Training set material

WP4	**Pilot application and assessment of the econometric model for SP fisheries**
Activity 4.1	**Training and education of the Adriatic fishermen**
D.4.1.3	**Training set material**
Responsible PP	**PP5 - CONFCOOP**

OGS Istituto Nazionale di Oceanografia e di Geofisica Sperimentale

Considerazioni sui fattori ecologici che influenzano la sostenibilità dell'attività di pesca dei piccoli pelagici

Simone Libralato (slibralato@inogs.it)

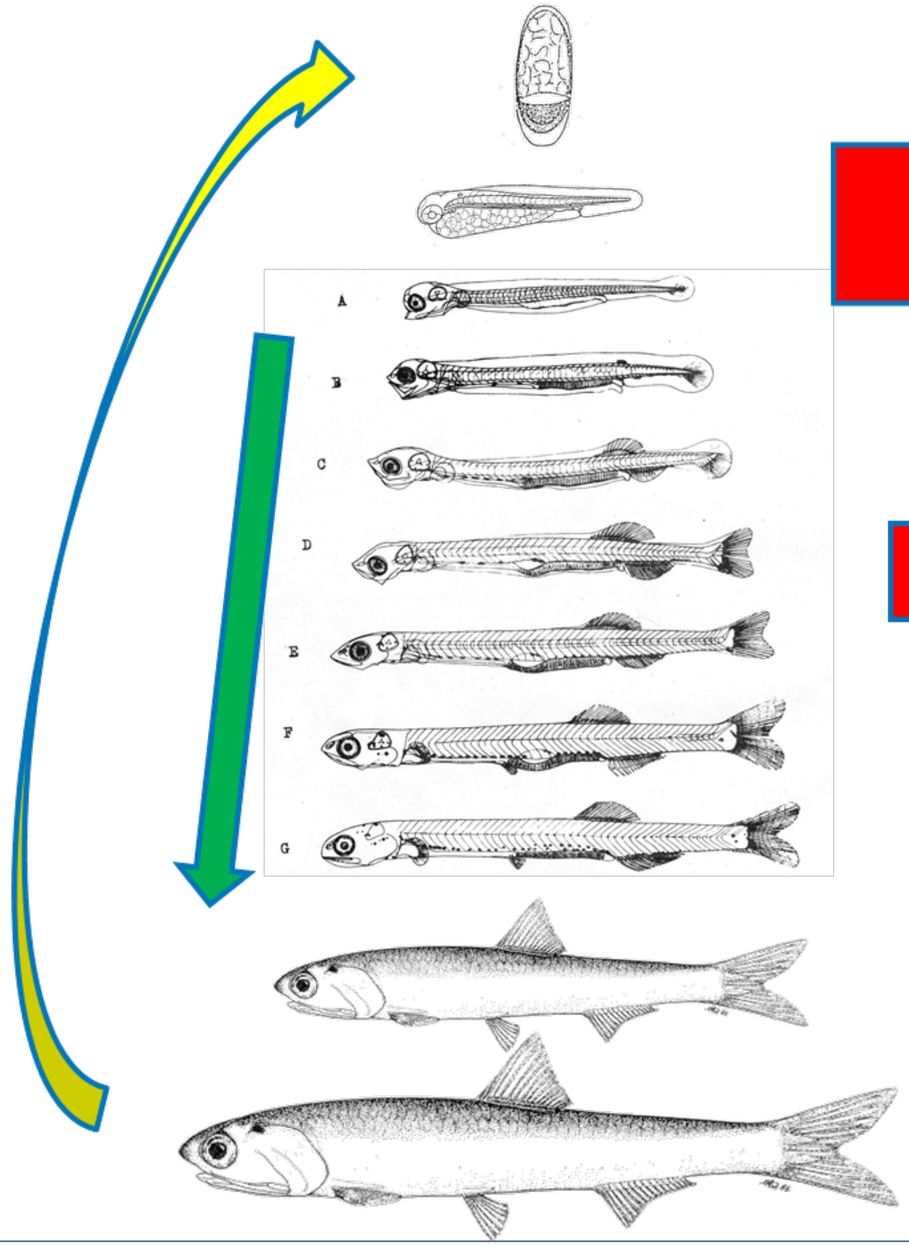
Contributo all'incontro 23 Settembre 2021
Istituzione del gruppo pilota di operatori per testare la ITACA Web APP
Progetto ITACA

Life cycle

GROWTH at all life stages >> depending on prey availability; environmental conditions;

SURVIVAL at all life stages >> depending on fisheries pressure, on predators abundance, on env conditions

RECRUITMENT >> depending on mature adults (SSB), environmental conditions

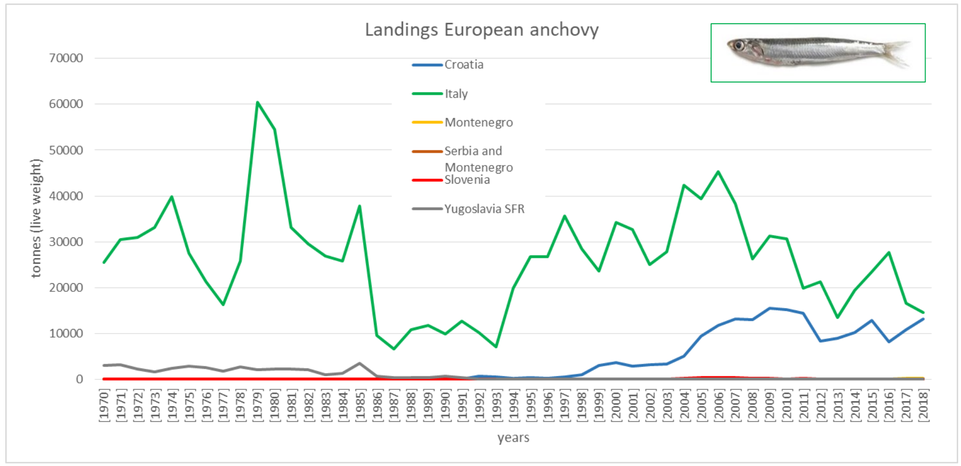


Natural mortality (senescence, predation, diseases etc)

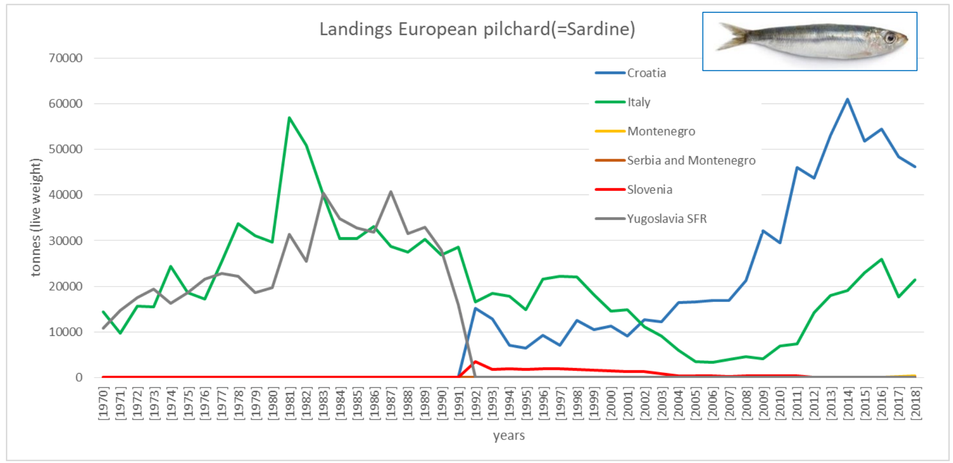
Fishing mortality

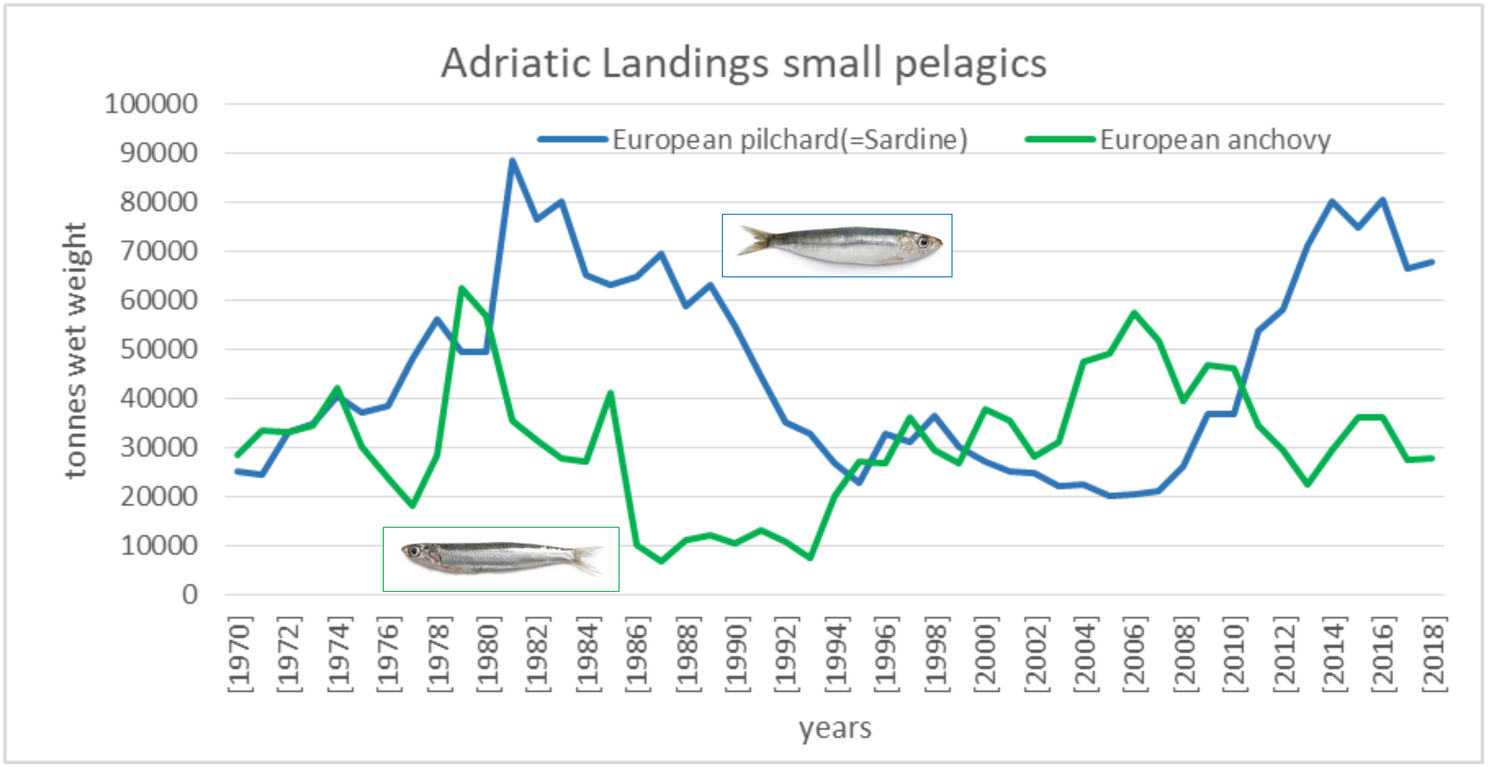
Dynamics over time in the Adriatic

European anchovy or, more commonly, **anchovy**
(*Engraulis encrasicolus*, Linnaeus, 1758)



European pilchard or, more commonly, **sardine**
(*Sardina pilchardus*, Walbaum, 1792)

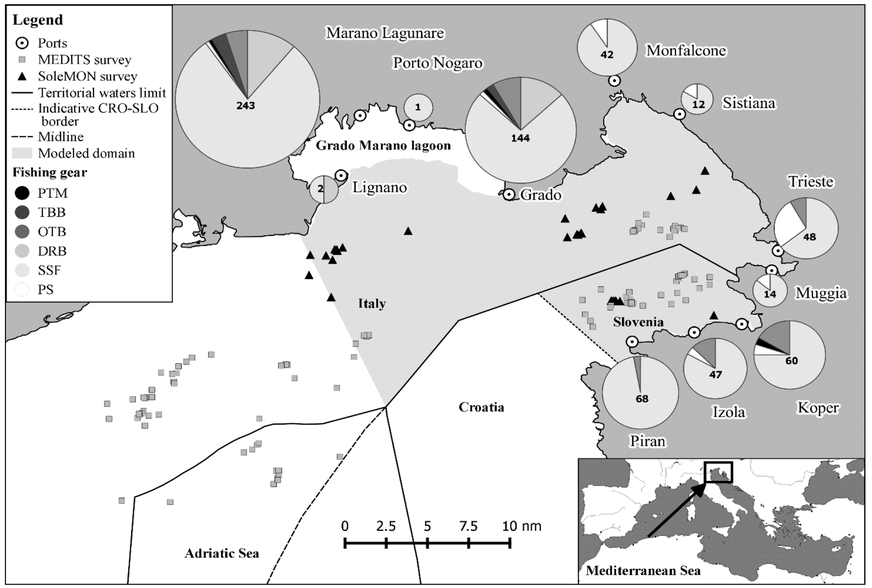


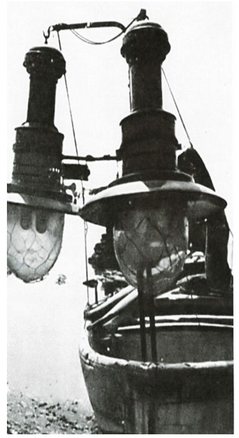


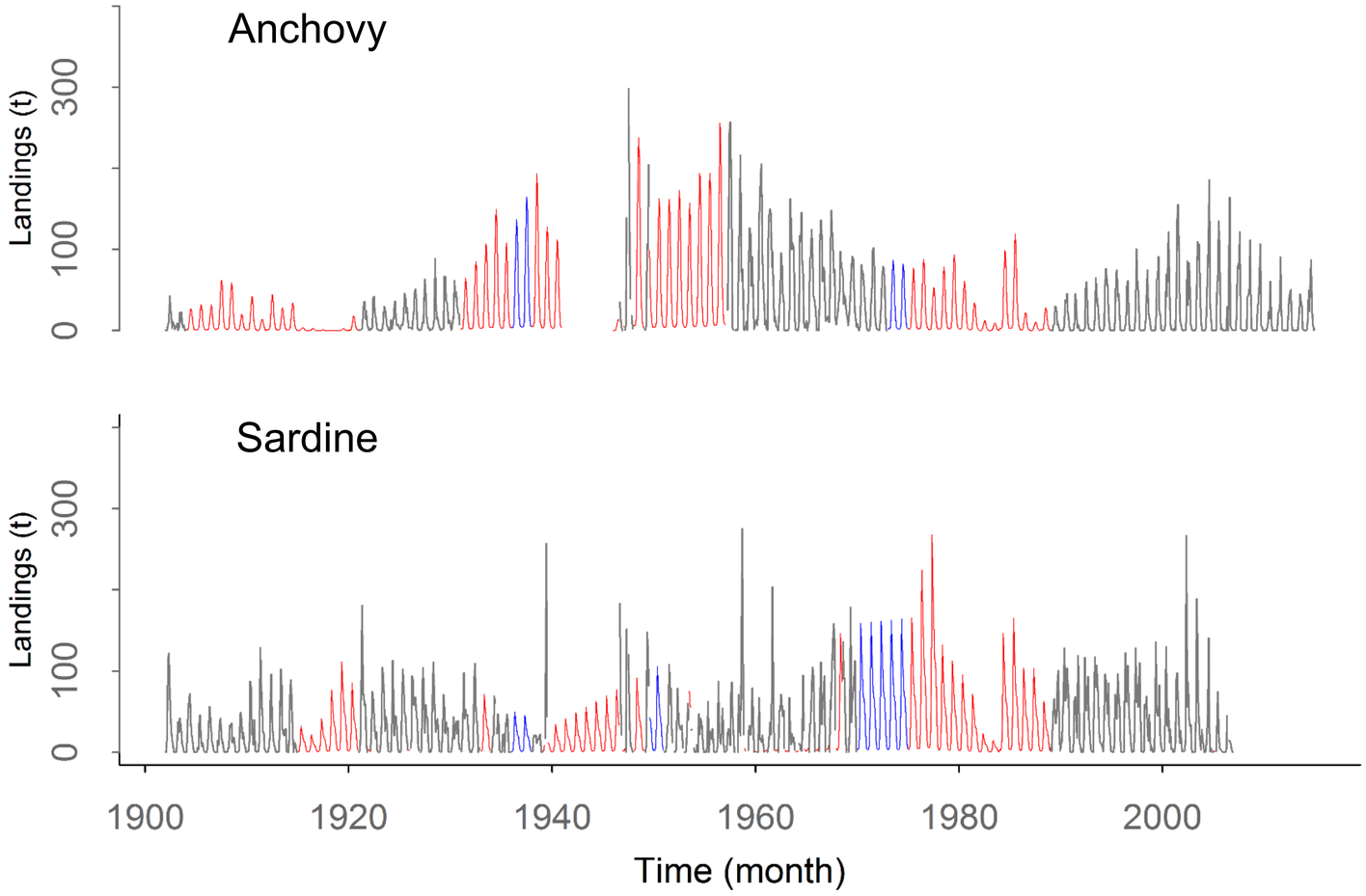
Why?

