European Commission

Food provision & Aquaculture assessments

Copernicus for Entrepreneurs and Developers

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

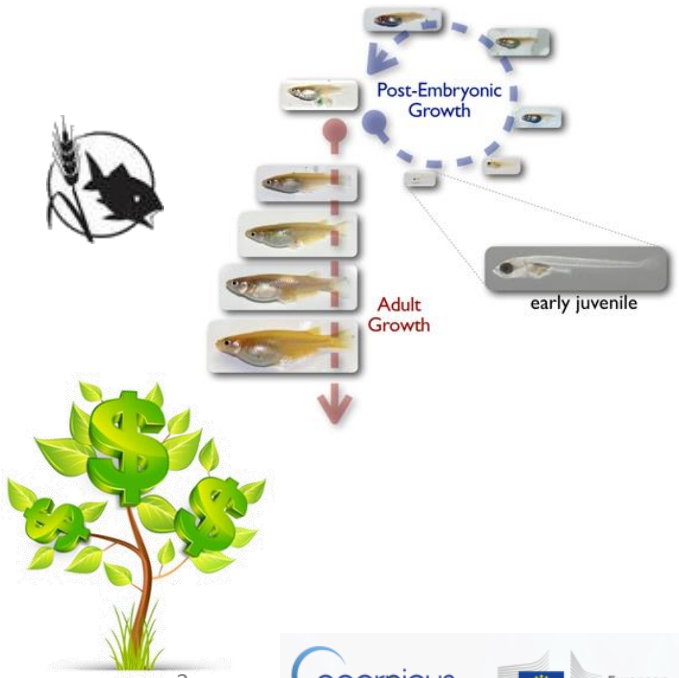
Authors: Emiliana Valentini, Andrea Taramelli, Federico Filipponi, Alessandra Nguyen Xuan & Nico Bonora

ISSUES TACKLED BY DEMONSTRATION

Food provision

The marine food provision assessment is aimed at:

- identify suitable fish growth conditions sites scenario
- estimate, among these sites, the potential fish growth rate



User Uptake

INTRODUCTION OF USE CASE 1

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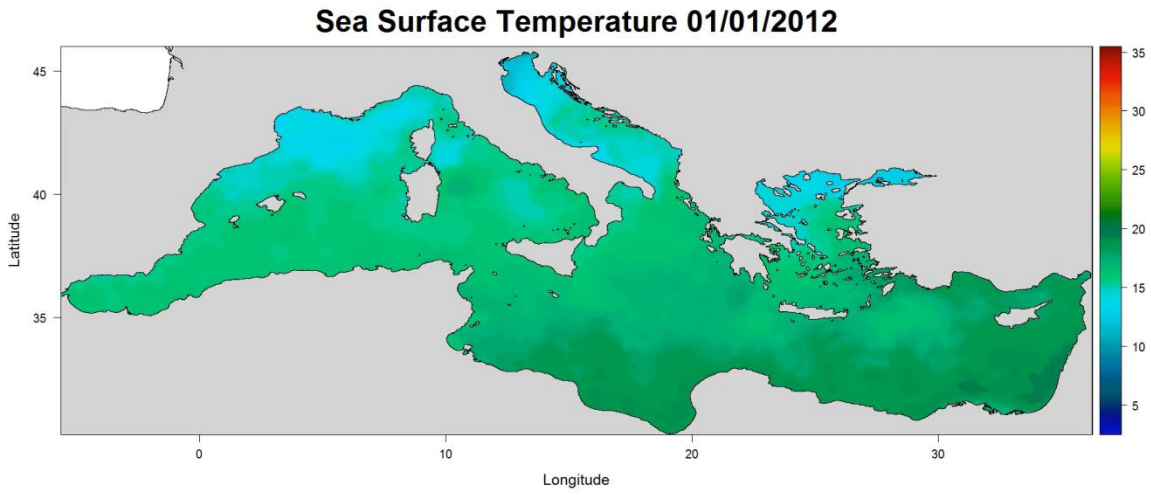
Area of Interest: Mediterranean Sea



Western and Eastern parts of Mediterranean Sea are seasonally different for both the salinity and the temperature

