# ECOAST kick-off meeting

Meeting venue: Ancona (Italy) – SEEPORT HOTEL
Date: 4th – 6th April 2016

## Final Agenda

### Monday 4th April

18.30 ***Icebreak welcome drink –*** LA CAPANNINA, Portonovo

### Tuesday 5th April

09.00 – 09.35 ***Registration***

09.35 – 09.40 **Welcome by project coordinator** **Fabio Grati**

09.40 – 10.10 **Roundtable Introductions**
Name, Institution, role in the project

10.10 – 10.20 **Brief overview of the ECOAST project** **Fabio Grati**

10.20 – 10.50 **Perspectives from COFASP** **Gianna Fabi**

10.50 – 11.20 ***Coffee break***

**Review of each Work Package in detail:** Presentation and discussion of the Work Package, with a focus on the deliverables and milestones, need for input from case studies, and need for input from other WP's and (vice versa) output to other WP's.

11.20 – 11.50 **WP1 –** Project management and dissemination
**Francesca Perretta, Rocco De Marco**

11.50 – 12.20 **WP2 –** Description of selected case studies in European Regional Seas. Mapping of productive marine areas and priority areas for fisheries and aquaculture
**Luca Bolognini, Roberto Gramolini**

12.20 – 14.00 ***Light lunch***

14.00 – 14.15 **CS1** – Adriatic Sea
**Michela Martinelli, Luca Bolognini**

14.15 – 14.30 **CS2** – Ionian Sea **Celia Vassilopoulou**

14.30 – 14.45 **CS3** – Black Sea **Laura Alexandrov**

14.45 – 15.00 **CS4** – Tyrrhenian Sea **Maria Grazia Finoia**

15.00 – 15.15 **CS5** – Baltic Sea **Francois Bastardie**

15.15 – 15.30 **CS6** – Norwegian Fjords **Thorleifur Agustsson**

15.30 – 15.45 **CS7** – NE Atlantic **Lúcia Guilhermino**

15.45 – 16.00 ***Coffee Break***

16.00 – 16.30 **WP3 –** Ecological footprint of fish farming in coastal areas: identification and response for improved management **Thorleifur Agustsson**

16.30 – 17.00 **WP4** – Identification of spatial synergies/conflicts between fisheries, aquaculture and other human activities and assessment of cumulative impacts of fisheries and aquaculture on coastal ecosystem components with special focus on priority conservation features **Celia Vassilopoulou**

20.00 ***Social Dinner*** – Ristorante MANDRACCHIO, Ancona

## Wednesday 6th April

9.30 – 10.00 **WP5 –** Analysis of fishermen's behavior to spatial management options and assessment of the economic and ecological performance of alternative spatial plans **Francois Bastardie**

10.00 – 10.30 **WP6 –** Identification of spatial and temporal potentials and limitations for the integration of fisheries, aquaculture and other activities in the coastal areas (through stakeholder consultation) **Erik Olsen**

10.30 – 11.00 ***Coffee Break***

11.00 – 12.00 **Conclusions and Plan of Action (timelines, future meetings)**

12.00 – 15.00 ***Light lunch & Departure***

# ECOAST
# New methodologies for an Ecosystem approach to spatial and temporal management of fisheries and aquaculture in COASTal areas

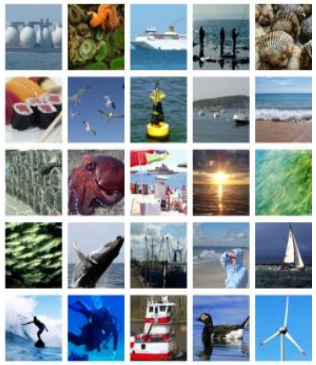
ERA-net COFASP second call
1st March 2016 – 28th February 2019

COFASP Call Topic: *Resource optimisation, mapping and reduction of ecological footprint, environmental sustainability of aquaculture, fisheries and seafood processing and interaction with other production*

Scope (trans-sectorial): *Developing methodologies and models to determine and manage the impacts of a multitude of activities at the appropriate ecosystem geographical and time scale (coastal fisheries and aquaculture)*

…the context

Human activities are causing exceptional environmental changes for coastal and marine ecosystems. Pressures from fishing, aquaculture, loss and degradation of sensitive habitats, and invasions of alien species are growing worldwide.



General aim:

*Merge ecological, social and economic approaches within a unified framework to provide overall information for future development of fisheries and aquaculture in coastal areas, also including spatial conflicts with other users and the stakeholders' point of view*

Specific objectives:

- to map productive marine areas and priority areas for fisheries and aquaculture;
- to assess the interaction of fisheries and aquaculture with other human activities;
- to assess the cumulative impact of fisheries and aquaculture on ecosystem components with special focus on priority/sensitive habitats;
- to measure economic and ecological performance of alternative spatial plans by scenario evaluations including delineating locations and space limits that ensures certain levels of production to local fishers and farmers;
- to develop an operational modelling framework to analyse stakeholders' behavior and predict their likely responses to spatial management options;
- to assess common opportunities and obstacles to integrate fisheries and aquaculture in MSP based on stakeholder consultations.

# Work plan

WP6

WP3 - WP4 - WP5

WP2

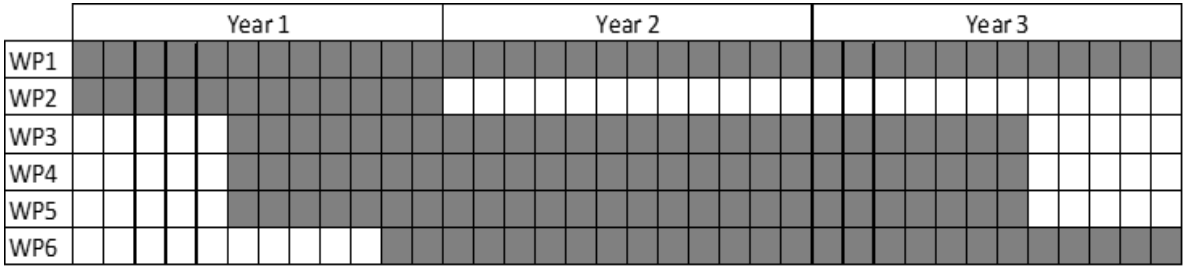
CS1 CS2 CS3 CS4 CS5 CS6 CS7

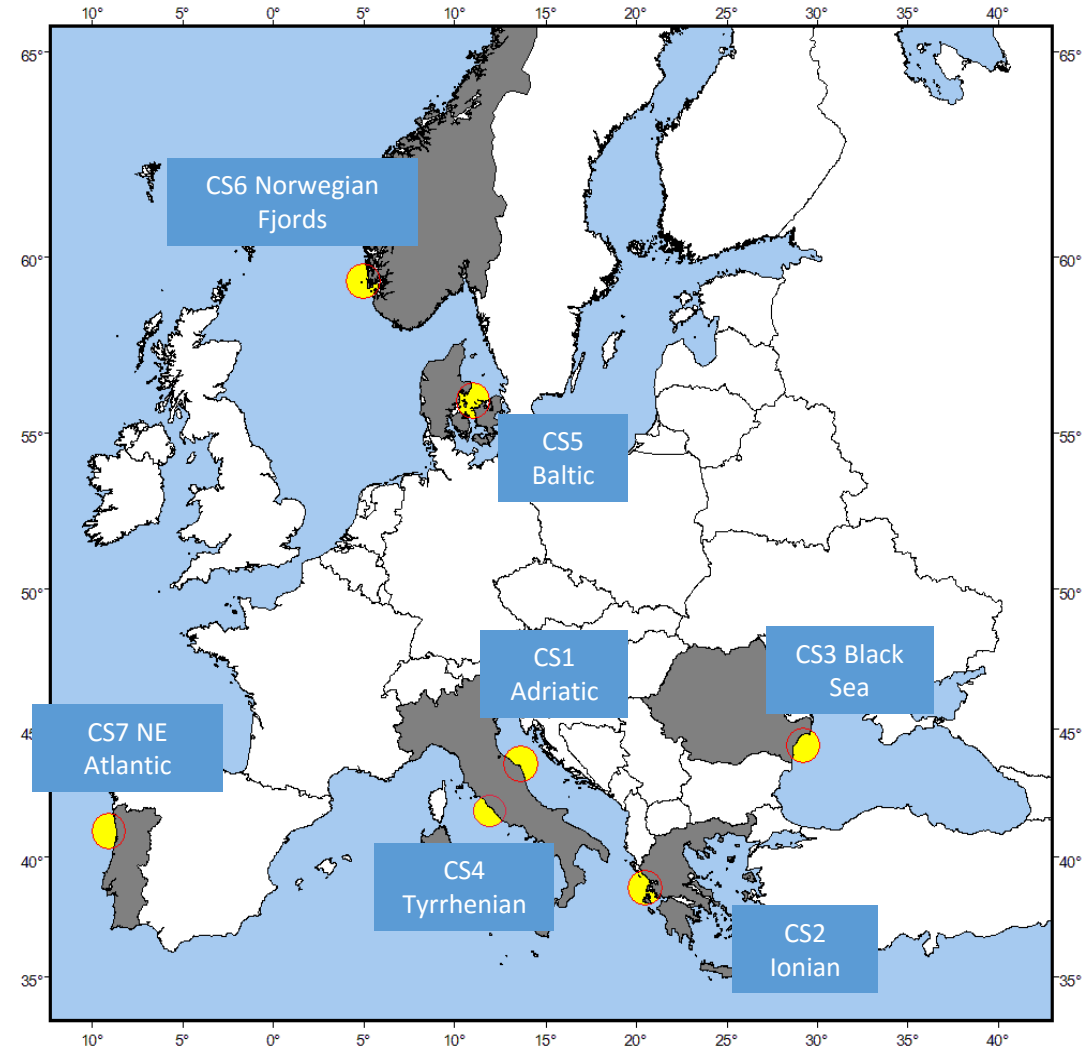
Future scenarios (stakeholder consultation)

- Aquaculture
- Fisheries
- Spatial analysis

Coordination and data management (GRID)

7 Case studies






Europe is surrounded by four sea regions: the Mediterranean, Black and Baltic Seas, and the North Atlantic Ocean which also includes the North Sea.

ECOAST's objectives will be addressed to various extends in seven case studies where there are requirements for sustainable and profitable activities from multiple human activities, especially fisheries and aquaculture.

*…the wide geographical spread of study areas suggest that the outputs of this work will be transferable or largely transposed to other areas of Europe…*
(evaluation report)

# COFASP ERA-NET

## Strengthening cooperation in European research on sustainable exploitation of marine resources in the seafood chains - ERANET

by

Gianna Fabi

CNR - Institute of Marine Sciences

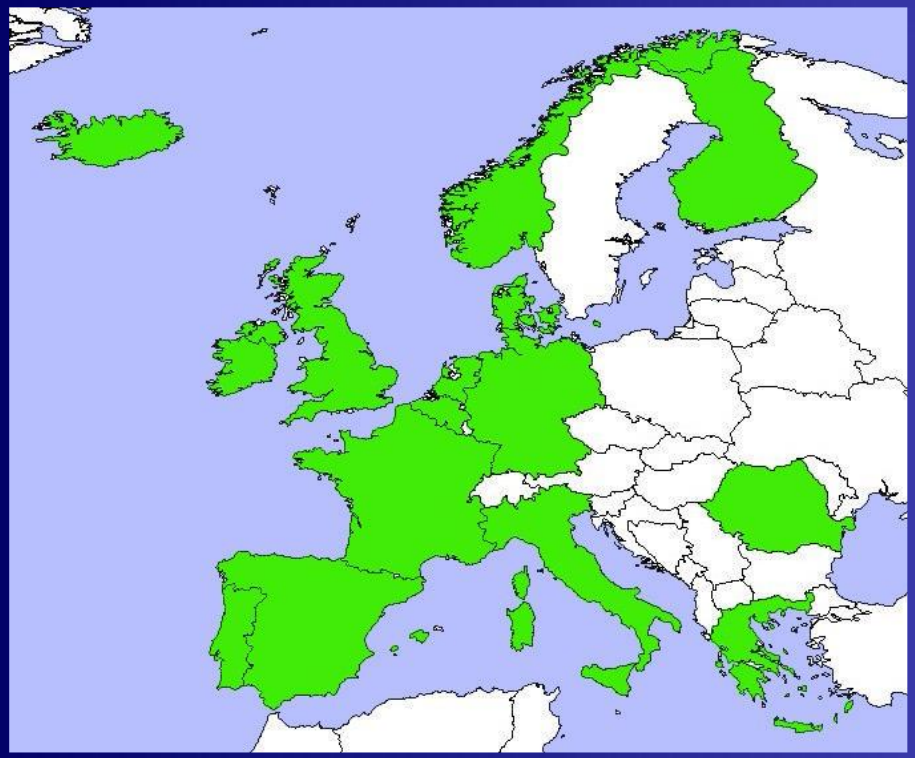
# COFASP OVERVIEW

**Project coordinator:** Niels Gøtke; DASTI, Denmark

**Start:** 1st Feb 2013

**End:** 31st Jan 2017

**Budget:** 2,852,227 €
(1,999,912 € contribution from EC)



## COFASP PARTNERSHIP

13 Member States
2 Associated Countries
(Norway and Iceland)

**26 partners**

13 Institutes
12 Agencies
1 International Organization
+
3 Subcontractors
EFARO (DLO), EurOcean (CNR), 727 (DASTI)

# PARTICIPANTS

1 DASTI - Danish Agency for Science, Technology and Innovation - Denmark
2 CNR - Department of Earth and Environment National Research Council of Italy
3 ICES - International Council for the Exploration of the Sea - Europe
4 FHF - Norwegian Seafood Research Fund - Norway
5 Tecnalia AZTI - Fundacion Azti/Azti Fundazioa - Spain
6 BLE- Bundesanstalt für Landwirtschaft und Ernährung Organisation - Germany
7 BMELV - Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz Organisation - Germany
8 DLO - Stichting Dienst Landbouwkundig Onderzoek - The Netherlands
9 RANNIS - The Icelandic Centre for Research - Iceland
10 IFREMER - French Research Institute for Exploitation of the Sea - France
11 UEFISCDI - The Executive Agency for Higher Education, Research, Development and Innovation funding - Romania
12 RCN - The Research Council of Norway
13 ANR - Agence Nationale de la Recherche - France
14 DEFRA - Department for Environment, Food and Rural Affairs - UK
15 Scottish Ministers - Scottish Ministers acting through Marine Scotland - UK
16 IEO - Instituto Español de Oceanografía - Spain
17 H.C.M.R. - Hellenic Centre for Marine Research - Greece
18 GSRT - General Secretariat for Research and Technology - Greece
19 FCT - Fundação para a Ciência e a Tecnologia - Portugal
20 MI - Marine Institute - Ireland
21 FGFRI - Finnish Game and Fisheries Research Institute - Finland
22 DAFA - Ministry of Food, Agriculture and Fisheries, Danish AgriFish Agency - Denmark
23 ILVO - Institute for Agricultural and Fisheries Research - Belgium
24 DTU Aqua/ DTU Food - National Institute of Aquatic Resources and National Food Institute, Technical University of Denmark
25 MATIS - The Icelandic Food and Biochtech R&D - Iceland
26 ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale - Italy

# OBJECTIVES

To strengthen cooperation and synergies between major European funding agencies that support research on sustainable exploitation of marine renewable resources

- To lay the basis for exploitation according to the precautionary principles and to enhance innovation in and competitiveness of the primary sectors fisheries and aquaculture as well as subsequent seafood processing and distribution to the consumer

- To define the science, information and data necessary to underpin the revision of the CFP and to ensure its successful implementation by designing complementary national research programmes and outlining monitoring and information/data sharing systems needed

# INPUTS to / from COFASP

Recent and existing ERA-NETs i.e. MariFish & SEAS-ERA

Managers Stakeholders Intern. Organiz. (e.g., SCARFISH)

**COFASP**

- Inventories
- Results from common activities
- Established links between policy-science and science-industry
- Experience from launching common calls
- Experience and best practices for science communication

Continuation, implementation, extension

advice on fisheries, aquaculture and seafood research priorities and infrastructure needs

- Implementation of national programs and Horizon 2020
- National implementation of the European Maritime and Fisheries Fund (2014-2020)
- Implementation of programming initiatives, e.g. SCAR SWG, SEAS-ERA, BONUS, JPI Oceans
- Implementation of the MSFD
- Enhance the dialogue with other maritime sectors
- Prepare the fisheries and aquaculture research for requests in the process of MSP

# Work packages

WP1 – Inventory and strategy (for strengthened cooperation) (Leader: CNR, Italy)

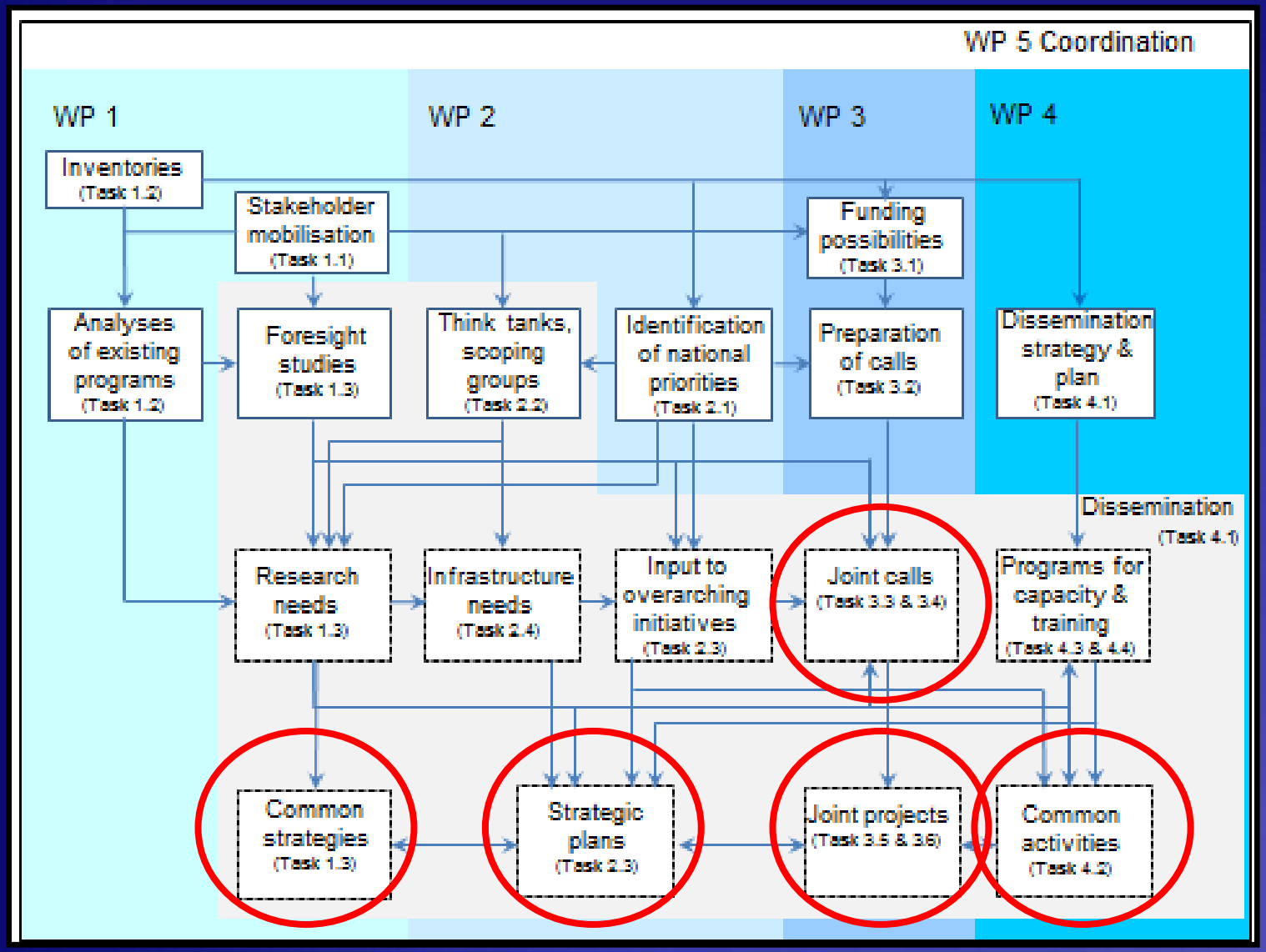
WP2 – Towards Common Programmes (Leader: Rannis, Finland)

WP3 – Joint calls on applied research and in support to advice (BLE, Germany)

WP4 – Dissemination and Capacity Building (CNR, Italy)

WP5 – Management (DASTI, Denmark)

# Major tasks and expected outputs



# CASE STUDIES

In 2015 COFASP organized a series of Case Studies within the sectors of Fisheries, Aquaculture, Seafood Processing, and EMFF

**WORKSHOPS with Experts and Stakeholkeders**

- 23-24 April 2015 (Brussels, Belgium): European Seafood processing challenges – Stakeholder Conversation
- 12-14 May 2015 (Rome, Italy): Regional differences in Aquaculture workshop 1
- 16-18 June 2015 (Frøya, Norway): Regional differences in Aquaculture workshop 2
- 23-25 June 2015 (Brussels, Belgium): Regionally-Integrated and Spatially-Explicit Fisheries and Ecosystem Management" (RISE-FEM)
- 24-25 Sept. 2015 (Tallinn, Estonia): Improvement the influence of the EMFF via the cooperation between the Member States
- 8 Oct. 2015 (Bilbao, Spain): Mobility and learning tools for human capacity building on the fisheries, aquaculture and seafood processing chain

**INPUTS FOR THE CALLS**

# The Calls

- Three calls in 2014-2016 (one call per year)
- Each call on 3 - 4 sectors (fisheries, aquaculture, seafood processing, trans-sectorial) depending on funds available from partners
- Call issues based on research priorities identified on:
  - inputs from national governments (WP2)
  - stakeholders' consultation (WP1)
  - analysis of past and on-going projects at national and international level (WP1)
  - outputs from Case Studies ( WP4)
- Procedure for call launching in preparation (WP3)
- Actions to find funds (all partners)

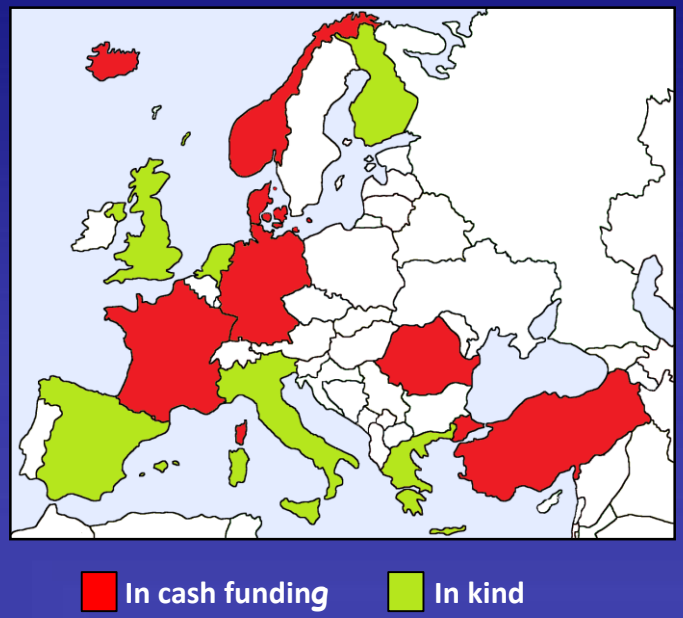
# The Calls

- 1st call (2014) → National priorities
- 2nd call (2015) → National priorities, stakeholders' inputs
- 3rd call (2016) → National priorities, stakeholders' inputs, past and on-going projects, CS inputs

# The Calls

**1st CALL : 1 February, 2014**

**Total funds: 5,075,000 Euro from 7 countries**




## Topics and objectives

### *Sector: Fisheries*

- The ecosystem approach to fisheries management

### *Sector: Fisheries and Aquaculture*

Spatial planning in fisheries and aquaculture

### *Sector: Aquaculture*

- Improved aquaculture: New and improved aquaculture systems
  Feed and nutrition in aquaculture
  Application of the improved capacity in genomics in aquaculture

### *Sector: Seafood processing and cross-cutting theme*

- Production chain

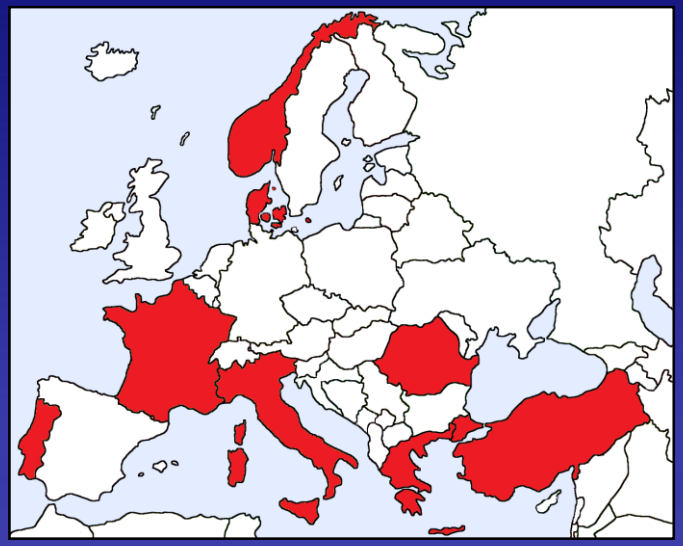
25 full proposals submitted; 22 eligible; 5 proposals selected

17 members of Scientific Evaluation Committee from 7 countries: EL, DE, FR, NO, PT, RO, TR

# The Calls

**2st CALL : 17 June, 2014**

**Total funds: 6,400,000 Euro**
**from 8 countries**



## Topics and objectives

***Sector: Fisheries***

- Mapping and modelling of the environmental, economic and social effects of the fishing sector under different schemes of maximization of resource efficiency and minimization of carbon footprint
- Developing techniques and strategies to assess the impact of coastal fisheries on sensitive habitats in a context of sustainable exploitation of fishery resources

***Sector: Aquaculture***

- Developing water treatment technology and technologies to increase water/feed efficiency to lower the production cost and the environmental impact of aquaculture.
- Developing strategies to increase efficiency of aquaculture production (e.g. feed conversion ratio, reduction of the time to slaughter …).
- Developing strategies to decrease waste effluents and bio-deposit impacts (for mariculture and inland aquaculture).

# The Calls

## 2st CALL : 1 February, 2014

## Topics and objectives

***Sector: Seafood processing***

- Mapping the environmental, economic and social aspects of the fish processing industry...
- Developing new strategies to appropriately manage and use the entire harvest of fish products...
- Developing new technology/techniques in the processing sector to adjust to changes in raw materials (e.g. species, size).

***Sector: Trans-sectorial***

- Mapping the environmental, economic and social aspects of the fish processing industry...
- Developing new strategies to appropriately manage and use the entire harvest of fish products...
- Developing new technology/techniques in the processing sector to adjust to changes in raw materials (e.g. species, size)
- Developing methodology to quantify the ecological footprint and the impact on biodiversity...
- Developing methodologies and models to determine and manage the impacts of a multitude of activities at the appropriate ecosystem geographical and time scale (coastal fisheries and aquaculture)

38 full proposals submitted; 36 eligible

6 proposals selected: 1 Fisheries, 4 Aquaculture, 1 Trans-sectorial

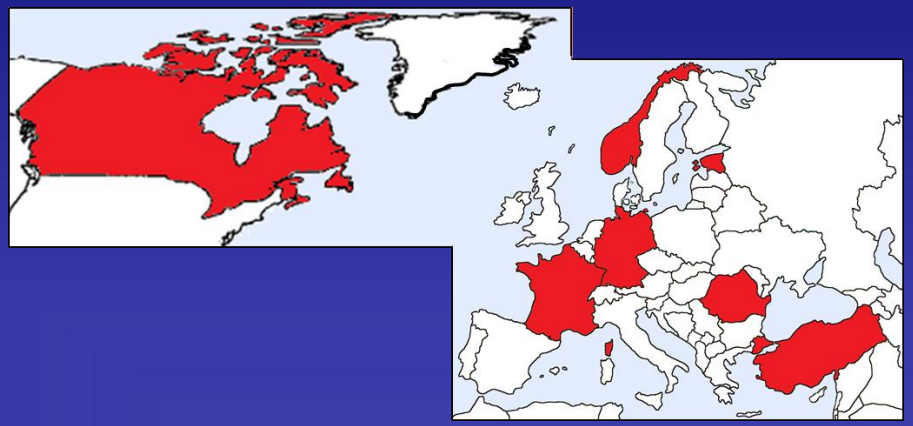
17 members of Scientific Evaluation Committee from 11 countries: EL, FR, HU, IE, IL, IT, NL, ES, SE, TR, UK

# The Calls

**3st CALL : 20 June, 2016**

Joint call by Marine biotechnology ERA-Net (MBT) and COFASP ERA-Net

**Total funds: 5,300,000 Euro from 7 countries (indicative)**



## Topics and objectives

***Sector: Fisheries***

- Fisheries stock assessment and dynamic modelling using 'omic' methodologies

***Sector: Aquaculture***

- Genome based approach to genetic improvement of aquaculture species

***Sector: Seafood processing***

- Explore opportunities for the use of biotechnological tools, including targeted enzymes to develop more efficient seafood processing methods and high value products

**http://www.cofasp.eu/**

# COST STATEMENT AND PROJECT EVALUATION

## Cost statement

- Each partner has to present cost statements to its national funding agency according with the rules of the agency
- Funds of the projects are not EU funds

## Project evaluation


- COFASP will not be able to evaluate the outputs of the projects because it will finish before the projects' end
- It is supposed that each partner of a project should submit reports and outputs to its national funding agency which funded the project
- Within COFASP we are discussing about the possibility of checking the progress of the projects funded.

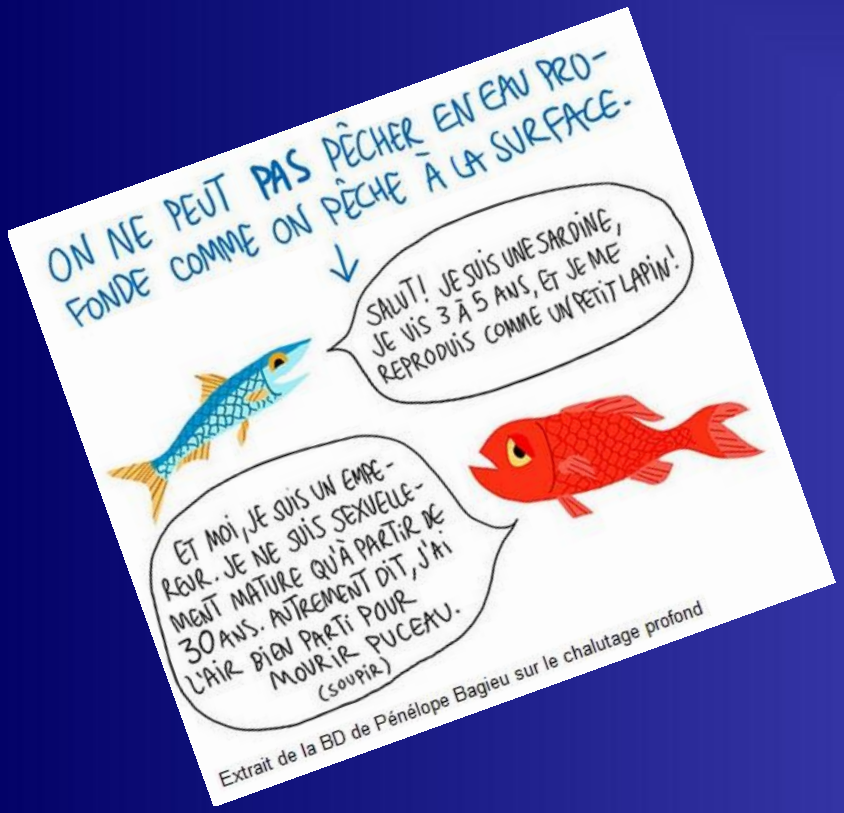
# RECOMMENDATIONS

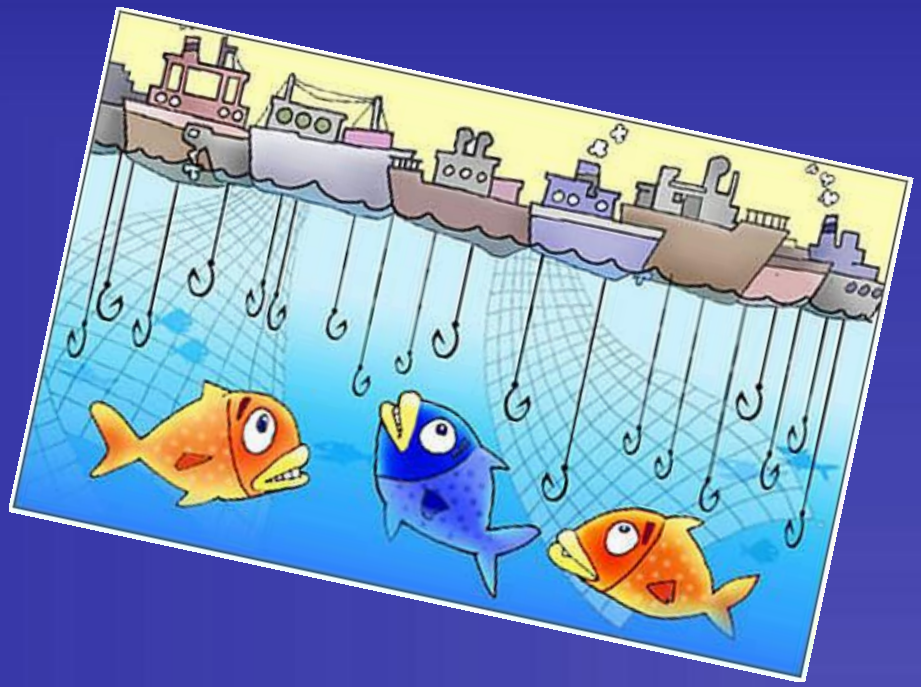
## Divulgate information on the project

## Disseminate the results of the project


# Thanks for your attention and……..

# GOOD LUCK FOR THE PROJECT!!!!!



# ECOAST PROJECT

*ERA-net COFASP second call*

# WP1
# Management

*Kick-off meeting*

*4-6 April 2016*

*SEEPORT HOTEL, Ancona*

# WP1 Project Management – Structure and goals (I)

Duration: 36 Months
Responsible: Fabio Grati, ISMAR-CNR

The Coordinator is the legal entity acting as the intermediary between the Parties and the Call Secretariat and is be responsible for the Consortium's internal management and performing of the tasks assigned to it as described in this Consortium Agreement( Section 6)

**WP's Goals:**

- Ensure project overall soundness from start to closure
- Project day by day management and coordination
- External and internal activities coordination
- Organization of Steering Committee meeting

# WP1 Project Management – Structure and goals (II)

**Governance structure:**

**General Assembly (GA)**: governing body chaired by coordinator where all partners are represented.

**GA main tasks:**

- Ensure project effective and efficient unrolling from technical and administrative point of view
- Taking decisions and corrective solution if needed. *The General Assembly shall not deliberate and decide validly unless two-thirds (2/3) of its Members are present or represented (quorum).*
- Validate outputs and findings

# WP1 Project Management – Structure and goals (II)

**Governance structure:**

**Steering Committee**: Project Operational Committee chaired by coordinator

with all WPs leaders participation/contribution.

**SC and GA meetings** *(Notice of a meeting and Agenda: 14 days before the scheduled date*)

1. April 2016 - Ancona
2. November 2016 – *Location to be decided*
3. May 2017- *Location to be decided*
4. November 2017- *Location to be decided*
5. May 2018 - *Location to be decided*
6. November 2018- *Location to be decided* (same venue /days of international workshop)

The chairperson shall produce **written minutes of each meeting** which shall be the formal record of all decisions taken. He shall send draft minutes to all Members within 10 calendar days of the meeting.

# WP1 Project Management - Project Reporting (I)

According to COFASP 2 call guidelines, 2 Reports should be drafted and submitted to the Call Secretariat by project coordinator with partners inputs

## MID- TERM REPORT:

Date of delivery: August 2017

## FINAL REPORT:

Date of Delivery: project end

## The Reports should:

- be written in English (whereas supplementary versions may be written in other languages at the project partners' discretion and own expense)
- include  deliverables have to be sent to the Call Secretariat by the project coordinator within two month of the mid-term and the end of the project respectively
- cover the research progress and the financial aspects of all consortium partners
- include a public summary of the research progress to be published on COFASP website
- include a minimum of 3 stakeholder-oriented articles (in English, whereas supplementary versions may be written in other languages at the project partners' discretion and own expense)

# WP1 Project Management - Progress Reporting (II)

The Call Secretariat will forward the reports to all involved countries and respective partners Project reports and the progress will be assessed against the expected output and timeline as described in the final project description (milestones and deliverables). Action may be taken by funding bodies in case of shortcomings or non-compliance.

## PARTNER PROGRESS REPORTS

Each Partner is responsible to its own national grant funders for their financial management of the Project, including the provision of annual and final financial reports.

If required by national obligations, each project partner has to report progress of their work to the national funding bodies Including financial reports

# WP1 Project Management – National Contact Points

| COUNTRY | NAME & ORGANISATION | TELEPHONE | E-MAIL |
|---|---|---|---|
| DENMARK | Marie-Kristine Weinberger, DAFA | +45 25 42 01 02 | MKTA@naturerhverv.dk |
| DENMARK | Floor ten Hoopen, Innofond | +45 6190 5040 | floor.tenhoopen@innofond.dk |
| FRANCE | Claude Yven, ANR | +33 (0)1 73 54 82 87 | claude.yven@agencerecherche.fr |
| GREECE | Paraskevi Afentaki, GSRT | +30 210 7458112 | pafe@gsrt.gr |
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| ROMANIA | Domnica Cotet, UEFISCDI | +0213023880 | domnica.cotet@uefiscdi.ro |
| TURKEY | Mehmet DİNGİL, GDAR | +90 312 315 76 23 | mdingil@tagem.gov.tr |

# THANK YOU
# FOR YOUR ATTENTION

http://www.ismar.cnr.it/

CNR
Consiglio Nazionale delle Ricerche

ISMAR
Istituto di Scienze Marine

# ECOAST Startup Meeting
# WP1 – Website and dissemination

April 4-6, 2016 – Ancona

*Rocco De Marco – rocco.demarco@cnr.it*

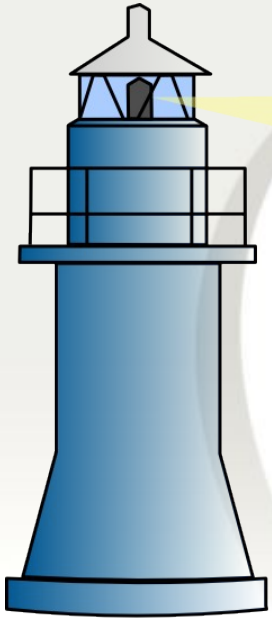
# Website and communication

*Speech summary*

- Ecoast logo
- Internet domain, email address
- Website, cms and structure
- Results presentation
- Other communication channels:
  - Facebook
  - Twitter
  - ?
- Roadmap

# ECOAST LOGO

Proposal logo:



ECOAST

*Era-net COFASP*

# Internet domain and email

- At the moment, e-coast.eu results available
- It is possible to choose to have some generic email address f.e.:
  - info@e-coast.eu
  - commitee@e-coast.eu
- Possible options (to be evaluated):
  - Email forwards
  - Mailing list(s)

# Website

- We are planning to use an external shared web hosting service
  - Contracted for 3 years
  - With uptime over than 98%
  - With customer support
- The website will be based on wordpress cms, a diffused, pretty and easy-to-use/update framework
- The development time, once contents are available, is really limited

# Website structure

The basic website structure will contains:

- Project description
- Members and people
- Mission
- Results
- Activities a/o photo gallery
- Contact page

# Results

Results could be arranged in several ways:

- Downloadable raster images/shapefiles;
- Googlemap based gis maps;
- (optionally) Plain/text datasets
- Final report in pdf format

We are not planning to add particular interactive functionality for data generation/manipulation, at the moment

# Other communication channels

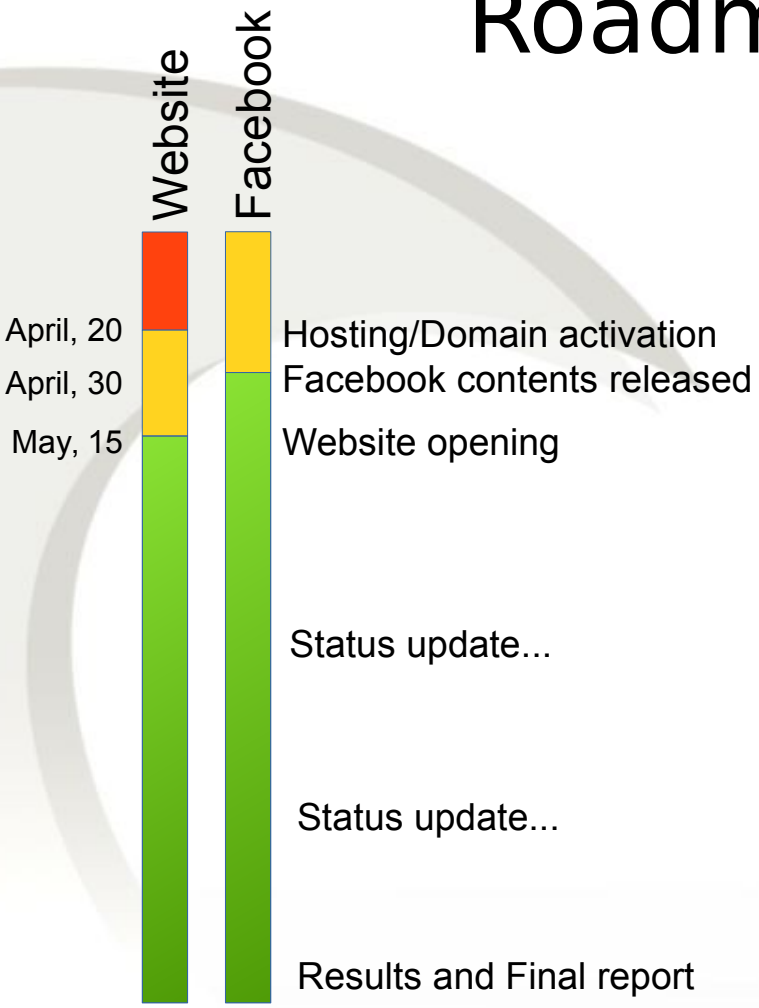
We have already openend a facebook page, and needs to be populated:

https://www.facebook.com/ecoastproject

Twitter/Istangram and other social webcommunity will be considered

As reported, also a mailing list could be activated

# Roadmap


Website
Facebook
April, 20
April, 30
May, 15
Hosting/Domain activation
Facebook contents released
Website opening
Status update...
Status update...
Results and Final report

CNR
Consiglio Nazionale delle Ricerche

ISMAR
Istituto di Scienze Marine

# Thank you!

ECOAST

Era-net COFASP

COFASP ERA-net

# WP2

## Description of selected case studies in European Regional Seas.

## Mapping of productive marine areas and priority areas for fisheries and aquaculture

Luca BOLOGNINI*, Fabio GRATI

Kick off Meeting ECOAST Project

*Ancona, Italy, 4th – 6th April 2016*

ISMAR

CNR Consiglio Nazionale delle Ricerche

# OBJECTIVES

Collect georeferenced data on:

| | ECOLOGICAL | SOCIAL | ECONOMIC |
|---|---|---|---|
| | • Priority Areas<br>• Nursery<br>• Spawning<br>• Chl<br>• Nutrient<br>• Natura 2000 | • Number of employees<br>• Cultural heritage | • Revenue<br>• Catch<br>• Fleet<br>• Farms' production<br>• Productive Marine Areas |
| FISHERIES | | | |
| AQUACULTURE | | | |
| OTHER | | | |

# An example:

- Juveniles mainly concentrate in the Italian side and adults aggregate close to Croatian waters
- Juveniles targeted by gillnetters in Italy & adults targeted with trammel nets in Croatia (Western coast of Istria)

Journal of Sea Research 84 (2013) 122–132

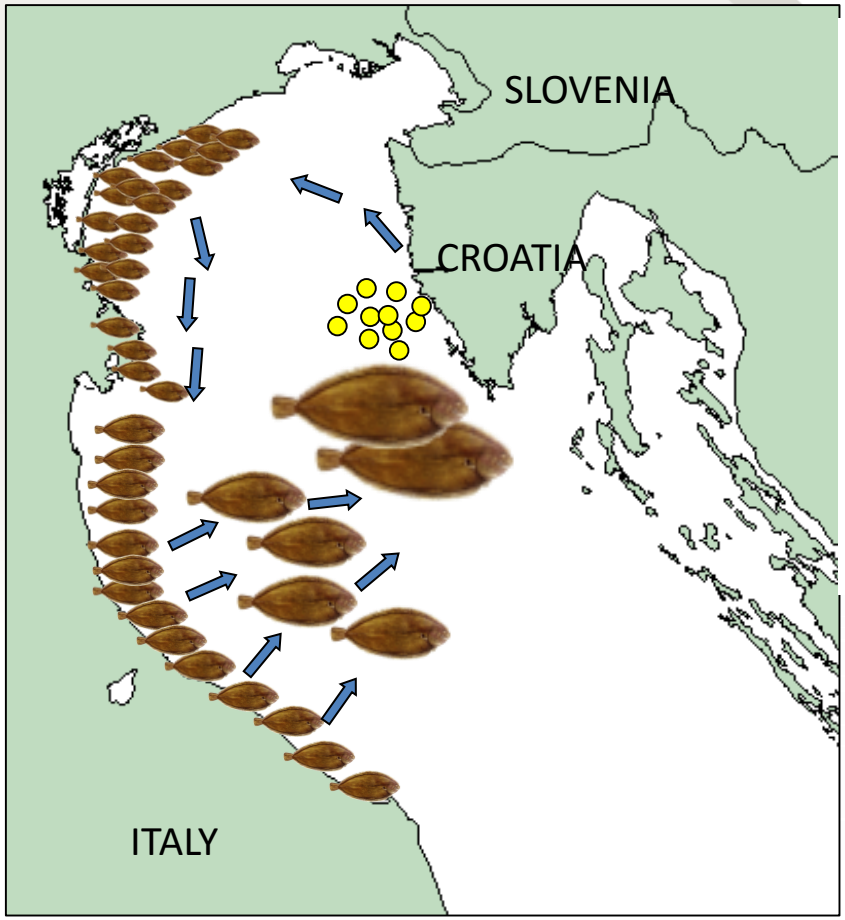
Contents lists available at ScienceDirect

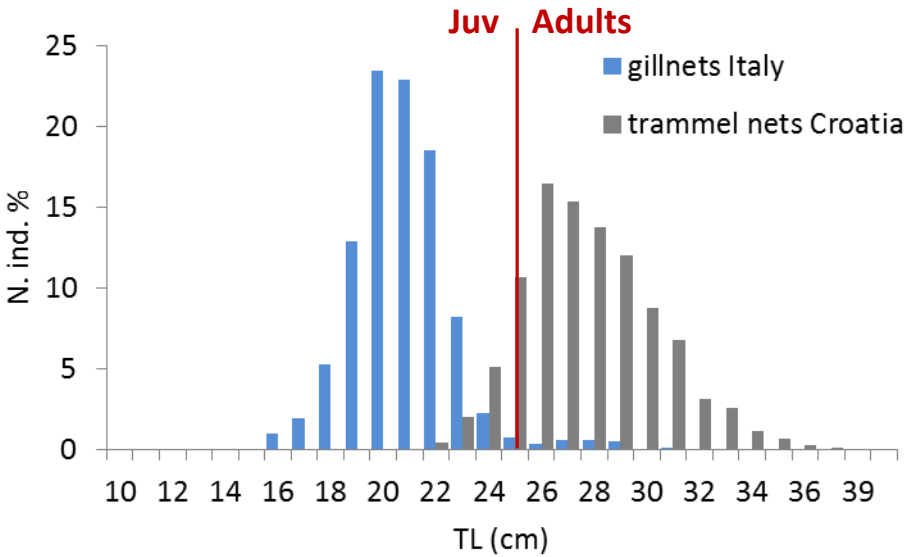
Journal of Sea Research

journal homepage: www.elsevier.com/locate/seares

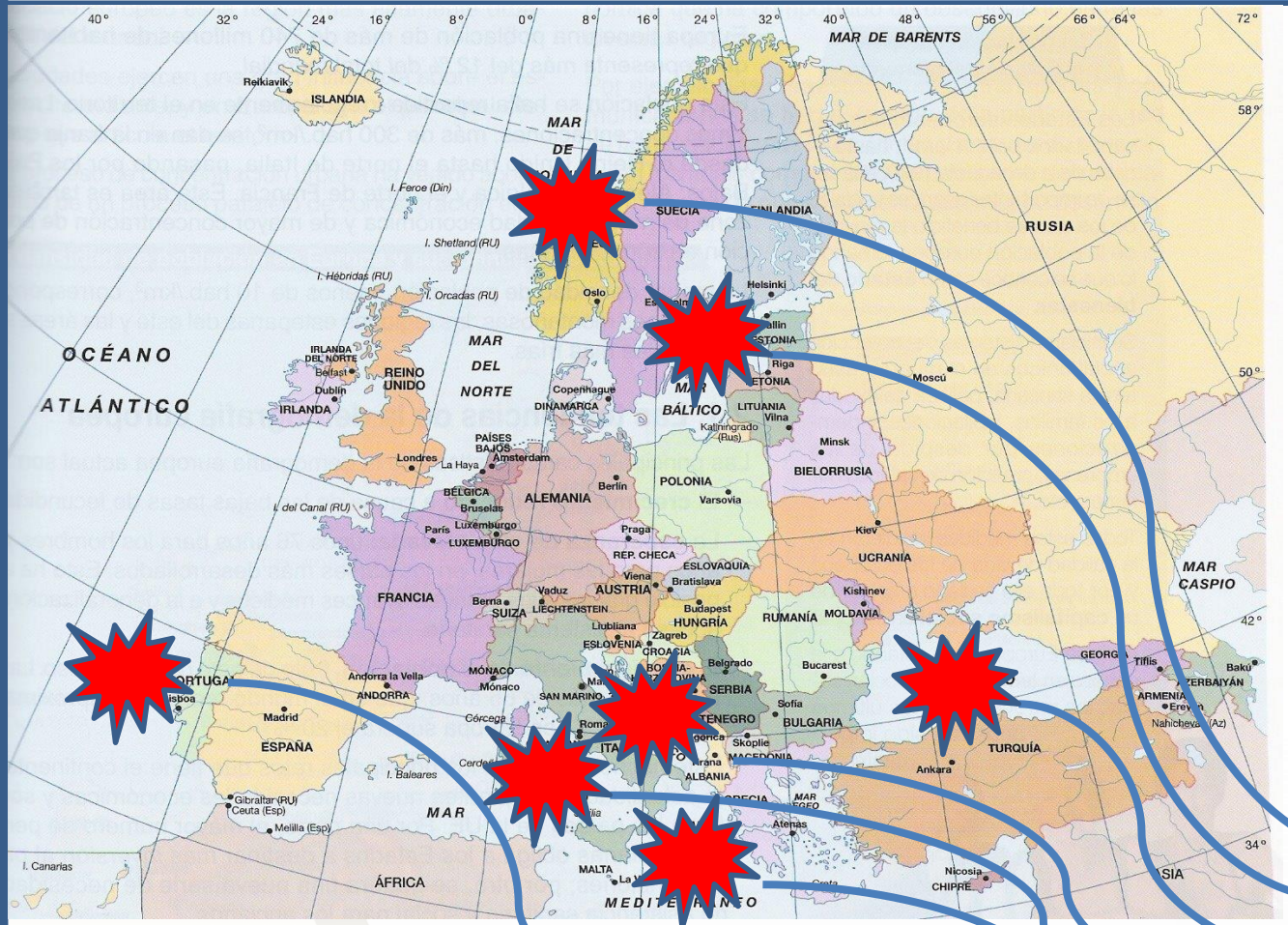
Multi-annual investigation of the spatial distributions of juvenile and adult sole (*Solea solea* L.) in the Adriatic Sea (northern Mediterranean)

Fabio Grati [a,*,1], Giuseppe Scarcella [a], Piero Polidori [a], Filippo Domenichetti [a], Luca Bolognini [a], Roberto Gramolini [a], Claudio Vasapollo [a], Otello Giovanardi [b], Saša Raicevich [b], Igor Celić [b], Nedo Vrgoč [c], Igor Isajlovic [c], Aljaž Jenič [d], Bojan Marčeta [d], Gianna Fabi [a]




# OBJECTIVES




7 case studies:

- *Adriatic Sea*
- *Ionian Sea*
- *Black Sea*
- *Tyrrhenian Sea*
- *Baltic Sea*
- *Norwegian Fjord*
- *NE Atlantic*

GRID

# What is GRID? (1)

**GRID is a tool developed in the framework of COEXIST UE funded project.**

**COEXIST - Interaction in European coastal waters: A roadmap to sustainable integration of aquaculture and fisheries.**

Characterization of relevant European coastal marine ecosystems, their current utilisation and spatial management

Evaluation of spatial management tools for combining coastal fisheries, aquaculture and other uses, both now and in the future

**TOOLS FOR SUPPORTING THE DECISION-MAKERS AND OTHER STAKEHOLDERS**

# What is GRID? (2)

- GRID is a web-based flexible database and tool to analyse interactions (conflicts and synergies) in marine coastal areas

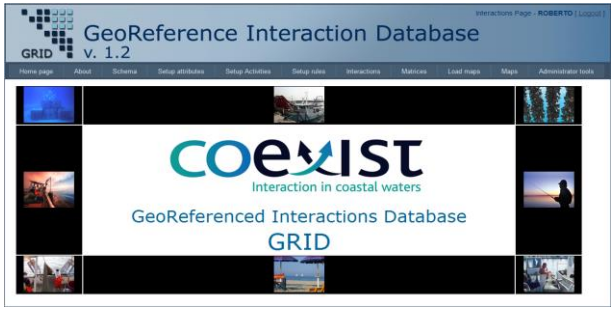
- It was developed by CNR ISMAR Ancona with the support of Thünen Institute of Sea Fisheries Hambourg

# GRID development

## GRID was developed with the intent to have:

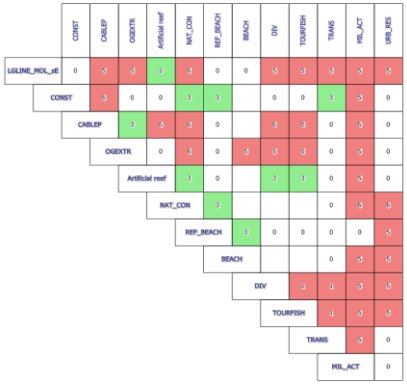
- A tool flexible enough to be used in different Case Studies;
- An intuitive Graphic Interface to be also used by people without specific knowledge in database and GIS software;
- to allow data sharing between stakeholders;
- to model different situations such as the present one and/or future scenarios in a very easy way;
- to improve transparency in decision making process.

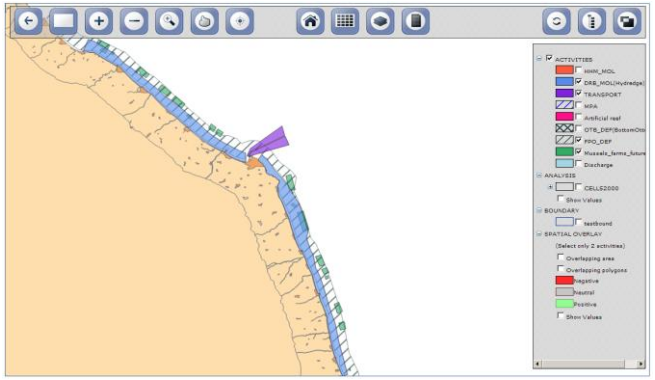
# Application structure




MySQL
Ddatabase

Manifold® IMS
Internet Map Server





## What does the GRID application do

**Version GRID 1.2 allows to perform the following analyses considering different possible scenarios:**

- **calculation of conflict scores;**
- **generation of Matrices of interactions;**
- **plot of maps;**
- **evaluation of spatial interactions existing in a marine coastal area;**
- **calculation of asymmetric spatial overlaps;**
- **calculation of stress levels.**

# Conflict scores and Interactions Matrix

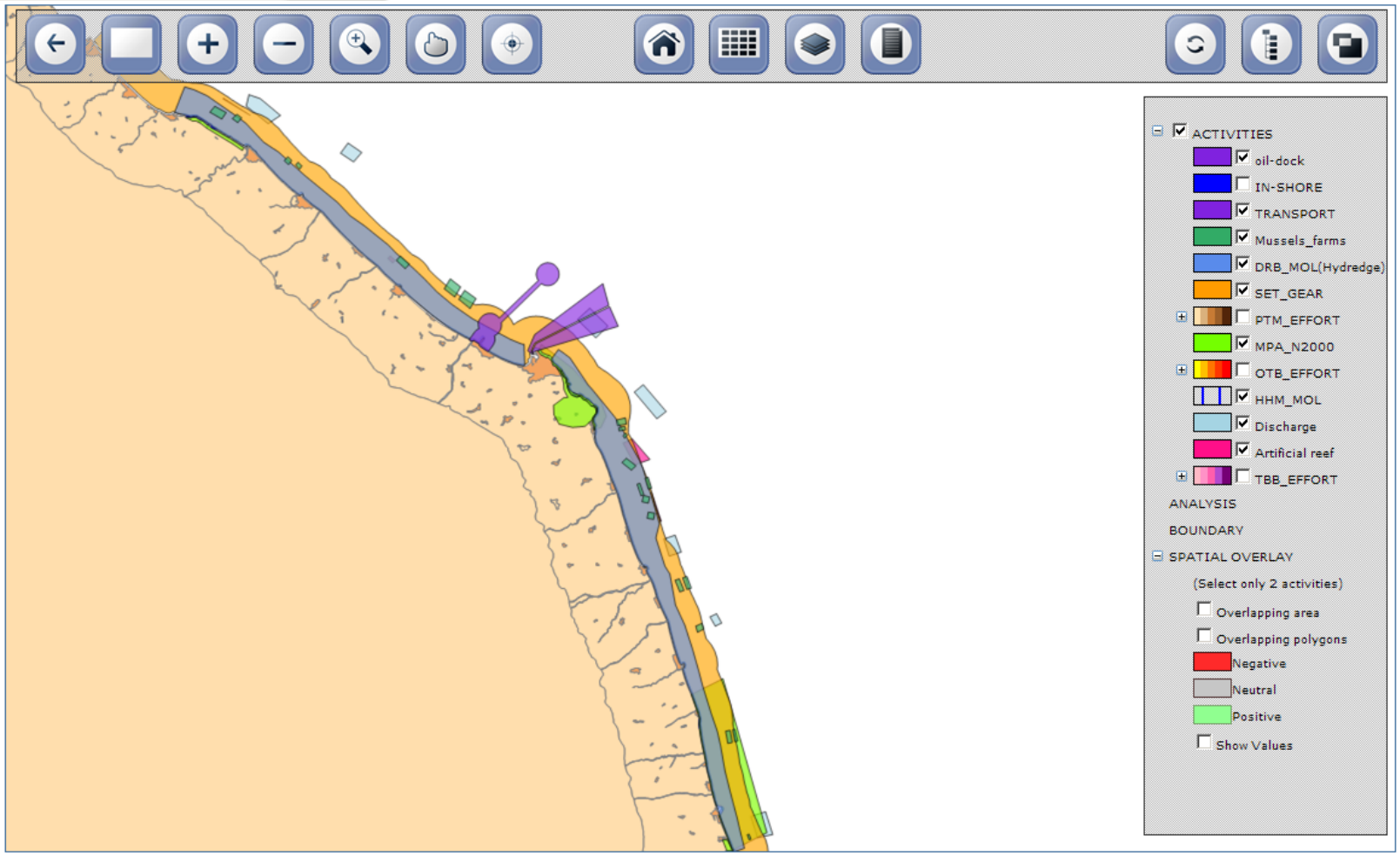
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mussel farms | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 0 | 3 | 6 | 0 | 0 | 4 | 0 | 5 | 5 | 5 | 5 |
| 2. Coastal protection | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 3. Harbors | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 0 | 3 | 3 |
| 4. Urban and rural residues | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 |
| 5. Urban development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 5 | 0 | 0 |
| 6. Dumping | 0 | 5 | 0 | 4 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 5 | 6 | 6 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Cables and pipelines | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | 6 | 4 | 6 | 6 | 6 | 0 | 0 |
| 8. Oil and gas extraction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 0 | 0 |
| 9. Pots | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 |
| 10. Fyke nets | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 |
| 11. Gillnets | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 0 | 0 |
| 12. Trammel nets | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 0 | 0 | 0 |
| 13. Otter trawl | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 14. Pelagic trawl | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 15. Rapido trawl | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 16. Hydraulic dredges | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 17. Mussel harvesting | 3 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 4 | 2 | 0 | 4 | 0 | 4 | 2 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| 18. Artificial reefs | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19. MPAs | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20. Natura 2000 sites | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 21. Refurbish beaches | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22. Ship wrecks | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23. Beach tourism | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24. Recreational diving | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25. Marinas | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26. Recreational fishing | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *27. Passengers and cargo ships | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

In RED negative interactions, in GREEN positive interactions, in WHITE no interactions

Conflict scores range from 1 (little conflict) to 6 (activities are virtually excluding each other).