Data from: FishstatJ+ (GFCM regional database; updated 2020)

Long term changes: the case of Lampara in Trieste

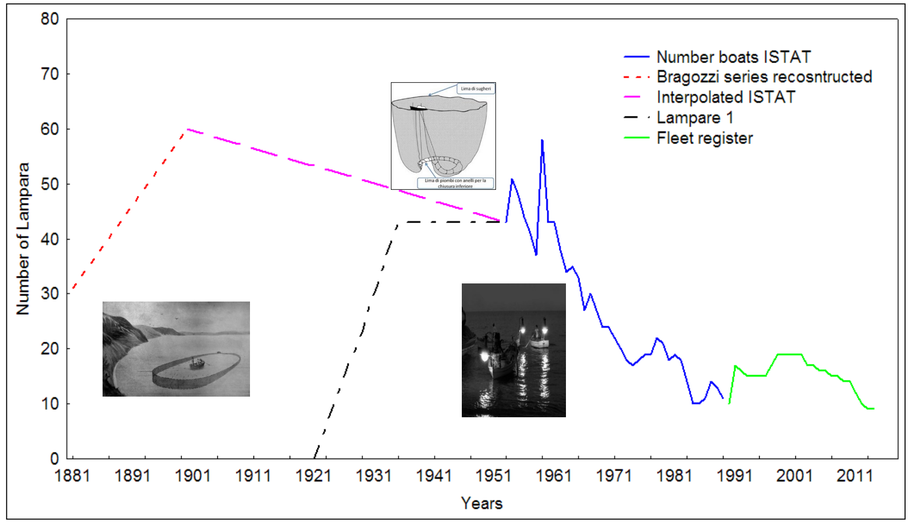




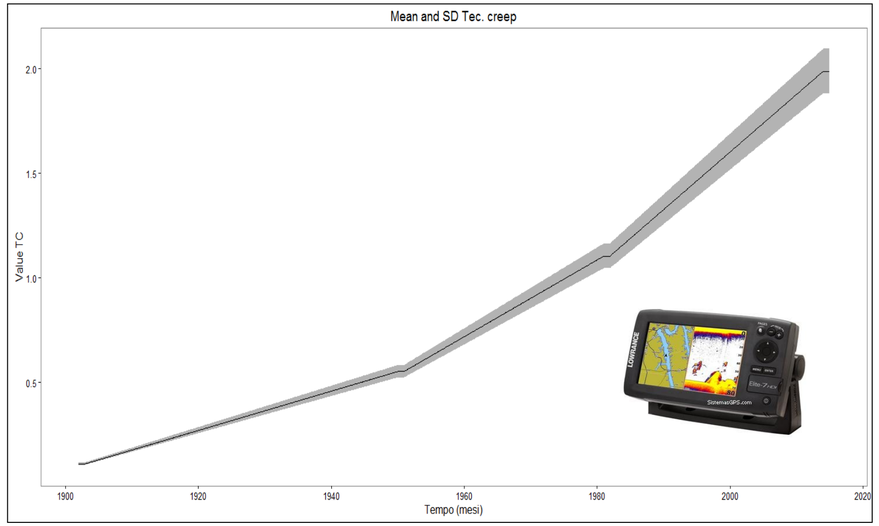


Panzeri et al., 2016

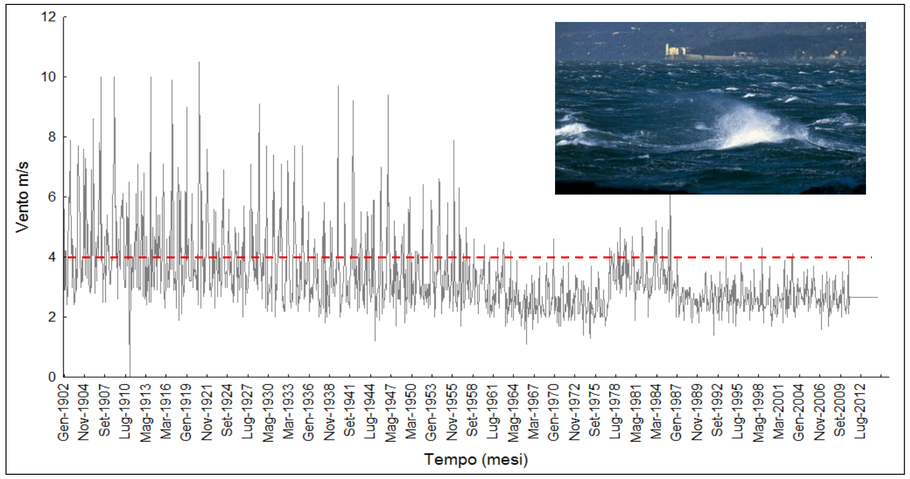
Fishing capacity [N lampara]



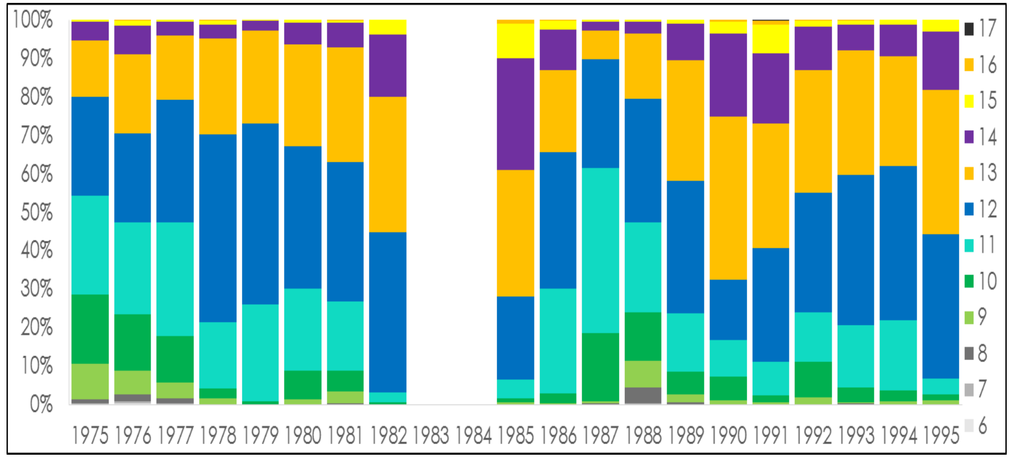
Estimated technological creep []



Wind speed [m/s]



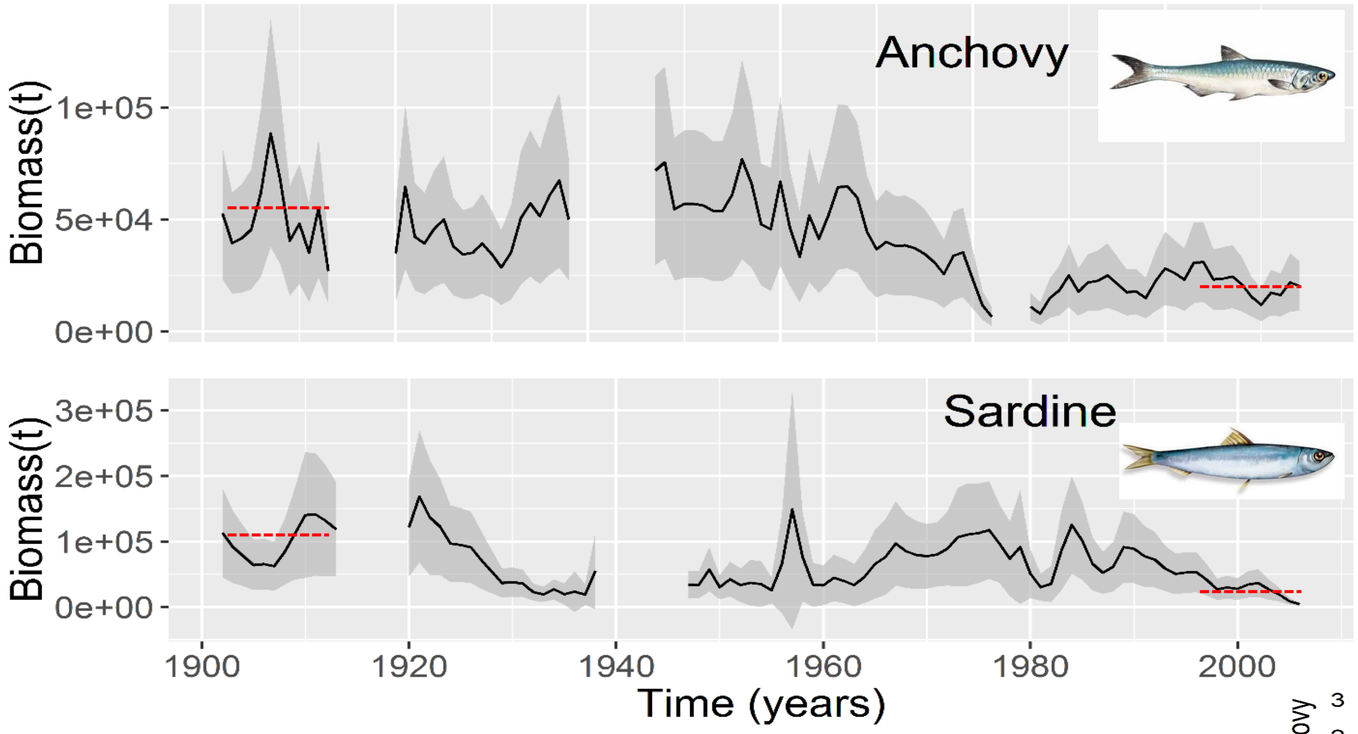
lenght [mm] classes in catches [%]

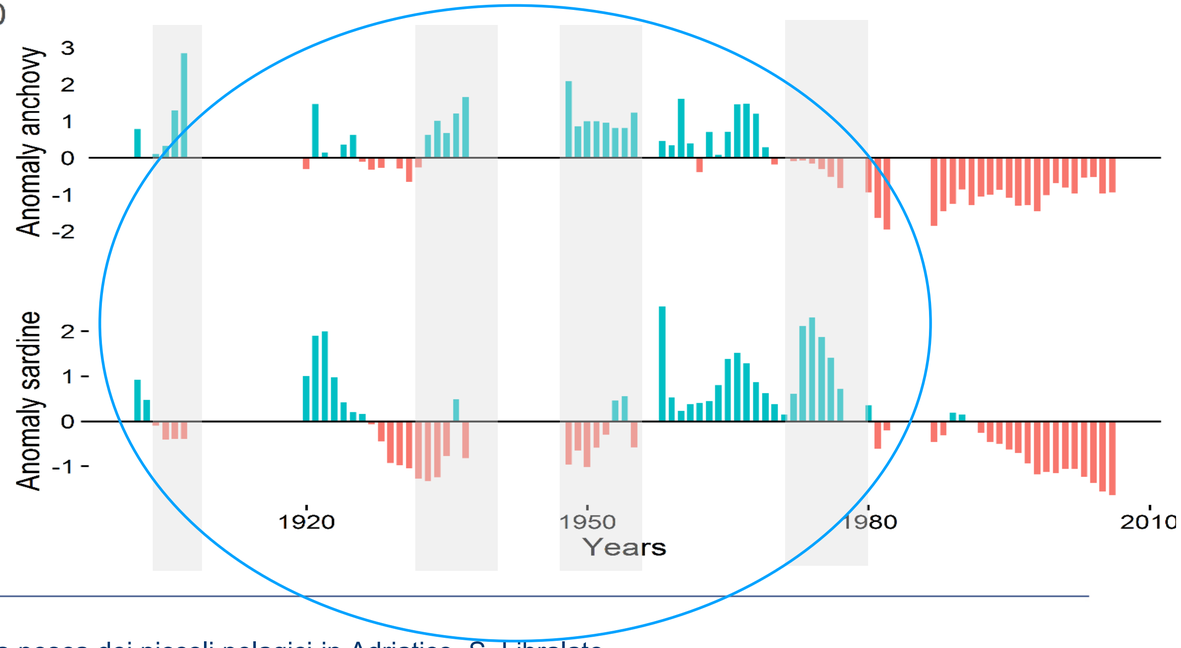


Panzeri et al., 2016

100 years reconstructions small pelagics in Adriatic

In spite of the very low contribution of the Gulf of Trieste on the overall catches of sardine and anchovy (approx. >1% of the Adriatic catches), the traditional fishing activity (basically not expanding fishing area) represent a **reliable and standardizeable sampling by accounting for other changes quantifiable through time: capacity; tech creep; wind; sizes….**

