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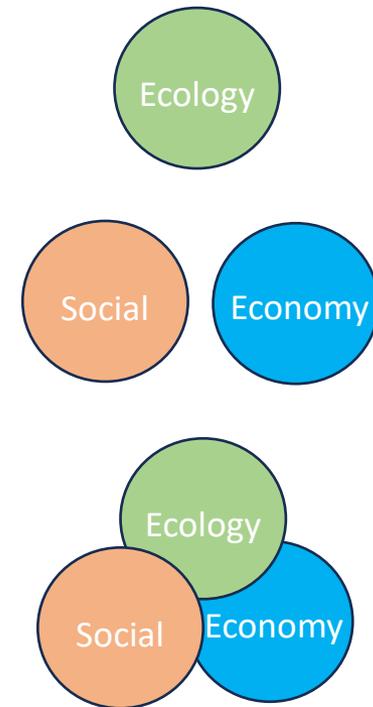
# Understanding the interactions between ecosystem, fisheries, aquaculture and offshore wind farms: the BEYOND contribution

Simone Libralato, Diego Panzeri, Davide Agnetta, Damiano Baldan, Vinko Bandelj, Sophie Burton Pogledic, Igor Celic, Fabrizio Gianni, Ivano Vascotto et al.

**OBJECTIVE:**

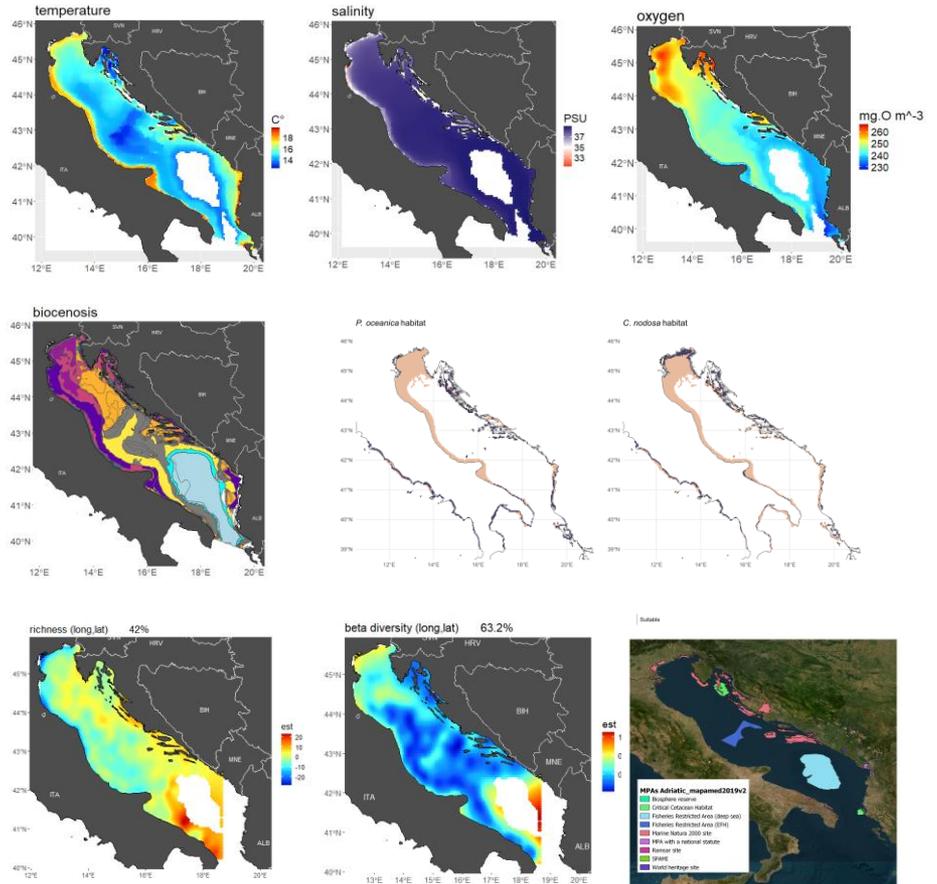
**Develop a comprehensive decision support tool that enable provision of recommendations for ensuring environmental sustainability and synergies of OWFs and other blue economy sectors. The work is composed by:**