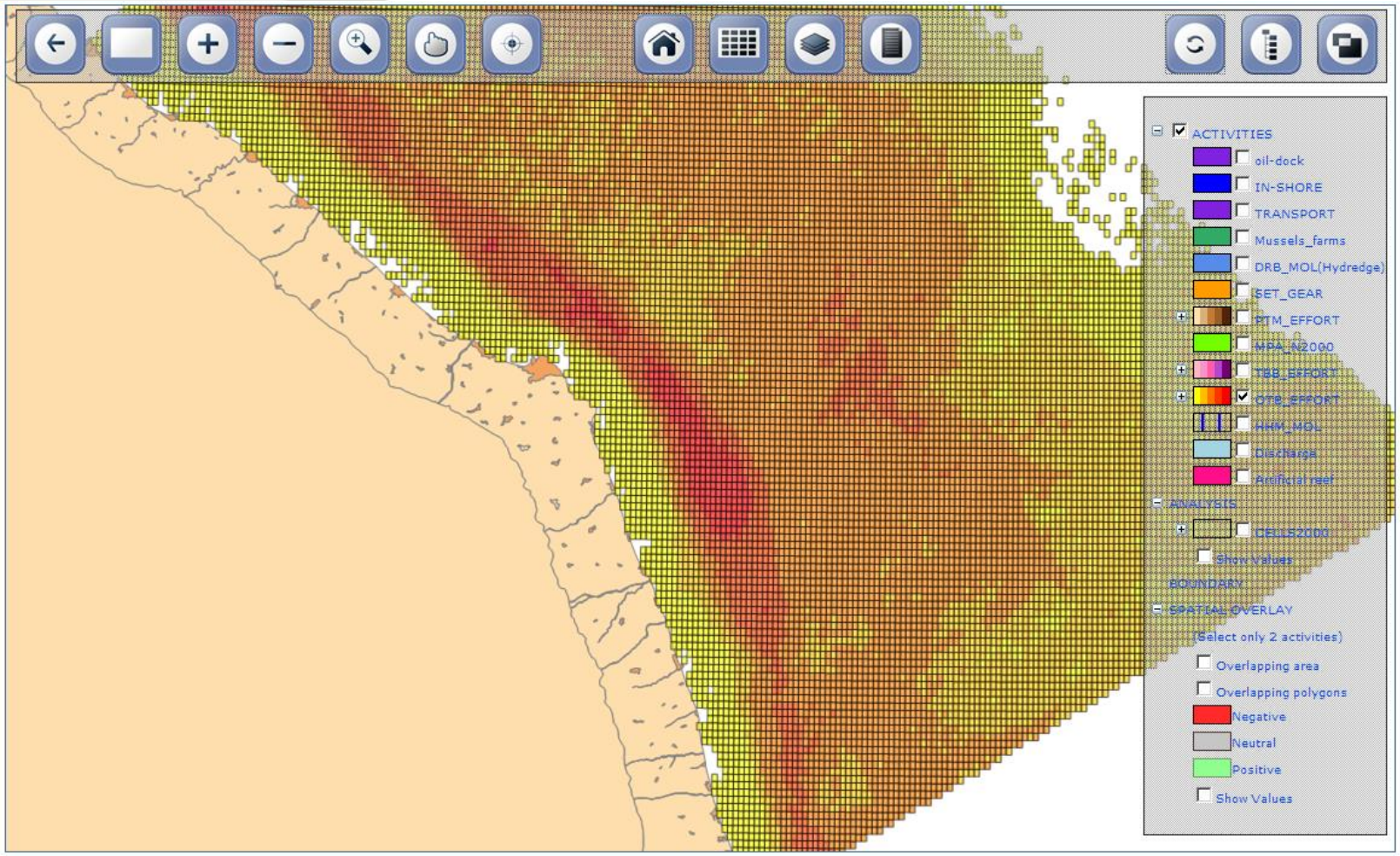
# Map of activities (1)

## In-shore activities

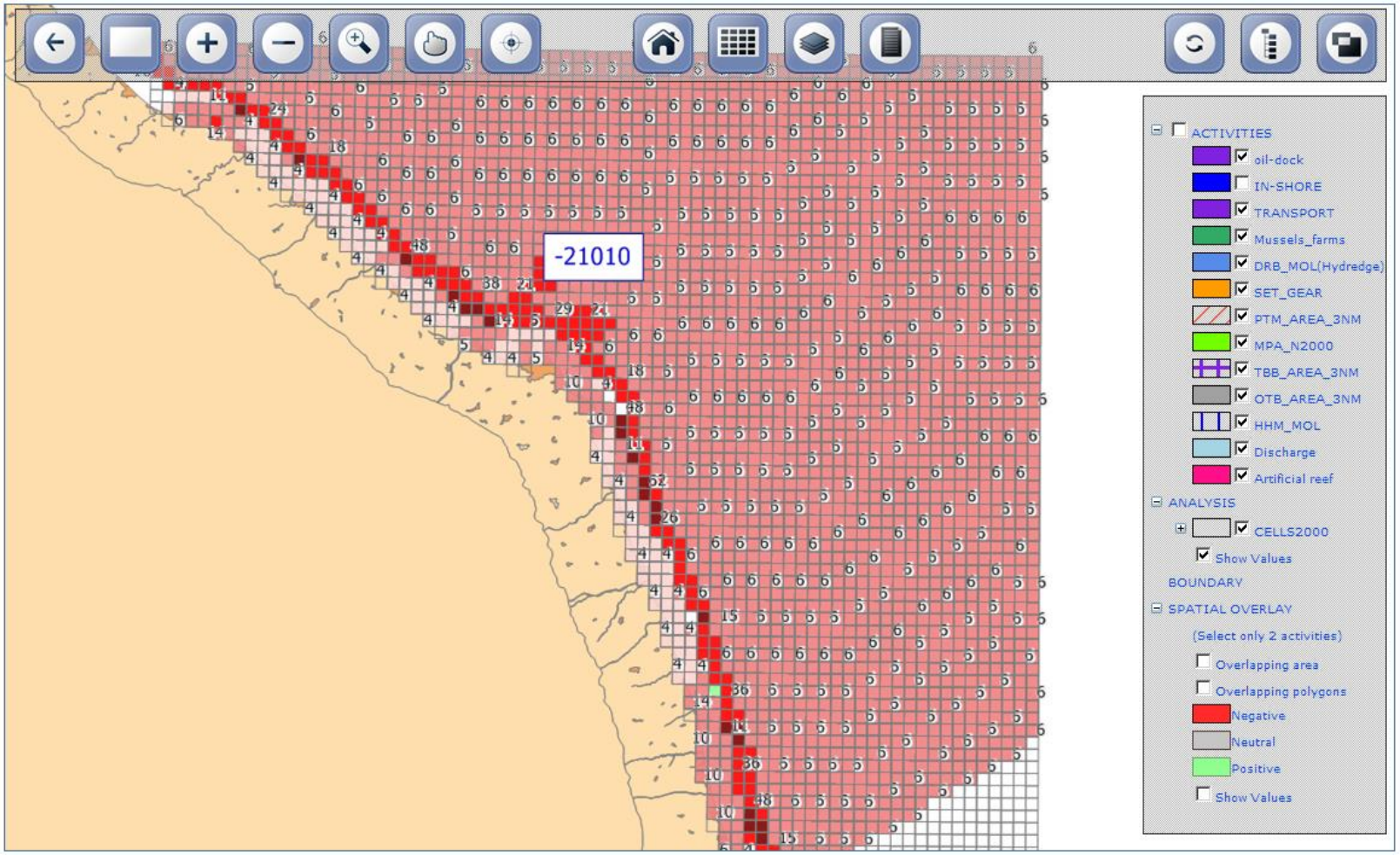


# Map of activities (2)

Off-shore activities (Otter trawlers spatial distribution)



# Area Total Conflict score

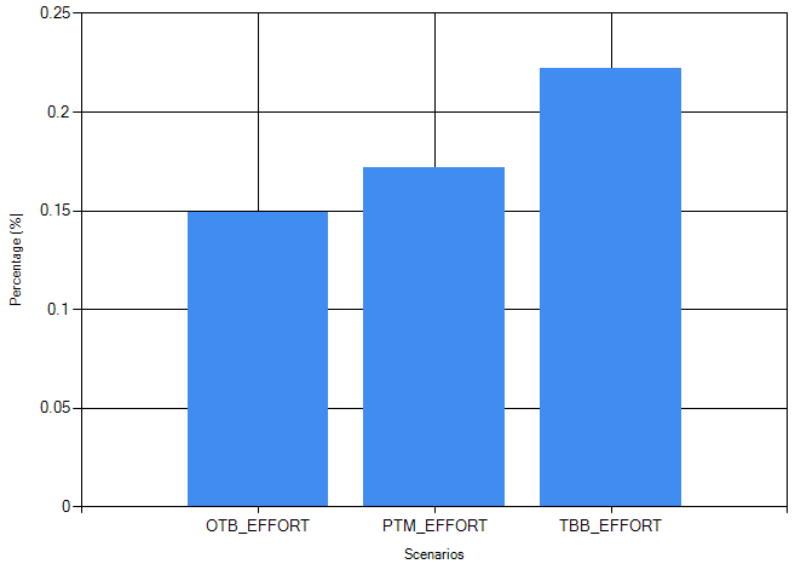


# 2 different scenarios


# Stress levels calculation (Fishing area losses (%))

## In-shore (scenario1)


## Off-shore (scenario2)



# WP2

## Description of selected case studies in European Regional Seas.

## Mapping of productive marine areas and priority areas for fisheries and aquaculture.

by Roberto Gramolini

Link:

http://prezi.com/bmcm34zpwidz/?utm_campaign=share&utm_medium=copy&rc=ex0share

ECOAST

Era-net COFASP

COFASP ERA-net

# *Adriatic Sea* case study

Luca Bolognini*, Michela Martinelli

Kick off Meeting ECOAST Project
*Ancona, Italy, 4th – 6th April 2016*

CNR Consiglio Nazionale delle Ricerche

ISMAR

**ISMAR Istituto di Scienze Marine** L.go Fiera della Pesca, 2 - 60125 Ancona, Italy

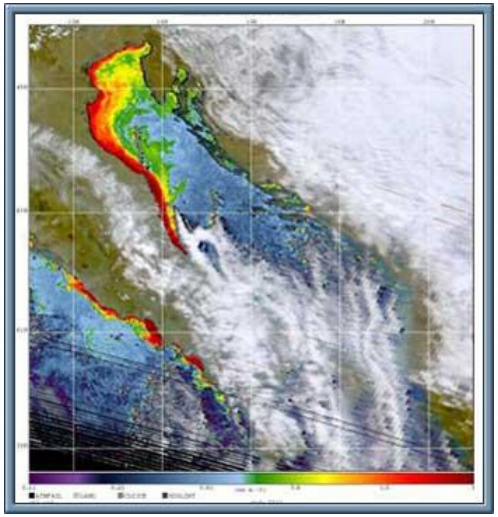
# The Adriatic Sea case: the basin

The Adriatic Sea is the most continental basin of the Mediterranean

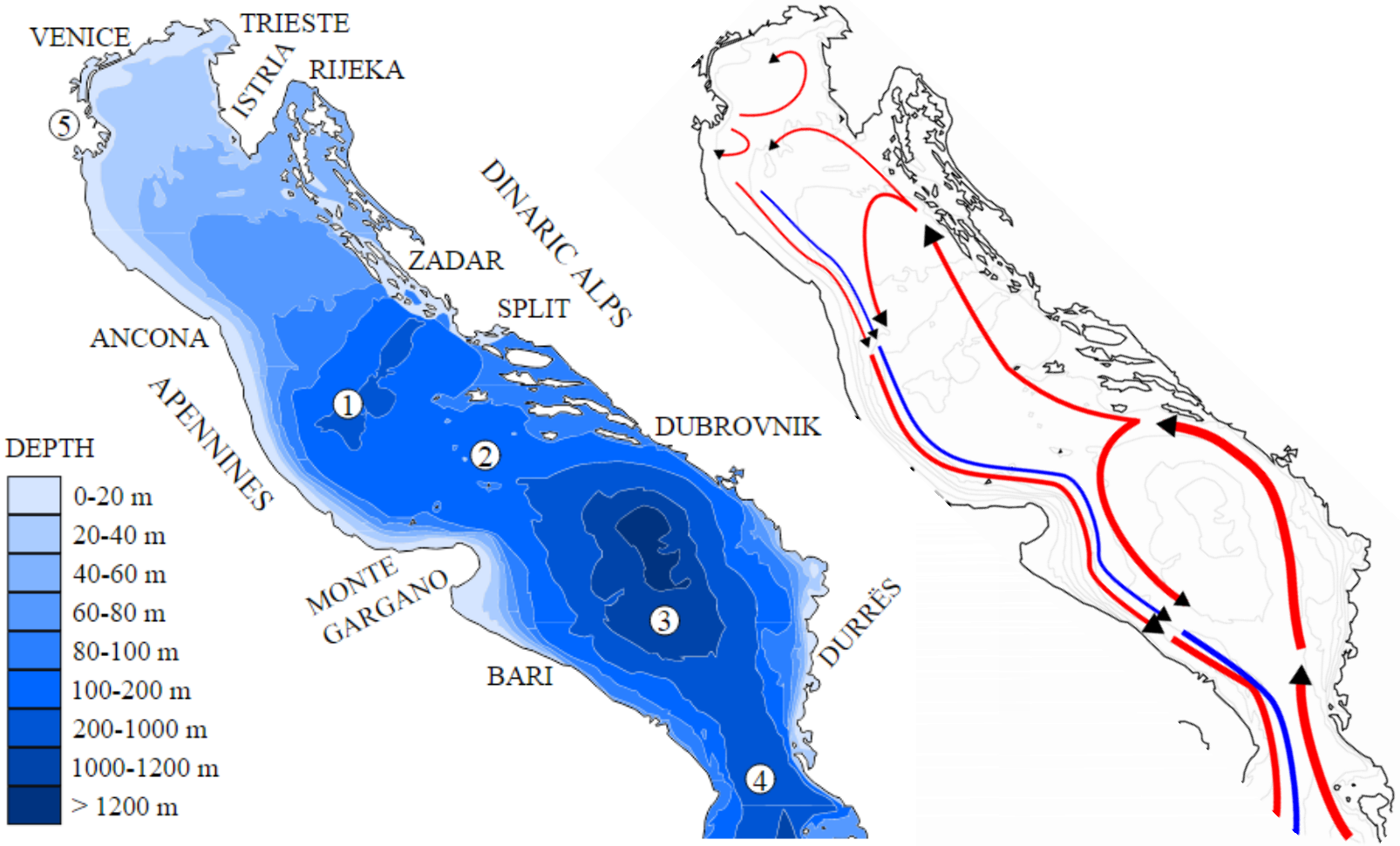
Central and northern Adriatic: make up 0.9% of Mediterranean surface and receive 15% of the total Mediterranean river runoff

River runoff affects the ecosystem by introducing large fluxes of nutrients


Seabed mostly sandy and muddy



# The Adriatic Sea case



# The Adriatic Sea case


Italy

Slovenia

Croatia

Bosnia & Herzegovina

Montenegro

Albania

# The Adriatic Sea case: human activities

Fishing: Trawl (pelagic, otter, rapido), Set gears (traps, gillnets, trammel nets), Mussel harvesting on wild banks, Hydraulic dredges

Aquaculture: Mussel farms on longlines

Tourism: Recreational fishing and boating, Beach tourism

Gas extraction: Offshore platforms

Ship transport: Passengers and Cargo


| Length in kilometers of Adriatic coastlines | | | | |
|---|---|---|---|---|
| Country | Mainland | Islands | Total | Coastal front[a] |
| Croatia | 1,777.3 | 4,058 | 5,835.3 | 526 |
| Italy | 1,249 | 23[b] | 1,272 | 926 |
| Albania | 396 | 10 | 406 | 265 |
| Montenegro | 249 | 11 | 260 | 92 |
| Slovenia | 46.6 | 0 | 46.6 | 17 |
| Bosnia–Herzegovina | 21.2 | 0 | 21.2 | 10.5 |
| **Total** | **3,739.1** | **4,102** | **7,841.1** | **1,836.5** |
| Notes: [a] The distance between the extreme points of each state's coastline, [b] Not including islands in coastal lagoons[13] | | | | |
| 1.000 mi = 1.609 km; 1.000 km = 0.621 mi | | | | |

| Most populous urban areas on the Adriatic coast | | | | |
|---|---|---|---|---|
| Rank | City | Country | Region/County | Population (urban) |
| 1 | **Bari** | Italy | Apulia | 320,475 |
| 2 | **Venice** | Italy | Veneto | 270,884 |
| 3 | **Trieste** | Italy | Friuli-Venezia Giulia | 205,535 |
| 4 | **Split** | Croatia | Split-Dalmatia | 167,121 |
| 5 | **Rimini** | Italy | Emilia-Romagna | 142,579 |
| 6 | **Rijeka** | Croatia | Primorje-Gorski Kotar | 128,384 |
| 7 | **Pescara** | Italy | Abruzzo | 123,103 |
| 8 | **Durrës** | Albania | Durrës | 115,550 |
| 9 | **Ancona** | Italy | Marche | 101,210 |
| 10 | **Pesaro** | Italy | Marche | 95,800 |

Sources: 2011 Croatian census,[51] Italian National Institute of Statistics (2011),[52] 2011 Albanian Census[53]

## Tourism in the Adriatic Sea area

| Country | Region | CAF beds* | Hotel beds | Overnight Stays |
|---|---|---|---|---|
| Albania | N/A | ? | ? | 2,302,899 |
| Bosnia-Herzegovina | Neum municipality | c. 6,000 | 1,810 | 280,000 |
| Croatia | Adriatic Croatia | 411,722 | 137,561 | 34,915,552 |
| Italy | Friuli-Venezia Giulia | 152,847 | 40,921 | 8,656,077 |
| | Veneto | 692,987 | 209,700 | 60,820,308 |
| | Emilia-Romagna | 440,999 | 298,332 | 37,477,880 |
| | Marche | 193,965 | 66,921 | 10,728,507 |
| | Abruzzo | 108,747 | 50,987 | 33,716,112 |
| | Molise | 11,711 | 6,383 | 7,306,951 |
| | Apulia** | 238,972 | 90,618 | 12,982,987 |
| Montenegro | N/A | 40,427 | 25,916 | 7,964,893 |
| Slovenia | Seaside municipalities | 24,080 | 9,330 | 1,981,141 |

*Beds in all collective accommodation facilities; includes "Hotel beds" figure also shown separately
**Includes both Adriatic and Ionian sea coasts

| Major Adriatic ports, annual transport volume | | | |
|---|---|---|---|
| Port | Country, Region/County | Cargo (tonnes) | Passengers |
| Ancona | Italy, Marche | 10,573,000 | 1,483,000 |
| Bari | Italy, Apulia | 3,197,000 | 1,392,000 |
| Barletta | Italy, Apulia | 1,390,000 | N/A |
| Brindisi | Italy, Apulia | 10,708,000 | 469,000 |
| Chioggia | Italy, Veneto | 2,990,000 | N/A |
| Durrës | Albania, Durrës | 3,441,000 | 770,000 |
| Koper | Slovenia, Slovenian Istria | 18,000,000 | 100,300 |
| Manfredonia | Italy, Apulia | 1,277,000 | N/A |
| Monfalcone | Italy, Friuli-Venezia Giulia | 4,544,000 | N/A |
| Ortona | Italy, Abruzzo | 1,340,000 | N/A |
| Ploče | Croatia, Dubrovnik | 5,104,000 | 146,000 |
| Porto Nogaro | Italy, Friuli-Venezia Giulia | 1,475,000 | N/A |
| Rabac | Croatia, Istria | 1,090,000 | 669,000 |
| Ravenna | Italy, Emilia-Romagna | 27,008,000 | N/A |
| Rijeka | Croatia, Primorje-Gorski Kotar | 15,441,000 | 219,800 |
| Split | Croatia, Split-Dalmatia | 2,745,000 | 3,979,000 |
| Trieste | Italy, Friuli-Venezia Giulia | 39,833,000 | N/A |
| Venice | Italy, Veneto | 32,042,000 | 1,097,000 |

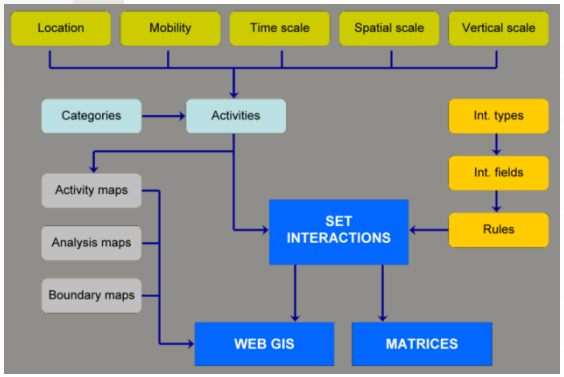
450 species (120 threatened by excessive commercial fishing)

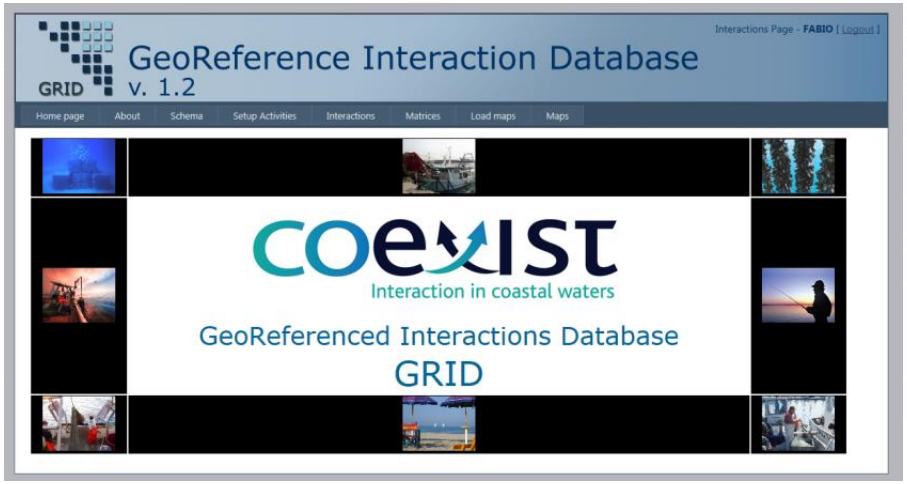
| Country | Production (2007) tonnes |
|---|---|
| Italy | 465,637 |
| Croatia | 53,083 |
| Bosnia & Herzegovina | 9,625 |
| Albania | 7,505 |
| Slovenia | 2,463 |
| Montenegro | 911 |

The combination of these activities inevitably results in spatial conflicts

GRID (GeoReference Interactions Database):

1) analyse and evaluate the interactions between human activities carried out in the coastal area
2) hypothesize a future scenario where a mitigation measure is applied



# Marche Region: matrix of interactions

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mussel farms | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 0 | 3 | 6 | 0 | 0 | 4 | 0 | 5 | 5 | 5 | 5 |
| 2. Coastal protection | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 3. Harbors | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 0 | 3 | 3 |
| 4. Urban and rural residues | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 |
| 5. Urban development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 5 | 0 | 0 |
| 6. Dumping | 0 | 5 | 0 | 4 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 5 | 6 | 6 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Cables and pipelines | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | 6 | 4 | 6 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. Oil and gas extraction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 0 |
| 9. Pots | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 |
| 10. Fyke nets | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 5 | 0 | 0 |
| 11. Gillnets | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 0 |
| 12. Trammel nets | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | 5 | 0 | 0 |
| 13. Otter trawl | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 4 | 0 | 0 |
| 14. Pelagic trawl | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 4 | 0 | 0 | 0 |
| 15. Rapido trawl | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 |
| 16. Hydraulic dredges | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 2 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 0 | 0 |
| 17. Mussel harvesting | 3 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 4 | 2 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 0 |
| 18. Artificial reefs | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 0 |
| 19. MPAs | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20. Natura 2000 sites | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| 21. Refurbish beaches | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22. Ship wrecks | 0 | 3 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23. Beach tourism | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24. Recreational diving | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 25. Marinas | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 0 |
| *27. Passengers and cargo ships | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 26. Recreational fishing | 1 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 0 |

In RED negative interactions, in GREEN positive interactions, in WHITE no interactions

Conflict scores range from 1 (little conflict) to 6 (activities are virtually excluding each other).

# Marche Region: matrix of interactions

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mussel farms | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 0 | 3 | 6 | 0 | 0 | 4 | 0 | 5 | 5 | 5 | 5 |
| 2. Coastal protection | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 3. Harbors | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 0 | 3 | 3 |
| 4. Urban and rural residues | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 |
| 5. Urban development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 5 | 0 | 0 |
| 6. Dumping | 0 | 5 | 0 | 4 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 5 | 6 | 6 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Cables and pipelines | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | 6 | 4 | 6 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8. Oil and gas extraction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9. Pots | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 | 5 |
| 10. Fyke nets | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 |
| 11. Gillnets | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 | 5 |
| 12. Trammel nets | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 |
| 13. Otter trawl | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 14. Pelagic trawl | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 15. Rapido trawl | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 16. Hydraulic dredges | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 0 | 2 | 2 | 2 | 2 |
| 17. Mussel harvesting | 3 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 4 | 0 | 4 | 2 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 4 | 4 | 4 |
| 18. Artificial reefs | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 3 | 3 |
| 19. MPAs | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20. Natura 2000 sites | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 |
| 21. Refurbish beaches | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| 22. Ship wrecks | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 3 | 3 |
| 23. Beach tourism | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24. Recreational diving | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25. Marinas | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 26. Recreational fishing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| *27. Passengers and cargo ships | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Conflict scores were calculated for each pair of activities basing on the traits of each activity: vertical scale, spatial scale, time scale, mobility and location

Rules: High conflict scores for large, immobile and long lasting activities; Low conflict scores for small, mobile and short lasting activities

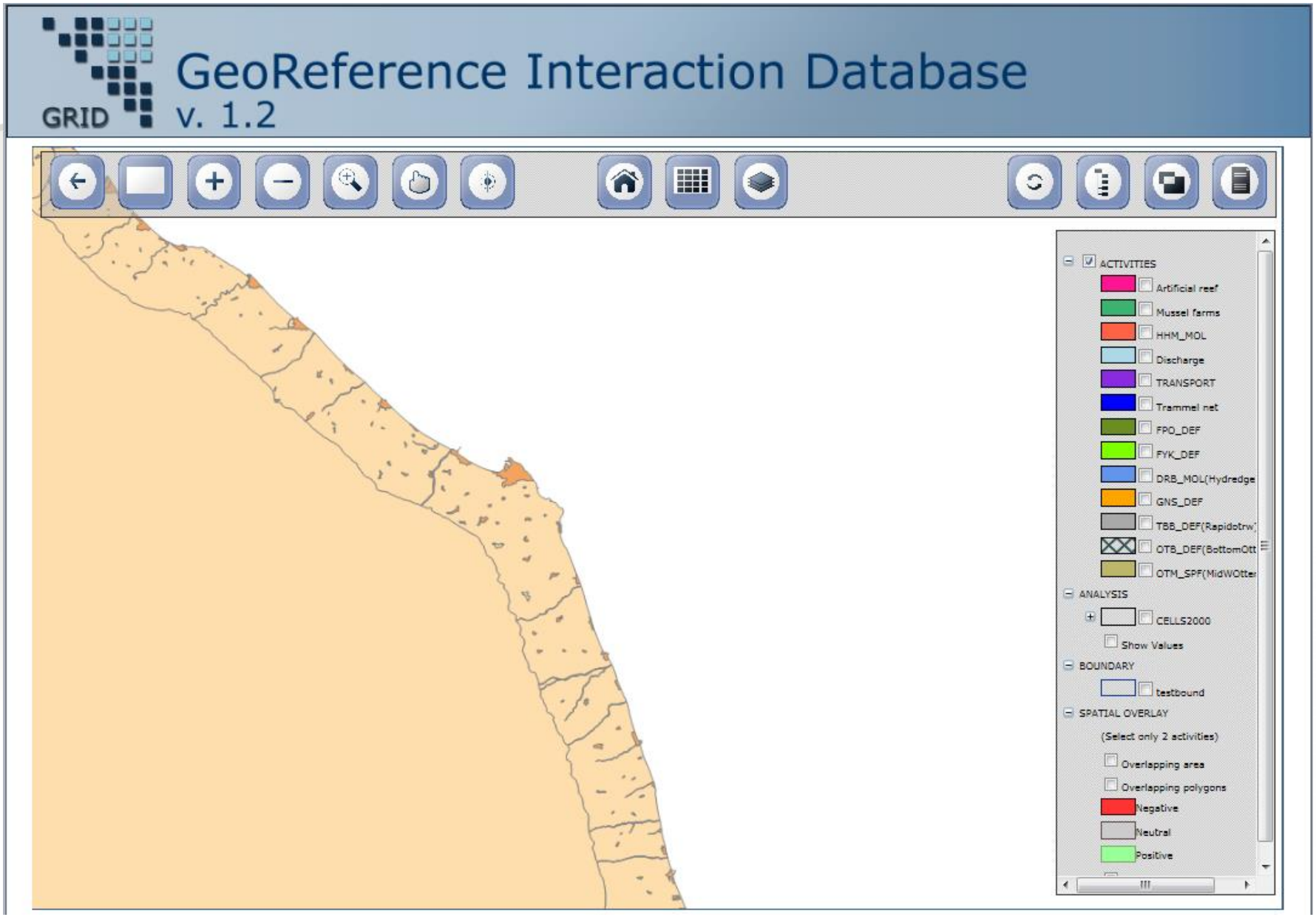
# Marche Region: matrix of interactions

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mussel farms | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 0 | 3 | 6 | 0 | 0 | 4 | 0 | 5 | 5 | 5 | 5 |
| 2. Coastal protection | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 3. Harbors | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 0 | 3 | 3 |
| 4. Urban and rural residues | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 |
| 5. Urban development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 5 | 0 | 0 |
| 6. Dumping | 0 | 5 | 0 | 4 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 5 | 6 | 6 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Cables and pipelines | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | 6 | 4 | 6 | 6 | 6 | 0 | 5 | 0 | 5 | 0 | 0 |
| 8. Oil and gas extraction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 |
| 9. Pots | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 |
| 10. Fyke nets | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 |
| 11. Gillnets | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 |
| 12. Trammel nets | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 5 |
| 13. Otter trawl | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 |
| 14. Pelagic trawl | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 |
| 15. Rapido trawl | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 16. Hydraulic dredges | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 1 | 2 | 2 |
| 17. Mussel harvesting | 3 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 | 4 | 2 |
| 18. Artificial reefs | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 19. MPAs | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20. Natura 2000 sites | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21. Refurbish beaches | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22. Ship wrecks | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23. Beach tourism | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24. Recreational diving | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 25. Marinas | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 26. Recreational fishing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| *27. Passengers and cargo ships | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Matrix of interactions evidenced a high number of negative interactions with high conflict scores

Positive interactions were scarce

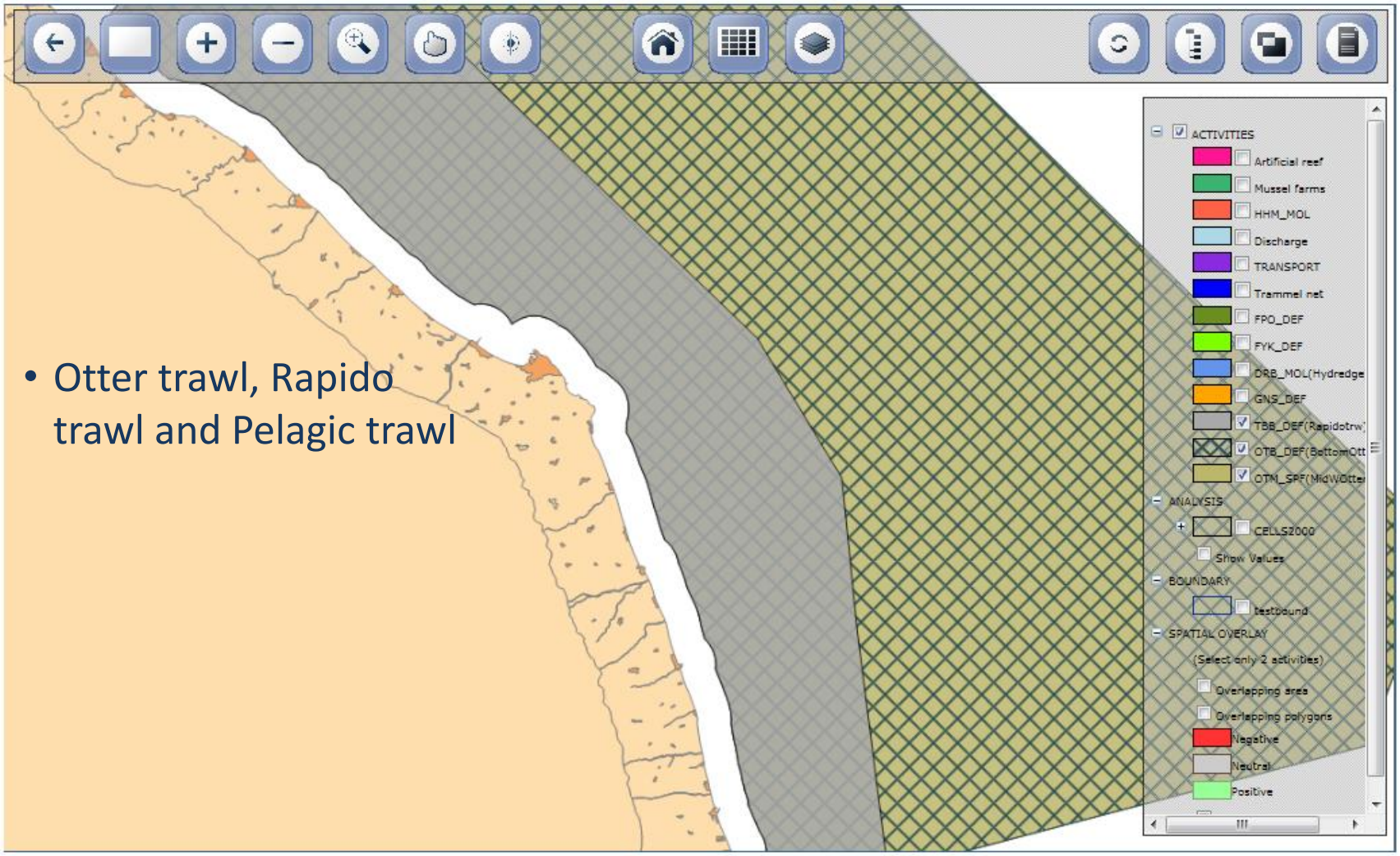
# Marche Region: mapping



# Marche Region: mapping

## GeoReference Interaction Database v. 1.2

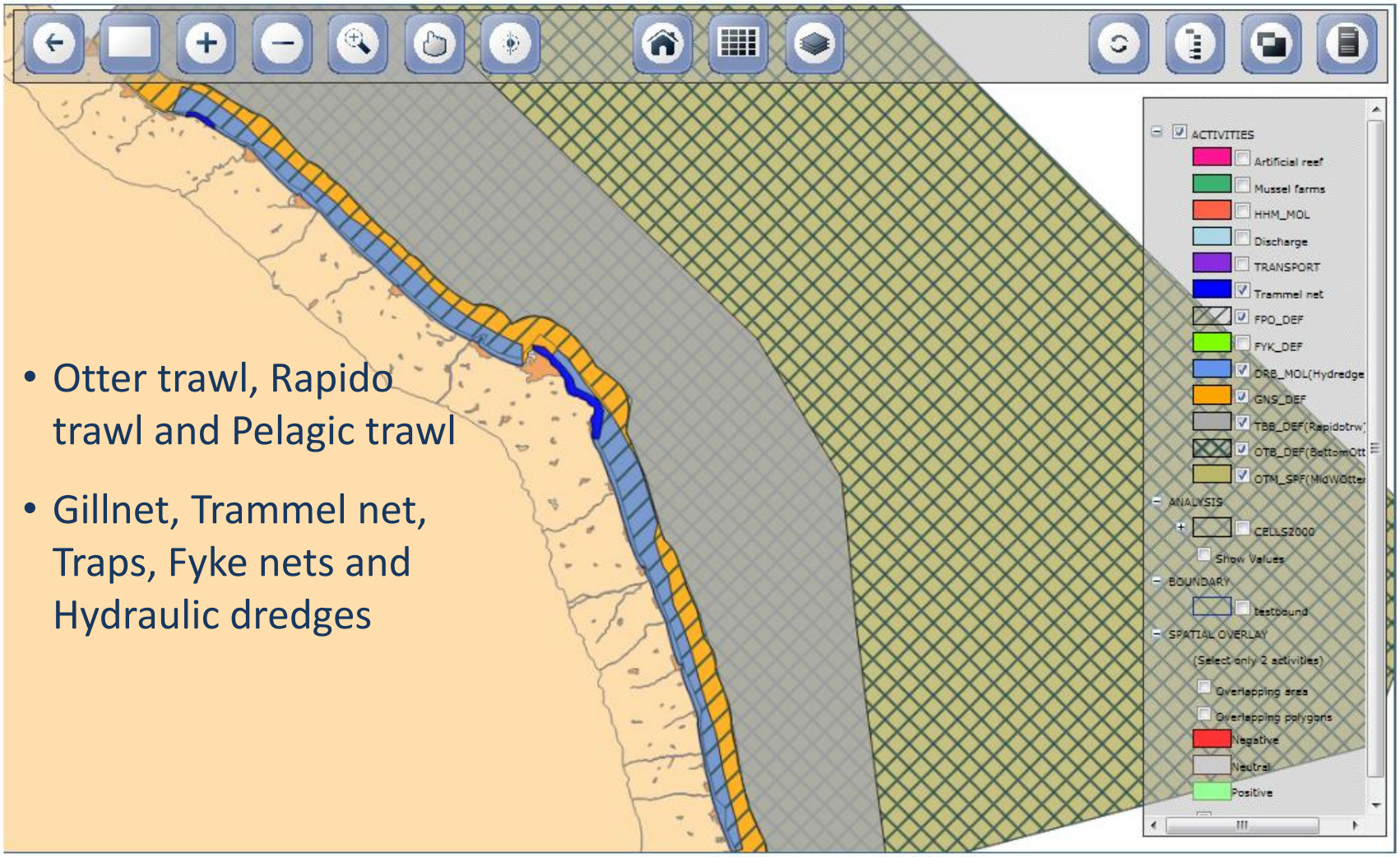
GRID




- Otter trawl, Rapido trawl and Pelagic trawl

# Marche Region: mapping

## GeoReference Interaction Database
GRID v. 1.2




- Otter trawl, Rapido trawl and Pelagic trawl
- Gillnet, Trammel net, Traps, Fyke nets and Hydraulic dredges

# Marche Region: mapping

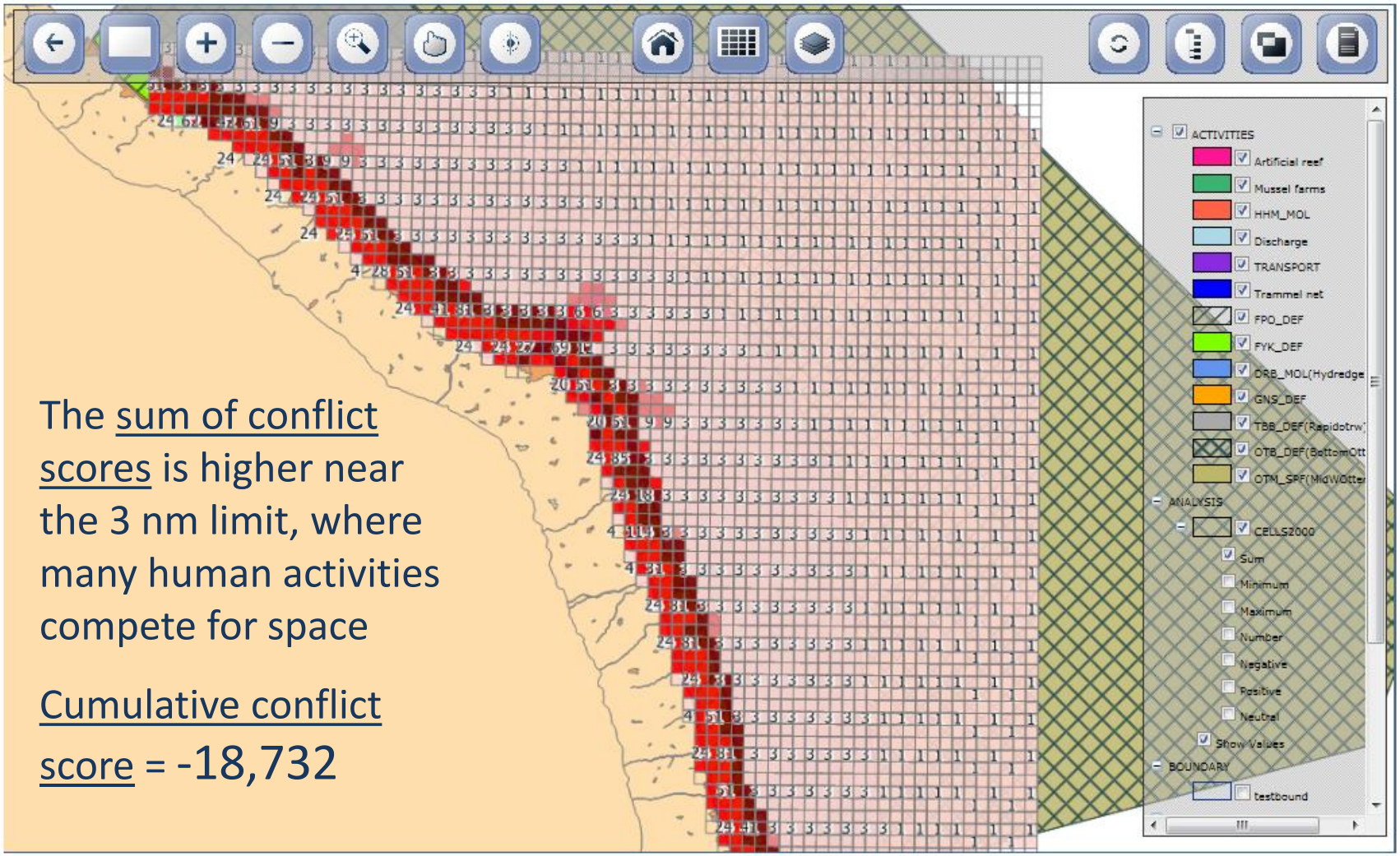
## GeoReference Interaction Database v. 1.2

GRID


- Otter trawl, Rapido trawl and Pelagic trawl
- Gillnet, Trammel net, traps, fyke nets and Hydraulic dredges
- Discharge areas, Mussel farms, ARs, Shipping routes

# Marche Region: map of conflict scores

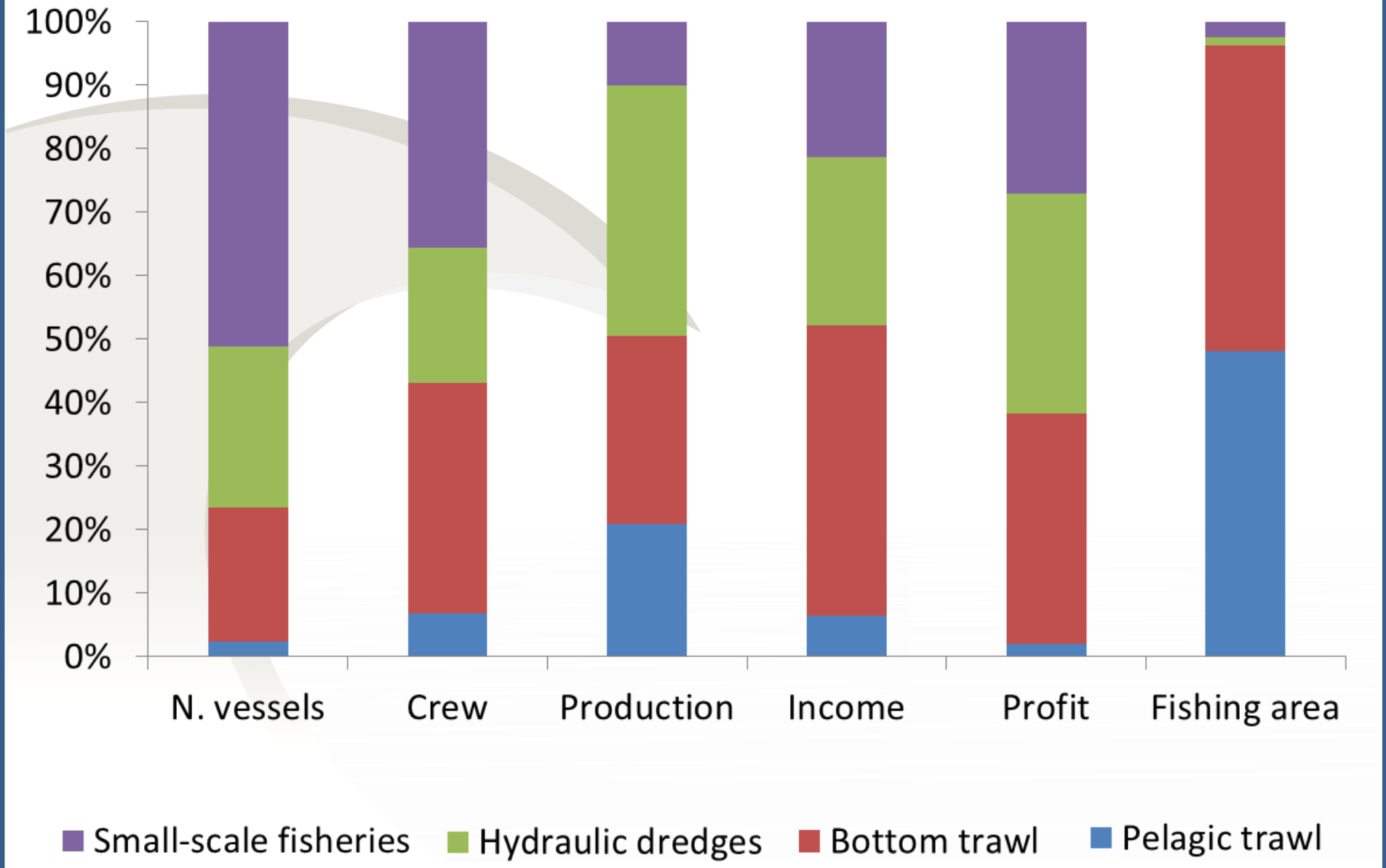
GeoReference Interaction Database
v. 1.2




The sum of conflict scores is higher near the 3 nm limit, where many human activities compete for space

Cumulative conflict score = -18,732

# Marche Region: data analysis

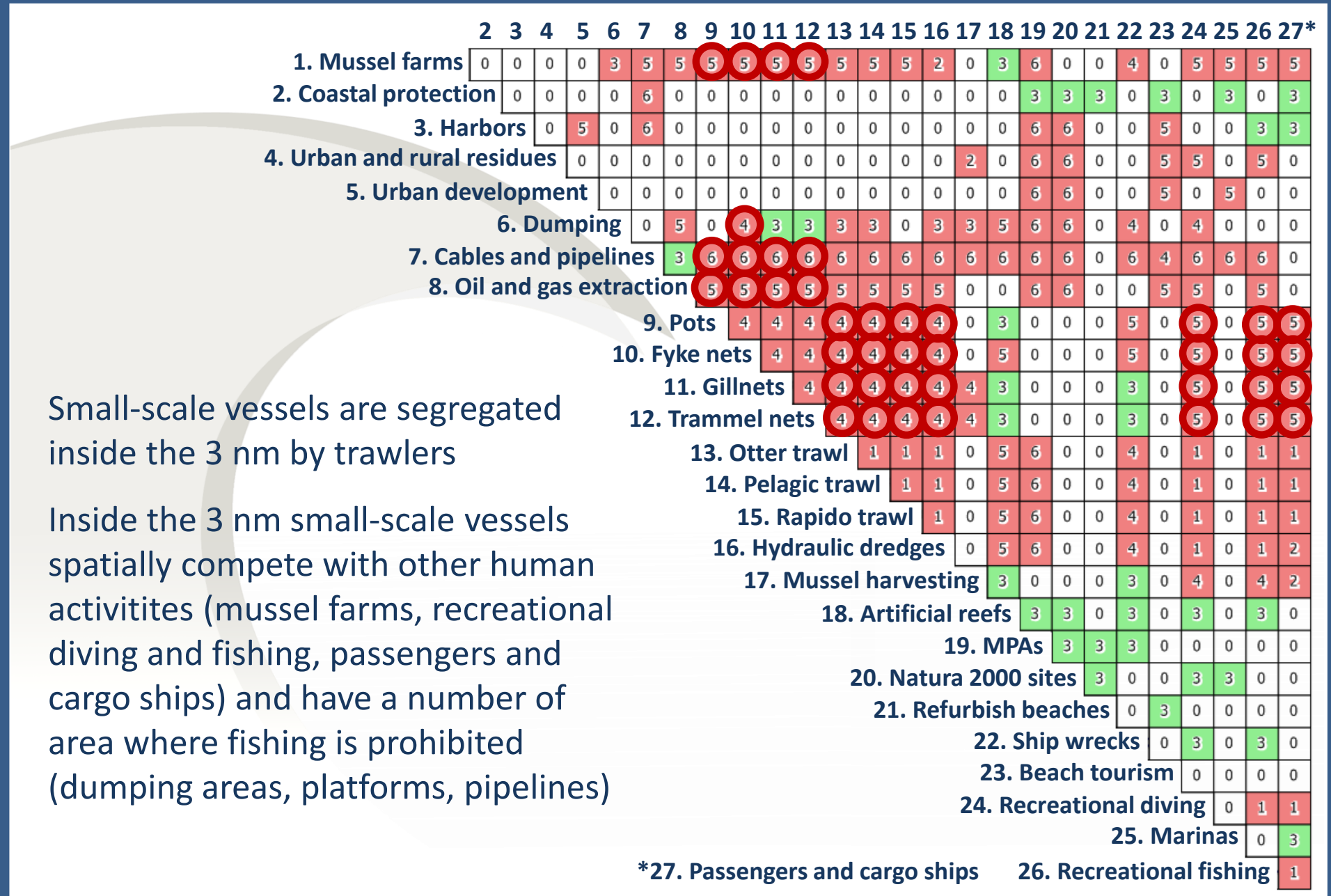


# Marche Region: analysis of conflict scores

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mussel farms | 0 | 0 | 0 | 0 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 0 | 3 | 6 | 0 | 0 | 4 | 0 | 5 | 5 | 5 | 5 |
| 2. Coastal protection | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 |
| 3. Harbors | 0 | 5 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 0 | 3 | 3 |
| 4. Urban and rural residues | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 |
| 5. Urban development | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 0 | 5 | 0 | 0 |
| 6. Dumping | 0 | 5 | 0 | 4 | 3 | 3 | 3 | 3 | 0 | 3 | 3 | 5 | 6 | 6 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7. Cables and pipelines | 3 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 0 | 6 | 4 | 6 | 6 | 6 | 0 | |
| 8. Oil and gas extraction | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 6 | 6 | 0 | 0 | 5 | 5 | 0 | 5 | 0 | | | | | | | |
| 9. Pots | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | | | | | | | |
| 10. Fyke nets | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 5 | 5 | 0 | | | | | | | | |
| 11. Gillnets | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | | | | | | | | | |
| 12. Trammel nets | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 5 | 5 | 0 | | | | | | | | | | |
| 13. Otter trawl | 1 | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | | | | | | | | | | | |
| 14. Pelagic trawl | 1 | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | | | | | | | | | | | | |
| 15. Rapido trawl | 1 | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | | | | | | | | | | | | | |
| 16. Hydraulic dredges | 0 | 5 | 6 | 0 | 0 | 4 | 0 | 1 | 0 | 1 | 2 | 0 | | | | | | | | | | | | | | |
| 17. Mussel harvesting | 3 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 4 | 2 | 0 | | | | | | | | | | | | | | | |
| 18. Artificial reefs | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 0 | | | | | | | | | | | | | | | | |
| 19. MPAs | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | |
| 20. Natura 2000 sites | 3 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | |
| 21. Refurbish beaches | 0 | 3 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | |
| 22. Ship wrecks | 0 | 3 | 0 | 3 | 0 | 0 | | | | | | | | | | | | | | | | | | | | |
| 23. Beach tourism | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | |
| 24. Recreational diving | 0 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 25. Marinas | 0 | 3 | 0 | | | | | | | | | | | | | | | | | | | | | | | |
| 26. Recreational fishing | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| *27. Passengers and cargo ships | | | | | | | | | | | | | | | | | | | | | | | | | | |

Small-scale vessels are segregated inside the 3 nm by trawlers

# Marche Region: analysis of conflict scores

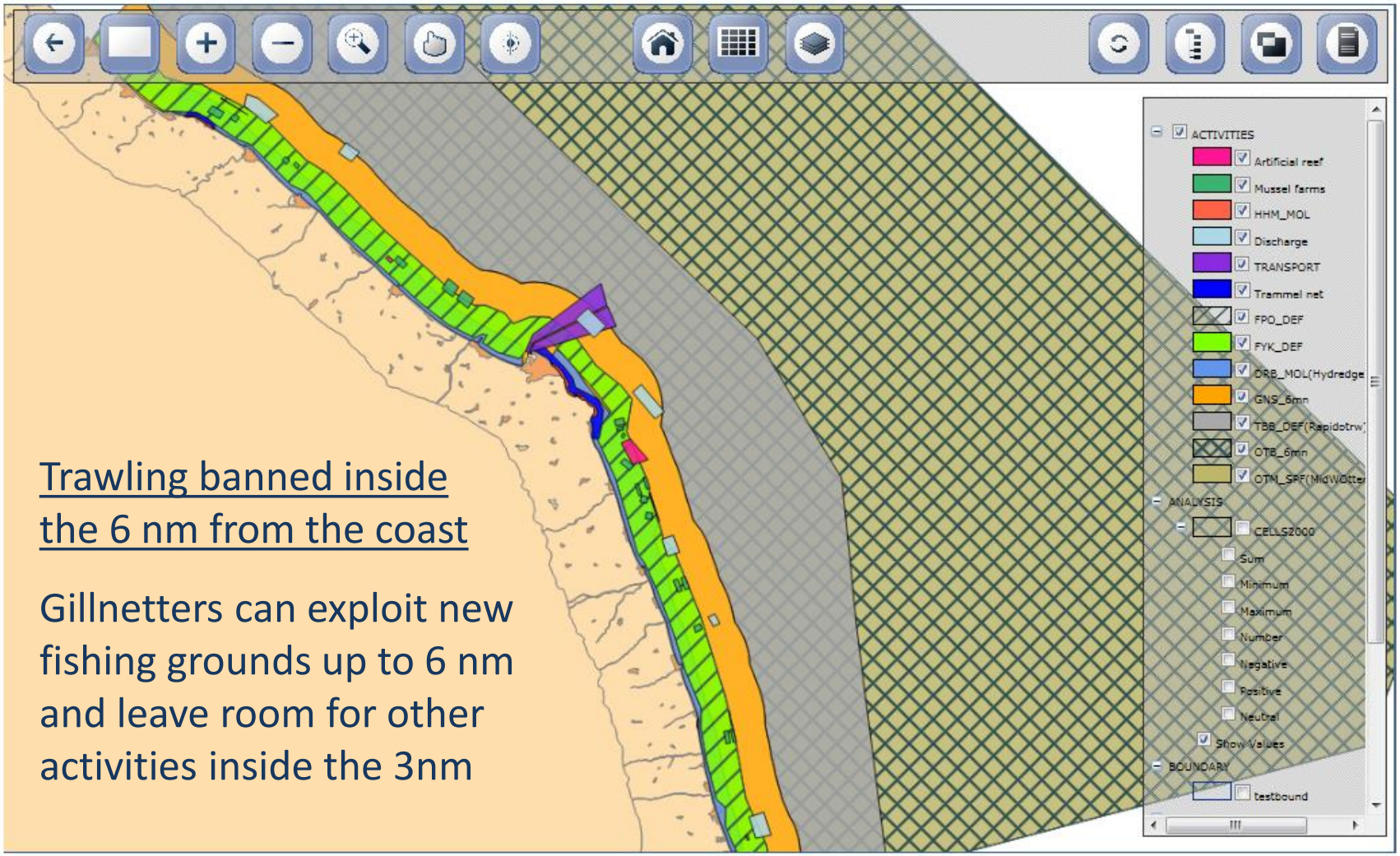



Small-scale vessels are segregated inside the 3 nm by trawlers

Inside the 3 nm small-scale vessels spatially compete with other human activitites (mussel farms, recreational diving and fishing, passengers and cargo ships) and have a number of area where fishing is prohibited (dumping areas, platforms, pipelines)

# Marche Region: future scenario

## GeoReference Interaction Database
GRID v. 1.2

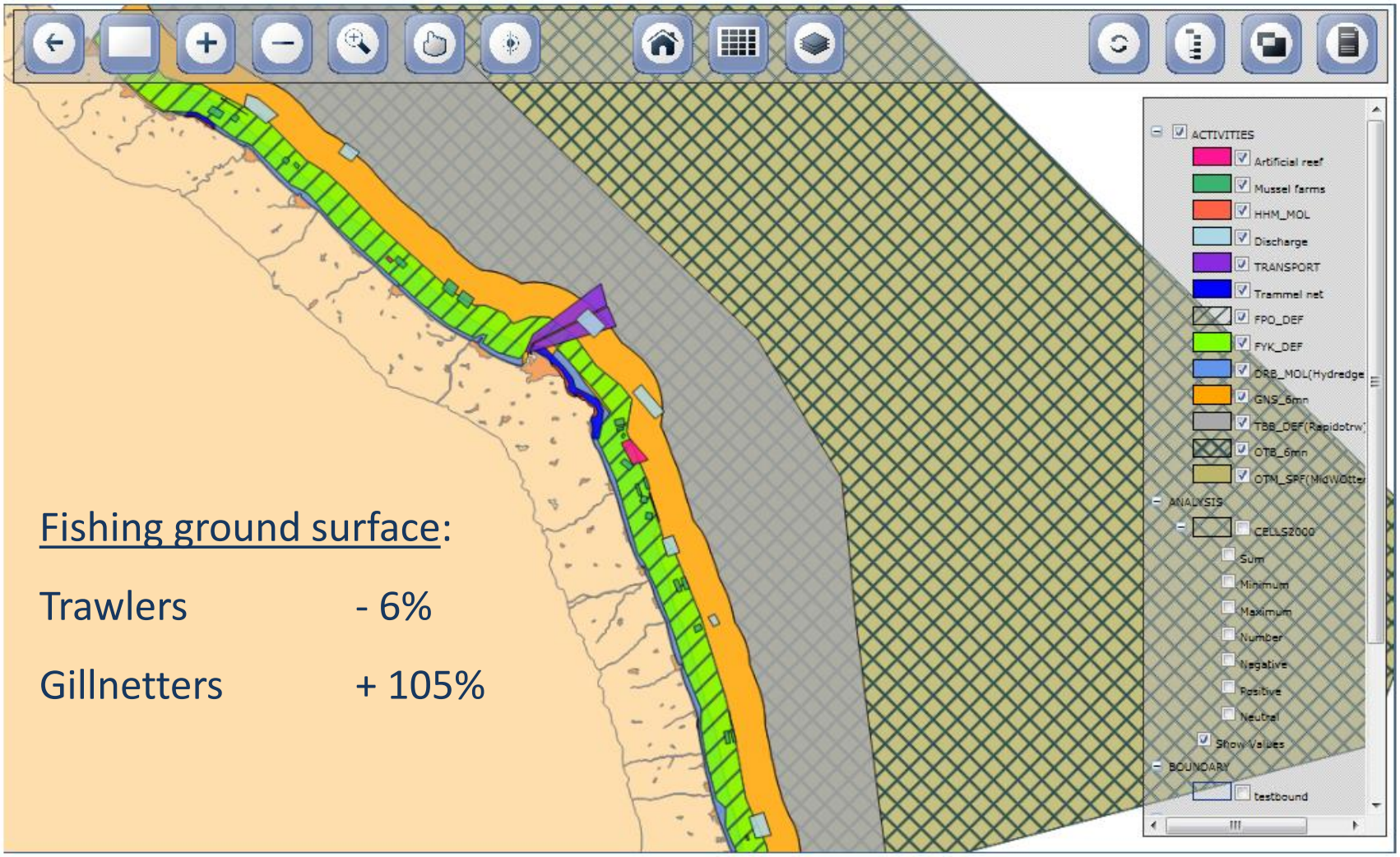



Trawling banned inside the 6 nm from the coast

Gillnetters can exploit new fishing grounds up to 6 nm and leave room for other activities inside the 3nm

# Marche Region: future scenario

## GeoReference Interaction Database
GRID v. 1.2



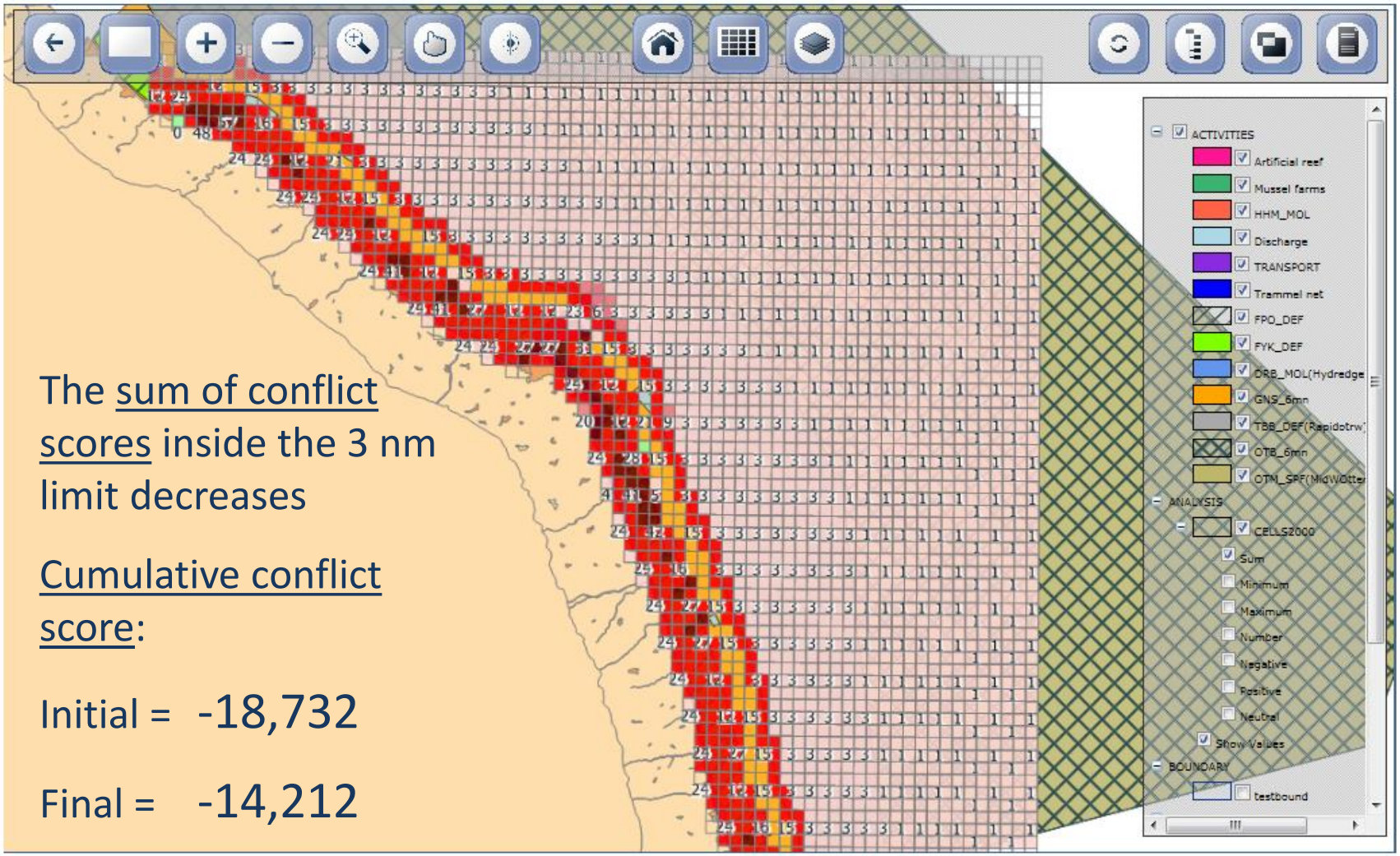

Fishing ground surface:

Trawlers - 6%

Gillnetters + 105%

# Marche Region: future scenario

## GeoReference Interaction Database
GRID v. 1.2




The sum of conflict scores inside the 3 nm limit decreases

Cumulative conflict score:

Initial = -18,732

Final = -14,212

# Marche Region: conclusion

Most of Marine Spatial Planning initiatives occur on a single-sector basis without any planning that looks at the area as a whole.

The approach adopted in this example was aimed to create a more rational organization of the use of marine space taking into account all the interactions between its users.

In the case of the Adriatic Sea, a little reduction of Trawlers' fishing ground results in the following benefits:

Ecological

Social

Economic

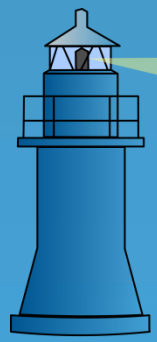
# Thank you for your attention!

