Ecological and economic effects of EU CFP discard landing obligation evaluated using a quantitative ecosystem approach for the Northern Adriatic Sea

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The EU CFP landing obligation

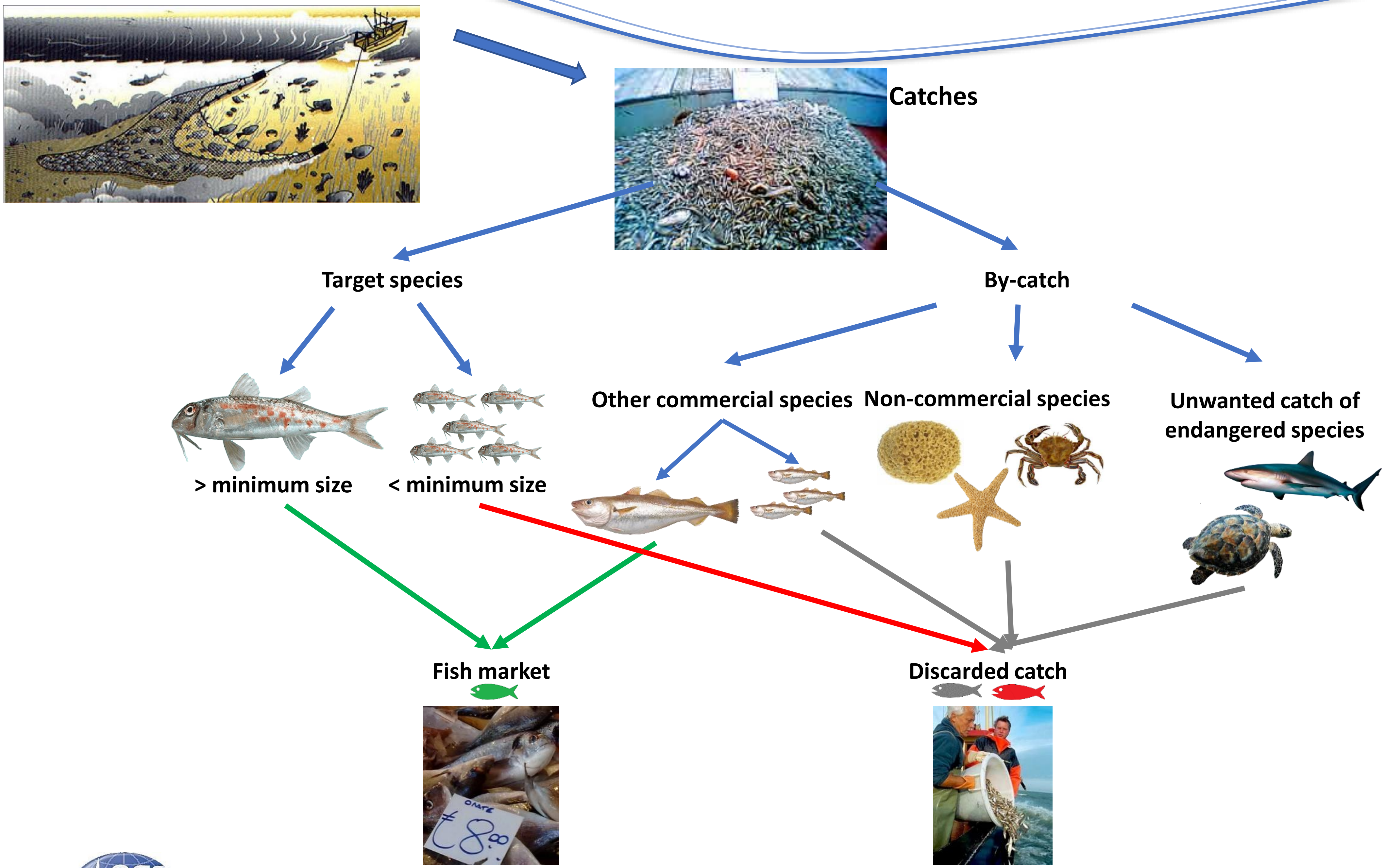
With the CFP regulations EU 1380/2013; EU 1392/2014 was introduced the so called discard ban or "landing obligation" (LO).

According to this regulation by-catch catch of species subject to **catch limits or minimum sizes** shall be retained on board the fishing vessel and landed

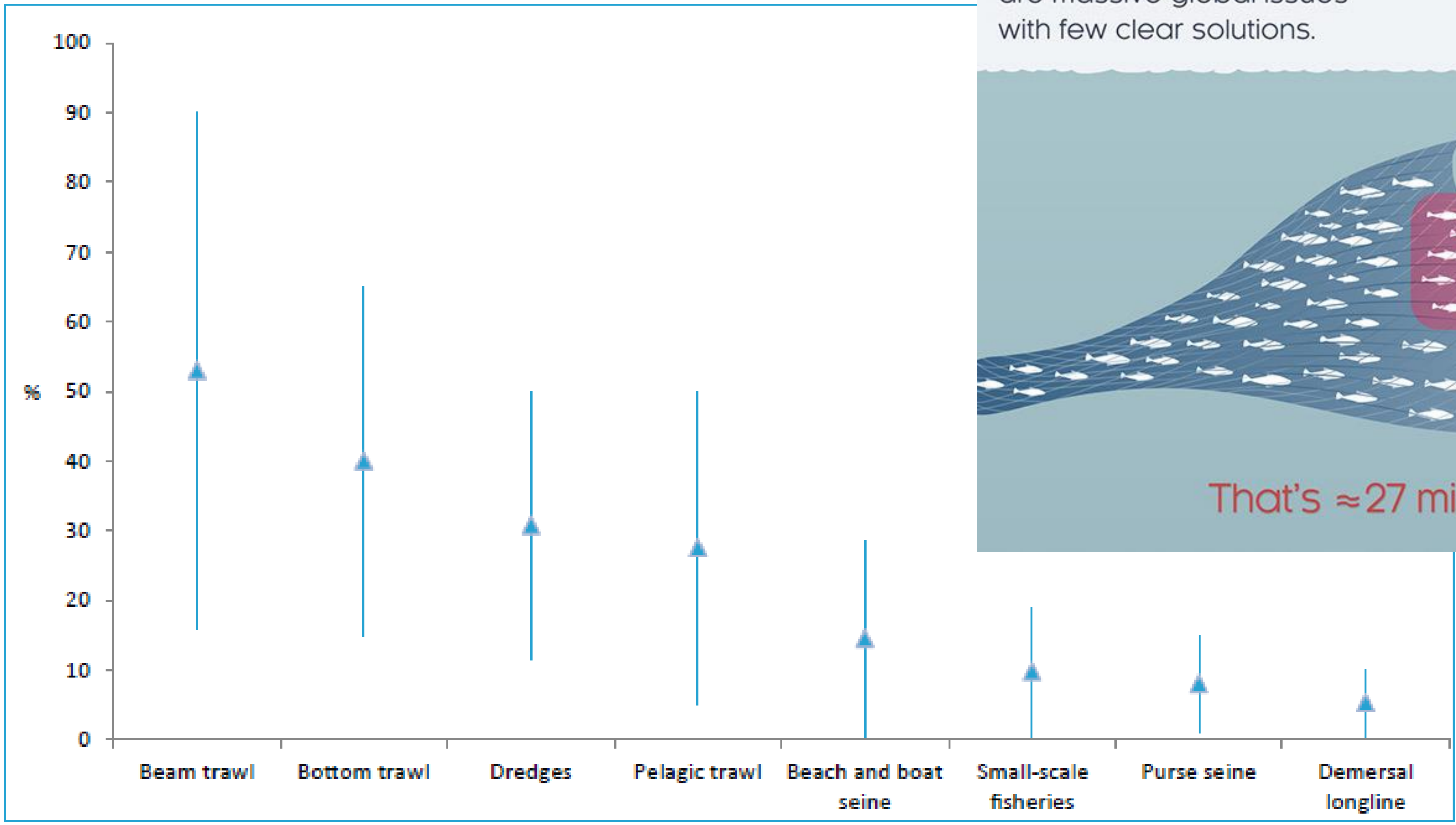
Common Fishery Policy regulation created for reducing the bycatch and the discards of european fisheries

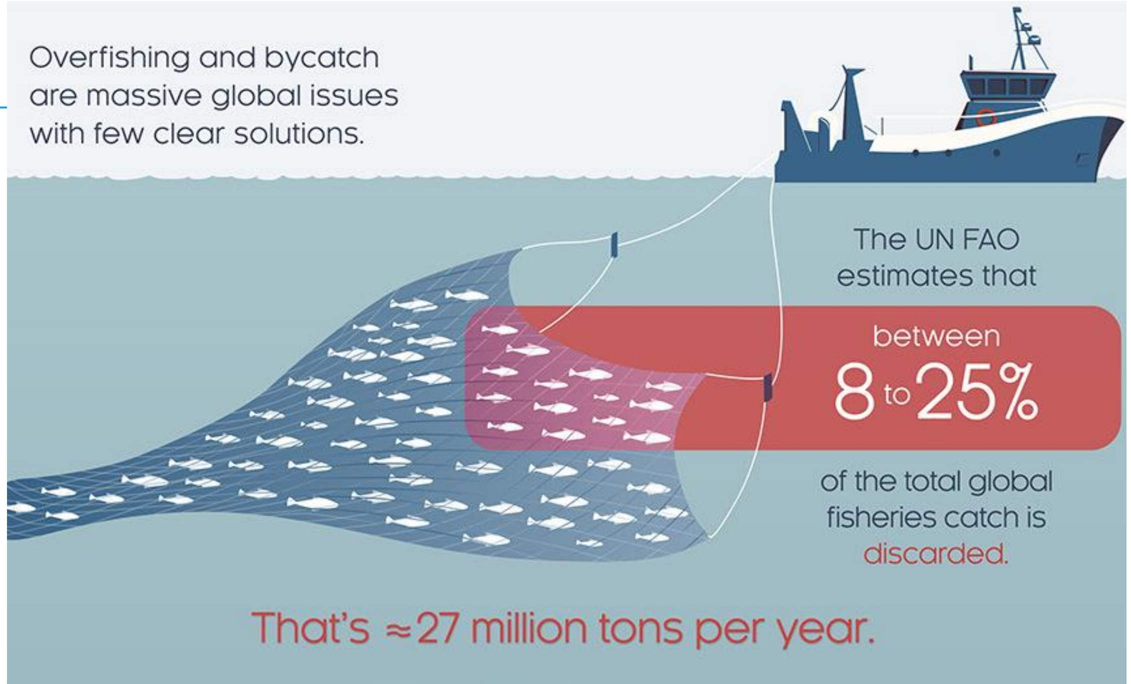
Application starting 2015 with a few species, full in place from January 2019

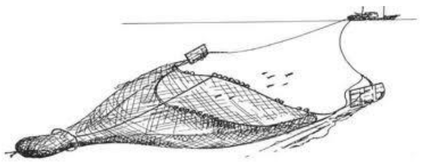
Discards

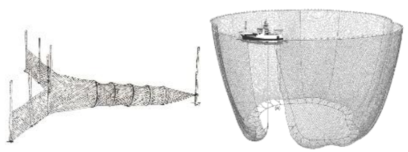

Catches
Target species
By-catch
> minimum size
< minimum size
Other commercial species
Non-commercial species
Unwanted catch of endangered species
Fish market
Discarded catch

Discards









FAO-GFCM. State of Mediterranean and Black Seas, 2017

In a situation (like the Med) where no quotas are in place:

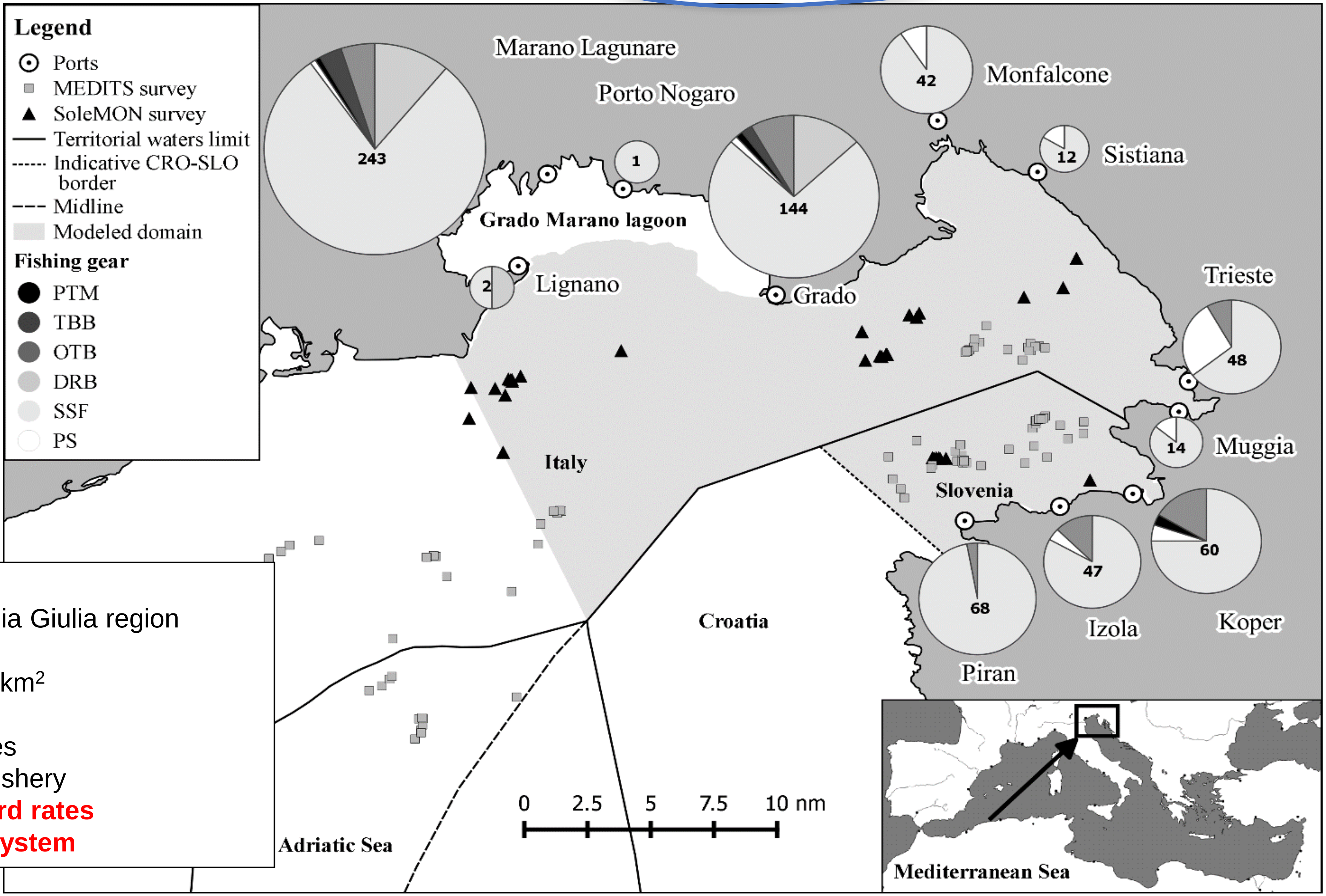
Minimum landing size

Species	Minimum size
Dicentrarchus labrax	25 cm
Diplodus annularis	12 cm
Diplodus puntazzo	18 cm
Diplodus sargus	23 cm
Diplodus vulgaris	18 cm
Engraulis encrasicolus	9 cm o 110 pz/kg
Epinephelus spp.	45 cm
Lithognathus mormyrus	20 cm
Merluccius merluccius	20 cm
Mullus spp.	11 cm
Pagellus acarne	17 cm
Pagellus bogaraveo	33 cm
Pagellus erythtinus	15 cm
Pagrus pagrus	18 cm
Polyprion americanus	45 cm
Sardina pilchardus	11 cm o 55 pz/kg
Scomber spp.	18 cm
Solea vulgaris	20 cm
Sparus aurata	20 cm
Trachurus spp.	15 cm

