WP4
The innovation approach of the FAIRSEA platform

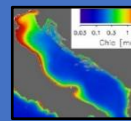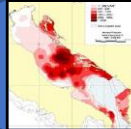## FAIRSEA Project

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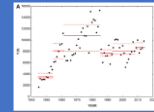
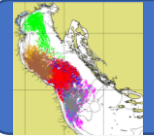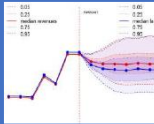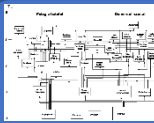CNR-IRBIM | Francesco Masnadi & Giuseppe Scarcella

WP4 - The innovation approach of the FAIRSEA platform

WP AIMS: This WP is dedicated to the development of an **integrated platform (IP)** for a quantitative ecosystem approach to fisheries that goes across territorial boundaries and across several disciplines. The platform will integrate datasets from physics to bioeconomy of fisheries as a state of the art and decision support tool.

The IP cornerstone elements are:

FSTAT
Catches and fleets statistics

HYDRO
Water circulation & connectivity

EFFORT
Spatial distribution and dynamics

BGC
Biogeochemical & plankton processes

BIOECO
Bio-economic responses

BSTAT
Distribution of resources


FWM
Food web dynamics

Implementation of local management actions in the IP will result in **applicative pilot actions** demonstrative of operative use and potential insights that can be gained from the shared integrated approach (WP5).

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WP4 - The innovation approach of the FAIRSEA platform
IP structure and development

https://www.docker.com/

FAIRSEA IP is a **web-GIS application** based on open source software, all services are deployed by *Docker* containers, main services are:
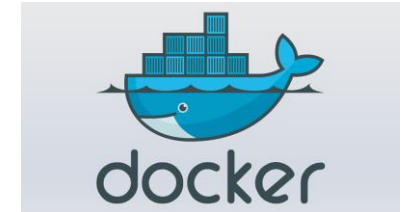
➢ Backend: REST API developed in Python with Django, Django Rest Framework and GeoDjango ;

➢ Frontend: a Single Page Application based on AngularJS with Angular Material framework ;

➢ Database: PostgreSQL with PostGIS ;

➢ Gis software: Geoserver ;

➢ Charts and dashboards: Plotly and Grafana ;

Other used libraries and services: GDAL, scipy, Shapely, netCDF4, Pandas, MapProxy, Pillow.

WP4 - The innovation approach of the FAIRSEA platform
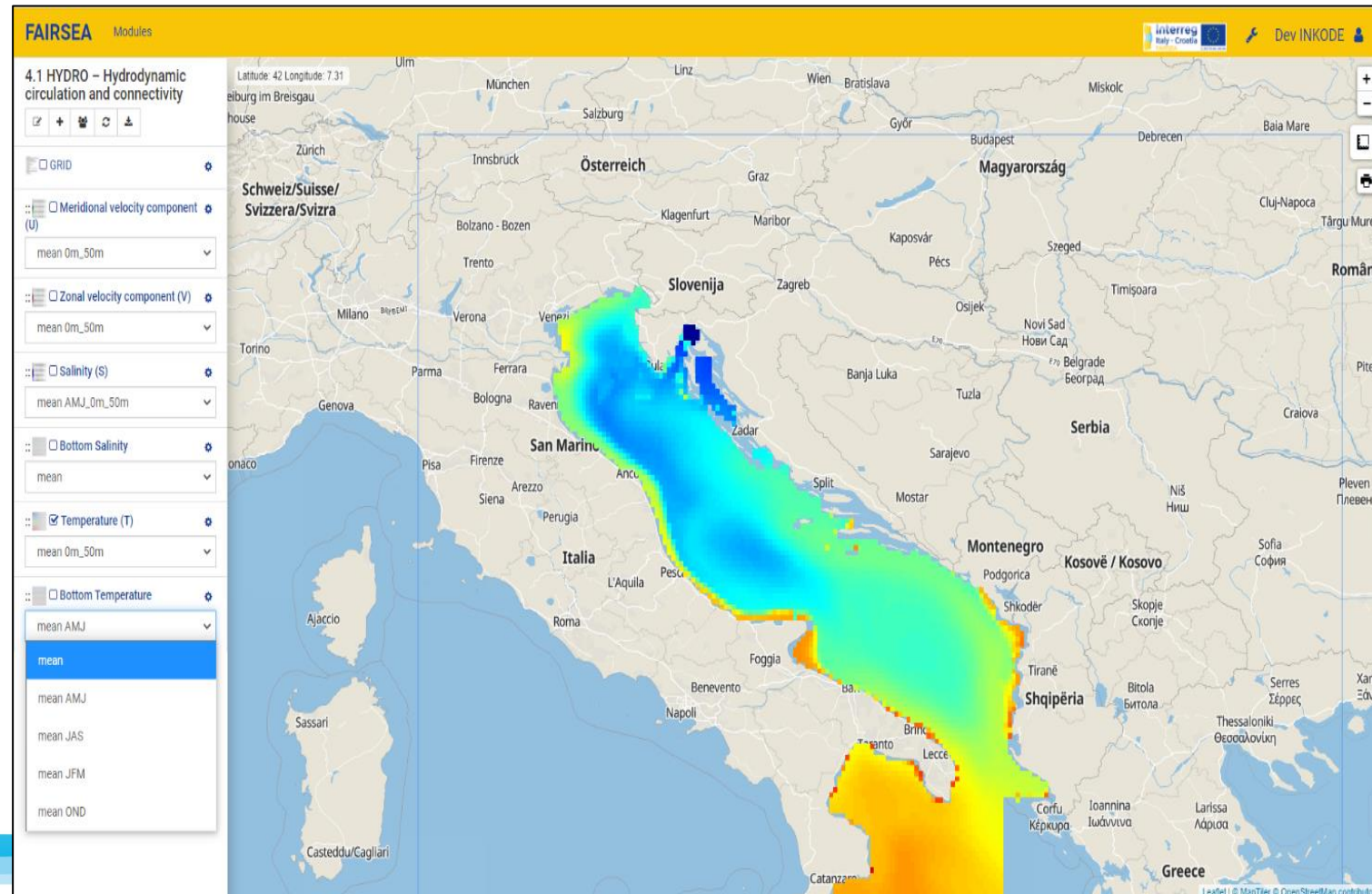## HYDRO – Hydrodynamic circulation and connectivity

This module contains the description of the physical properties of the Adriatic and Ionian basins provided by a multidecadal reanalysis of the Mediterranean Sea for the past 20 years.
(CMEMS data, http://marine.copernicus.eu/).