CNR
Consiglio Nazionale delle Ricerche

ISMAR
Istituto di Scienze Marine

New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas

# Case study:Ionian Sea

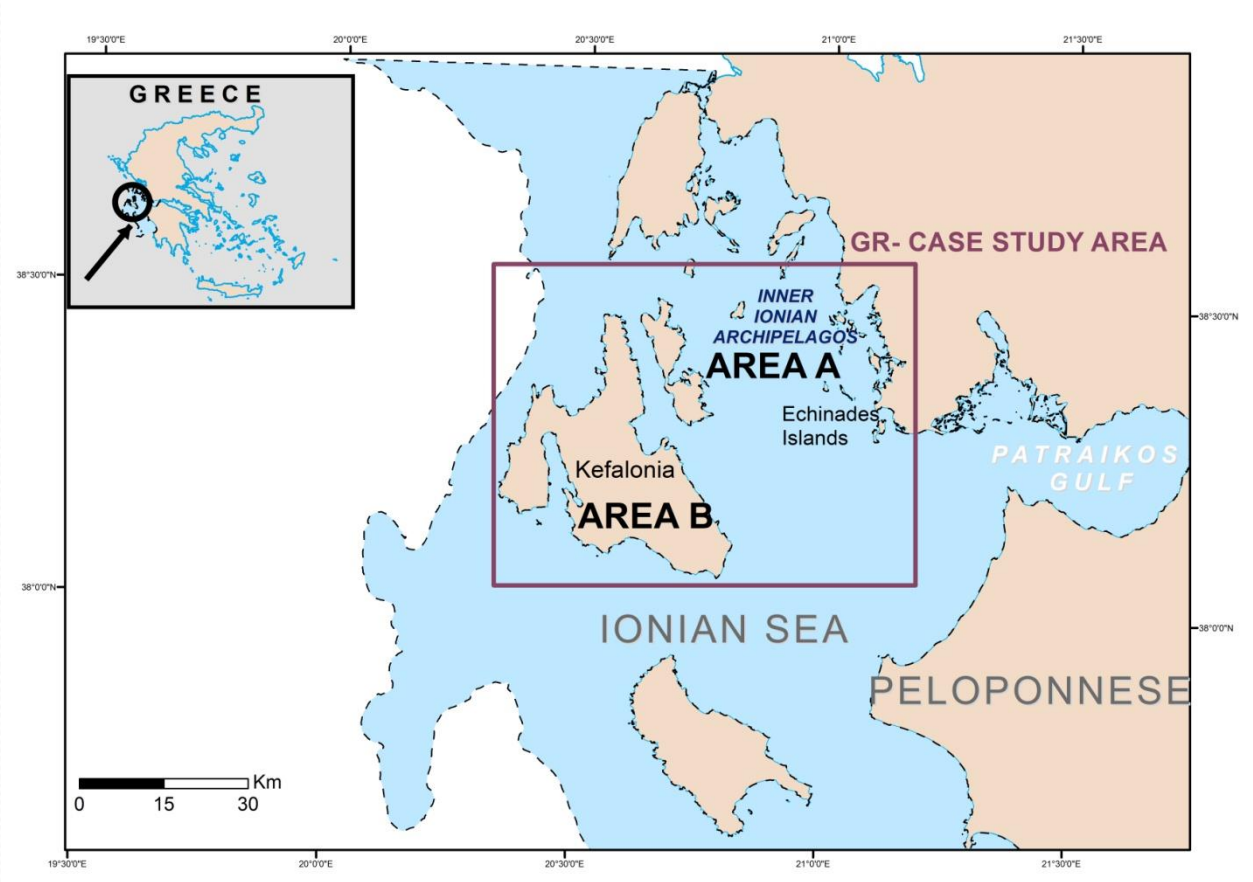


ECOAST

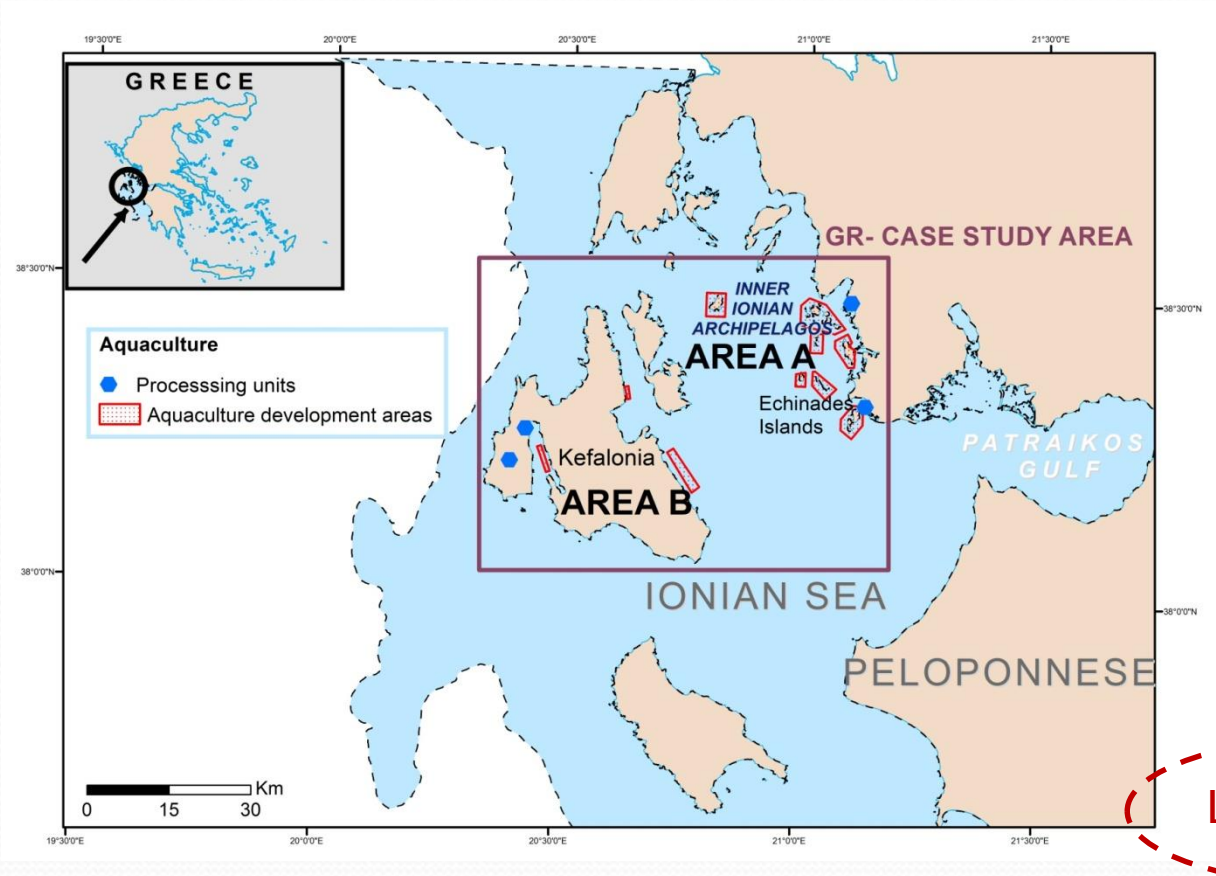
Era-net COFASP

# *Ionian Sea*
# *GR- case study area*

The Greek Case Study is located in central western Greek waters, and includes two areas; namely the Inner Ionian Archipelagos/Echinades Islands **(Area A)** and the Island of Kefalonia **(Area B)**



# Fish farming in the Greek case study area



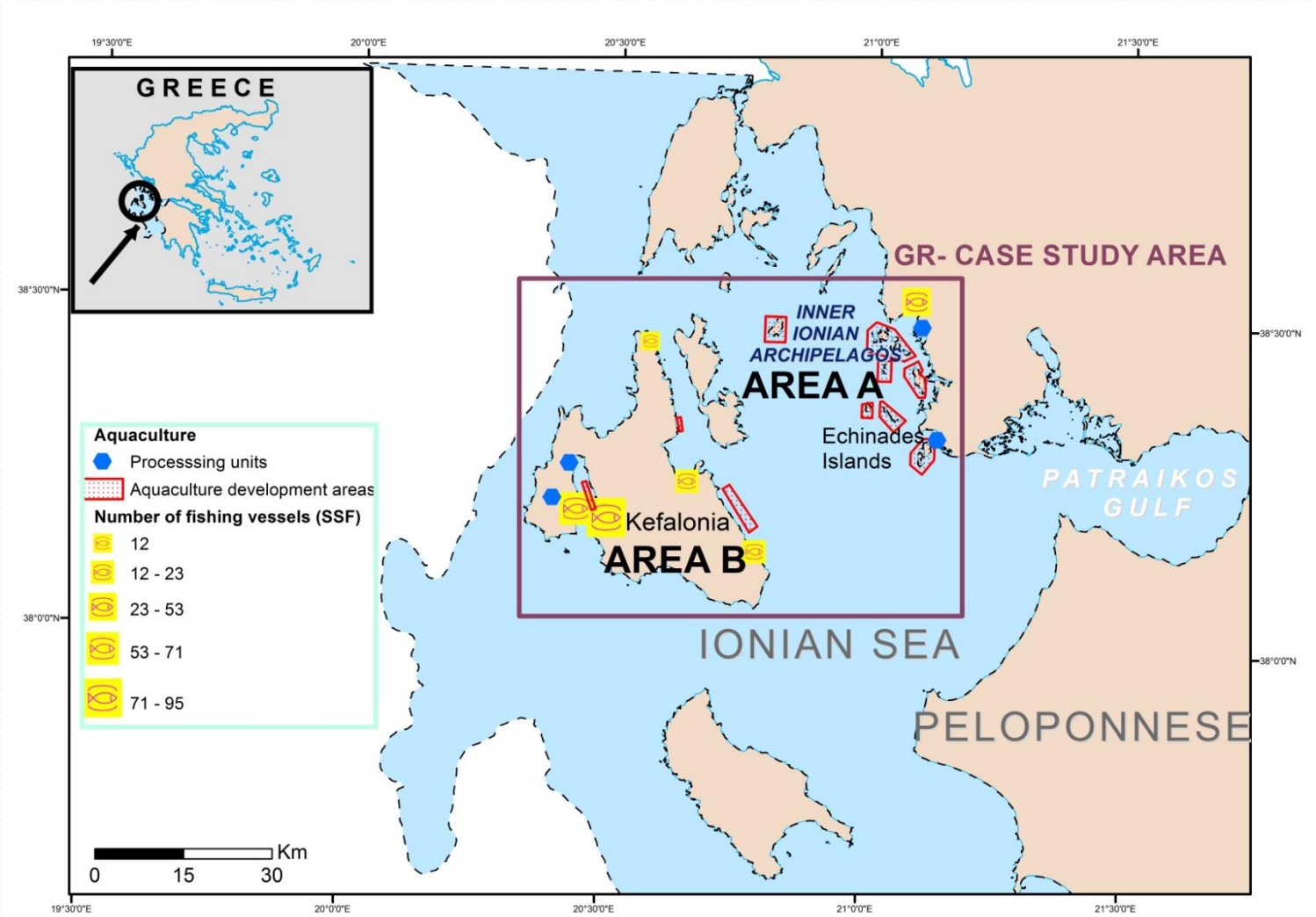

Links with WP3

Allocated Zones for future aquaculture development according to the national regional plans will be depicted

**Echinades Fish Farm in Area A** is nestled amongst a small group of islands in the Ionian Sea and is situated in a marine Natura 2000 site between the Greek mainland and the islands of Lefkada, Ithaki, and Kefalonia to the North and West considered as a refuge for many top marine predators, including the critically endangered Mediterranean Monk Seal (*Monachus monachus*). Other species include the Bottle-nosed Dolphins (*Tursiops truncatus*), Common Dolphins (*Delphinus delphis*), and various shark species. The farm was established in 2004 and focuses on sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus auratus*).

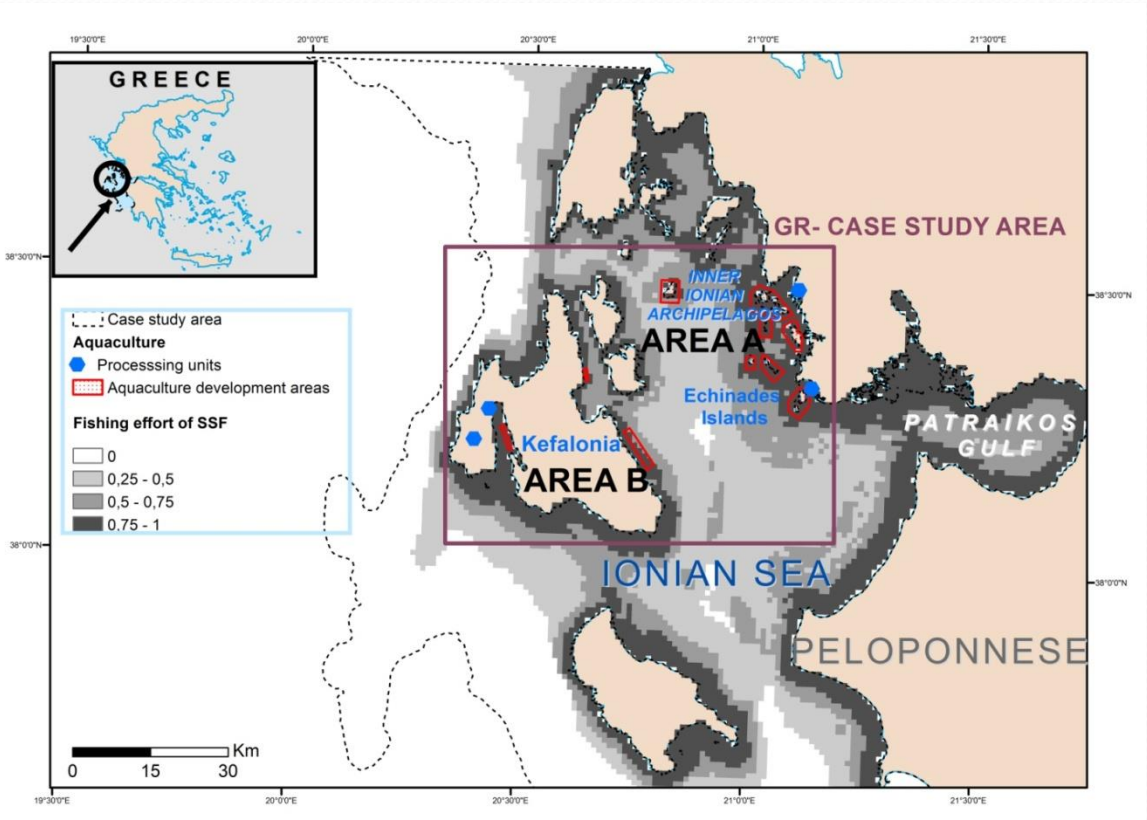
**Kefalonia Fisheries S.A. in Area B** is located on the island of Kefalonia, the largest of the Ionian Islands. Kefalonia Fisheries was established in 1981 and is the first farm established for the production of Mediterranean sea bass and sea bream in Europe. It is regarded as a world-wide pioneer in the production of these species.

# Fish farming & Small Scale Fisheries (Fishing ports) in the study area



# Fish farming & Small Scale Fisheries (Fishing effort) in the study area

**Fishing pressure index from coastal fisheries (FPc)** was estimated by a Multi-criteria Decision Analysis methodology following a fuzzy product process of the coastal fishery suitability index (**Sc**) and the spatial coastal vessels activity index of registered vessels (**Ac**) (Kavadas *et al.*, 2015).



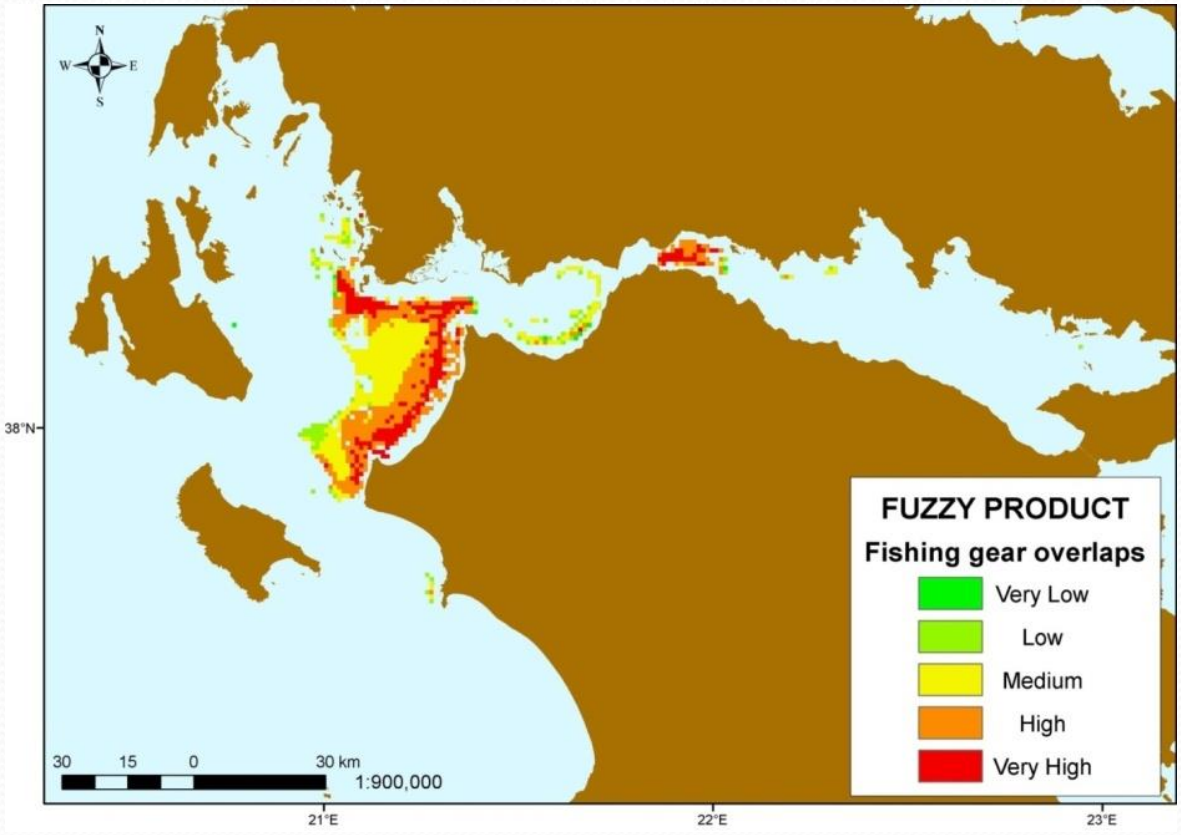

Ground-truthing of outcomes will be made through on-site surveys for SSFs

Links with WP5

➢ **Identify and map priority areas for aquaculture and fisheries**

# Identification of conflicts between human activities

## An example of conflicting fishing grounds between SSF and bottom trawlers




**Need to consider data needs from SSF!**

# Existing other human activities (aside from fisheries and aquaculture)

Within the frame of the project we will:

- Identify and map other important human activities in the two areas (e.g. shipping, tourism)
- Consider potential future human activities (e.g. H/C exploitation)(?)

Organize interaction with stakeholders

Links with WP6

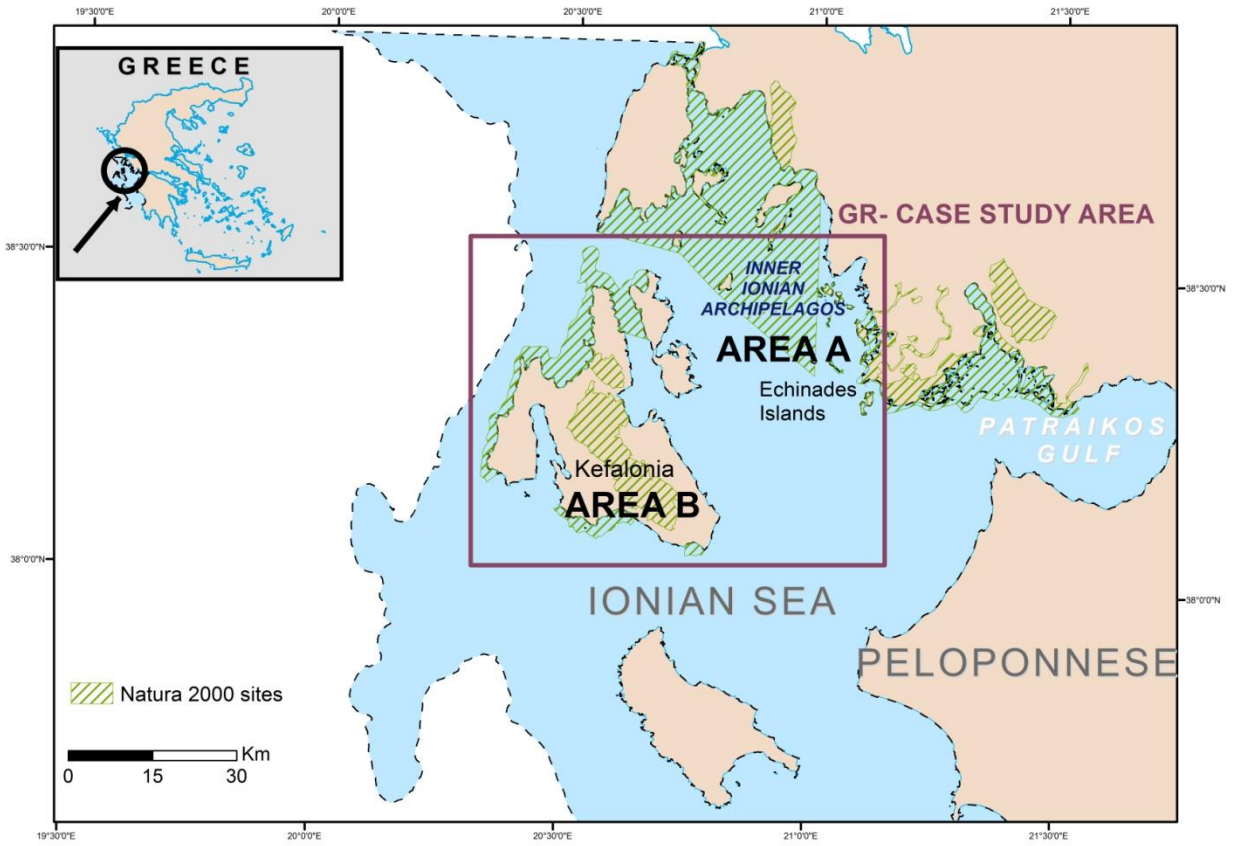
# Marine environment
## Ecosystem components

- Network of marine NATURA-2000 sites
- *Priority habitats (e.g. Posidonia oceanica* meadows)
- Marine mammals (cetaceans, pinnipedia)
- Seabirds ➔ Marine Important Bird Areas (mIBAs)

- Essential Fish Habitats
- Spatial info on fish distribution

-Capitalize knowledge derived from other projects (e.g. DCF, MEDISEH)

-




**➢Identify and map key ecosystems components and productive marine areas**

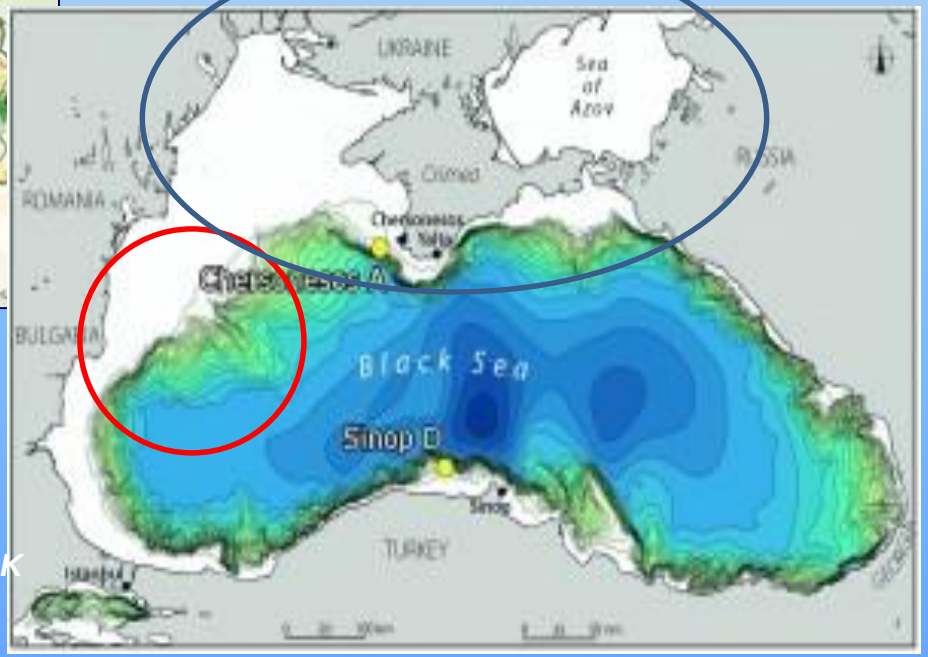
**Main Deliverable**:

Maps of aquaculture, fisheries, other activities, productive marine areas, priority areas for aquaculture and fisheries, and key conservation areas of the Ionian Sea case study will be stored in the GRID database (month 6)

***Furthermore, specific data required for the needs of WPs 3-6 coordinated through WP2 will be also gathered in the frame of the Ionian case study!***

DANUBE catchment area


# Fisheries and Aquaculture in the BLACK SEA Basin in spatial and temporal context




## ROMANIAN COAST

- Coastal length: 245 km (6%)
- Shelf: ~30,000 km$^2$ (16%)
- EEZ (1986) : 22,486 km$^2$

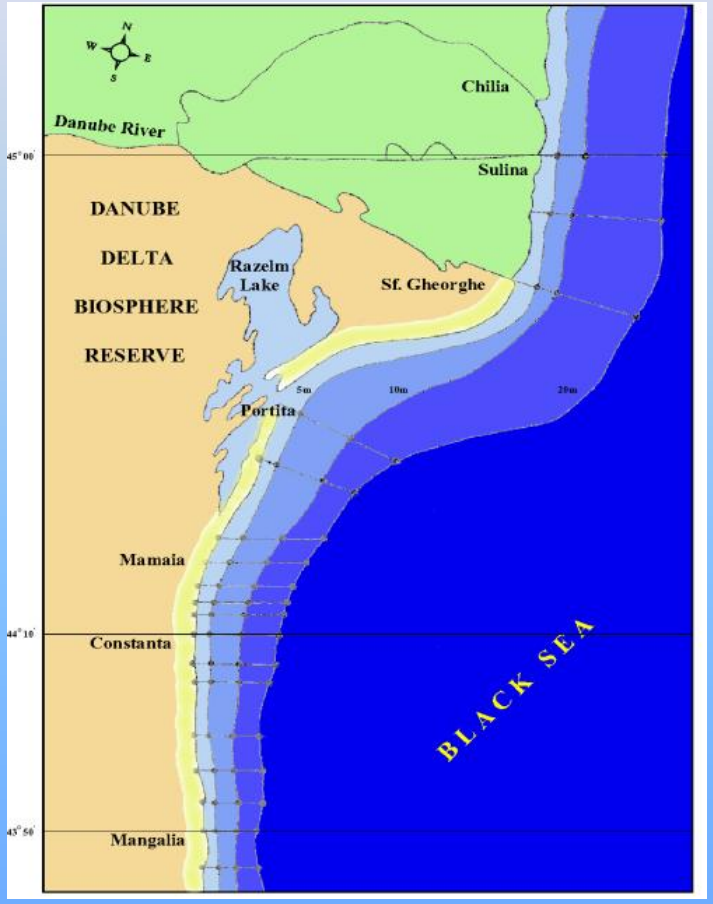
58% aquaculture,
28% inland fisheries
14% marine fisheries

***WATER NETWORK***
almost
730,000 ha

***FISHERY CAPACITY***
400,000 ha

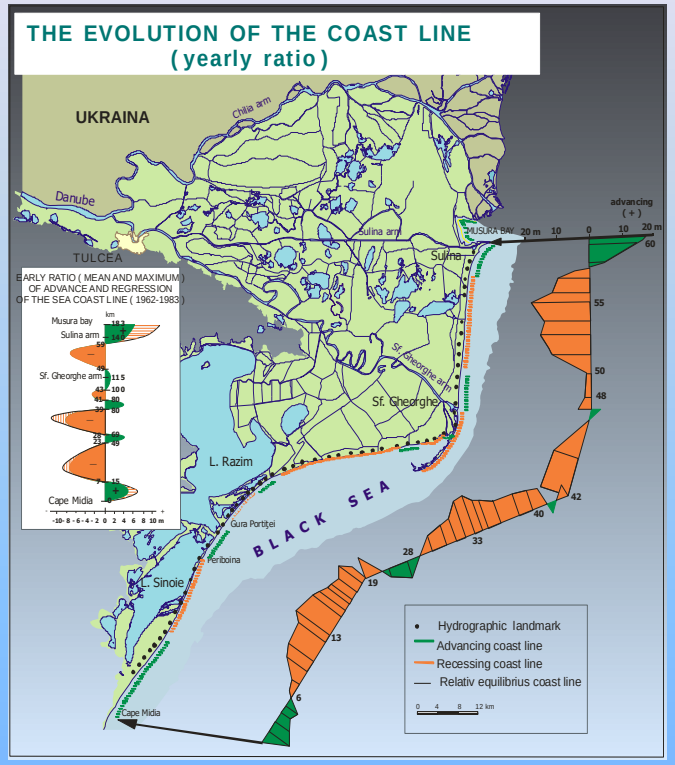
MAREA NEAGRA

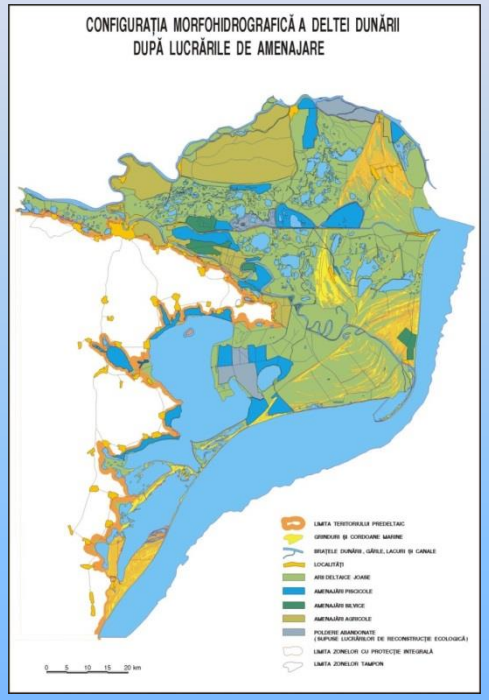
# STATE OF INSTABILITY




- **Climate, Hidrology, Water level, Biodiversity**
- ***Coastal erosion, Marine Protected Areas, Coastal and Marine Habitats inventory, etc.***
- **Co-existence of uses**

# TRADITIONAL FISHERY




# Danube Delta

*Has one of the richest and most diversified inland water networks in Europe*

## Integrated Monitoring

## TRADITIONAL FISHERY

- Sulina-Musura
- Razelm-Sinoe Complex / ecological rehabilitation
- Coastal belt - vulnerability
- * Tasaul Lake – fishery, catchments impact
- Mamaia Bay – defenses
- Siutghiol Lake - pollution
- Eforie - erosion
- Tekirghiol Lake – salty water
- Hagieni-Limanu-Mangalia - dam link
- Vama Veche – protected area

NIMRD
Grigore Antipa

## NATIONAL INSTITUTE FOR MARINE RESEARCH AND DEVELOPMENT "GRIGORE ANTIPA" - CONSTANTA

NACE Code 7219 - Research and development for natural sciences and engineering; UNESCO Code 2510 - Biological oceanography, Chemical oceanography, Descriptive oceanography, Marine botanics, Marine Zoology, Sea bottom processes, Physical oceanography, Sea-air interactions, Marine Ices, Seaside and under-seaside processes, Marine underwater acoustics.

### Operational Oceanography Area

- National Oceanographic and Environmental Data Center (RNOEDC)
- North-Western Atlantic, Mediterranean and Connecting Seas Tsunami Early Warning and Mitigation System (IOC)

# NATIONAL INSTITUTE FOR MARINE RESEARCH AND DEVELOPMENT "GRIGORE ANTIPA" - CONSTANTA

## Marine Living Resources and Fisheries Area

- Black Sea Fisheries Activity Center/Advisory Group for Environmental Aspects of Fisheries and other Marine Living Resources
- National scientific responsibilities for fisheries data collection and assessment of living resources
- National scientific responsible for the General Fisheries Commission for the Mediterranean/Working Group on the Black Sea of the GFCM

## Marine Environment Protection Area

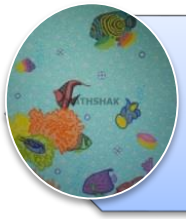
- National Integrated Monitoring System (National Operator)
- National scientific responsibility for the implementation of MSFD
- Focal points for: Biodiversity, Pollution, Land-based Sources Pollution, ICZM, Fisheries and Other Marine Living Resources of the Black Sea Commission
- Focal points for: ACCOBAMS and Convention for Migratory Species (CMS)
- Residency and registered office of the Romanian National Committee of Oceanology/CNR-UNESCO since 2004
- Permanent Technical Secretariat of the National Coastal Zone Committee
- Administration of the 2 Mai - Vama Veche Marine Reserve (ROSCI0269) (Custody Agreement no. 306/13.12.2011 for 2011-2016)

# NIMRD PROJECTS

11 specific ICZM projects. Projects with direct reference to PSM (Interreg-Cadses-PlanCoast, FP7PEGASO, NATIONAL PROGRAM PN) were dedicated to MSp

Maritime spatial plans and contribute to the development strategy of integrated coastal zone management in Romania

Collected marine data and information to support the formulation of integrated plans for coastal and marine spatial planning, noting the need for their permanent updating



Evaluated effects of coastal and marine activities, including planning / scheduling in the marine space

- *Towards COast to COast NETworks of marine protected areas (from the shore to the high and deep sea), coupled with sea-based wind energy potential* **in other words…CoCoNet**
- **ECOMAGIS** Project PN2-32164/2008 Implementation of a complex GIS for Ecosystem-based Management, through integrated monitoring and assessment of the biocoenosis status and its evolution trends in the fast changing environment (2012-2015)

  http://www.rmri.ro/RMRI/NationalPrograms/ECOMAGIS1/index.html
- **EU-FP7 Project PERSEUS** - Policy oriented environmental research in the southern European Seas

- **IRIS -** Pilot Project - New Knowledge for an integrated management of human activities in the sea: *Integrated Regional monitoring Implementation Strategy in the South European Seas, http://iris-ses.eu/*
- **MISIS** *"MSFD Guiding Improvements in the Black Sea Integrated Monitoring System",* Project Nr. 07.020400/2012/616044/SUB/D2

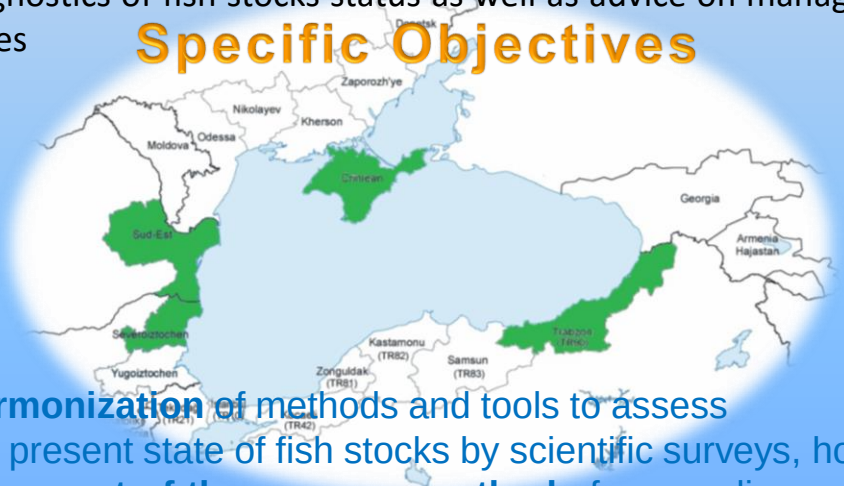



# "STRENGTHENING THE REGIONAL CAPACITY TO SUPPORT THE SUSTAINABLE MANAGEMENT OF THE BLACK SEA FISHERIES" (SRCSSMBSF)- 88

**Contract Number 1.2.1.6570.88 MIS – ETC 303**

Cooperation between the Black Sea riparian countries to know and rationally manage the marine ecosystem and its resources, carrying out diagnostics of fish stocks status as well as advice on management strategies

## Specific Objectives

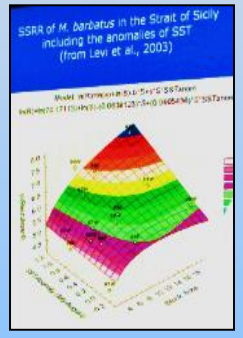


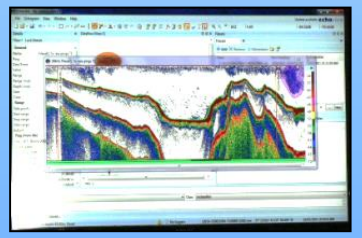

- **Harmonization** of methods and tools to assess the present state of fish stocks by scientific surveys, holistic models;
- **Alignment of the common methods** for sampling, processing and interpretation data from fisheries and stock assessment using analytic models;
- **Awareness of the fishery organizations and decision–makers** from national fisheries regarding the need to use in the **management strategies** of the advice from research and joint – regional stock assessment.

**2011-2013**

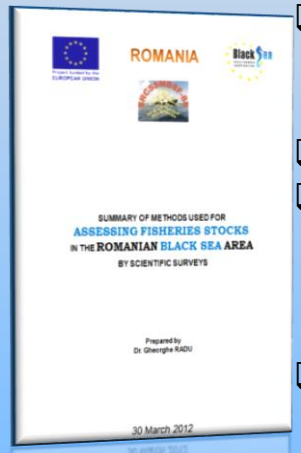
## *"STRENGTHENING THE REGIONAL CAPACITY TO SUPPORT THE SUSTAINABLE MANAGEMENT OF THE BLACK SEA FISHERIES"* (SRCSSMBSF)- 88

- **Meetings of specialists** in assessment from the Black Sea coastal countries
- **Working visits and trainings** of specialists
- *Report on* ***state of the Black Sea Fisheries***
- ***Inventories of the national authorities, focal points, scientists and non-governmental organizations*** *concerned with fisheries*
- ***Awareness materials***

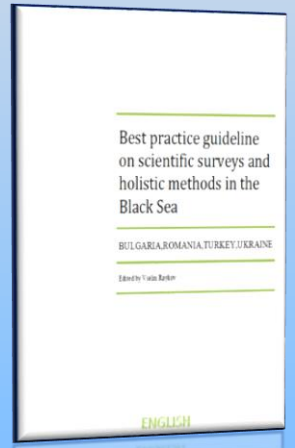


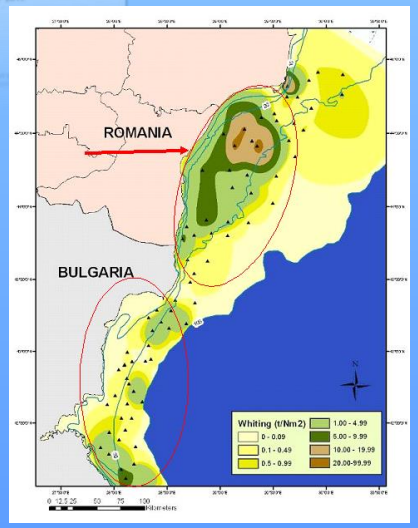



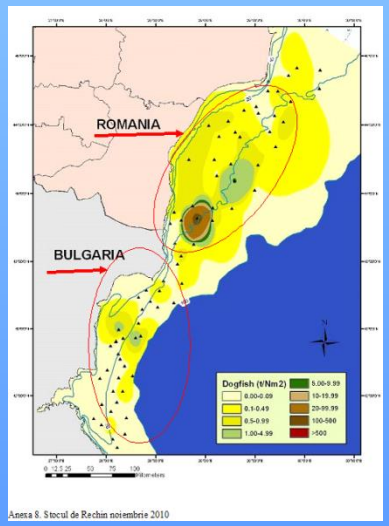
## *"STRENGTHENING THE REGIONAL CAPACITY TO SUPPORT THE SUSTAINABLE MANAGEMENT OF THE BLACK SEA FISHERIES"* (SRCSSMBSF)- 88

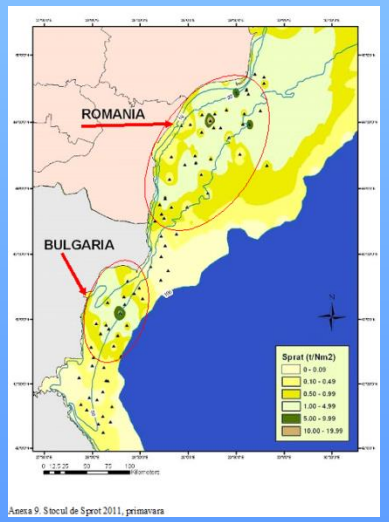


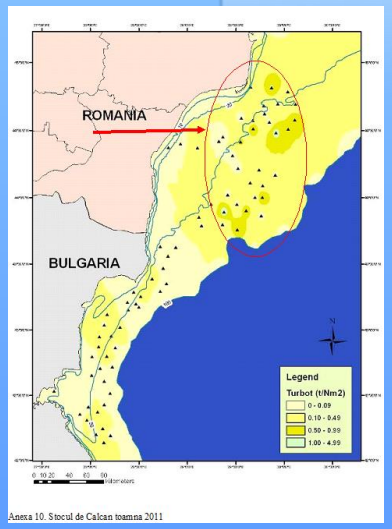

- **National reports** on methods for sampling, processing and interpretation data from fisheries and stock assessment using analytic models;
- A ***best-practice guideline*** *for stock assessment using scientific surveys*
- **Manual of protocols** on methods used for assessing fish stocks in the Black Sea by analytic methods realised in English by Ukrainian partner YugNIRO" trnslated **in Bulgarian, Romanian, Turkish, and Ukrainian/Russian**
- **Management Plan f**or Black Sea Fisheries



- Update the **available information** on fisheries in the Black Sea **(fleet and effort, catches, biological, ongoing research)** and contribute to the GFCM bi-annual report on the status of fisheries.
- Collaborate with the **BSC/AG FOMLRM** (list of **indicators** for BSIMAP, updated template for national reports, biological safety limit for selected species;
- Advance towards the **design of fisheries independent surveys in the whole area** of distribution for the main demersal/pelagic species;
- Compile the **existing information on data collection systems for all BS countries, including the harmonization of scientific survey** projects;

**1. Fishing Gears and Methods**

**2. Number of Fishing Vessels**

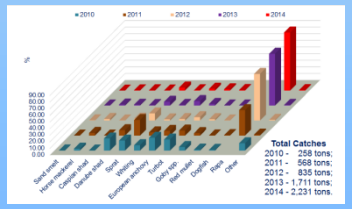
**3. Total catch of the Black Sea**

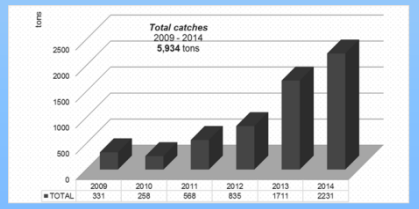
**4. Catch Species Composition**

**5. State of Marine Fishery Stocks**

**6. The species minimum admissible length**

**Stock value (tons) for the major fish species in the Romanian Black Sea**




| Species | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|---|
| Sprat | 61,916 | 60,059 | 59,643 | 60,000 | 68,887 | 56,429 | 60,000 |
| Whiting | 8,659 | 11,846 | 20,948 | 21,000 | 5,650 | 19,797 | 5,550 |
| Goby | 500 | - | 500 | 500 | 450 | 300 | 300 |
| Turbot | 2,356 | 1,500 | 1,149 | 1,147 | 628 | 554 | 298 |
| Dogfish | 1,450 | 2,500 | 13,051 | 10,000 | 1,550 | 4,483 | 1,520 |

**REPORT ON STATE OF THE BLACK SEA FISHERIES**

# REPORT ON STATE OF THE BLACK SEA FISHERIES

In the 1980s, studies revealed that, in the north-eastern Black Sea, approximately **166 fish species are present**, of which 11 of Atlantic origin, 20 Ponto-Caspian species, 6 acclimated, 9 enedemic and 23 local species.

Currently, after having analyzed the results of experts from Bulgaria, Turkey, Ukraine, Romania, Georgia and Russia, **185 species** have been identified at Black Sea basin level, of which **75 species (40.54%) are commercial fish species**: pelagic (12 families) , demersal (8 families);

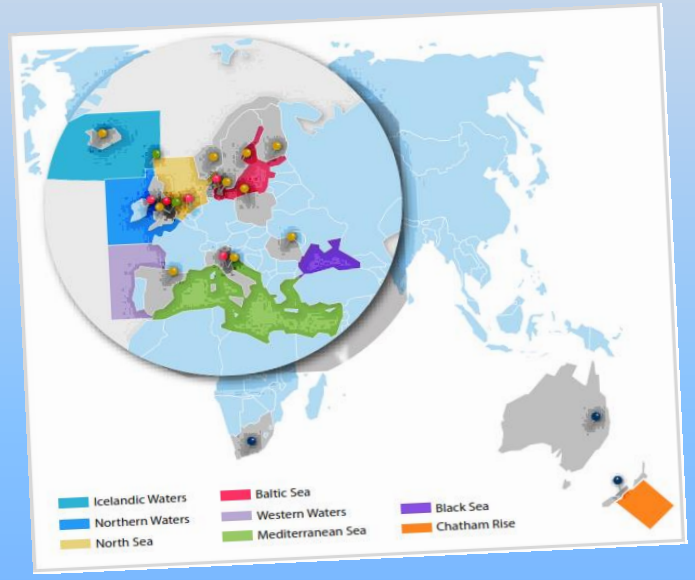
In 2014, in the Romanian marine sector, the fishing industry practiced by fishermen was done in two ways:

- **active fish**ing gear with coastal trawler vessels, made at depths of 20 m,
- **fixed fishing gear**, practiced along the coastline in 18 fishing points, located between Sulina and Vama Veche, in shallow waters (3-11 m pound nets), but also at 20-60 m depths/gillnets and long lines).

The following trends were reported:

- **Evolution *of status indicators*, *pressure indicators, impact indicators***
- ***Measures for solving critical issues (nationally, regionally)***

# Co-creating Ecosystem based Fisheries Management Solutions




- MareFrame seeks to remove barriers that currently prevent a more widespread use of an Ecosystem-based Approach to Fisheries Management (EAFM) by developing:
- Novel data based on new tools and technologies
- Ecosystem models and assessment methods based on indicators of Good Environmental Status (GES)

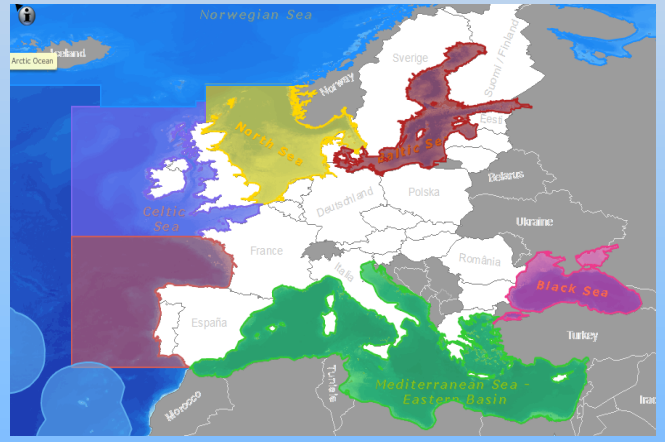
**2014-2017**

A **Decision Support Framework (DSF**) adapted to the needs of decision makers, managers, operators, and other stakeholders that will support the implementation of the new **Common Fisheries Policy (CFP), Marine Strategy Framework Directive (MSFD) and Habitats Directive (HD)**

## *Co-creating Ecosystem based Fisheries Management Solutions*

## Sustainable development and growth in the maritime sector

According to the **Regulation on environmental protection in the marine environment,** promulgated in State Gazette 94/30.11.2010, the marine strategy should be based on the EBA.'




Romania, by NIMRD Constanta, as partner, developed two important projects on ecosystem approach for marine fisheries:

- **MAREFRAME** - *Co-creating Ecosystem-based Fisheries Management Solutions* (http://mareframe-fp7.org/) http://www3.moew.government.bg/files/file/Legislation/Naredbi/vodi/N_morskite_vodi.pdf
- **CREAM - CREAM** - *Coordinating research in support to application of ecosystem approach to fisheries and management advice in the Mediterranean and Black Sea* (http://www.cream-fp7.eu/)

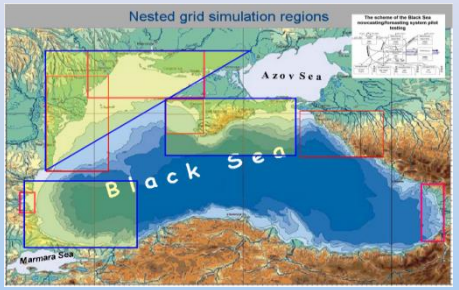
**Coherence with other processes:**

- **MSFD**
- **ICZM**
- **Strategic Environmental Assessment**
- **Stakeholder Involvement**

- **Trans-boundary cooperation**
- **Cooperation with third countries (Black Sea Case)**

- Resilience of climate change impacts
- Land-sea interactions


# PlanCoast Project
# 2005 - 2007




## NATIONAL INSTITUTE FOR MARINE RESEARCH AND DEVELOPMENT
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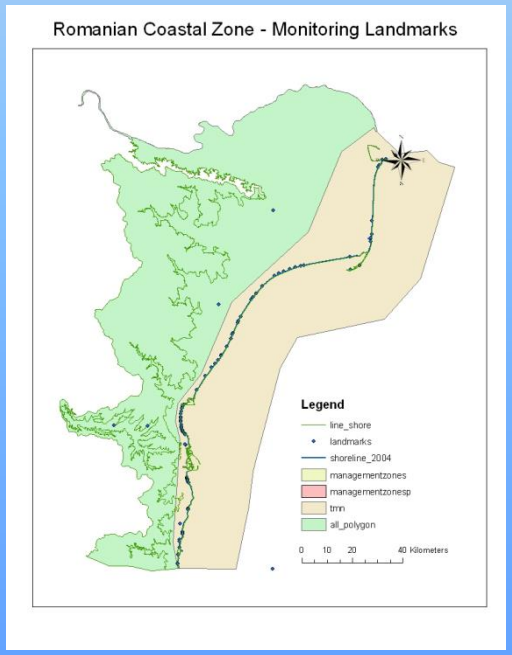
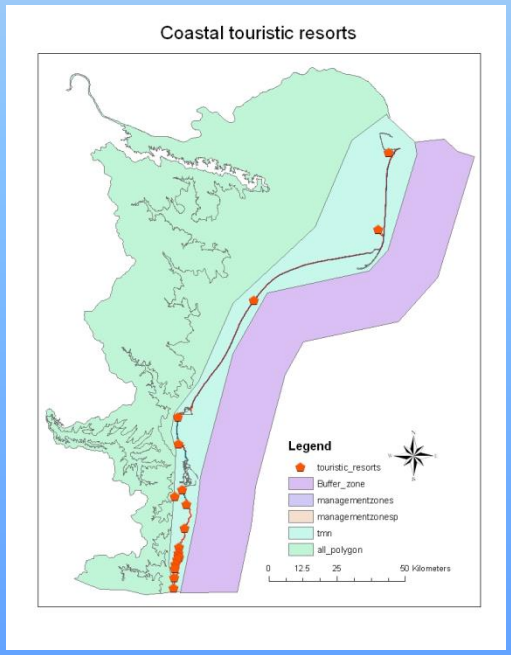
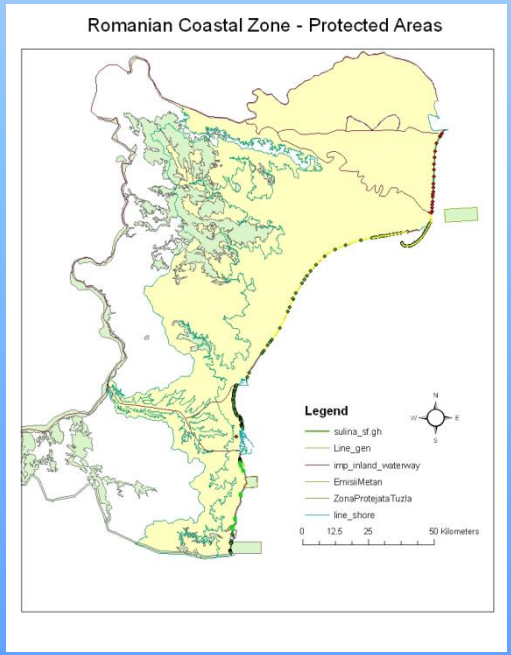
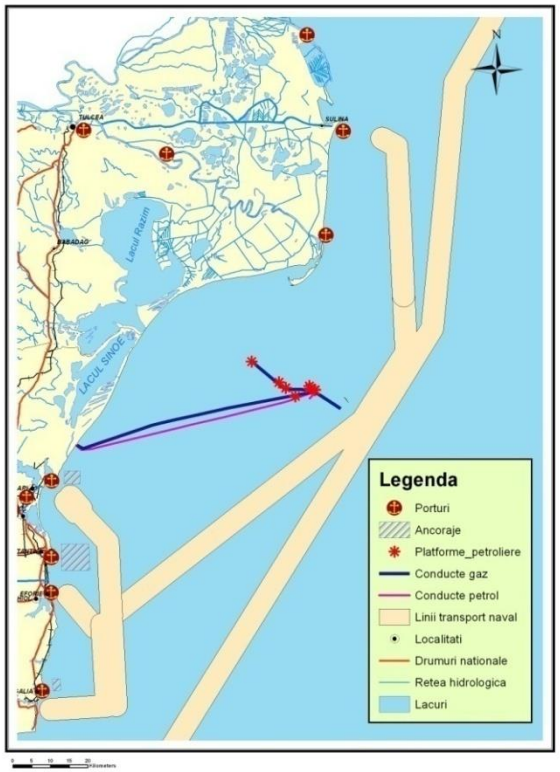


**Project PN 09-320302** ***Preparation of the informational support and and database updating to sustain the elaboration of Integrated Maritime Spatial Planning Strategy 2009 -2013***





# Directive for MSP main steps AND terms

For the Directive MSP implementing must be established competent authorities, commissions with duties on information changes, in Romania, with the obligation in their communication within six months after the entry into force of the Directive. For the member countries, including ours there are planned terms:

- Directive **came into force** 20 days after its publication in the Official Journal of the European Union (28 August 2014),
- **Transposition** into Member States' legislation and its regulations, according to the possibilities and needs of each country, will take place by 18 September 2016,
- **Marine spatial pla**ns should be established at national level, as soon as possible, and no later than **31 March 2021,**
- The **plans** must be reviewed at least once every 10 years and continuously updated

# NIMRD present Projects In Maritime Spatial Planning

- Project DG MARE/2014/23
  MARSPLAN 2016-2019
- Project DG MARE/2014/23
  ECORYS – 2016 - 2017
- Project Horizon 2014-2020
  ResponSEAble 2015- 2019

European Commission
Directorate-General for Maritime Affairs and Fisheries
Unit MARE-E-1
Ref. MARE/2014/22
Lot:
Office: J-99 2/89
B – 1049 BRUSSELS

# MARSPLAN Project OBJECTIVES

- Supporting the **implementation of the EU Directive for MSP**
- Creating an **institutional framework for Romania-Bulgaria** cross-border MSP
- Developing the **cooperation with all Black Sea countries** for MSP
- Consolidating the **cross-border cooperation** and exchange information between RO-BG
- Setting out the **vision and strategic goals** for Black Sea area on MSP, taking into account **the land sea interaction**
- **Elaborating MSP for cross-border area**
- Contributing to a **wider dissemination** of all gathered information concerning MSP, Black Sea, best practices and stakeholders

## Aquaculture and Marine Fisheries Study Case

European Commission
Directorate-General for Maritime Affairs and Fisheries
Unit MARE-E-1
Ref. MARE/2014/22
Lot:
Office: J-99 2/89
**B – 1049 BRUSSELS**

# MSP in Romania

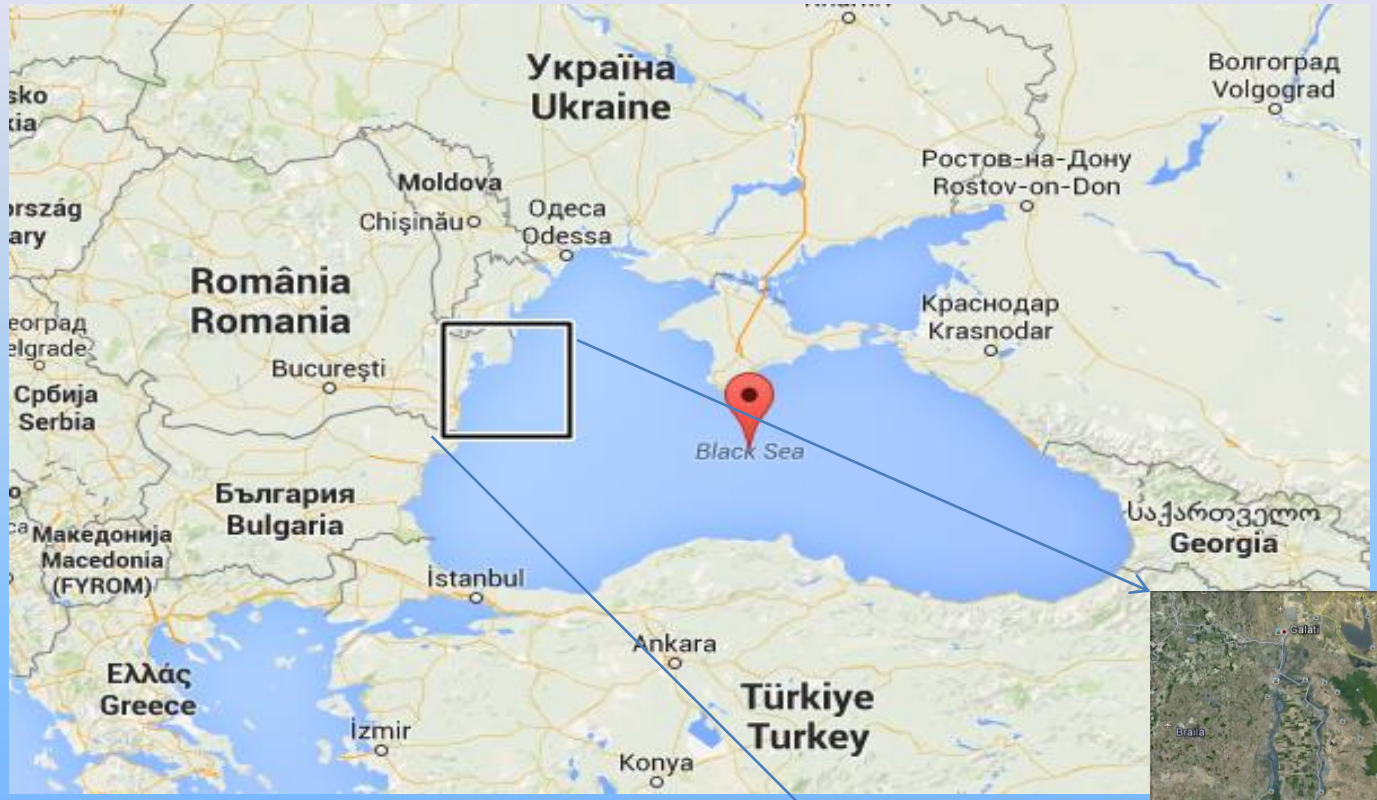
Considering the experience of the last 10 years, gained in various projects or based on national legislation on Integrated Management of the Coastal Zone, discussions and debates in the MSP in Romania have made progresses, including by NIMRD contribution, exemplifying:

- Achieving a **better delimitation of the coastal zone**,
- Creating **better links between marine and coastal environment** (erosion control, beaches quality)
- Improved **management information** about the vicinity areas of beaches, including the habitats description, established marine protected areas, location of specific activities (e.g. fishing)
- Increasing efficiency in the preparation of **documents** for PSM decisions makers.