Although discards are clearly undesiderable and need to be reduced they have an ecological role

AIM:
Evaluating ecological, economic consequences of the Landing Obligation (LO), including effects on natural capital, and possible strategies

Northern East Adriatic Sea (NEAS)



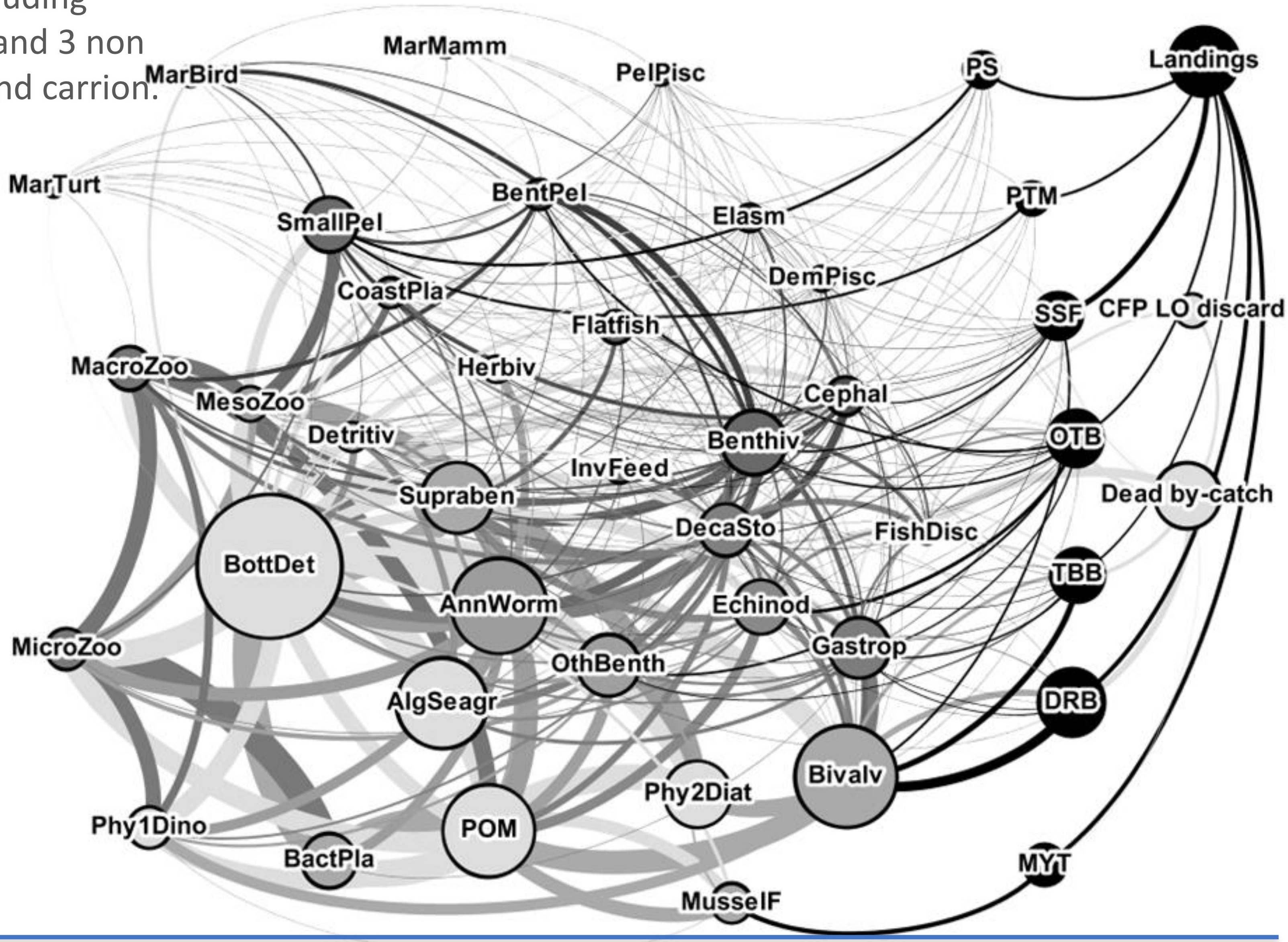
Slovenia
Friuli Venezia Giulia region

Area: 1020 km^2

Multi-species
Multi-gear fishery
High discard rates
No quota system

Ecosystem model for the NEAS

Approach: an ecosystem/food web model, with species aggregated into 30 «functional groups» from marine mammals to plankton (including main targets of fisheries), and 3 non living groups for detritus and carrion.



Initial conditions of the NEAS model

Group	Group code	Trophic level	Biomass (t/km^2)	P/B (/year)	Q/B (/year)	EE	P/Q	Unassim. cons.
Marine mammals	MarMamm	4.65	**0.0150**	**0.08**	**11.01**	0.0000	0.0072	**0.200**
Marine birds	MarBird	4.19	**0.0529**	**4.61**	**69.34**	0.0000	0.0664	**0.200**
Marine turtles	MarTurt	4.00	**0.0317**	**0.16**	**2.54**	0.0000	0.0653	**0.200**
Elasmobranchii	Elasm	3.91	**0.4386**	**0.31**	**3.95**	0.9939	0.0786	**0.200**
Small pelagic fish	SmallPel	3.20	**5.0000**	**1.90**	**9.13**	0.6212	0.2081	**0.200**
Benthopelagic fish	BenthPel	3.99	0.7646	**1.70**	**5.82**	**0.9000**	0.2920	**0.200**
Coastal planctivorous fish	CoastPla	3.13	**0.6377**	**1.07**	**8.40**	0.8211	0.1273	**0.200**
Pelagic piscivorous fish	PelPisc	4.21	**0.0815**	**0.57**	**5.13**	0.3159	0.1111	**0.200**
Invertebrate feeding fish	InvFeed	3.02	**0.3376**	0.87	**5.80**	0.8368	**0.1500**	**0.300**
Detritivorous fish	Detritiv	2.39	**0.6236**	**0.91**	**17.70**	0.6117	0.0514	**0.500**
Herbivorous fish	Herbiv	2.11	**0.4156**	**0.99**	**14.40**	0.4209	0.0687	**0.400**
Flatfish	Flatfish	3.33	**0.8021**	**1.43**	**6.13**	0.3503	0.2332	**0.200**
Benthivorous fish	Benthiv	3.20	**6.5292**	**2.45**	**6.70**	0.6740	0.3656	**0.200**
Demersal piscivorous fish	DemPisc	4.01	**0.2860**	**1.00**	**5.24**	0.3238	0.1908	**0.200**
Cephalopoda	Cephal	3.71	**1.3438**	**3.10**	**12.97**	0.5640	0.2390	**0.200**
Mussel farms	MusselF	2.00	**1.5386**	**1.99**	**13.59**	0.5685	0.1468	**0.775***
Bivalvia	Bivalv	2.00	**42.0000**	**0.70**	4.66	0.8627	**0.1500**	**0.650**
Annelida & Other worms	AnnWorm	2.05	**30.9370**	**0.80**	5.37	0.7032	**0.1500**	**0.260**
Suprabenthos	Supraben	2.00	8.2800	**4.67**	**35.43**	**0.7000**	0.1318	**0.250**
Decapoda & Stomatopoda	DecaSto	2.75	**3.5000**	**4.30**	**14.00**	0.9529	0.3071	**0.200**
Gastropoda	Gastrop	2.84	**5.5000**	**1.06**	**3.13**	0.7779	0.3386	**0.300**
Echinodermata	Echinod	2.11	**4.0072**	**0.84**	5.63	0.9507	**0.1500**	**0.300**
Other benthic filter feeders	OthBenth	2.19	**5.8221**	**1.06**	**3.13**	0.7234	0.3386	**0.200**
Macro-zooplancton & Jellyfish	MacroZoo	2.99	**2.0000**	**14.60**	**50.48**	0.1948	0.2892	**0.200**
Micro-zooplancton	MicroZoo	2.94	**1.7070**	**177.80**	**254.00**	0.1749	0.7000	**0.165**
Meso-zooplancton	MesoZoo	2.17	**1.0480**	**61.80**	**107.40**	0.7380	0.5754	**0.124**
Bacterioplancton	BactPla	2.00	**3.8890**	**141.66**	**244.35**	0.7536	0.5797	**0.185**
Phyto1 - Dinoflagellate	Phy1Dino	1.00	**1.7641**	**92.03**		0.3087		
Phyto2 - Diatoms	Phy2Diat	1.00	**7.8371**	**61.19**		0.3120		
Macroalgae & Seagrass	AlgSeagr	1.00	**24.2500**	**6.13**		0.1910		
POM	POM	1.00	**26.7168**			0.8102		
Fishery discard	FishDisc	1.00	**0.0001**			0.9951		
Bottom detritus	BottDetr	1.00	**296.2990**			0.9971		

Parameters for the NEAS Ecopath model (initial conditions; reference year, 2005)

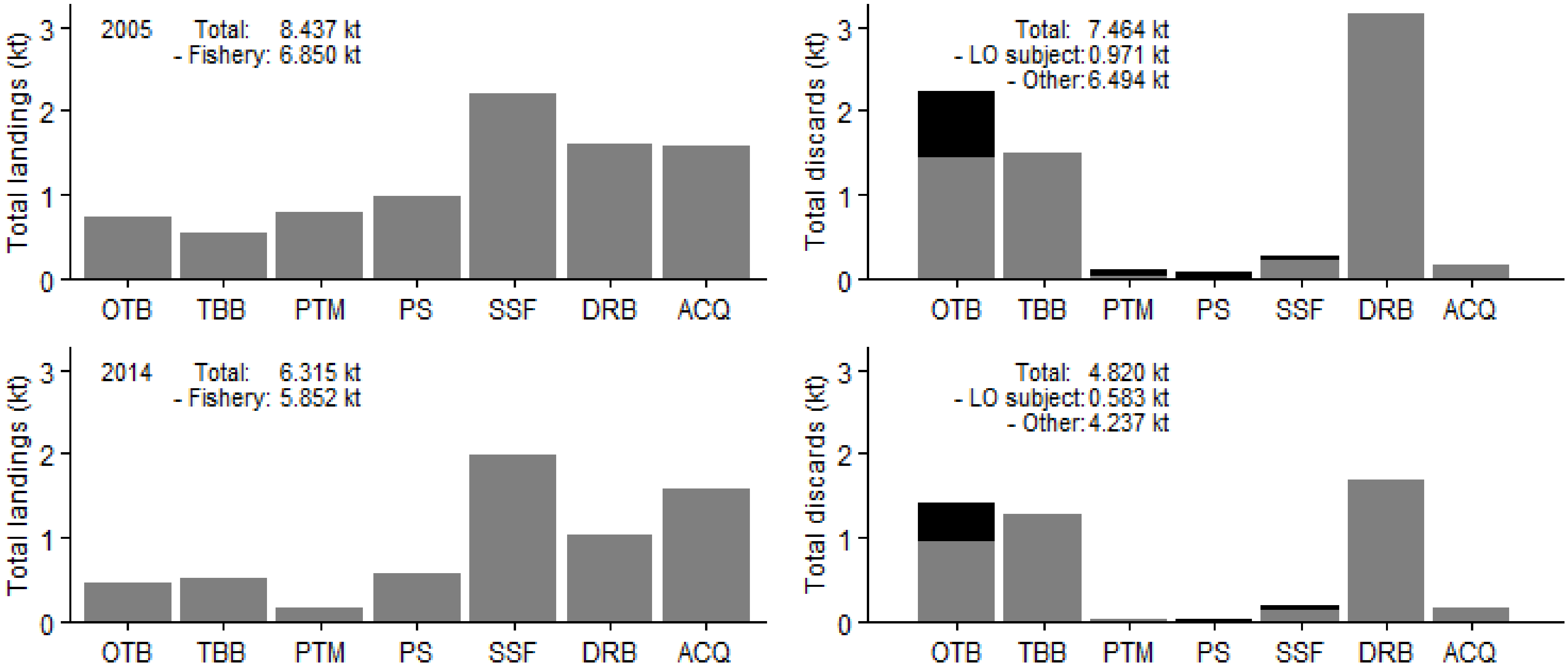
Ecosystem model for the NEAS

Fisheries: 6 fishing gears (plus mussel farms) for Friuli Venezia Giulia region and Slovenia described with their landings (IREPA and fish market), discards (SOSPECO, literature), discard mortality (various sources), prices (IREPA).