The variables selected for the period 1999-2018 are:

- **Temperature**

- **Bottom Temperature**

- **Salinity**

- **Currents** (meridional and zonal component used as a proxy of the connectivity)

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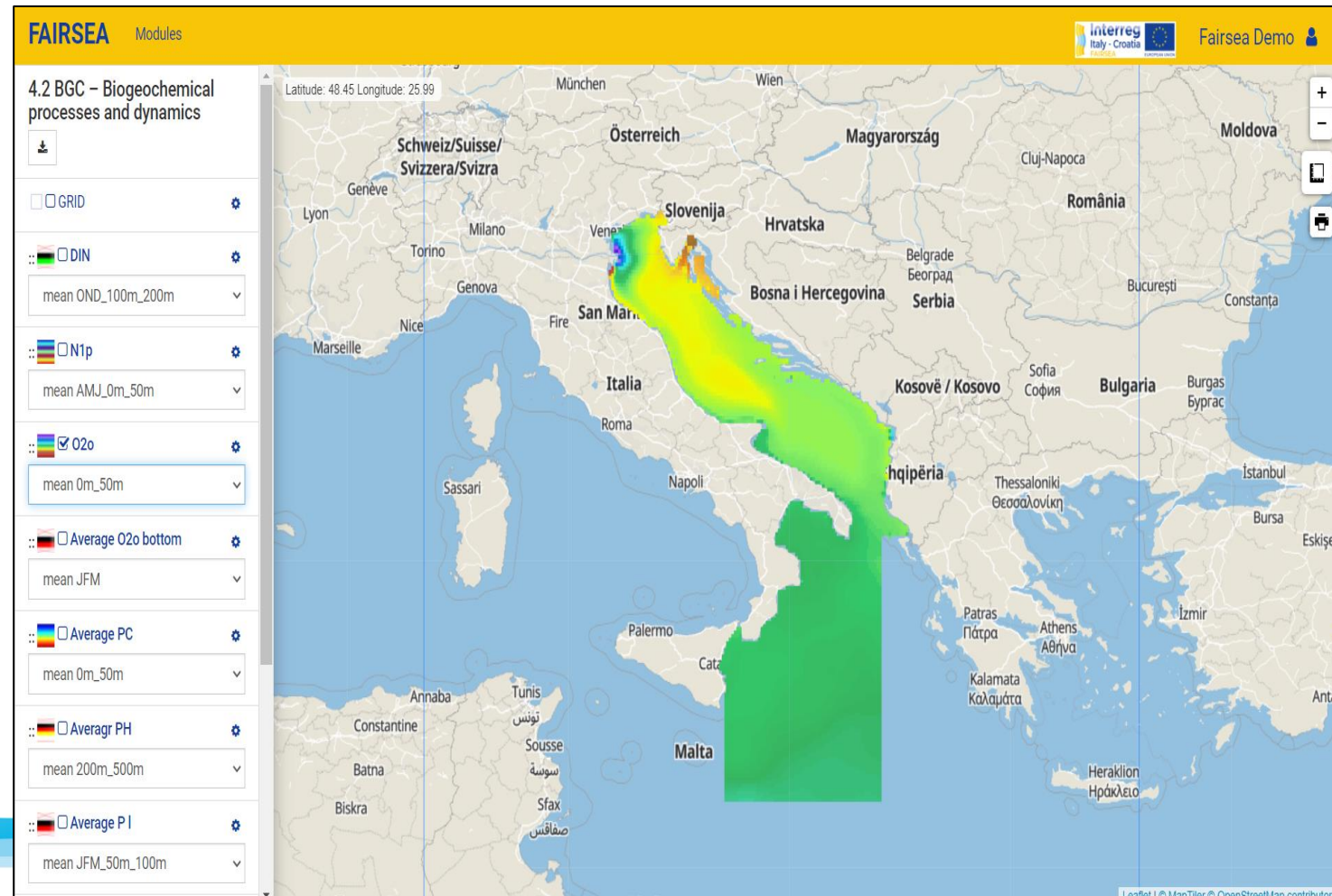# WP4 - The innovation approach of the FAIRSEA platform
BGC – Biogeochemical processes and dynamics

This module contains the description of the biogeochemical properties of the Adriatic and Ionian basins provided by a multidecadal reanalysis of the Mediterranean Sea for the past 20 years. (CMEMS data, http://marine.copernicus.eu/).

The variables selected for the period 1999-2018 are:

- **Chlorophyll-a**
- **Dissolved Nitrogen**
- **Phosphate**
- **Dissolved Oxygen**
- **Phytoplankton carbon biomass**
- **Zooplankton carbon biomass**
- **Particulate organic carbon**
- **pH**
- **Net primary production**

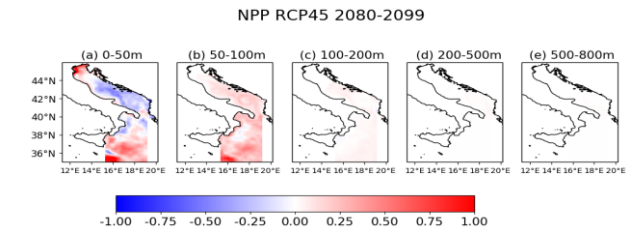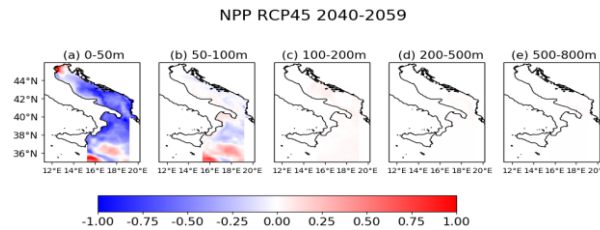*II International stakeholder Meeting | 23-24.02.2021*