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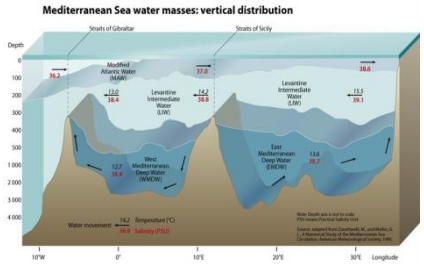
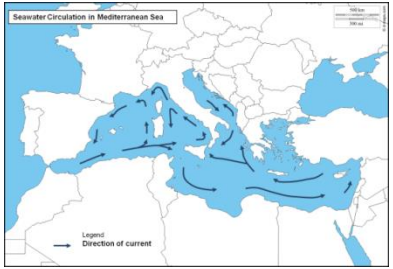
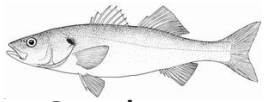
USE CASE 1: FACTS

User Uptake

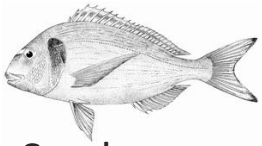
- **Selection of fish species (example):** sea bass and sea bream
- **Identification of relevant parameters** to characterize “fish vitality conditions”



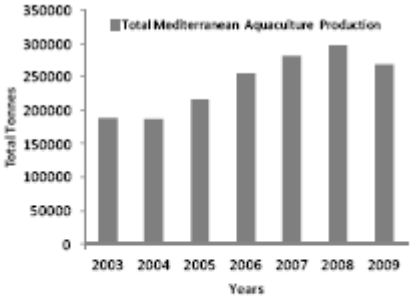




Sea bass



Sea bream



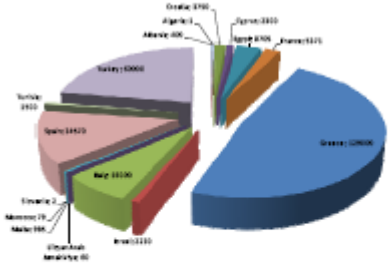


Figure - Mediterranean sea bass and gilthead sea bream production in aquaculture farms: a) temporal trend from [5] and b) production per country in 2009.

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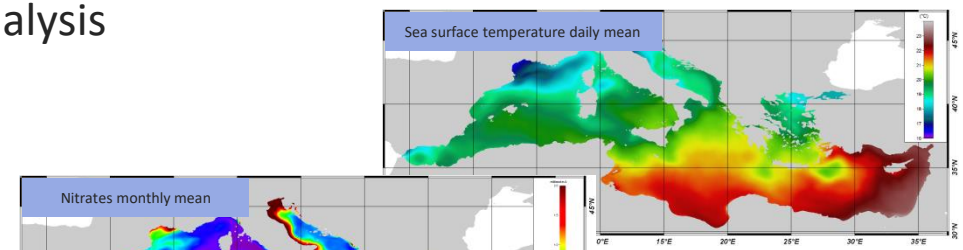
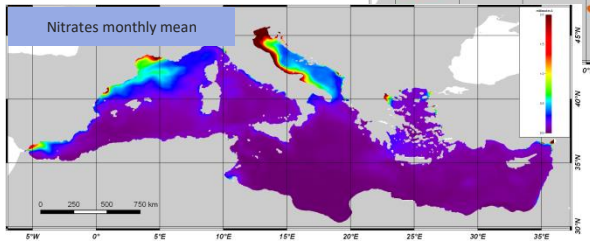
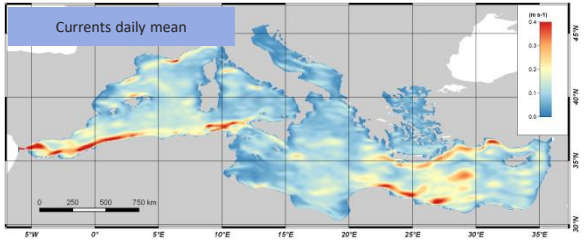
Used EO products: from observation and modeling

- Copernicus Marine Environment Monitoring Service (CMEMS) for spatial and temporal multiscale analysis

CMEMS
http://marine.copernicus.eu







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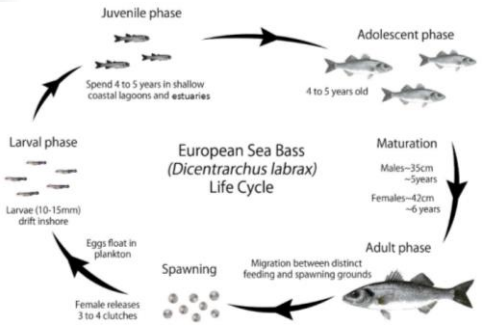
USE CASE 1 DATA ACCESS : OTHER DATA