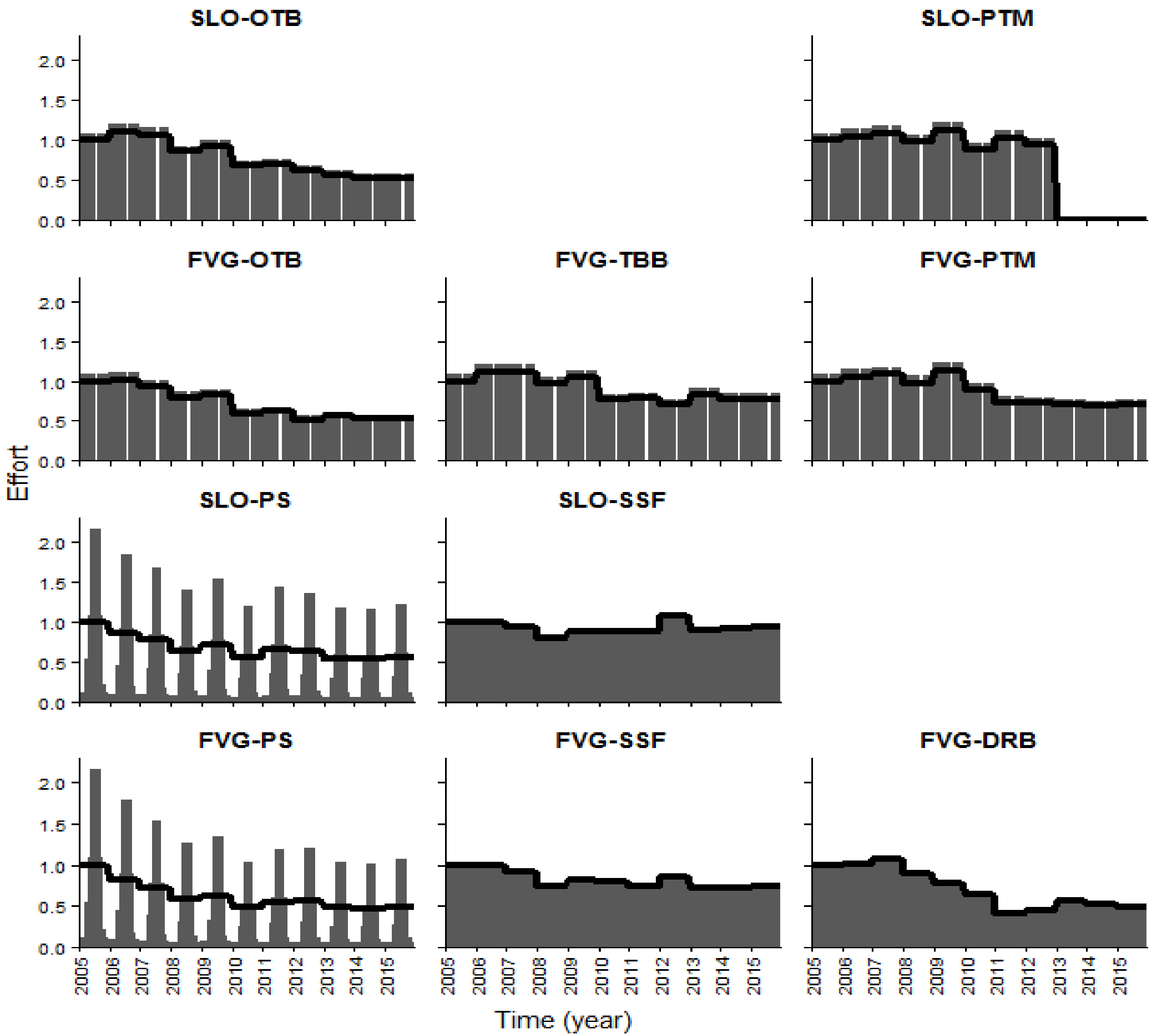
	Landings (L_{tot}, t)							Discards (D_{tot}, t)						
	OTB	TBB	PTM	PS	SSF	DRB	ACQ	OTB	TBB	PTM	PS	SSF	DRB	ACQ
Elasm [1]	27.9	0.2	6.31		78.5			0.2						
SmallPel [2]	5.2		715.5	835.3	6.7			172.7		73.4	71.0			
BentPel [3]	126.1		32.1	69.9	94.7			617.4		0.7	1.8	24.7		
CoastPla [4]	19.3			5.1	9.4			41.3	0.1					
PelPisc			0.5	0.1	7.6									
InvFeed [2]	13.3		0.1	1.1	100.6			7.0				28.9		
Detritiv [2]	13.8		10.7	17.9	150.7			0.1		20.9				
Herbiv				0.8	0.4									
Flatfish [5]	1.2	48.2			151.3			2.1	1.7				4.7	
Benthiv [2]	192.1		14.7	30.7	400.5			475.3		1.59	0.9	40.4		
DemPis [2]	14.2	4.0		2.0	16.4			0.7						
Cephal [6]	249.5	51.2		5.5	348.7			24.5	10.8					
MusselF [2]							1586.8							158.6
Bivalv [7]	0.01	252.4			537.7	1599.8		0.01	1154.2				3014.2	
AnnWorm [8]								7.3	7.4				0.3	
DecaSto [9]	63.9	14.5			232.2			28.2	84.1			167.3	110.7	
Gastrop [10]	21.5	172.4			73.3			39.7	31.9			3.5	28.5	
Echinod [11]								473.2	62.9	0.5			1.8	
OthBenth[12]								335.5	129.8					
MacroZoo[2]								0.01						

Ecosystem model for the NEAS

Fisheries: 6 fishing gears (plus mussel farms) for Friuli Venezia Giulia region and Slovenia described with their landings (IREPA and fish market), discards (SOSPECO, literature), discard mortality (various sources), prices (IREPA).



Top down main drivers



Models Calibrated with time series (2005-2015) of effort (Fleet register reviewed with local port information).

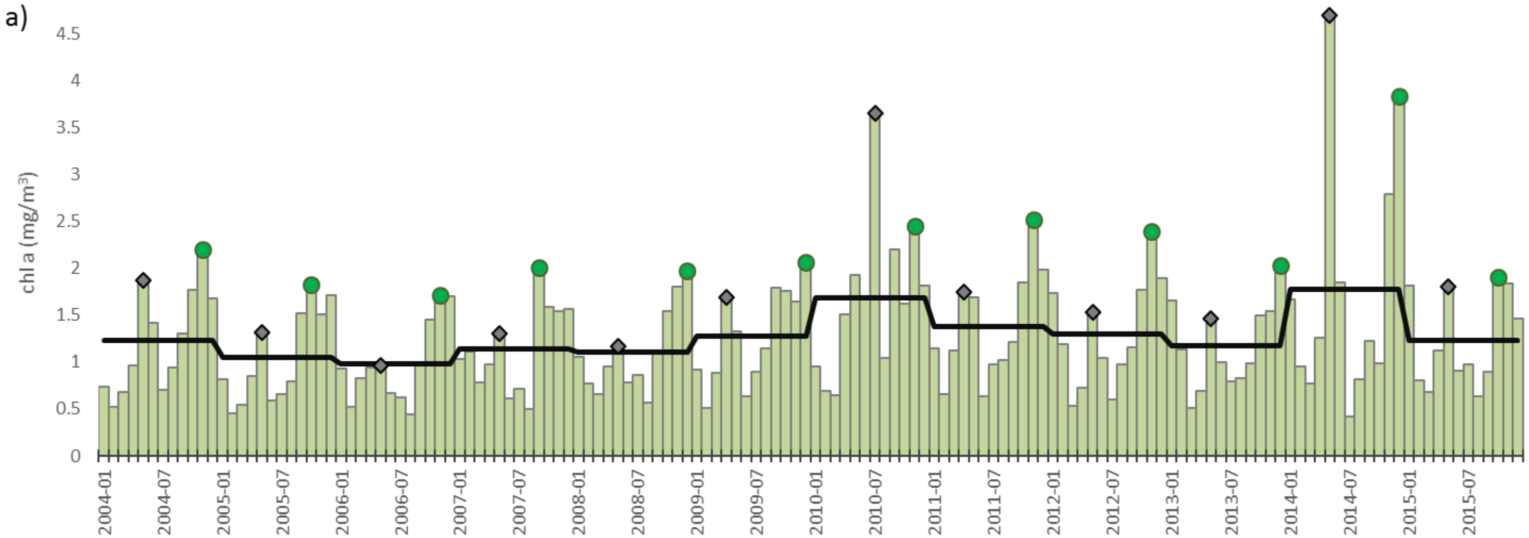
Fishing effort (E) by year (y) and fleet (fl) was based on individual vessel's (v) specifications (EU Fleet Register), and fleet fishing yearly activity derived from monitoring (IREPA)

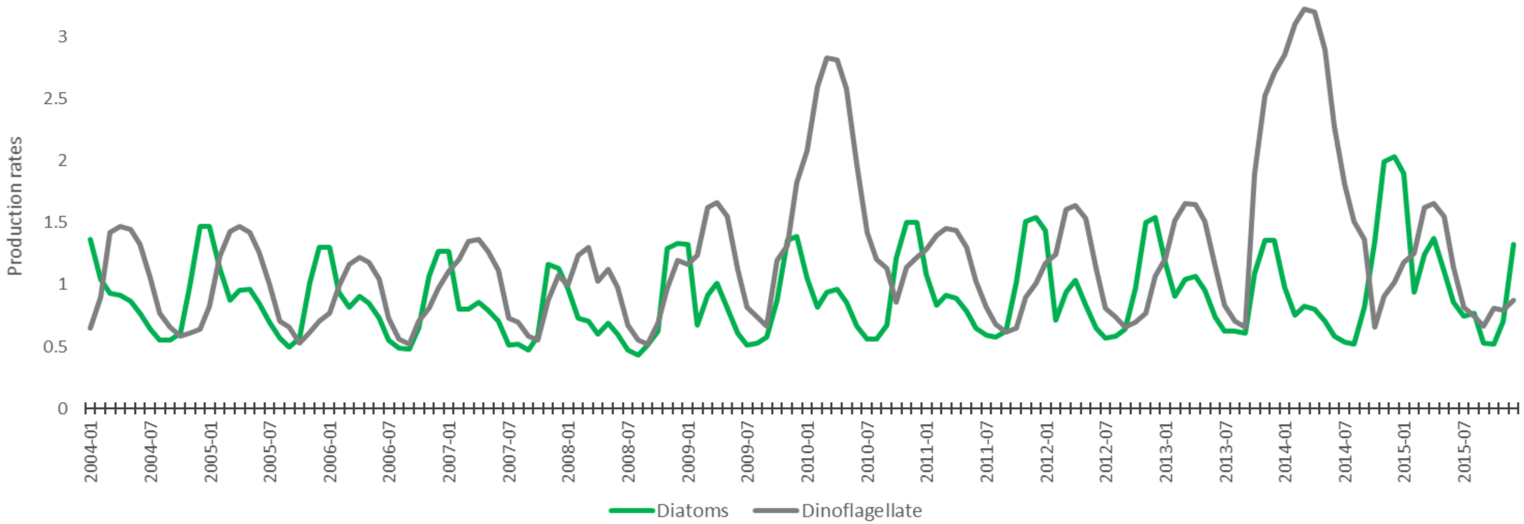
for OTB, TBB and PTM the cubic LOA (Length Over All, in meters) was considered more reliable and thus used as a descriptor of fishing capacity. Number of vessels was considered a good indicator of fishing capacity for PS, SSF and DRB

Bottom-up main drivers

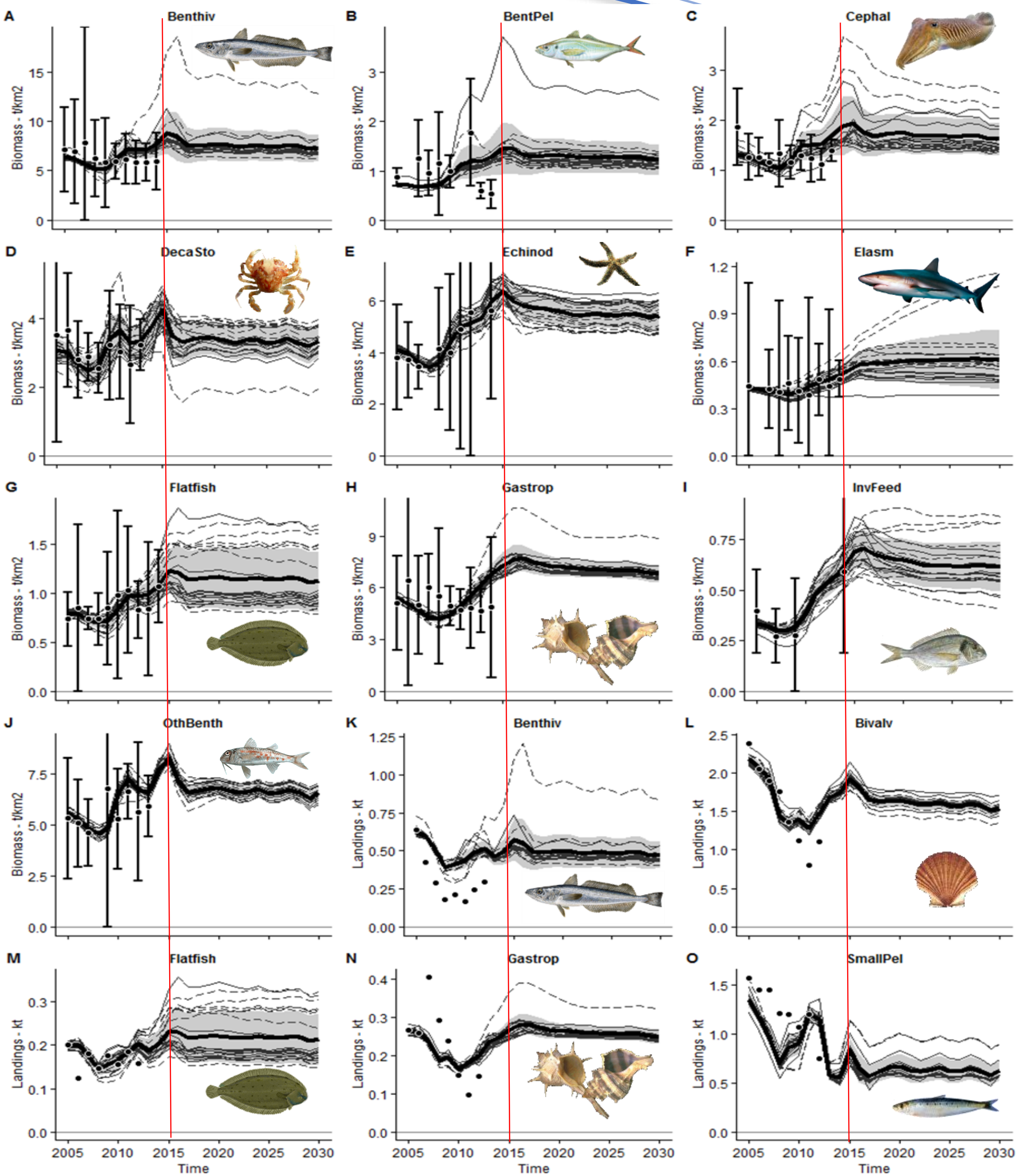
Time series (2005-2015) of bottom-up forces (primary production) was derived from a combination of satellite data, on site data sampling and modelling integration.

