear and LOA
- BIOECO (MCDA part): jpeg and csv
- FWM: jpeg and csv

Deliverables related to each module can be downloaded in pdf format from the platform.

3.3 Inputs to the MCDA

The MCDA (Multiple-criteria decision analysis), part of the BIOECO model, has been implemented in the on-line platform. The embedded MCDA component allows to include stakeholder's preference about management objectives and rank scenarios accordingly. Within the platform, the goal is to allow the ranking of the results from different scenarios under different management criteria (e.g. socioeconomic vs. biological objectives); variations in the form of vector of weighting in the indicators may result from consultation with stakeholders. Weight value can be set between

0.1 and 0.5, according to the importance to give to the corresponding indicator. The sum of all the weights has to be equal to 1.

3.4 Limitations

At the moment, one of the biggest limitations of FAIRSEA IP is that it is not possible for an external user to upload new data or update existing datasets. To do this, the user needs to contact the project partners. The same thing applies to the scenarios tested in the two final modules BIOECO and FWM; the user interested in testing different scenarios from those presented and discussed during the FAIRSEA project (see deliverable *"D5.3.1 Report on the results from the application of scenarios for fisheries management in the Adriatic Region")* will necessarily have to go through the project partners. This point should not be considered indeed as a limitation as the models used (Bemtool in BIOECO and Ecosapce in FWM) require considerable experience that the project partners have gained over decades of scientific research. Incorrect use of these tools could lead to inconclusive settings or incorrect conclusions and consequently distort the possible decision-making process.

4 Future of the FAIRSEA platform

4.1 Assuring durability and transferability

The platform will be managed by the INKODE company under the supervision of the project partners (in particular PP4: CNR-IRBIM). The platform will not cease to exist at the end of the FAIRSEA project but will remain online and public, so it can be used as a tool within other research projects/studies. It should be noted that the partners promote the use of IP outside the FAIRSEA project as the transferability of this product is one of the objectives of the project itself.

Given the limit of the free upload of new files (described in 3.2 - Limitations), the project partners undertake to keep the IP and the data contained as updated as possible so that it can become a focal point for the EAF in the Mediterranean Sea.

4.2 Mid-term future improving steps

Although the FAIRSEA platform has been developed with recent technology, best input data and resolution it is clearly done for a continuous improvement. A set of improvements can be considered a natural update and steps for the platform and are included here as mid-term improving steps. More complex addings are also foreseen in the subsequent long-term improving steps.

4.2.1 Increase spatial resolution

Actual spatial resolution of 1/16 of degree (approximately 6 km) was chosen to adhere to HYDRO and BGC modules. However, recently the tools of these modules have been improved in resolution to 1/24 and thus would be easy to update HYDRO and BGC results with this new resolution. Yet BSTAT and EFFORT modules will require full update and more efforts for accommodating this update. Finally, duration of the scenarios with spatial models (SMART and ECOSPACE) will be severely impacted by the new resolution.

4.2.2 Involve data that can be aggregated in different ways

Necessarily when increasing the number of species represented there is a need to aggregate them into so called “functional groups” in ECOSPACE. These groups were defined and discussed among experts and represent a best compromise between ecological significance and fisheries economy usefulness. Yet several other aggregations could be tested, and this might become more feasible if the disaggregated data (e.g., species biomass) are given disaggregated.

4.2.3 Explicit more the socio-economic data

Socio-economic data are embedded in the BEMTOOL approach but they can be presented as layers in the future with information on costs (fixed, variable) and prices, as well as their variability over time. This might allow embedding more accurately these information also in other approaches (such as SMART and ECOSPACE) and might more easily provide basis for future scenarios.

4.2.4 Include more scenarios

The developed modules and approaches could be used to test additional scenarios, that need to be set considering the specificity of each approach and should consider their limitations. Additional scenarios might be defined on the basis of participatory approaches, scientific request, stakeholder request or pre-assessment of future regulations by the management authority.

4.2.5 Saving the MCDA inputs from the web for statistical uses

A potential update could be the possibility to save the utility factors included by the user and thus the related MCDA inputs and outputs. This will allow to have a historical statistics of choices that can possibly be used for representing different stakeholders.

4.3 Long-term future improving steps

Some more efforts are required in case relevant improvements or updates of the platform are foreseen. This list is not necessarily complete and it is given just to give idea of potential improvements.

4.3.1 Enlarging to bigger areas

A natural need is to extend the domain of the platform and/or apply to another area, for example of the Mediterranean Sea. Such extension requires additional efforts for completing analysis on all the modules. The best cost/benefit ration would be the extension of the actual platform to the ADRION region. Some modules, however, require substantial effort for this update.

4.3.2 Link with available websites of information

The platform contains several data but could include additional information that can be taken from relevant public repositories (Fishbase, CMEMS, EU DCF, GFCM SAC, etc). Making this automatic would facilitate update if the original websites will have a fixed standardized structure (e.g., the EU DCF website).

4.3.3 Embedding in other platforms (e.g., CMEMS).

The actual platform could be transformed and integrated in larger efforts, such as that of the CMEMS that would require well established protocols of integration and production of results.

4.3.4 Online Dynamic modelling

Embedding the code of the models into the platform will allow producing a kind of twin of the ocean, where data provided in the different modules and layers are integrated and used as an input for models directly applied by the user online. This will allow also producing scenario testing online with great relevance especially for wide public.

5 Potential use and benefits for each specific target group

5.1.1 General public

The tool could be used as a demonstrator for showing to the general wide public the complexity of fisheries, the importance of data, the relevance of the multiple approaches, the potential for producing scenarios including climate and fisheries management. No need of accurate or complex features, most important is the great accessibility and the simplicity of outputs.

5.1.2 Local action group, NGOs

Also, at technical meetings with policy makers, the participants provided several requests that represent tests, scenarios or analyses useful for this target groups. This target group for example highlighted the importance of representing the fisheries with so much realism but stressed the need to make it simple and accessible. The local action groups and NGOs found the approach very interesting for assessing ecological issues related to fisheries that might be explored more in the future, such as the role of large pelagic, the importance of marine mammal interactions and others.

5.1.3 SMEs and cooperative

Directly interested stakeholders, such as fishers, could be interested in the evaluation of the fleet of which they are part, in terms of ecological and economic sustainability. This, for example, might be supportive of certification of fisheries products.

5.1.4 Institutional fisheries management bodies

These representatives might be interested in evaluating effects of management plans and their ecological, social and economic effects, as well as the studies of single measures to be adopted (see sensitivity of FRAs). The natural evolution of the platform is to be the basis for official assessments.

6 REFERENCES

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