- **Data from literature:** Coefficient for Fish weight (W) formula



A-b-t

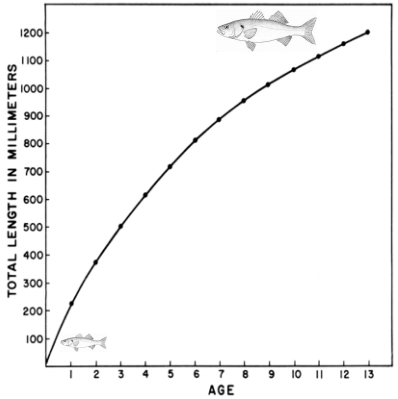


FIGURE 10 Growth rate of white seabass, fitted by the von Bertalanffy growth equation.

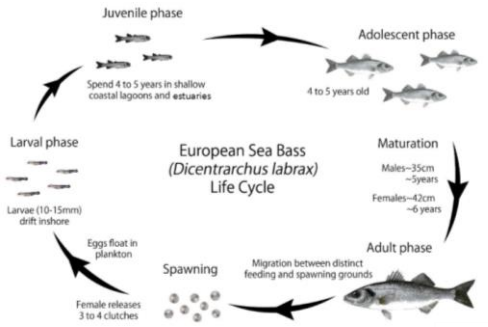
$$W_{t,y,f} = (\alpha W_{t-1,y,f}^{\beta} \cdot e^{T_{t-1,f}\tau}) + W_{t-1,y,f}$$

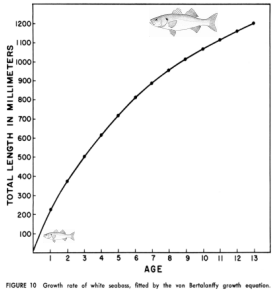
USE CASE 1 : REQUIRED KNOWLEDGE

User Uptake

Marine/Maritime expert knowledge:

- identification of relevant parameters to characterize “fish vitality conditions”
- definition of parameters threshold values (fish vitality constraints)





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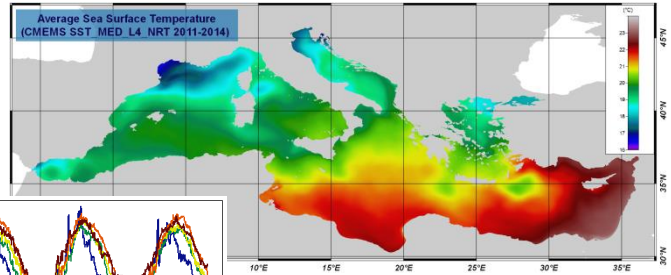
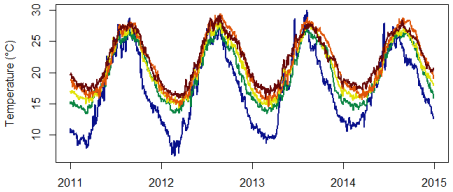
$$W_{t,y,f} = (\alpha W_{t-1,y,f}^{\beta} \cdot e^{T_{t-1,f}\tau}) + W_{t-1,y,f}$$

Technical knowledge:

- spatial and temporal analysis, frequency distribution and basic statistics, clip on use case area





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USE CASE 1: DEMONSTRATION

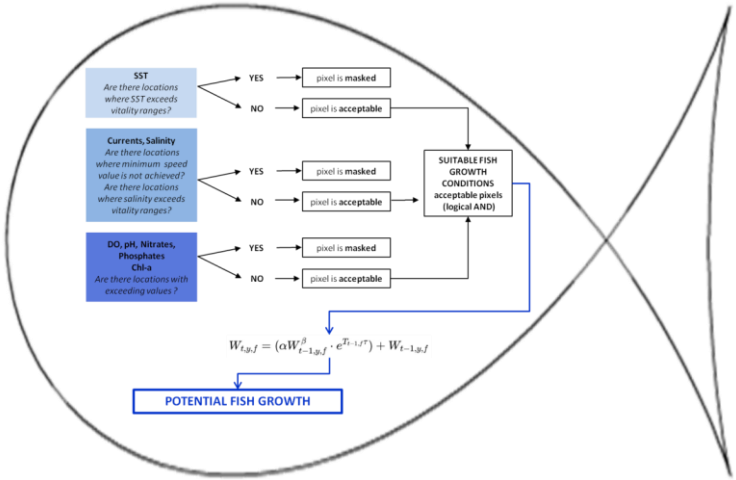
EO products used:

- Sea surface temperature (SST)
- Currents
- Salinity
- Dissolved Oxygen, pH, Nitrates, Phosphates, Chl-a

Tools used:

- A software for spatial and temporal analysis
- A software for management NetCDF data format

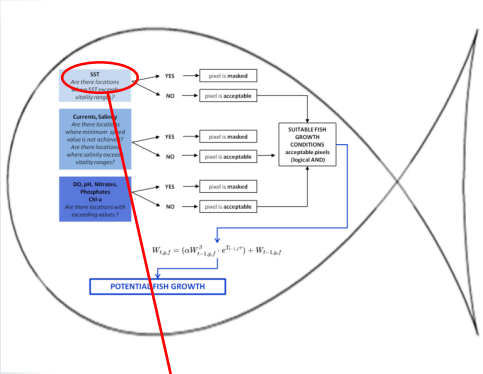
A DECISION MODEL IS NEEDED!

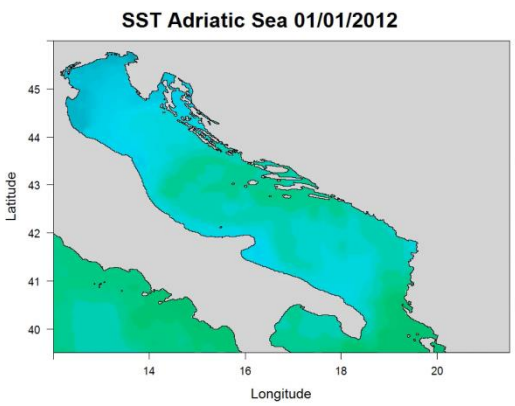


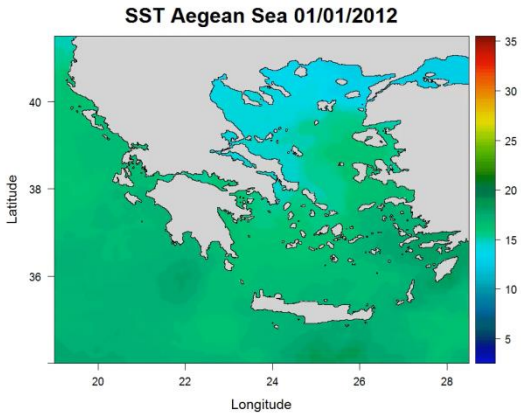
Source: Valentini, E., Filipponi, F., Nguyen Xuan, A & Taramelli, A. (2016). Marine food provision ecosystem service assessment using EO products. *Conference paper: ESA Living Planet Symposium 2016, Prague (Czech Republic)*

USE CASE 1: DEMONSTRATION

User Uptake





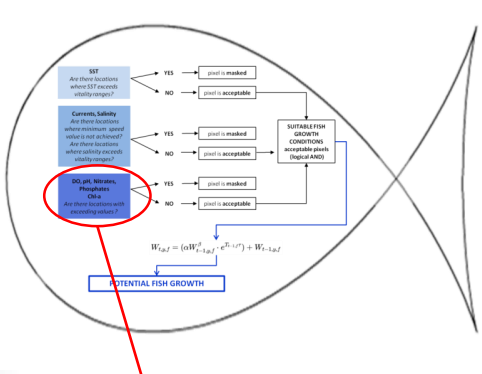


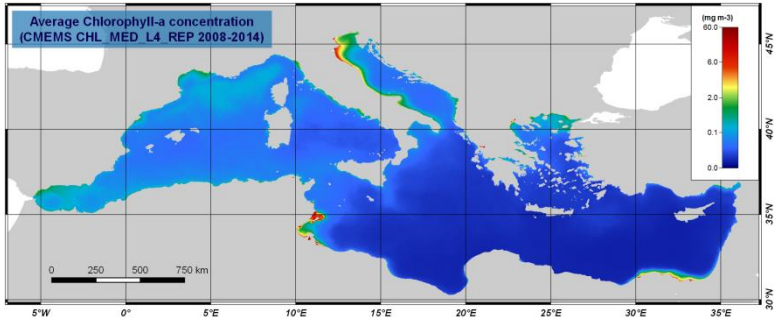
SEA SURFACE TEMPERATURE (SST)
Are there locations where SST exceeds vitality ranges?