- (1) Analysis of Ecosystem components** possibly interested/affected by Offshore Wind Farms in Adriatic Sea;
- (2) Analysis of Fishing and aquaculture activities** in potential areas for development of Offshore Wind farms in Adriatic Sea.
- (3) Represent the OWF into a spatial ecosystem modelling approach** for evaluating OWF effects on ecosystem and blue sectors (mainly fisheries and aquaculture).

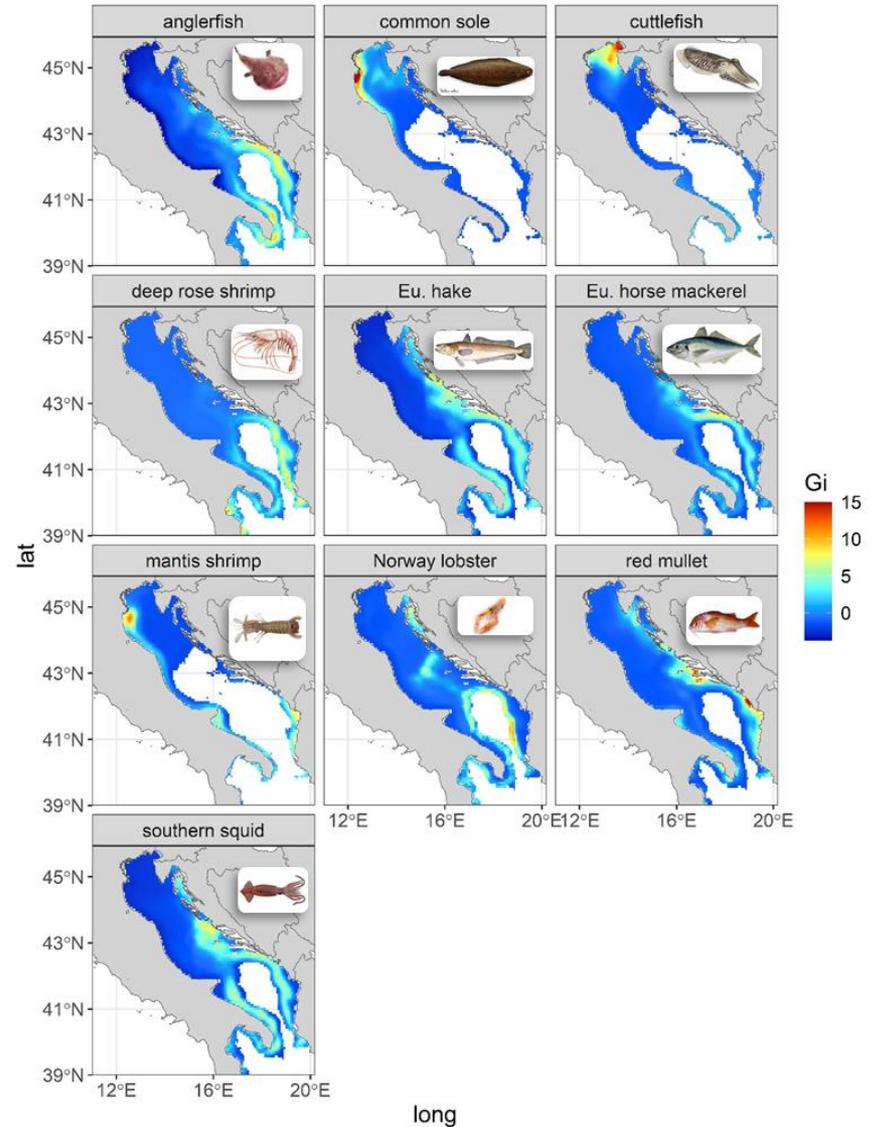


- Water characteristics
- Bottom habitats
- Seagrass habitats
- Benthic biodiversity
- Fish Species richness
- Fish species biodiversity
- Marine mammals distribution
- Seabirds migrating routes
- Sensitive & protected areas