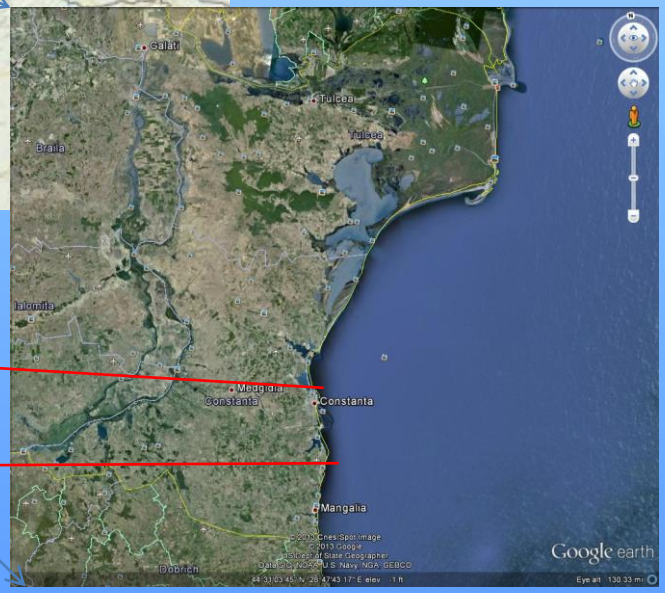
# MSP in Romania

**RECOMMENDATION FOR THE NECESSARY STEPS on THE DIRECTIVE IMPLEMENTATION IN ROMANIA:**

1. Nomination of the **responsible authorities**,
2. National **standards** developing,
3. Directive **harmonization of in terms of national / local conditions**,
4. **INCDM** involvement as a national institute for multidisciplinary marine research, the sole holder of many kind of historical data monitoring
5. **Cooperation** with other institutions involved in the marine components inventorying and the spatial plans development




**MARINE AQUACULTURE**

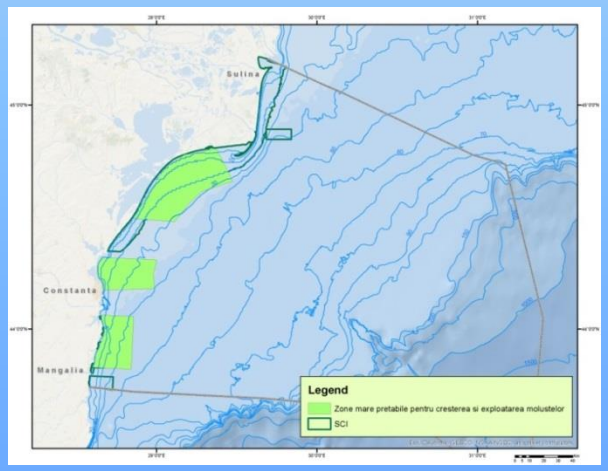



Turbot farm

Molusks farm

## MARINE AQUACULTURE

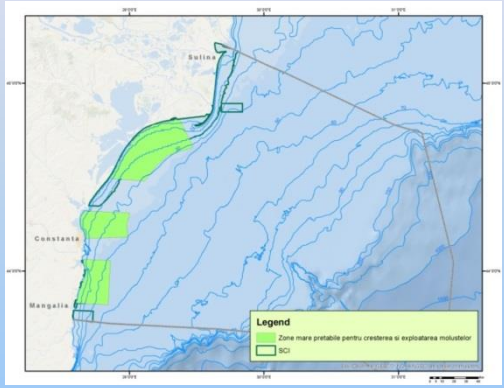
The materialization of the **zoning of mollusc waters** (suitable not only for molluscs, but also for other resources, such as macrophyte algae) - approved through GD no. 201/22.03.2002, for the approval of the Technical norms regarding the quality of mollusc waters, modified and completed by GD no. 467/2006 (according to the WATER QUALITY REQUIRED FOR REARING MOLLUSCS **DIRECTIVE 2006/113/**EC OF THE EUROPEAN PARLIAMENT AND COUNCIL of 12 December 2006 requirements) and by MO no 983/2015



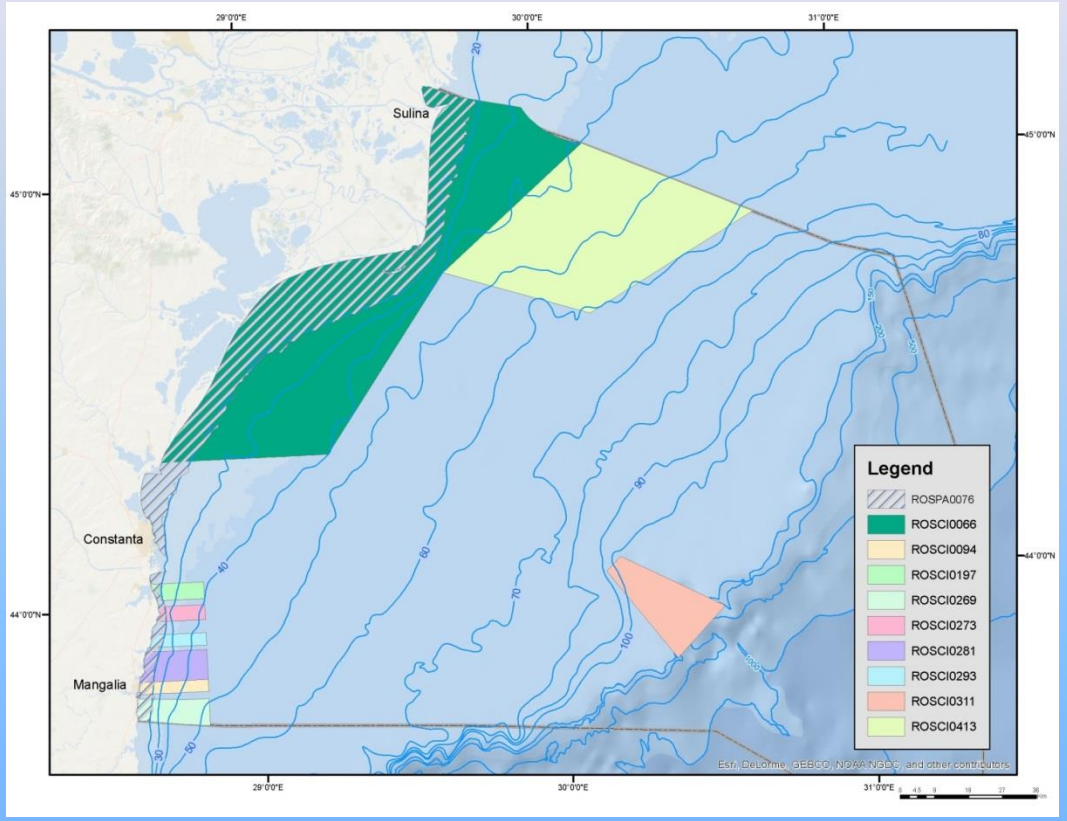

To be implemented in the future:

- Council Directive 91/492/EEC - 15.07.1991 laying down the health conditions for the production and the placing on the market of live bivalve molluscs
- Council Directive 97/61/EEC - 20.10.1997 ammending the Annex to Directive 91/492/EEC laying down the health conditions for the production and placing on the market of live bivalve molluscs
- Commmission Decision 93/51/EEC - 15.12.1992 on the **microbiological criteria** applicable to the production of cooked crustaceans and shellfish
- Council Decision 1999/313/EC - 20.04.1999 on reference laboratories for monitoring bacteriological and viral contamination of bivalve molluscs
- Council Decision 93/383/EEC - 14.06.1993 on reference laboratories for the monitoring of marine biotoxins

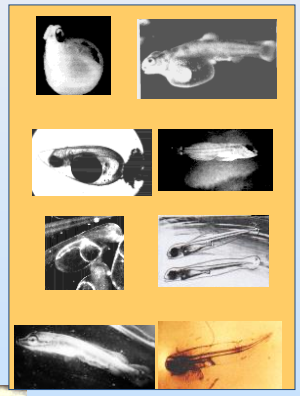
## MARINE AQUACULTURE




Currently, marine aquaculture in Romania is at its beginnings, a single mussel farm being registered (*Mytillus galloprovincialis*),




despite the fact that certain studies suggest that there is interest and there are possibilities for developing this sector. With the view to practicing marine aquaculture, as well as exploiting natural marine mollusc stocks, the implementation of the 79/923/EEC Directive, on the shellfish water quality, was carried out, by identifying four **AREAS SUITABLE FOR THEIR CULTURE AND EXPLOITATION** (Annex 2 - Areas recommended for rearing and catching molluscs at the Romanian Black Sea)




***MAIN SPECIES***

mussel (*Mytillus galloprovincialis*)
white clam (*Anadara* sp.)
grass shrimp (*Palaemon sp.*)
mullet (*Mugilus* sp.)
flounder (*Platychthys flesus luscus)*
rainbow trout (*Onchorynchus mykiss*
pike pearch (*Stizostedion lucioperca*)

***EXPERIMENTS OF ACCLIMATIZATION***

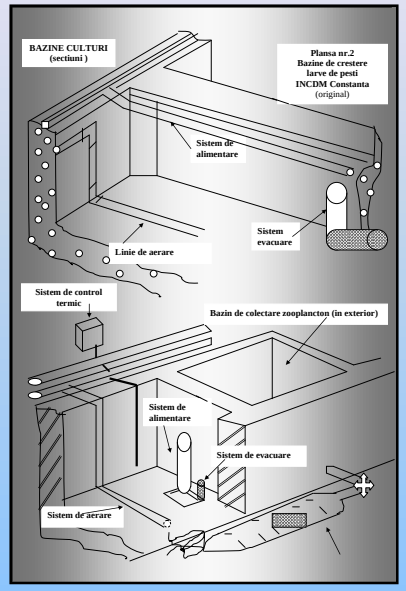
oyster species (*Crassostrea* type)
large shrimps (*Penneus* sp.)
flounder (*Platychthys flesus luscus*)

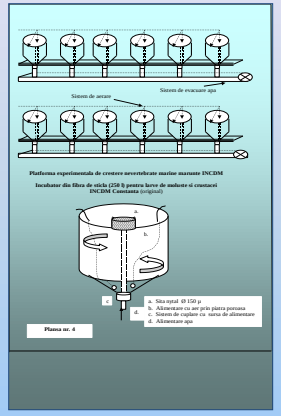
***OTHERS***

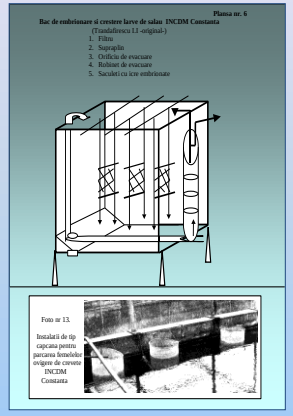
turbot (*Psetta maeotica*) populations,
Sturgeons:
Danube Sturgeons *(Acipenser guldenstad*i)
Stary sturgeons (*Acipenser stellatus*)
Beluga (*Huso huso*)

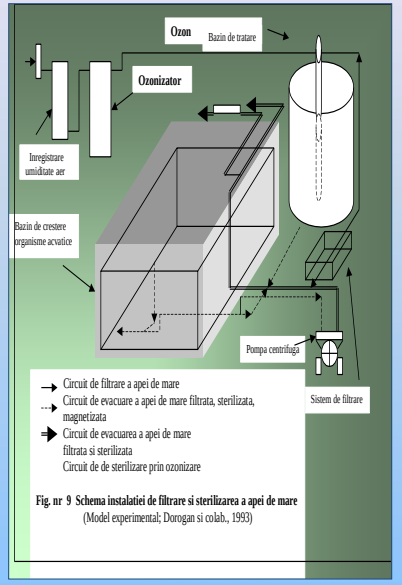
psamobiontic bivalves
(*Cerastoderma edule, Anadara* sp., *Mya arenaria)*

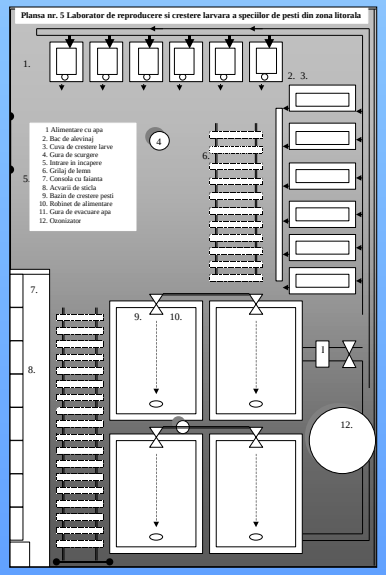
# NIMRD CONSTANTA AQUACULTURE RESEARCH (1970 -present)

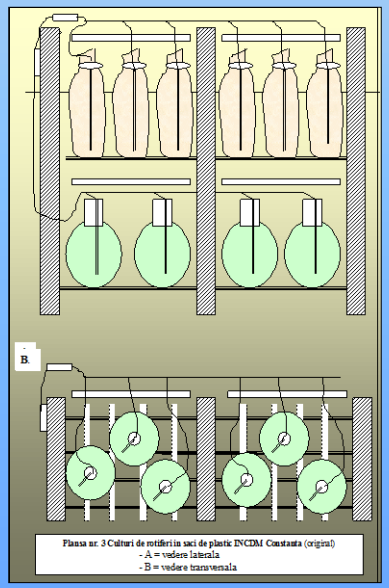


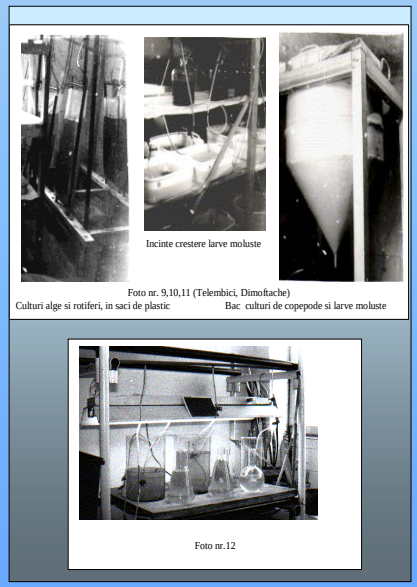



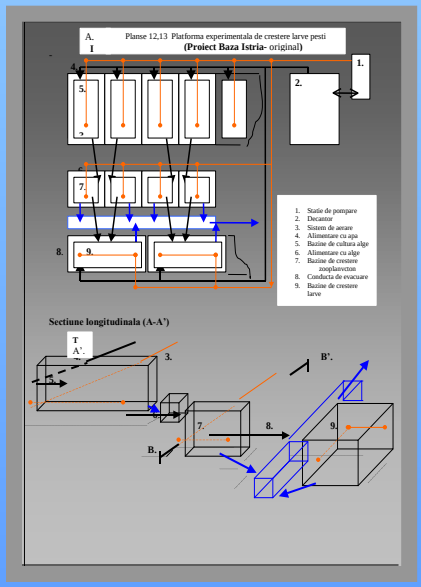




# General facilities

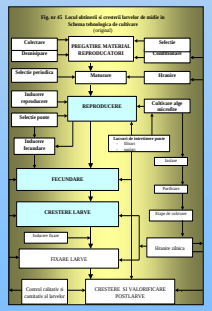
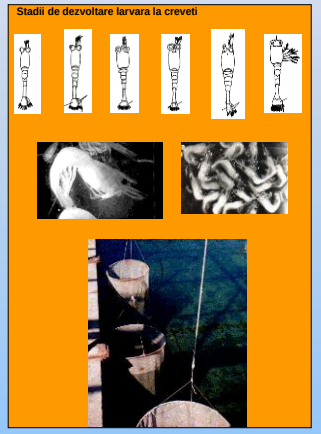
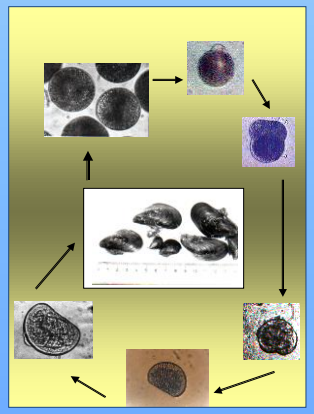
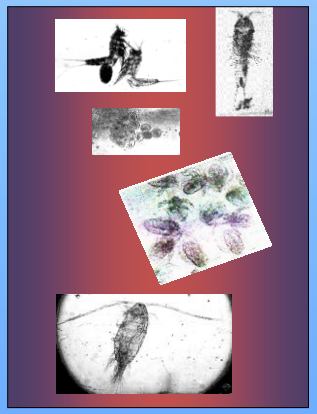


Fig. nr 45 Larul obtinerii si cresterii larvelor de midie in
Schema tehnologica de cultivare
(original)
Colectare
Deznisipare
PREGATIRE MATERIAL REPRODUCATORI
Selectie
Conditionare
Selectie periodica
Maturare
Hranire
Inducere reproducere
REPRODUCERE
Cultivare alge microalge
Selectie pante
Inducere fecundare
Larvarii de intretinere pentru filtrare
Sedare
FECUNDARE
Purificare
CRESTERE LARVE
Stop de cultivare
Inducere fixare
Montare stinica
FIXARE LARVE
Control calitate si cantitate al larvelor
CRESTERE SI VALORIFICARE POSTLARVE


Stadii de dezvoltare larvara la creveti





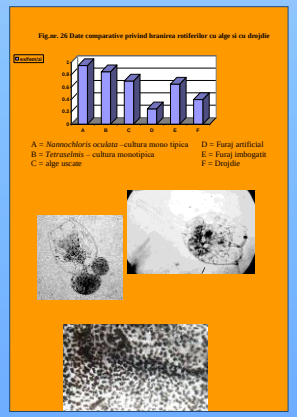


Fig.nr. 26 Date comparative privind hranirea rotiferilor cu alge si cu drojdie
Rotifers/ml
A = Nannochloris oculata –cultura mono tipica
B = Tetraselmis – cultura monotipica
C = alge uscate
D = Furaj artificial
E = Furaj imbogatit
F = Drojdie

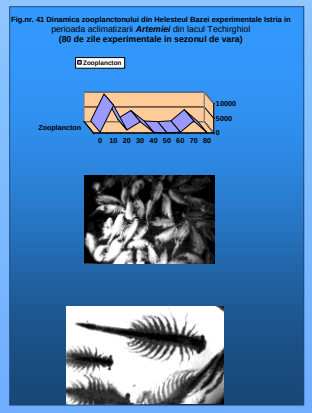
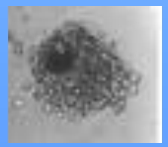
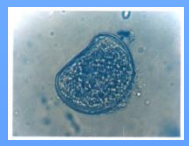
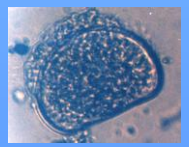
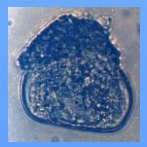


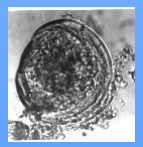
Fig.nr. 41 Dinamica zooplanctonului din Helesteul Bazei experimentale Istria in
perioada aclimatizarii Artemiei din lacul Techirghiol
(80 de zile experimentale in sezonul de vara)
Zooplancton
Zooplancton
10000
5000
0
0 10 20 30 40 50 60 70 80

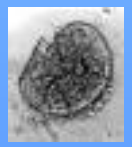


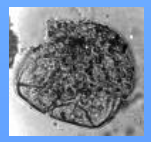










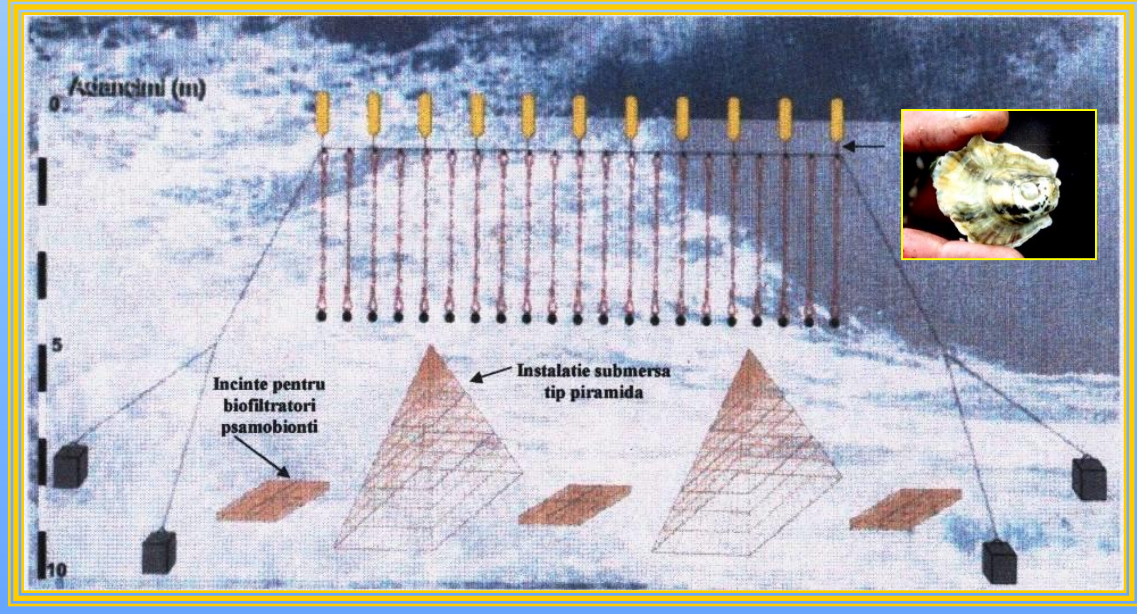





# Installation for cultivation and/or sea water biofiltration







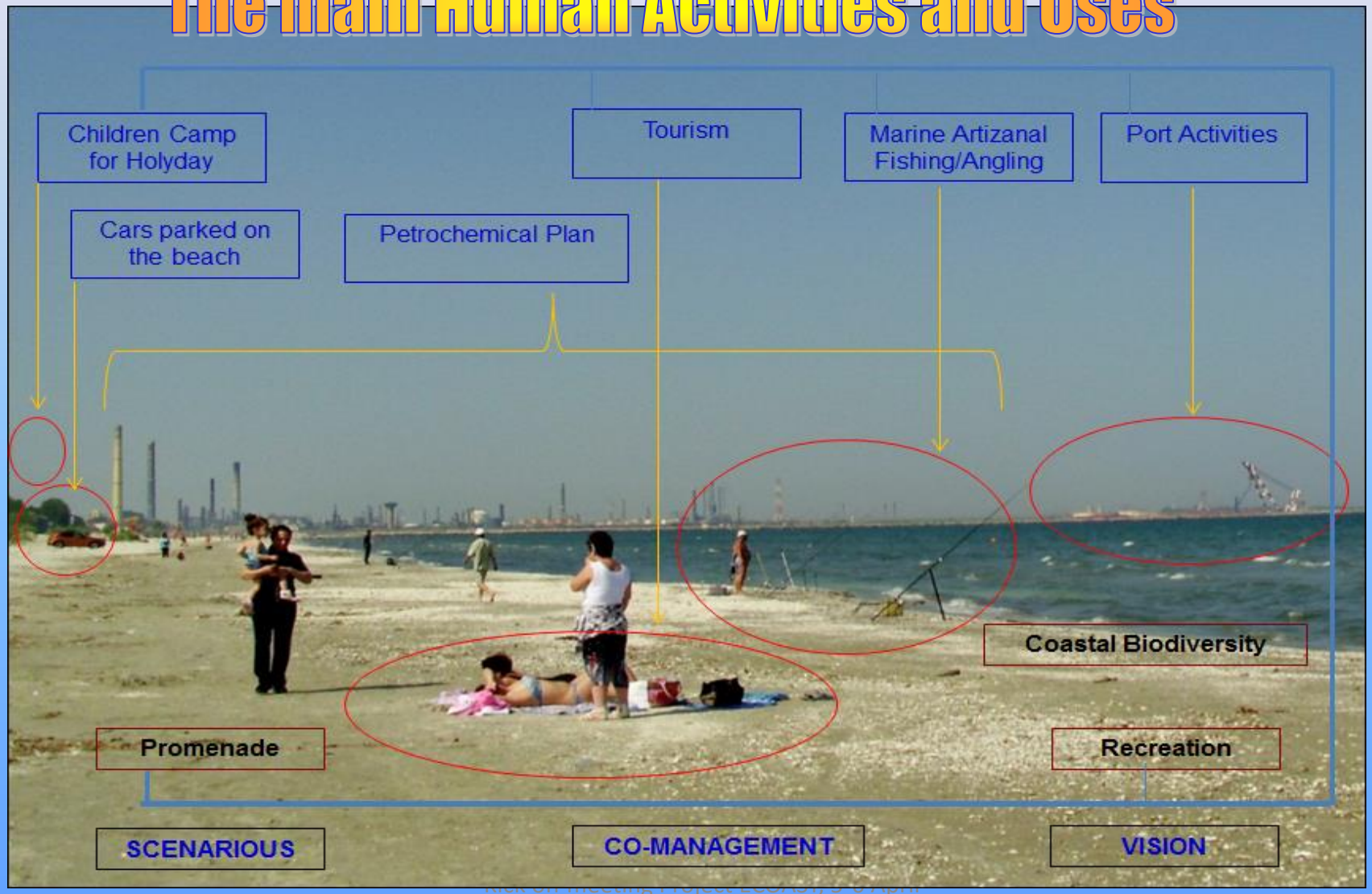
# MARINE AQUACULTURE - Requirements and constraints

| Factor | Good | Average | bad | Romania |
|---|---|---|---|---|
| Exposure | partial | sheltered | exposed | exposed |
| Waves | ≤1 m | From 1 to 3 m | ≥3 m | > 3m |
| Depth | > 30 m | From 15 to 30 m | < 15 m | ≥15 m |
| Currents | strong | moderate | weak | strong |
| Pollution | absent | low | high | low |
| Max. temperature | Fom 22 to 24ºC | From 24 to 27ºC | > 27ºC | From 24 to 27ºC |
| Temperatura min. | 12ºC | 10ºC | <8ºC | <8ºC |
| Average salinity | From 25 to 35 | From 15 to 25 | <15 | From 15 to 19 |
| Fluctuation of salinity | <5 | From 5 to 10 | > 10 | <5 (central - South |
| Dissolved oxigen (%) | >100 | From 70 to 100 | < 70 | From 70 to 100 |
| Slope (topography) (%0) | > 30 | From 10 to 30 | <10 | 5 - 20 |
| Substratum | Sandy and rocky | mixed | muddy | Sandy, rocky, muddy |
| Trophic state | oligotrophic | mezotrophic | eutrophic | Eutrophic to mesotrophic |
| Fouling | low | moderate | high | Moderate to high |
| Predators | no | rare | abbundant | some |

# MARINE AQUACULTURE - Possible conflicts with other users

| Activity | Industry and harbors | Urbanisation | Tourism | Agriculture | Fishery |
|---|---|---|---|---|---|
| **Spatial resources** | The need for land<br>Ship traffic<br>Military areas<br>Nevoia de teren<br>Dredgings | The use of land<br>The need for land | The need for land<br>Navigation/Bathing/ Tourism | Coastal lands | Reproduction and growth habitats<br>Artificial reefs<br>Fishing areas |
| **Environment quality** | Contaminants<br>Ballast waters<br>Waste water discharges | Waste water discharges<br>Organic substance | Anti-fouling substances | Fertilizers<br>Pesticides<br>Organic substance<br>Suspended solids<br>Fresh waters | Genetic escapes |
| **Economy** | Infrastructure | Infrastructure | Infrastructure | - | Infrastructure |
| **Social Resources** | - | The need for space | - | - | Education<br>Competences |
| **Legislation** | Navigation areas<br>Harbors<br>Military areas | Reglementations | The wild flora and fauna<br>Protected areas | - | Fishery reserves |

# The main Human Activities and Uses




Thank you for your attention


# Description of selected case studies in European Regional Seas. Mapping of productive marine areas and priority areas for fisheries and aquaculture: TYRRHENIAN SEA

M.G. FINOIA

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Italian National Institute for Environmental Protection and Research (ISPRA)
Rome (Italy)

# The Department of Sustainable Use of Resources – Aquaculture

**ISPRA**

**Main research topics include:**

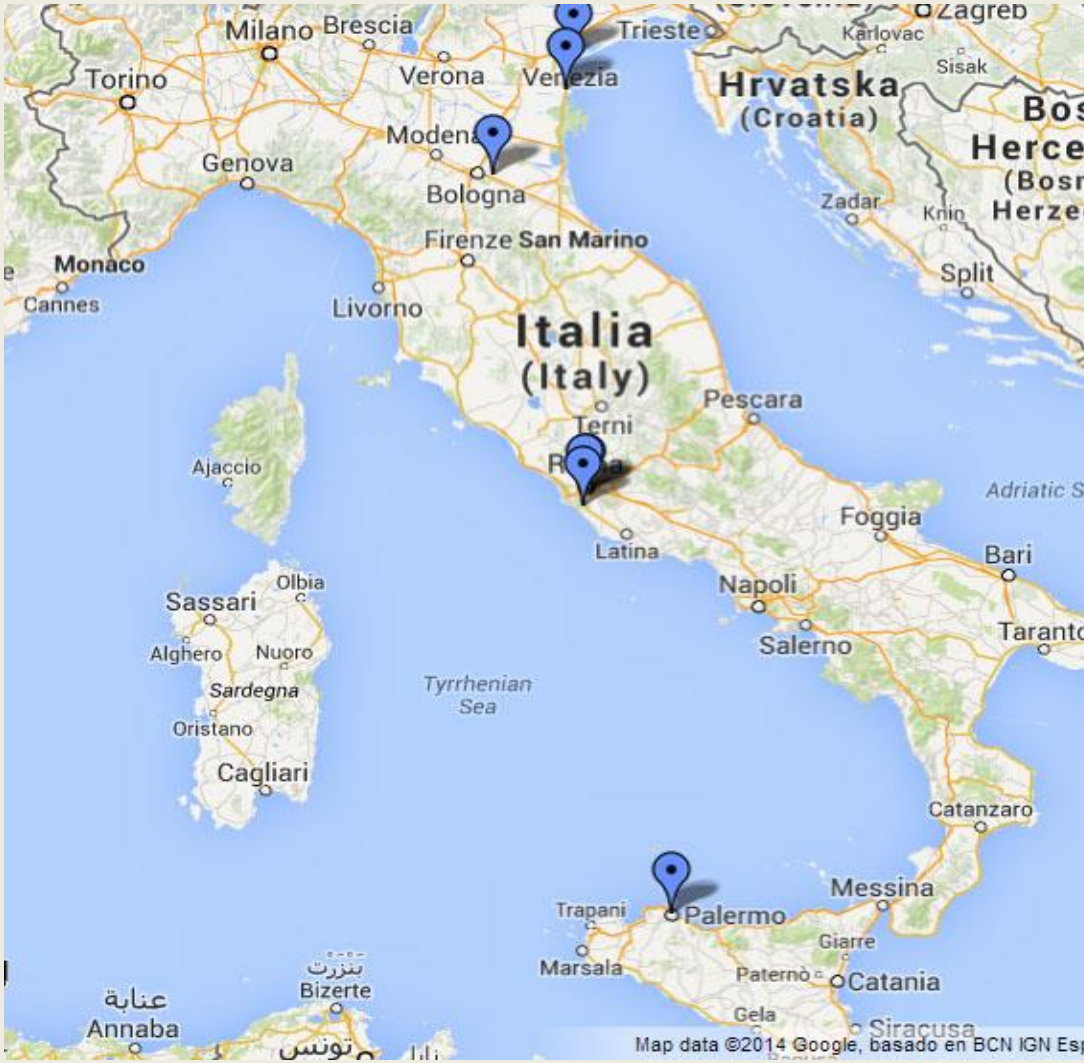
- ecosystem approach to sustainable aquaculture
- marine spatial planning and integrated coastal zone
- management
- development of environmental best management practices
- aquaculture-environment interactions
- quality of productions
- fish health and welfare

**Laboratories:**

- Nutrients in marine ecosystems and lagoons
- Benthic Ecology
- Molecular Marine Biology
- Fish Physiology
- Fish Histology and morphology
- Experimental Aquaculture (under construction)

Ministry of Agriculture, Food and Forestry Policies - General Directorate of Fisheries and Aquaculture (DGPEMAC) of the

Ministry of the Environment and Sea - Directorate foe Nature Conservation



# CASE STUDY OBJECTIVE

- Provide indicators, maps and tools for aquaculture spatial planning in the Tyrrhenian coastal area
- Identify suitable, unsuitable and potential suitable areas for aquaculture to support local authorities decisions in the Allocation of Zone for Aquaculture (AZA)

*Resolution FAO GFCM/36/2012/1 on AZA for Mediterranean & Black Sea*

*Directive 2014/89/EU*

**AZA IDENTIFICATION**

# AZA Steps

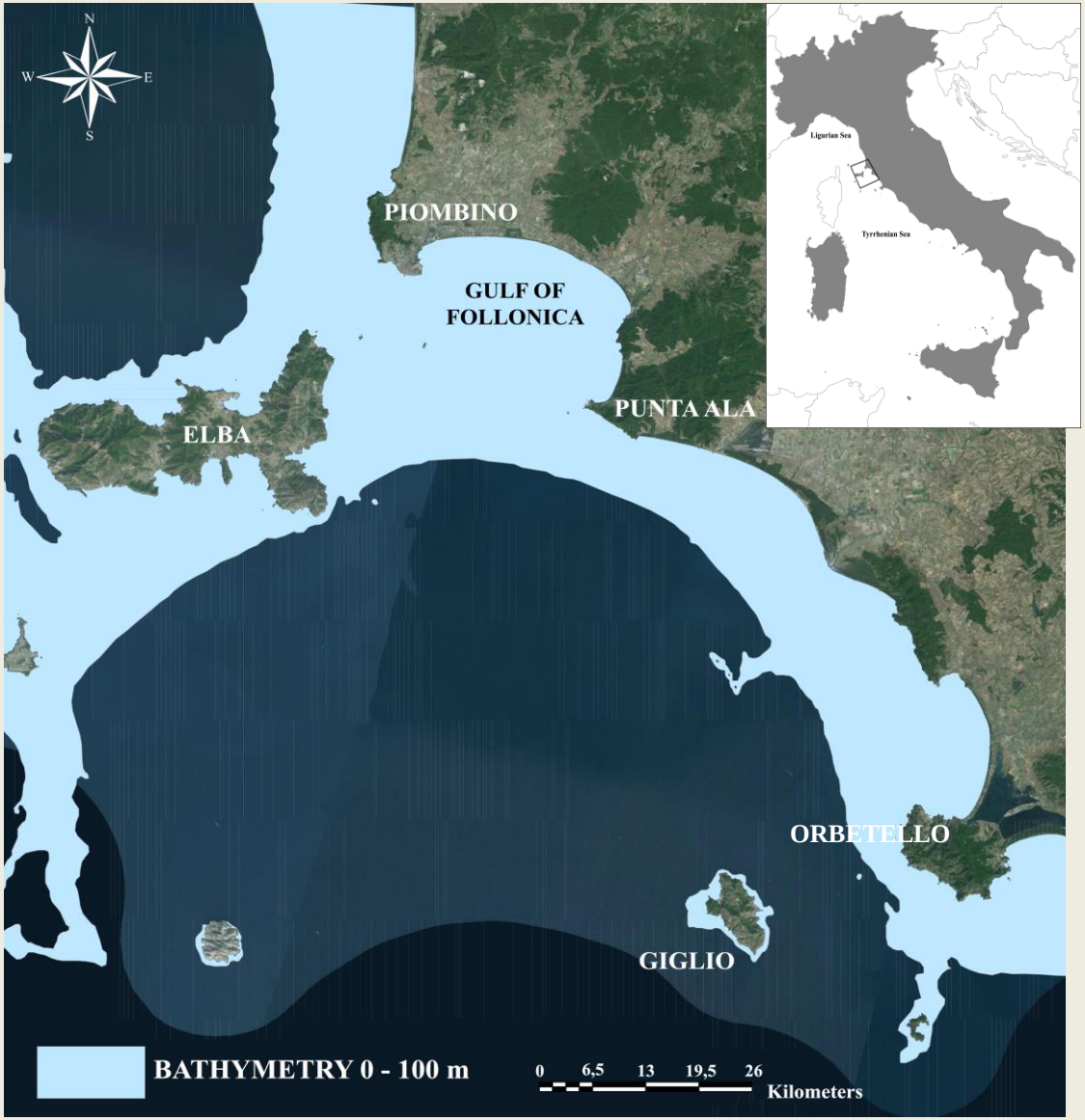
- **I- Study area**: Development of experimental plan to identify AZA along the Central Tyrrhenian Sea.
- **II- Data input**:

  a) Data collection (infrastructural, environmental and economical information)

  b) Analysis of infrastructural data in order to identify the major physical constrains/barriers and to exclude areas for AZA

  c) Overlapping of the environmental and economical data to discriminate the most suitable areas for AZA
- **III-Tools:** GIS and Modelling
- **IV- Validation:** Sharing results with stakeholders

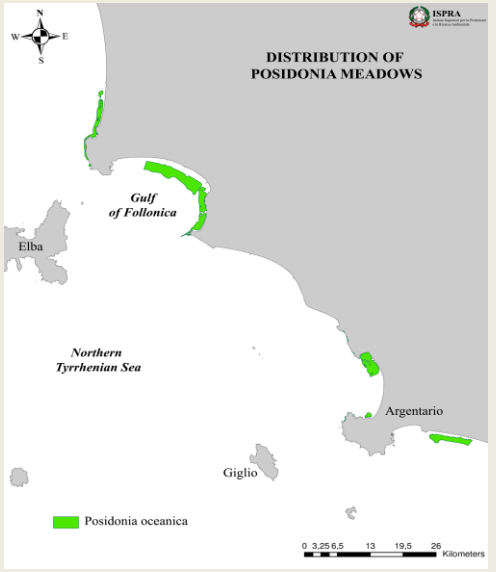
# Step I: Study area



# Step I: Area selection

**Major factors that motivated the choice of the study area**






- Presence of **Natura 2000 sites** (wetlands and dune systems), Natural parks (e.g. Pelagos Sanctuary for Mediterranean Marine Mammals, Natural Park of the Tuscan Archipelago) and protected species ( Habitat Directive)
- **Favorable environmental** and geographical features (e.g. seawater currents, deep seabed)
- The area is characterized by several **human activities** (e.g. industry, shipping, tourism, small-scale fishery, aquaculture)

# Step I: Study area

## Major factors that motivated the choice of the study area:

- Production pole in Italy (30% of total production) for sea bass and sea bream


European sea bass

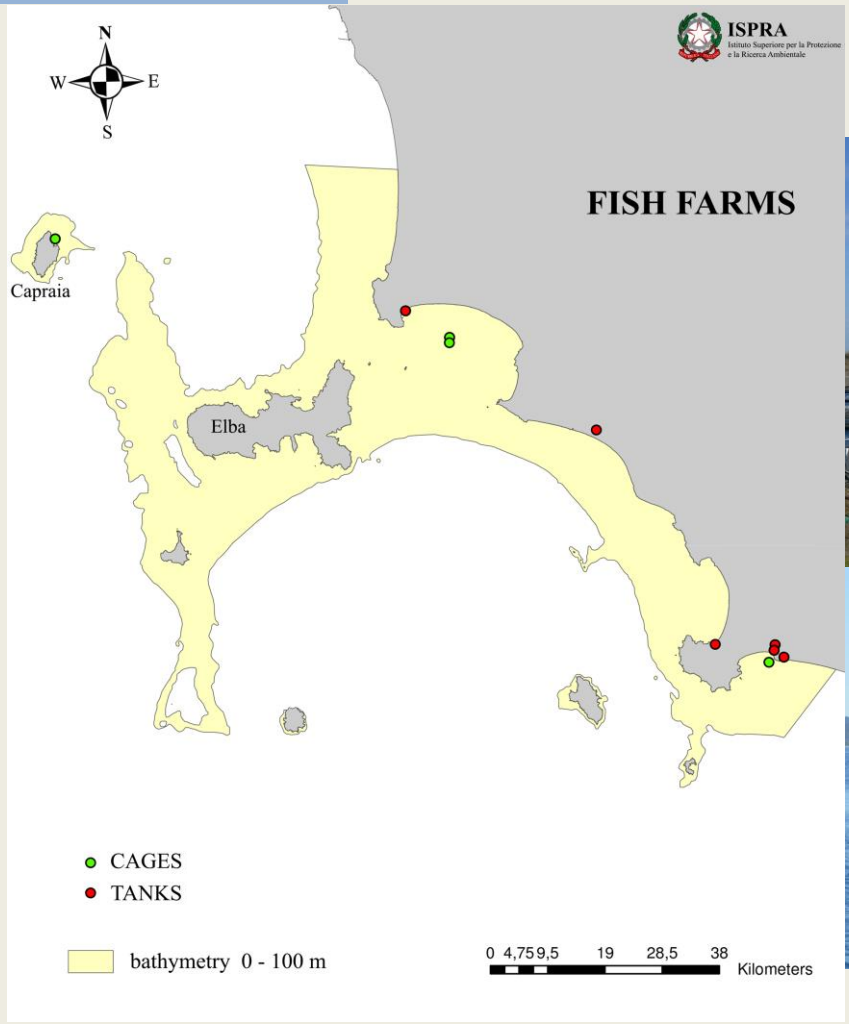

Meagre


Gilthead sea bream

*Mussels have been further farmed in previous years*

- The interest to obtain new licenses for off-shore production

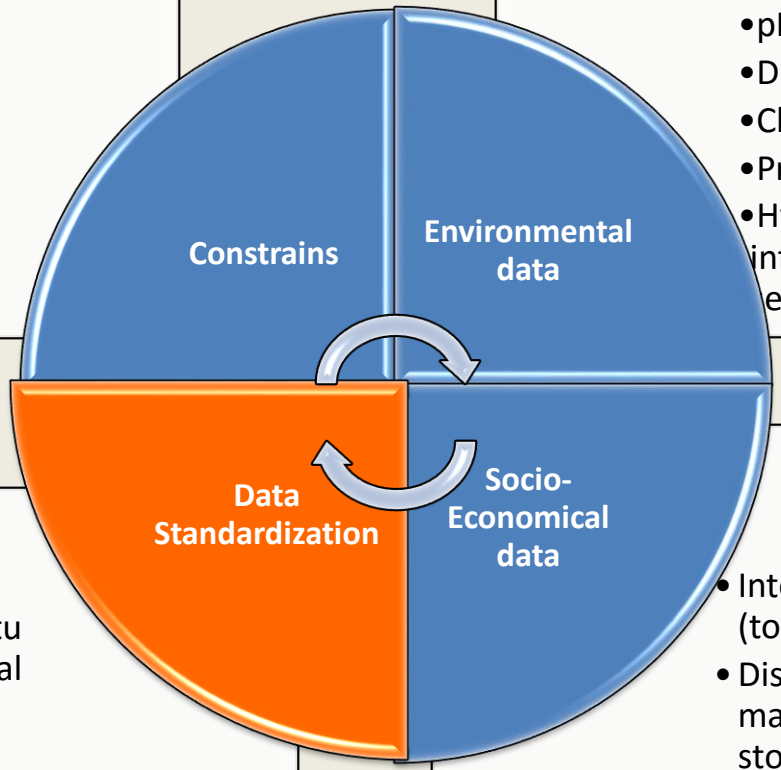

- Regional public authorities and other stakeholders are sensitive to issues related to marine spatial planning and sustainability of aquaculture production



# Step II: Input data

- Exclusion zones (e.g. security and border areas, marine protected areas, etc)
- Presence of infrastructure (e.g.underwater pipes)
- Distance from the coast
- Visual impact
- Interaction of farm sites with environment

- Bathymetry
- Turbidity and suspended solids
- Sea Surface Temperature
- Salinity
- pH
- Dissolved oxygen
- Chl a
- Prevailing wave heights
- Hydrographic data (including information on bottom sediment types)




- Data typology (mapping, in situ data, remote sensing data, local historical series)
- Spatial resolution (high, low) and temporal scale of data.
- Identification of data gaps

- Interrelation with other users (tourism, fishing)
- Distance from shore (ports) for many servicing activities (feeding, stocking etc)
- Commercial maritime traffic
- Distance from other cage farms

# Step III: Tools

*The use of GIS will allow to:*

- a) Prepare maps (layers of data)
- b) Identify exclusion zones
- c) Identify sensitive and conflict zones with buffers

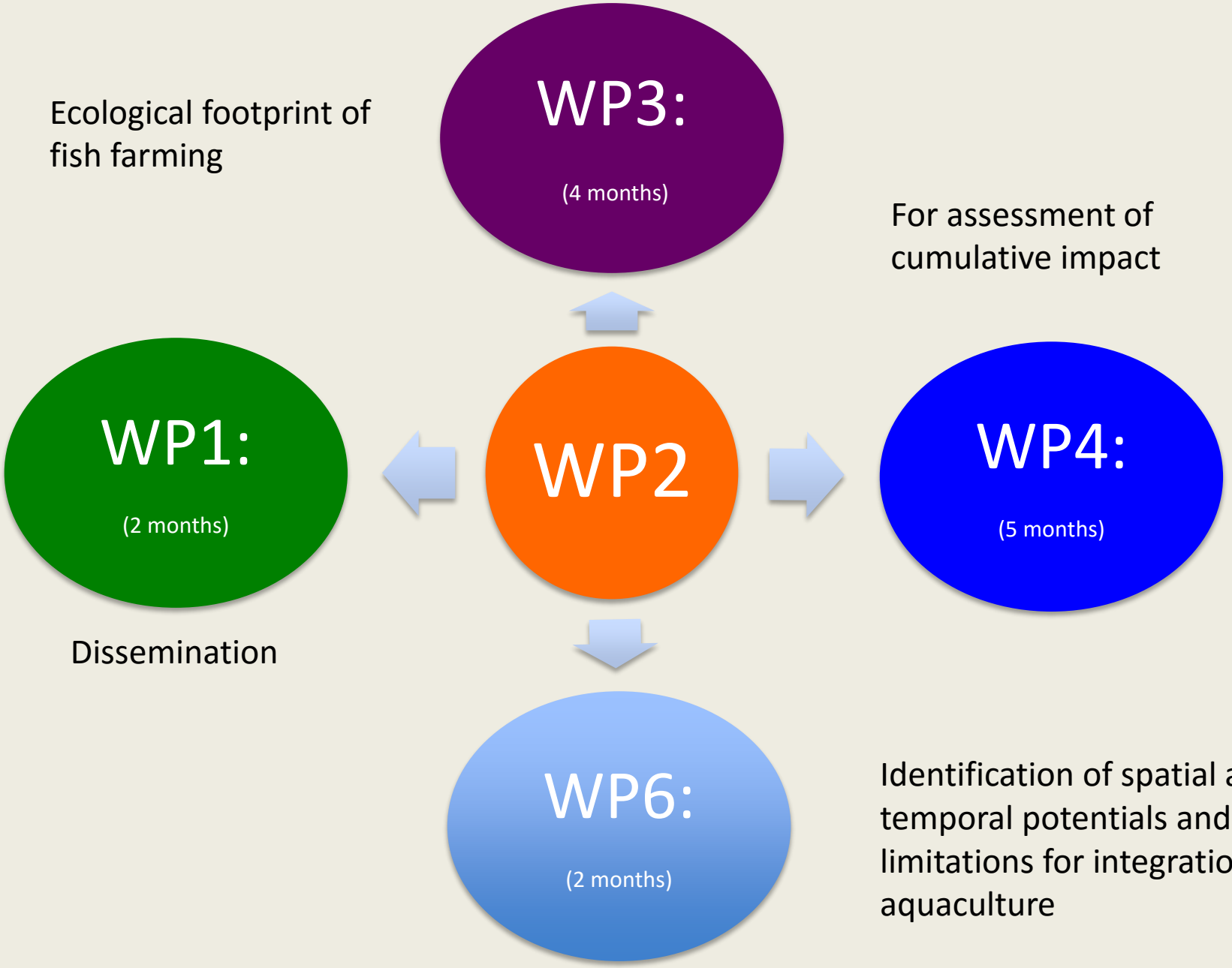
*Methodological statistical approach to*:

Identify AZA by deterministic or probabilistic models and to develop thematic maps

# Step IV: Validation

- Share of results and reach consensus among stakeholders (involvement of competent authorities, managers, industries….) through a “participatory approach”.

# Relations with other WPs



# Timesheet

**Data will be added in GRID database**

| | A | M | J | J | A | S | O | N | D | J | F | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WP1 | | | | | | | | | | | | |
| WP2 | | | | | | | | | | | | |
| WP3 | | | | | | | | | | | | |
| Wp4 | | | | | | | | | | | | |
| Wp5 | | | | | | | | | | | | |
| WP6 | | | | | | | | | | | | |

**WP2:**

- **Data collection**
- **Standardization and modelling**
- **Validation**
- **Reporting**

# Working group at ISPRA

- T. Petochi,
- P. Di Marco
- M. Manca Zeichen
- M. Archina
- P. Tomassetti
- S. Porrello
- G. Marino


ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

# Thank you for your attention

ECOAST
Era-net COFASP

ECOAST

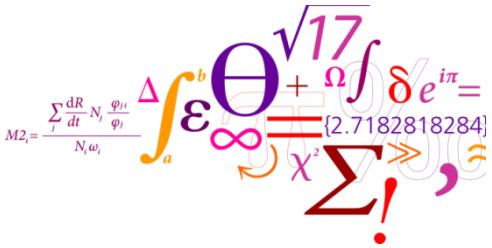
Era-net COFASP

DTU

# ECOAST WP2 – W. Baltic Case Study

Francois Bastardie & J. Rasmus Nielsen

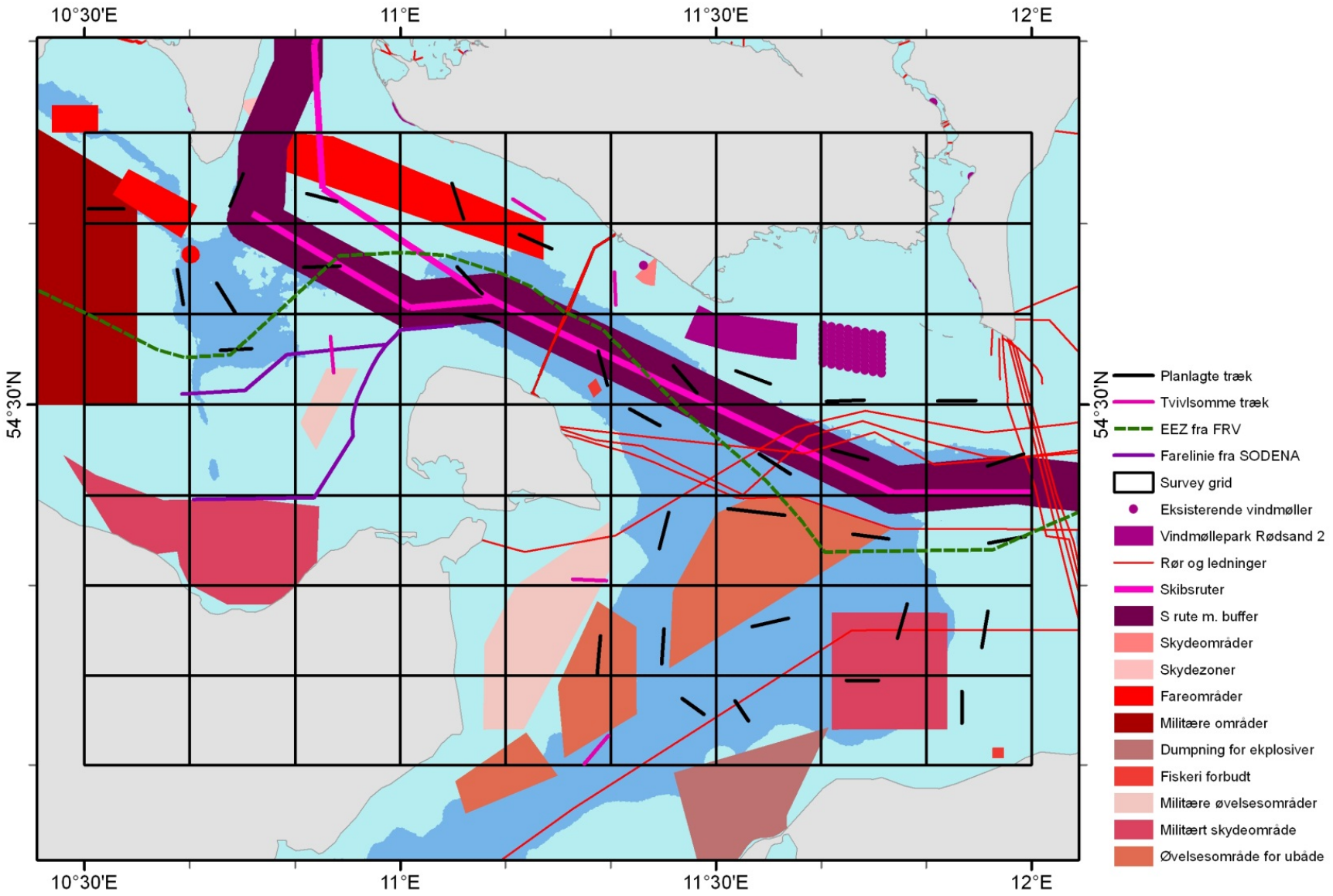
Kick-off meeting,  April 2016



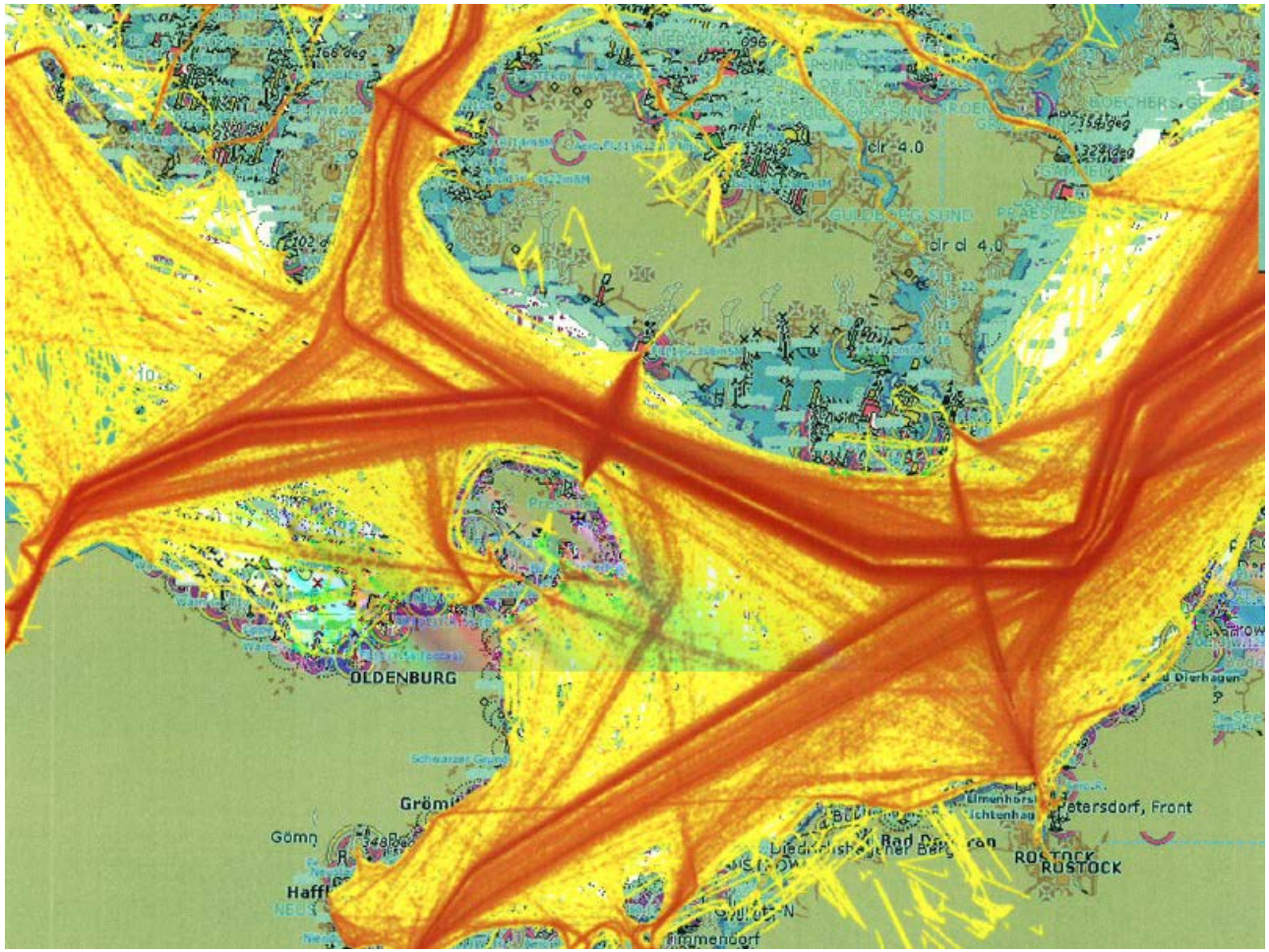
DTU Aqua
National Institute of Aquatic Resources

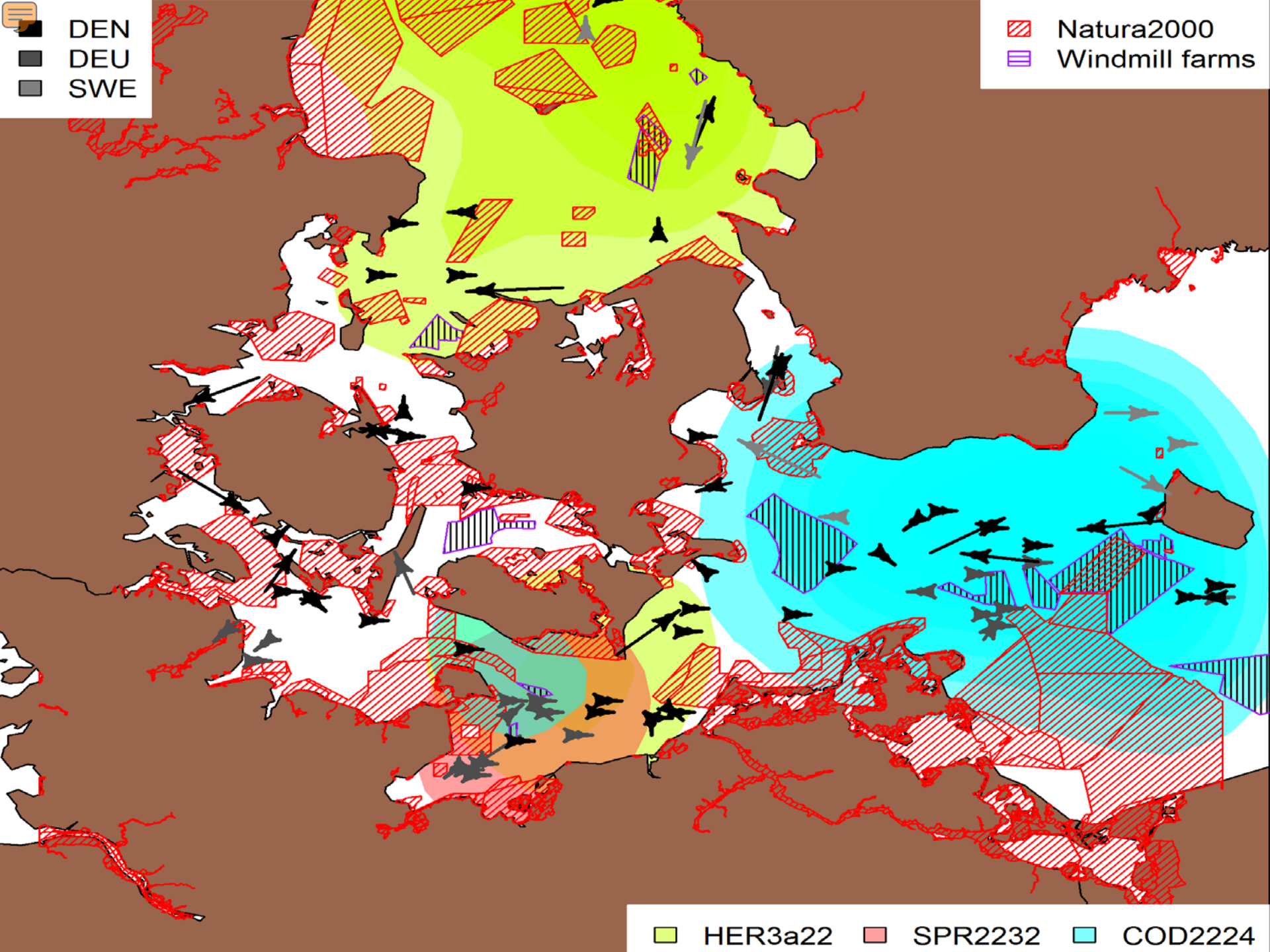
# Femern Belt: Examples of activities and parties involved

## In relation to Spatial Planning: Activities besides fishing



# Navigation traffic from 1 July 2006 to 31 July 2006




DEN
DEU
SWE
Natura2000
Windmill farms
HER3a22
SPR2232
COD2224

# W Baltic area: Directives involved

## EU Directives + Associated National Regulations (Ministries)

**Environmental and Fisheries Sector Directives:**

**EU Marine Spatial Planning (MSP) Directive**
**EU Marine Strategy Framework Directive (MSFD)**
**EU Mediterranean Action Plan (Phase I+II)**
**EU Common Fisheries Policy (CFP)**
**EU Habitat Directive (HD) and EU Bird Directive (BD)**
**EU Water Framework Directive (WFD)**

**Other Marine Sector Directives:**

**EU Tourism Directives**
**EU Transport Directives**
**EU Harbor Directives**
**EU Renewable Energy Directives**
**EU Energy Directives**
**EU Mineral Exploitation Directives (e.g. mining, sand and gravel extraction)**
**EU Public Heritage Directives**

**Etc., etc.,……..**

**EU and NATO Defense Directives**

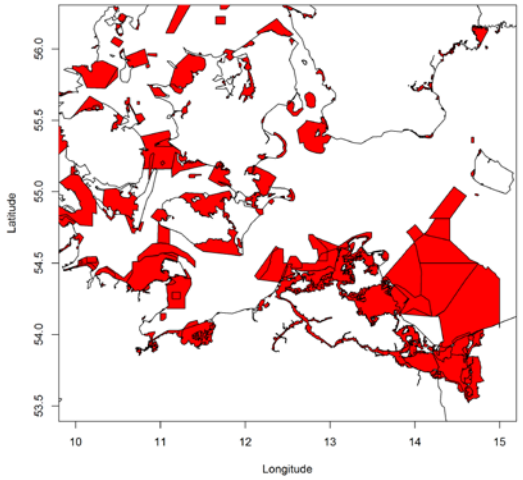
# Competition for Baltic marine space and fisheries resources - A DISPLACE Model Evaluation (example)

**Maritime spatial planning (MSP) constrains fisheries** and this require that the fishing industry and managers have the right management evaluation tools and knowledge to engage in the MSP dialogues.