According to temperature vitality min-max constraints we defined for sea bass and sea bream (5 and 30 °C) both Adriatic, Ionian and Aegean Sea can be considered as acceptable for the year 2012

USE CASE 1: DEMONSTRATION

User Uptake

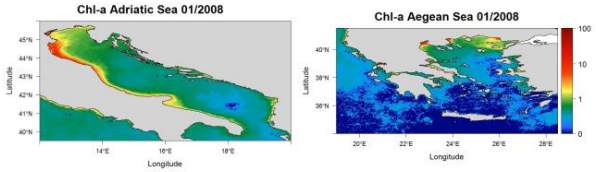




Mediterranean Sea is more oligotrophic in the eastern part than in the western

Chl-a

Are there locations with exceeding values ?



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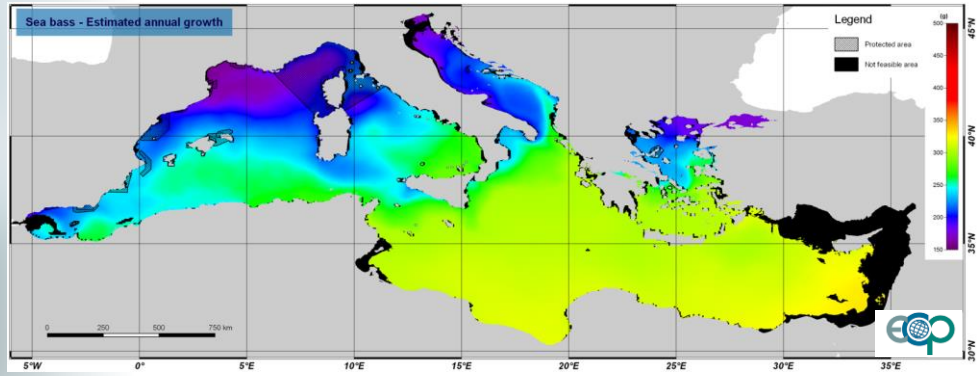
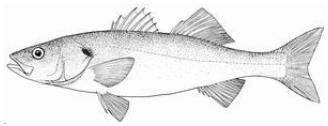
USE CASE 1: DEMONSTRATION

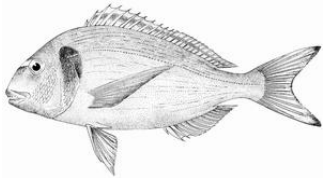
User Uptake

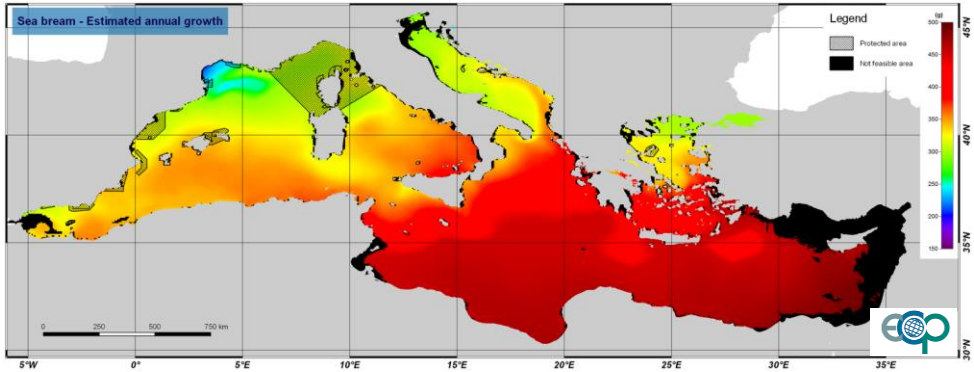




Annual Food provision service associated to Sea bass

ranges among 160 and 360 g y^{-1}





Annual Food provision service associated to Sea bream

ranges among 250 and 500 gy^{-1}

(on average higher than that of sea bass)