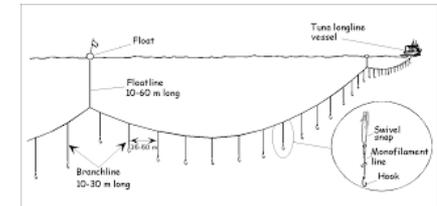
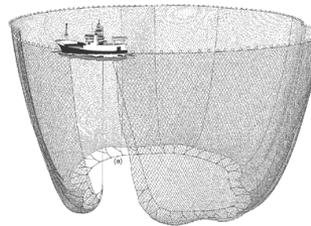
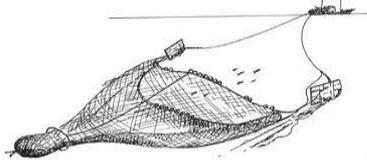
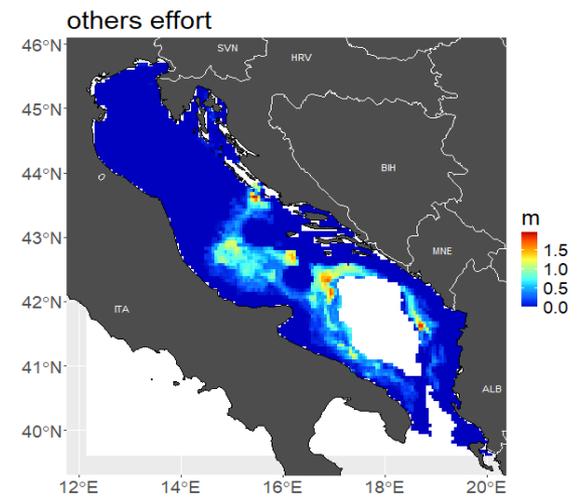
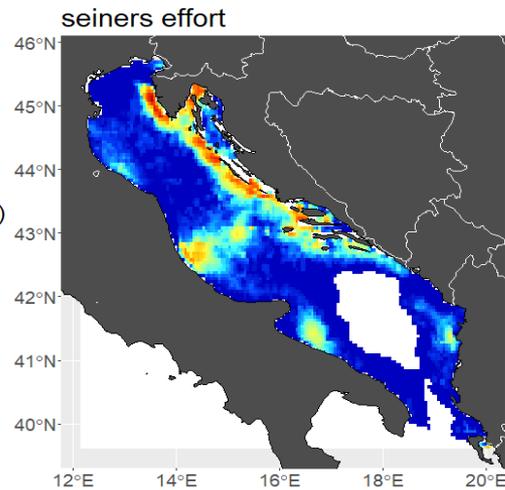
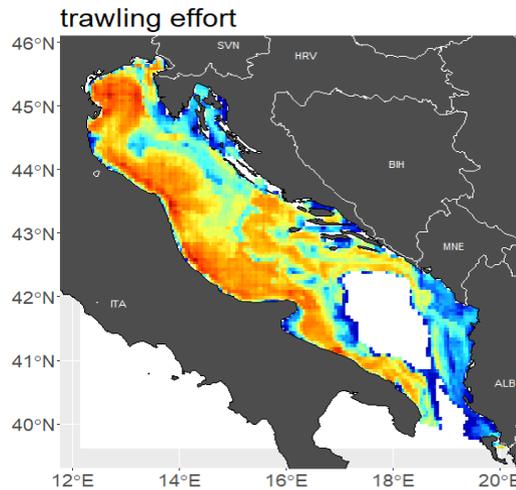
## Ecosystem analysis span over several layers of information that is under collection and analysis