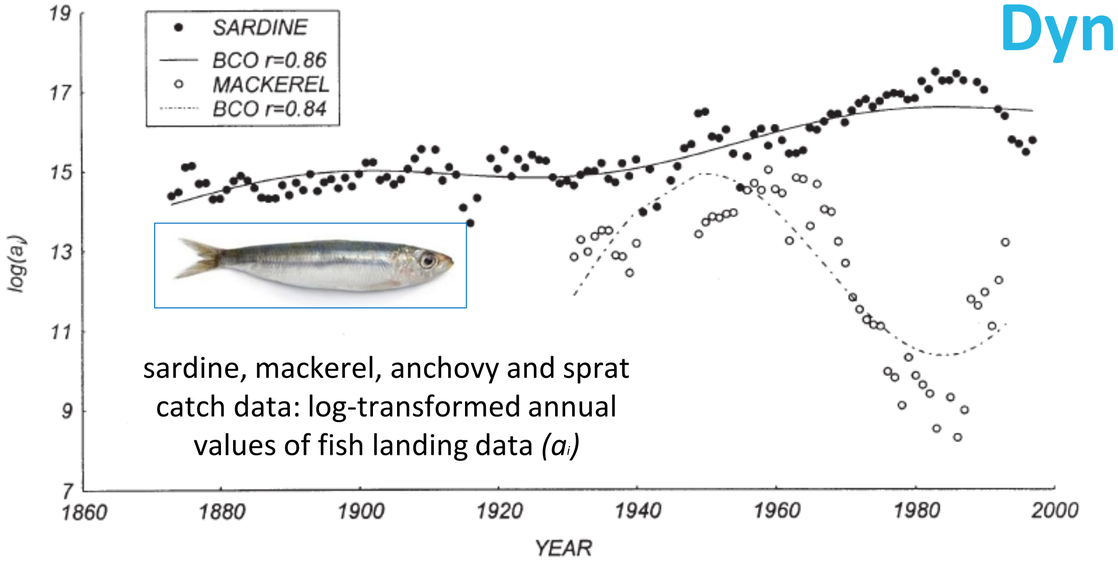




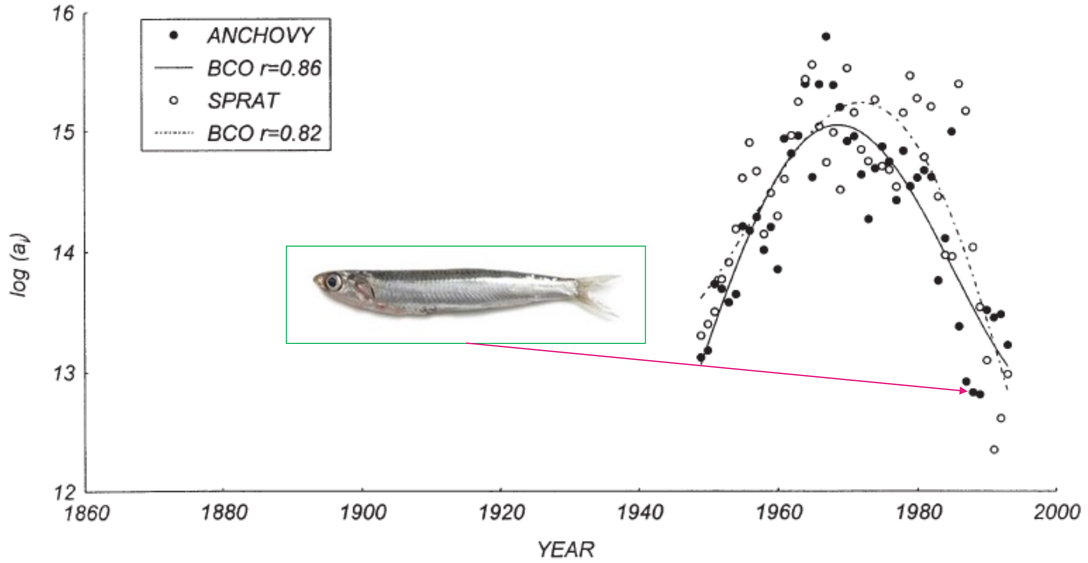
These long terms fluctuations might be induced by several factors. But note that last years the situation is quite negative (break-out of the cyclicity)

Panzeri et al., in prep

Dynamics depending on hydrographic conditions



sardine, mackerel, anchovy and sprat catch data: log-transformed annual values of fish landing data (a_i)



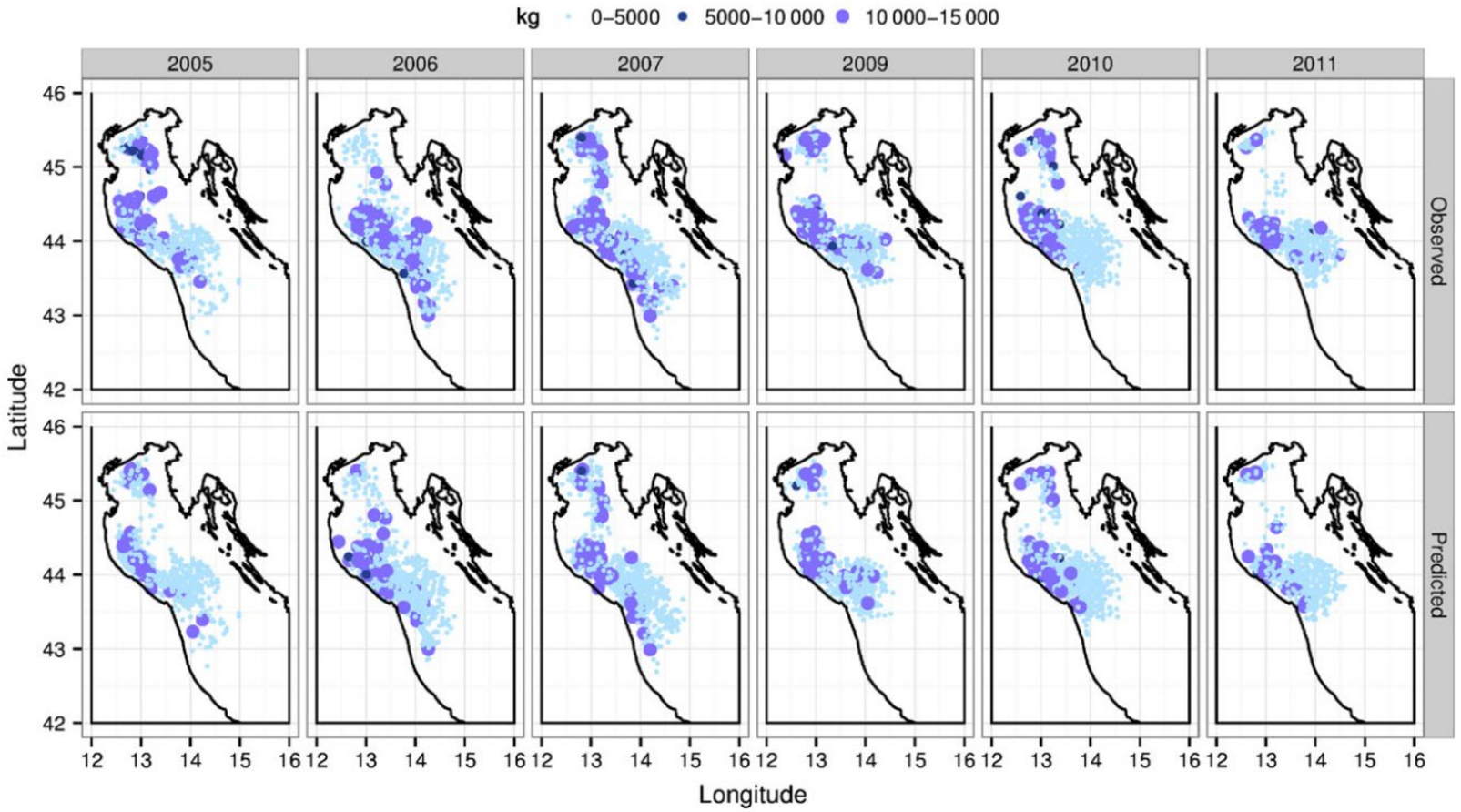
*"since these species **prefer somewhat different hydrographic conditions,** it is possible that suitable conditions for one of them means that conditions are not favourable for the other. Different responses to salinity are confirmed from the opposite sign of the correlation coefficients between the fish data (sardine and mackerel) and salinity."*

	NAO index	Pressure differences	Salinity
Sardine	0.05	0.56*	0.43*
Mackerel	−0.08	−0.19	−0.53*
Anchovy	−0.45*	0.04	0.12
Sprat	−0.52*	0.03	0.34*

"The positive pressure difference implies higher pressure over the mid Atlantic and lower pressure over the southeast Mediterranean. Such a pressure distribution is favourable for LIW formation in the eastern Mediterranean, intensified inflow of more saline LIW into the Adriatic and dense water formation in the northern Adriatic. […] Years with positive pressure differences, which are years of higher salinity, are also more productive years, considering the phytoplankton productivity.»

Grbec et al., 2003

Environmental variables influencing distribution for anchovy larvae



Data (FOOS catches)

Best GAMM model prediction

*The results indicate that **the mean depth, surface temperature and salinity gradients** are the most important predictors in the anchovy model. This means that anchovy catches increase according to these three parameters, more specifically at temperatures below 11 °C and between 14 and 22 °C, depths between 20 and 50 m and with a positive increase in the salinity gradient. Surface temperatures higher than 22 °C seem to reduce the catches of anchovy and high salinity gradients* *Carpi et al., 2015*

Spawning area and season (sardine)

Species	Area	Spawning season	Spawning peak	Temperature range (temperatures at peak spawning) (°C)	Salinity (psu)	Reference
Sardine	Split	Oct–May	Jan–Feb	10.2–20.2 (10.2–12.4)	35.2–37.0	Gamulin 1940
	Central Adriatic	Winter				Mužinić 1954
	Northern and central Adriatic	Oct–May				Gamulin & Karlovac 1956
	Central Adriatic	Oct–Apr	Dec–Feb	(13–16)	37–38	Gamulin & Karlovac 1957
	Vlora bay, Seman-Viase bay, Sazan Island (Albania)	Nov–Feb	Dec & Feb	12–20	37.5–38.5	Rakaj 1962
	Central Adriatic	Nov–Apr		11.9–19.4	37.1–38.8	Karlovac 1969a
	Central Adriatic	Oct–May	Mar	13.1–18.0	38–38.5	Karlovac 1969b
	Central Adriatic	Sept–May				Vučetić 1971
	Central Adriatic	Oct–April	Jan			Vučetić 1975
	Kvarner, Susak and Dugi Otok	Nov–June	Nov & Apr	11.6–11.7	38.1–38.2	Teskeredžić 1978
	Northern and central Adriatic (Trieste-Gargano)			8.4–14.7 (12.1–13.9)	37.6–38.8	Regner et al. 1987
	Southern Adriatic (Gargano-Otranto)	Oct–May	Oct & Dec			Casavola et al. 1998
	Northern and central Adriatic (Trieste-Gargano)			9–15 (11–15)		Regner et al. 1988
	Albania (2003)	Sept–Apr				Kolitari 2006
	Albania (2004)	Oct–Apr				Kolitari 2006
	Albania (2005)	Oct–Apr				Kolitari 2006

Spawning, in the Adriatic Sea, has been reported to ***take place between 9 and 20°C at salinities ranging from 35.2 to 38.8 psu****[…] at depths between 30 and 150 m although more typically between 60 and 120 m*

spawning takes place mainly in winter, generally between October and May

[…] two main spawning grounds in the Adriatic Sea: the northern Adriatic off the Dugi Otok Island and the southern Adriatic around the exterior of the mid-Dalmatian Islands and extending offshore to Palagruža. […] despite food being of major importance for post-larval development and survival, all sardine spawning grounds mentioned are located within the least productive […] Sardine spawning areas, located at depths ranging from 10 to 20 m, coincided with the boundaries of these frontal zones produced by the upwelling and in both cases […]

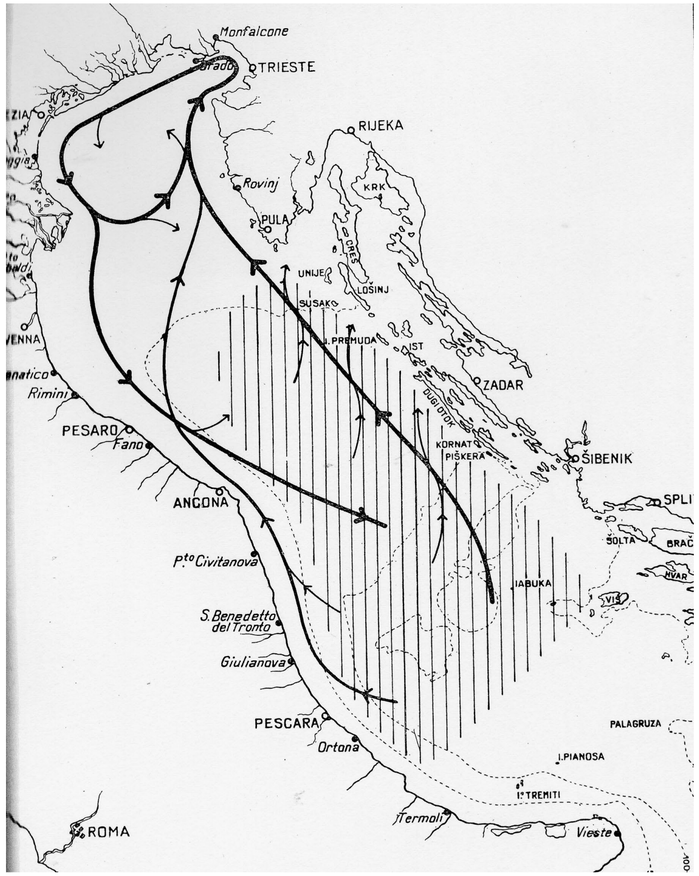
Piccinetti, 1970; Morello & Arneri, 2009

Spawning area and season (anchovy)

Species	Area	Spawning season	Spawning peak	Temperature range (temperatures at peak spawning) (°C)	Salinity (psu)	Reference
Anchovy	Northern Adriatic	Summer				Syrski 1876
	Northern Adriatic	Summer				Graeffe 1888
	Northern Adriatic	Apr–Oct				Steuer 1910
	Northern Adriatic	June–Sept				Stiasny 1910
	Central Adriatic (mid-Dalmatian islands)	Apr–Aug	May, July, Aug			Gamulin 1940
	Mljet Island	May–Sept		13–27		Vučetić 1957
	Northern and central Adriatic	Apr–Oct	May, Aug–Sept			Varagnolo 1964a
	Dugi Otok Island	May–Sept	June			Vučetić 1964
	Istria	May–Sept				Zavodnik 1969
	Northern Adriatic	Apr–Oct	June–July	11.6–27.5 (22)	9.1–38.5	Zavodnik 1970
	Northern Adriatic	May–Sept	July–Aug			Štirn 1969, 1970
	Central Adriatic (mid-Dalmatian Islands)	May–Sept	May–June			Vučetić 1971
	Central Adriatic (mid-Dalmatian Islands)	Mar–Nov	June–July	13.2–23.7 (18.3–22.1)	33.86–38.69	Regner 1972
	Gulf of Trieste	Apr–Oct	July			Specchi & Furlan 1974
	Central Adriatic	Late spring and summer	Aug			Sinovčić 1978
	Gulf of Trieste	Apr–Oct	May–June, Aug			Di Marcotullio & Catolla Eulambio Di Marcotullio 1983
	Northern and central Adriatic	Apr–Oct	June–Sept			Regner et al. 1985
	South-western Adriatic	Apr–Oct				Casavola et al. 1987
	Gulf of Trieste	Apr–Oct	Aug	12–28 (21–28)		Orlandi et al. 1994
	Fano	Apr–Oct	July	12–26 (25–26)		Orlandi et al., 1994
	South-western Adriatic	May–Sept	Aug			Casavola et al. 1996a
	South-western Adriatic	Apr–Oct	July–Sept			Marano et al. 1998
	Miramare (Trieste)	May–Sept	July	>17 (21–28)		Specchi et al. 1998
	Inshore coastal waters (Kastela bay)	Apr–Oct	Aug			Sinovčić 2000b
	Open waters (Vis & Bisevo Islands)	March–Oct	July			Sinovčić 2000b
	Albania (2003)	Apr–Oct				Kolitari 2006
	Albania (2004)	May–Oct				Kolitari 2006
	Albania (2005)	May–Oct				Kolitari 2006

In contrast to sardine, anchovy spawning takes place in the warmer months, generally between April and October

Migration routes of anchovy in the Adriatic Sea Dashed area is main the winter resting area Anchovy adults migrate from the deeper overwintering waters to shallower coastal areas forspawning (Sinovčić 2000b) and similar migrations have been reported for the Black Sea (Majarova & Chugunova 1954, Demir 1963).