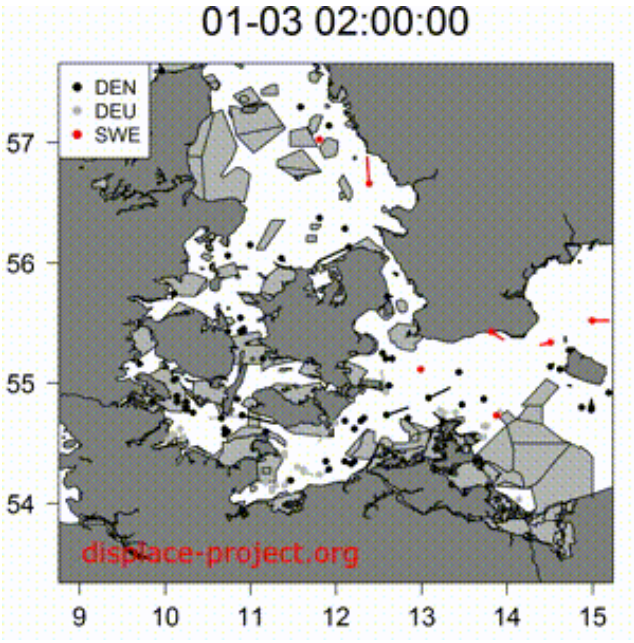
**Impact assessment** and scenario evaluation of fishing closures due to planned offshore windmills farms and Natura 2000 conservation zonation (and Femern Belt transport route) in the Baltic Sea is conducted with the DISPLACE model-based, dynamic, complex, stochastic individual-based approach for fisheries bio-economic and energy efficiency evaluation. www.displace-project.org

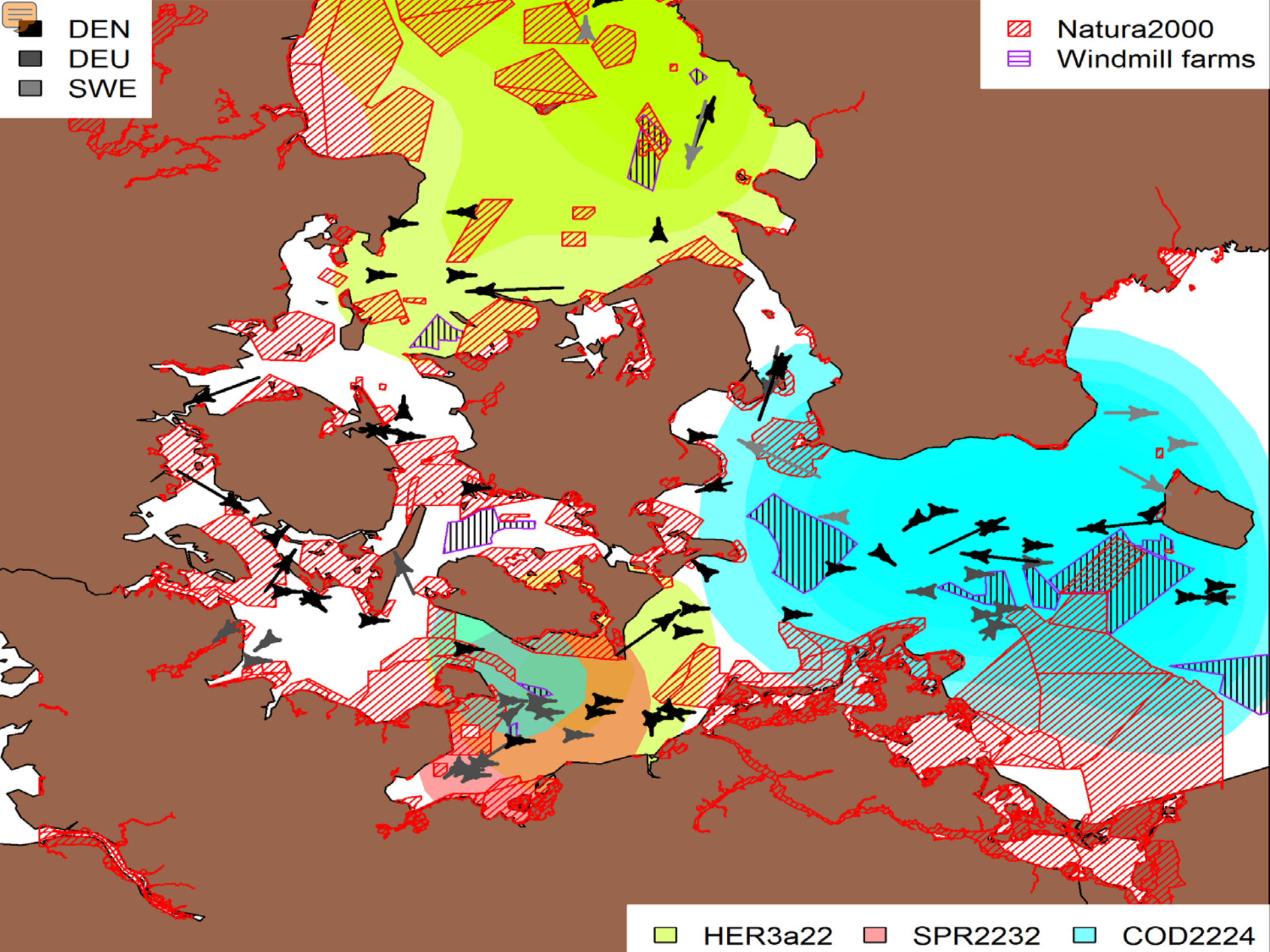
**A cross-border socioeconomic impact assessment: Parameterization of DISPLACE** for the international western Baltic Sea fisheries (>12m, DEN, SWE and GER) and for the Baltic cod, sprat and herring fish stocks

**Sustainability** of the cod, sprat and herring stocks given exploitation and evaluation of the economic viability of the fishery including consequences on cost for fishing

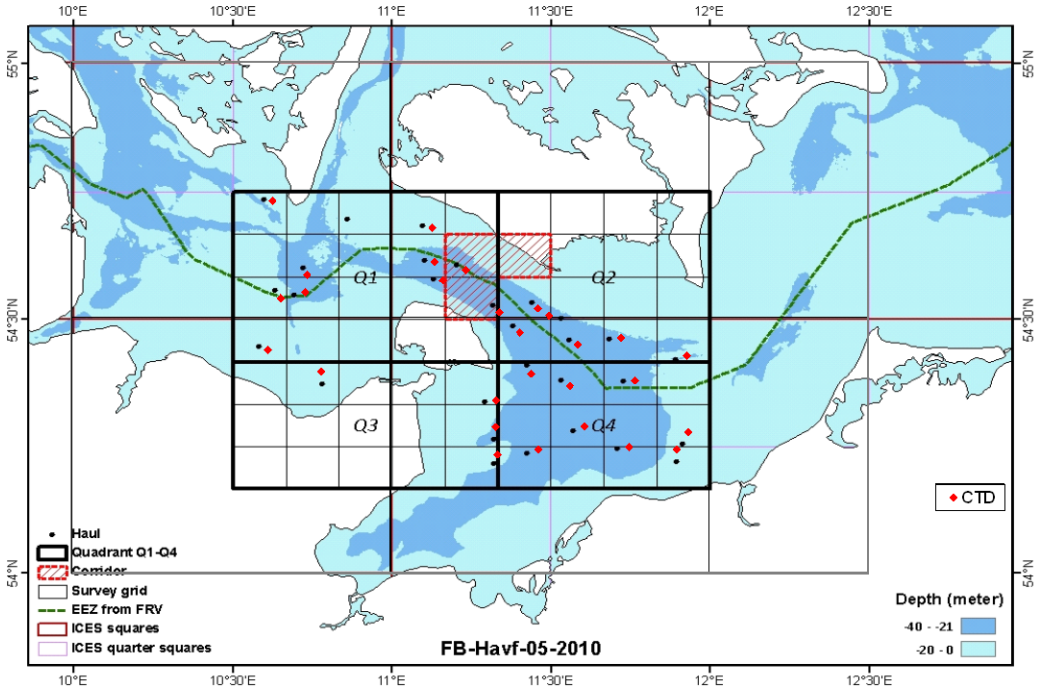


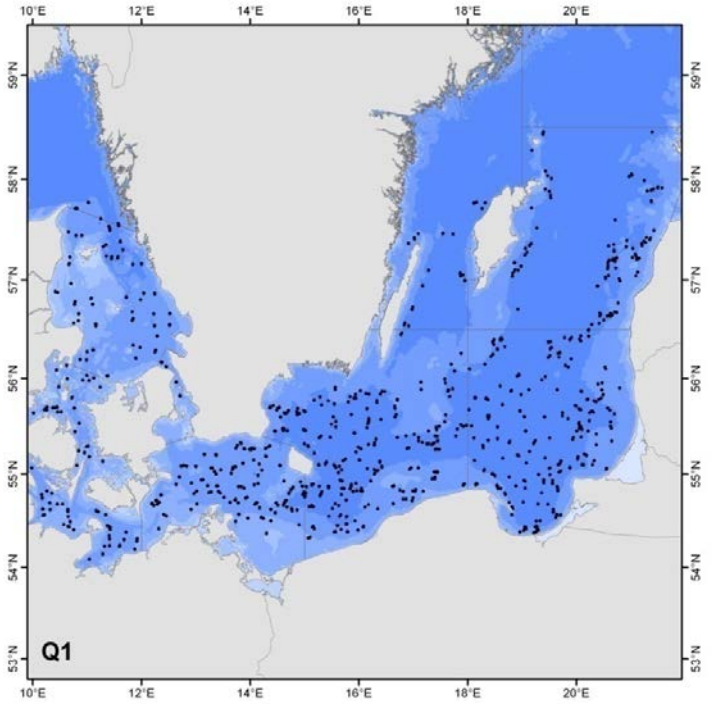

Fishing activities constrained by the BSAPs / NATURA 2000 sites (seabirds directive; habitat directive)




DEN
DEU
SWE
Natura2000
Windmill farms
HER3a22
SPR2232
COD2224

# Evaluating and Estimating Underlying Ressource Abundance: New Research Survey Data Analysis Methods & New Survey Design: Example Femern Belt area



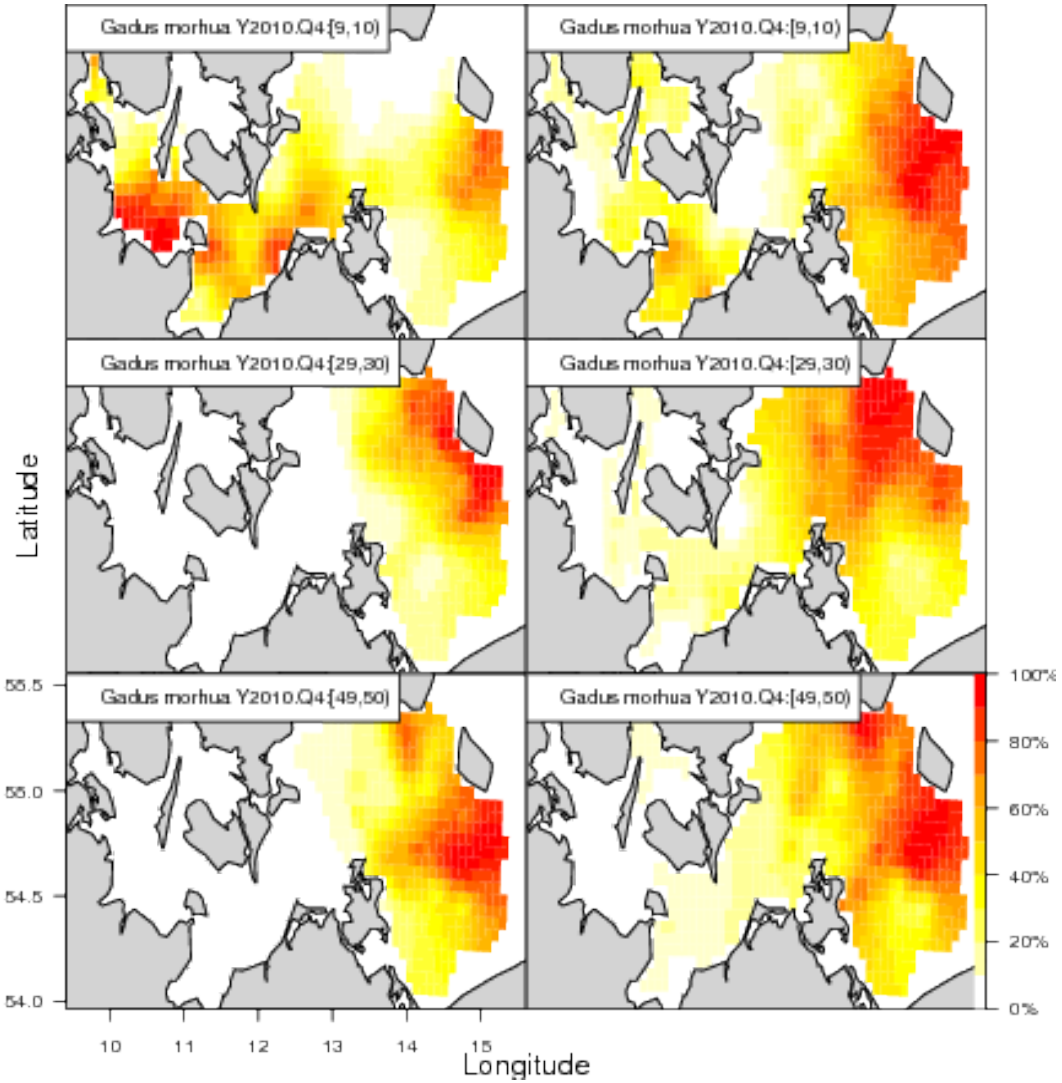





- ***Nielsen, J.R.*,[1], Kristensen, K.*, Lewy, P., and Bastardie, F. 2014.*** A statistical model for estimation of fish density including correlation in size, space, time and between species from research survey data. **PLoS ONE 9(6): e99151, p. 1-15.**
- ***Nielsen, J.R.*, Lundgren, B., Kristensen, K, and F. Bastardie. 2013.*** Localization of nursery areas based on comparative analyses of horizontal and vertical distribution patterns of juvenile Baltic cod. ***PLoS ONE 8 (8): e70668, p. 1-20.***
- ***Lewy, P.*, J. R. Nielsen*, and H. Hovgård*. 2004.*** Survey gear calibration independent of spatial fish distribution. **Can. J. Fish. Aquat. Sci.: 61 (4): 636-647. (**Authorship equal.*Correspondence to all authors*)**

# Evaluating underlying Resource Abundance (Spatially)
## (Observations and Predictions, Extended LGCP Model):

Figure 12: Maps of relative cod abundance 2010/Q4 based on *cod observations that year* (left column) versus the same maps based on *cod observations previous year* (right column) utilizing model (c) of Table 9.

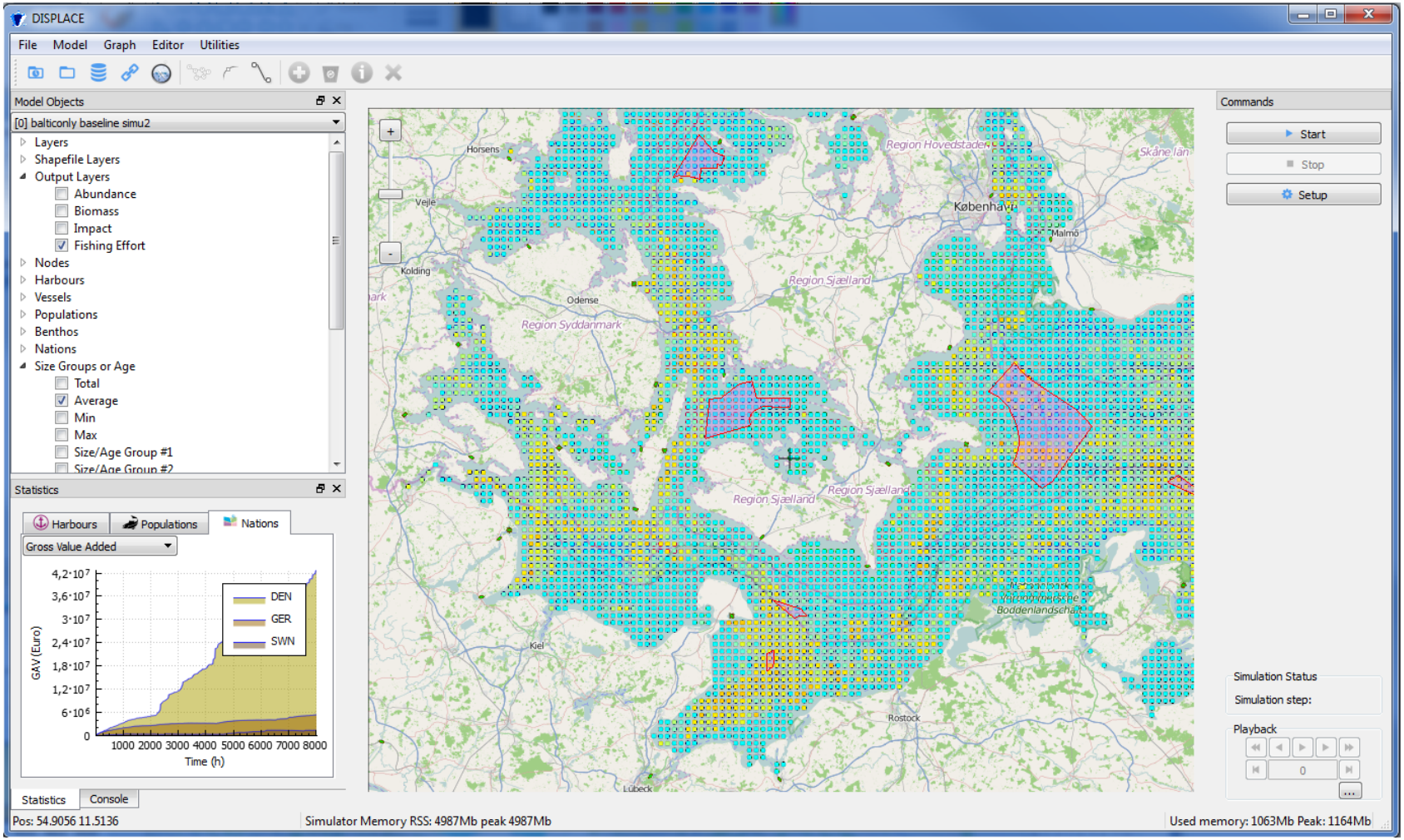



***Nielsen, J.R.*[1], Kristensen, K.*, Lewy, P., and Bastardie, F. 2014.*** A statistical model for estimation of fish density including correlation in size, space, time and between species from research survey data. **PLoS ONE 9(6): e99151, p. 1-15.**

# The Baltic DISPLACE Evaluation

| Management Option | Risk factor 0 | Risk factor 1 | Risk factor 2 |
|---|---|---|---|
| Status Quo | Baseline | | |
| Alternative 1 | Wind | | |
| Alternative 2 | Natura2000 | Natura2000+LowProd | |
| Alternative 3 | Wind + Natura2000 | Wind+Natura2000+ LowProd | Wind+Natura2000+ 20%FuelPrice |

# The DISPLACE software – Baltic Sea



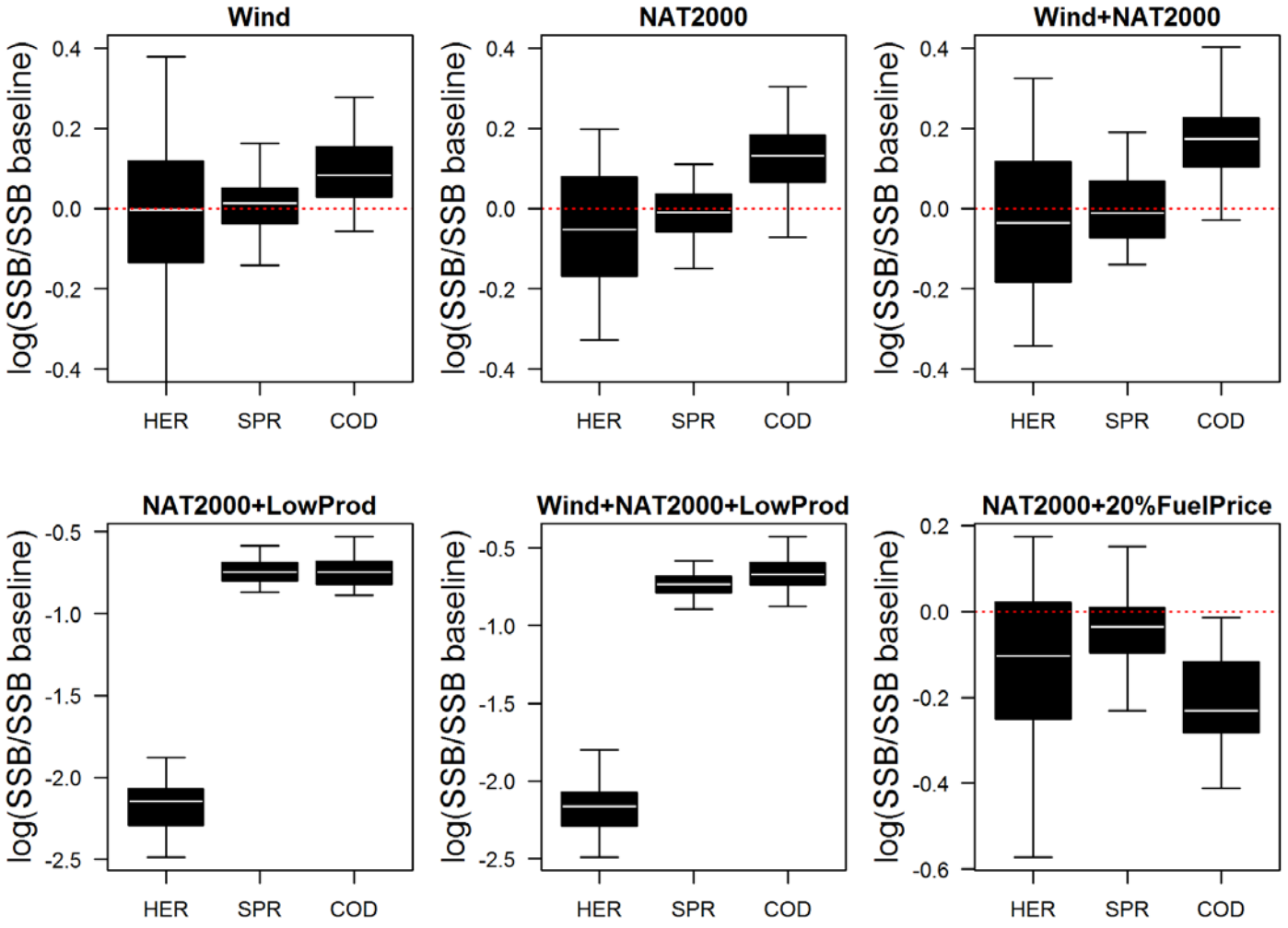
# Consequences on fisheries of alternative scenarios – effort and trip patterns

| Scenario | Total effort (%) | Steaming Effort (%) | Number of trips (%) | Average trip duration (%) |
|---|---|---|---|---|
| Wind | -1.0 ± 0.5** | 0.2 ± 0.2** | -0.5 ± 0.2*** | -0.2 ± 0.3 |
| NAT2000 | -1.9 ± 0.5*** | 1.0 ± 0.2*** | -4.8 ± 0.2*** | 4.5 ± 0.3 |
| Wind+NAT2000 | -2.5 ± 0.6*** | 1.1 ± 0.2** | -4.7 ± 0.2*** | 4.0 ± 0.3*** |
| LowProd | 0.5 ± 0.5 | 0.1 ± 0.2 | -0.3 ± 0.2** | 0.6 ±0.3** |
| NAT2000+LowProd | -1.8 ± 0.5*** | +1.0 ± 0.2*** | -5.2 ± 0.2** | 4.9 ± 0.3** |
| Wind+NAT2000+LowProd | -2.2 ± 0.6*** | 1.2 ± 0.3*** | -5.1 ± 0.2*** | 4.7 ± 0.4*** |
| Wind+NAT2000+20%FuelPrice | -1.3 ± 0.4*** | -0.9 ± 0.2*** | -4.7 ± 0.2*** | 3.8 ± 0.3*** |

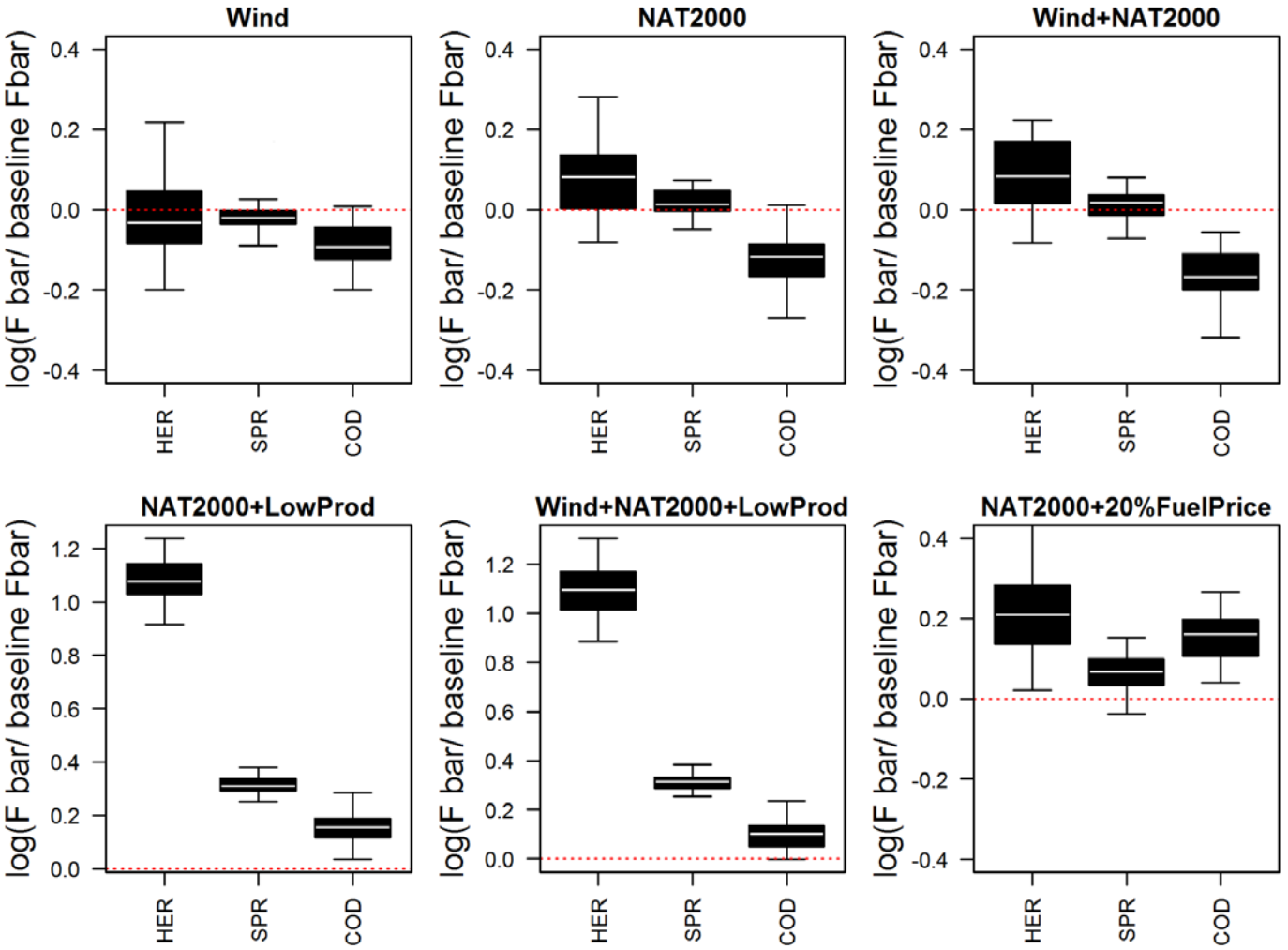
# Consequences on fisheries of alternative scenarios – revenue, cost & energy efficiency

| Scenario | Fuel cost (%) | CPUE cod only | CPUE cod sprat herring stocks (%) | CPUE other stocks (%) | GVA (%) | VPUF (%) |
|---|---|---|---|---|---|---|
| Wind | 0.1 ± 0.5 | -1.1 ± 0.7** | 2.2 ± 3.2 | -0.8 ± 1.2 | 1.3 ± 2.0 | 1.7 ± 1.8 |
| NAT2000 | -0.5 ± 0.5* | -2.4 ± 0.7*** | 5.9 ±3.4** | -15.0 ± 1.2*** | -2.8 ± 2.6** | -8.9 ± 1.8*** |
| Wind+NAT2000 | -0.9 ± 0.5** | -2.7 ±0.7*** | 8.4 ± 3.1*** | -13.7 ± 1.4*** | **-1.2 ± 2.5** | **-4.6 ± 2.0*** ** |
| LowProd | -0.1 ± 0.6 | -21.0 ±0.6*** | -34.6 ± 1.7*** | -1.0 ± 1.5 | -16.3 ± ±2.3*** | -7.5 ± 1,4*** |
| NAT2000+LowProd | -0.6 ± 0.5* | -22.3 ± 0.5*** | -33.4 ± 1.6*** | -14.5 ± 1.3*** | -19.0 ± 1.5*** | -14.7 ± 1.6*** |
| Wind+NAT2000+LowProd | -0.5 ± 0.5* | -22.6 ± 0.5*** | -32.8 ± 1.6*** | -13.0 ± 1.2*** | **-16.6 ± 2.1*** ** | **-11.0 ± 2.0*** ** |
| Wind+NAT2000+20%FuelPrice | 18.3 ± 0.7*** | 5.5 ± 0.7*** | 31.2 3.4*** | -19.2 ± 1.2*** | -9.9 ± 1.8*** | -8.9 ± 1.4*** |

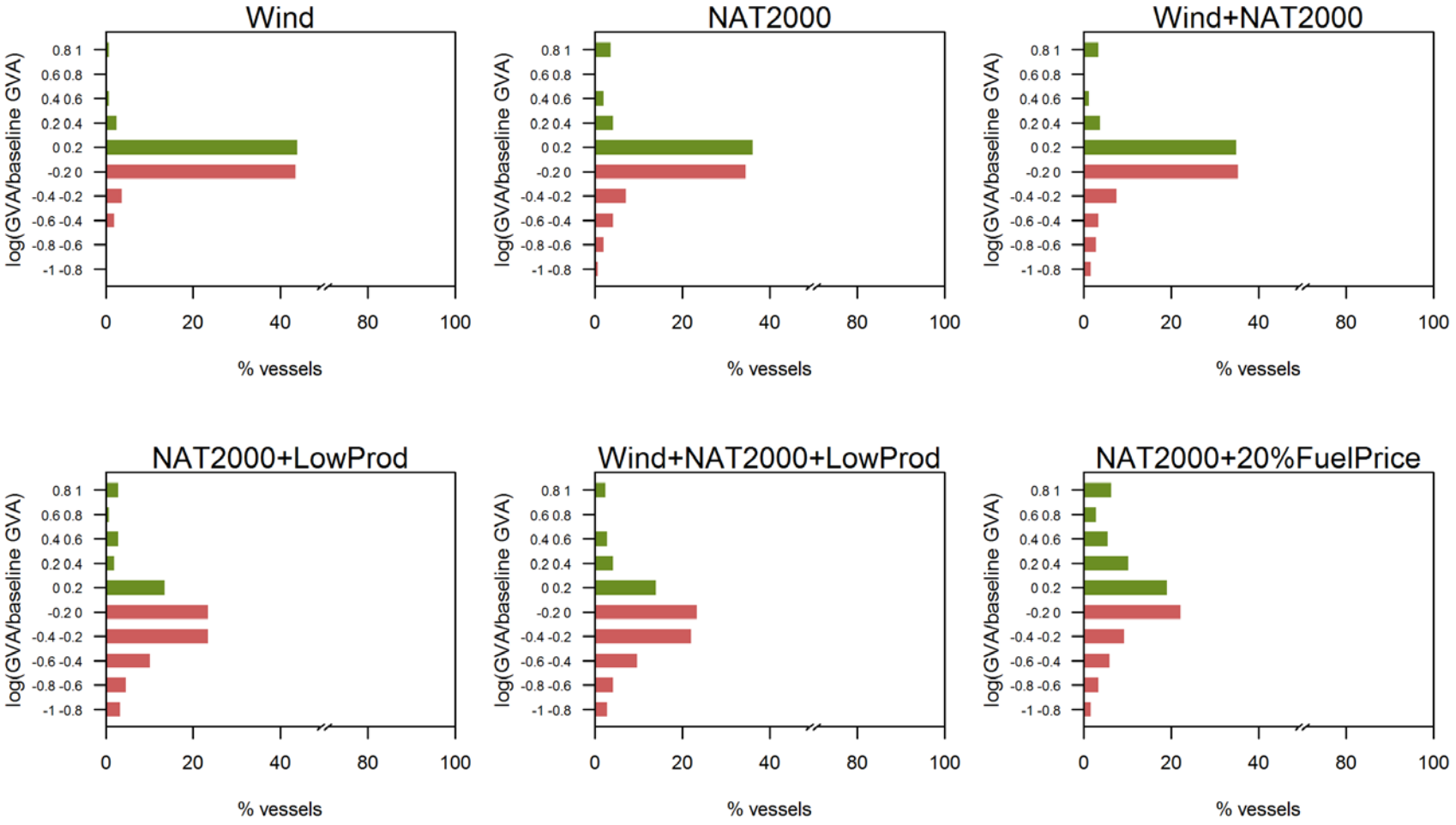
# Consequences on stocks of alternative scenarios – biological sustainability, SSB



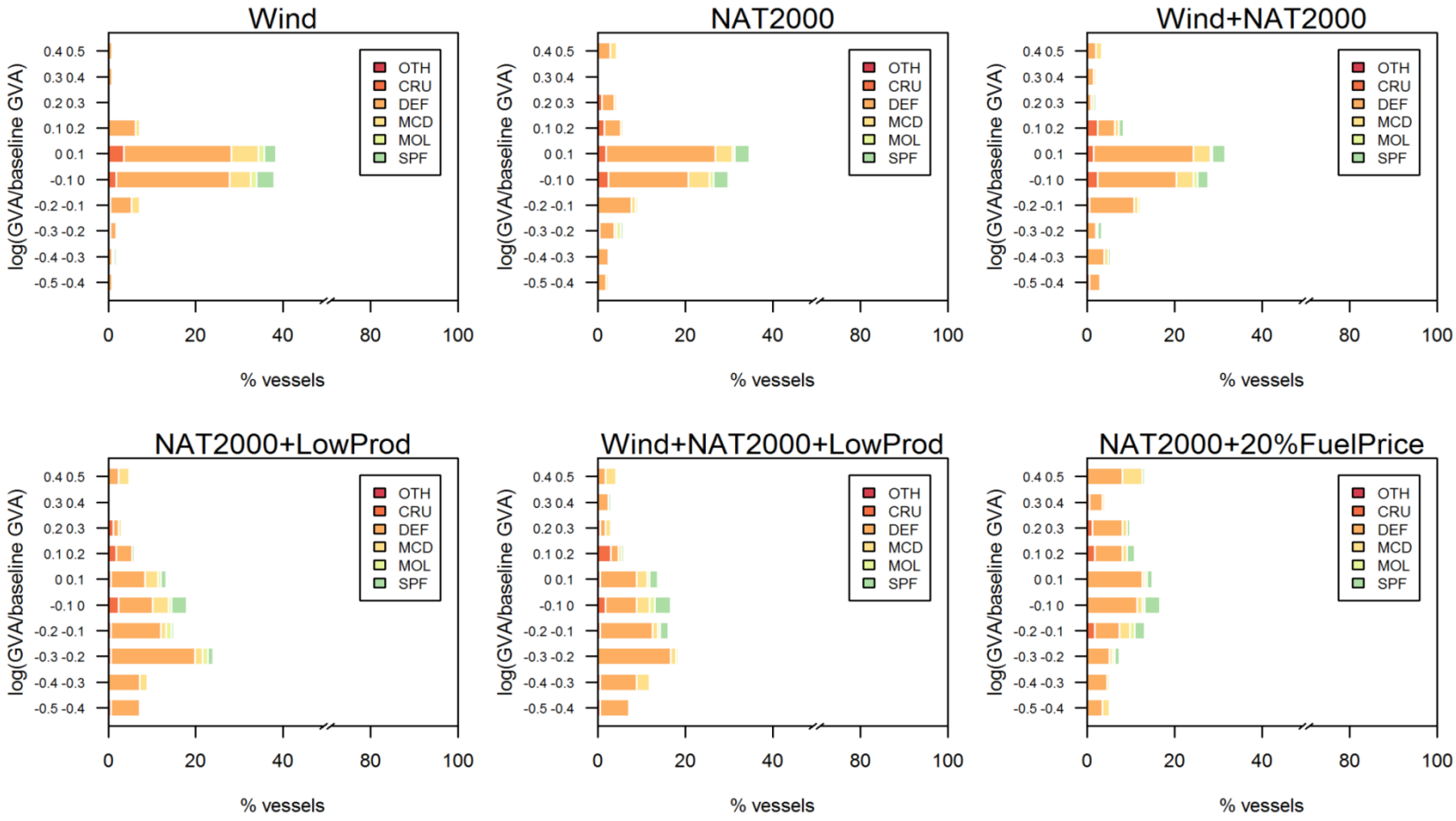
# Consequences on stocks of alternative scenarios – biological sustainability, F



# Consequences on fisheries of alternative scenarios – individual stress levels



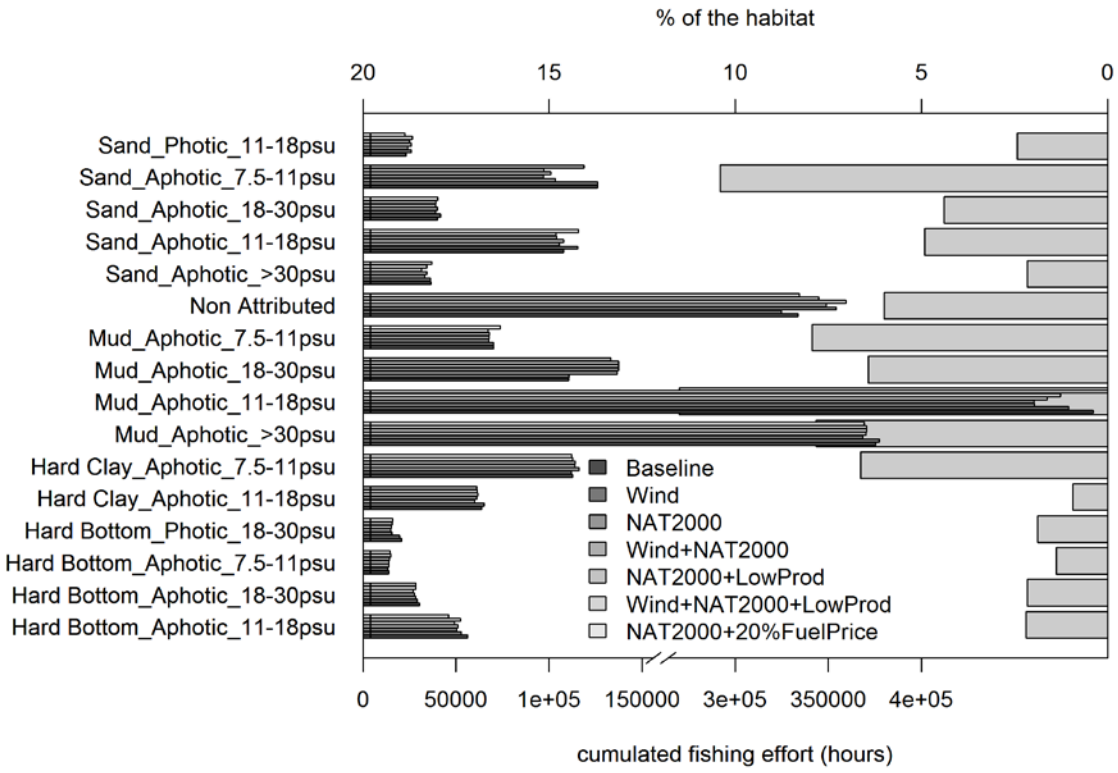
# Consequences on fisheries of scenarios – Individual stress levels per community – target assemblage

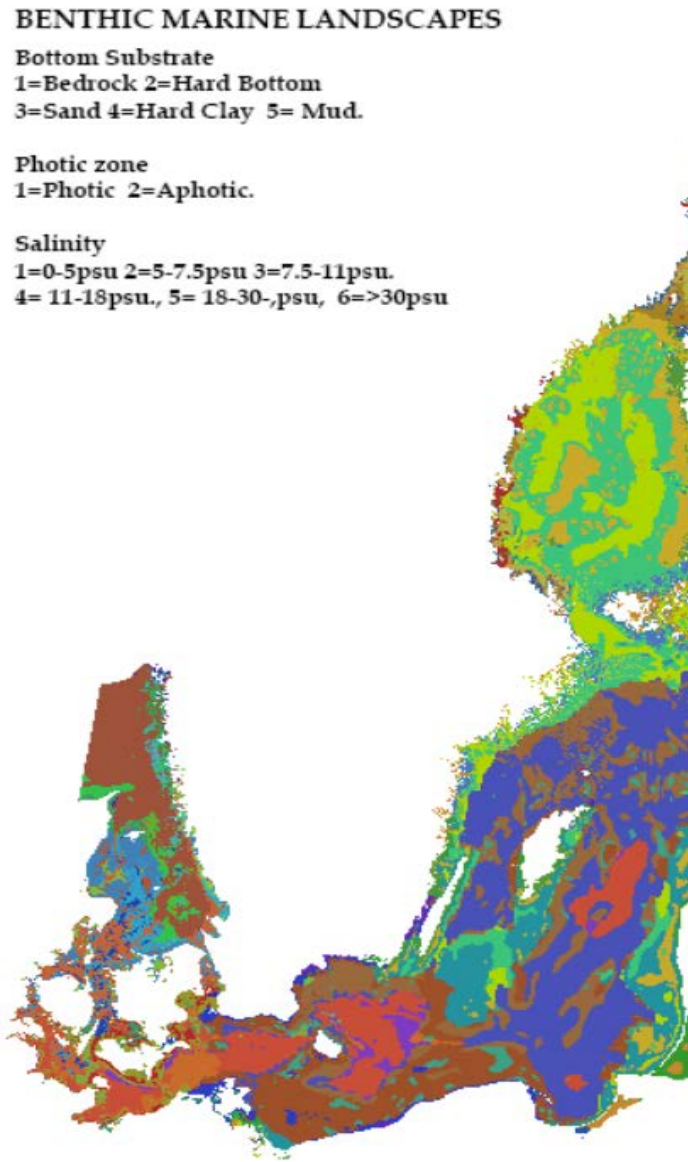


# General consequences of scenarios

- **Stable profit from compensation** are possible over the medium term even if opportunities for fishing grounds are constrained by closures;
- **Positive global effects** on stocks with released fishing pressure from closures, and concentration of effort towards high catch rate grounds;
- **Higher costs** from effort displacement and increased steaming time is balanced out by higher revenue from healthier stocks on the medium term, however, the closures results in **decreased energy efficiency**;
- Some **individual vessels belonging to certain fleets are strongly affected** by closures and cannot maintain catch rates, which creates new opportunities for others (winners) making profit;
- **DISPLACE = support tool** for fisheries and management for facilitating understanding of dynamics, reproducing observed patterns and evaluating alternative scenarios involving technical and biological interactions.

# Is effort displaced on sensitive habitats?



# Future perspectives

- **Transport** more offshore: Interactions between fishery and the T-route. Are there effort differences in the fishery between areas in the T-route and just outside the T-route given habitat type and maybe also given underlying survey based abundance/density patterns of target resources of the fishery?

- **Aquaculture** plants coastal and offshore: Existing and planned aquaculture plants and their direct spatial interactions with fishery. Are there fisheries in the vicinity and in the habitat types of existing aquaculture plants; mapping of planned aquaculture plants (e.g. trout, blue mussels) and a similar analyses as with already established aquaculture plants in relation to fishery.

- **Gravel extraction** areas coastal and offshore: Same as with aquaculture plants.
- Indirect effects on wild fish occurrences and changes herein according to gravel extraction and aquaculture plants (more offshore).

- **Detailed analyses of survey data** with respect to comparative analyses of fish occurrences / densities close to and more far from aquaculture plants and gravel extraction areas.

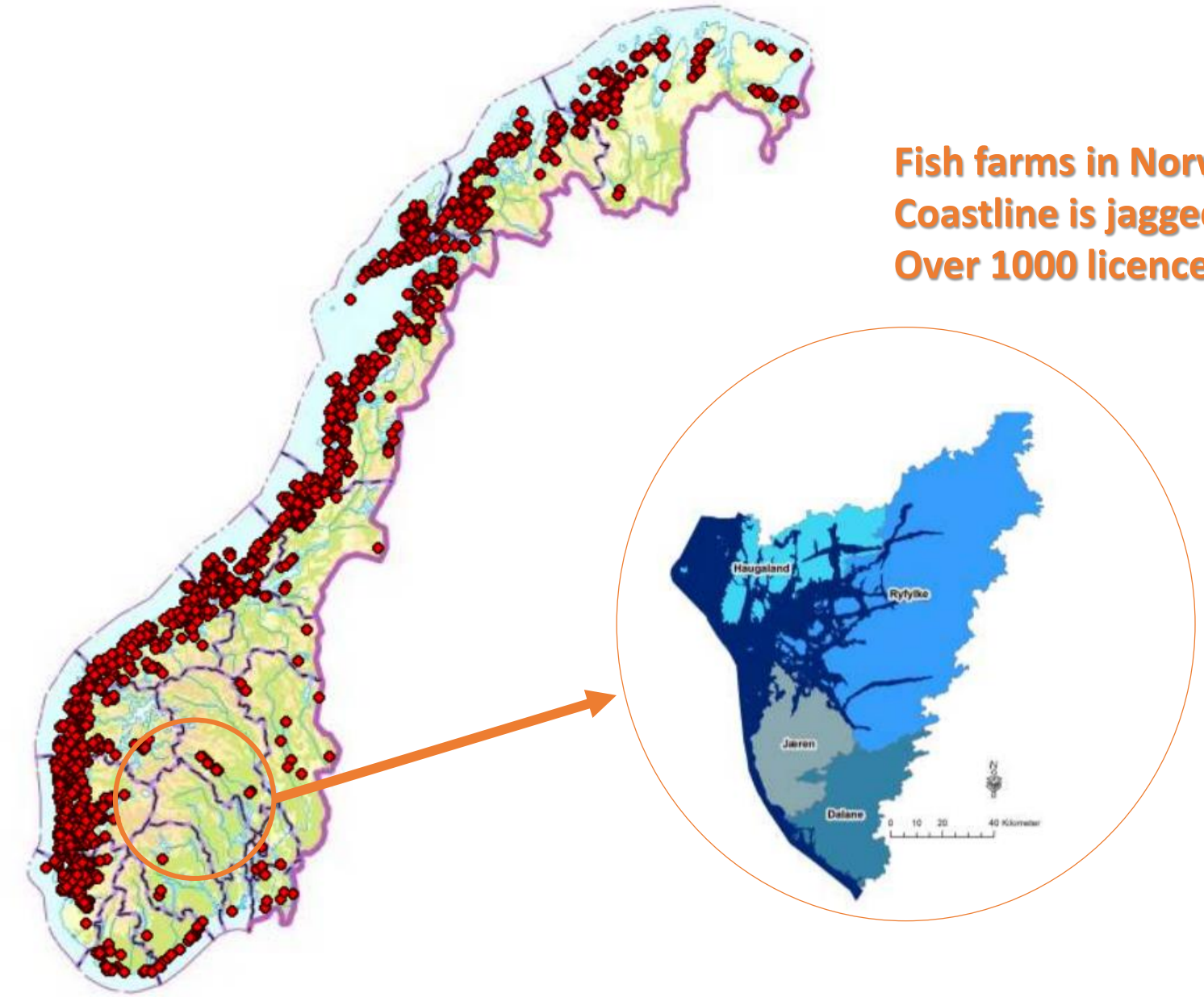
# Case study Norwegian Fjords (Responsible: Thorleifur Agustsson IRIS, Norway)
# Collaboration between IRIS in Stavanger and IMR in Bergen. Site selection will be based up on needs/focus in WP3 (IRIS) and WP6 (IMR)

ECOAST
Era-net COFASP

- IN short:
- Focus on coastal region in Rogaland county. Currently there are there are two main Atlantic salmon farming companies operating in this area: Marine Harvest and Grieg Seafood salmon production in Rogaland in recent years and it has now reached more than 50,000 tons per year.
- Rogaland county is hosting companies operating throughout the value chain from salmon eggs to salmon feed, in addition to the important research related to sustainability within salmon farming and for development of feed for salmon.

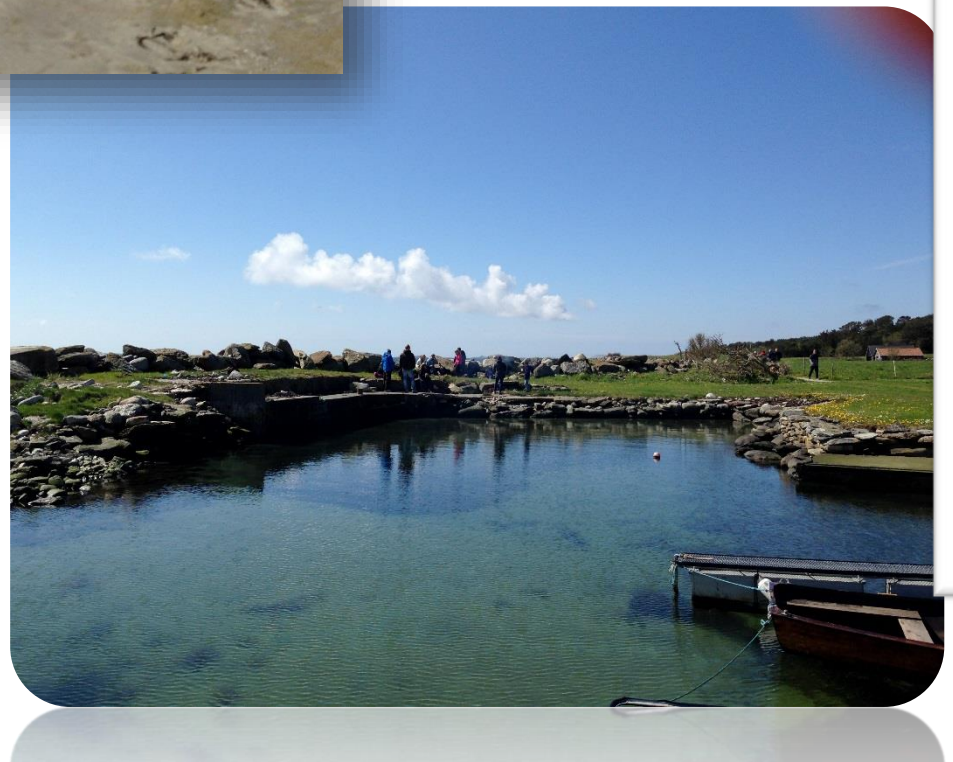
- In addition to salmon aquaculture, in the region there is also production of oysters, scallops, sea urchins, lumpfish and lobster, as well as kelp.
- The county council has established a regional aquaculture strategy where the maingoal is to double the production volume of farmed salmon within 2020; at the same time the industry has a strong focus on developing environmentally friendly and sustainable production, to achieve a growth in volume (Taranger et al., 2015).
- In the Rogaland region, there is an increasing number of stakeholders linked to the use of the coastal areas, such as recreational activities, transport, tourism, local fisheries, Oil & Gas related services, as well as protected areas.
- The case study will identify coastal areas in the Rogaland county where areas of conflict between aquaculture and other stakeholders are present, and areas where there is a possibility for the aquaculture industry to grow. Preliminary environmental impact assessment evaluations will be performed to establish where the production could be increased (both for old and new sites); in this evaluation the main focus will be on the local and regional impact of organic load and nutrients from marine salmon farms. The feasibility for use of novel methods involving rapid detection techniques to analyze environmental impact will be assessed in conjunction with WP 3.

ECOAST
Era-net COFASP



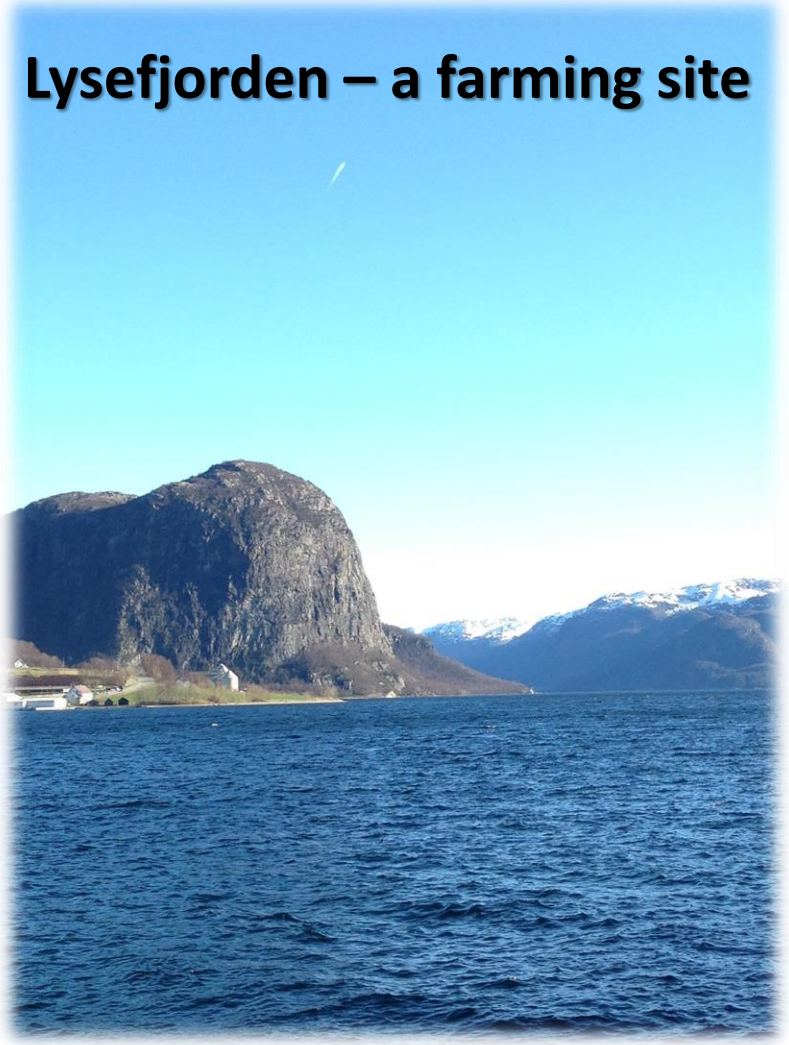
**Fish farms in Norway.**
**Coastline is jagged and approx >15000 km**
**Over 1000 licences for fish farming.**

# Recreation - beaches

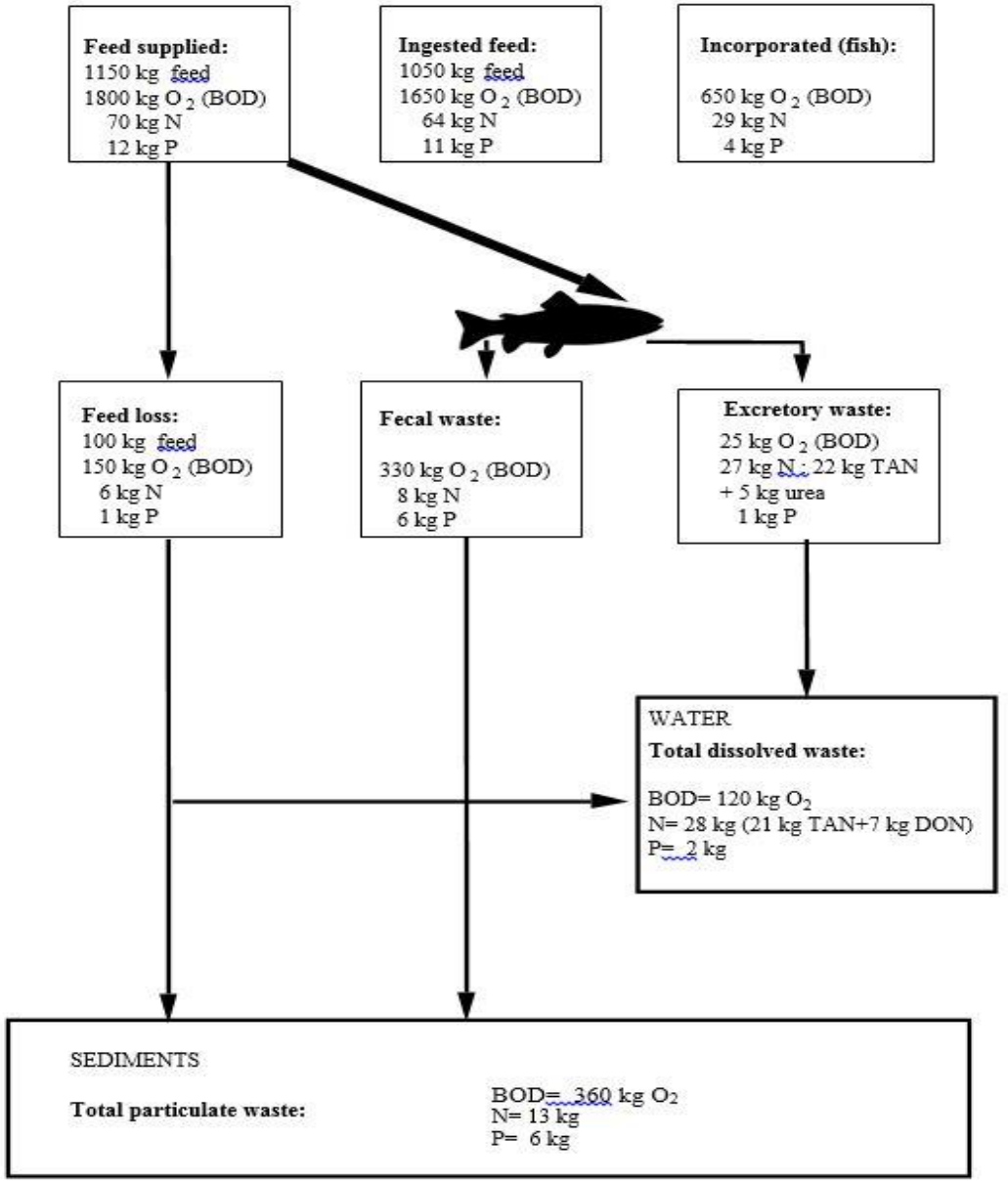


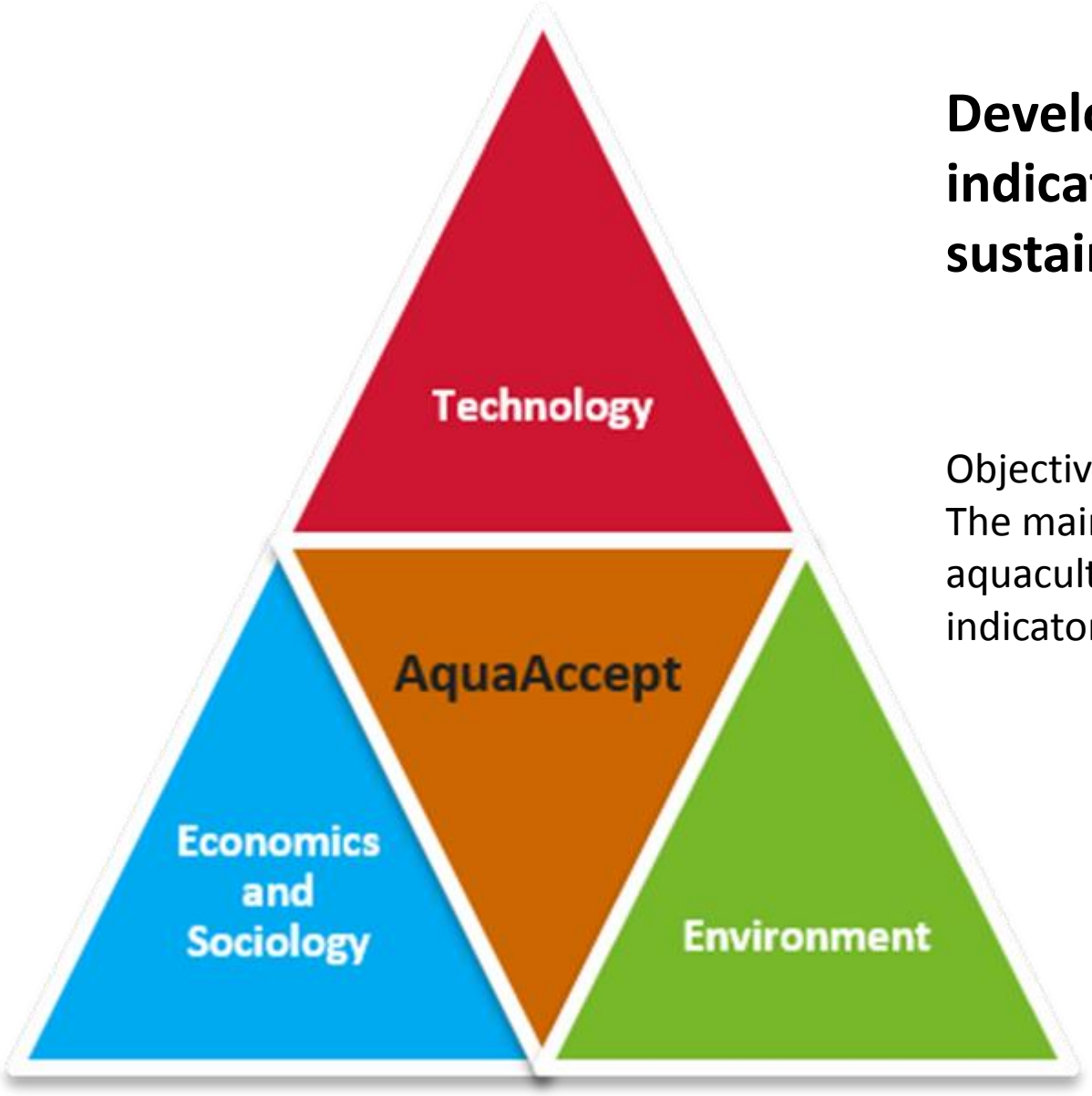
## Boknafjorden – a farming site

## Lysefjorden – a farming site




At this farm location – 25 tonns of feed are fed every day!


Feed supplied:
1150 kg feed
1800 kg O 2 (BOD)
70 kg N
12 kg P
Ingested feed:
1050 kg feed
1650 kg O 2 (BOD)
64 kg N
11 kg P
Incorporated (fish):
650 kg O 2 (BOD)
29 kg N
4 kg P
Feed loss:
100 kg feed
150 kg O 2 (BOD)
6 kg N
1 kg P
Fecal waste:
330 kg O 2 (BOD)
8 kg N
6 kg P
Excretory waste:
25 kg O 2 (BOD)
27 kg N; 22 kg TAN
+ 5 kg urea
1 kg P
WATER
Total dissolved waste:
BOD= 120 kg O2
N= 28 kg (21 kg TAN+7 kg DON)
P= 2 kg
SEDIMENTS
Total particulate waste:
BOD= 360 kg O2
N= 13 kg
P= 6 kg




# Developing novel socio-environmental indicators and management tools for a sustainable aquaculture

Objectives

The main objective is to investigate the acceptable impacts of aquaculture on marine coastal systems. Focus will be biological indicators, social acceptability and integrated management.

http://www.iris.no/research/environment/aquaaccept

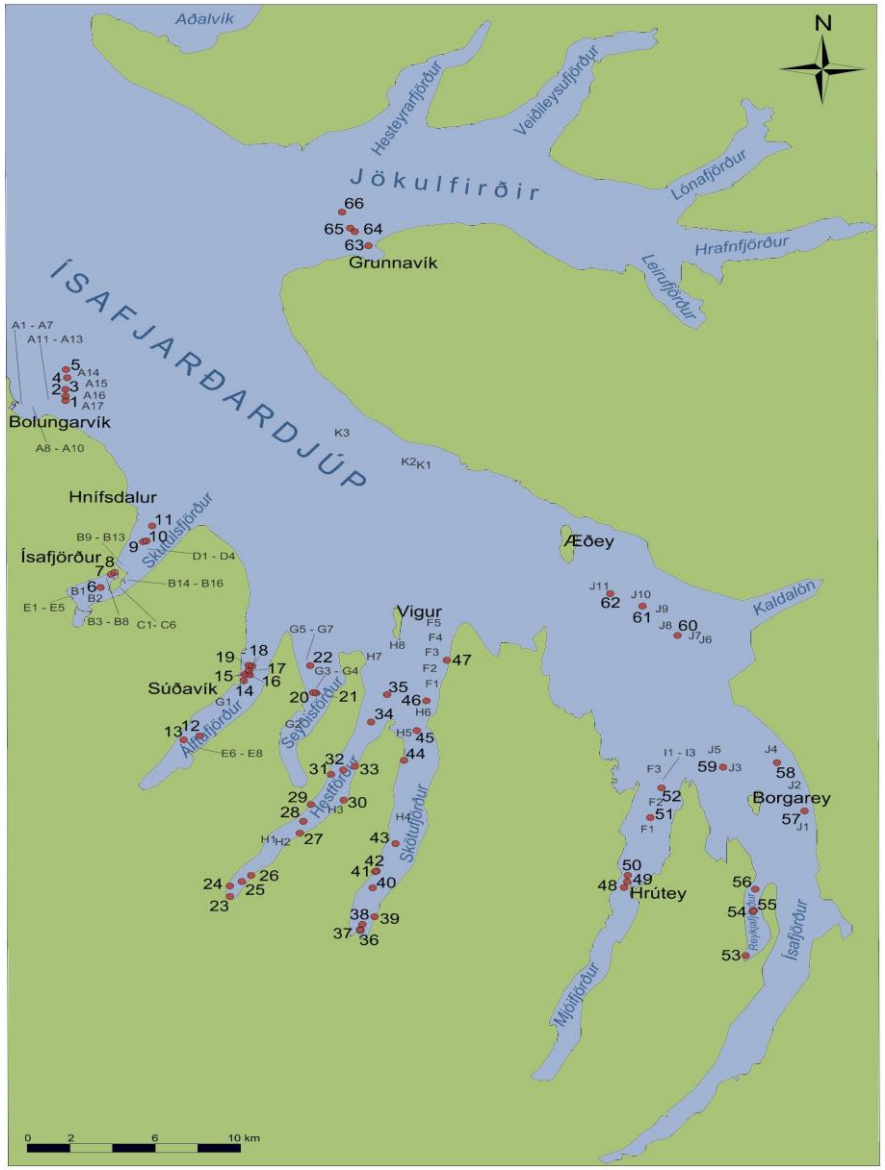



Figure 1. Sampling loactions. Sampling locations marked with number only, are presented here.

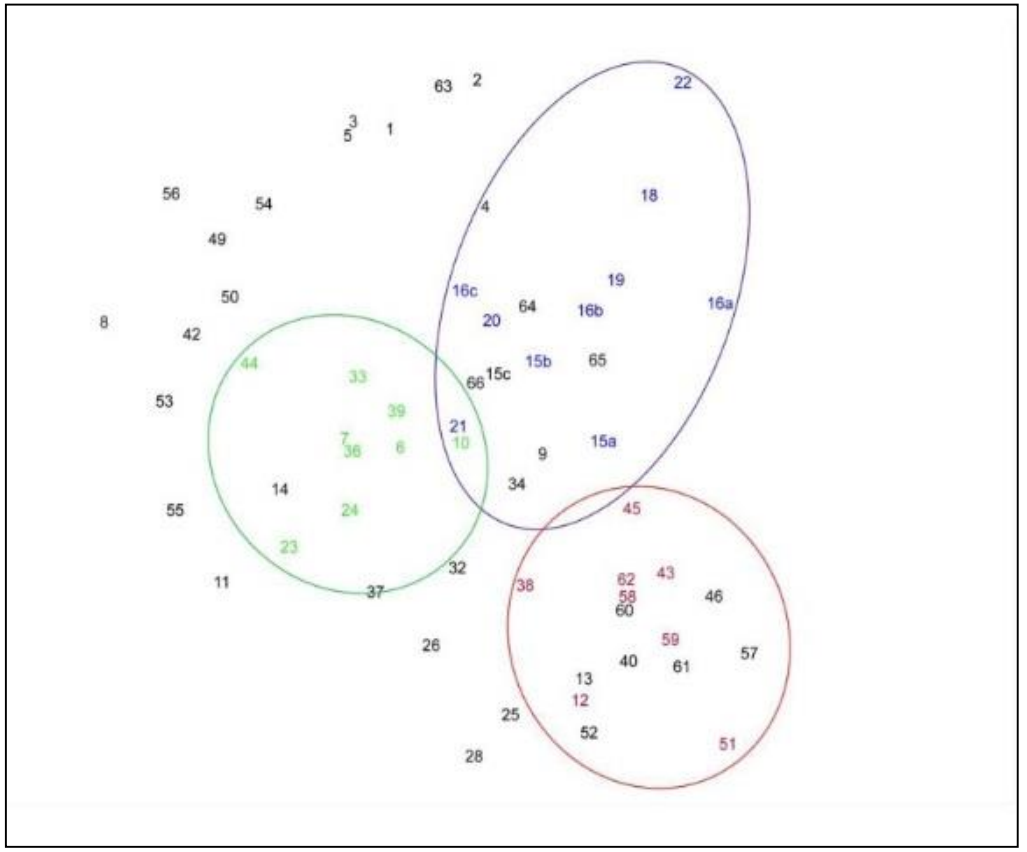


Figure 2. Multi dimensional scaling map indicating three main groups of benthic animal communities.