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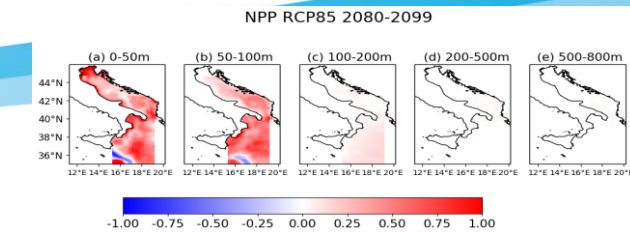# WP4 - The innovation approach of the FAIRSEA platform

HYDRO & BGC: future scenarios
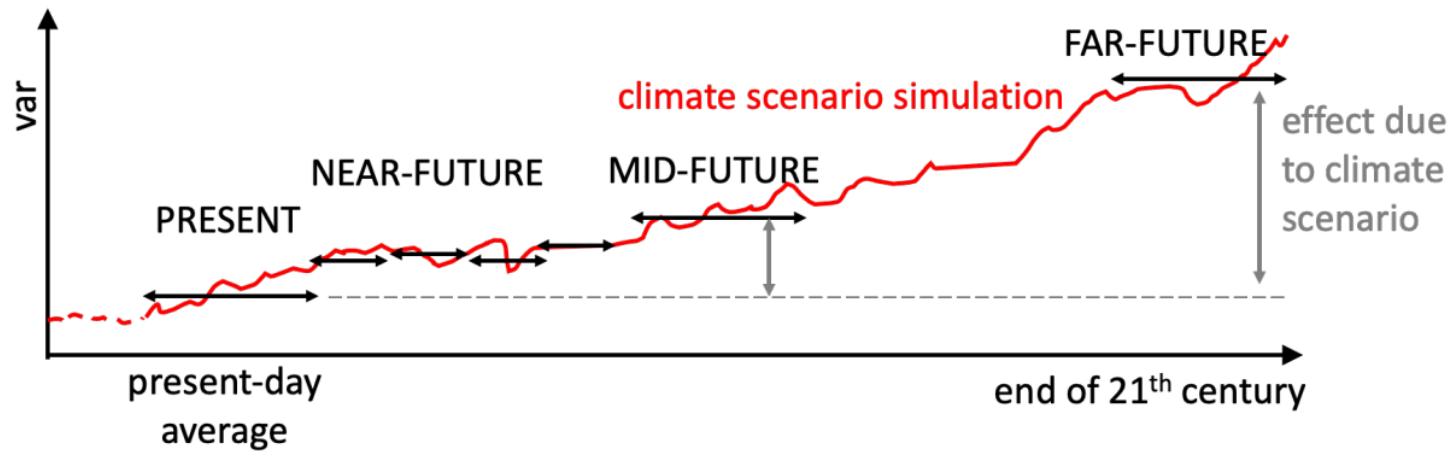