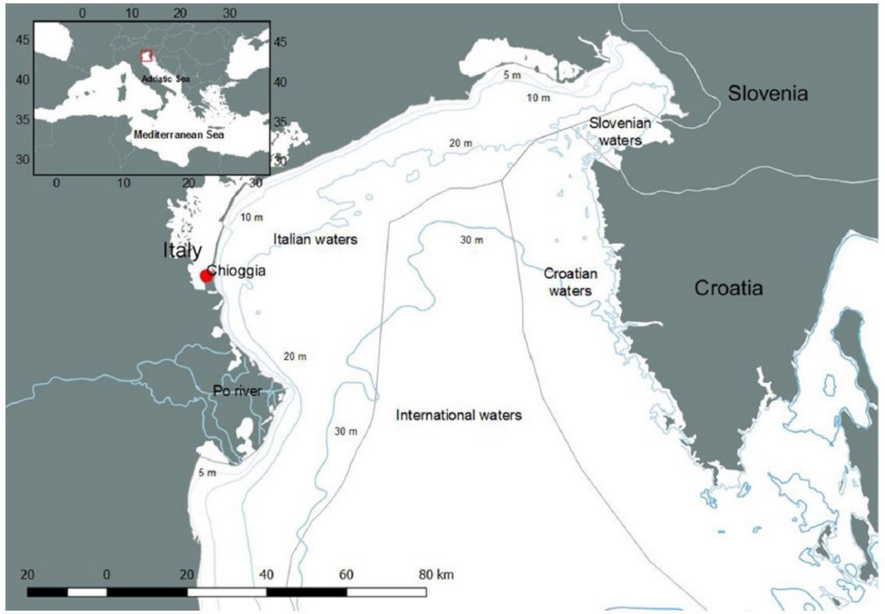
*The presence of **anchovy eggs in the Adriatic has been reported at temperatures between 11.6 and 28°C, and at salinities ranging from 9.1 to 38.7 psu (Table 1).** Spawning peaks occur at the higher temperatures in the range, between 18 and 28°C (Table 1) whereas egg density is inversely proportional to salinity (Zavodnik 1970).*

Piccinetti, 2001

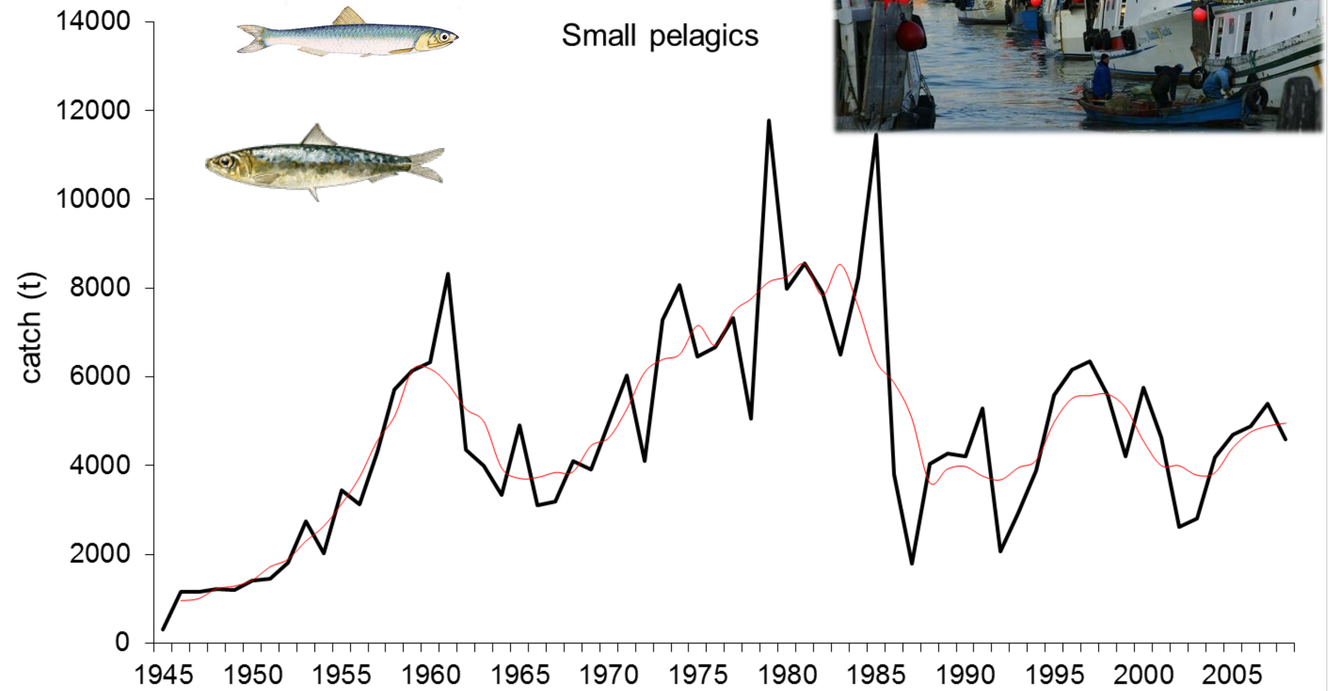
Piccinetti, 1970; Morello & Arneri, 2009

Importance of hydrodynamics, but… That's all?

Analysis of long term landing data (Chioggia)

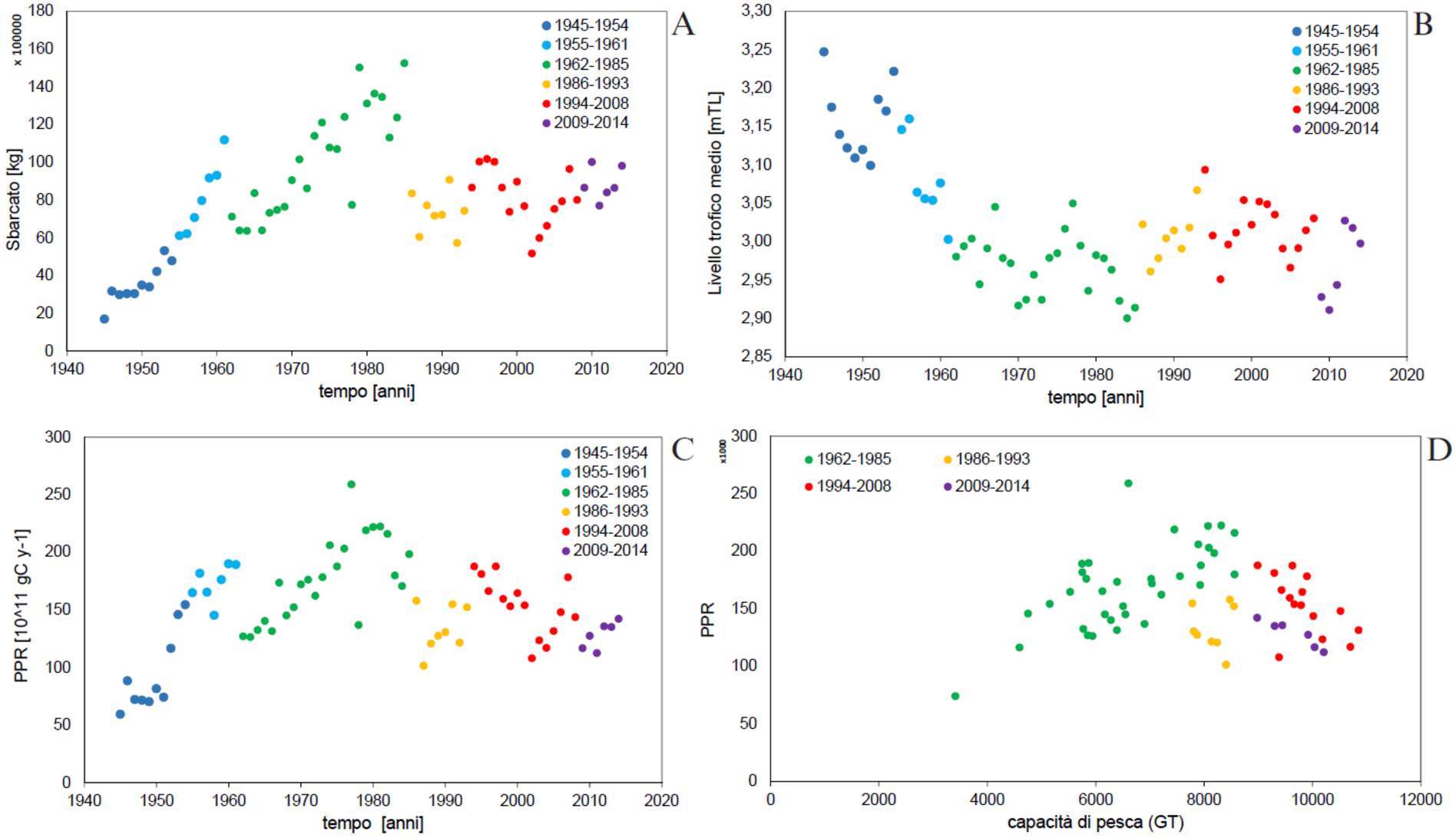


Disaggregated (by species) landings from the main fishing port of the Northern Adriatic (Chioggia) online, with data starting from 1945 up to now



Fortibuoni et al., 2017

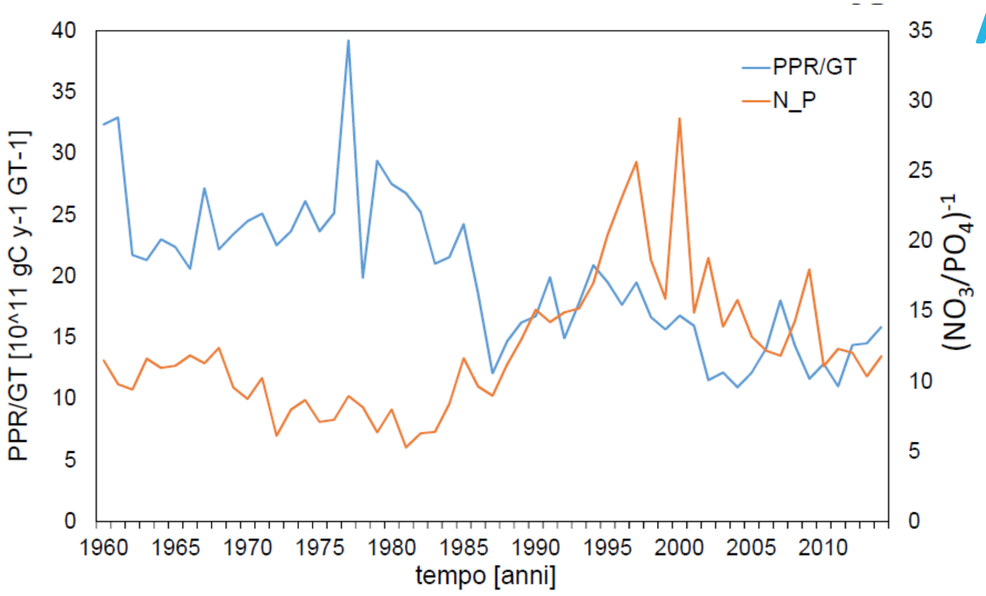
Analysis of long term landing data (Chioggia)



Primary production required (PPR) is a good way to synthesize all catch data (kg) into a common and compareable unit (gC needed to build such catched biomass)

Fortibuoni et al., 2017; Libralato et al., 2019

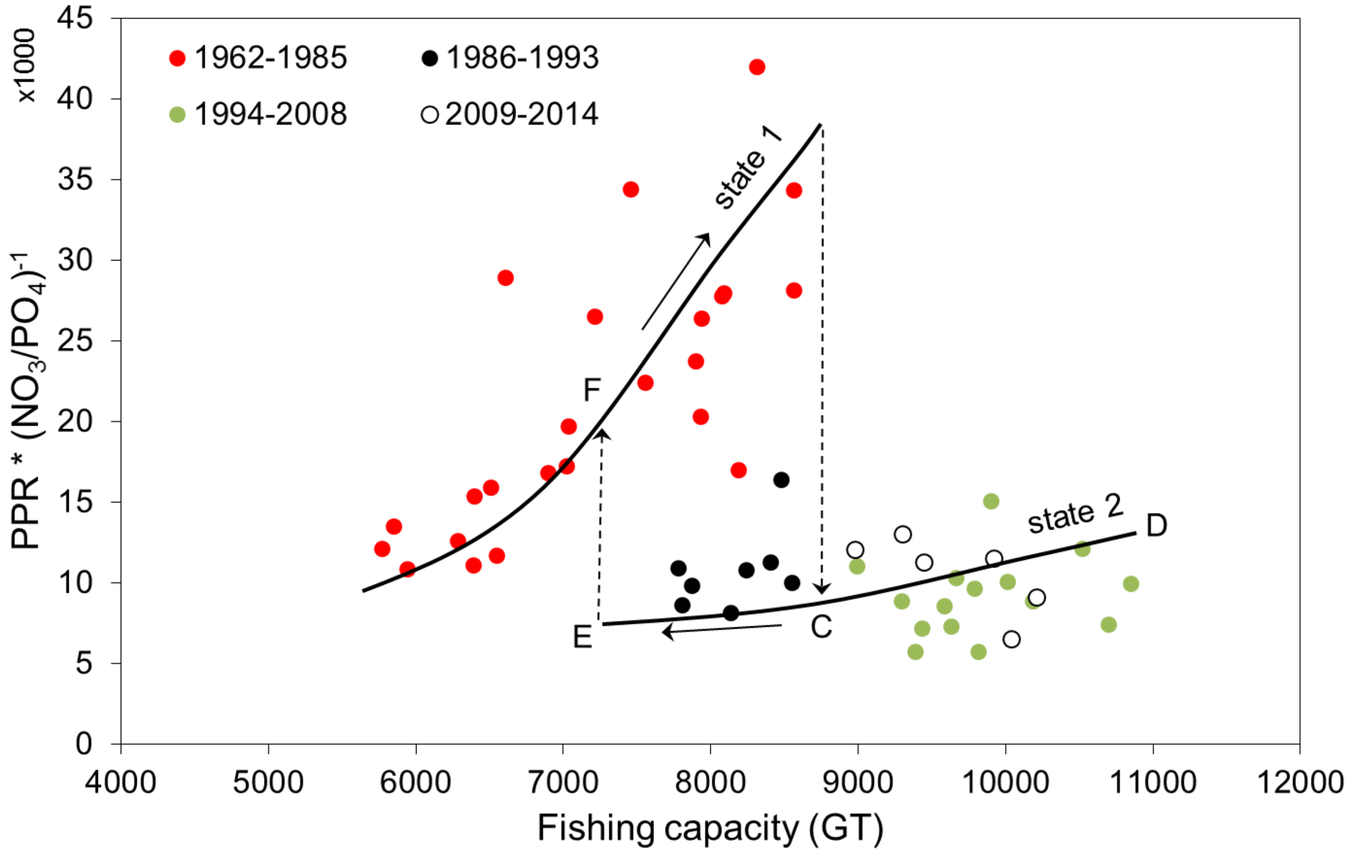
Analysis of long term landing data (Chioggia)



Hysteresis pattern highlight the presence of fundamental factors that resulted in ecosystem shift

The natural systems are not simply reverible.