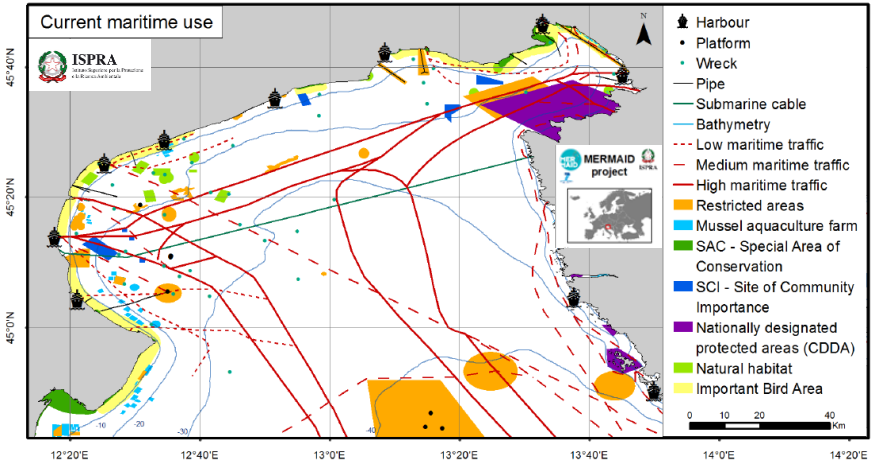
From: Valentini Emiliana; Filipponi Federico; Nguyen Xuan Alessandra; Passarelli Francesco Maria; Taramelli Andrea, 2016. Marine food provision ecosystem services assessment using EO products. Proceedings of: ' European Space Agency Living Planet Symposium', Prague (Czech Republic), 9-13 May 2016, ESA SP-740 (CD-ROM).

Aquaculture

The potential aquaculture assessment is aimed at:

[considering the actual competing uses of the maritime space]

- identifying sites with conditions feasible for aquaculture fish growth (feasibility scenario)
- assessing their different productivity performances in terms of potential fish harvest (suitability scenario)



User Uptake

INTRODUCTION OF USE CASE 2

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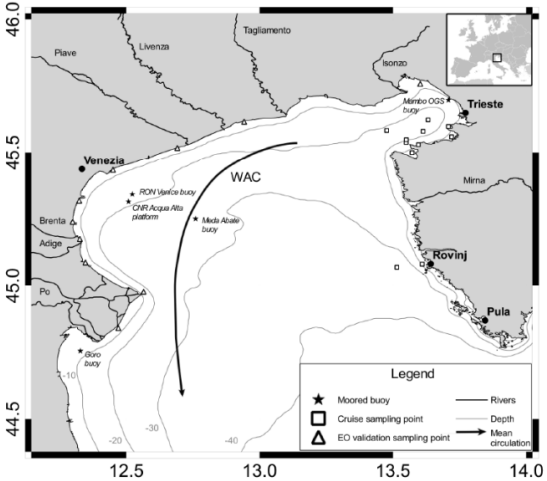
USE CASE 2: FACTS

Area of Interest: northern Adriatic Sea

- fish species selected (example): sea bass and sea bream
- relevant parameters to characterize “fish vitality conditions”
- evidence of overfishing
- shallow semi-enclosed shelf sea
- water turbidity due to river discharge
- surface temperature shows a seasonal cycle



Used EO products: from observation and modeling

- Copernicus Marine Environment Monitoring Service (CMEMS)
- Ocean Color archive
- MERIS (ENVISAT)

CMEMS
http://marine.copernicus.eu

MODIS
http://oceancolor.gsfc.nasa.gov

MERIS
http://merisfrs-merci-ds.eo.esa.int

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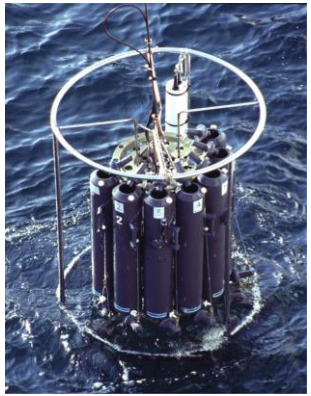
USE CASE 2 DATA ACCESS : OTHER DATA

Data Access

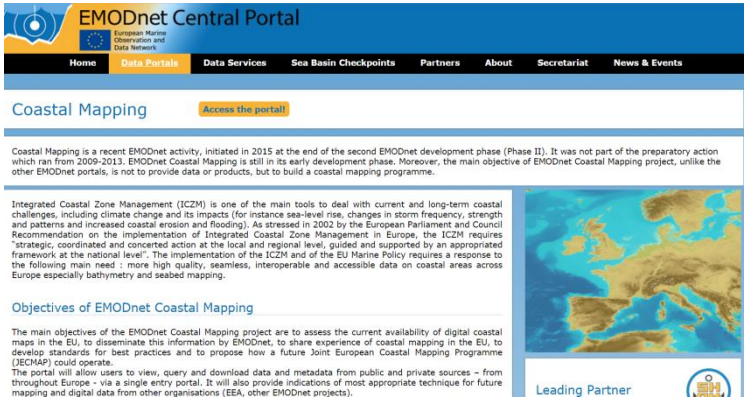
- **In situ data:** from platforms, buoys, EMODnet portal, regional database
- **Modeled data:** fish harvest estimates

Platform

Water sampler



EMODnet Portal: http://www.emodnet.eu/coastal-mapping



EMODnet Central Portal

European Marine Observation and Data Network

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Coastal Mapping

Access the portal!