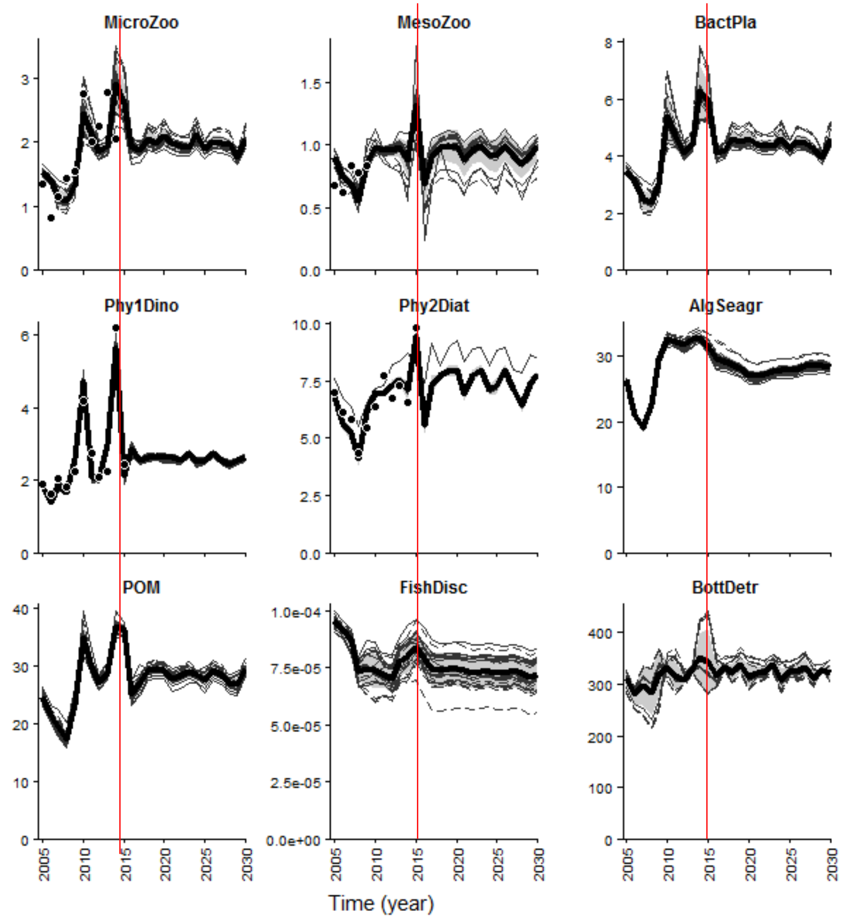
Montly changes in primary production was decomposed into dynamics of production by dinoflagellates and diatoms as major bottom-up forces





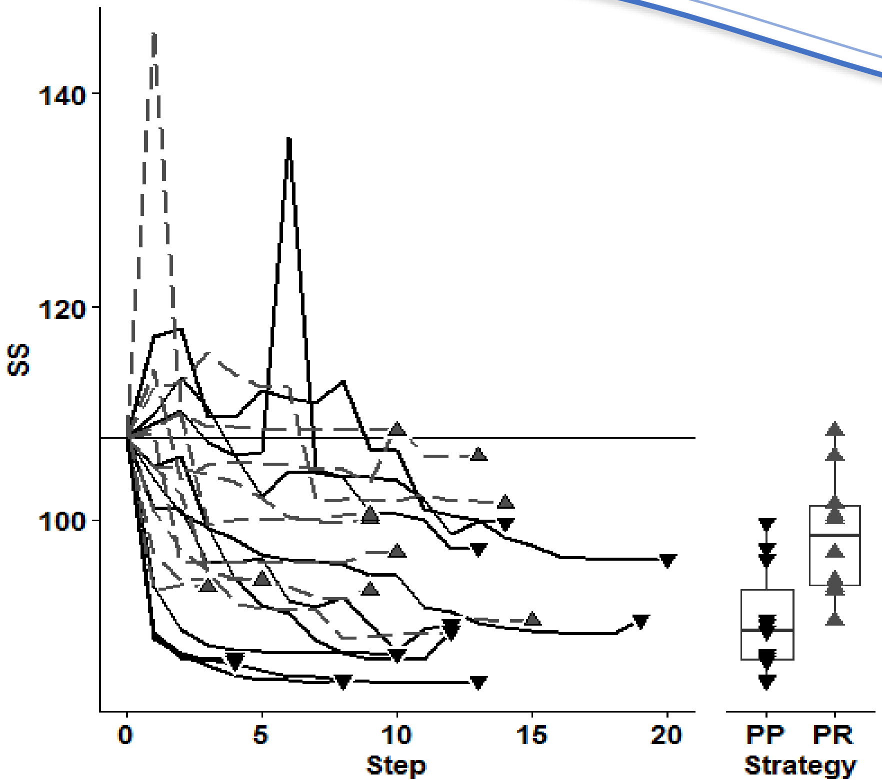
Calibrating the NEAS model



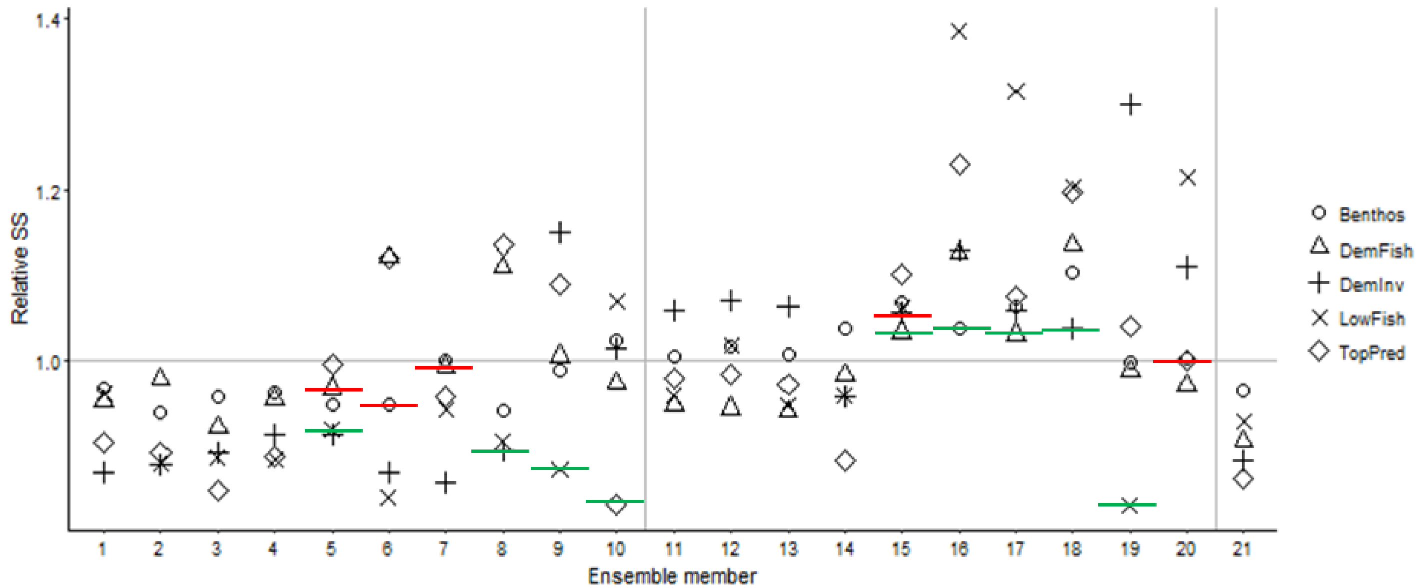


An ensemble of 21 Models Calibrated
with time series (2005-2015) of effort
(Fleet register; local port information)

Calibrating the NEAS model



Performances of the ensemble of 21 Models Calibrated with respect to data available (biomass estimates)



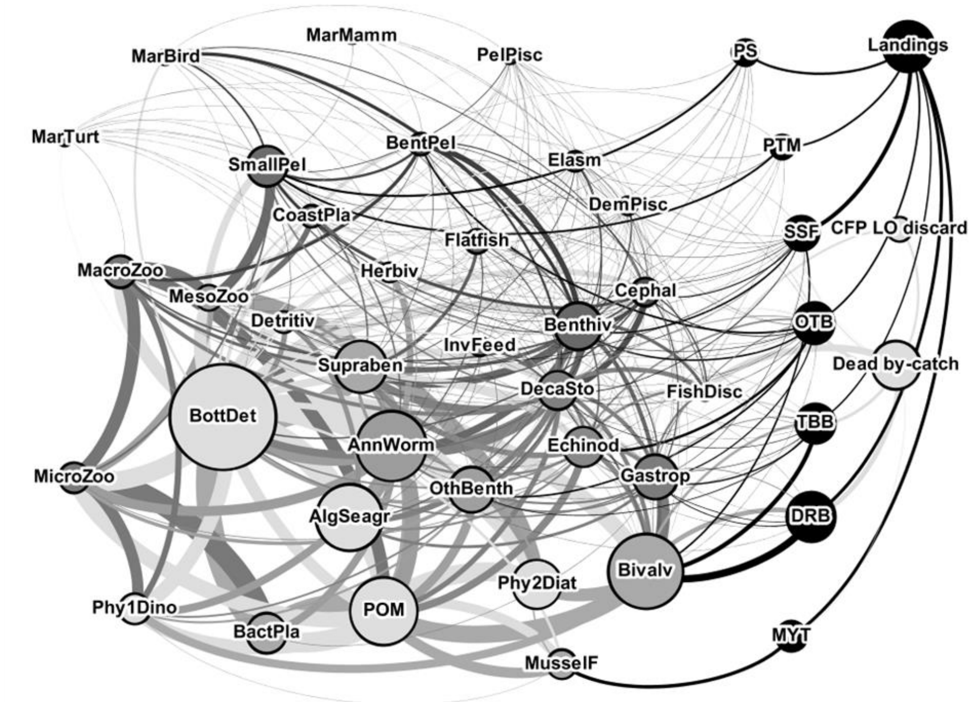
Simulating landing obligation

Simulating Landing Obligation (LO):

Comparing simulation assuming fishing effort constant from 2015 to 2030 but:

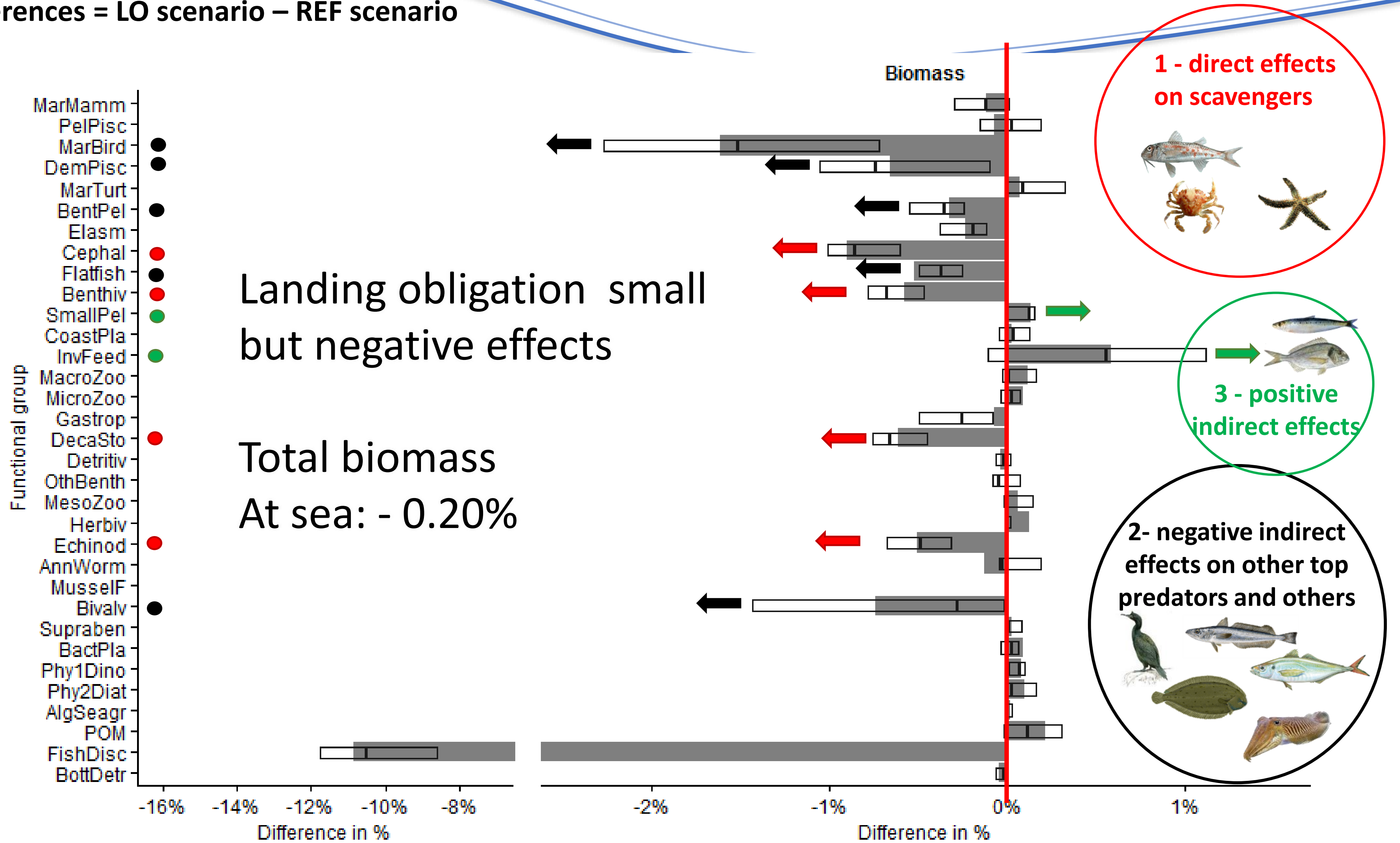
- **REFERENCE (no LO)** : same destiny of discards as in 2015 for the period 2016-2030 (organic matter returning to the sea)