# ECOAST - New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas

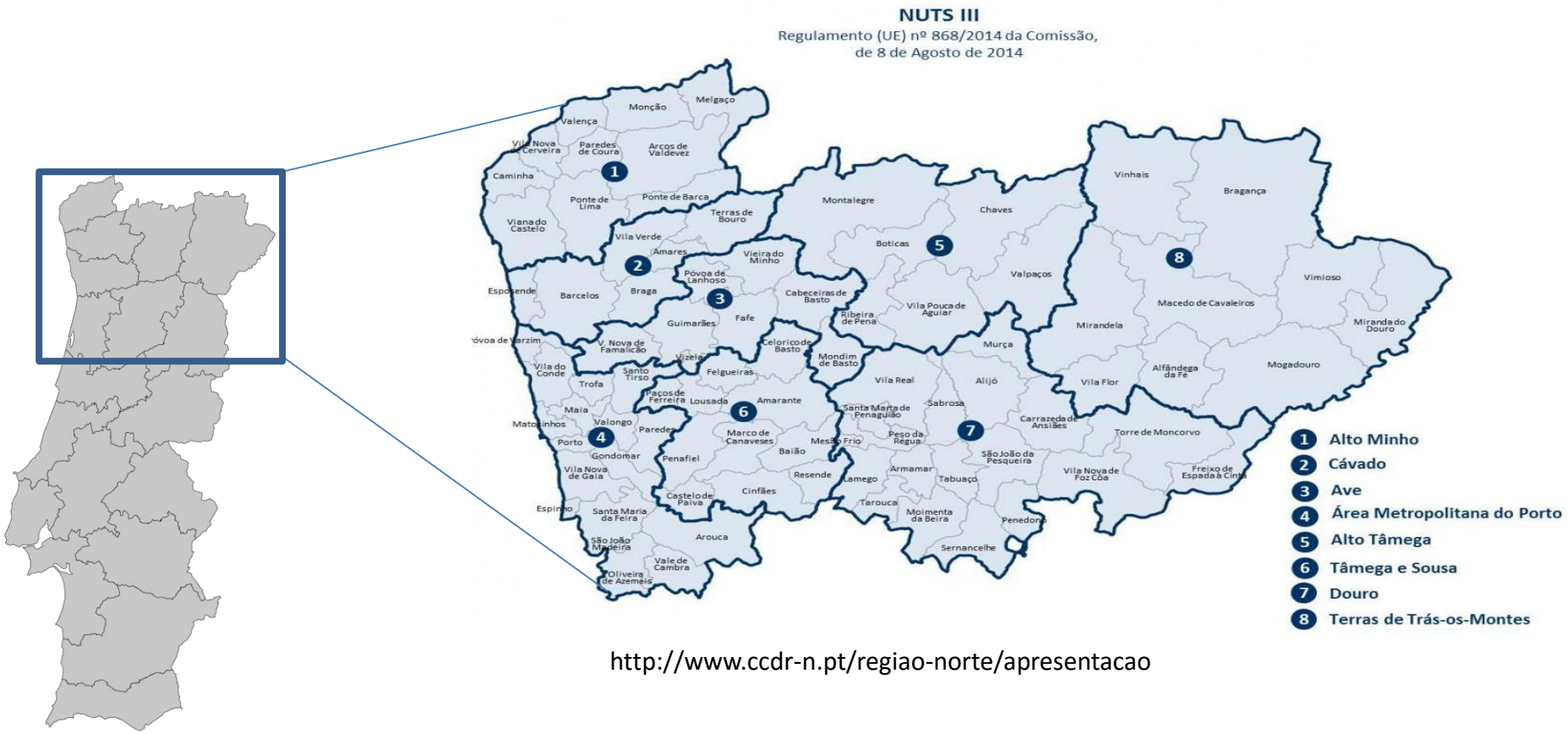

**Lúcia Guilhermino, Luís R. Vieira**

**ICBAS – Institute of Biomedical Sciences of Abel Salazar, University of Porto, Department of Population Studies, Lab of Ecotoxicology (ECOTOX), Porto, Portugal**

# NE Atlantic Coast

- **All tasks of the project**

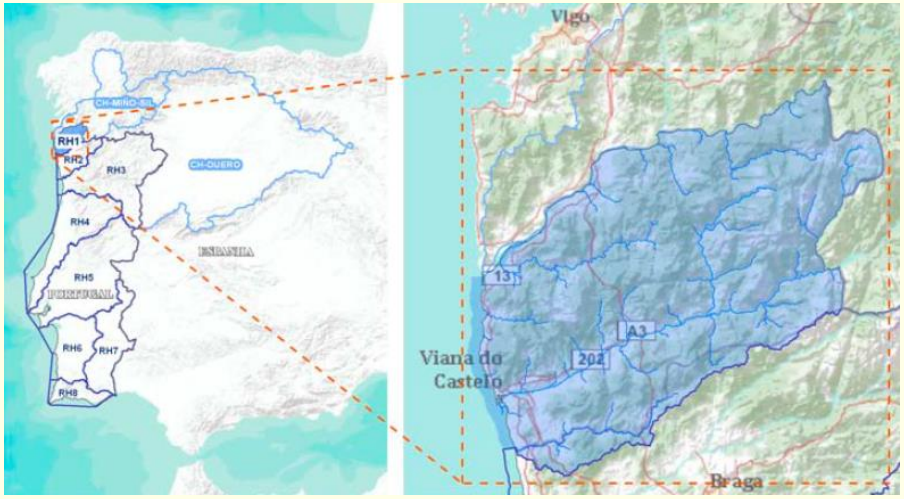
- **Partner responsible for Case study 7 – NE Atlantic coast, specifically the NW Portuguese coast, hereafter indicated as ATL**




http://www.ccdr-n.pt/regiao-norte/apresentacao

# Minho and Lima

- 2 400 km$^2$
- 276 000 residents
- 56 Rivers
- 3 lakes
- 10 transitional waters
- 2 coastal waters




**Minho**: Relatively low impacted, however, in the last decades, the environmental pressures and impacts have been increasing.

Included in the Natura 2000 Network

**Lima**: Recipient for diffuse pollution originated from industrial waste discharge, agricultural runoff and urban sewage discharges transporting nutrients and other substances.

# Viana do Castelo Harbour


- > 900,000 tons of cargo per year;
- Ships up to 180 meters long;

- Aluminium, steel, wood pallets, cement, fertilizers, kaolin, liquid bulk (asphalt) and roll-on / roll-off cargo;

- Equipped for the construction and repair of chemical tankers, oil tankers, container ships, general cargo as well as warships.

## Natural Park (Parque Natural do Litoral Norte de Portugal)


http://www.icnf.pt/portal/turnatur/visit-ap/pn/pnln/inf-ger

# *Leça da Palmeira* Refinery

- Fuel production 3,700,000 tons per year;
- Oil production base 150,000 tons per year;
- Aromatics production and solvents 440,000 tons per year;
- Manufacture of greases 1,500 tons per year;
- Manufacturing and molding of paraffins 10,000 tons per year;
- Bitumen production 150,000 tons per year;

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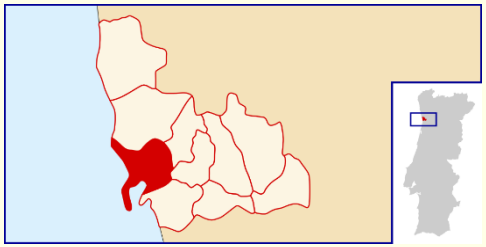
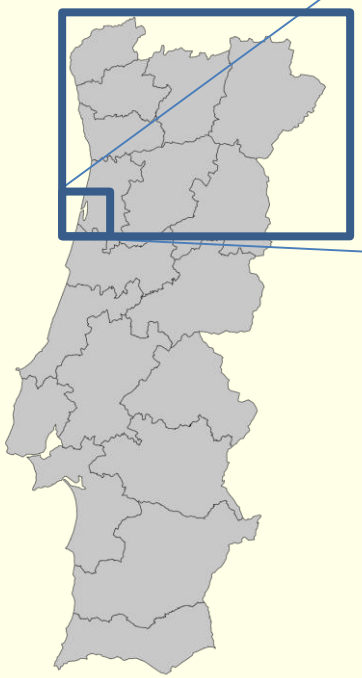


# Aveiro Lagoon

## Aveiro Harbour




- ~4.1 million tons / year(SSTI);
- Multifunctional Port - different sectors of industry: Ceramic, chemical, wine, metal, wood products, food agriculture.

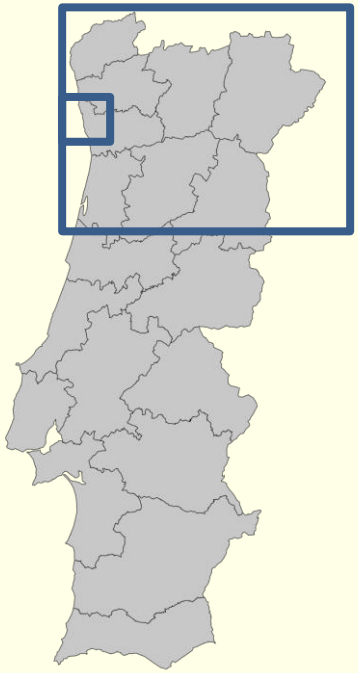
- **Other smaller protected areas**

- **Overall, the environmental quality of all the NW Portuguese coast as high interest, including in relation to tourism (e.g. high number of beaches, including fluvial ones, ecotourism, game fishery….)**

# *Main exploited resources*

- **Industrial and artisanal fishery** (coast, platform, and estuaries):

  - Sardine (*Sardina pilchardus*) (~65.000 tons);



Matosinhos harbour (~ 20.000 tons)

# *Main exploited resources*

- **Industrial and artisanal fishery** (coast, platform, and estuaries):

  - Octopus (Octopoda spp. (10.000 tons / triennium)

Olhares.sapo.pt

  - Anchovy (*Engraulis encrasiocolus*);

# *Main exploited resources*

- **Game and hobby fishery** (mainly in estuaries and beaches)

  - European sea bass (*Dicentrarchus labrax*);
  - Lamprey (*Petromyzontidae spp*.);
  - Shad (*Alosa alosa*) ;

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# *Main exploited resources*

- **Water**

greensavers.sapo.pt

- **Algae (crop fertilization, other industries – small extent but increasing)**
- **Sand (e.g. for building)**


**Increasing impact on natural resources**

# *Main pressures*

- **Habitat lost, degradation and fragmentation (e.g. landscape occupation for habitation, tourism facilities, other industry facilities, dams, routes, bridges)**

- **Over-exploration of some species (those with higher economic value)**

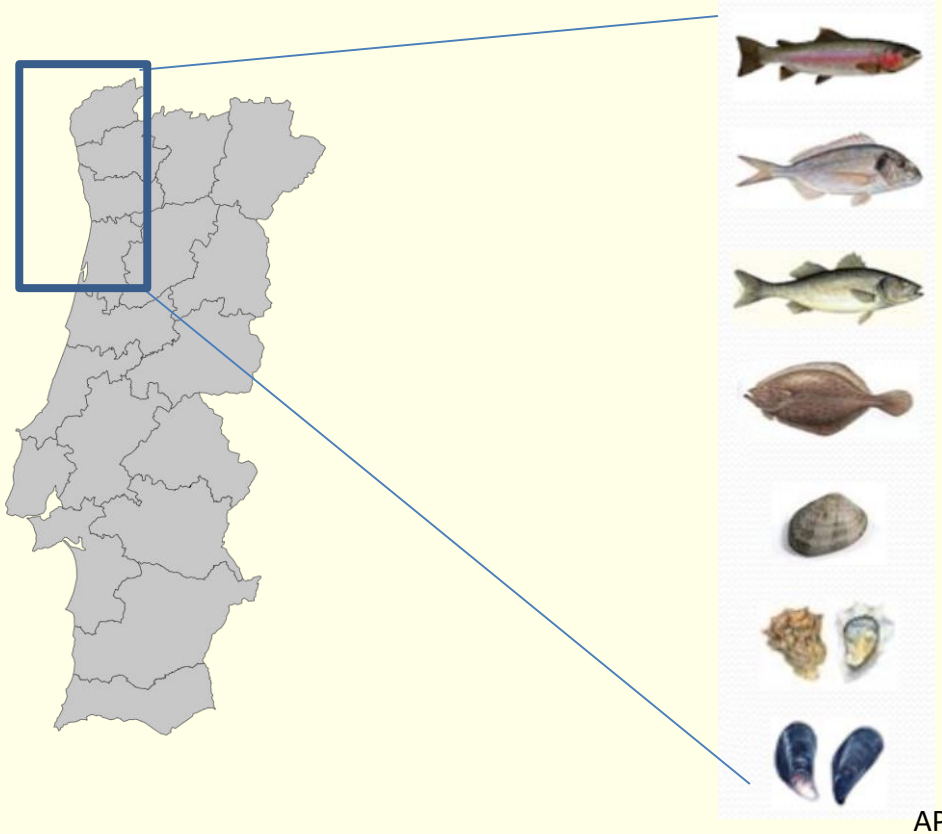
- **Sediment extraction (estuaries and rivers navigation)**

# Main pressures

- **Alterations due to climate changes**
- **Exotic invasive species** (e.g. *Corbicula fluminea*)
- **Pollution:**
  - Three main harbours (*Leixões, Viana do Castelo and Aveiro*);
  - 1 oil refinery (with ETAR);
  - Several types of other industries affecting estuaries and the coastal area (e.g. agriculture, textiles, shoes, mining);
  - Several small ports and other facilities supporting recreational activities in relation to the sea and fluvial transport;
  - Urban sewage.

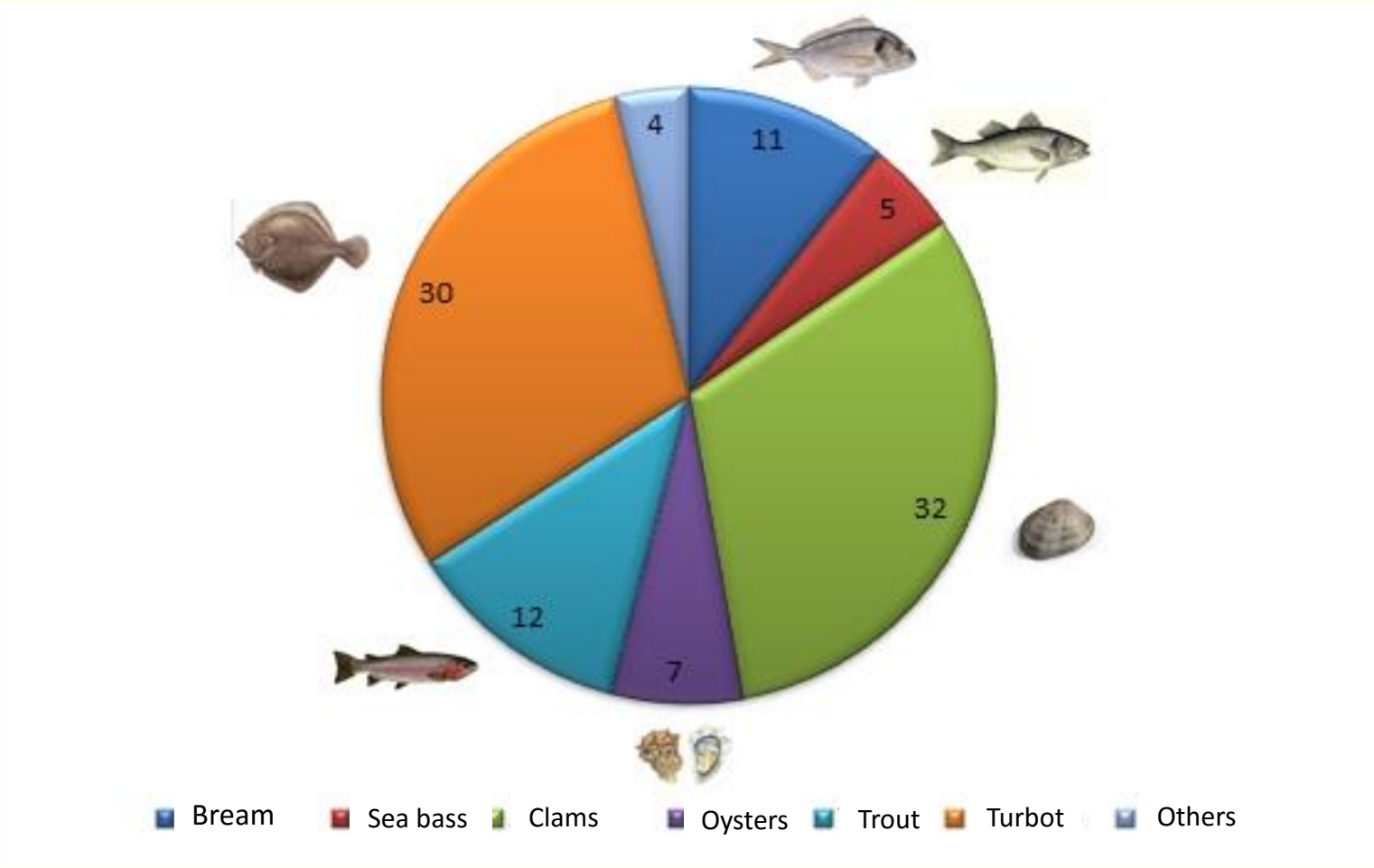
# Aquaculture facilities

- ~ 11 000 tonnes, equivalent to 56 million euros;
- The main destination of production is the domestic market;
- 95.4% - Brackish and marine waters.



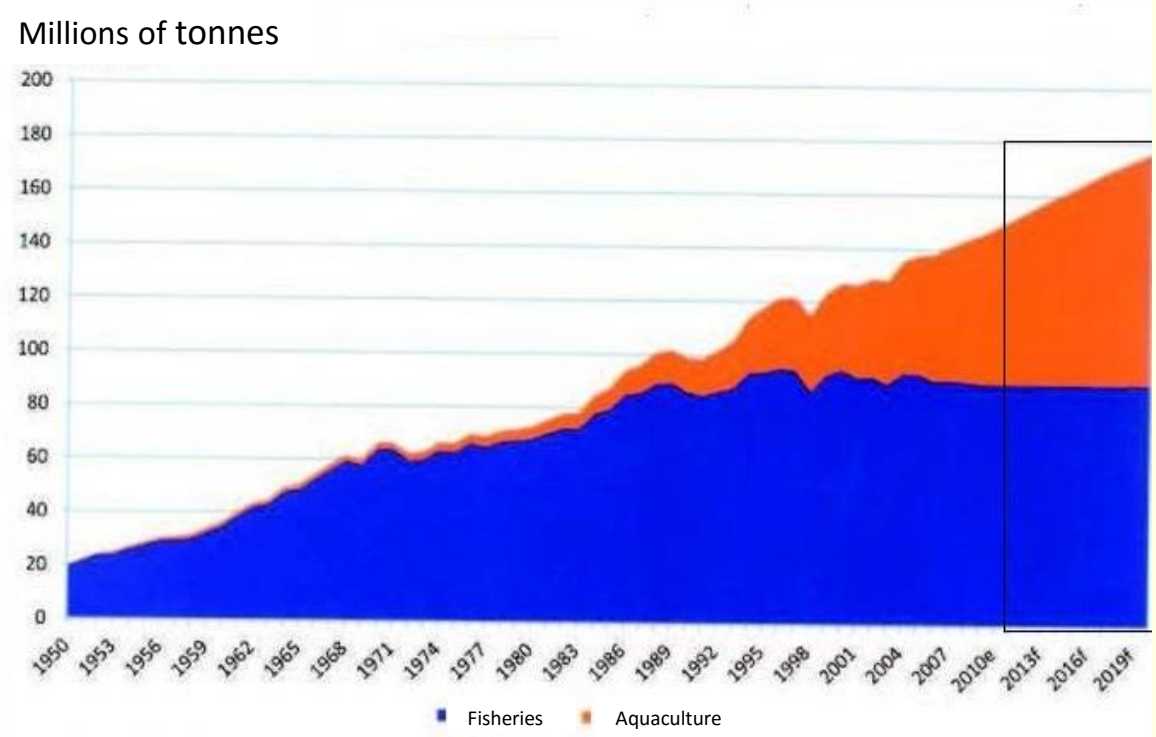
APA 2014

# Aquaculture production



# Aquaculture facilities

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|
| **Consumption *per capita* (kg)** | 17.4 | 17.6 | 17.8 | 18.1 | 18.6 | 18.8 |



# Objectives

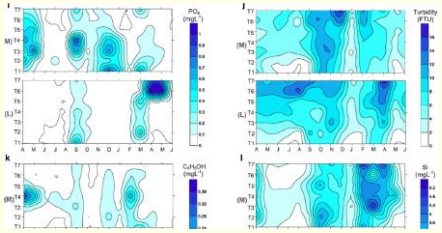
- ✓ Investigating the impact of the aquaculture and other contamination sources in the water quality, biota and ecosystem functioning is of high interest, and spatial planning is urgently needed.

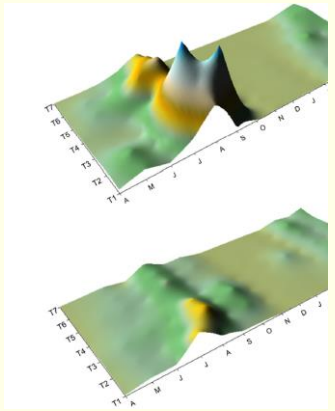
- ✓ The increase of aquaculture industry in Portugal is one of the goals of the Maritime National Strategic Plan, and the improvement or maintenance of the good status of the marine water is a goal of regional, national and European Strategies.

# *Main projects in that area by the team*

The team involved in the project has been working in the NW coast of Portugal (ecotoxicological and ecological studies, monitoring and risk assessment).

- A considerable amount of data is available for ECOAST, including data in spatial occupation, sources of environmental contamination and other impacts, among other types of data.





*Thanks for attention!*

*Dr. Thorleifur Agustsson Research Director*
*Dr. Fiona Provan Senior Scientist*
*Dr. Alessio Gomiero Senior Scientist*
*Dr. Asbjørn Bergheim Senior Scientist*
*Dr. Elisa Ravagnan Senior Scientist*

ECOAST

*Era-net COFASP*

IRIS


6 April 2016

**WP3 – Ecological footprint of fish farming in coastal areas: identification and response for improved management**

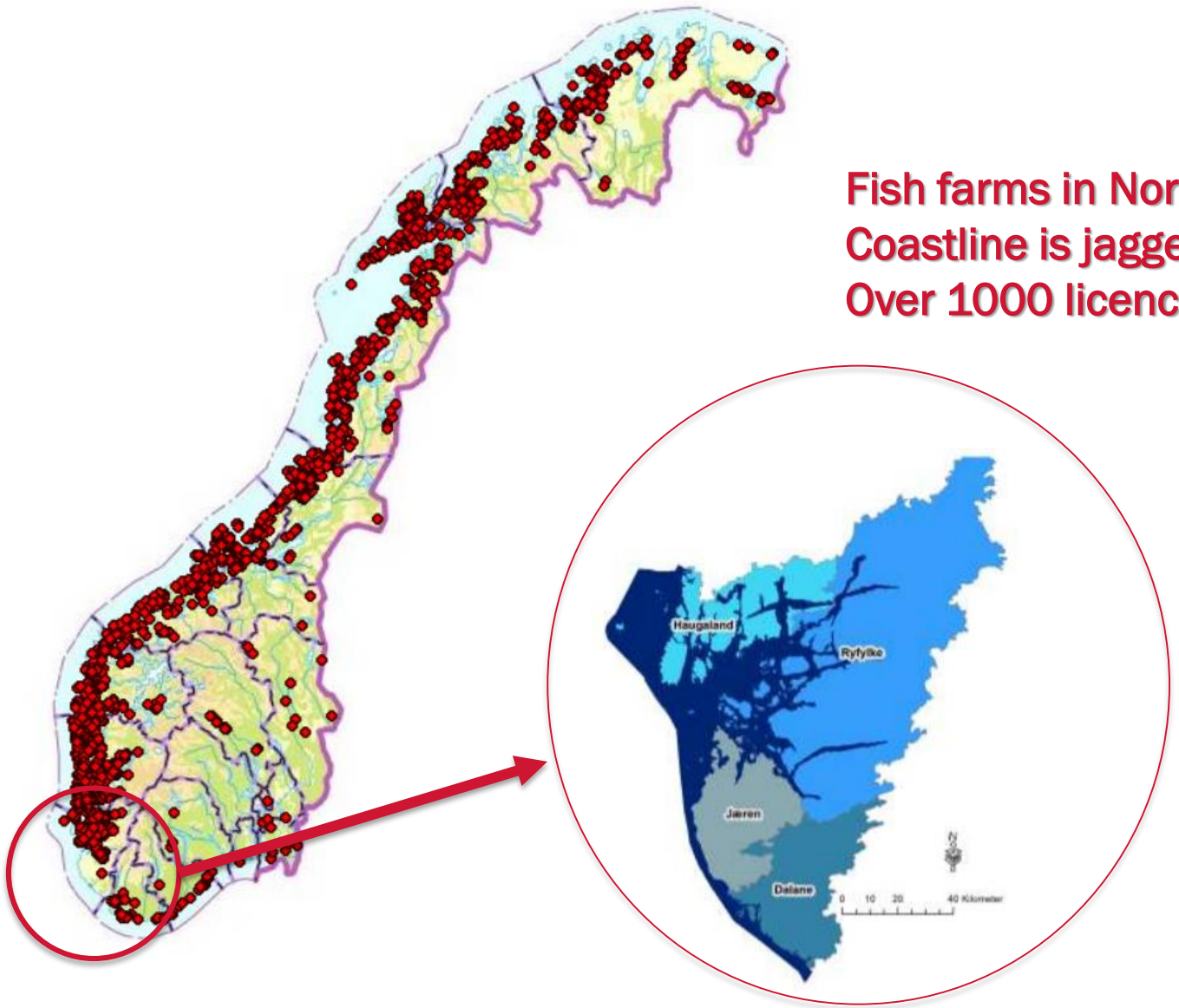
**(Responsible: Thorleifur Agustsson IRIS, Norway)**

| Participant | ISMAR-CNR | ISPRA | DTU Aqua | IRIS | IMR | HCMR | NIMRD | ICBAS |
|---|---|---|---|---|---|---|---|---|
| Person months | 5 | 3 | 0 | 20 | 2 | 5 | 20 | 6.7 |

Objectives:

- to identify the knowledge needs concerning the ecological impact of the aquaculture at the selected case study sites in order to meet criteria set by regulators and policymakers;
- to establish guidelines for operators to assess ecological impacts of operations and to suggest new diagnostic tools to improve the quality of information.

| Milestones (delivery month) | Deliverables (delivery month) |
| --- | --- |
| M3.1. List of currently used tools in Norway for assessing impact of aquaculture (10)<br>M3.2. List of currently used tools in European aquaculture (10)<br>M3.3. List of needs from policymakers and regulators (14)<br>M3.4. Information from policymakers and regulators on their needs for improved tools (18) | D3.1. Report on ecological impact of aquaculture at selected case study sites and present current tools (procedure for gaining knowledge related to a policy aim) used in EU and Norway to assess such impact. (in connection with WP2) (20)<br>D3.2. Report on needs for knowledge about ecological impact detection as defined by regulators and policy makers at selected sites. Assess need for new tools to meet demands of regulators and propose relevant tools (24)<br>D3.3. Guidelines for operators about ecological impact assessment and requirement for production growth (30) |




Fish farms in Norway.
Coastline is jagged and approx >15000 km
Over 1000 licences for fish farming.



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## Norwegian salmon farming and sustainability

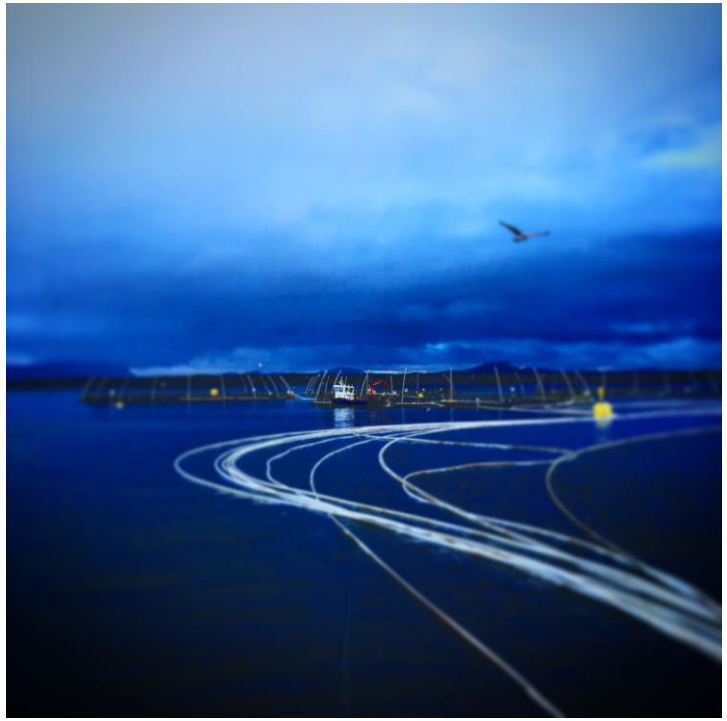
› In 2009 Norwegian government published «Strategy for environmentally sustainabe aquaculture industry»

| | |
|---|---|
| Goal 1: Disease | Disease in fish farming will not have a regulating effect on stocks of wild fish, and as many farmed fish as possible will grow to slaughter age with minimal use of medicines. |
| Goal 2: Genetic interaction | Aquaculture will not contribute to permanent changes in the genetic characteristics of wild fish populations. |
| Goal 3: Pollution and discharges | All fish farming locations in use will maintain an acceptable environmental state and will not have higher emissions of nutrient salts and organic materials than the receiving waters can tolerate. |
| Goal 4: Zoning | The aquaculture industry will have a location structure and zoning which reduces impact on the environment and the risk of infection. |
| Goal 5 Feed and feed resources | The aquaculture industry's needs forraw materials for feed will be met without overexploitation of wild marine resources |

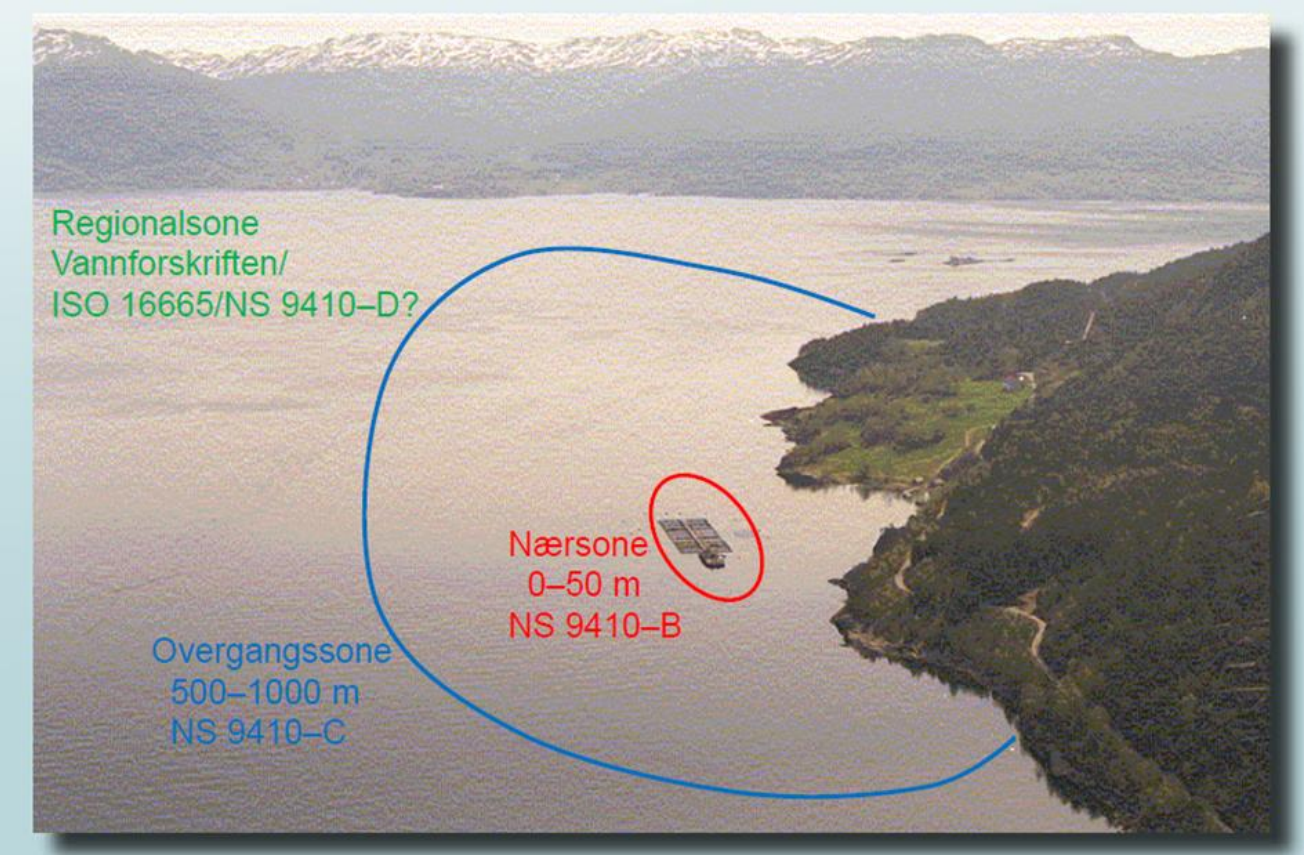
Taranger et al., 2014

# Goal 3 Pollution and discharges

› All fish farming locations in use will maintain an **acceptable** environmental state and will not have higher emissions of nutrient salts and organic materials than the receiving waters can tolerate.



# Environmental monitoring of the benthic effects of marine aquaculture sites




- Minimize impact on environment
- Impact should be acceptable
- Impact should be constant

  (not increasing)

# The MOM surveys

MOM stands for Fish farm Surveillance Modelling (Matfiskanlegg Overvåking Modellering), and is a type of monitoring designed to have a standard for environmental monitoring of areas around fish farms.

From 1 January 2005, an accredited or approved company must carry out all MOM-B and MOM C surveys.

By monitoring the environment around the farms, it can be assured that neither the surrounding areas nor the farmed fish cage-environment deteriorates. This is essential to exploit areas and localities optimally.

MOM investigations supply important information used in connection with locating and monitoring of farms and recipient in connection with possible discharge from the farm. By taking repeated MOM investigations at a site, it is possible to draw conclusions about the evolution of environmental conditions on the seabed under the locality. MOM investigations are divided into two different classes: B and C.

MOM-B is the most widely used standard for environmental studies of marine fish farms and carried out by specialized personnel. It retrieves ten sediment samples from the seabed scattered throughout the territory. Samples are analysed chemically (pH, Eh), biological and sensory (smell, colour and consistency). The biological part consists of a preliminary sorting of the animals in different groups (crustaceans, polychaetes, echinoderms, snails and shells). Results from sediment samples are analysed and classified according to NS 9410, Environmental monitoring of marine fish farms.
MOM-C investigations are primarily ordered by the county governor (monitoring) or in conjunction with research. In some cases also fish farmers initiated MOM C survey. This is a thorough examination of the diversity of species in an area. The sediment samples are collected with a larger grab sampler than for MOM B survey. Species composition and number are statistically rated to arrive at a state of the environment of the area.



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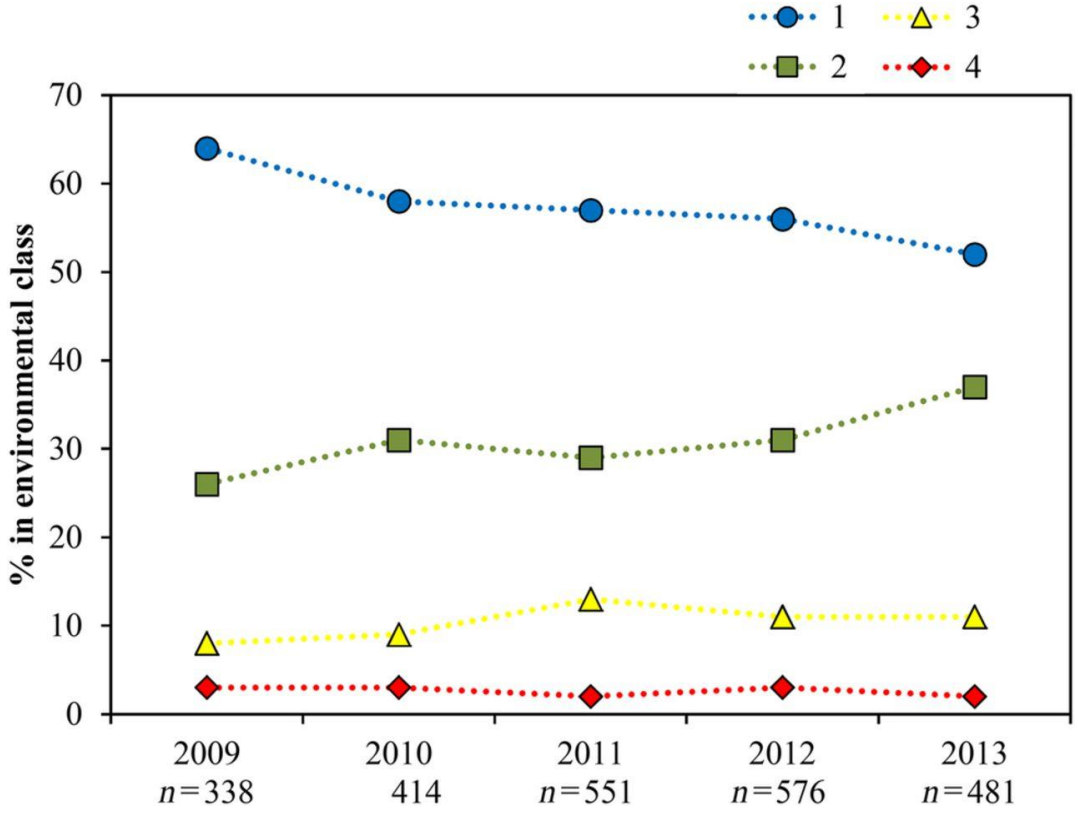
# Status in Norway in marine farming – overview




| Klasse | Tilstand miljømål |
|---|---|
| Svært god | Miljømål tilfredsstilt |
| God | |
| Moderat | Tiltak nødvendige for å nå miljømål |
| Dårlig | |
| Svært dårlig | |

**Impact of organic load from Norwegian marine finfish farms monitored by the mandatory MOM-B investigations (NS9410:2007) in the period 2009–2013.** Data are given as percentage number of farms with ecological condition: 1 (**blue**), low organic loading; 2, (**green**), moderate organic loading; 3 (**yellow**), high organic loading (maximum allowed loading); 4 (**red**), overloading of the site, n = number of reported MOM-B investigations (data from Norwegian Directorate of Fisheries).

# Organic loading on a local scale

- The endpoint : unacceptable change in faunal communities and sediment chemistry in the production zone is estimated. The criterion of unacceptable change is determined by Norwegian authorities and salmon farms in Norway are monitored through mandatory investigation (MOM system).

- Pre examination (new 2016) : analysis of topography, currents and benthic conditions in both local and transition zone before the site is placed or before major expansions. This is a reference measurement and can be used to determine monitoring sites.

# Organic loading on a regional scale

- **MOM C (**NS9410 2016**)** extended investigation of several sites in the extended influende zone around farms. Consist of quantitative measurement of organic enrichment and impact on biodiversiy in infauna communities. Farming sites categorized into differnet environemnetal state saccording to nationally set thresholds. Data shows that at distant sites 95% of farms had a high or very high ecological condition.

- **Estimate risk on regional scale–** data from case studies in Hardanger fjord and regional monitoring according to parameters and thresholds defined from implementation of European Water Framework Directive. Data shows that ecological condition in fauna communities and oxygen values in deep regional basins are high to very high in regions with high salon farmin activities.

- Lack sufficient data from entire coastline.

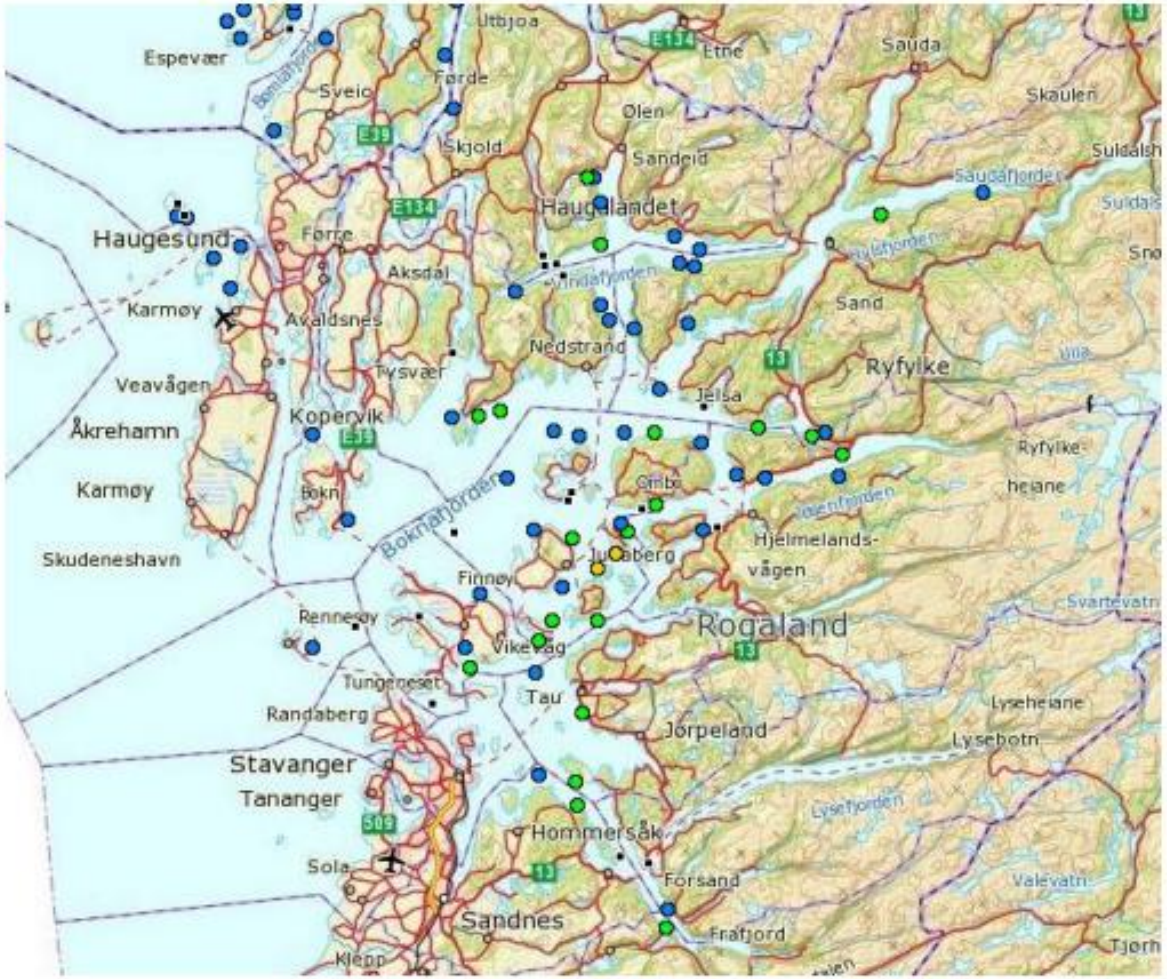
# Nutrient emission

- **Nutrient emission on a regional scale-** local impact from nutrients and fine particulates in the euphotic zone are not monitored, no data to measure endpoint nutrients from fish farms result in local eutrophication.

- **Nutrient emission regional scale-** to estimate endpoint nutrients from fish farms results in regional eutrophication, we do not have sufficient data from Norwegian coastal waters to fulfil complete risk estimation. Three years monitoring in Hardangerfjord and Rogaland (NB Uni research) of nutrient values and chlorophyll a show that ecological condition are within national acceptance thresholds.

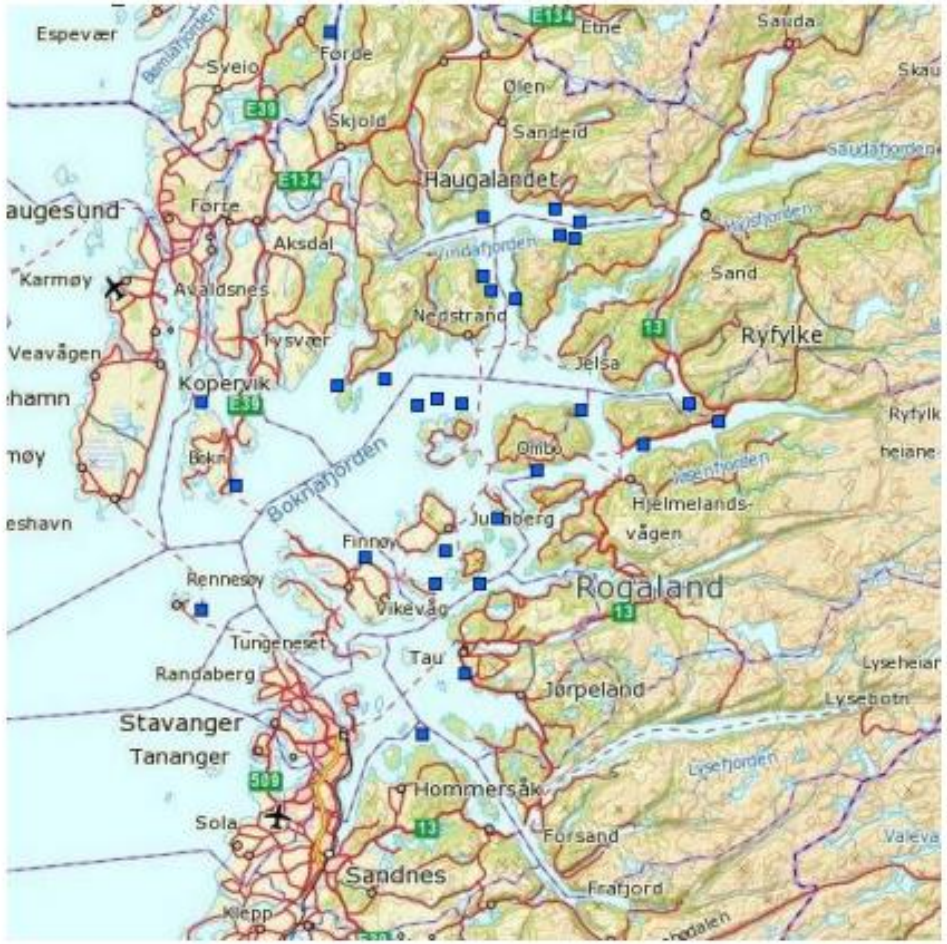
# MOM B undersøkelser i Rogaland rapportert inn per 2. november 2015

| Miljøtilstand |
| --- |
| 1 – Meget god |
| 2 – God |
| 3 – Dårlig |
| 4 – Meget dårlig |




(Fiskeridirektoratet)

# MOM C undersøkelser i Rogaland rapportert inn per 2. november 2015


(Fiskeridirektoratet)



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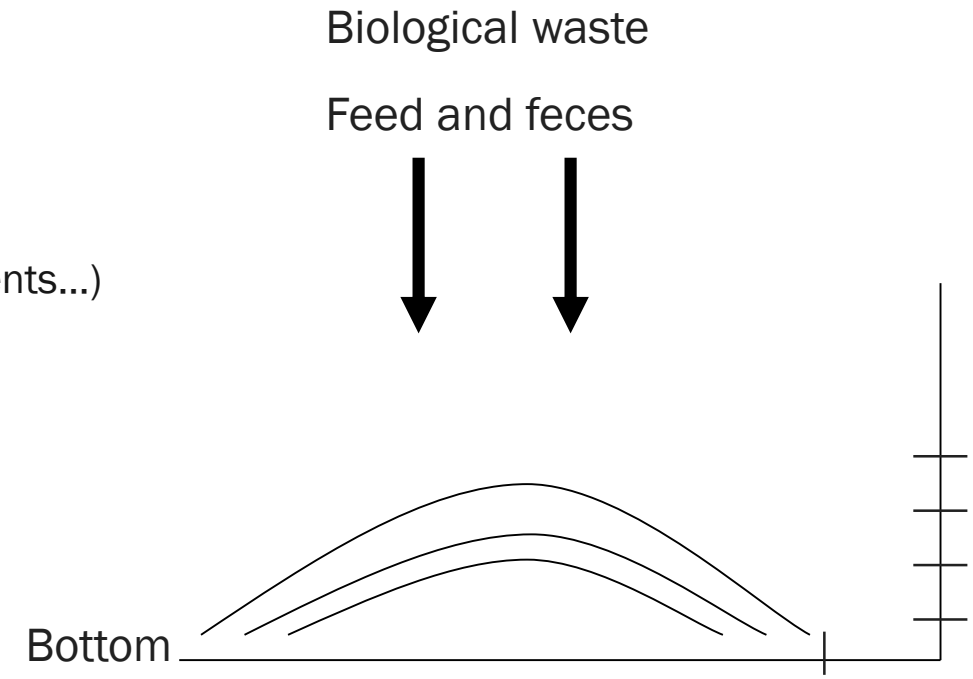
# What can be considered as Pollution….

- Chemical pollution such as:
  - Copper
  - Zink
  - PAH, PCB
  - Pharmaceuticals (antibiotics, oxidizing agents…)
- Eutrophication
  - Carbon
  - Phosphorus
  - Nitrogen
- Accumulation of organic material




# The importance of recovery time

› After accumulation of organic matter has stopped

› Breakdown of excess organic matter

› Colonization of new species (species in the vicinity)

› Growth and reproduction

## When has the area recovered….

# Classification of recipients

- Sensitivity to organic pollution
- Classification must be simple
- Classification must be accepted

**Used to make aquaculture sustainable**



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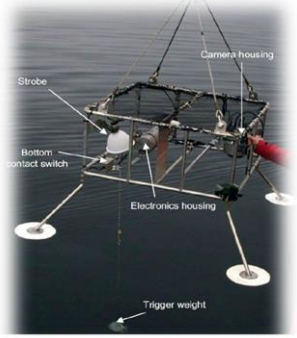
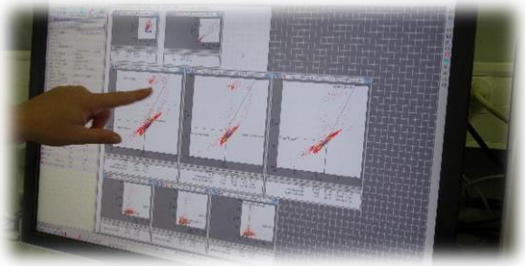
# How can aquaculture become sustainable?

**The importance of:**

- Good description of environment
- No permanent changes
- Constant monitoring
- Total recovery possible

# The state-of-the-art monitoring Technology – online – plug and play!



Or is it so simple....



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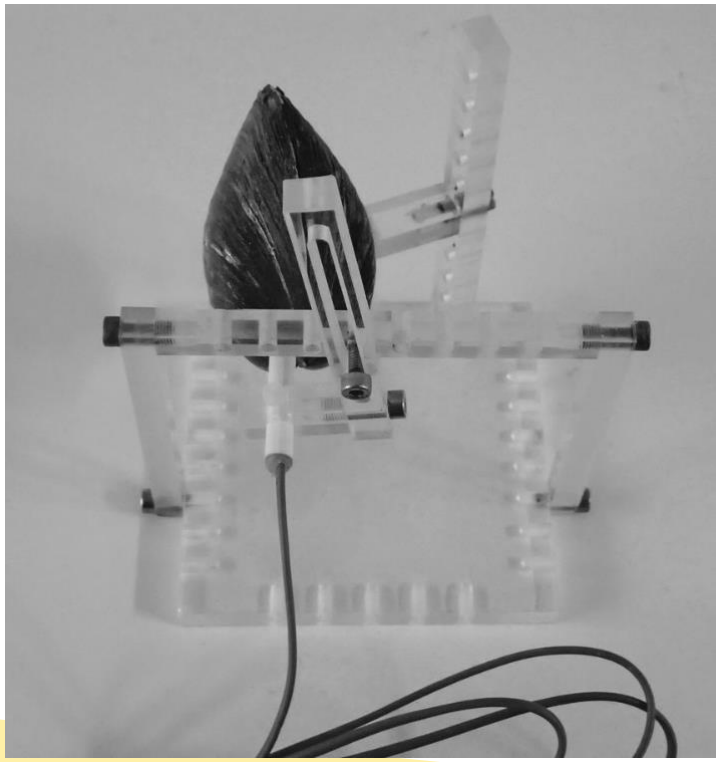
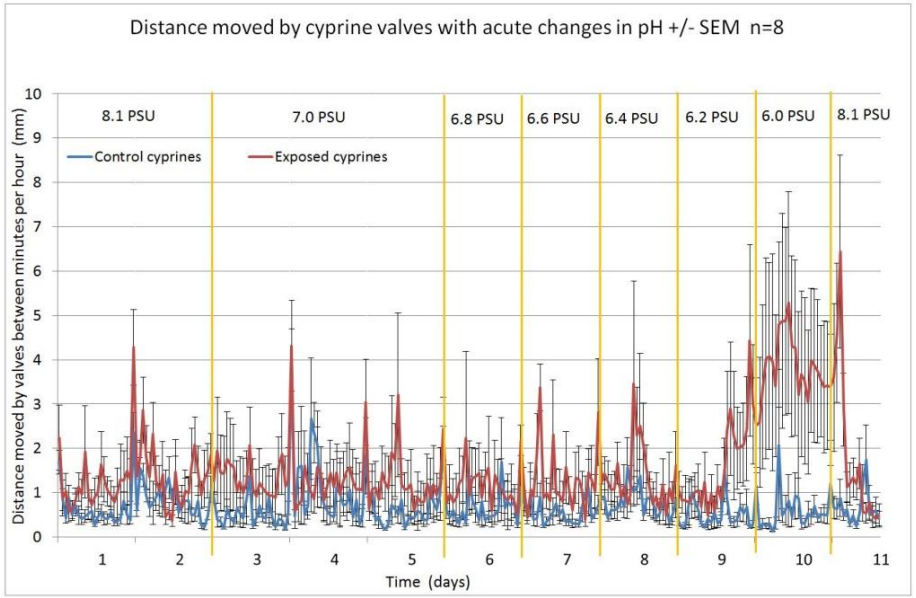
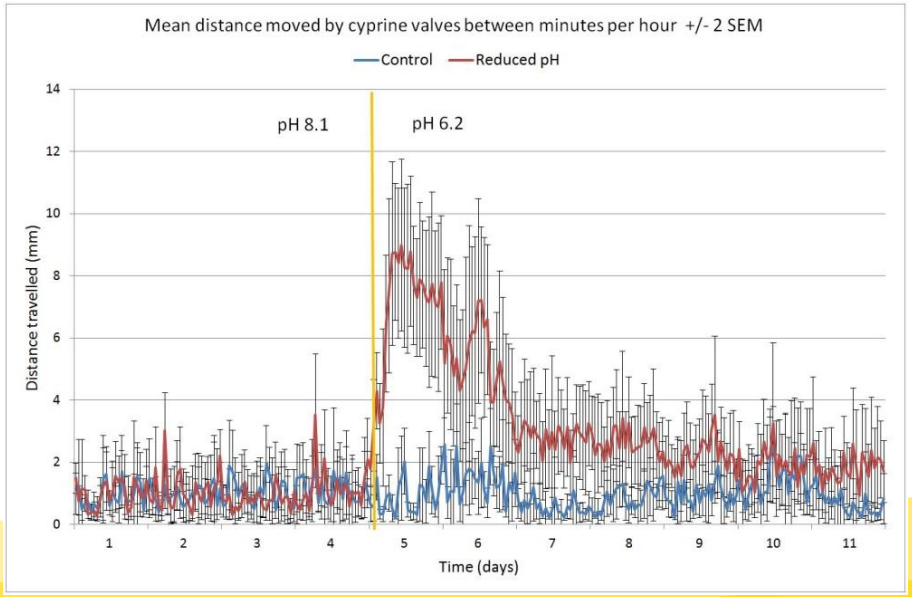
# The cyprine (*Arctica islandica*) Valve gape behaviour





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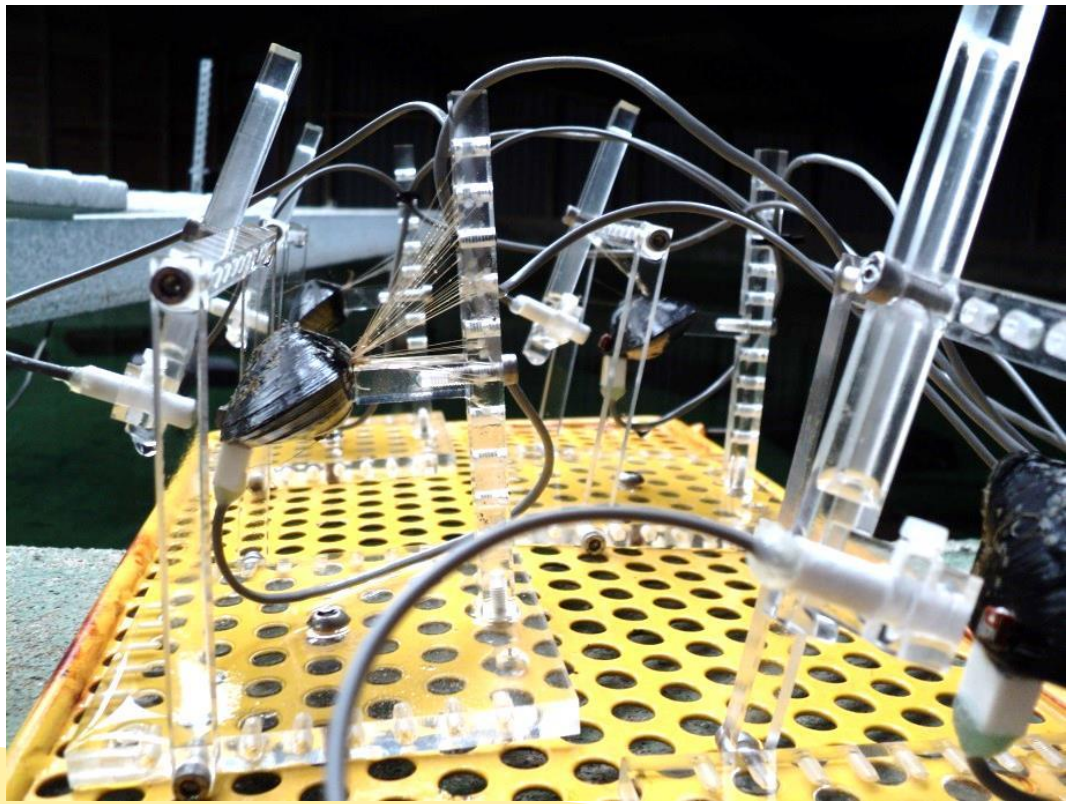
# The use of animals as «sensors»

IRIS Biomiljø is providing support for biological measures taken from test animals exposed to seismic firing , both in the laboratory and the field.
The major objective of the study is to determine the physiological and behavioural responses of snow crabs and blue mussels to a simulated seismic array firing in the laboratory and to a real seismic firing sequence in the field.