Coastal Mapping is a recent EMODnet activity, initiated in 2015 at the end of the second EMODnet development phase (Phase II). It was not part of the preparatory action which ran from 2009-2013. EMODnet Coastal Mapping is still in its early development phase. Moreover, the main objective of EMODnet Coastal Mapping project, unlike the other EMODnet portals, is not to provide data or products, but to build a coastal mapping programme.

Integrated Coastal Zone Management (ICZM) is one of the main tools to deal with current and long-term coastal challenges, including climate change and its impacts (for instance sea-level rise, changes in storm frequency, strength and patterns and increased coastal erosion and flooding). As stressed in 2002 by the European Parliament and Council Recommendation on the implementation of Integrated Coastal Zone Management in Europe, the ICZM requires "strategic, coordinated and concerted action at the local and regional level, guided and supported by an appropriated framework at the national level". The implementation of the ICZM and of the EU Marine Policy requires a response to the following main need : more high quality, seamless, interoperable and accessible data on coastal areas across Europe especially bathymetry and seabed mapping.

Objectives of EMODnet Coastal Mapping

The main objectives of the EMODnet Coastal Mapping project are to assess the current availability of digital coastal maps in the EU, to disseminate this information by EMODnet, to share experience of coastal mapping in the EU, to develop standards for best practices and to propose how a future Joint European Coastal Mapping Programme (JECMAP) could operate.
The portal will allow users to view, query and download data and metadata from public and private sources – from throughout Europe - via a single entry portal. It will also provide indications of most appropriate technique for future mapping and digital data from other organisations (EEA, other EMODnet projects).

Leading Partner

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USE CASE 2 : REQUIRED KNOWLEDGE

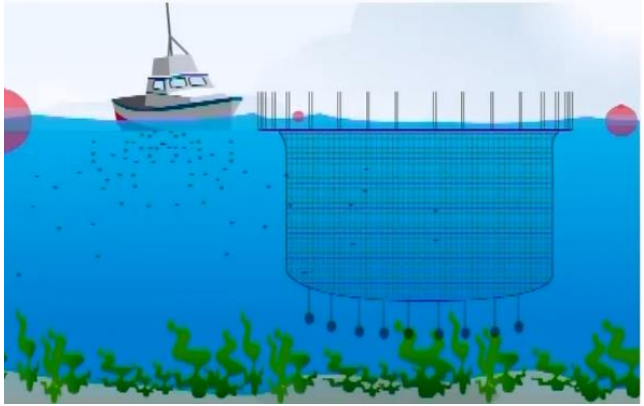
Marine/Maritime expert knowledge:

- Identification of relevant parameters to characterize “fish vitality conditions”, and plant/cages functioning conditions
- definition of parameters threshold values (fish vitality constraints)

Thresholds to define high turbid waters.

Parameter	Threshold Value	Reference
Chl-a	2.0 mg· m^{-3}	Hopkins *et al.*, 2013 [54]
TSM	3.0 g· m^{-3}	Petus *et al.*, 2014 [55]
CDOM	0.6· m^{-1}	Authors’ estimation *

* CDOM threshold concentration was statistically estimated by correlation analysis on the basis of TSM and Chl-a concentrations.



Technical knowledge:

- spatial and temporal analysis, frequency distribution and basic statistics, clip on use case area

USE CASE 2: DEMONSTRATION

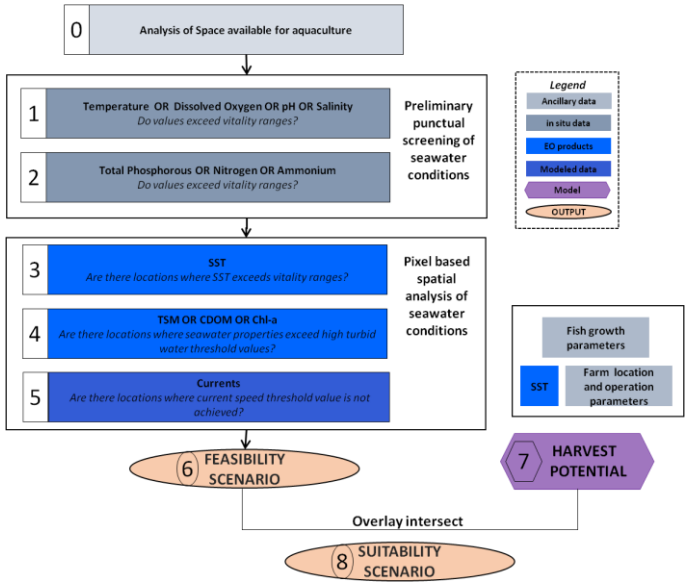
EO products used:

- Sea surface temperature (SST)
- Total Suspended Matter (TSM); Colored Dissolved Organic Matter (CDOM) and Chlorophyll,
- Currents

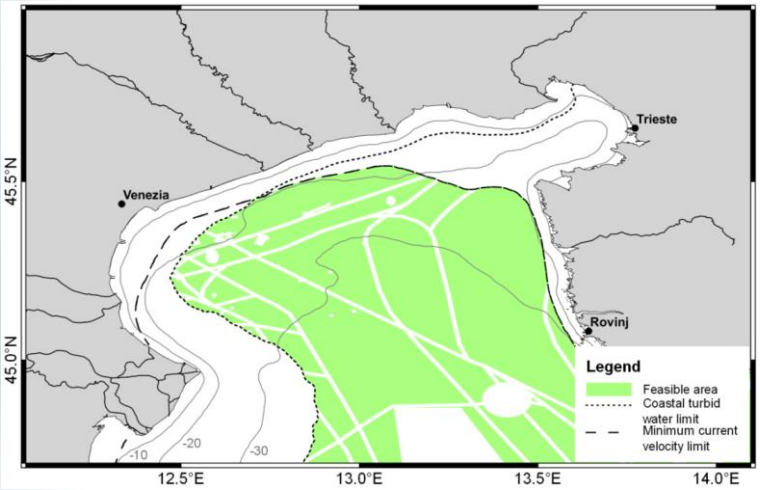
Tools used:

- A software for spatial and temporal analysis
- A software for management NetCDF data format

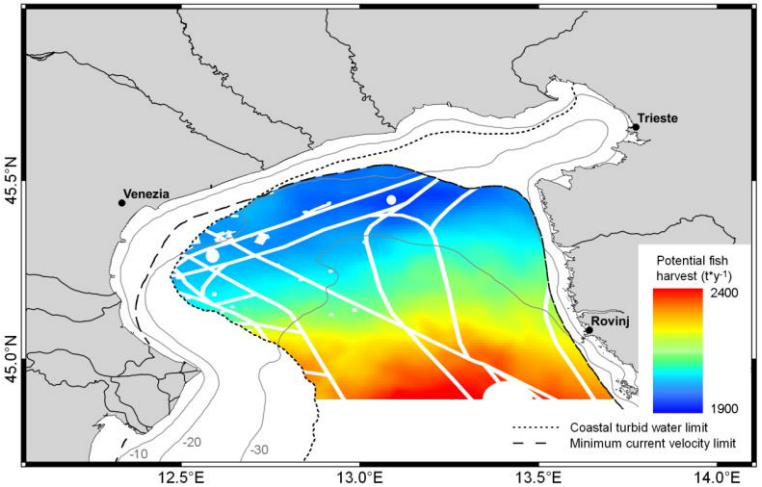
A DECISION MODEL IS NEEDED!



USE CASE 2: DEMONSTRATION



Feasibility scenario: sites with feasible conditions for aquaculture



Suitability scenario: potential fish harvest estimated within the areas identified as feasible for aquaculture

From: Valentini, E., Filipponi, F., Nguyen Xuan, A., Passarelli, F. M., & Taramelli, A. (2016). Earth Observation for Maritime Spatial Planning: Measuring, Observing and Modeling Marine Environment to Assess Potential Aquaculture Sites. Sustainability, 8(6), 519.

User Uptake

ACKNOWLEDGEMENT

The material included in this presentation is based on the results of EU-funded projects:

- **ECOPOTENTIAL**: “Improving future ecosystem benefits through Earth Observations”, grant agreement No 641762, H2020

  www.ecopotential-project.eu

- **MERMAID**: “Innovative Multi-purpose Offshore [illegible]ning, Design and Operation”, contract No 244104, FP7.OCEAN2011-1

User Uptake

THANK YOU

This Food provision & Aquaculture assessments Information Session is prepared by the Italian Institute for Environmental Protection and Research in the framework of the European Commission's Copernicus User Uptake initiative

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