- **With LO:** discards subjected to LO landed to port (gradually from years 2015-2019 and then constant LO till 2030)



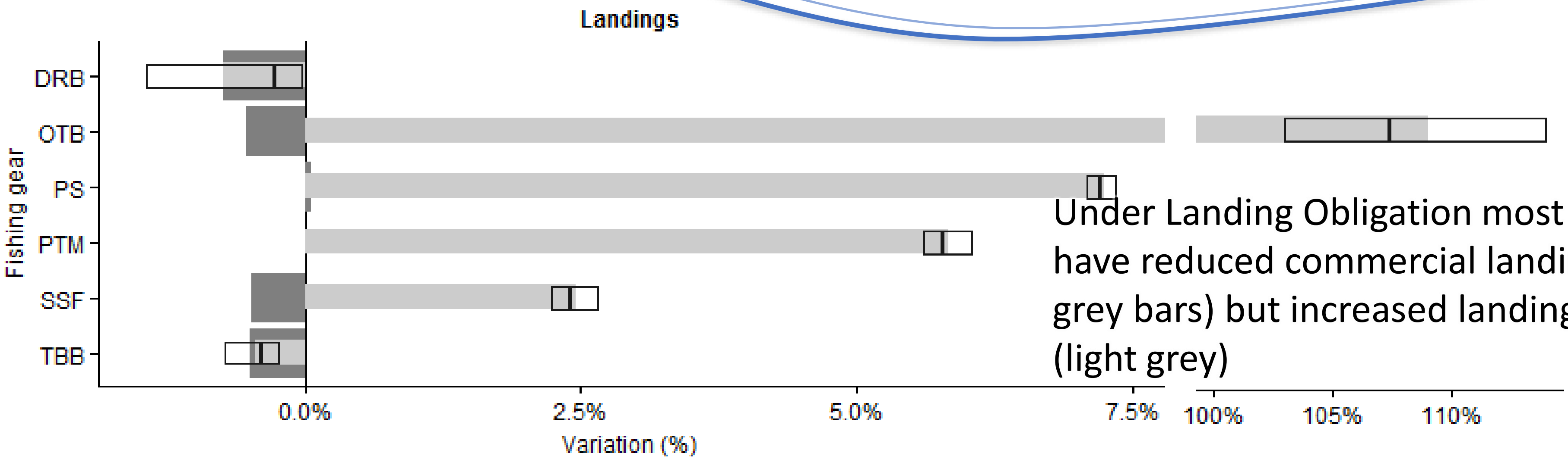
Ecological effects of landing obligation

Differences = LO scenario – REF scenario

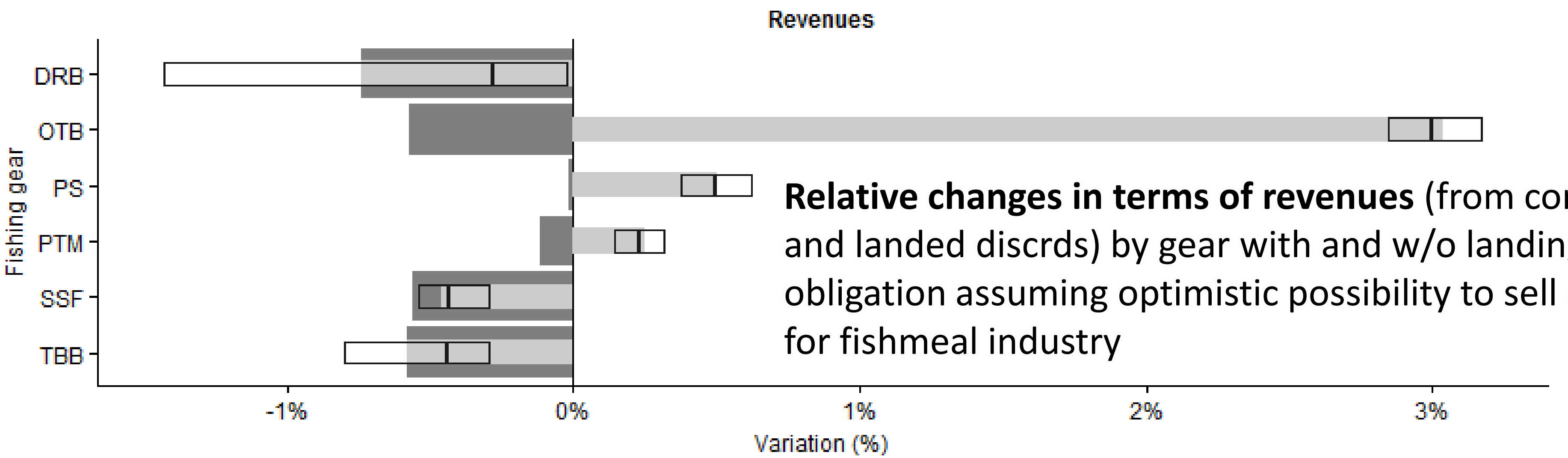


Landing obligation result in **small BUT NEGATIVE effects** on most of the food web components due to: the reduced resources for scavengers (e.g. Decapods; Marine birds); the cascading effects up to their predators (e.g. cephalopods); Then these predators exert less predation with benefits for some other preys (e.g. invertebrate feeder fish)

Socio-economic implications of LO

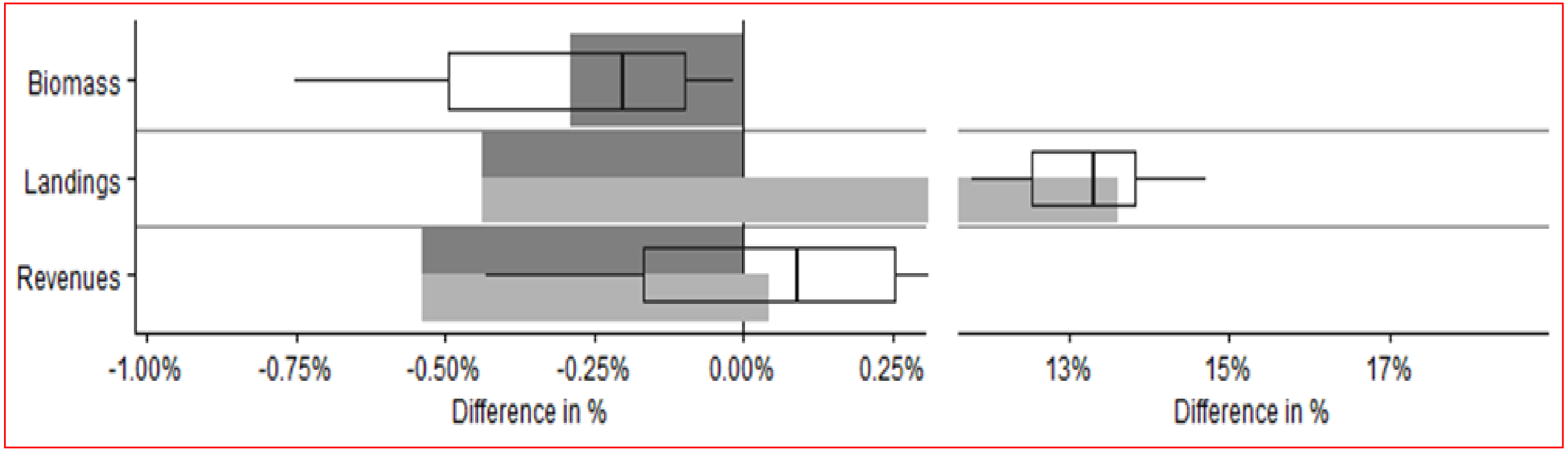


Under Landing Obligation most gears will have reduced commercial landings (dark grey bars) but increased landing material (light grey)



Relative changes in terms of revenues (from commercial and landed discrds) by gear with and w/o landing obligation assuming optimistic possibility to sell discards for fishmeal industry

Overall effects of landing obligation



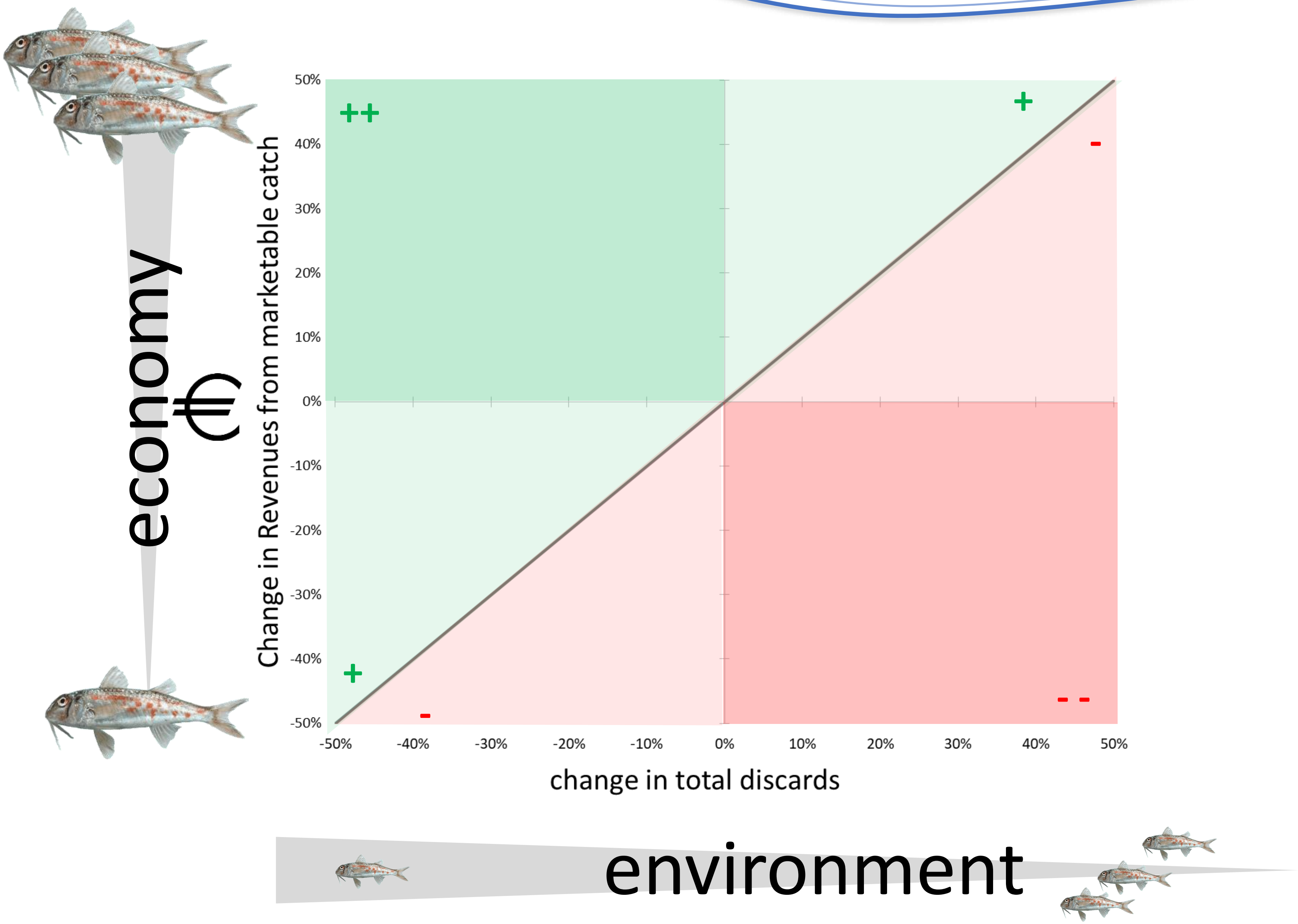
The PCP Landing obligation will potentially have the following effects:

Reduce biomasses at sea (approx -0.2%) [reduction of natural capital]