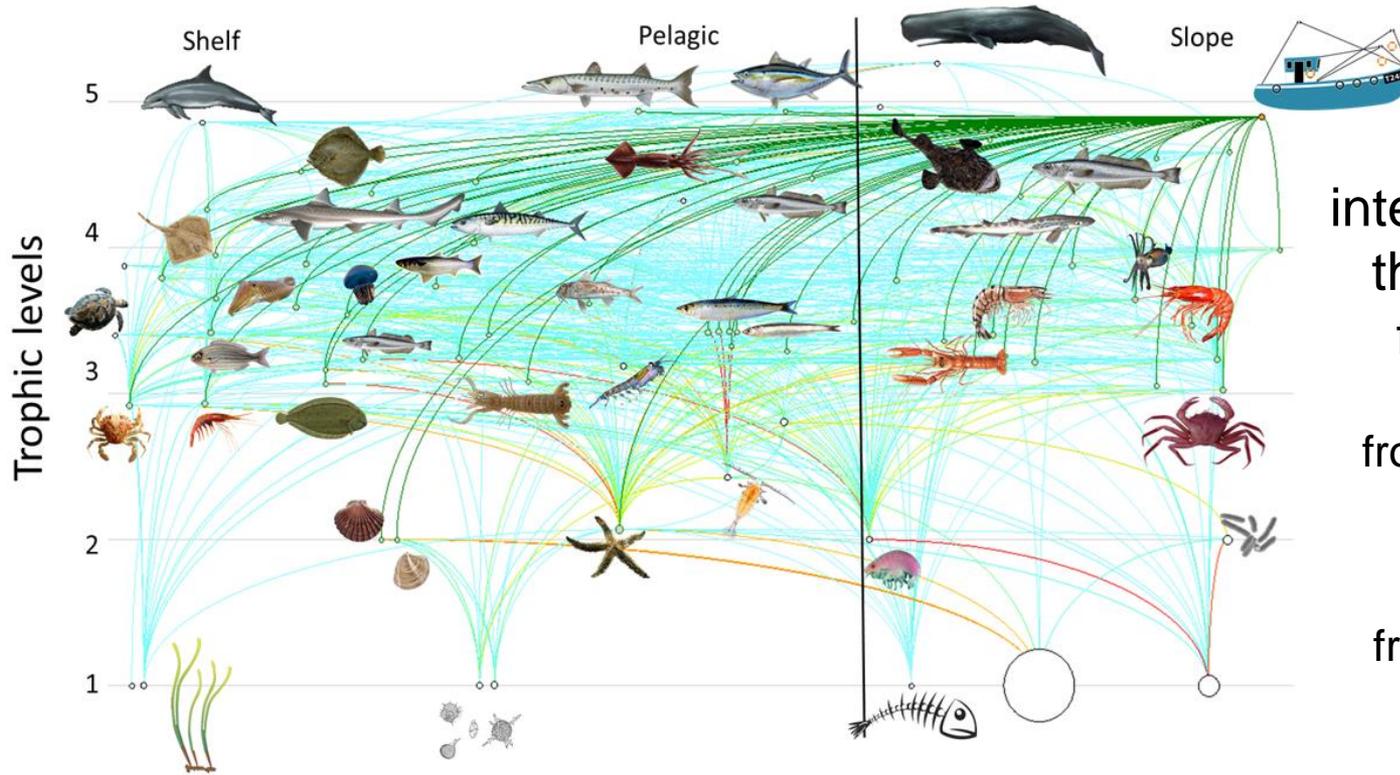
**Fisheries resource analysis will use best estimate of distribution of main fishing species in the domain using best available information (trawl surveys) and determining hot spots of aggregation for juveniles and adults as essential fish habitats**



**Fisheries analysis** will include representation of main fishing grounds determined using VMS and AIS information systems