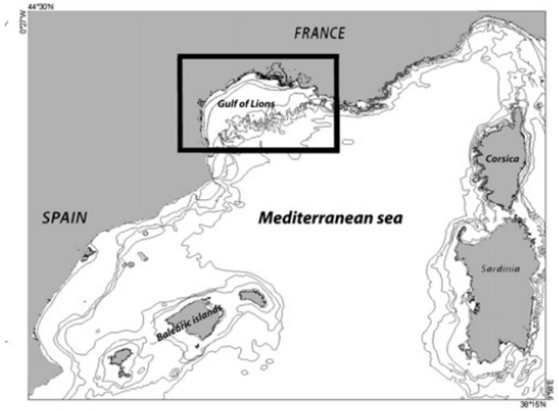
Last 30 years is a «*different story*» than periods before: **and this is the only part we can see with modern scientific data**



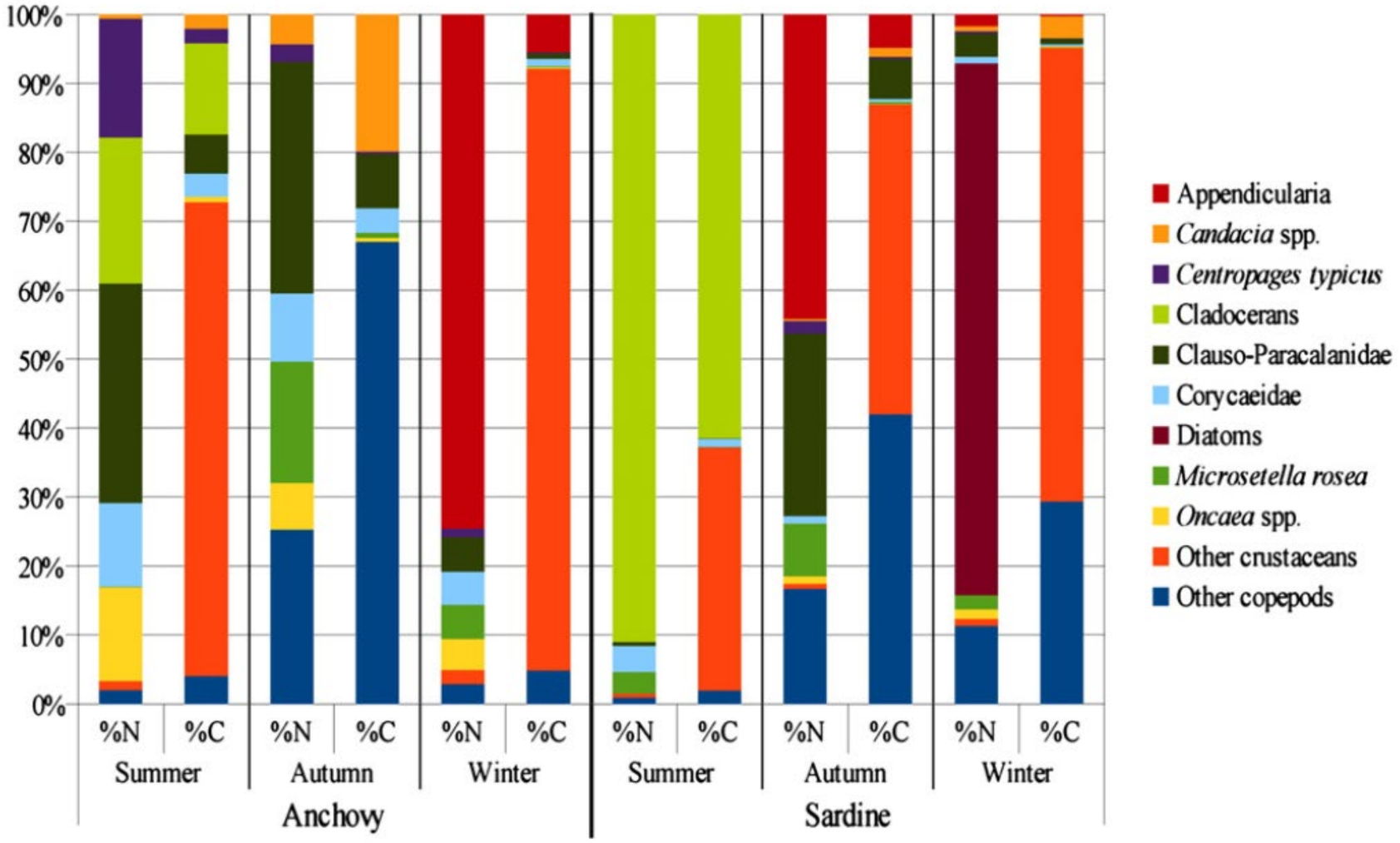
Nutrient discharged are connected to the primary productivity of the sea, on which depends zooplankton…

Fortibuoni et al., 2017; Libralato et al., 2019

Feeding preferences



Prey in the stomachs of juvenile anchovy and sardine, in percentages of number (%N) and of carbon content (%C).

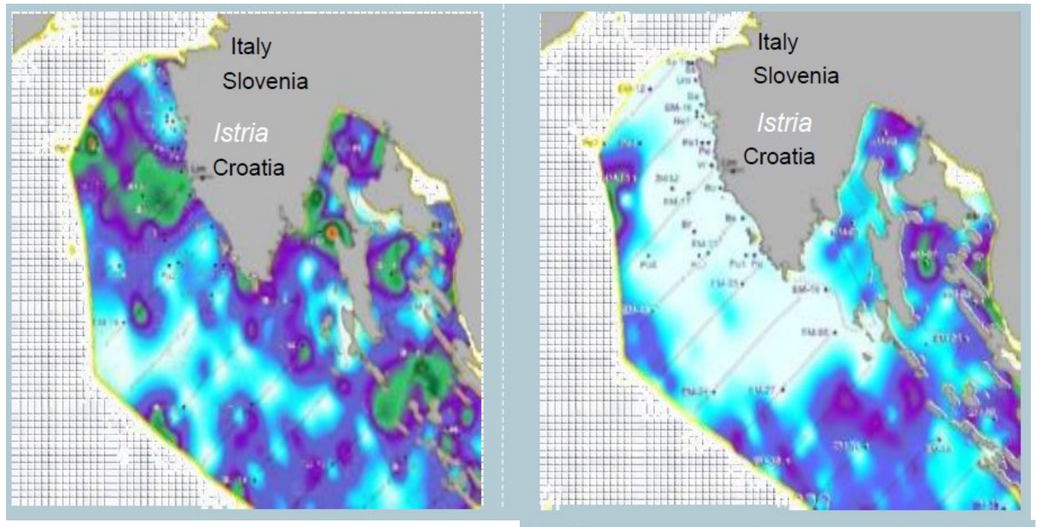


Costalago et al., 2014

Other disturbing factors: Competition with invasive species

Sept 2015

Sept 2017

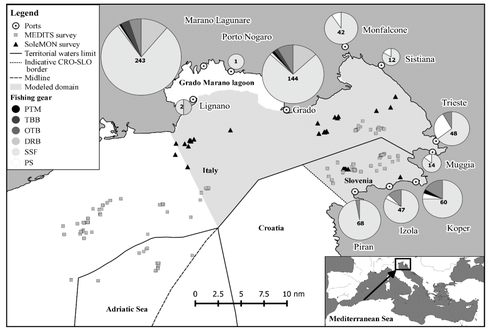


Anchovy (echosurvey)

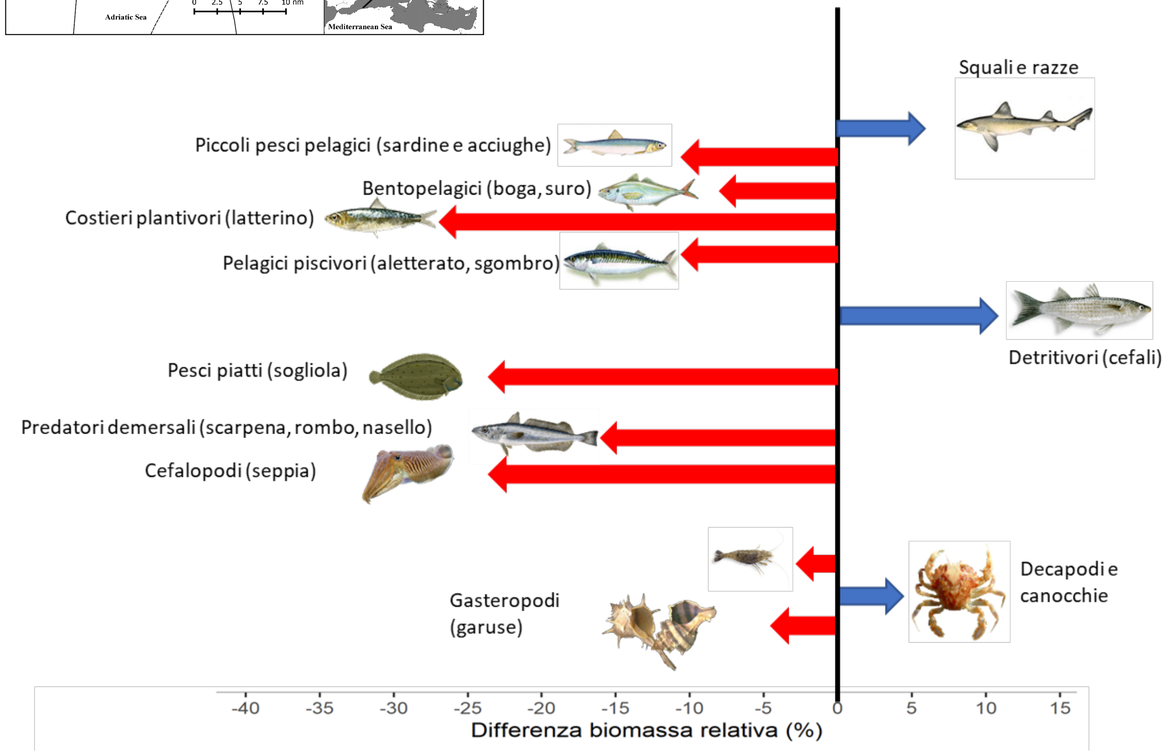
Mnemiopsis leydi, september 2017

Shiganova et al., 2019; Paliaga et al., 2019

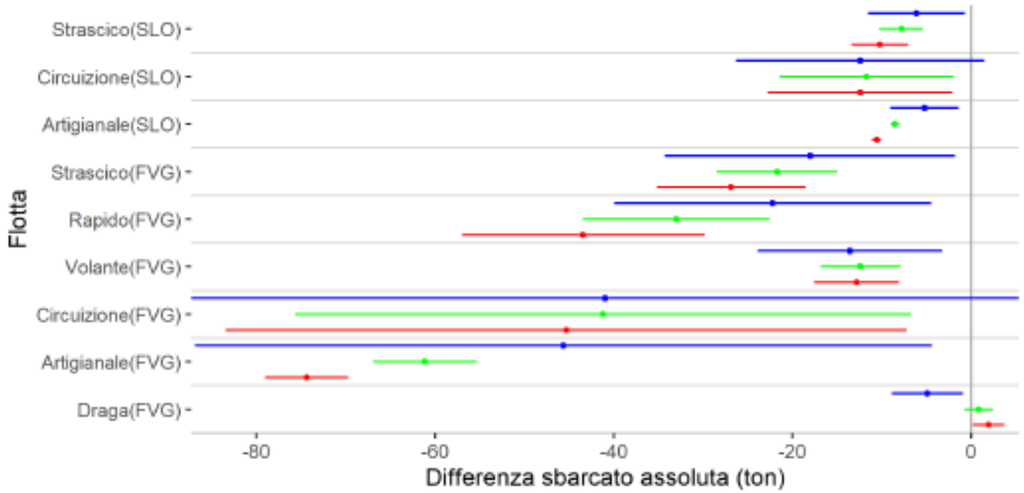
Scenarios of invasion using modelling approach



Changes in Biomass at sea after introduction of Mnemiopsis

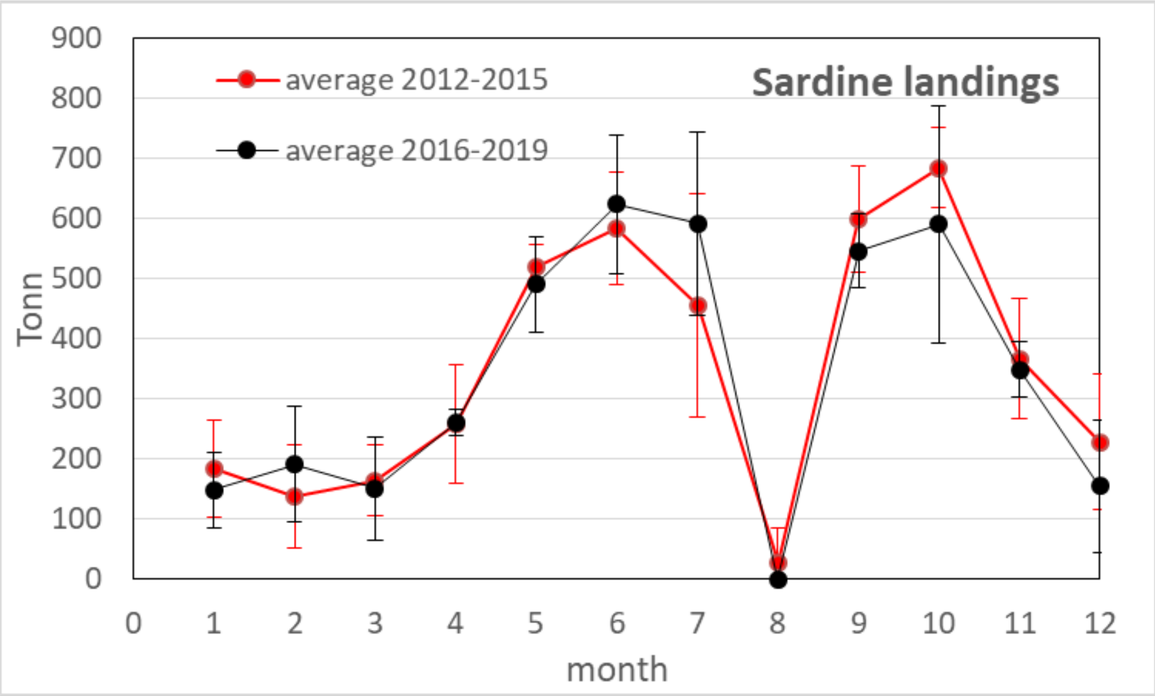


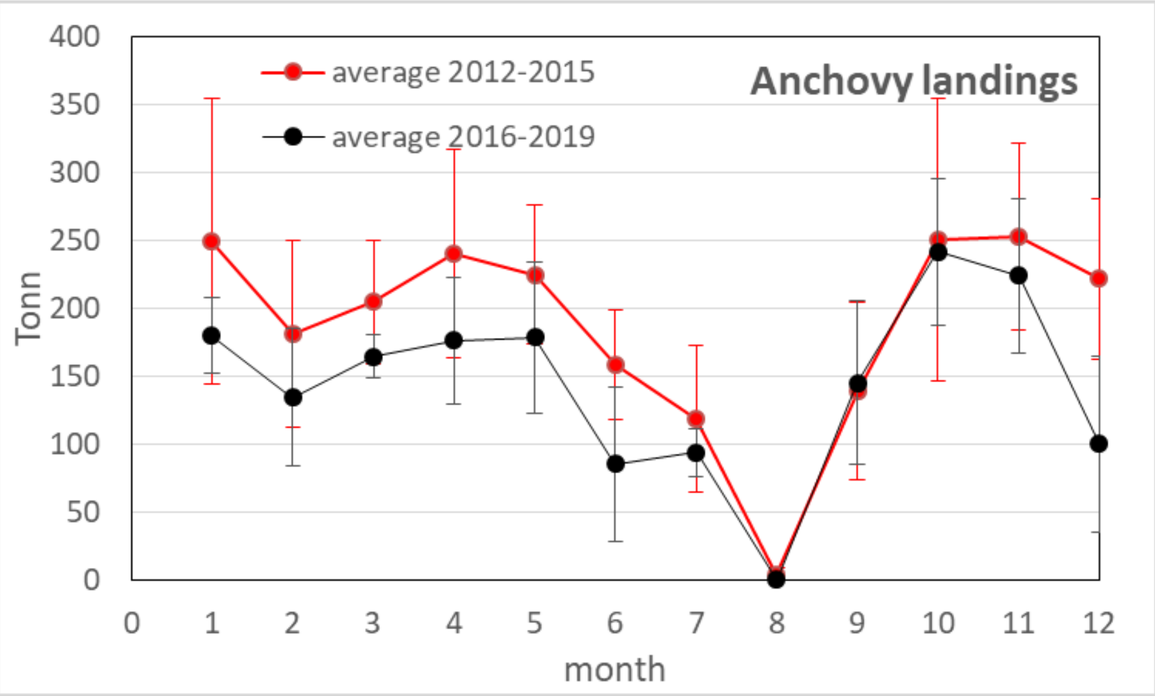
Catches after introduction of Mnemiopsis



Tirelli et al., 2019

Mnemiopsis effects on landings (Chioggia market)?