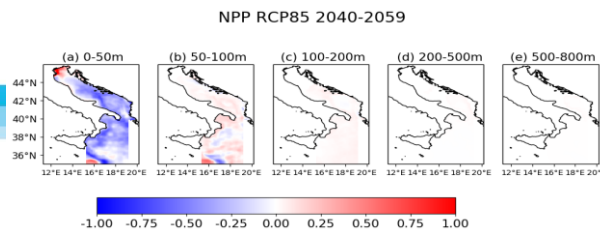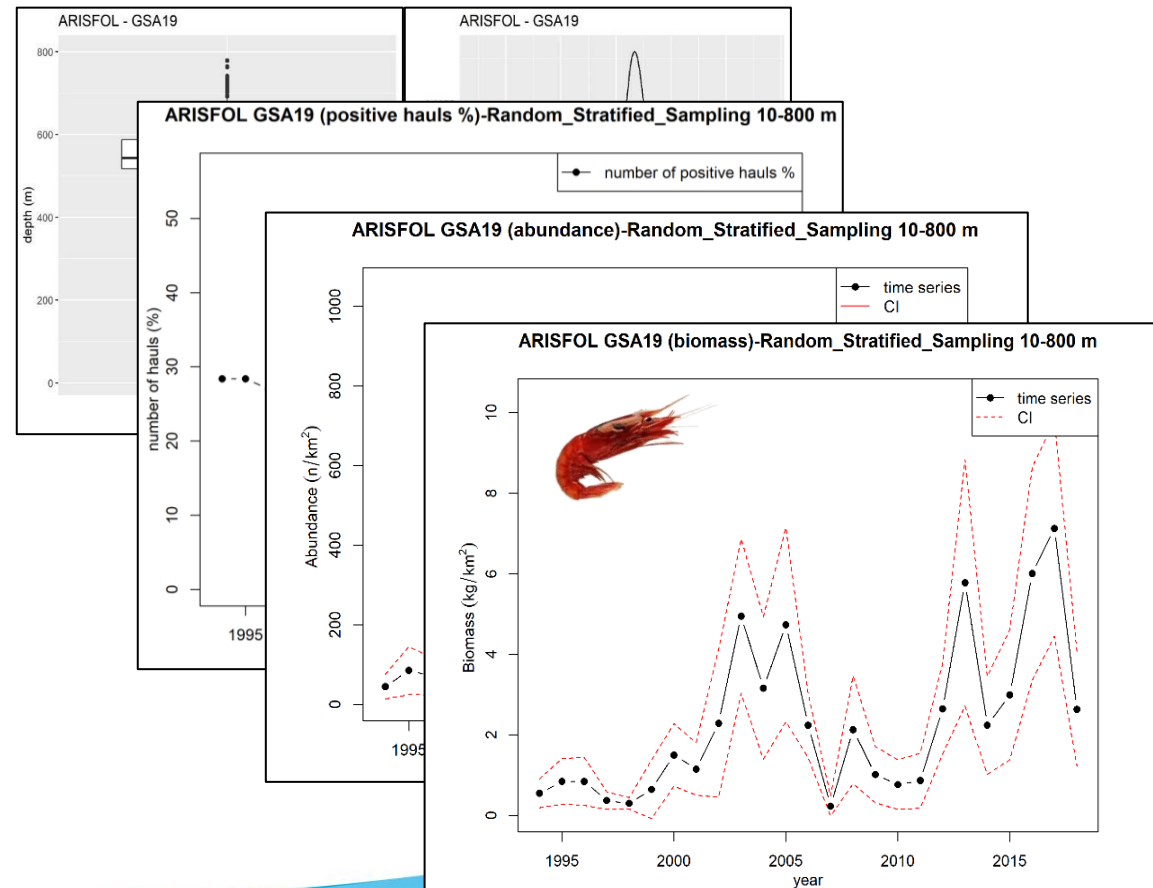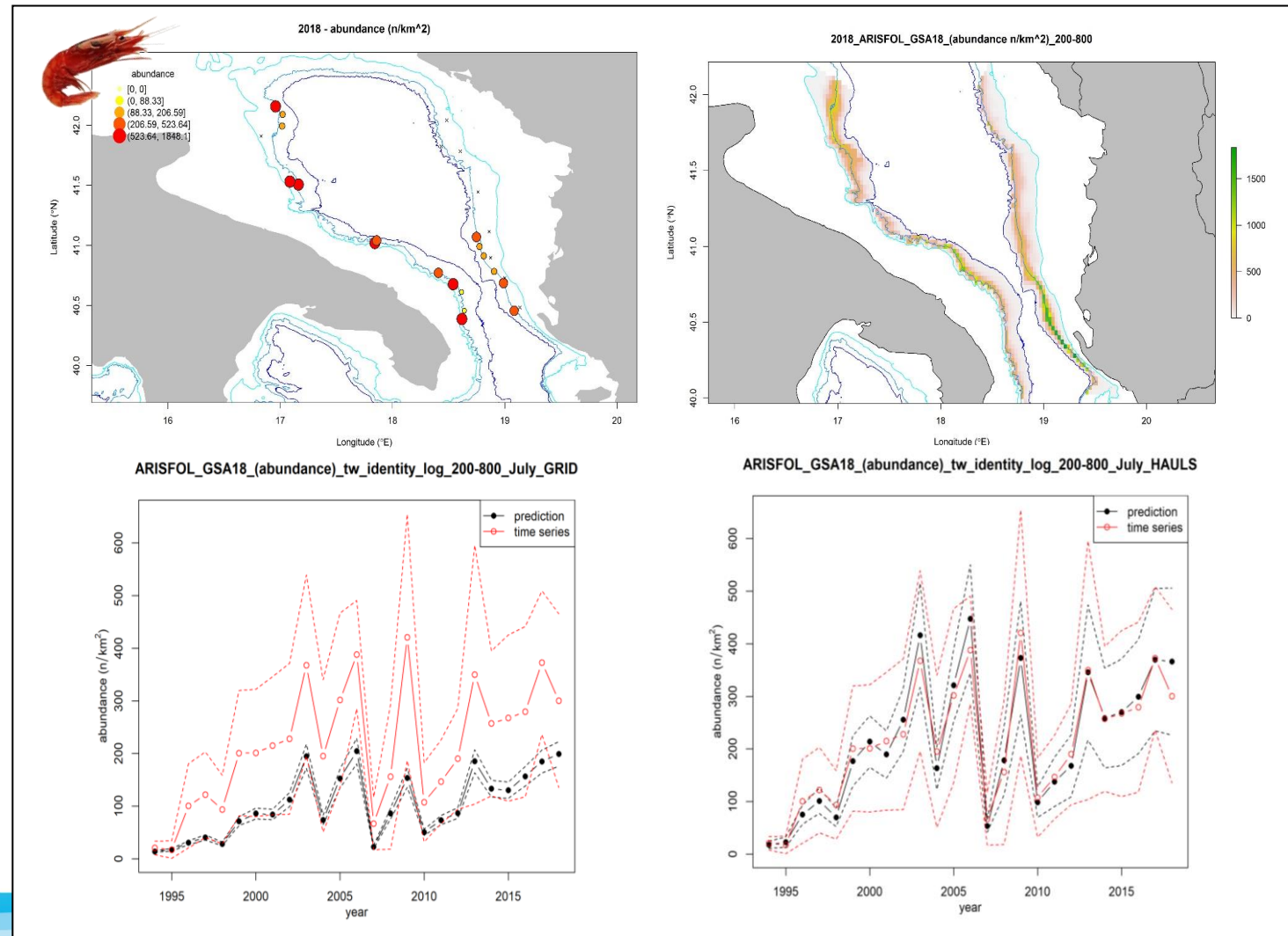
2 main reference periods (20 yrs) + 4 additional periods (5 yrs)