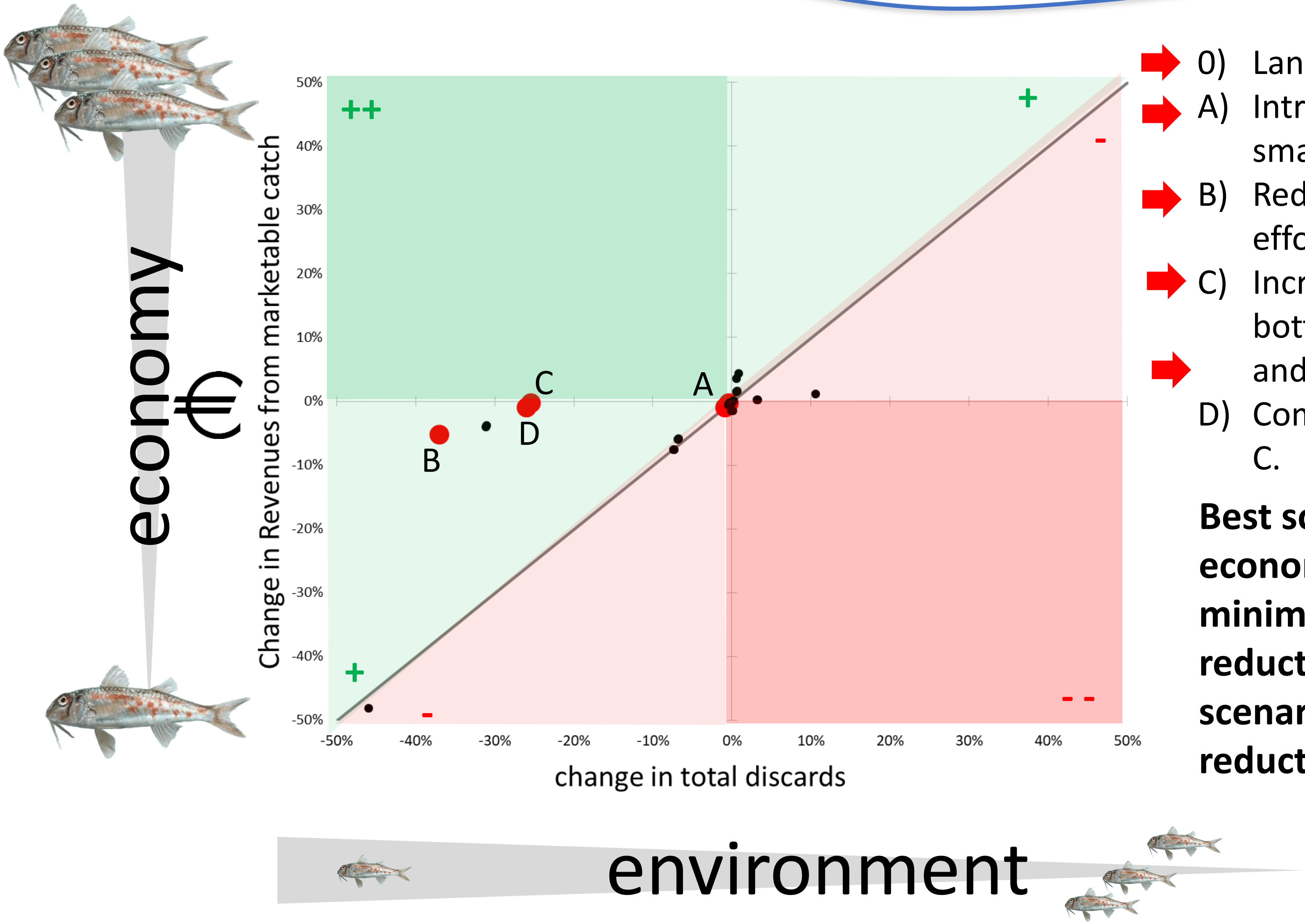
(obviously) increase landed material (approx +13%) [more work for fishermen]

Reduce profits from commercial landings (-0.5%) [econommic loss]

Optimistic case of discards landed and sold for fishmeal: no increase in profit (change 0%)


economy
€
Change in Revenues from marketable catch
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
-40%
-50%
++
+
-
+
-
- -
-50%
-40%
-30%
-20%
-10%
0%
10%
20%
30%
40%
50%
change in total discards
environment

Alternative scenarios



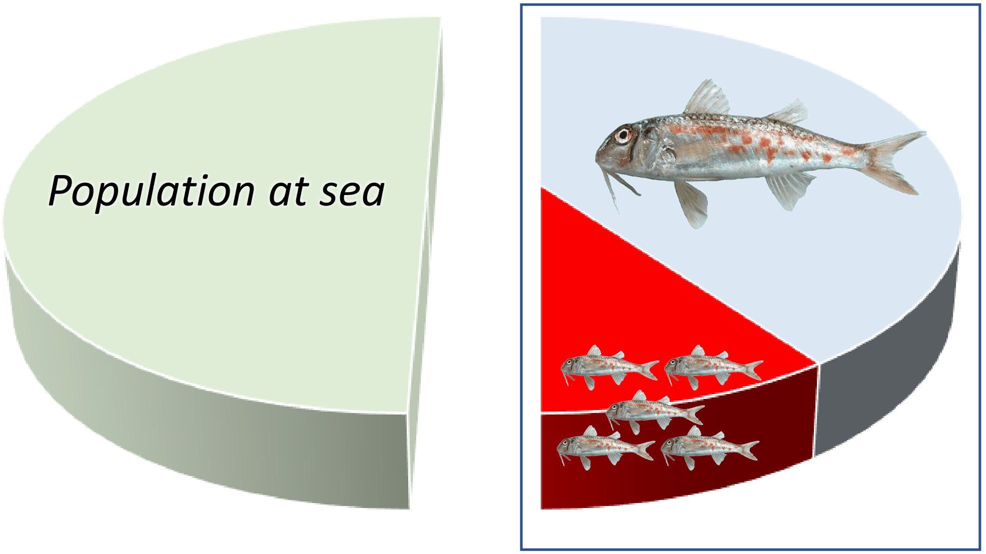
0) Landing Obligation
A) Introduction of quotas for small pelagics;
B) Reduction (relevant) of effort for bottom trawling;
C) Increased selectivity of bottom trawling (both otter and rapido trawl);
D) Combined scenarios A and C.

Best scenarios are C e D: economic losses are minimal but discard reduction is relevant. All scenarios with LO include reduction of revenues

When LO can work

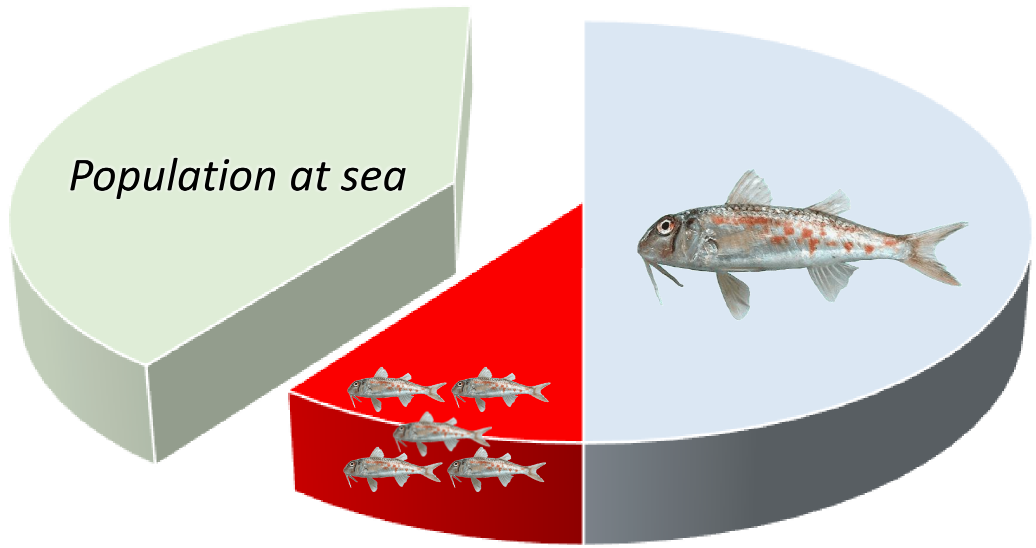
Fisheries managed by Quota system (Northern European Seas)

Quota is defined and it includes discards



Landings constant before and after Landing obligation

Fisheries managed by effort control (Mediterranan Sea)



Landings increase because of Landing Obligation

Conclusions

Introduction of the landing obligation has a series of negative effects:

- On the ecosystem (reduction of energy reclycling and increase of exports from the ecosystems): reduction of biomasses at sea;
- On the commercial landings: reduced revenues;
- On the workload: increase material to handle by fishermen;
- Even in the optimistic case in which the landed discards can be sold for fishmeal there is NO increase of profit
- Adaptation possibility (ralistic) by fishermen is limited and anyway never balancing negative effects

These conclusions have a general validity and might be even more critical in oligotrohic areas of the Med

The regulation is not going to help solvig problems of overexploitation in the Mediterranean Sea

Reduction of discards by increasing selectivity is of course a needed process

Further reading

ICES Journal of
Marine Science

ICES CIEM

ICES Journal of Marine Science (2018), doi:10.1093/icesjms/fsy069

Ecological and economic effects of the landing obligation evaluated using a quantitative ecosystem approach: a Mediterranean case study

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The reformed Common Fisheries Policy [Regulation (EU) 1380/2013] introduces the obligation to land unwanted catches gradually from 2015 to 2019 with the aim to reduce discards. The ecological and economic consequences of this controversial regulation are evaluated here using an ecosystem model for the North-Eastern Adriatic Sea to quantify the long-term stocks' biomass, landings, and fisheries revenues under future scenarios with and without landing obligation. Results indicate that landings will increase by +13%, causing an increase in fishermen workload, reduction of biomasses at sea (∼−0.20%) for species of both commercial and non-commercial interest, thus a small decrease in fisheries revenue (∼−0.50%). Selling landed unwanted catches for fishmeal production will not compensate the economic losses. Additional adaptation scenarios were tested: (i) introduction of quotas for small pelagics, (ii) reduction of effort for bottom trawlers, (iii) improvement of gear selectivity, and (iv) a combination of (i) and (iii). Improving selectivity and introducing quotas resulted the best alternative but none of the adaptation scenarios compensated the adverse effects of the landing obligation, suggesting that this management measure has ecological and economic negative effects in systems where fisheries are not regulated by quota such as the Mediterranean Sea.

Keywords: discards, ecosystem modelling, landing obligation, Mediterranean Sea, mixed fishery, quantitative assessment.

Introduction

Discards represent unwanted fisheries catches of target and non-target marine species and are a management issue in fisheries worldwide (Kelleher, 2005; Tsagarakis *et al.*, 2014). The EU included in the reformed Common Fisheries Policy [CFP; Regulation (EU) 1380/2013; EU, 2013] measures to contrast the discarding practices, in particular the so-called "landing obligation" (hereafter LO). According to this regulation the catches of species that are subjected to catch limits (quotas) or minimum conservation reference size (MCRS) shall be retained on board of fishing vessels and landed, but not used for human consumption.

For stocks regulated through the control of fisheries output, i.e. total allowable catches (TAC), the discards sum to the marketable landings in the TAC. These conditions apply to many stocks in the northern EU seas (Cardinale *et al.*, 2017) where the LO results in a strong incentive to adopt technical solutions as well as to choose fishing grounds and seasons that allow reducing the

Celić, I., Libralato, S., Scarcella, G., Raicevich, S., Marčeta, B., & Solidoro, C. (2018)

Ecological and economic effects of the landing obligation evaluated using a quantitative ecosystem approach: a Mediterranean case study.

ICES Journal of Marine Science, 75(6), 1992-2003.

FAIRSEA

Fisheries in the AdriatIc Region - a Shared Ecosystem Approach

FAIRSEA| OGS | Simone Libralato

WG MEDAC| Roma | 18 February 2020

BACKGROUND

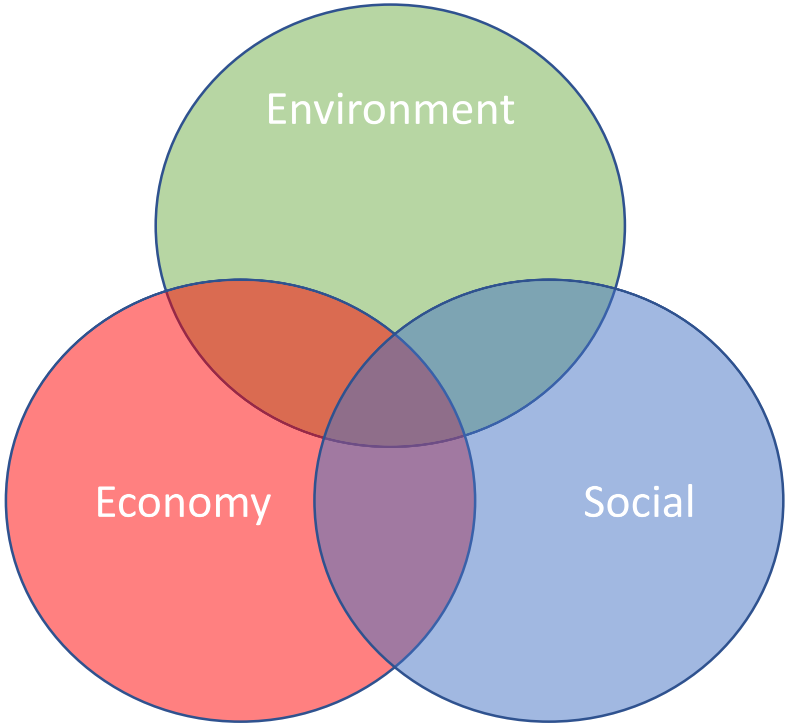
STATE OF ADRIATIC FISHERIES

- Stock assessments (STECF and SAC-GFCM) indicates critical status for assessed pelagic and demersal recourses
- Landings variability due to several factors (environmental factors, long term changes, exploitation effects, regulations, etc).
- Establishment of large Fisheries regulated area (Pomo pit)
- Multi-target multi-gear fisheries

BACKGROUND

ECOSYSTEM APPROACH TO FISHERIES

translate the economic, social and ecological policy goals and aspirations of sustainable development of EAF into operational objectives, indicators and performance measures (FAO guidelines)



“Clearly, economic and social objectives [of fisheries] will not be met while a stock is in such a depleted state that the long-term sustainability of the fishery is threatened, but equally, biological objectives are unlikely to be met without consideration being given to economic and social objectives.” Beddington et al., 2007, Science

THANKS for the attention

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale – OGS
(National Institute of Oceanography and Applied Geophysics – OGS)
Section Oceanography
ECHO Group Ecology and Computational Hydrodynamics in Oceanography