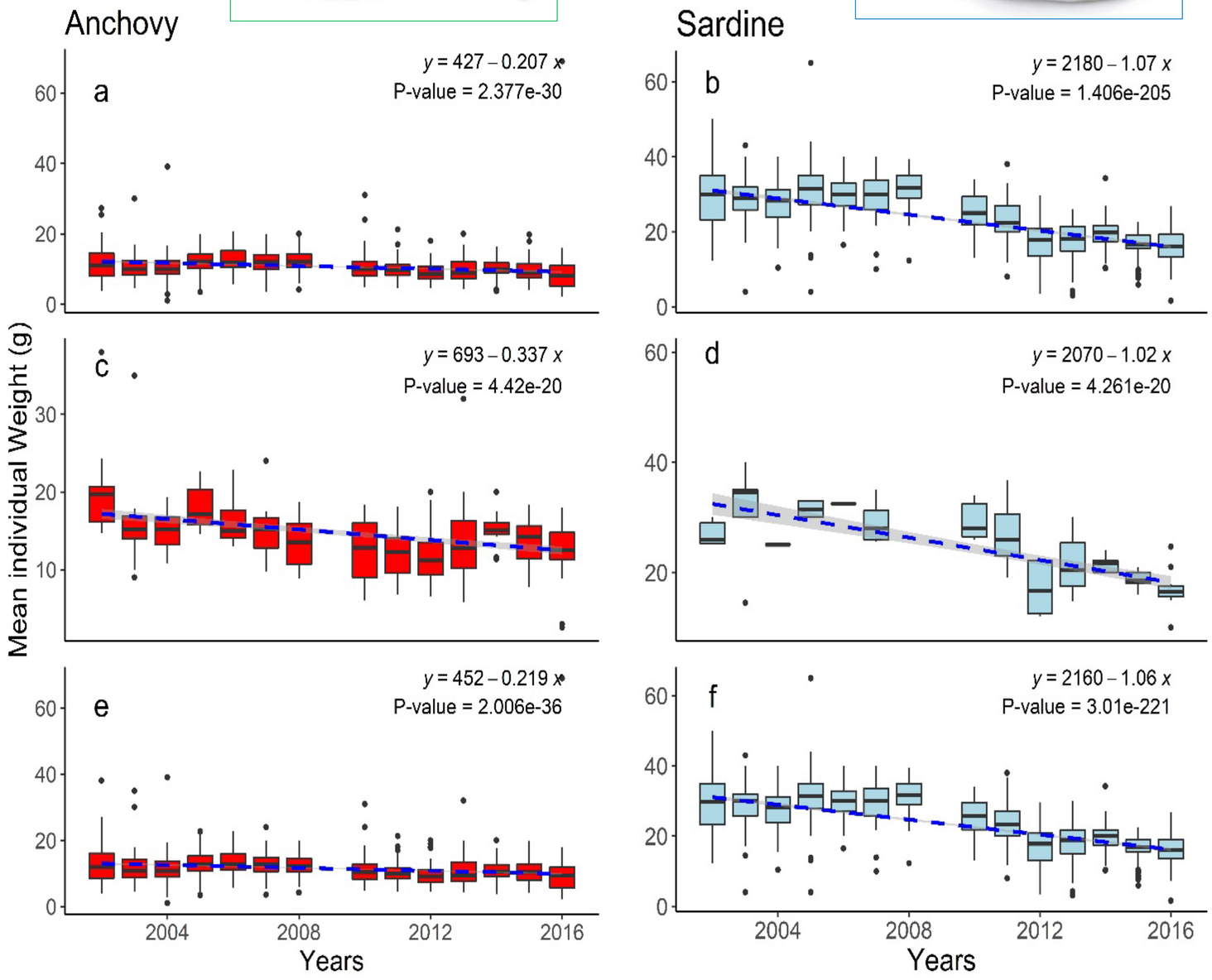


Stock assessments are primary tools for describing the situation; are there other easy indicators to tell us the situation?

Clodia Database: https://chioggia.biologia.unipd.it/banche-dati/

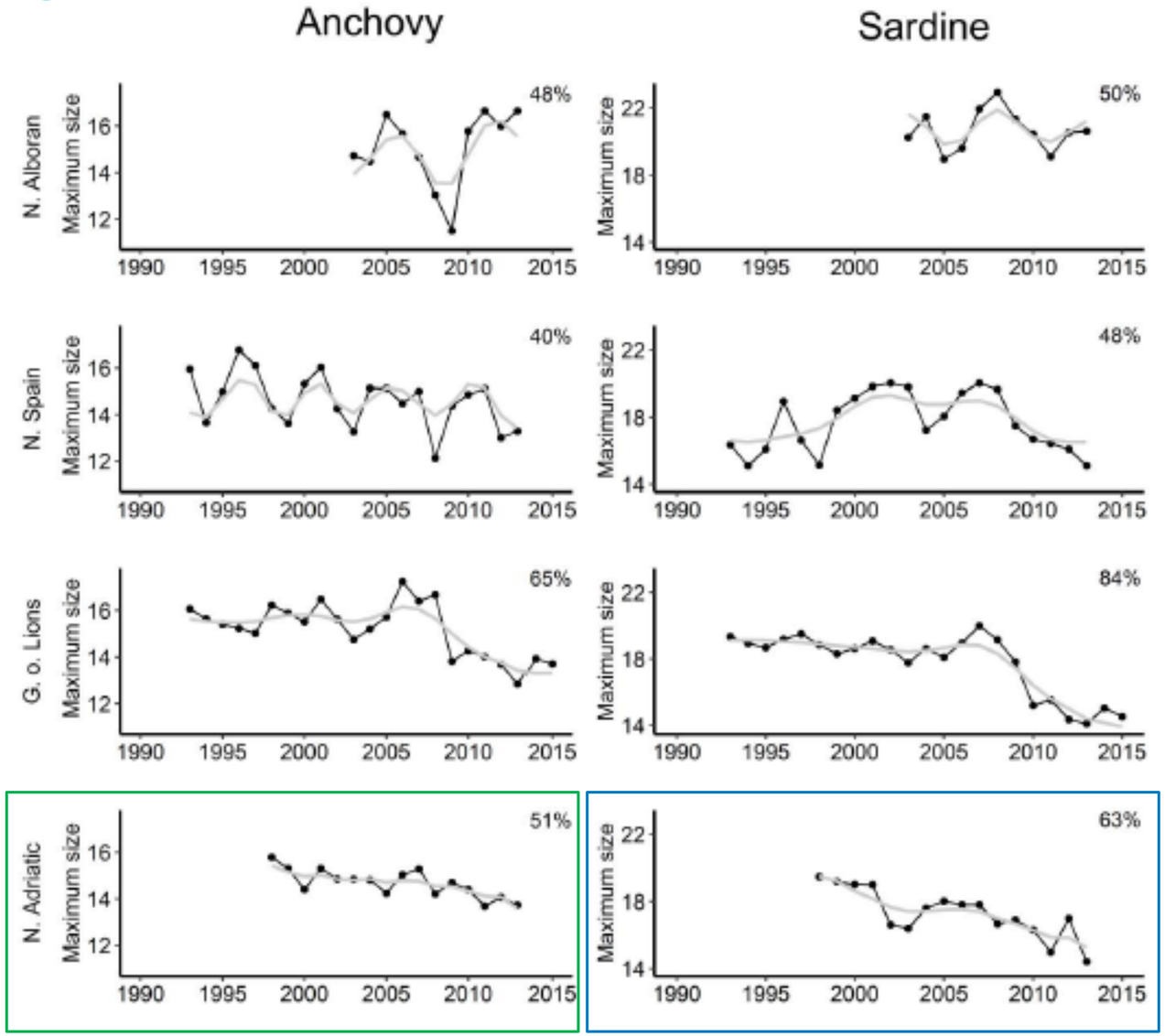
Year 2020 data:
Carlotta Mazzoldi (University of Padua)

Size of anchovy and sardine in the Adriatic Sea (GSA17)



Fisheries independent trawl survey (MEDITS) data from 2002 to 2016.

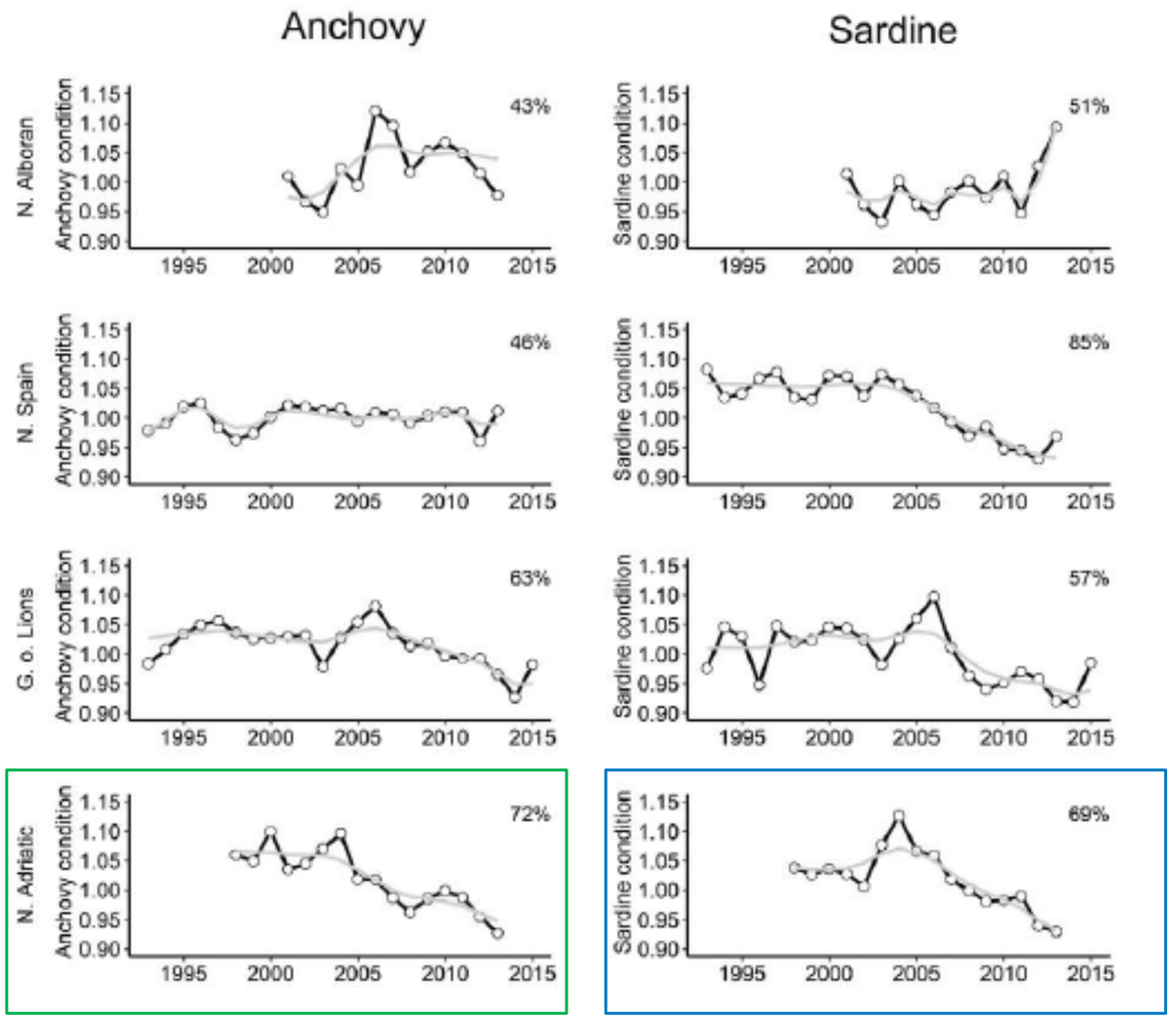
Maximum size



Brosset et al., 2016

A relevant easy signal of difficult times for small pelagics

Body conditions

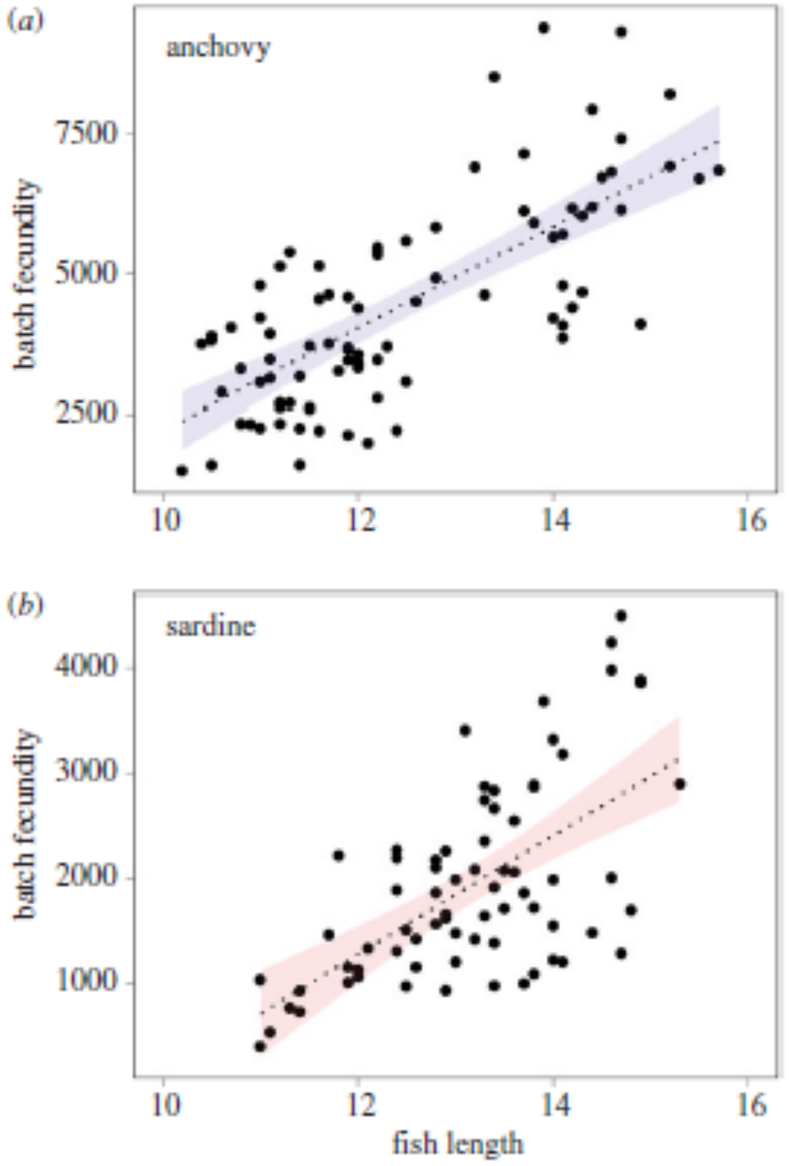


*Time series of monthly body condition from 1975 to 2012 derived from **fisheries data** in the Adriatic Sea displayed long term decreases. A first drop occurred in the mid-80s for both species. It is followed by a slight decrease (1995) and increase (2005) for anchovy and a final decrease between 2008 and 2012 only for sardine,*

Small pelagic fish body condition is known to be primarily affected by food availability, especially the zooplanktonic compartment which constitutes the bulk of small pelagic fish preys