WP4 - The innovation approach of the FAIRSEA platform

BSTAT – Spatial distribution of marine resources

CoNISMa
Consorzio Nazionale
Interuniversitario
per le Scienze del Mare

These sub-modules (BSTAT GSA17, BSTAT GSA18, BSTAT GSA19) contain database of standardized indices and maps of commercial species distribution based on the knowledge from the past 20 years divided by GSAs.

Data are gathered from the main bottom trawl surveys conducted in the Adriatic Sea and in the Western Ionian Sea by several FAIRSEA partners:
MEDITS (GSA17,18,19) & **SOLEMON** (GS17)

Outputs from trawl surveys are provided thanks to specifically designed open source tools, as Rroutine BioIndex and BioStand (available at: https://www.coispa.it).

COISPA
Tecnologia & Ricerca
Stazione sperimentale per lo
studio delle risorse del mare

GSA17
Mullus barbatus
Illex coindetii
Merluccius merluccius
Micromesistius poutassou
Merlangus merlangus
Trachurus mediterraneus
Trachurus trachurus
Eledone moschata
Boops boops
Loligo vulgaris
Pagellus erythrinus
Trisopterus capelanus
Parapenaeus longirostris
Solea solea
Squilla mantis

GSA19
Mullus barbatus
Pagellus acarne
Trachurus trachurus
Merluccius merluccius
Parapenaeus longirostris
Illex coindetii
Phycis blennoides
Pagellus erythrinus
Micromesistius poutassou
Aristeus antennatus
Trachurus mediterraneus
Aristaeomorpha foliacea
Lophius budegassa
Pagellus bogaraveo
Helicolenus dactylopterus
Eledone cirrhosa
Nephrops norvegicus
Galeus melastomus

GSA18
Mullus barbatus
Merluccius merluccius
Illex coindetii
Spicara flexuosa
Trachurus trachurus
Parapenaeus longirostris
Spicara smaris
Apitrigla cuculus
Loligo vulgaris
Phicis blennoides
Micromesistius potassou
Pagellus erythrinus
Helicolenus dactylopterus
Bothus podas
Trachurus mediterraneus
Lophius budegassa
Eledone cirrhosa
Octopus vulgaris
Pagellus acarne
Boops boops
Todaropsis eblanae
Pagellus bogaraveo
Allotheutis media
Conger conger
Aristaeomorpha foliacea
Aristeus antennatus

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MARINE

BSTAT – Spatial distribution of marine resources

BioIndex folders contains plots and data table of biomass and abundance index together with temporal and spatial trend of key population state-indicators providing comparable information among the various GSAs.

1. bathymetric distribution
2. number of positive hauls to the species
3. the mean biomass index (kg/km^2)
4. the mean abundance index (number/km^2),
5. the inverse of mean abundance Coefficient of Variation (CV)
6. the mean individual weight (MIW)
7. the sex-ratio
8. the index of recruits (number/km^2)
9. the index of spawners (number/km^2)
10. the length at 95° percentile (L0.95)

WP4 - The innovation approach of the FAIRSEA platform
BSTAT – Spatial distribution of marine resources

BioStand folder contains plots and table outputs from the standardization procedure using Generalized Additive Models (GAM).

1. Standardized biomass index (kg/km^2)

2. Standardized abundance index (number/km^2)

3. Various model diagnostic plots

4. Maps of predicted spatial distribution

WP4 - The innovation approach of the FAIRSEA platform
BSTAT – Spatial distribution of marine resources

Spatial distribution of of interesting species in the GSA17 from MEDITS survey
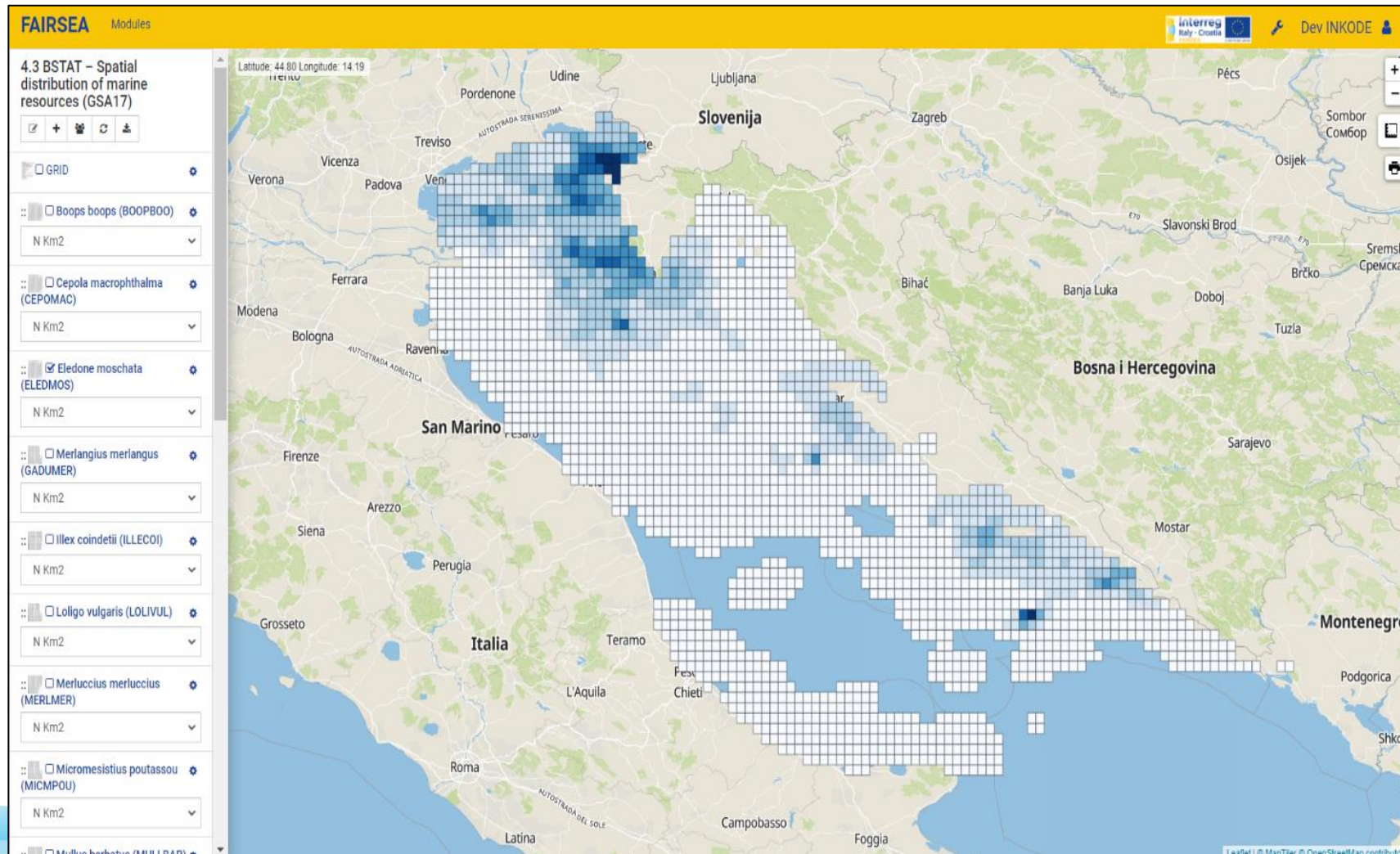
WP4 - The innovation approach of the FAIRSEA platform
FSTAT – Catches and fishing capacity by fleet segment