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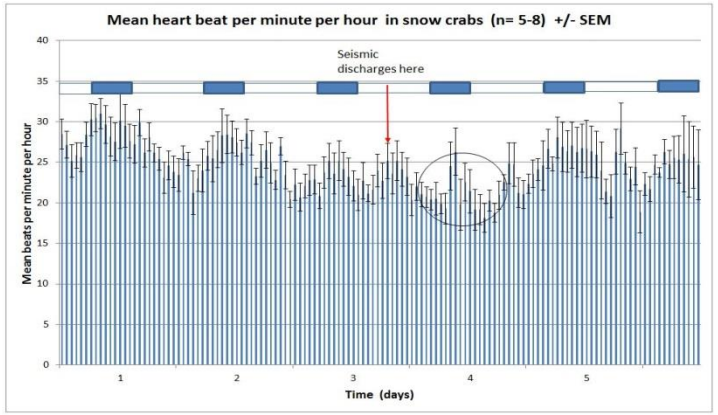
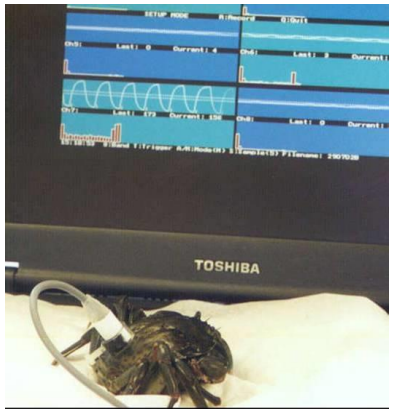
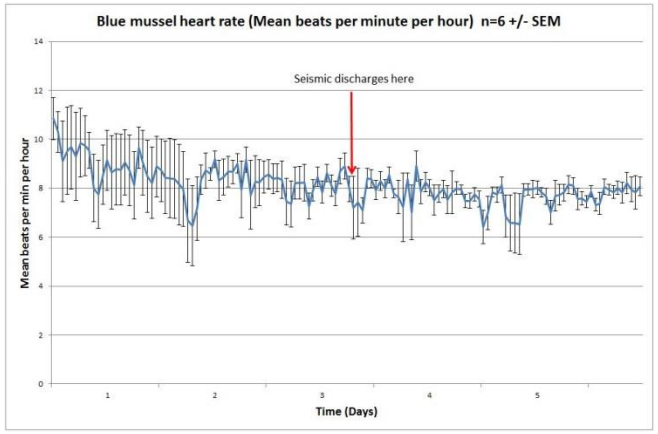
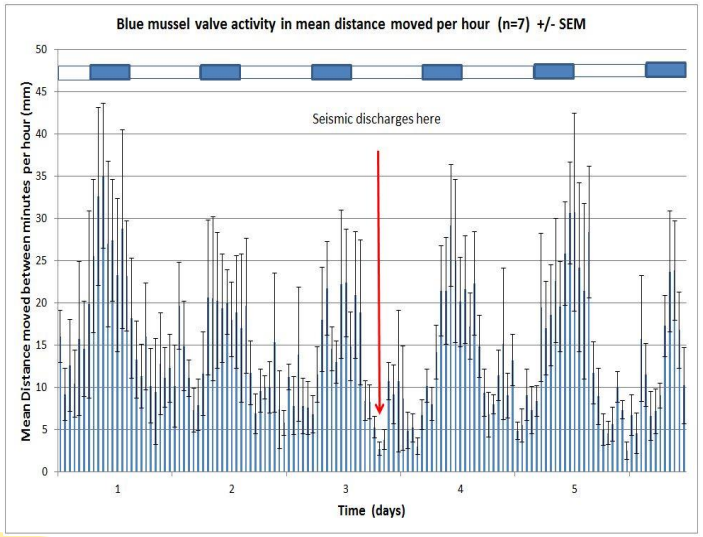
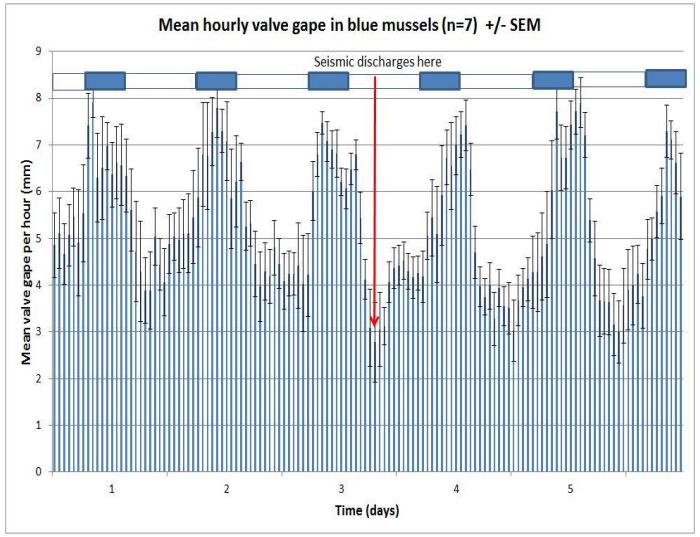
# Some results from the laboratory seismic exposure study



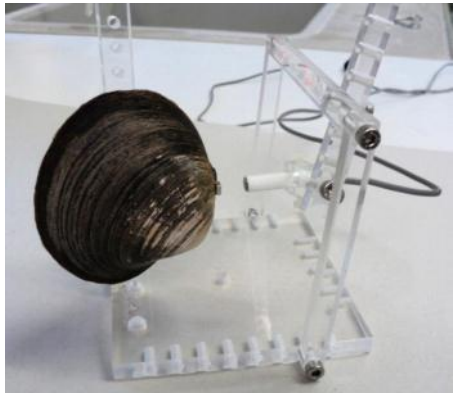



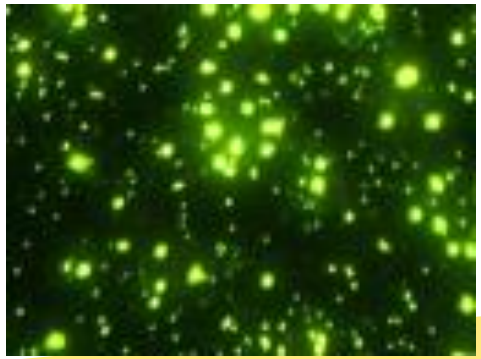



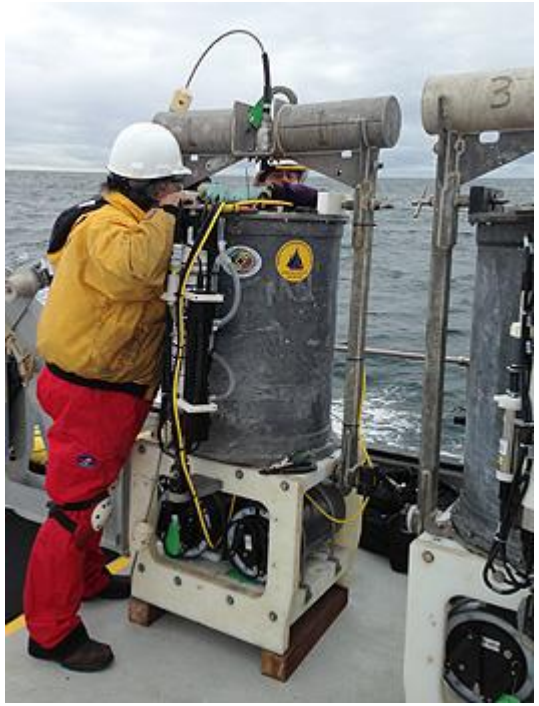
# Environmental biosensors

- IRIS working with environmental issues, particularly related to biological changes to petroleum, for a number of years
- Biological changes = Effective reflection of changes in environmental conditions
- «Real time» biology = biosensors
- Environmental biosensors
  - use of DNA
  - use of living organisms
  - use of natural marine microbes as biosensors

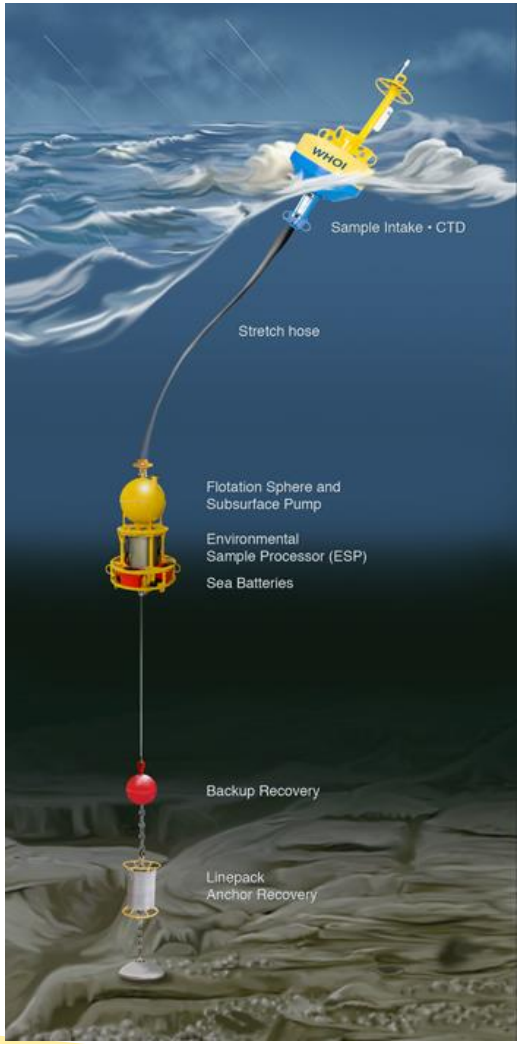


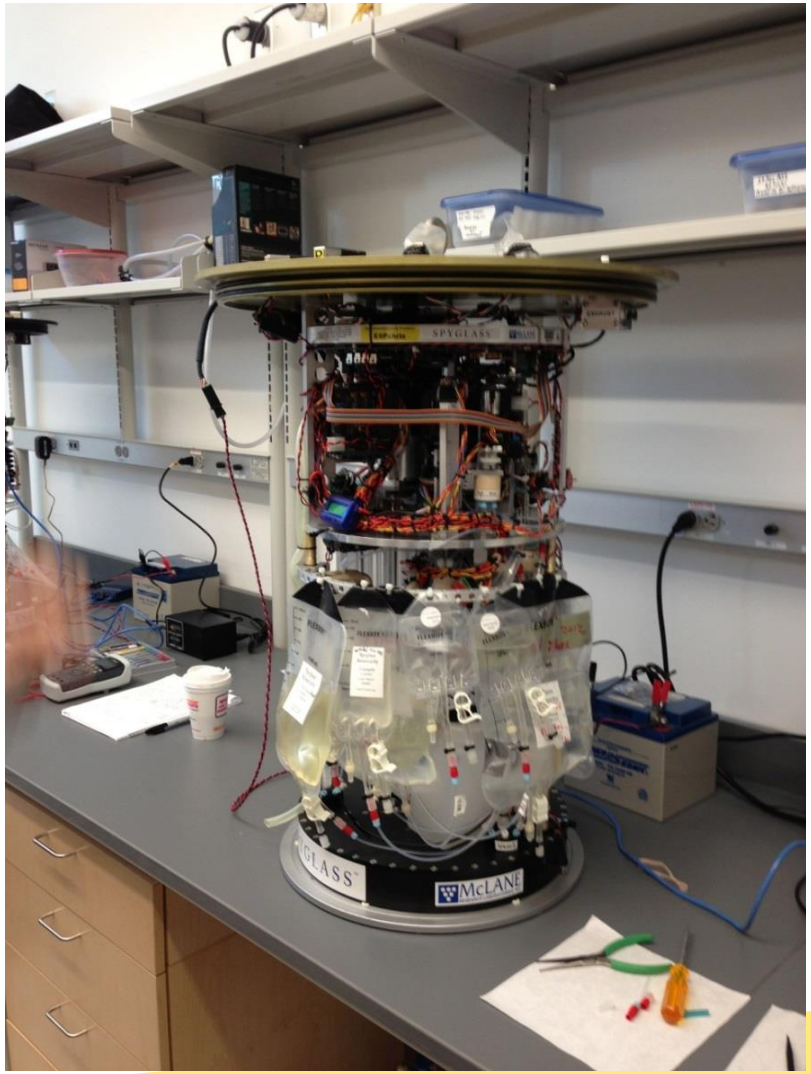


# Environmental Sample Processor – ESP developed at MBARI
# Species detection based on near real-time gene-based assays



«Lab in a can»

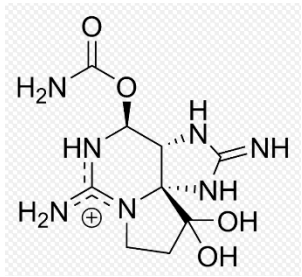


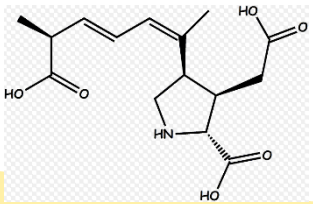



# The ESP can detect a wide range of targets based on their gene signatures

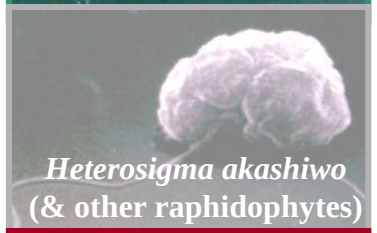
## Microbes

## Toxins



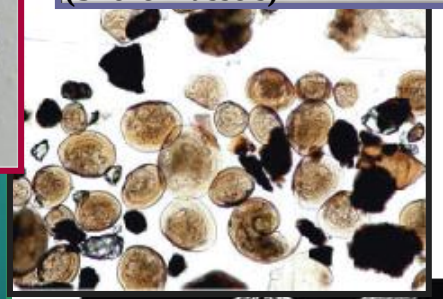

## Harmful Algae




## Invertebrate Larvae





# The IRIS Environment scientific team!
# Thanks!

**EU water water framework directive**

› Guide “Classification of environmental state in water - ecological and chemical classification system for coastal waters, groundwater, lakes and rivers” Norwegian classification system for water in compliance with the water framework directive.

› The environmental objective for natural water bodies of surface is that they should have at least good ecological and chemical status and groundwater at least good chemical and quantitative status.
Water Regulations require the preparation of a classification of water bodies.

› The classification system provides specific class limits of a range of chemical, physical and biological parameters of importance for environmental conditions in lakes, rivers, coastal waters and groundwater.

› Along with monitoring data and expert assessments, this forms the knowledge-based foundation to clarify the overall ecological and chemical status of a water body in one of the five classes of very good to very poor.

- The main principle is that organic state of water bodies should be classified on the basis of biological quality elements, while physical and chemical conditions are support parameters. (Groundwater is an exception.)

**The biological quality elements are:**

- Phytoplankton (in lakes and coastal waters)
- On-groing algae (in running water)
- Aquatic plants (in lakes)
- Macroalgae and eelgrass (in coastal waters)
- The benthos (in lakes, rivers and coastal waters)
- Fish (in lake and river)

- Specified parameters and indices for each quality item. As a basis for classification of ecological status, parameters and indices for various water types that make it possible to indicate a deviation from the natural state.

- Good chemical status means that limits for the 33 priority hazardous substances are not exceeded in water, sediment or biota. They selected hazardous substances are compounds which are toxic and often persistent in theaquatic environment.

- The list of pollutants consists of both of organic compounds and heavy metals (Cd, Hg, Ni, Pb). The use of the priority hazardous substances will be phased out by 2020, while for the remaining sunbstances there will be  emission reductions so that limits observed.

# Life Cycle assessment

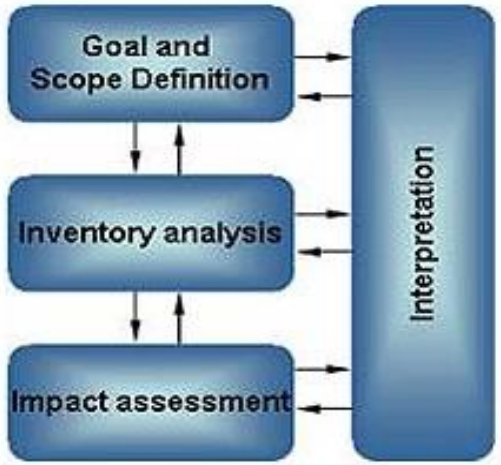
- International standardized method (ISO, 2006)
- Designed to evaluate global impact of product or process on the environment
- «Life cycle implies» the assessment of all the different phases required for or caused by products existence, includes raw material and energy productions, manufacturing transport and use.

# Life Cycle Assessment

## What is Life Cycle Assessment?

Life Cycle Assessment (LCA) is a tool for the systematic evaluation of the environmental aspects of a product or service system through all stages of its life cycle. LCA provides an adequate instrument for environmental decision support. Reliable LCA performance is crucial to achieve a life-cycle economy. The International Organisation for Standardisation (ISO), a world-wide federation of national standards bodies, has standardised this framework within the series ISO 14040 on LCA.

## The Phases of Life Cycle Assessment




http://www.unep.org/resourceefficiency/Consumption/StandardsandLabels/MeasuringSustainability/LifeCycleAssessment/tabid/101348/Default.aspx

Goal and Scope Definition, the product(s) or service(s) to be assessed are defined, a functional basis for comparison is chosen and the required level of detail is defined;

Inventory Analysis of extractions and emissions, the energy and raw materials used, and emissions to the atmosphere, water and land, are quantified for each process, then combined in the process flow chart and related to the functional basis;

Impact Assessment, the effects of the resource use and emissions generated are grouped and quantified into a limited number of impact categories which may then be weighted for importance;

Interpretation, the results are reported in the most informative way possible and the need and opportunities to reduce the impact of the product(s) or service(s) on the environment are systematically evaluated.



Era-net COFASP

Towards environmentally sustainable aquaculture: Comparison between two trout farming systems using Life Cycle Assessment

Emmanuelle Roque d'Orbcastel a, Jean-Paul Blancheton a,*, Joe¨l Aubin

Different categories of environment impacts selected to evaluate the effect of aquaculture production systems on the environment

| **Environmental impact indicators** | **Units** |
|---|---|
| Global warming potential | kg of $CO_2$ equivelants |
| Net primary product use | kg of carbon |
| Energy use | MJ |
| Eutrophication potential | kg of $PO_4$ |
| Acidification potential | kg of $SO_2$ |
| Water dependence | m3 |
| Surface use | m2 |



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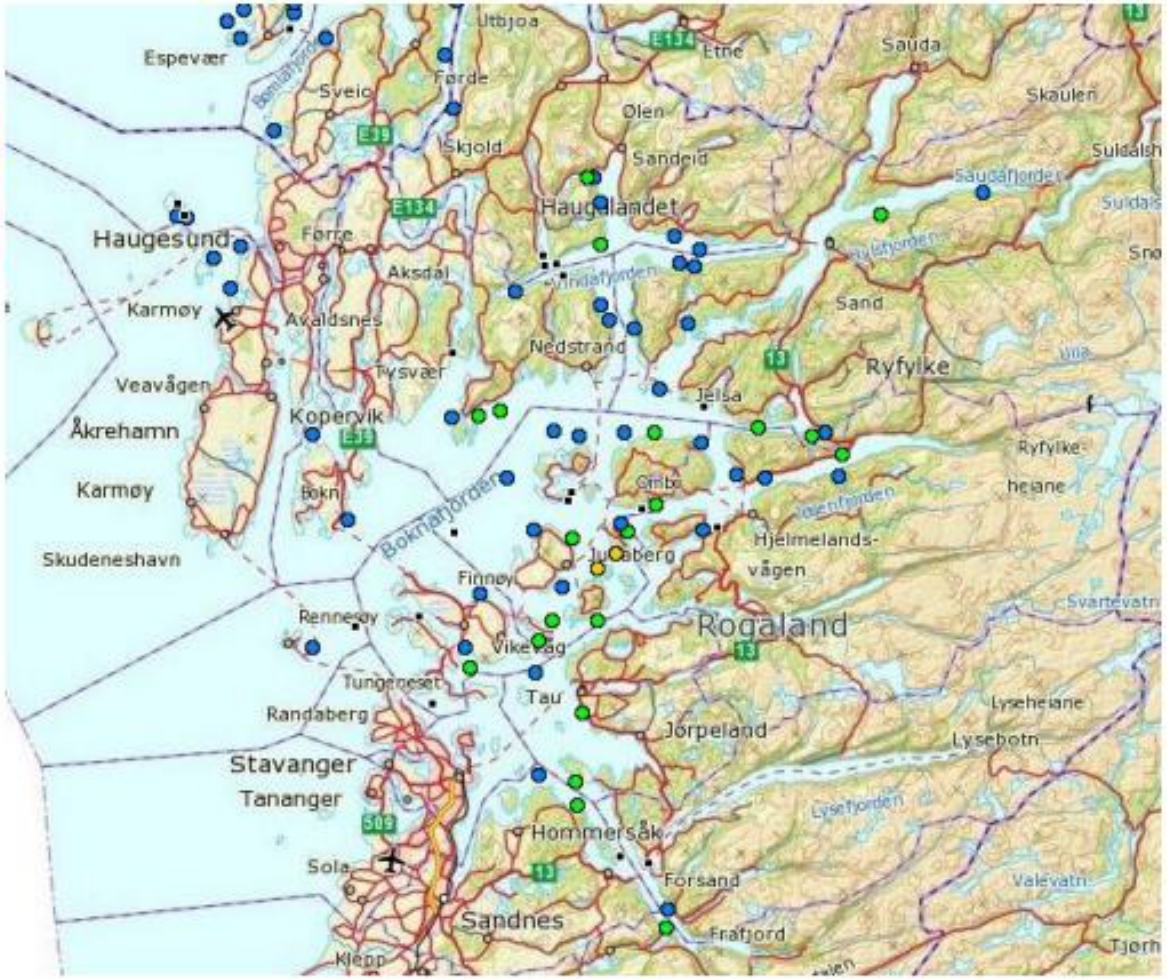
# MOM B undersøkelser i Rogaland rapportert inn per 2. november 2015

| Miljøtilstand |
| --- |
| 1 – Meget god |
| 2 – God |
| 3 – Dårlig |
| 4 – Meget dårlig |

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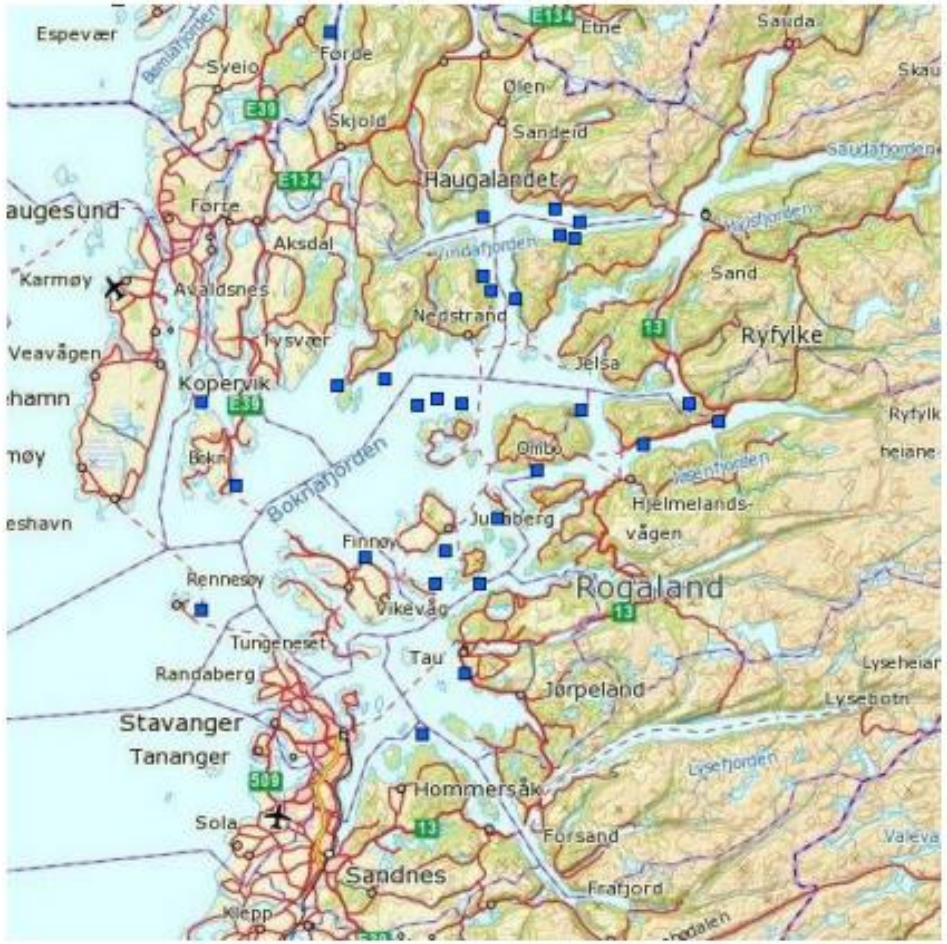
# MOM C undersøkelser i Rogaland rapportert inn per 2. november 2015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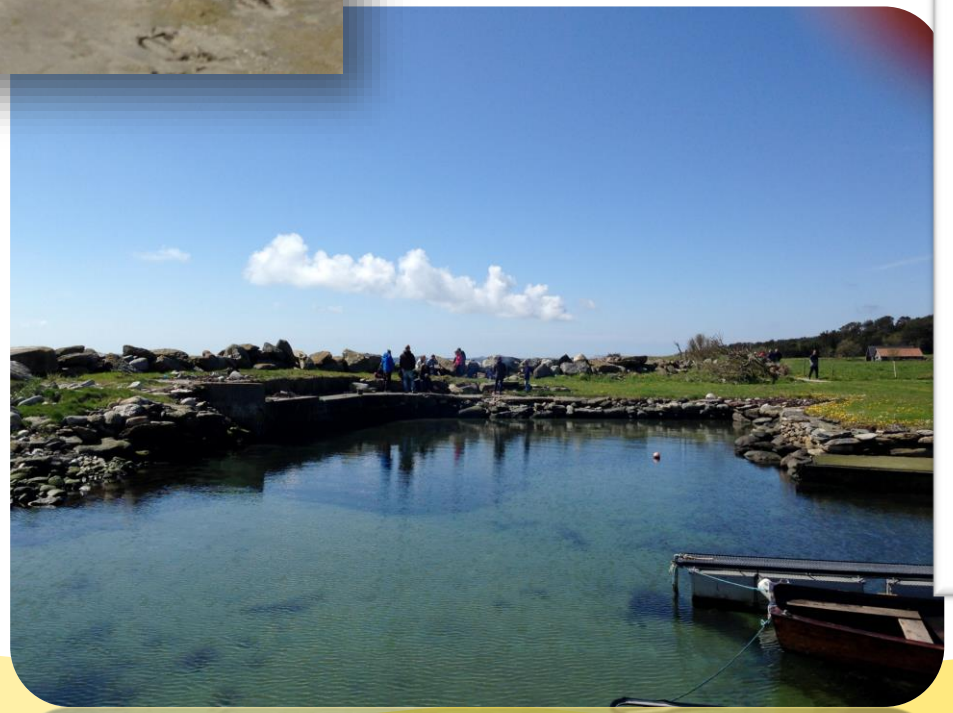
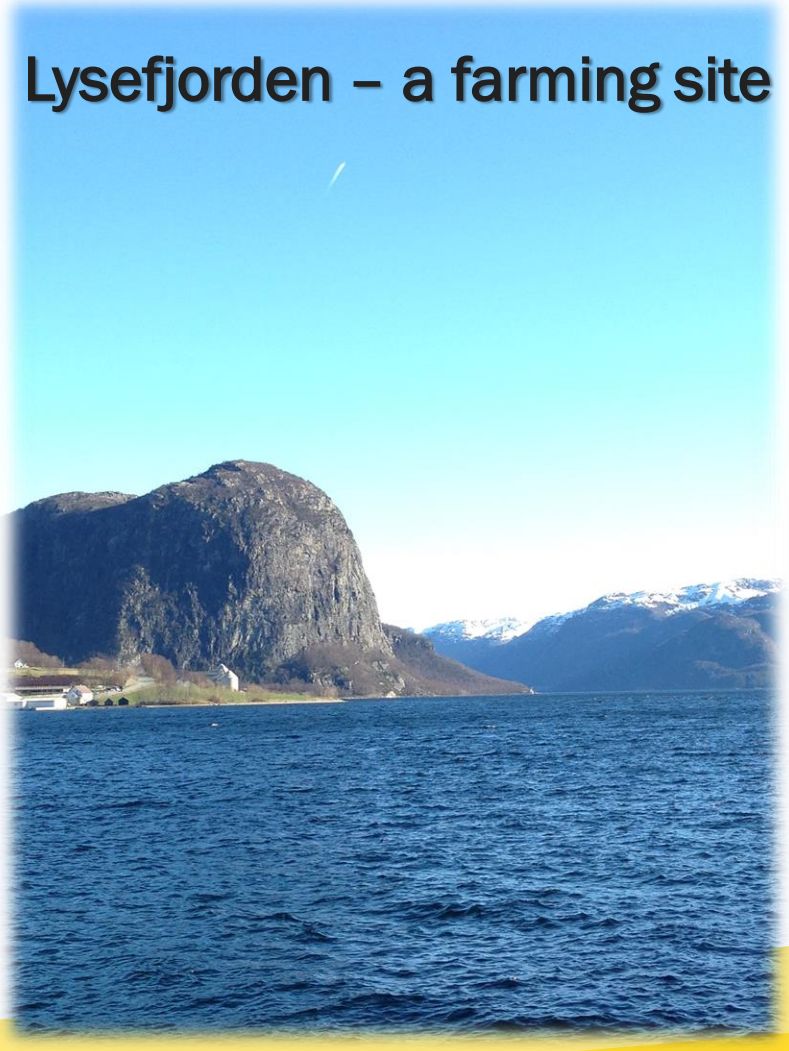
# Recreation - beaches

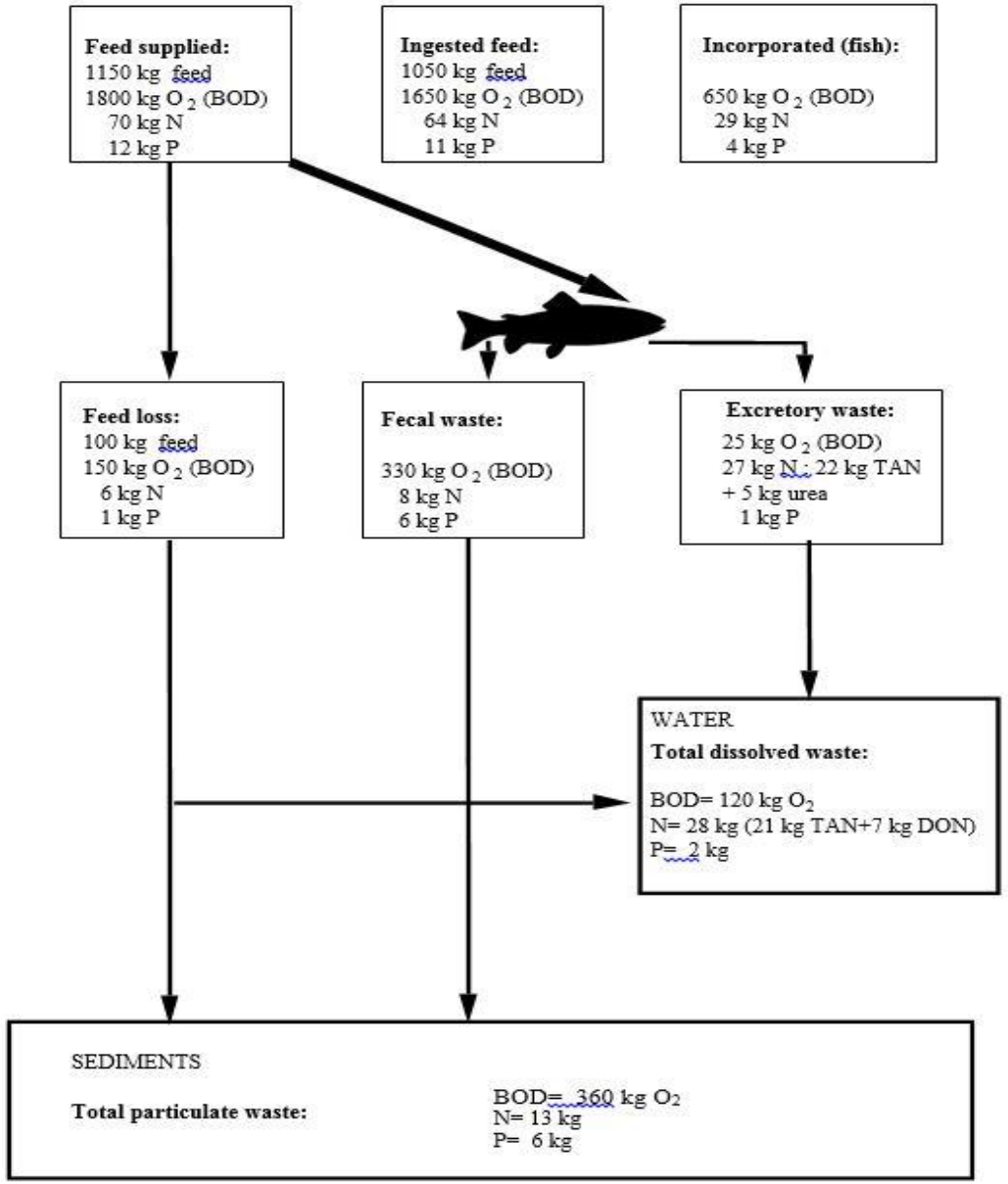


## Boknafjorden – a farming site

## Lysefjorden – a farming site




At this farm location – 25 tonns
of feed are fed every day!


Feed supplied:
1150 kg feed
1800 kg O 2 (BOD)
70 kg N
12 kg P
Ingested feed:
1050 kg feed
1650 kg O 2 (BOD)
64 kg N
11 kg P
Incorporated (fish):
650 kg O 2 (BOD)
29 kg N
4 kg P
Feed loss:
100 kg feed
150 kg O 2 (BOD)
6 kg N
1 kg P
Fecal waste:
330 kg O 2 (BOD)
8 kg N
6 kg P
Excretory waste:
25 kg O 2 (BOD)
27 kg N; 22 kg TAN
+ 5 kg urea
1 kg P
WATER
Total dissolved waste:
BOD= 120 kg O2
N= 28 kg (21 kg TAN+7 kg DON)
P= 2 kg
SEDIMENTS
Total particulate waste:
BOD= 360 kg O2
N= 13 kg
P= 6 kg


IRIS

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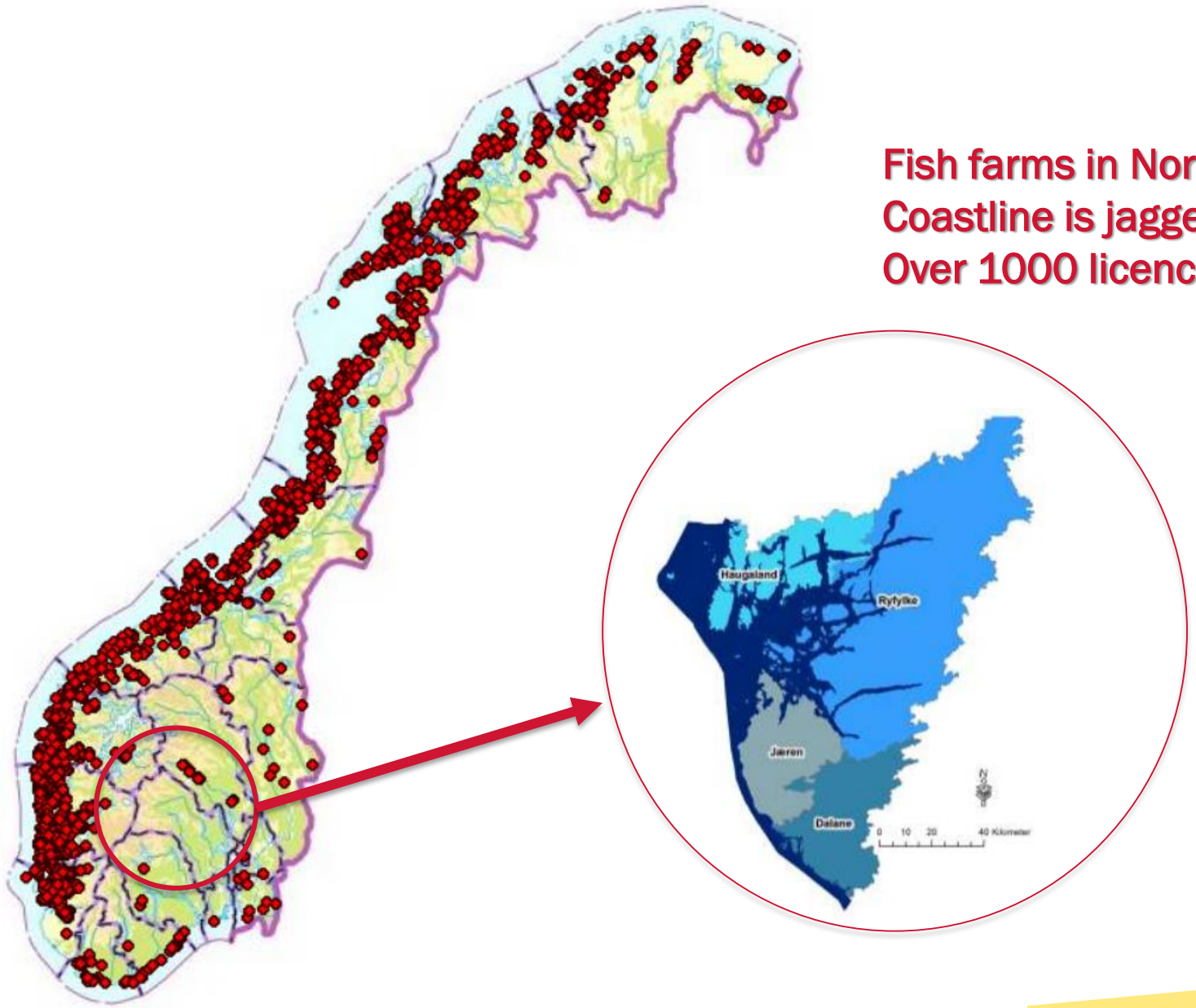


Fish farms in Norway.
Coastline is jagged and approx >15000 km
Over 1000 licences for fish farming.

IRIS

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**Case study Norwegian Fjords (Responsible: Thorleifur Agustsson IRIS, Norway)**
**Collaboration between IRIS in Stavanger and IMR in Bergen. Site selection will be based up on needs/focus in WP3 (IRIS) and WP6 (IMR)**

- IN short:
- Focus on coastal region in Rogaland county. Currently there are there are two main Atlantic salmon farming companies operating in this area: Marine Harvest and Grieg Seafood salmon production in Rogaland in recent years and it has now reached more than 50,000 tons per year.
- Rogaland county is hosting companies operating throughout the value chain from salmon eggs to salmon feed, in addition to the important research related to sustainability within salmon farming and for development of feed for salmon.
- In addition to salmon aquaculture, in the region there is also production of oysters, scallops, sea urchins, lumpfish and lobster, as well as kelp.
- The county council has established a regional aquaculture strategy where the maingoal is to double the production volume of farmed salmon within 2020; at the same time the industry has a strong focus on developing environmentally friendly and sustainable production, to achieve a growth in volume (Taranger et al., 2015).
- In the Rogaland region, there is an increasing number of stakeholders linked to the use of the coastal areas, such as recreational activities, transport, tourism, local fisheries, Oil & Gas related services, as well as protected areas.
- The case study will identify coastal areas in the Rogaland county where areas of conflict between aquaculture and other stakeholders are present, and areas where there is a possibility for the aquaculture industry to grow. Preliminary environmental impact assessment evaluations will be performed to establish where the production could be increased (both for old and new sites); in this evaluation the main focus will be on the local and regional impact of organic load and nutrients from marine salmon farms. The feasibility for use of novel methods involving rapid detection techniques to analyze environmental impact will be assessed in conjunction with WP 3.

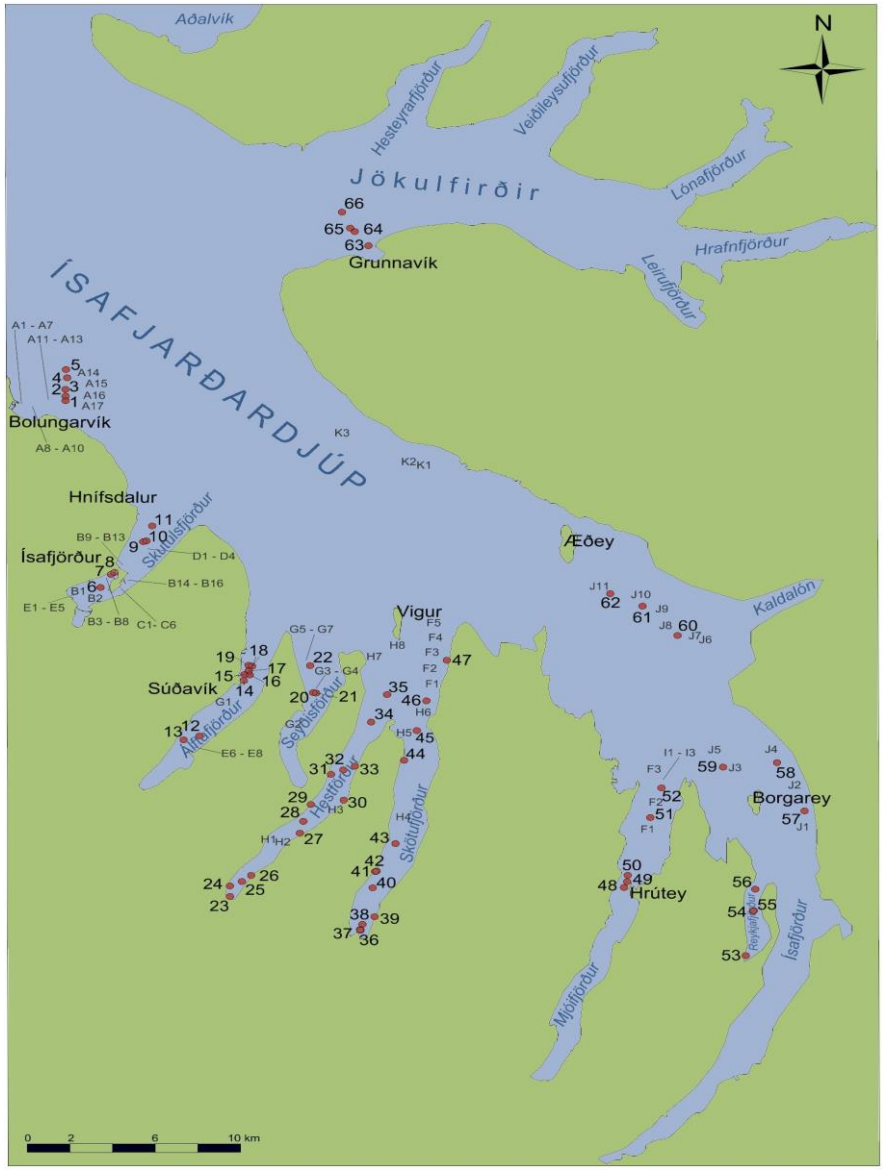


Figure 1. Sampling loactions. Sampling locations marked with number only, are presented here.

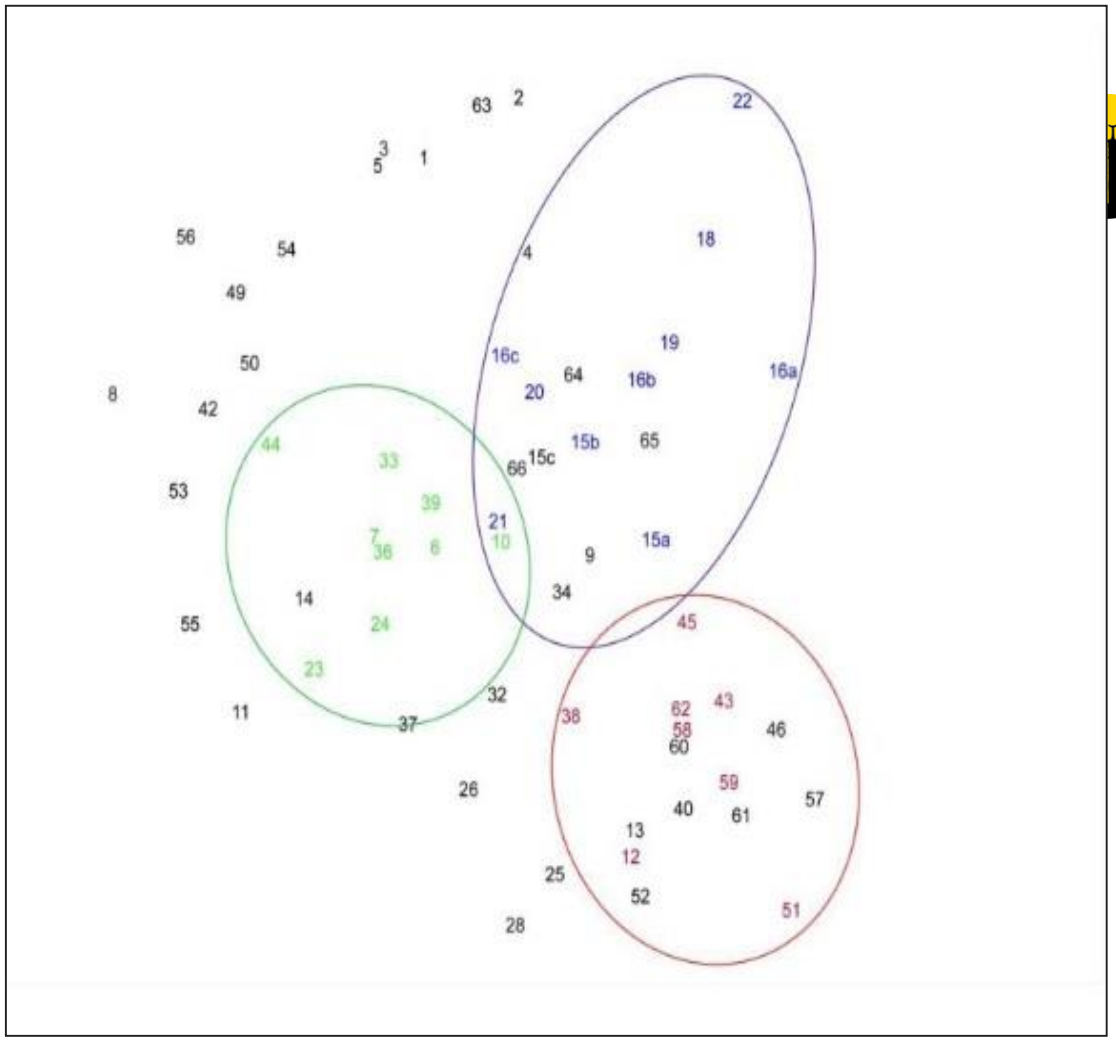

Figure 2. Multi dimensional scaling map indicating three main groups of benthic animal communities.

# New methodologies for an ecosystem approach to spatial and temporal management of fisheries and aquaculture in coastal areas

## WP4

Identification of spatial synergies/conflicts between fisheries, aquaculture and other human activities and assessment of cumulative impacts of fisheries and aquaculture on coastal ecosystem components with special focus on priority conservation features

Dr. Vassiliki Celia Vassilopoulou
HCMR

ECOAST

Era-net COFASP

# Objectives

1. to assess and map the **cumulative impact of fisheries and aquaculture on coastal ecosystems** including essential fish habitats and conservation priority habitats *in seven case study areas*

2. to identify and map the **spatial interactions among human activities** visualizing conflicts and synergies *in seven case study areas*

**Start date: Month 6**
**End date: Month 31**

# Objective 1

## Cumulative impact assessment

- Cumulative impact assessment relies on the available compilation of data on human activities and the selected ecosystem components in a specific area

- It will capitalize on previous well-established methodologies (Halpern *et al.*, 2008, Korpinen *et al.*, 2012, Micheli *et al.*, 2013)

# Cumulative impact assessment

STEPS

1. Identify **pressures derived from aquaculture and fisheries on key ecosystem components** in each case study area

2. Evaluate **the vulnerability i.e. the sensitivity of a specific feature to a particular pressure**

3. Assess a cumulative impact index value (I)

## Annex 4: Indicative list of human activities and their possible pressures on the marine environment

| Indicative list of human activities | | Biological disturbance | | | Physical loss | Physical damage | Interference with hydrological processes | Other physical disturbance | | Contamination by hazardous substances | Systematic and/or intentional release of substances | Nutrient and organic matter enrichment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Activity theme | Activity | - Extraction of species including non-target catches | - Non-indigenous species and translocations | - Microbial pathogens | - Smothering<br>- Sealing | - Siltation<br>- Abrasion<br>- Extraction | - Thermal regime<br>- Salinity regime | - Underwater noise/energy | - Marine litter | - Synthetic compounds<br>- Non-synthetic substances<br>- Radio-nuclides | e.g. produced water, carbon storage | - Fertilisers and other nitrogen- and phosphorus-rich substances<br>- Organic matter |
| Extraction of living resources | Fisheries incl. recreational fishing (fish and shellfish) | | | | | | | | | | | |
| | Seaweed and other sea-based food harvesting | | | | | | | | | | | |
| | Extraction of genetic resources/bioprospecting/maerl | | | | | | | | | | | |
| Food production | Aquaculture (fin-fish and shellfish) | | | | | | | | | | | |

## Annex 5: Integration table, linking state characteristics to pressures through impacts

| Annex III Table 1 | | | COM Decision | Annex III Table 2 | Pressure theme | Biological disturbance | | | Physical loss | Physical damage | Interference with hydrological processes | Other physical disturbance | Other physical disturbance | Contamination by hazardous substances | and/or intentional release of substances | Nutrient and organic matter enrichment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Pressure | - Extraction of species, including non-target catches | - Non-indigenous species and translocations | - Microbial pathogens | - Smothering<br>- Sealing | - Siltation<br>- Abrasion<br>- Extraction | - Thermal regime<br>- Salinity regime | - Underwater noise | - Marine litter | - Synthetic compounds<br>- Non-synthetic substances<br>- Radio-nuclides | e.g. produced water, carbon storage | - Fertilisers & other nitrogen- & phosphorus-rich substances<br>- Organic matter |
| Characteristic | Component | | State criteria & indicators | | Pressure criteria & indicators | 6.1 Level of pressure of the fishing activity 6.1.1; 6.1.2 | 2.1 Abundance & state characterisation of non-indigenous species, in particular invasive species 2.1.1 | | 6.1 Physical damage, having regard to substrate characteristics | 6.1 Physical damage, having regard to substrate characteristics | 7.1 Spatial characterisation of permanent alterations: 7.1.1 | 11.1 Distribution in time & place of loud, low & mid frequency impulsive sounds: 11.1.1<br>11.2 Continuous low frequency sound: 11.2.1 | 10.1 Characteristics of litter in the marine & coastal environment: 10.1.1; 10.1.2; 10.1.3 | 8.1 Concentration of contaminants: 8.1.1<br>8.2.2) Acute pollution events<br>9.1 Levels, number & frequency of contaminants: 9.1.1; 9.1.2 | 8.1 Concentration of contaminants: 8.1.1 | 6.1 Nutrients levels: 6.1.1; 6.1.2 |
| Physical and chemical features | Physical - Topography and bathymetry | | | | | | | | | | | | | | | |
| | Physical - Temperature regime, ice-cover, current velocity, upwelling, wave exposure, mixing characteristics, turbidity, residence time | | | | | | | | | | 7.2 Impact of permanent hydrographical changes: 7.2.2 | | | | | 6.2 Direct effects of nutrient enrichment: 6.2.2 |
| | Chemical - Salinity | | | | | | | | | | | | | | | |
| | Chemical - Nutrients (DIN, TN, DIP, TP, TOC) and oxygen | See pressure criterion 6.1 | | See 6.1.1, 6.1.2 | | | | | | | | | | | | 6.3 Indirect effects of nutrient enrichment: 6.3.2 |
| | Chemical - pH, pCO2 profiles or equivalent | | | | | | | | | | | | | | | |
| Biological features (other than habitat types and ecosystems) | At level of individual species - Fish<br>- Mammals<br>- Reptiles<br>- Seabirds<br>- Other species of Community legislation & international agreements<br>- Genetically distinct forms of native spp. | 1.1 Species distribution | | 1.1.1; 1.1.2; 1.1.3 | | | 2.2 Environmental impact of invasive non-indigenous species: 2.2.1; 2.2.2 | | | | 7.2 Impact of permanent hydrographical changes: 7.2.2 | | 10.2 Impacts of litter on marine life: 10.2.1 | 8.2 Effects of contaminants: 8.2.1; 8.2.2 (impact on biota) | | |
| | | 1.2 Population size | | 1.2.1 | | | | | | | | | | | | |
| | | 1.3 Population condition | | 1.3.1; 1.3.2 | | | | | | | | | | | | |
| | | 3.2 Reproductive capacity of the stock | | 3.2.1; 3.2.2 | | 3.2 Reproductive capacity of the stock: 3.2.1; 3.2.2<br>3.3 Population age & size distributions 3.3.1; 3.3.2; 3.3.3; 3.3.4; 3.3.4 | | | | | | | | 8.3 Effects of contaminants: 8.3.1; 8.3.2 (impact on biota)<br>8.1 Levels, number & frequency of contaminants: 9.1.1; 9.1.2 | | |
| | | 3.3 Population age and size distribution | | 3.3.1; 3.3.2; 3.3.3; 3.3.4 | | | | | | | | | | | | |
| | | - Fish & shellfish (commercially exploited)<br>- additional criteria/indicators | | | | | | | | | | | | | | |
| | At level of functional groups - Non-indigenous species | | | See pressure criterion 2.1 | | | | | | | | | | | | |
| | At level of functional groups - Fish<br>- Mammals<br>- Reptiles<br>- Seabirds | 1.6 Habitat condition | | 1.6.1; 1.6.2; 1.6.3 | | | 2.2 Environmental impact of invasive non-indigenous species: 2.2.1; 2.2.2 | | | | | | | 8.3 Effects of contaminants: 8.3.1; 8.3.2 (impact on biota) | | |
| Habitat types | At level of habitats - Predominant seabed & water column habitat types, including their biological communities (phytoplankton, zooplankton, angiosperms, macro-algae, benthic fauna) | 1.4 Habitat distribution | | 1.4.1; 1.4.2 | | | | | | | | | | | | |
| | | 1.5 Habitat extent | | 1.5.1; 1.5.2 | | | | | | | | | | | | |
| | | 1.6 Habitat condition | | 1.6.1; 1.6.2; 1.6.3 | | | | | | | | | | | | |
| | | 6.2 Condition of benthic community | | 6.1.1; 6.2.1; 6.2.2; 6.2.3; 6.2.4 | | 6.2 Condition of benthic community: 6.2.1; 6.2.2; 6.2.3; 6.2.4 | 2.2 Environmental impact of invasive non-indigenous species: 2.2.1; 2.2.2 | | 6.1.1 Type, abundance, biomass & areal extent of biogenic substrata<br>6.1.2 Extent of seabed significantly affected | 6.1.1 Type, abundance, biomass & areal extent of biogenic substrata 6.1.2 Extent of seabed significantly affected<br>6.2 Condition of benthic community: 6.2.1; 6.2.2; 6.2.3; 6.2.4 | 7.2 Impact of permanent hydrographical changes: 7.2.1; 7.2.2 | | 10.2 Impacts of litter on marine life | 8.2 Effects of contaminants: 8.2.1; 8.2.2 (impact on biota) | | 6.2 Direct effects of nutrient enrichment: 6.2.1; 6.2.2; 6.2.4<br>6.3 Indirect effects of nutrient enrichment: 6.3.1 |
| | | - Special habitat types, especially those under Community legislation & international conventions | | 6.1.1; 6.2.1; 6.2.2; 6.2.3; 6.2.4 | | | | | | | | | | | | |
| Eco-systems | At level of ecosystems - Habitats in particular areas (e.g. intensely specific pressures, specific protection) | | | | | | | | | | | | | | | |
| | | 1.7 Ecosystem structure | | 1.7.1 | | | | | | | | | | | | |
| | | 4.1 Productivity of key species or trophic groups | | 4.1.1 | | | 2.2 Environmental impact of invasive non-indigenous species: 2.2.2 | | 6.1.2 Extent of seabed significantly affected | 6.1.2 Extent of seabed significantly affected | 7.2 Impact of permanent hydrographical changes: 7.2.1; 7.2.2 | | | 8.2 Effects of contaminants: 8.2.1; 8.2.2 (impact on biota) | | 6.3 Indirect effects of nutrient enrichment: 6.3.2 |
| | | 4.2 Proportion of species at the top of food webs | | 4.2.1 | | | | | | | | | | | | |
| | | 4.3 Abundance/ distribution of key trophic groups/spp. | | 4.3.1 | | | | | | | | | | | | |
| Other features | - Chemicals giving rise to concern, sediment contamination, hotspots, health issues & contamination of biota (esp. for human consumption) | See pressure criterion 8.1 | | | | | | | | | | | | 8.2 Effects of contaminants: 8.2.1; 8.2.2 (impact on biota)<br>8.1 Levels, number & frequency of contaminants: 9.1.1; 9.1.2 | | |
| | - Features or characteristics typical or specific to region or subregion | | | | | | | | | | | | | | | |

KEY: Characteristics: Annex III table 1 | Pressures and impacts: Annex III table 2 | State criteria & indicators | Pressure criteria and indicators | Impact criteria and indicators

SEC(2011) 1255 final

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# VULNERABILITY

**(Zacharias and Greg, 2005)**

Biotic (species, communities)
or
Abiotic (habitats) structures / processes

**Vulnerability is the probability that a feature will be exposed to a stressor to which it is sensitive**

The degree to which marine features respond to a given stress

Natural
or
anthropogenic

Marine and coastal environment attracts a considerable number of human activities

Certain activities may pose pressures which may constitute threats on specific marine ecosystem components

Identify potential pressures that may constitute threats to ecosystem features

Ecosystem response ≈

**Vulnerability**

Depicts the mostly affected ecosystem components

Need to identify the extent and the nature of **ecosystems' responses** to a threat

# Methodology

- Semi-quantitative analysis using **expert judgment procedures** through structured questionnaires, and **ecosystem vulnerability scores** developed previously **for each stressor–ecosystem combination** (Halpern *et al.*, 2007)
- to identify if fisheries & aquaculture exert pressures on key selected ecosystem components of the case studies
- to evaluate vulnerability for every combination of ecosystem component and human activity (i.e. fisheries, aquaculture)

According to Halpern *et al.* (2007):

**5 Vulnerability measures**: weighted average vulnerability score

&

**a certainty score**: greater importance to values with higher certainty

# Vulnerability measures

(Halpern *et al.*, 2007)

| Measure | Categories | Rank |
|---|---|---|
| **Scale**<br>Average scale at which a threat event affects ecosystem | no threat | 0 |
| | <1 | 1 |
| | 1-10 | 2 |
| | 10-100 | 3 |
| | 100-1,100 | 4 |
| | 1,100-10,000 | 5 |
| | >10,000 | 6 |
| **Frequency**<br>How often discrete threat events occur in a given ecosystem | never occurs | 0 |
| | rare | 1 |
| | occasional | 2 |
| | annual or regular | 3 |
| | persistent | 4 |
| **Functional impact**<br>Threats affect only a few species or the entire ecosystems | no impact | 0 |
| | species (single or multiple) | 1 |
| | single trophic level | 2 |
| | >1 trophic level | 3 |
| | entire community | 4 |
| **Resistance**<br>Average tendency of an ecosystem to react to a threat | no impact | 0 |
| | high | 1 |
| | medium | 2 |
| | low | 3 |
| **Recovery time (years)**<br>Average time to return to pre-threat state | no impact | 0 |
| | <1 | 1 |
| | 1-10 | 2 |
| | 10-100 | 3 |
| | >100 | 4 |
| **Certainty**<br>Level of confidence of the respondents | none | 0 |
| | low | 1 |
| | medium | 2 |
| | high | 3 |
| | very high | 4 |

# An example of ecosystem vulnerability evaluation at a Greek MPA

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## Ecosystem components

**Loggerhead sea turtles**
(*Caretta caretta*)

**Mediterranean monk seals**
(*Monachus monachus*)

**Seagrass meadows**
(*Posidonia oceanica*)

**Sort-beak common dolphin**
(*Delphinus delphis*)

**Bottlenose dolphin**
(*Tursiops truncatus*)

**Scopoli's shearwater**
(*Calonectris diomedea)*

**Mediterranean Shag**
(*Phalacrocorax aristotelis desmarestii*)

## Human activities

**Small scale fishing**

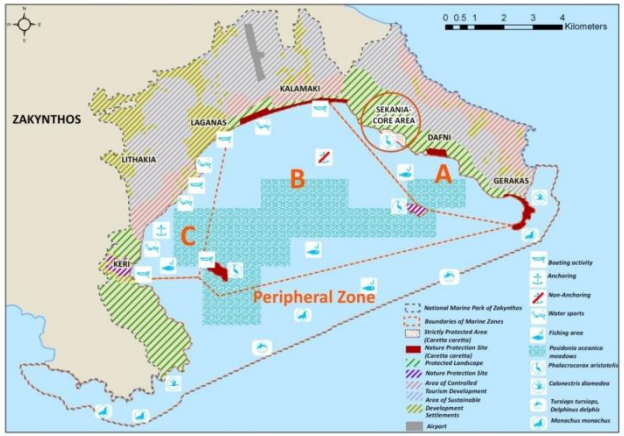
**Boating**

**Touristic activities**

**Shoreline development**

**Coastal, atmospheric, riverine inputs from land**

- **agricultural run-off**
- **municipal waste water discharge**



# An example of ecosystem vulnerability evaluation at a Greek MPA

| Priority status | Ecosystem species | Activity | Pressure | Vulnerability Score |
|---|---|---|---|---|
| High | *Caretta caretta* | Small scale fishing | Accidental entanglement | 2.1 |
| | *Caretta caretta* | Boating | Boat strike | 2.1 |
| | *Caretta caretta* | Touristic activities | Physical damage-Disturbance | 2.5 |
| | *Caretta caretta* | Boating | Contamination | 1.9 |
| | *Monachus monachus* | Small scale fishing | Prey depletion | 1.9 |
| | *Monachus monachus* | Small scale fishing | Direct harming | 2.4 |
| | *Monachus monachus* | Shoreline development | Habitat loss/degradation | 1.8 |
| | *Phalacrocorax aristotelis* | Small scale fishing | Accidental by- catch | 1.6 |
| | *Posidonia oceanica* | Small scale fishing | Extraction | 1.9 |
| | *Posidonia oceanica* | Boating | Extraction | 1.8 |
| | *Posidonia oceanica* | Coastal, riverine and atmospheric inputs from land | Contamination | 2.1 |
| Low | *Delphinus delphis* | Small scale fishing | Accidental entanglement | 1.5 |
| | *Delphinus delphis* | Small scale fishing | Prey depletion | 1.7 |
| | *Delphinus delphis* | Small scale fishing | Direct killing | 1.8 |
| | *Tursiops truncatus* | Small scale fishing | Accidental entanglement | 2.1 |
| | *Tursiops truncatus* | Small scale fishing | Prey depletion | 1.7 |
| | *Tursiops truncatus* | Small scale fishing | Direct harming | 1.8 |
| | *Calonectris diomedea* | Small scale fishing | Accidental by- catch | 2.3 |

# An example of ecosystem vulnerability evaluation at a Greek MPA

Radar diagrams provide **certainty scores** assigned to each vulnerability measure

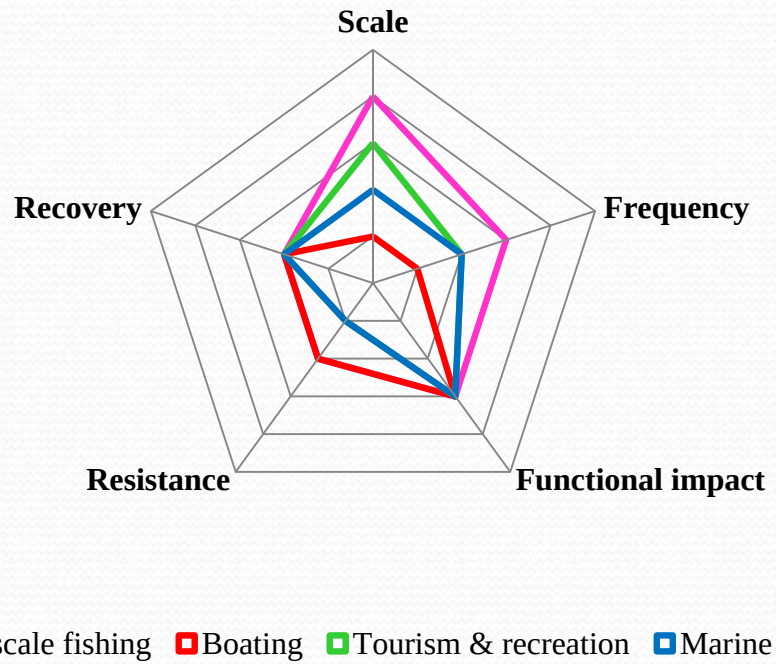
"Scale"
"Frequency"
"Functional impact"

→ Highest certainty

"Recovery"
"Resistance"

→ Lowest certainty

***Caretta caretta***




**Expert judgment process has high subjectivity** which may include inherent bias and further risk assessment processes for decreasing uncertainty need to be implemented

# Cumulative impact ($I_C$) is the per-pixel average of the ecosystem vulnerability-weighted stressor intensities

$$I_C = \sum_{i=1}^{n} \frac{1}{m} \sum_{j=1}^{m} D_i \times E_j \times \mu_{i,j}$$

n, m: number of human activities and ecosystems

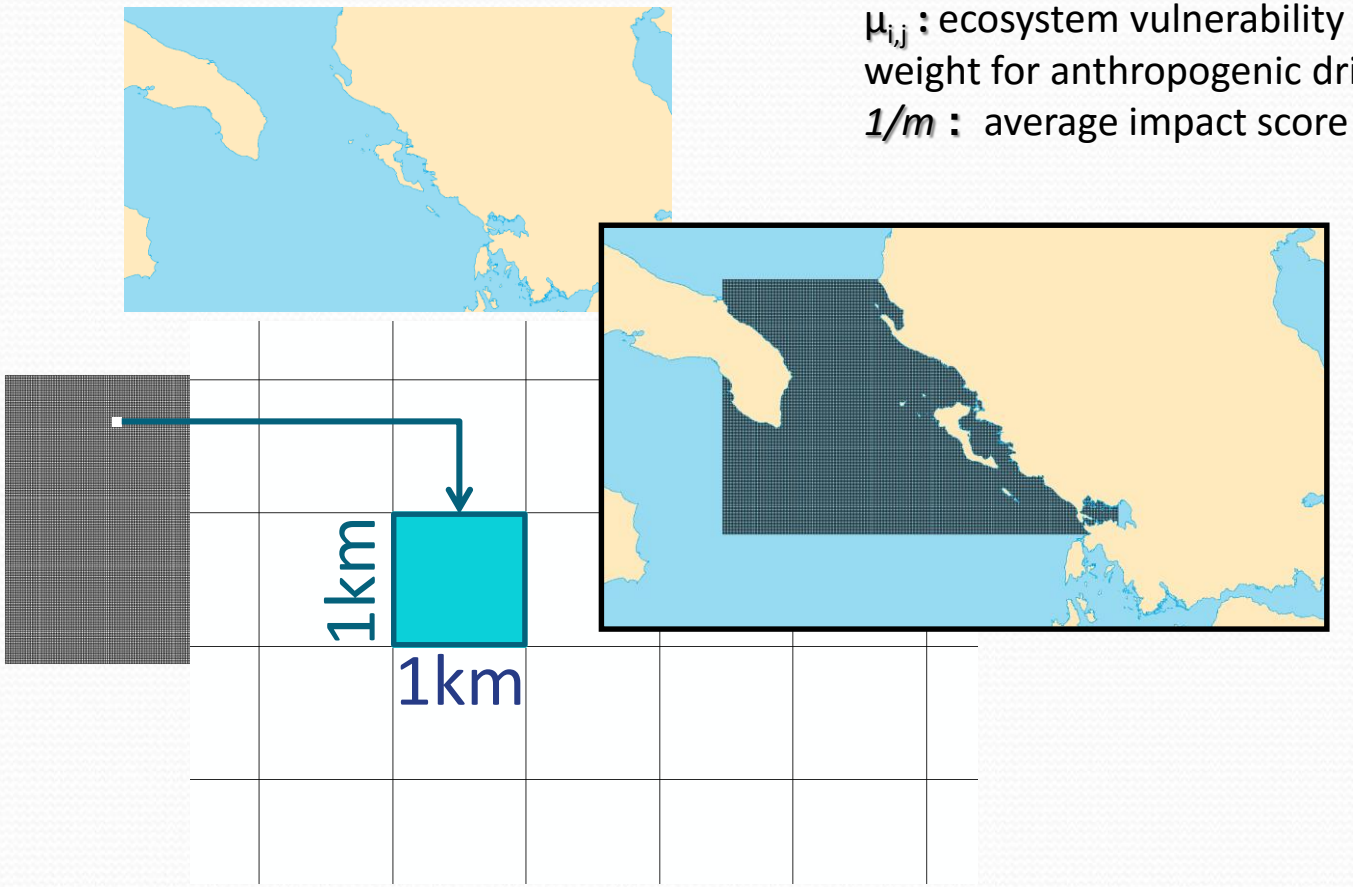
$D_i$ : normalized values of human activities

$E_j$ : presence/absence of the m marine ecosystem components

$\mu_{i,j}$ : ecosystem vulnerability weights (the impact weight for anthropogenic driver *i* and ecosystem *j)*

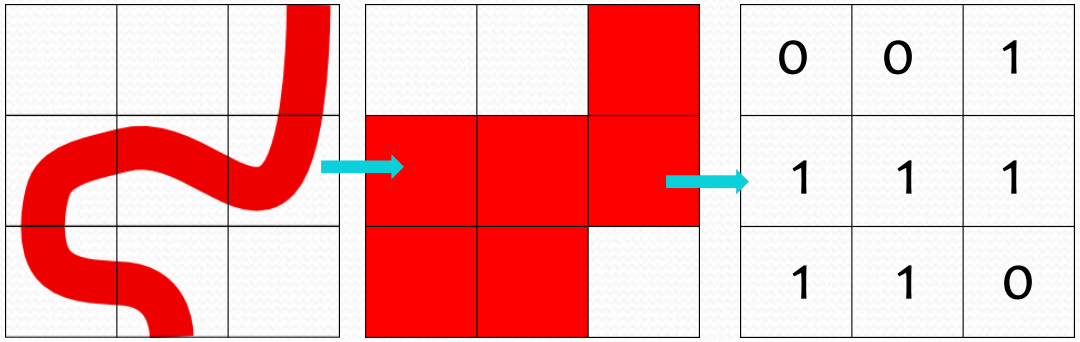
*1/m* : average impact score across ecosystems

(Micheli *et al*., 2013)



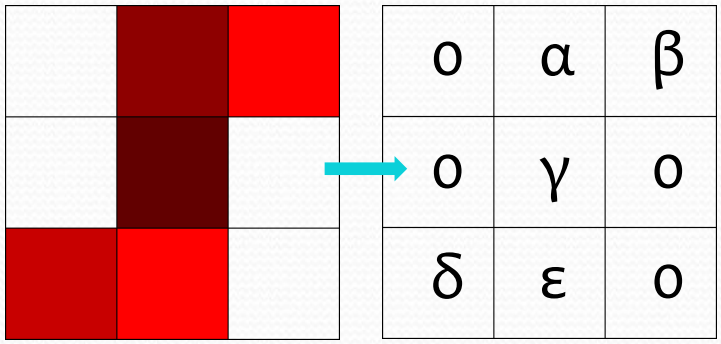
# Spatial data – Filling each grid cell

- Use of different types of spatial data (points, polygons, lines)
- All spatial data will be transformed to the same geographic coordinate system (ETRS 89 or WG84)
- Data will be derived from different sources such as National authorities, Ministries, NGOs, research centers…)



| | | |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 1 | 1 |
| 1 | 1 | 0 |

Presence absence



| | | |
|---|---|---|
| 0 | α | β |
| 0 | γ | 0 |
| δ | ε | 0 |

Normalization of values (α, β, γ, δ, & ε) through log(x+1) transformation in a range from 0 to 1.