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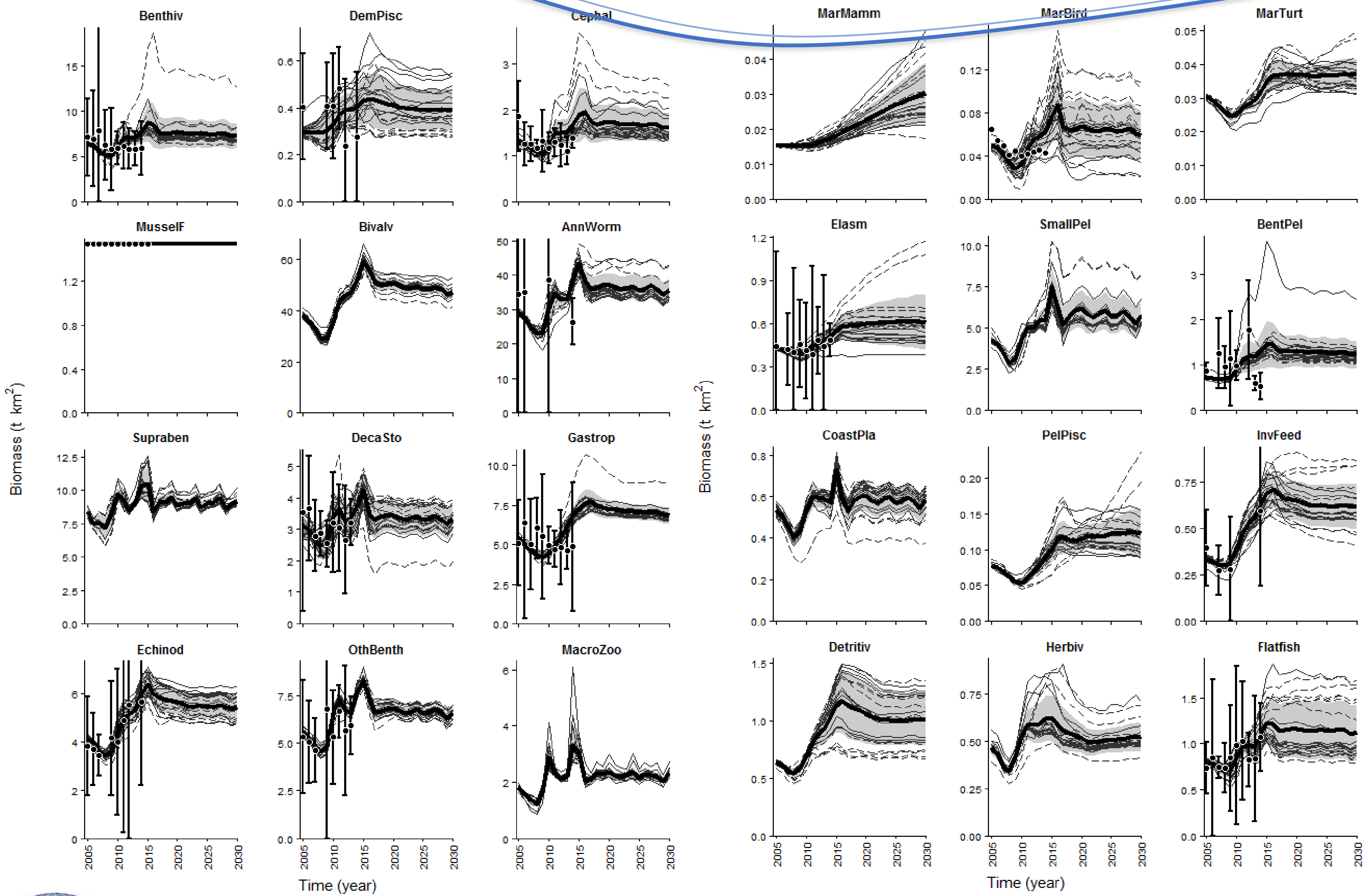
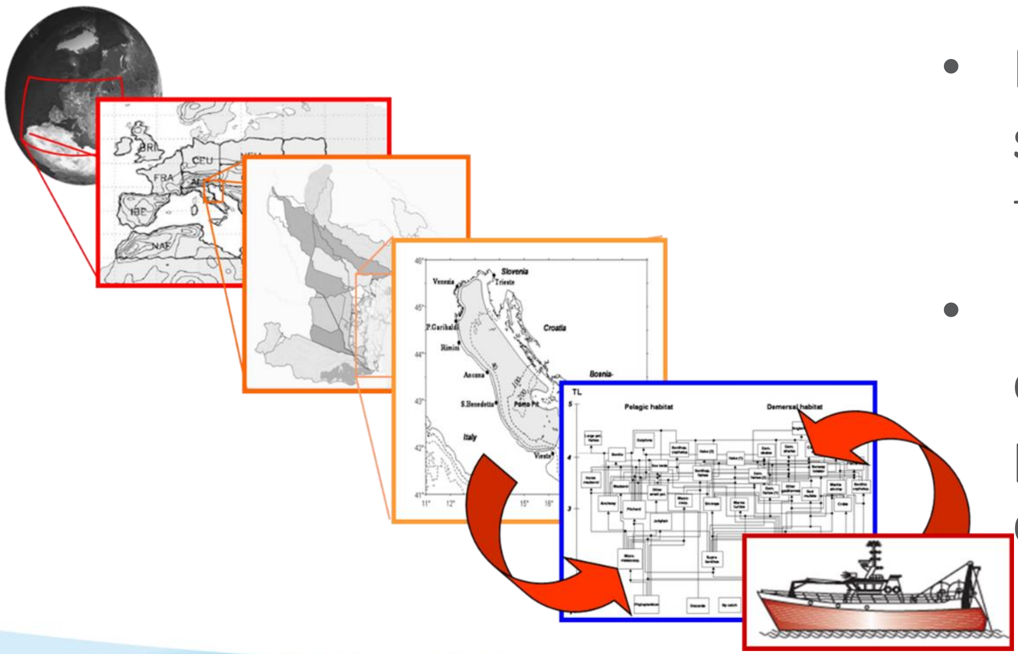
Model calibration



THE PLATFORM

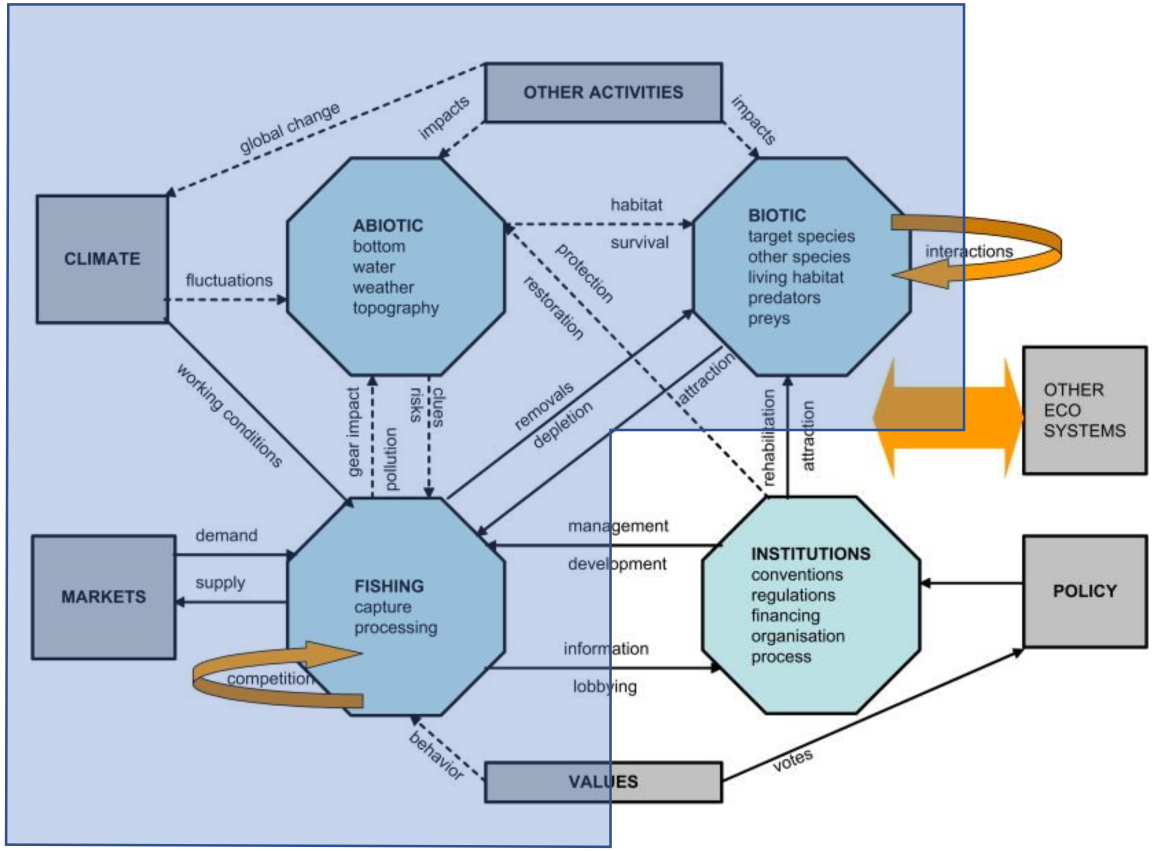
INTEGRATED DECISION SUPPORT TOOL



- **Integration of environmental variability.** Application of a transboundary and transdisciplinary approach that integrates physical, biochemical and biological processes
- **Multispecies, multigear approach**. Harmonized management can be achieved by going beyond single species and single gear approaches, and at the same time moving beyond boundaries.
- **Fisheries displacements and fisheries socioeconomic drivers** need to be included in the approach
- Moving toward an **operational application of the ecosystem approach to fisheries useful for providing advice for management plans development**

FAIRSEA RATIONALE

A SHARED ECOSYSTEM APPROACH



- **Aim:** increase fisheries productions within a sustainable framework or at least identifying ways that assure a more **economically efficient and sustainable** harvesting of marine resources
- **Method: Transboundary and transdisciplinary** development of a conceptual and applied approach that **facilitate an harmonized and optimized management.**
- **How:** developing collectively an **integrated platform** for sharing efforts, sharing data, sharing methods and test solutions. A tool **contributing to developing fisheries management plans**

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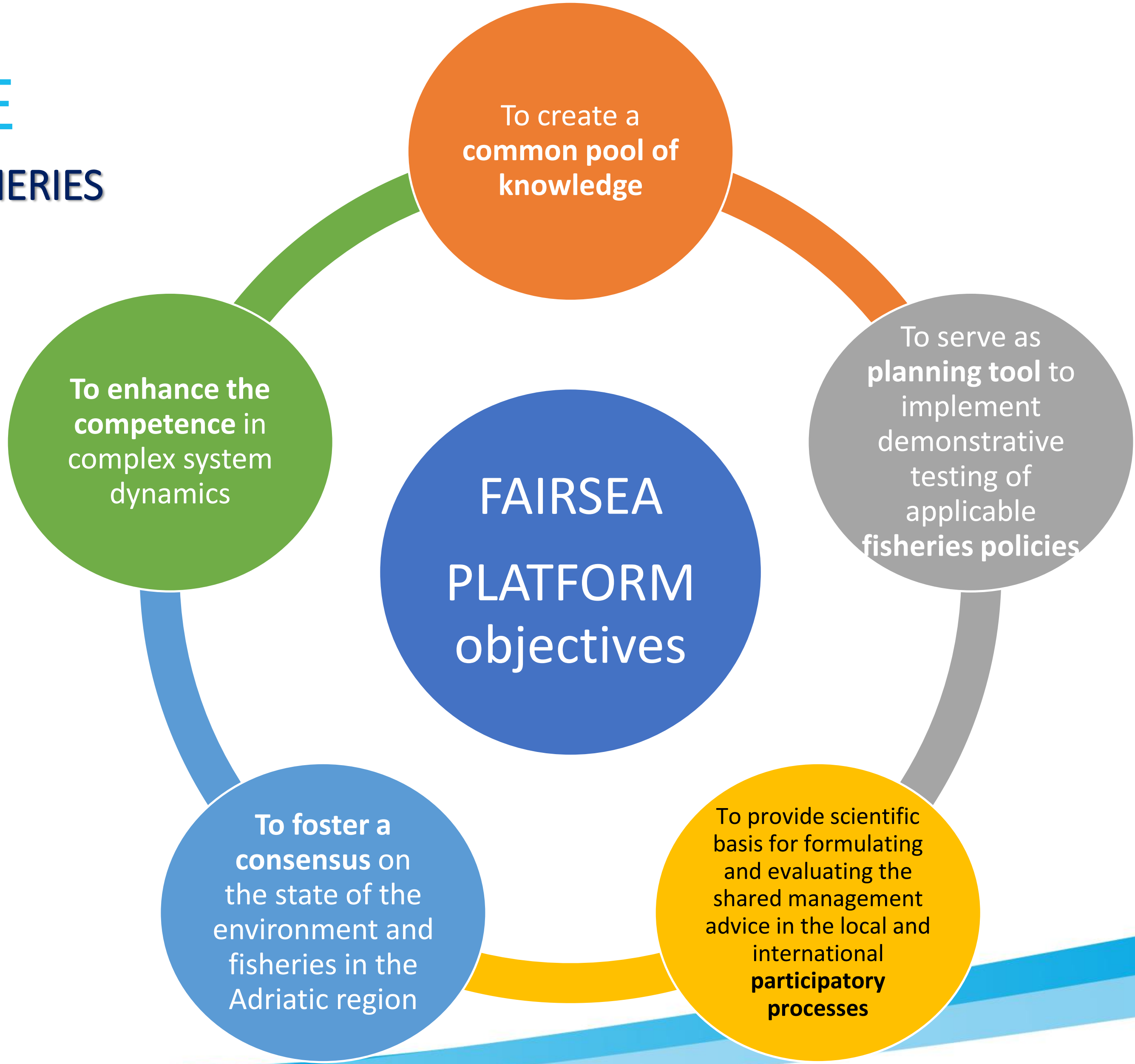
A QUANTITATIVE