This module contains a dataset of fisheries dependent information including data for the last decade in terms of catches (both quantities and price), length frequency distribution (LFD) and fleet capacity (number, GT, LOA, and fixed and variable costs) by species and fleet segment.
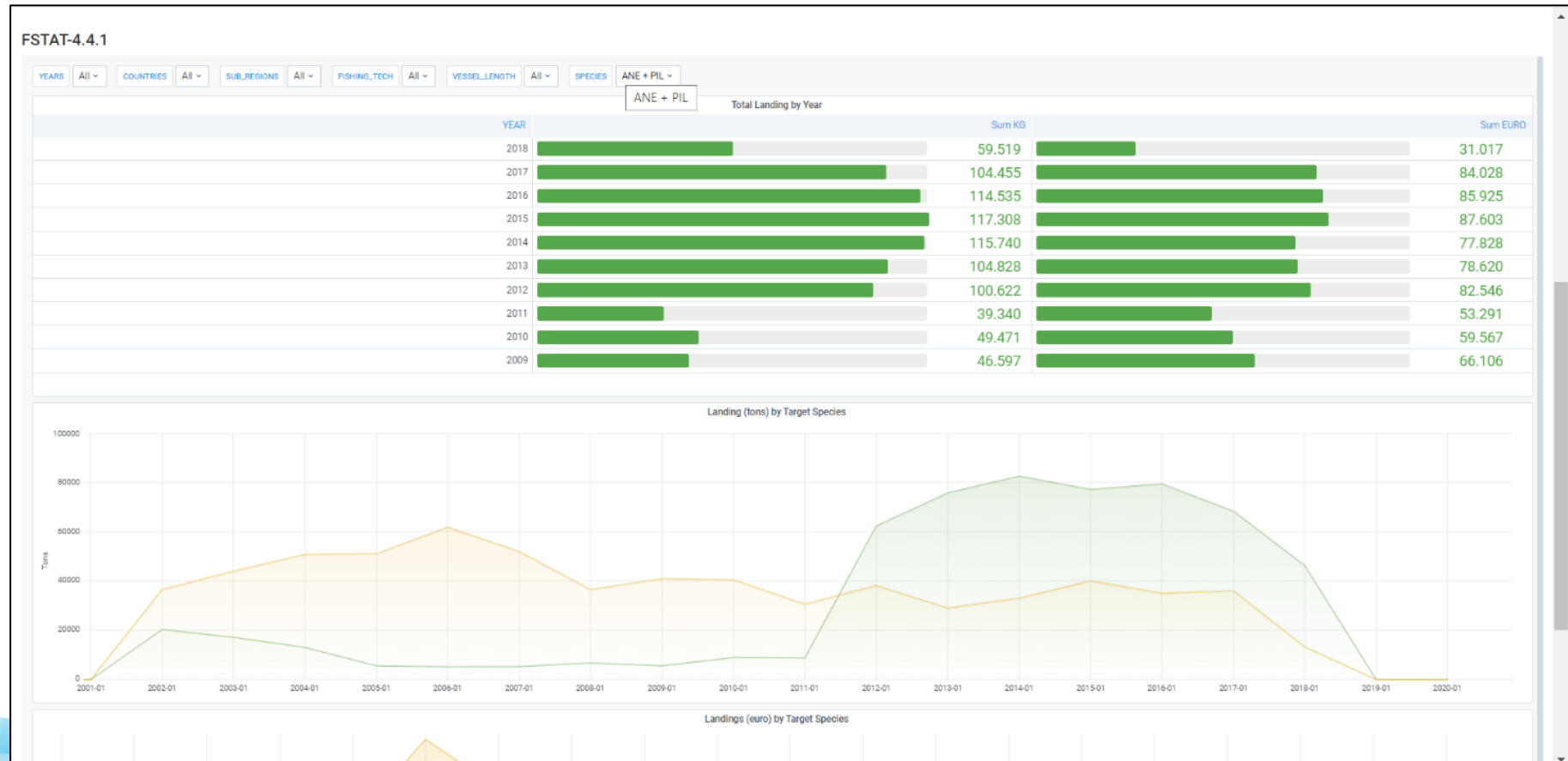
WP4 - The innovation approach of the FAIRSEA platform
EFFORT – Effort distribution and fleet displacement

This module contains fishing effort maps distribution by the main fishing segments obtained by VMS/AIS data on vessel displacement using the state-of-the-art **VMSbase** platform (Russo et al., 2014; D'Andrea et al., 2020)

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BIOECO – Effort distribution and fleet displacement

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This module will contains the output of different alternative management scenarios in the Adriatic-Ionian region obtained using **BEMTOOL** bio-economic model (Spedicato et. al 2016). This tool allows to set scenarios for evaluating how changes/shifts in population traits (e.g. natural mortality, growth), fishery-driven impacts (e.g. fishing mortality, population and gear 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.