# Embed all possible information in an already existing food web spatial model (Ecospace Adriatic Sea)



Trophic interactions on the Adriatic food web

from predators

**989**

from fisheries

**1252**

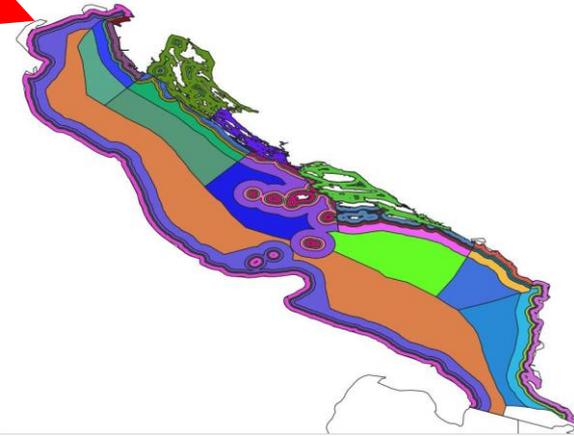
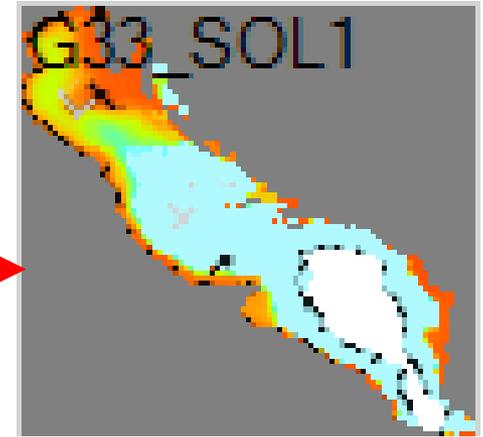
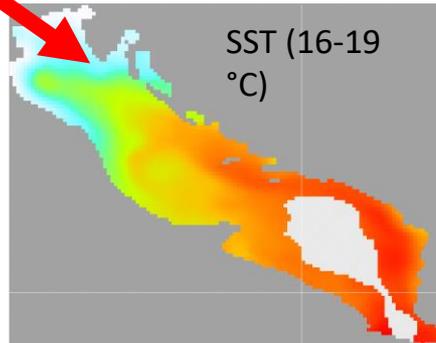
## Spatial modelling:

We **simulate** the spatial and temporal dynamics in a 2D space representing the Adriatic of:

- biological resources (73 functional groups)
- fishing activities (33 fishing fleets)

We **drive** the spatial and temporal dynamics using:

- environmental conditions, like temperature and salinity (from Copernicus)
- area restrictions, like no take zone



## Adriatic OWF case studies

- Gulf of Venice
- South of Istria
- Dalmatia, offshore Split
- Puglia region

# Include OWF Effects and responses using available data or other case studies



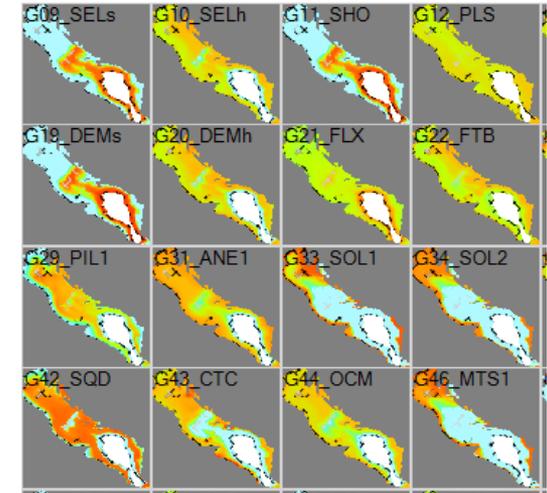
## How does ecosystem approach help identifying synergies between Blue sectors and OWF?