## PRESSURE LAYERS

Values log-transformed and normalized [0-1]

## WEIGHTING COEFFICIENTS

-Expert judgment
-Existing info
Pressures will be transformed to impacts

## ECOSYSTEM LAYERS

-Values log-transformed and normalized [0-1]

## CUMULATIVE IMPACT INDEX

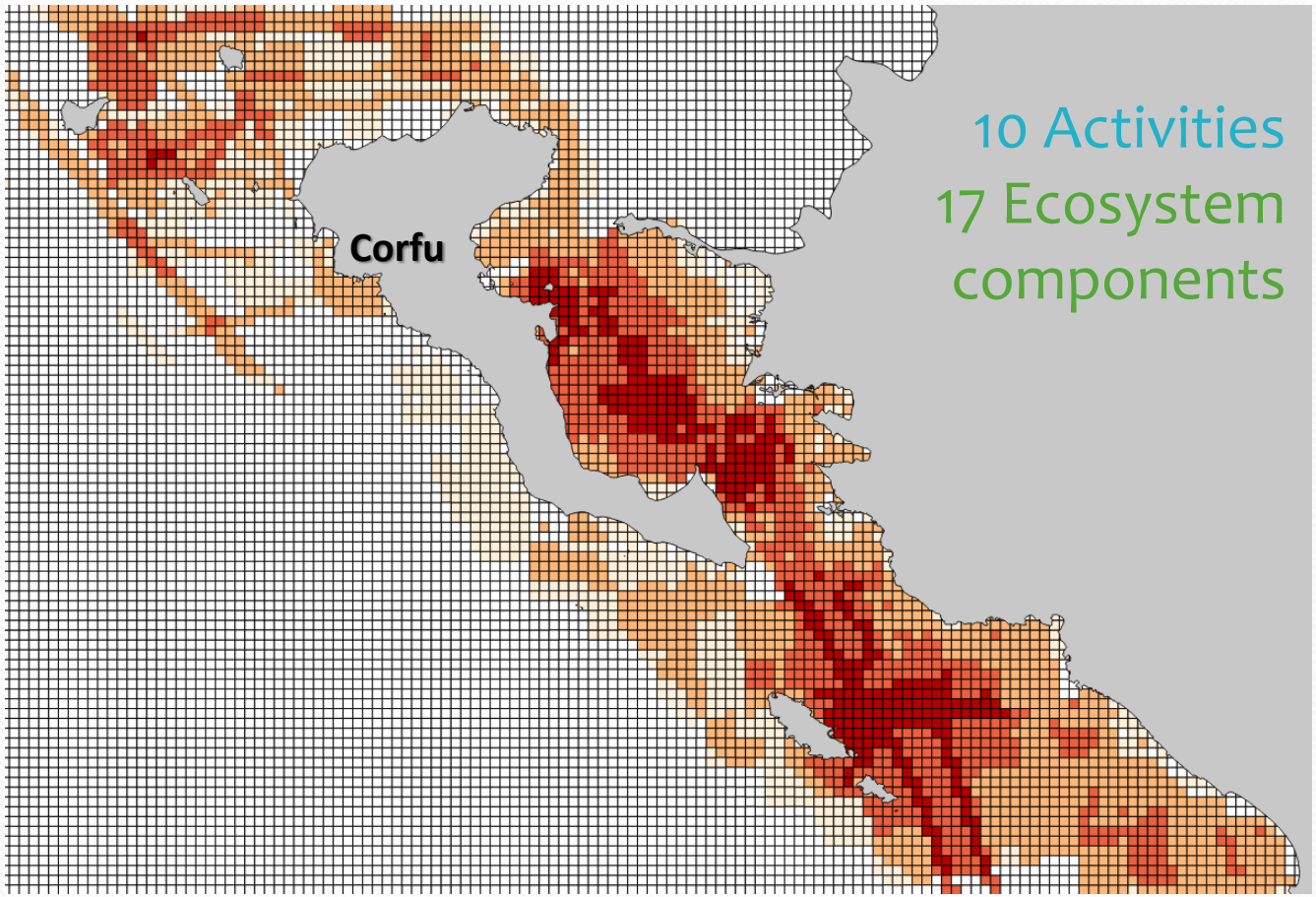
- Multiply the three factors and sum them up within an assessment unit

**Matlab (Mathworks®)**

## MAPPING

- Create maps in ARCGIS environment to indicate **highly impacted areas**

# Example: Impacted marine sites off Corfu Island




Source: ADRIPLAN project, 2015

# Objective 2

## Identification of spatial interactions among human uses

### Aim

- Identification of **spatial interactions** among existing and potential future human activities
- **Spatially based analysis** considering both spatial and temporal factors
- Application of the spatial analysis on the seven case studies

Crucial step towards the implementation of an effective **Marine Spatial Planning (MSP)** process

# The methodological approach

- **Step 1**: Mapping human activities (current and potential future situation)
- **Step 2**: Describe each human activity according to a set of factors considering spatiotemporal attributes
- **Step 3**: Calculate conflict scores according to predefined rules (matrix presentation)
- **Step 4**: Visualize the results spatially using a “grid-based” approach

Gramolini *et al.* (2013)
COEXIST EU FP7

# Spatiotemporal factors

- **Vertical scale**

  *pelagic, benthic, whole water column*
- **Spatial scale**

  *small, medium, large area*
- **Temporal scale**

  *short, medium, long/permanent*
- **Mobility**

  *mobile, fixed*
- **Location**

  *land, sea*

# Analysis of interactions

- Types of interactions between human uses:
  - ✓positive (**synergy**)
  - ✓negative (**conflict**)
  - ✓neutral or no interaction
- The quantification of conflicting human interaction is based on specific rules
- The final conflict score is calculated summarizing the interactions of individual combinations
- A conflict score value corresponds to each grid cell (cell size is predefined)

# Computation of conflict scores

Suppose two human uses (HU1 & HU2)

- **Rule 1**:

  **IF** vertical scale HU1 ≠ vertical scale HU2
  **AND** vertical scales ≠ water column
  conflict score = 0

- **Rule 2**:

  **IF** HU1: mobile **AND** HU2: mobile
  conflict score= min(temporal scale)+min(spatial scale)

- **Rule 3**:

  **IF** Rule 1 **AND** Rule 2 are not applied
  conflict score= max(temporal scale)+max(spatial scale)

**Conflict score in cell** = sum(conflict score$_i$)

*i: all human uses combinations within cell*

# Data needed from case studies

- Spatial boundaries from case study areas (polygon)
- Human activities/uses taking place in the case study areas that will be used for the analysis (polygons, lines, points, ex. Aquaculture zones, Shipping lanes, Fisheries Ports…)

- All spatial data will be transformed to the same geographic coordinate system (ETRS 89 or WG84)
- Partners will depict the different data sources

# **Example:** Calculation of conflict scores between activities/uses (matrix presentation)

| Activities | Blue flags | Shipping lanes | Purse seiners | Trawlers | Ports | Artisanal fishing | Aquaculture | H/C area 1 | H/C area 2 | Future Natura |
|---|---|---|---|---|---|---|---|---|---|---|
| Natura | -4 | -4 | -5 | -5 | -4 | -4 | -4 | -4 | -4 | 3 |
| Blue flags | | 0 | 0 | 0 | 0 | 0 | -4 | -4 | -4 | -4 |
| Shipping lanes | | | 0 | 0 | 0 | 0 | -4 | -4 | -4 | -4 |
| Purse seiners | | | | 0 | 0 | -3 | -5 | -5 | -5 | -5 |
| Trawlers | | | | | 0 | -3 | -5 | -5 | -5 | -5 |
| Ports | | | | | | -4 | -4 | 0 | 0 | -4 |
| Artisanal fishing | | | | | | | -4 | -4 | -4 | -4 |
| Aquaculture | | | | | | | | -4 | -4 | -4 |
| H/C area 1 | | | | | | | | | 0 | -4 |
| H/C area 2 | | | | | | | | | | -4 |

Spatial conflict score

- -6 *high conflict*
- -5 *medium high conflict*
- -4 *medium conflict*
- -3 *low medium conflict*
- -2 *low conflict*
- 0 *neutral or no interaction*
- 3 *synergy*

Source: ADRIPLAN project, 2015

# WP4 Milestone

M4.1 **Consultation of experts on setting fisheries and aquaculture impact scores on selected ecosystem components** (8)

**Link activities with other WPs' needs**

# WP4 Deliverables

D4.1 **Thematic maps** of cumulative impact assessment of aquaculture and fisheries on selected ecosystem components in the seven case studies (12)
D4.2 **Report** on the cumulative impact assessment of aquaculture and fisheries on selected ecosystem components in the seven case studies (18)

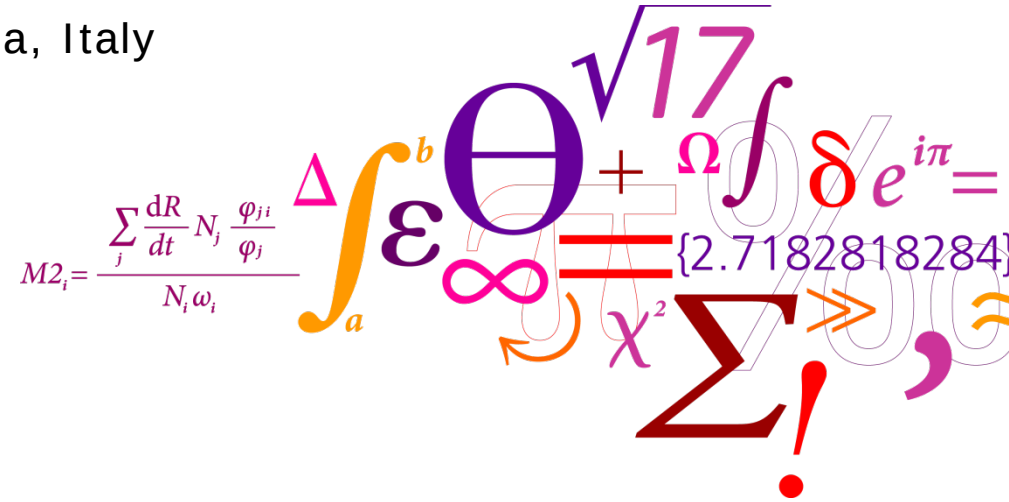
D4.3 **Thematic maps** of spatial interactions between activities and spatial compatibility matrix indicating conflicts and synergies among uses of the marine environment in the seven case studies (18)
D4.4 **Report** on spatial interactions of marine uses in the selected case studies (28)

Names of contact persons from each participating institute

ECOAST
Era-net COFASP

# ECOAST WP5 (lead: Francois Bastardie) – Assessment of the economic and ecological performance of alternative spatial plans from the perspective of the fisheries

Kick-off meeting, April 2016, Ancona, Italy




DTU Aqua
National Institute of Aquatic Resources

# Objectives – ECOAST WP5

| Participant | ISMAR-CNR | ISPRA | DTU Aqua | IRIS | IMR | HCMR | NIMRD | ICBAS |
|---|---|---|---|---|---|---|---|---|
| Person months | 8 | 0 | 20 | 1 | 3 | 5 | 12.4 | 11.3 |

Objectives:

- to develop an operational modelling framework to analyze fishermen's behaviour and predict their likely responses to spatial management options;
- to measure economic and ecological performance of alternative spatial plans by scenario evaluations including delineating locations and space limits that ensures certain levels of production to local fishers and farmers;
- to identify recommendations for a better integration of fisheries and aquaculture in MSP (link to WP6).

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- to identify recommendations for a better integration of fisheries and aquaculture in MSP (link to WP6).

# ...into operational objectives

- Collect the spatial data (effort allocation & stock availability) and inform GRID (=>WP2). If effort allocation not available then use suitability index e.g. from MARXAN outcomes
- Conduct questionnaire surveys, fit an explanatory model ((both large or small vessels; RUM on few areas; fleet-based) or parameterize DISPLACE (both large or small vessels, many areas, individual based)
- Define scenarios from other marine space user maps and/or delineated priorities areas for fishing
- Use the model in predictive mode (predictive RUM or DISPLACE) to predict reaction to and consequences from a spatial restriction to get the dynamic beyond the **WP2** static GRID approach and quality the cumulative impact assessment (**WP4**)
- Systematic scenario evaluation of option in spatial plans– performance metrics => sustainability and economy

# Deliverable – ECOAST WP5

| Milestones (delivery month) | Deliverables (delivery month) |
|---|---|
| M5.1 Guidelines for collecting the relevant spatial data to be used in the modelling approaches (6)<br>M5.2 Tools for the investigation of the drivers in fisher´s decision making explaining the current distribution of fishing effort (12)<br>M5.3 Tools for scenario evaluation study rating the costs and benefits of alternative coastal MSP plans and including displacement scenarios (18)<br>M5.4 Tools for delineating locations and space limits that ensure certain levels of production to local fishers and farmers (20)<br>M5.5 Define and run spatial fisheries scenarios for the BS case using the WP spatial modelling tools (24) | D5.1 Guidelines and tools for explaining the current distribution of fishing effort from the data collection of spatial layers and random utility models (12)<br>D5.2 Parameterization of the static evaluation (RUM) or the dynamic evaluation (DISPLACE) depending on the CS (16)<br>D5.3 Scenario testing and summary of the costs and benefits of the set of MSP scenarios and scientific publications on major findings (24) |

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- M5.1 Collect the spatial data (effort allocation & stock availability) and inform GRID **D5.1**
- If effort allocation not available then use suitability index e.g. from MARXAN outcomes
- M5.2 Conduct questionnaire surveys, fit an explanatory model ((both large or small vessels; RUM on few areas; fleet-based)
- M5.3 A documentation for the use of existing models (DISPLACE) and further development
- M5.4 Define scenarios from other marine space user maps and/or delineated priorities areas for fishing
- Case study M5.5: Use the model in predictive mode RUM or DISPLACE to predict reaction to spatial restriction doing scenario evaluation of option in spatial plans– performance metrics => sustainability and economy

# Deliverable – ECOAST WP5

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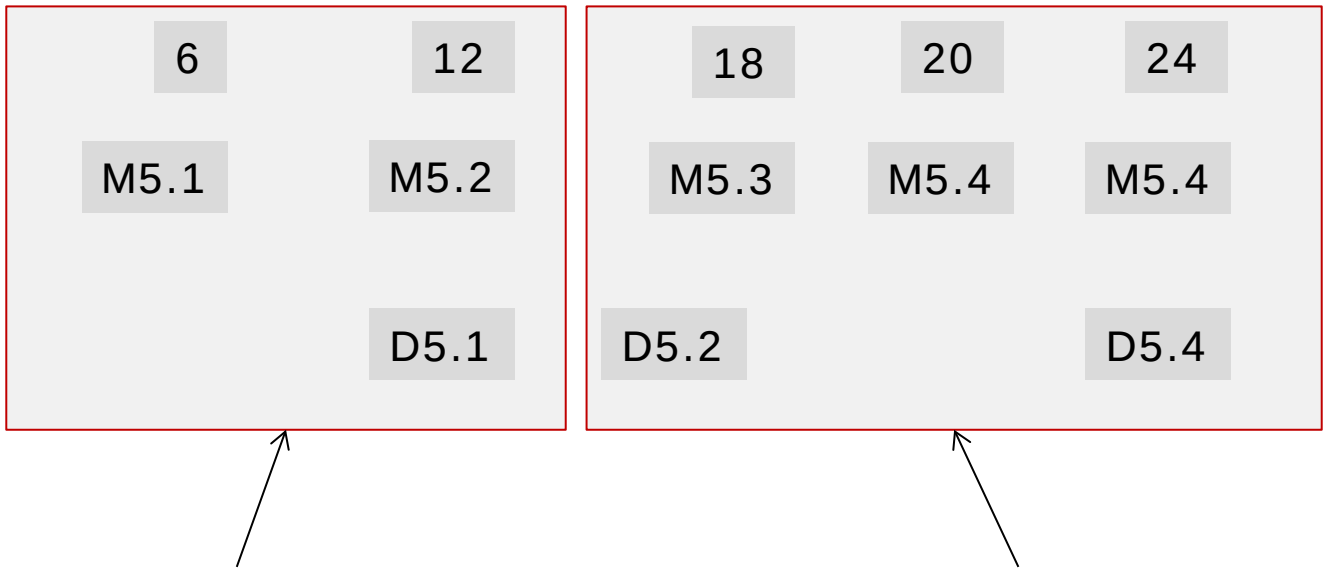
- If effort allocation not available then use suitability index e.g. from MARXAN outcomes
- M5.2 Conduct questionnaire surveys, fit an explanatory model ((both large or small vessels; RUM on few areas; fleet-based)

- M5.3 A documentation for the use of existing models (DISPLACE) and further development
- M5.4 Define scenarios from other marine space user maps and/or delineated priorities areas for fishing **D5.2 & D5.3**
- Case study M5.5: Use the model in predictive mode RUM or DISPLACE to predict reaction to spatial restriction doing scenario evaluation of option in spatial plans– performance metrics => sustainability and economy

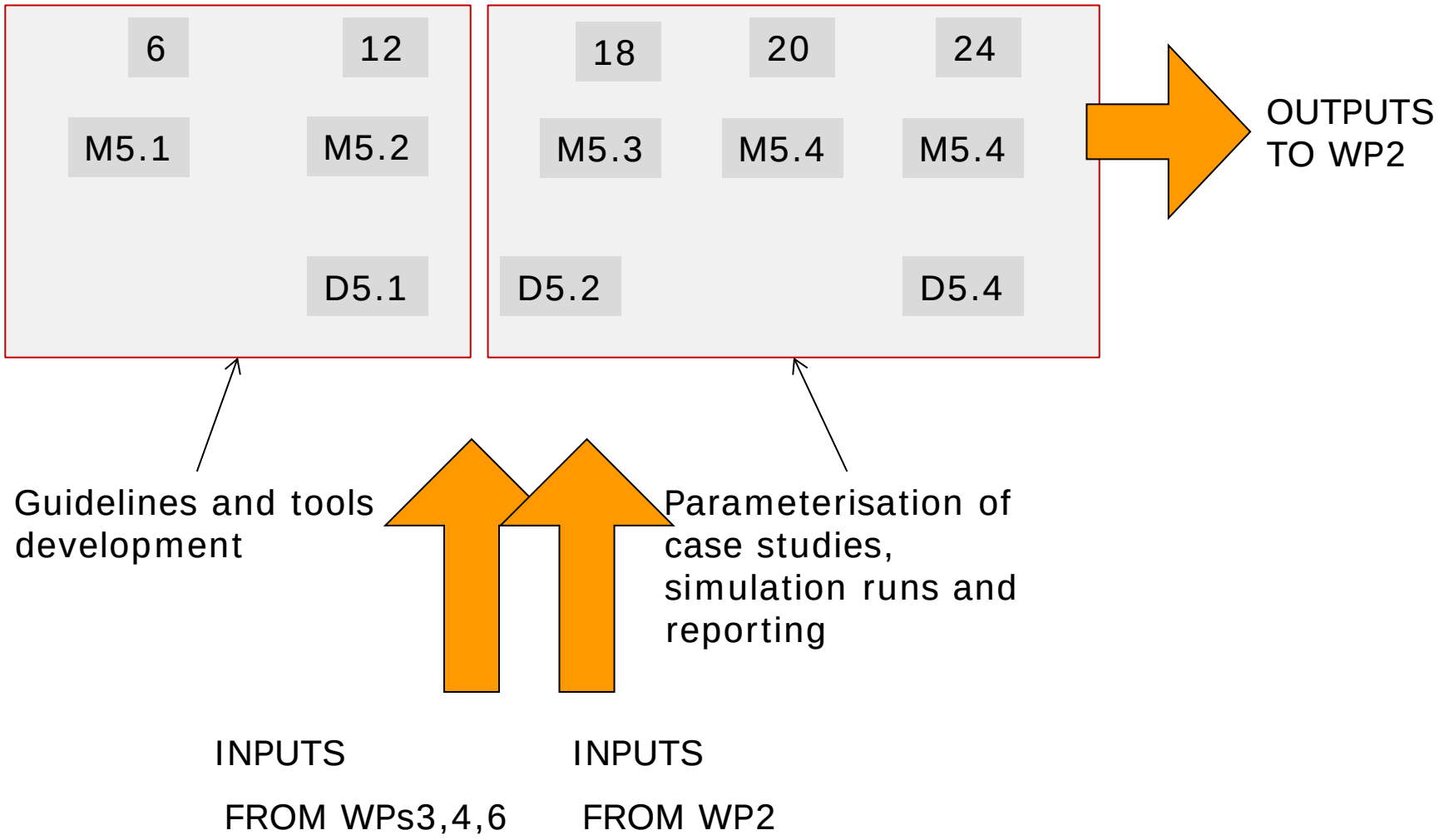
# Workplan – ECOAST WP5




Guidelines and tools development

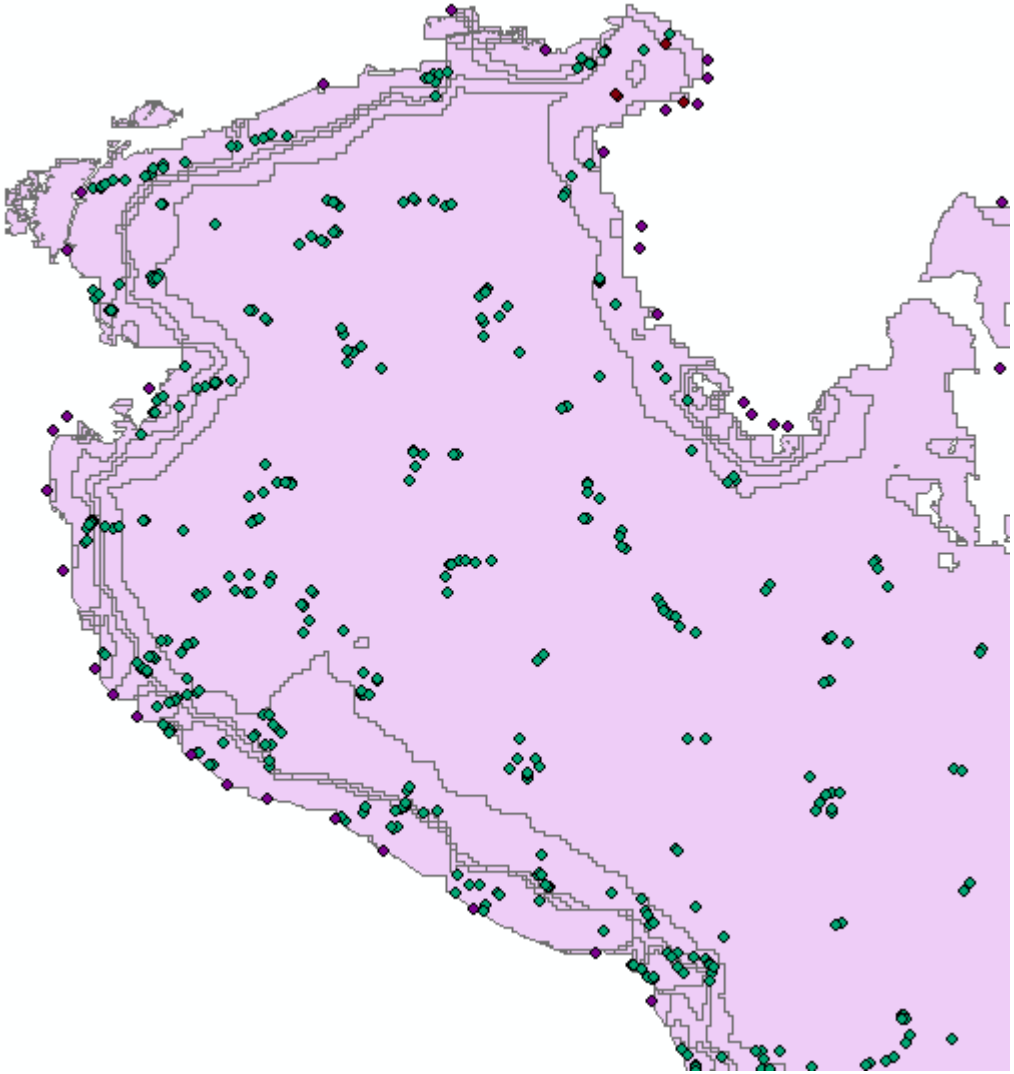
Parameterisation of case studies, simulation runs and reporting

# Workplan – ECOAST WP5

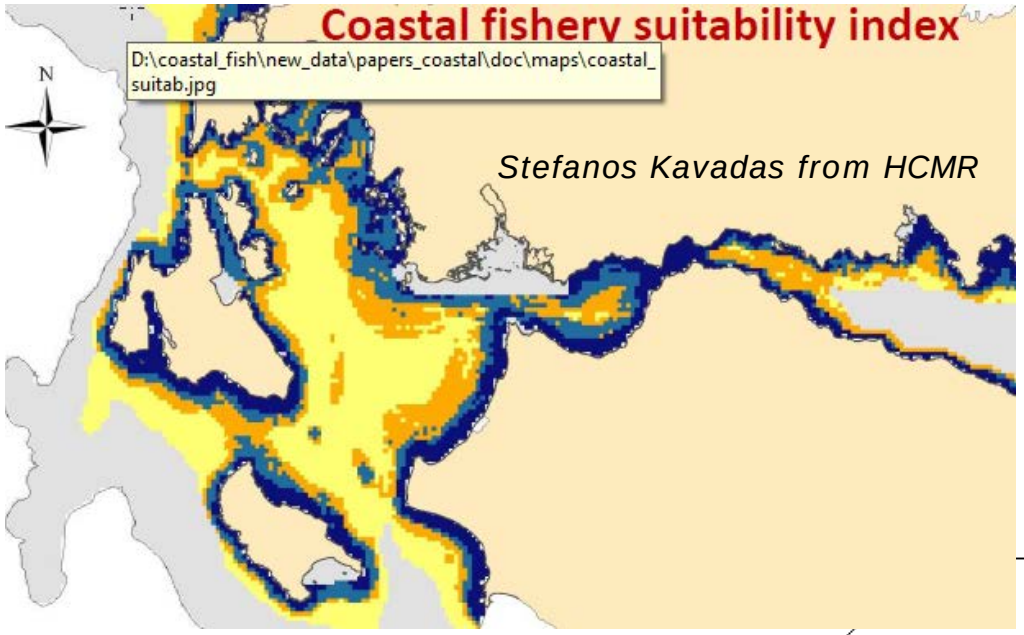


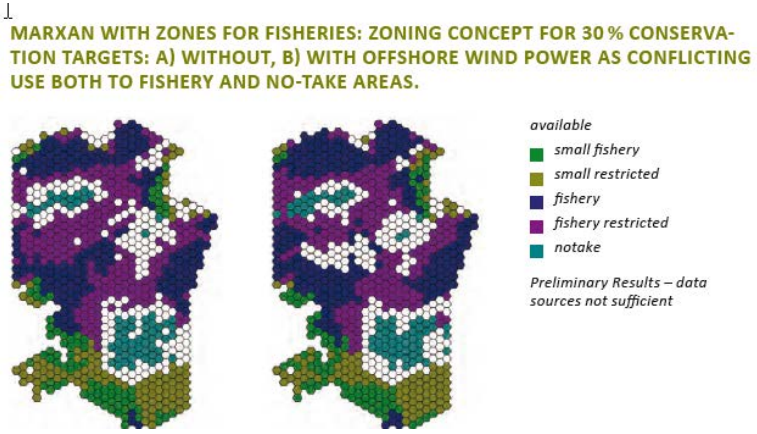
# ECOAST WP5 - GRID

- Incorporate GIS layers
- Build composite map from weighted score impact
- Delineate priority areas for fisheremen

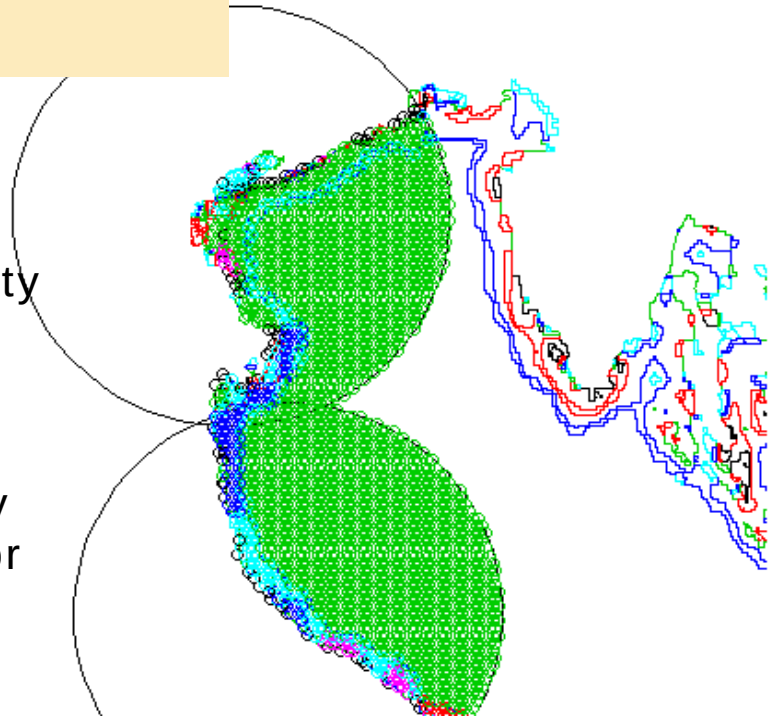


# ECOAST WP5 – suitability index mapping



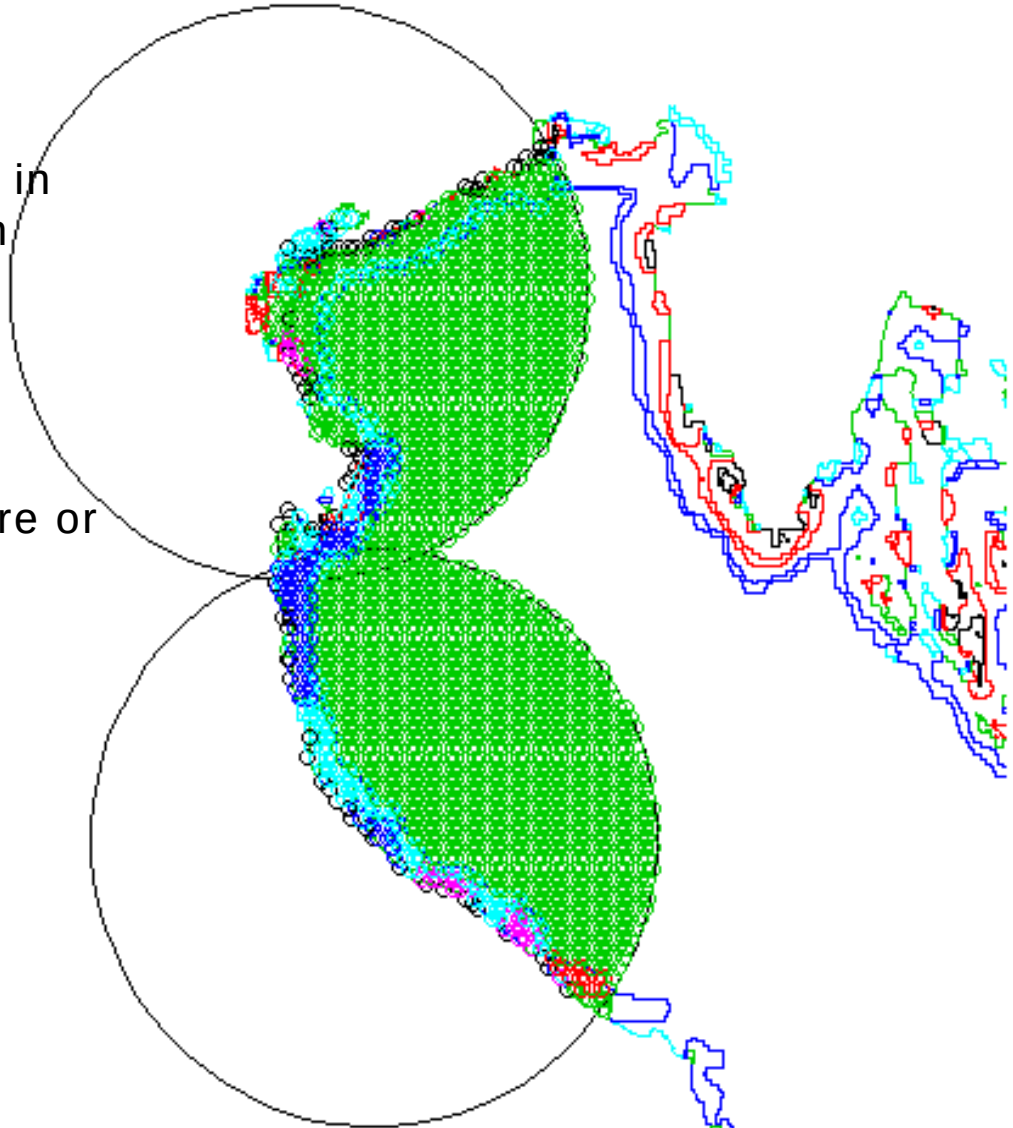

- Delineate priority areas for fishermen by computing suitability index mapping
- …these priority areas for fishermen to be further tested by simulation either applying RUM or applying DISPLACE



# ECOAST WP5 – Random Utility Model

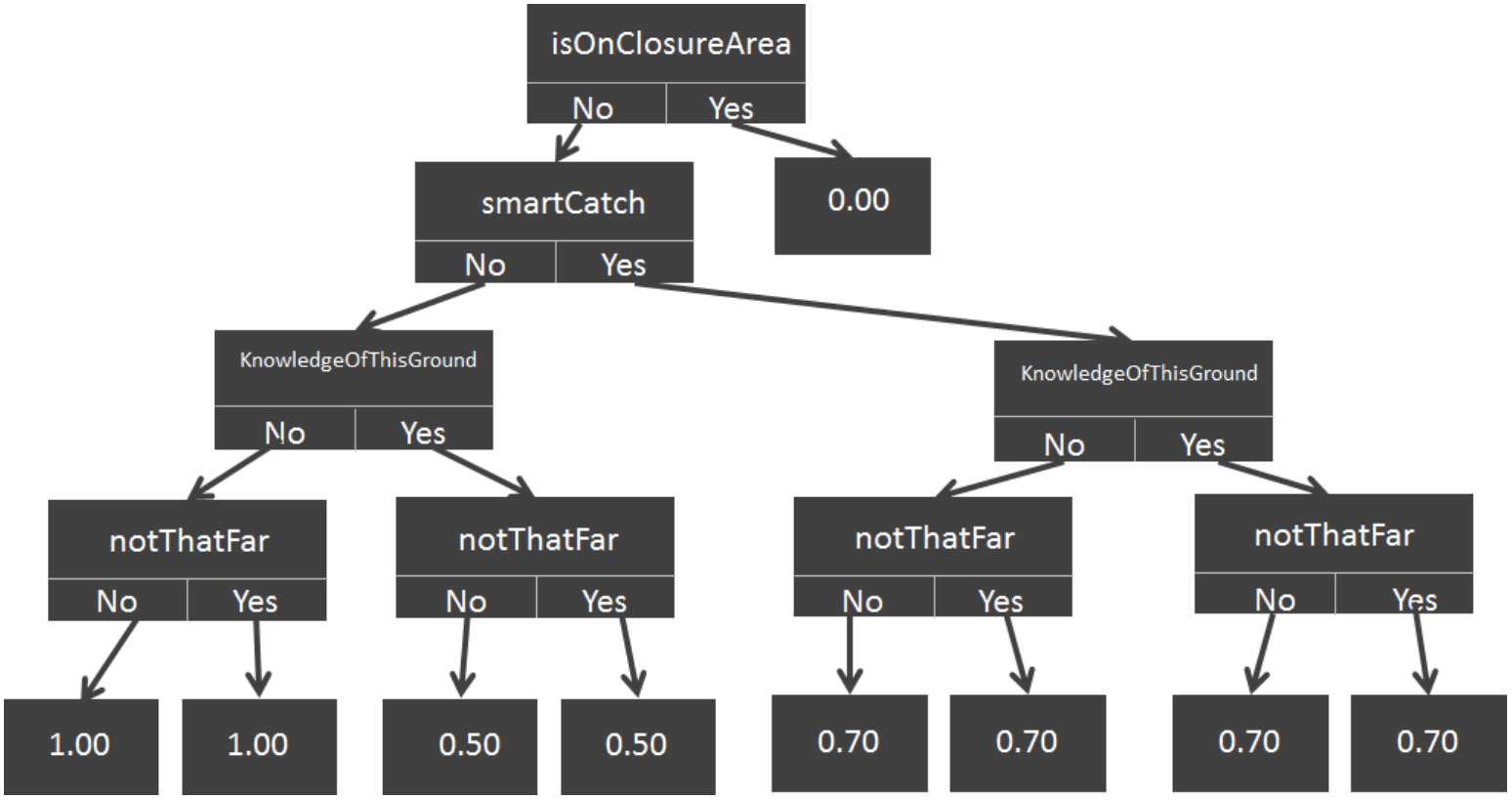
Mainly used to figure out the drivers in the fishermen decision-making when selecting fishing grounds….

But can further be used in ”what if analysis” e.g. a response to a closure or displacement



# ECOAST WP5 – Decision trees

Figure out the drivers in the fishermen decision-making by conducting yes/no questionnaire and build decision trees



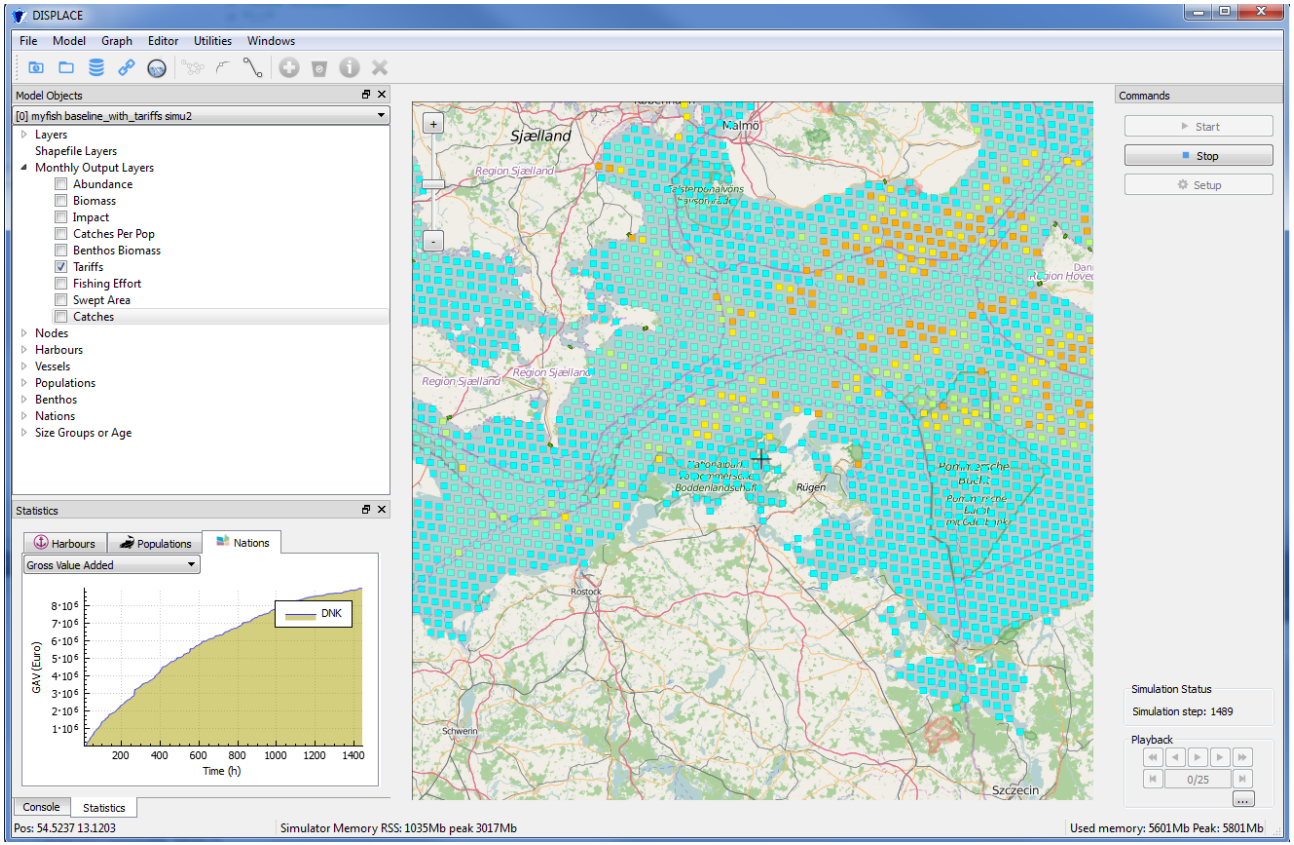

….can further be used in ”what if analysis” e.g. a response to a closure or displacement

e.g. Bastardie *et al.* 2013 Fis. Res.

# ECOAST WP5 – DISPLACE dynamic approach

* Model structure and parameterisation (a prezi presentation), including installing the software and running from the example dataset (a prezi presentation 2), looking at documentation on http://displace-project.org/blog/

* Western Baltic application – shortlist for data needed, to be completed together



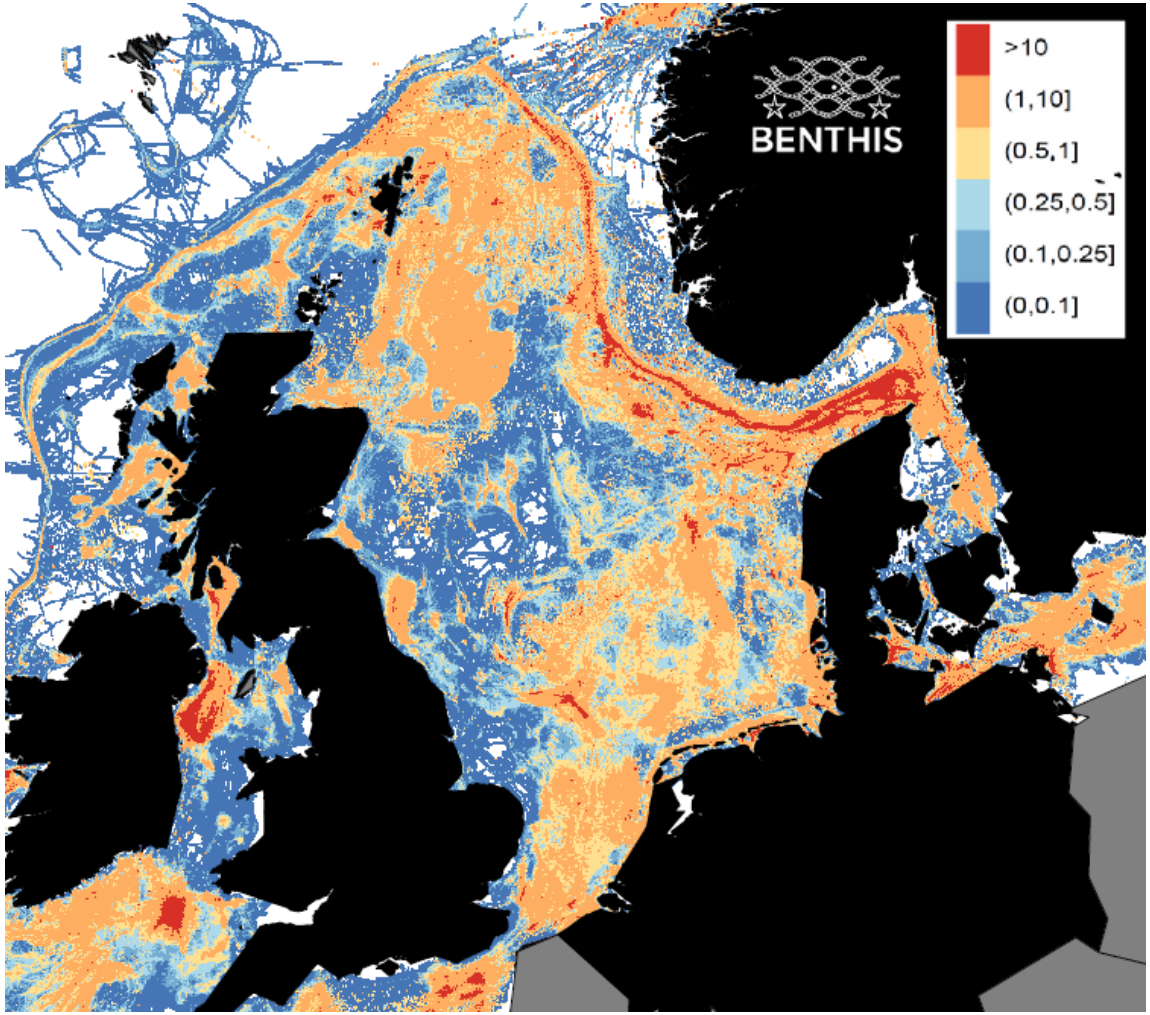
# A first approach to DISPLACE

* putting first hands in data, especially concerning

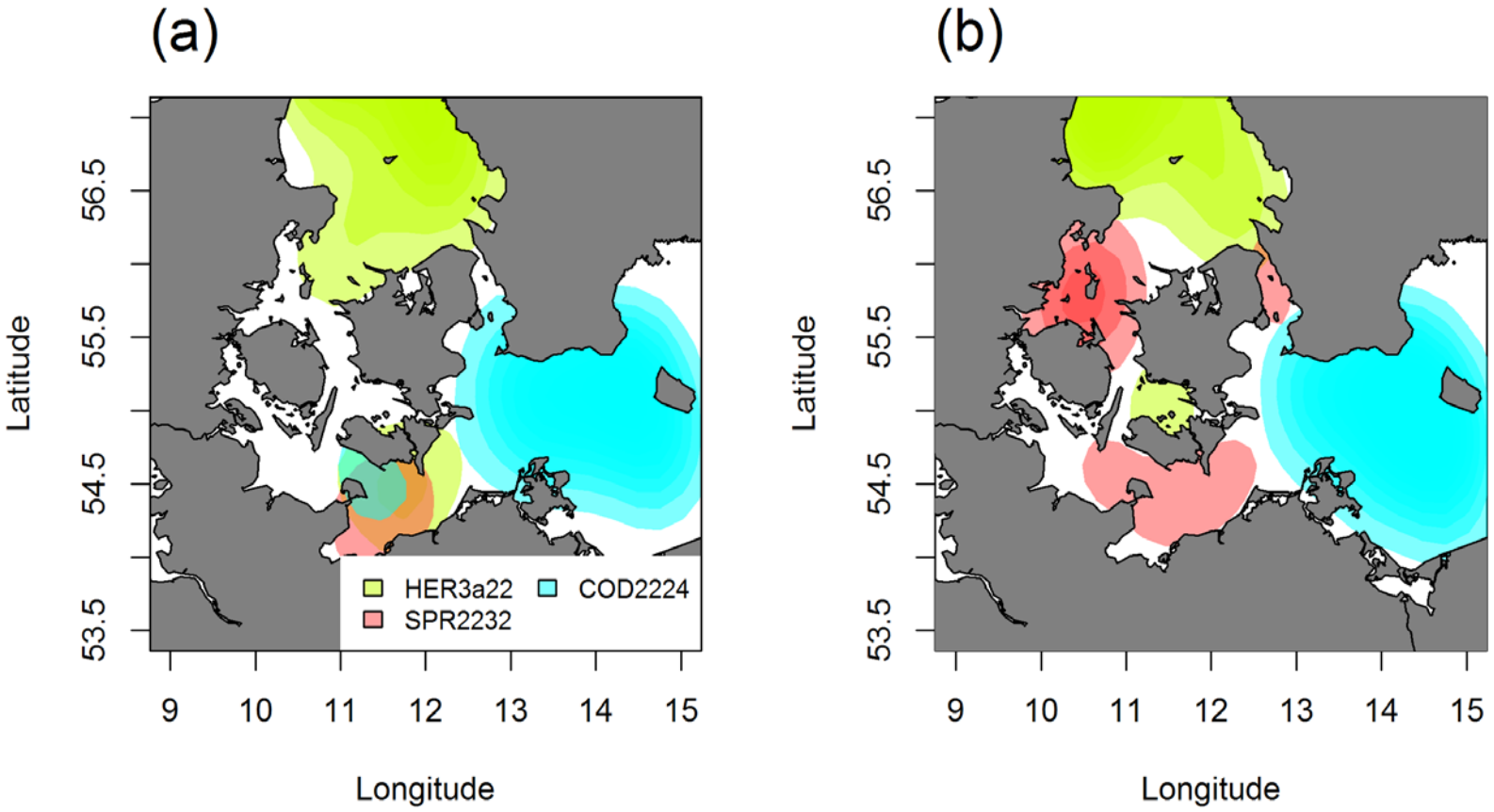
* Most recent logbooks & VMS data for coupling in VMStools, in eflalo and tacsat format

* Obtain the spatial distribution of stocks and biological features

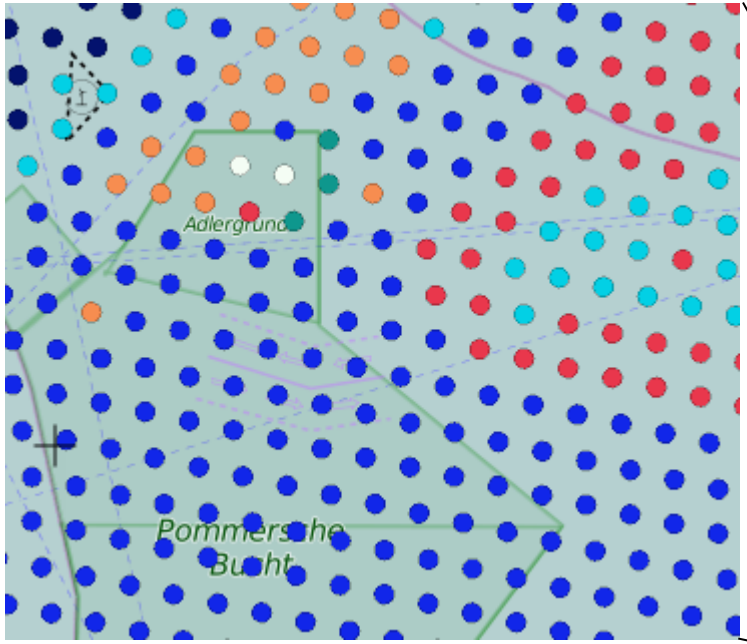
* Describe the management in place e.g. Harvest Control Rules, spatial closure, etc.

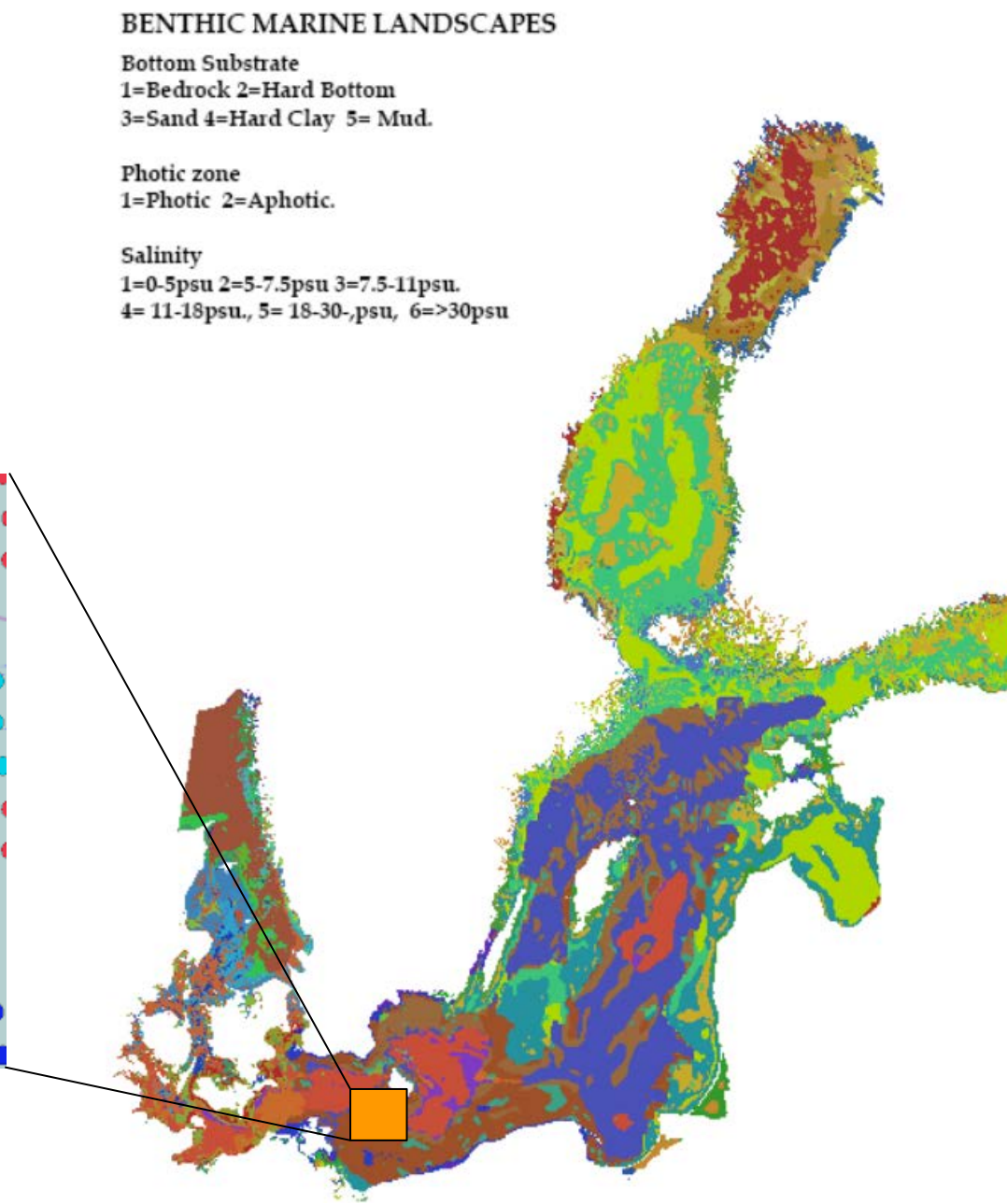


# Spatial distribution of stocks



# Habitat mapping



# ECOAST WP2 -> WP5 Ex. Adriatic Sea

POPULATION

1- Stock data from various sources e.g. fishbase for growth, condition factors, SSB-R Ricker a and b, etc.

2- Stock abundances at age e.g. from ICES WG

3- only one GIS shape file per stock for the spatial distribution (polygons in absolute or in categorical abundance e.g. low, medium, high and a multiplier e.g. 1 10 100) e.g. from survey

4- size bins 3cm and 14 bins

FISHERIES

1- graph: 2 by 2 km in GSA 17 (I will do it)

2- a GIS layer for relative fishing effort allocation per metier per vessel size category (<12m and >12m) e.g. from Stefanos (or from AIS or from VMS for larger vessels)

3- price per harbour per commercial categories

4- commercial categories per size group per species

5- catch rate per stock per metier-harbour (e.g. kg per hour; special case for gillneters?)

6- Selectivity per metier (i.e. ogive 0 to 1); 2 metiers: trawlers and gillneters

7- crew number per vessel

8- a data table (vessel id / start port / metier name) to design some set of vessels (the "super-individuals" assumption)

MANAGEMENT

1- The GIS layer for the polygon exclusion

2- Total landings per stock done by the simulated vessels (to compare simulation vs. declared landings)

3- A written description of the scenario to compare against the baseline

# ECOAST WP2 -> WP5

## .....among the WP2 Case Studies,

## who is willing to inform a DISPLACE application?

POPULATION
1- Stock data from various sources e.g. fishbase for growth, condition factors, SSB-R Ricker a and b, etc.
2- Stock abundances at age e.g. from ICES WG
3- only one GIS shape file per stock for the spatial distribution (polygons in absolute or in categorical abundance e.g. low, medium, high and a multiplier e.g. 1 10 100) e.g. from survey
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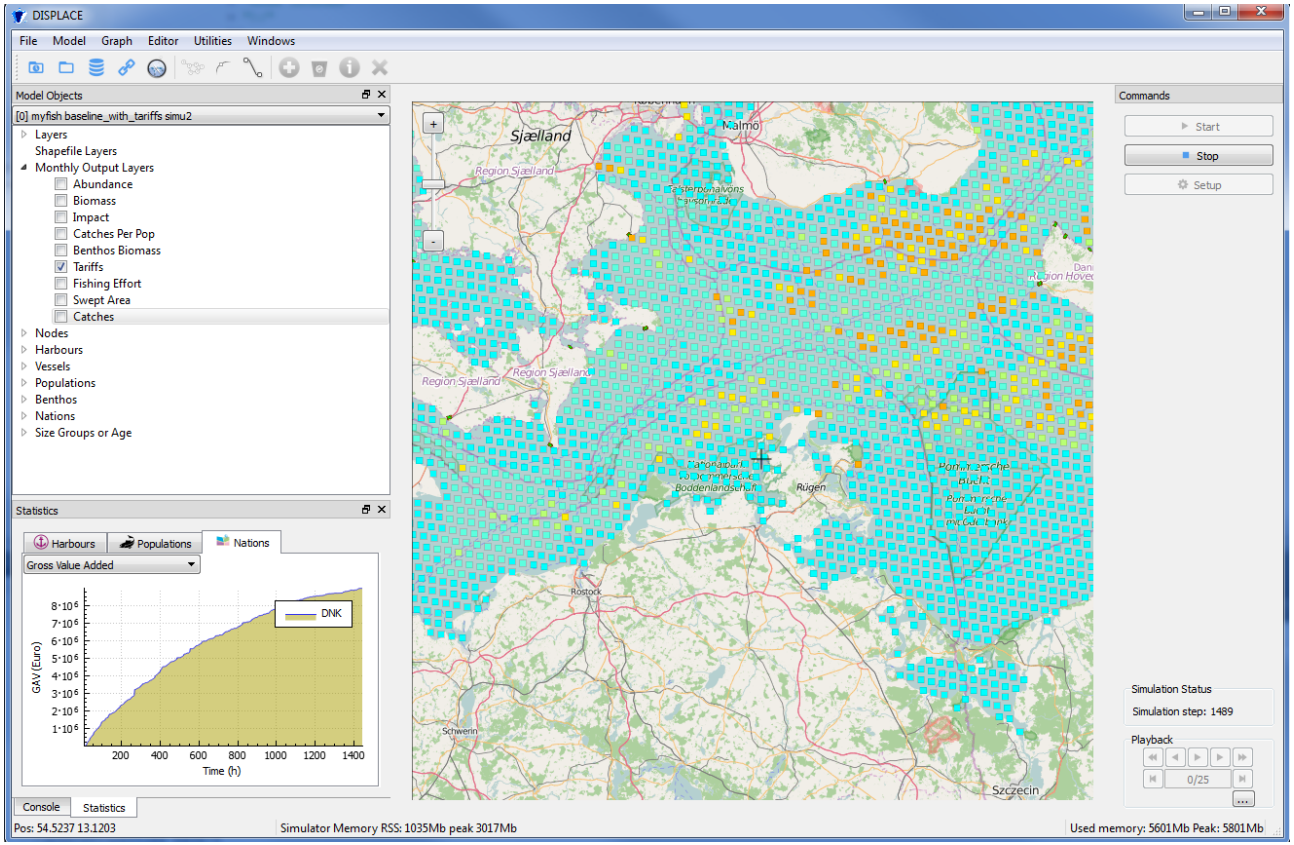

# WP6

Identification of spatial and temporal potential and limitation for the integration of fisheries, aquaculture and other activities in the coastal areas (through stakeholder consultation).

by Erik Olsen

Link:

http://prezi.com/l2qhv2qml5tl/?utm_campaign=share&utm_medium=copy&rc=ex0share

ECOAST
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**ECOAST Project**

kick-off meeting

Seeport Hotel

COFASP
ERA-net

DAY 5TH APRIL 2016

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ECOAST
Era-net COFASP

# ECOAST Project

## kick-off meeting

## Seeport Hotel

DAY 6TH APRIL 2016

## LIST OF PARTICIPANTS

COFASP ERA-net

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Ancona, Italy
4-6 April 2016
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