BEMTOOL model includes 6 sub-modules:
a) biological;
b) impact;
c) socio-economic;
d) policy/harvest rules;
e) fleet behaviour;
f) MCDA.
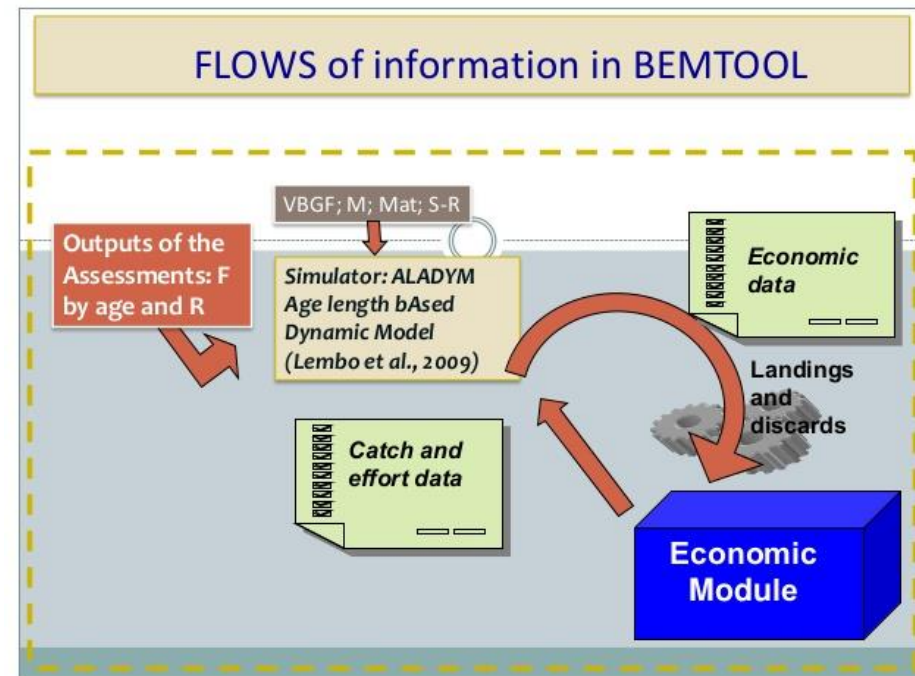
FLOWS of information in BEMTOOL

VBGF; M; Mat; S-R

Outputs of the Assessments: F by age and R

Simulator: ALADYM Age length bAsed Dynamic Model (Lembo et al., 2009)

Economic data

Landings and discards

Catch and effort data

Economic Module

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WP4 - The innovation approach of the FAIRSEA platform
BIOECO – Effort distribution and fleet displacement

MCDA (Multiple-criteria decision analysis) **:** allow the dynamic generation of different scenarios results under different management criteria (e.g. socioeconomic vs. biological objectives)
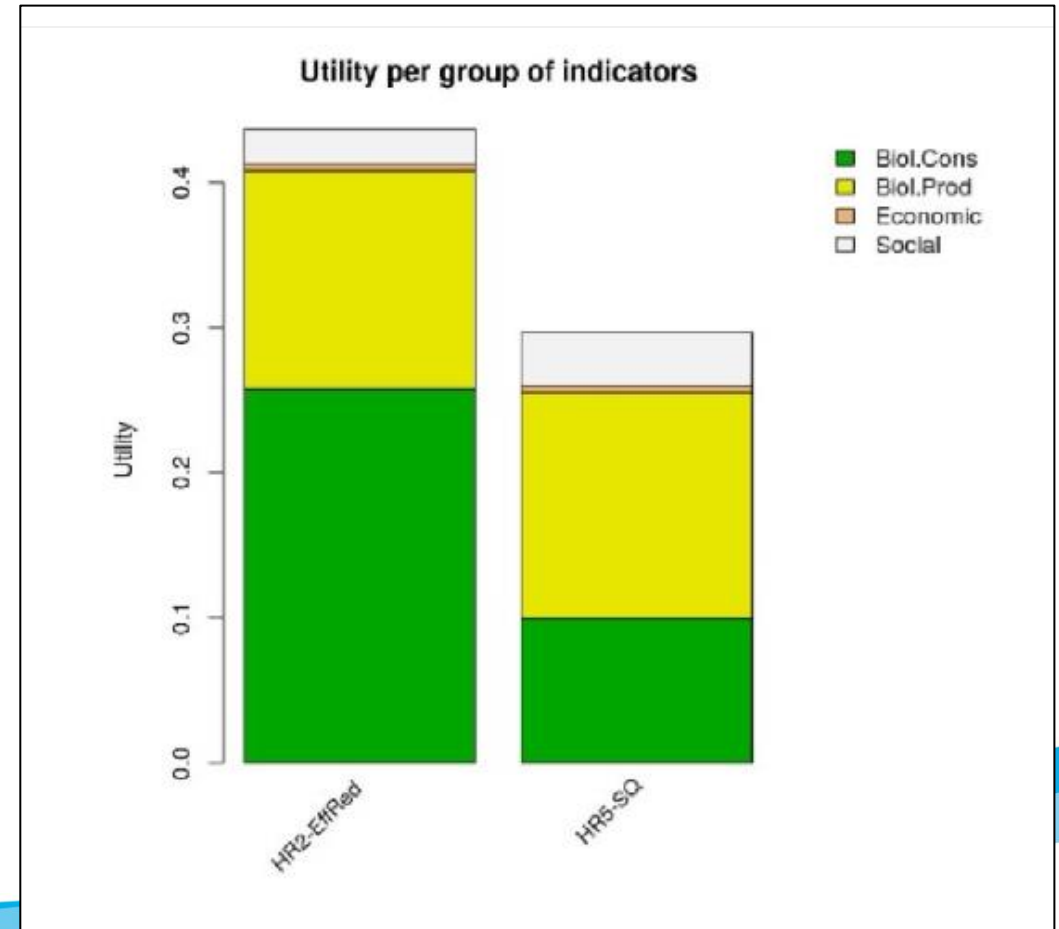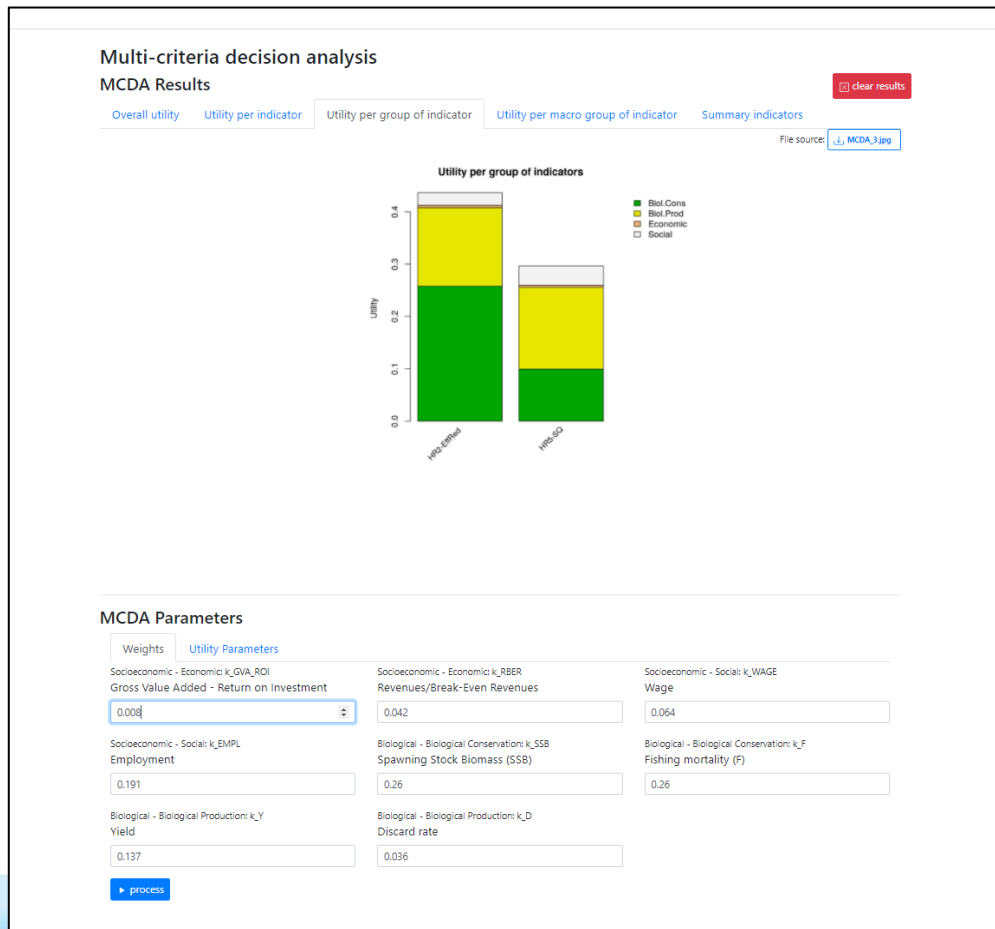
WP4 - The innovation approach of the FAIRSEA platform
FWM – Food web modelling