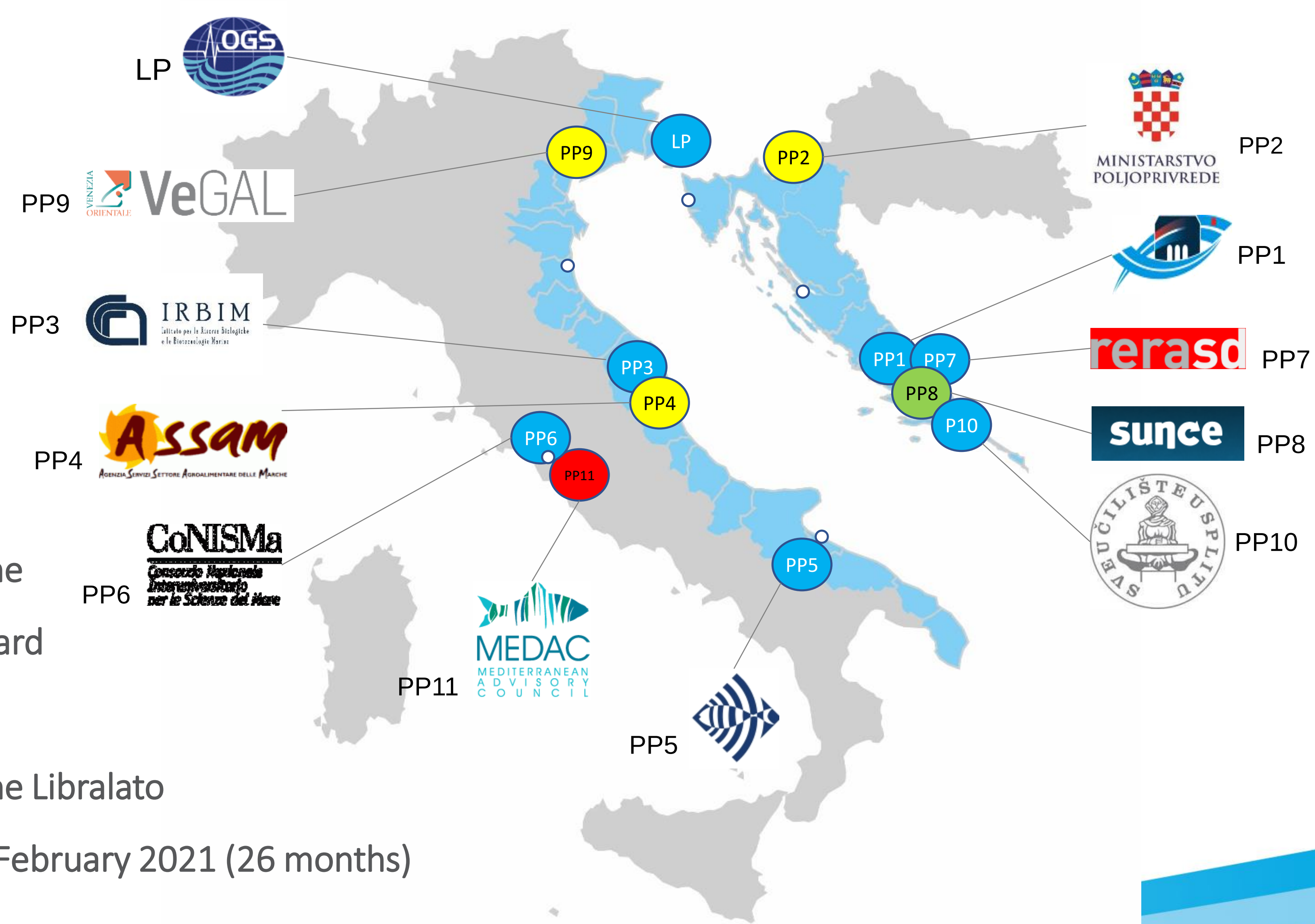
ECOSYSTEM APPROACH TO FISHERIES

The main result of FAIRSEA will be the development of an INTEGRATED PLATFORM FOR A QUANTITATIVE ECOSYSTEM APPROACH TO FISHERIES that goes across territorial boundaries and involves several disciplines.



FAIRSEA

Fisheries in the AdriatIc Region - a Shared Ecosystem Approach



2014 - 2020 Interreg V-A

Italy - Croatia CBC Programme

Call for proposal 2017 Standard

Leading partner: OGS

Scientific Responsible: Simone Libralato

Duration: January 2019 end February 2021 (26 months)

Total budget: 2.060.00,00 Euro

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FAIRSEA GENERAL OBJECTIVES

DEVELOP INTEGRATED UNDERSTANDING

- **Develop a spatially explicit science-based shared integrated platform that will constitute an innovative and applied framework in the Adriatic region for management and planning management.** The platform that will allow to share expertise, create a common pool of knowledge, boost the operational application of the ecosystem approach to fisheries, enhance the competence in complex system dynamics, foster a consensus on the state of the environment and fisheries in the region, evaluate management alternatives to support management plans.

- **Enhancing transnational capacity and cooperation** in the field of an ecosystem approach to fisheries in the Adriatic region by exchanging knowledge and **sharing good practices among partners and beyond**. The best way to reach sustainability, in fact, is **to ensure stakeholders' participation in the process** that requires time, trust, transparency and efficient steering.

GENERAL STRUCTURE

Managing, coordinating and communicating the project

WP1- Management & Coordination

WP2- Communication

WP3

Sharing and enhancing Technical capabilities

- Context analysis
- Cross border roadmap for operational EAF
- Advanced schools on EAF
- Technical events (to local/regional focal points)
- International working groups (ICES, GFCM, STECF, FAO-Adriamed, EUSAIR)

MINISTARSTVO POLJOPRIVREDE

WP4

Integrated platform

- HYDRO – water circulation & connectivity
- BGC – biogeochemical & plankton processes
- BSTAT – Distribution of resources
- FSTAT – Catches and fleets statistics
- EFFORT – Spatial distribution and dynamics
- BIOECO – Bio-economic responses
- FWM – Food web dynamics

Consiglio Nazionale delle Ricerche

WP5

Toward an applied DSS

- Stakeholder events
- Pilot actions (EAF analysis at local level: 3 areas)
- Scenarios of policy application (& climate)
- Best practices and guidelines

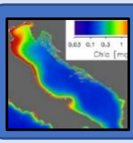
MEDAC MEDITERRANEAN ADVISORY COUNCIL

THE PLATFORM

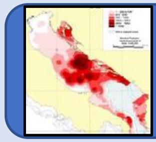
The platform will result in a spatially explicit dynamic tool integrating cornerstone elements for an ecosystem approach to fisheries

INTEGRATING PROCESSES (NOT only LAYERS)

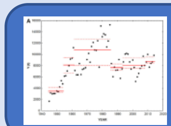
HYDRO
water circulation & connectivity



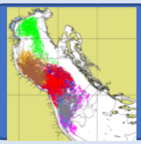
BGC
biogeochemical & plankton processes



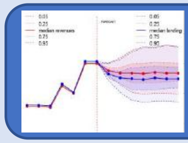
BSTAT
Distribution of resources



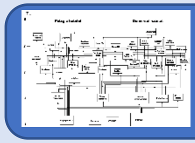
FSTAT
Catches and fleets statistics



EFFORT
Spatial distribution and dynamics



BIOECO
Bio-economic responses

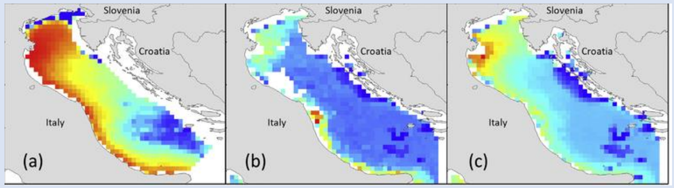


FWM
Food web dynamics

IRBIM Istituto per le Risorse Biologiche e le Biotecnologie Marine

WP4

Integrated platform



Spatio-temporal integration using modelling tool(s)

Alternative management scenarios
Supporting management plans develpment

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SHARING & ENHANCING

TECHNICAL CAPACITIES

WP4

- HYDRO – water circulation & connectivity
- BGC – biogeochemical & plankton processes
- BSTAT – Distribution of resources
- FSTAT – Catches and fleets statistics
- EFFORT – Spatial distribution and dynamics
- BIOECO – Bio-economic responses
- FWM – Food web dynamics

Integrated platform

WP3

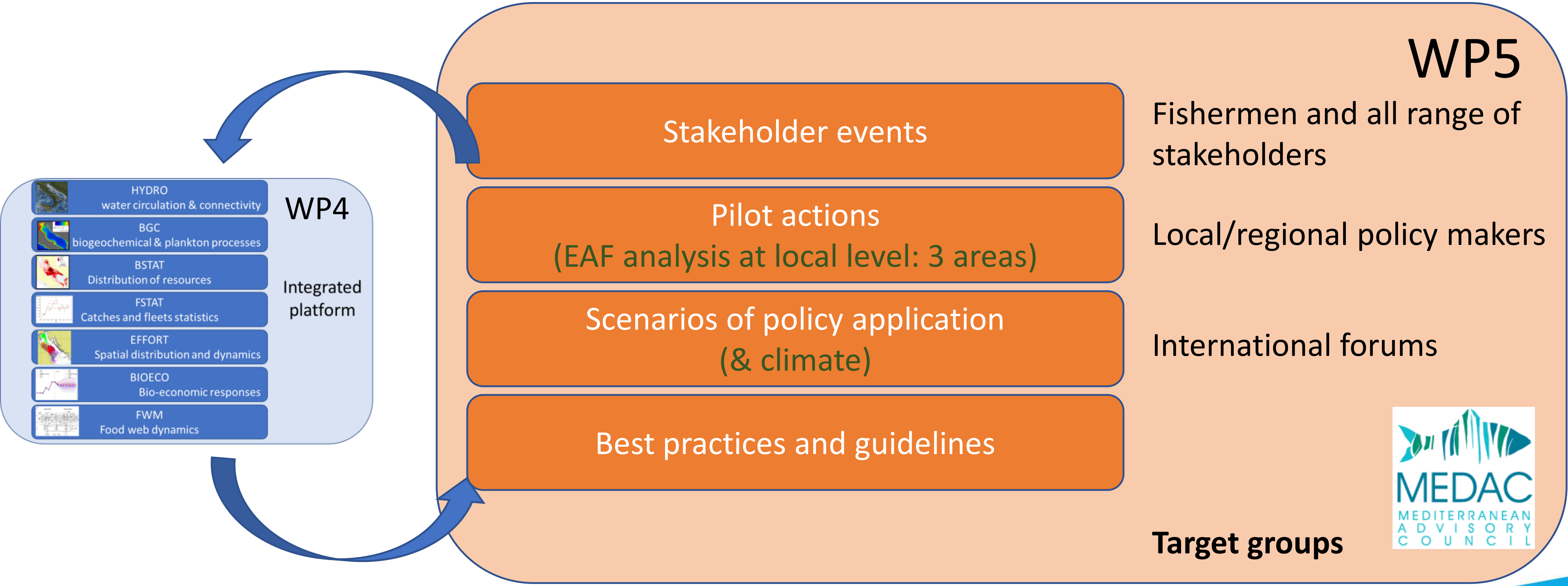
MINISTARSTVO POLJOPRIVREDE

Activity	Target groups
Context analysis	
Cross border roadmap for operational EAF	
Advanced schools on EAF	Students, PhD, researchers,
Technical events (to local/regional focal points)	Local/regional policy makers
International working groups (ICES, GFCM, STECF, FAO-Adriamed, EUSAIR)	International forum

STAKEHOLDER ENGAGEMENT

TOWARD A DECISION SUPPORT SYSTEM

to ensure stakeholders' participation (two ways) in the process



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IVORY TOWER?

NO: PARTECIPATORY APPROACH!

Developing the platform also through (your) involvement as a way to:

Share objectives to reduce the risk to make something useless;

Identify the perceived important factors to be embedded;

Decide together scenarios to test;

Evaluate results

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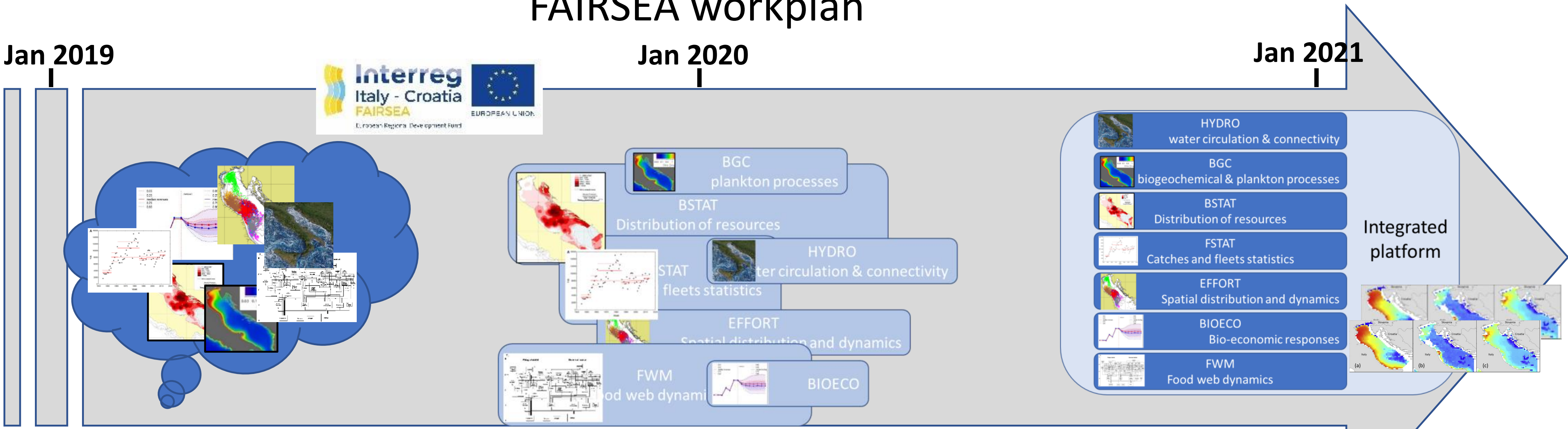
PARTECIPATORY APPROACH

The platform development can be a mutual occasion

MUTUAL BENEFIT

FAIRSEA workplan



1 Inputs on:
- General objectives
- management scenarios
- Indicators to evaluate

2 Drafting management scenarios
Quantitative ranking of Indicators

3 Evaluating scenarios and tool produced

STAKEHOLDERS

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