Brosset et al., 2016

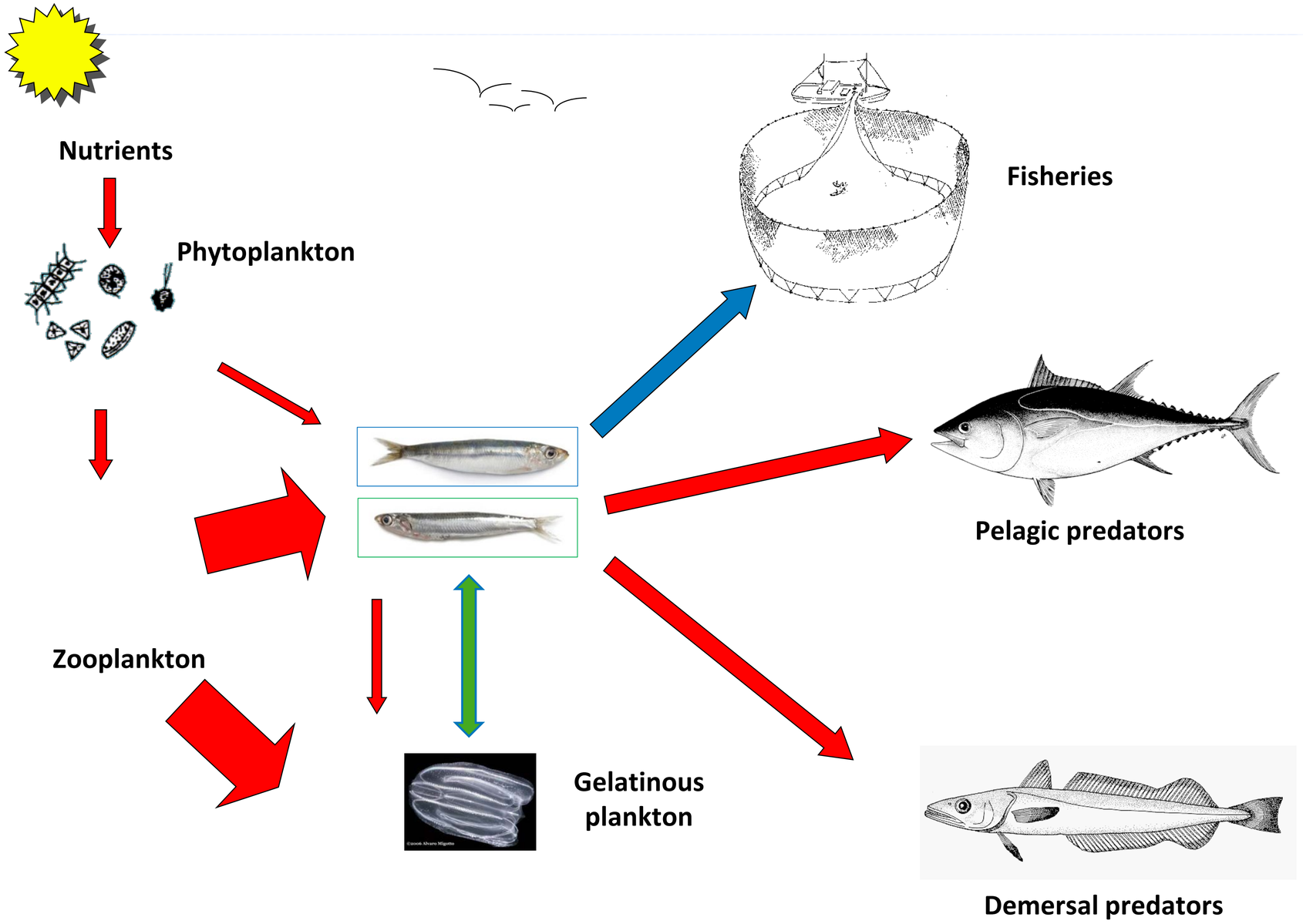
Fecundity and size



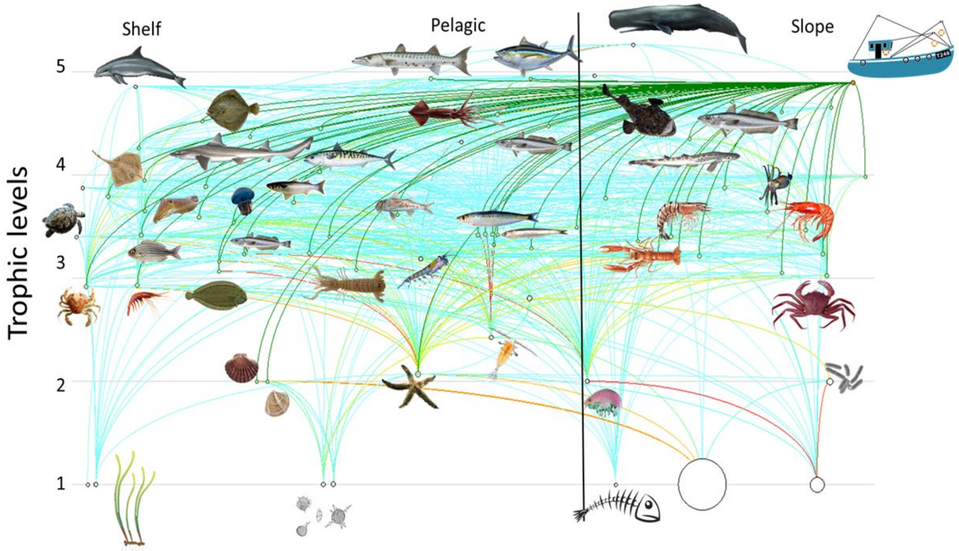
The size decline of small pelagics, whatever is the reason, is a matter of great concern and need precautionary choices…

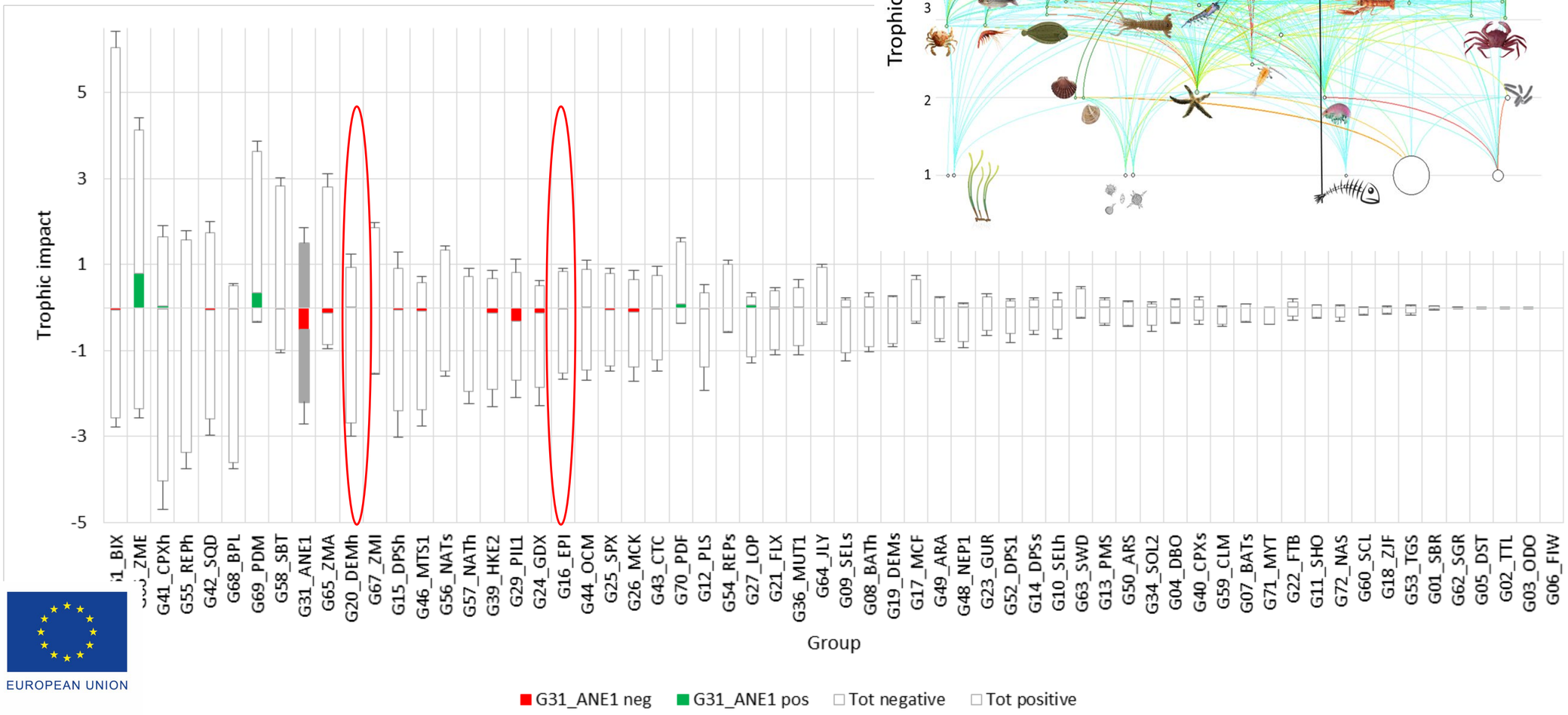
Brosset et al., 2016

Role of small pelagics in the food web



Quantified role of small pelagics in the food web





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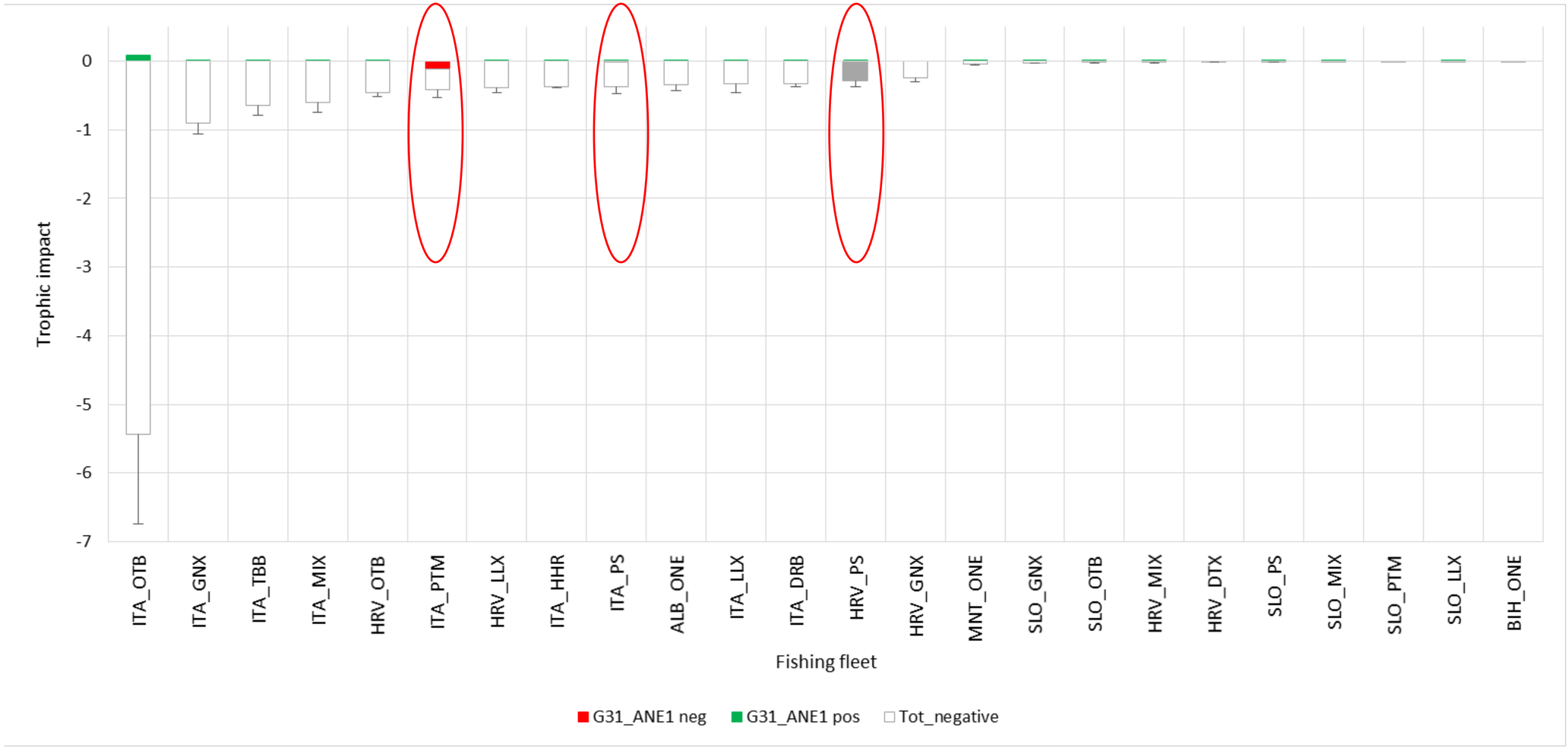
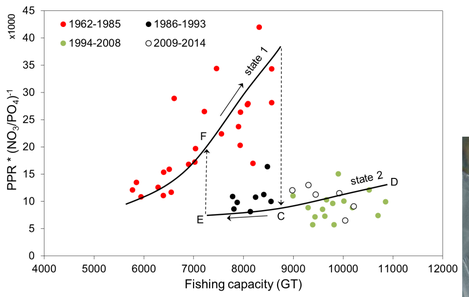
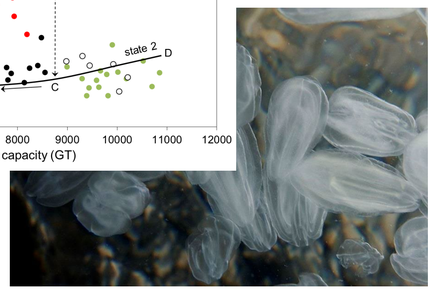
Quantified role of fisheries in the ecosystem



Sustainability of exploitation of small pelagics

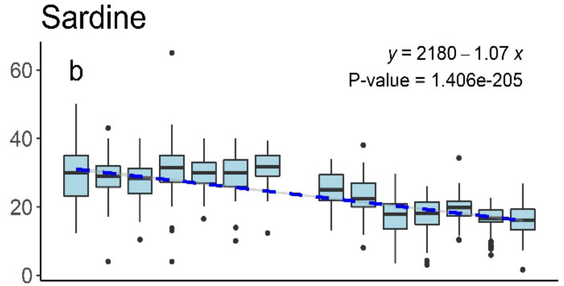
Dynamics of small pelagis is largely dependent on oceanographic conditions, that can change also because of climatic changes

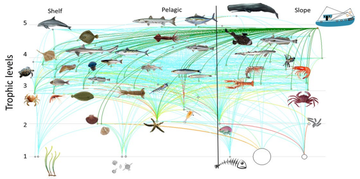




Nutrient loads from coastline are potentially impacting the productivity dynamics and thus the biomass at sea.
Other stressors are active in the basin (Mnemiopsis)…conditions are really critical for small pelagics…

Body size and body conditions decline is a remarkable sign of critical situation but disentangling the role of different factors in current perceived dynamics is difficult





Althrough their explitation from the ecosystem point of view small pelagics have a key role in food webs (also for predators), : a precautionary approach is needed!

OGS Istituto Nazionale di Oceanografia e di Geofisica Sperimentale

Thank you!