This module will contains the output from **Ecopath** approach applied to 3 food web models describing the trophic structure of the Adriatic and Ionian Sea.
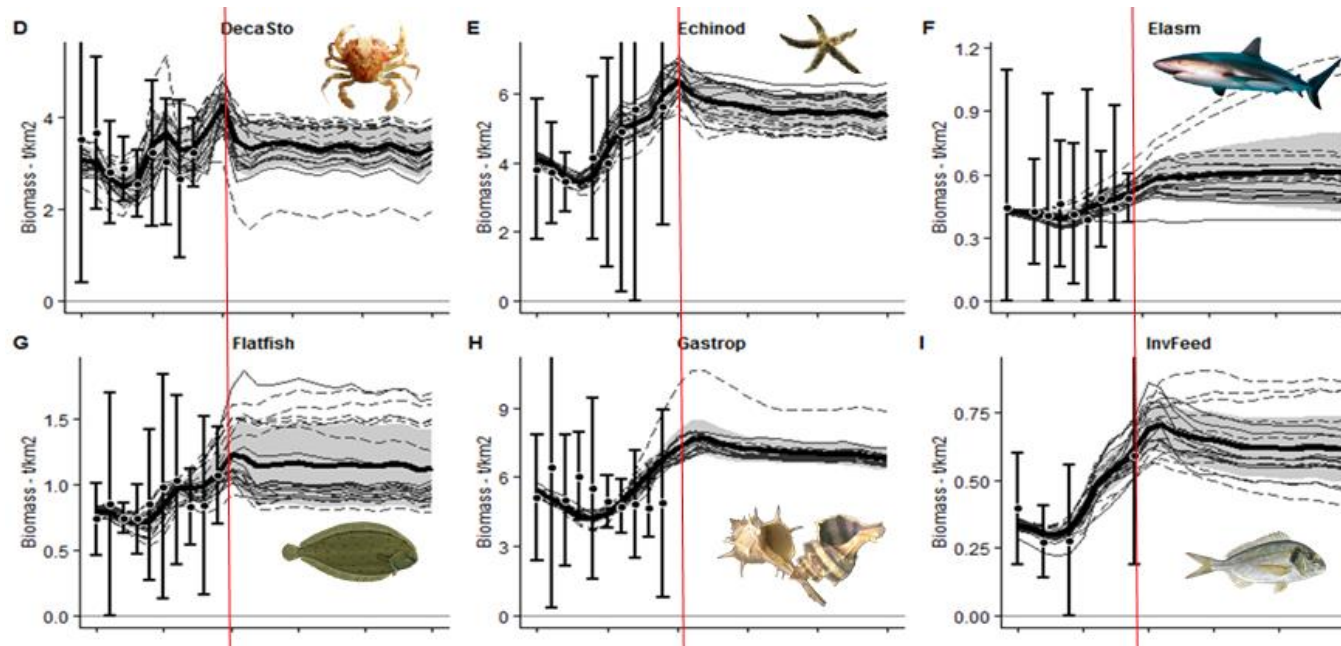
Example from the North Adriaic model (Celić et al. 2018)

WP4 - The innovation approach of the FAIRSEA platform
Summary Module

Interaction workspace between different modules. Possibility of simple calculations on the layers on a regional/county basis (mean, sum, min and max value)

WP4 - The innovation approach of the FAIRSEA platform

Alpha/testing version 0.8 running at
http://fairsea.caspar.inkode.it:8887/#/login

View-only credentials:

username → *viewer*

password → *fairsea2020*

THANKS for the attention

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