- Used for environmental impact assessment
- A tool for environmental management in European Union
- Assessment of cumulative and in-combination effects
- Analyze different management / environmental scenarios
- Help identify effective mitigation measures

### Case studies:

- Courseulles-sur-mer and Dieppe-Le Tréport offshore wind farm (Bay of Seine, English Channel),
- Natura 2000 site on land, construction of road and WF (Germany)
- Lysekil (Skagerrak)
- Gulf of Lion, floating offshore wind turbines (France)
- Rudong offshore wind farm (Jiangsu coast, China)
- Lanzarote-Fuerteventura ecosystem (Canary islands, Spain)

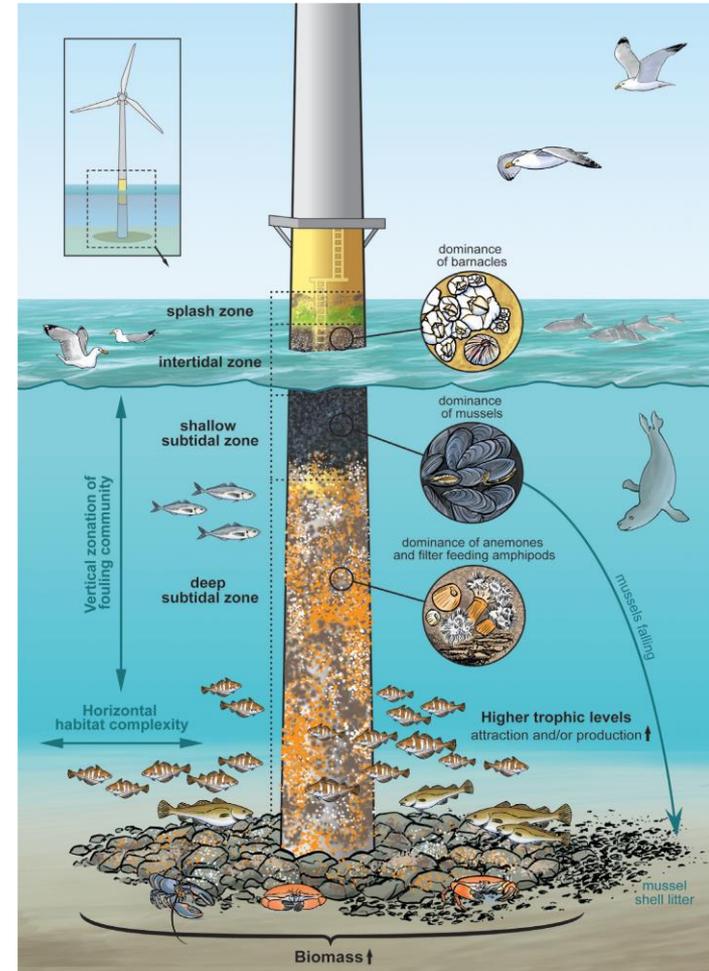


## Italy – Croatia



- **Added Vertical Substrate** (reef effect): attraction of benthic and cascading effects;
- **Shading/hiding features** (aggregating devices): attraction of fish and cascading effects
- **Physical barrier effects:** any infrastructure that hamper species presence or increase mortality (seabirds)
- **Underwater noise:** specific per species and by source, need information on noise fields and responses
- **Fishing restriction** (reserve effect) and cascading effects (spillover)
- **Transitional effects during OWF construction** (resuspension, noise, disturbance, habitat change)

To set properly the model some information from other systems can be used



### Potential effects to be highlighted?

- Increase of fishing opportunities in the surrounding by spillover to possibly compensate less trawlable area
- Potential increase of benthic species with the reef effect related to the installation of hard structures for the OWF
- Local complex ecosystem regime shift (modifying the abundance and diversity of species)

### How can we use the model?

- Assessment through the model of benefits and treats for the ecosystem from OWF development
- Assess duration of transitional effects due to construction
- Management options of fishing and aquaculture can be studied through scenarios and in general trade-offs among uses of the OWF space



Scenario analysis will be implemented involving Sustainable Blue Economy Labs (regional and transregional participatory groups)



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