Simone Libralato (slibralato@inogs.it)

Contributo all’incontro 23 Settembre 2021
Istituzione del gruppo pilota di operatori per testare la ITACA Web APP
Progetto ITACA

ITACA

Establishment of the SP operators' pilot group for testing the ITACA Web APP

Virtual meeting 23rd September 2021

LP - Veneto Agricoltura

PP5 – Confcooperative Veneto

Interreg Italy - Croatia ITACA European Regional Development Fund

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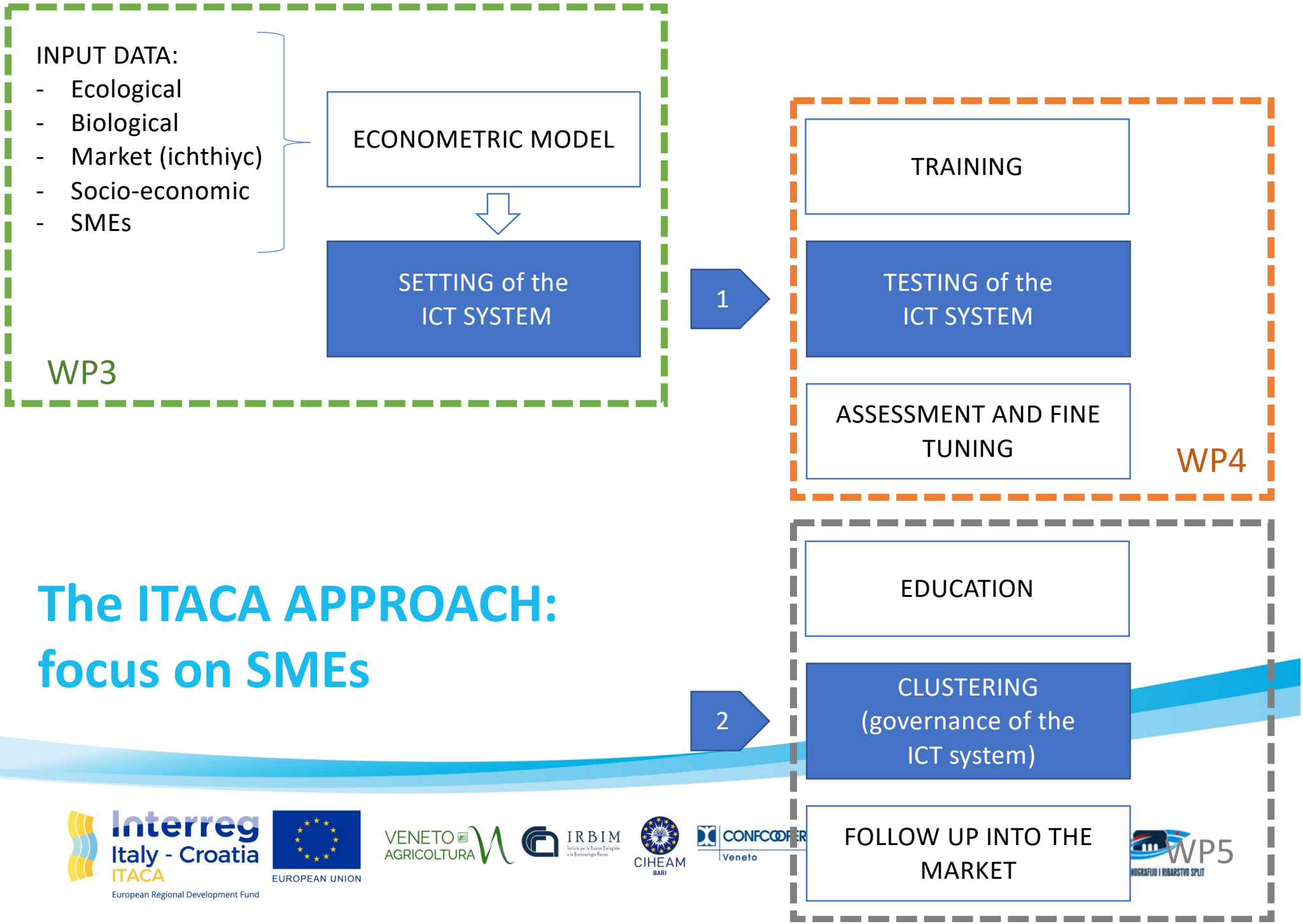
ITACA at a glance

Axis 1: Blue Innovation

- ✓ FISHERIES SMEs;
- ✓ INCREASE OF MARKET OPPORTUNITY;
- ✓ INNOVATION OF PROCESS;
- ✓ ENVIRONMENTAL but MOSTLY SOCIO-ECONOMIC SUSTAINABILITY

Duration: 42 months, from 01.01.2019 to 30.06.2022

Partnership: Veneto Agricoltura, CNR-IRBIM, International Centre For Advanced Mediterranean Agronomic Studies, Public Institution RERA Sd For Coordination and Development of Split-Dalmatia County, Agency for Rural Development of Istria, Confcooperative - Regional Union Of Veneto, Institute of Oceanography and Fisheries



The ITACA APPROACH: focus on SMEs

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EUROPEAN UNION
VENETO AGRICOLTURA
IRBIM
CIHEAM BARI
CONFCOOPERATIVE Veneto

INPUT DATA/OUTPUT TO SET THE MODEL

CATCHES BY SPECIES AND BY MARKET, YEARS 2018-2020

REVENUES BY SPECIES AND BY MARKET, YEARS 2018-2020

DAILY basis in IT
MONTHLY basis in HR

3-4 ANALYTICAL BUDGETS OF SP SMEs YEARS 2018-2019

Some management parameters have been extracted from a significant sample of SMEs (fixed costs /management strategy)

PREDICT THE NEXT MARKET PRICE

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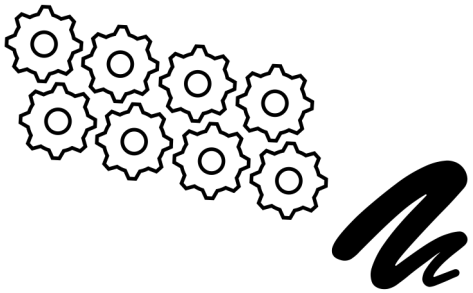
INPUT DATA/OUTPUT TO WORK THE MODEL

CATCHES BY SPECIES

REVENUES BY SPECIES

DAILY basis in IT

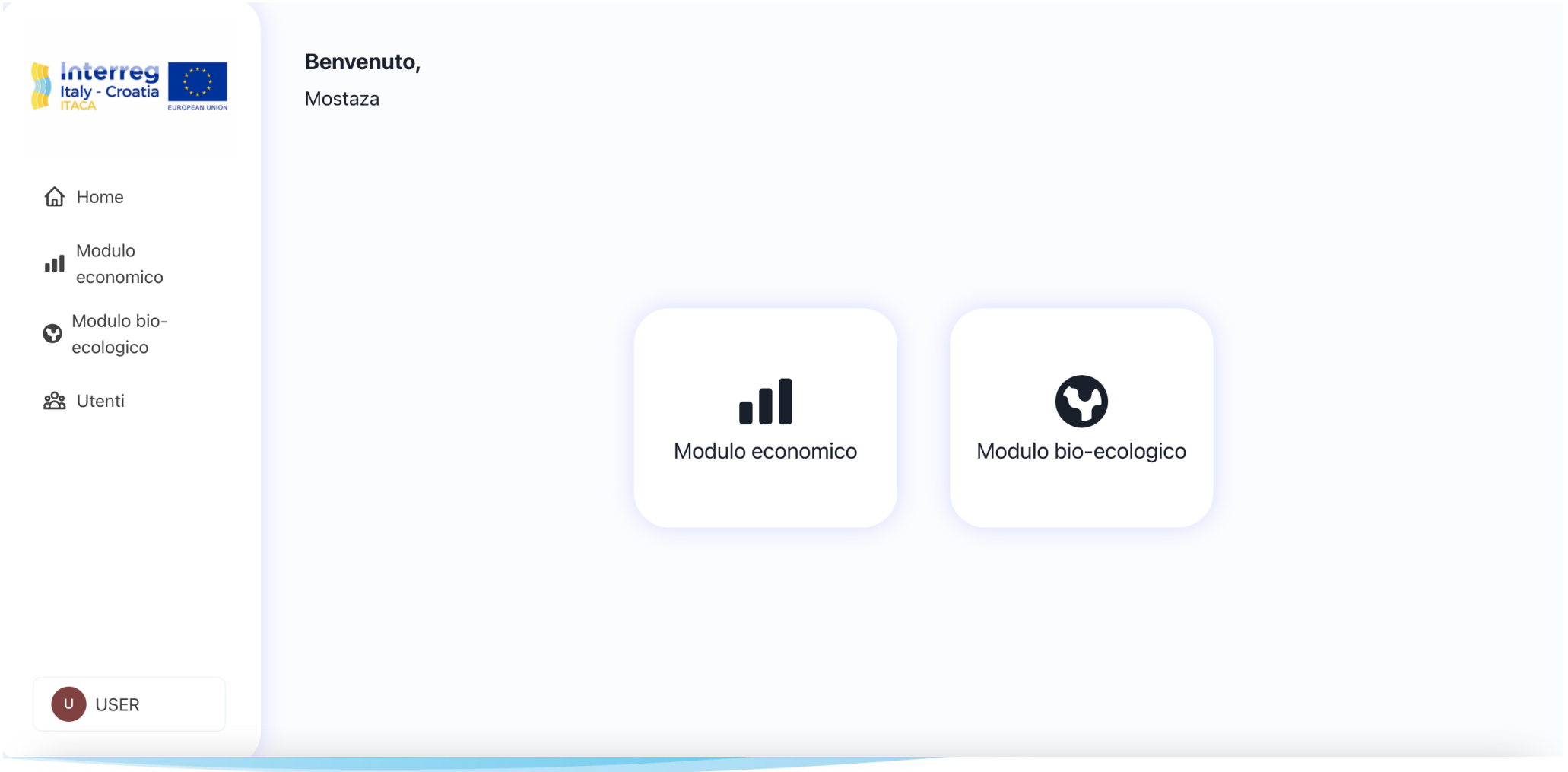
MONTHLY basis in HR



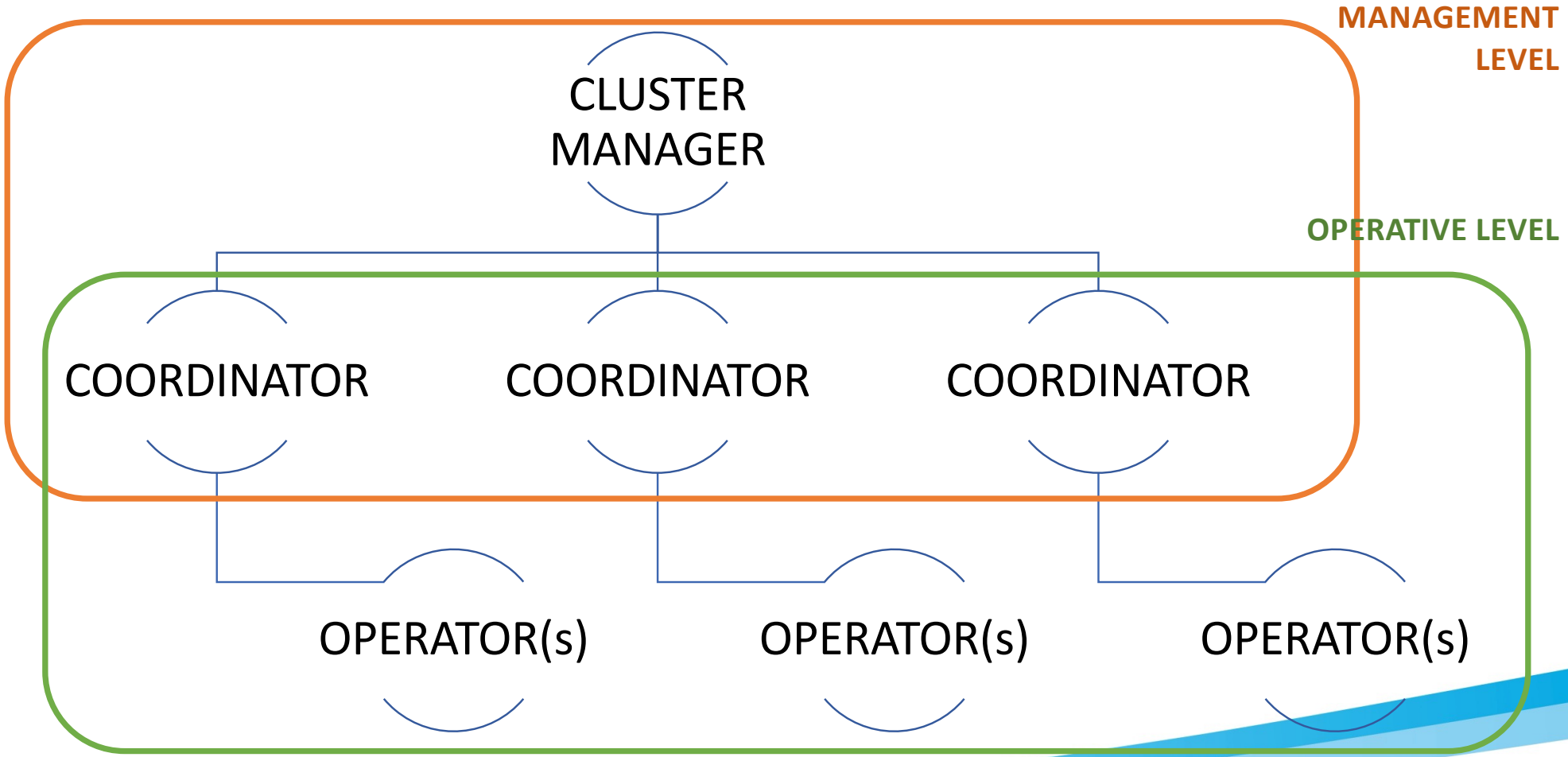
PREDICT THE NEXT MARKET PRICE (next week/month)

European Regional Development Fund

ITACA WEB-APP



GOVERNANCE OF ITACA CLUSTER DURING PILOT ACTION



GOVERNANCE: CLUSTER MANAGEMENT BODY

MANAGER OF THE CLUSTER: LP - Veneto Agricoltura

- *Owner of the WebAPP*
- *Public body*
- *General management and coordination of the cluster and its participants*
- *Supervision and monitoring of activities*
- *Owner and manager of the data (final check on data)*

RUNNING OF CLUSTER: COORDINATORS

COORDINATORs: ITACA PARTNERS

- *Coordination at national/regional/local level*
- *Coordinate and monitor the data collection by operators at local level*
- *Check collected data and, if the case, correct them*
- *Collect and input official data (EUMOFA + Croatian Ministry data on an annual basis for the model correction)*

RUNNING OF CLUSTER: OPERATORS

OPERATORs

- *Periodical (weekly/monthly) inputting of data on the ITACA WebAPP)*

- *The participation is free of charges*

RUNNING OF CLUSTER: INPUTTING OF DATA

- **DAILY/WEEKLY ECONOMIC MODEL (FOR ITALY)**
  - Data on catches and prices
  - Data input on weekly basis (also daily inputting is possible)
  - Data are inputted by IT operators

- **MONTHLY ECONOMIC MODEL (ALL)**
  - Data on catches and prices
  - Data input on monthly basis (also weekly inputting is possible)
  - Data are inputted by HR operators
  - Official data (EUMOFA + Croatian Ministry data) are inputted by Coordinator on an annual basis for the model correction

For the **biological model**, the data input should be on a daily basis, even if the input could be done with a lower frequence

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RUNNING OF CLUSTER: CONSULTATION OF DATA

Catches and prices
Forecast prices to set up fishing strategy

1. *MANAGER OF THE CLUSTER*

- Total broken down data

2. *COORDINATORs*

- Broken data for territorial level of competence (national or regional)
- Could ask for broken down data to the Manager

3. *OPERATORS*

- Own data
- Aggregated data for the fishing harbour
- Past average price for the total cluster/nation/regions

NEXT STEPs

- ✓Today: formal establishment of cluster
- ✓ Next days: work closely with partners to start up the pilot action (distribution of formal document + training on web up + devices)
- ✓First week of October: OFFICIAL START OF THE PILOT ACTION