Teaching Week 2024

Key Concepts in Fisheries Biology - the Management Toward Sustainability

Fano Marine Center, 27 February 2024

Key concepts in Fisheries Biology

FishMed-PhD

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Consiglio Nazionale delle Ricerche

CNR IRBIM

Key concepts in Fisheries Biology

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https://ec.europa.eu/eusurvey/runner/EMD2022WorkshopN17Preserve_biodiversity_and_boost_resilience_to_climate_change_for_sustainable_fisheries

Preserve biodiversity and boost resilience to climate change for sustainable fisheries

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European Maritime Day 2022, Workshop No 17:

Preserve biodiversity and boost resilience to climate change for sustainable fisheries.

The aim of this workshop is to collect your opinion on the interaction between fishing and biodiversity. Q methodology will be used and it provides a foundation for the systematic study of subjectivity. A set of statements is presented about the topic and it is asked to rank-order them from "agree" to "disagree", an operation referred to as Q sorting. There is obviously no right or wrong way to provide your own point of view.

e-mail address for the link: If you do not properly see this form and are interested to contribute to this consultation, leave your e-mail address, and we will send the link to your mailbox.

@

Select your country

Select your sector

- Private company
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- University
- Authority/Government
- NGO
- Consulting
- International organization
- Other

Ranking the statements from the most to the less relevant.

Use drag&drop or the up/down buttons to change the order or accept the initial order.

- Fishing is unsustainable or destructive.
- Marine ecosystems are mostly impacted by climate change, rather than fisheries.
- Oceans are so vast and fishery resources are so resilient, that there are no reasons to think they could be impacted and/or depleted by human activities.
- Native and indigenous species are living parts of our natural heritage.
- We should increase species-specific fishing ban to protect the spawning and recruitment season of commercial species.
- New Marine Protected Areas should be established in order to protect marine resources.
- An increase in biodiversity is not always something desirable.
- The cultural value of marine species is more important than the economic one.
- Some marine species are more important than others.
- The absence of generational turnover among fishers prevents the perception of the ecological value of marine species.
- Sustainable exploitation of marine resources could be achieved through a lower production and a higher value of landings.
- Marine species have only a commercial value.
- The extinction of a species is not a big issue.
- Stakeholders representing the sectors operating in the coastal areas are not interested in marine conservation.
- No additional restrictions are needed for the fishery sector, what is lacking is the surveillance and the inspection of their compliance.
- Marine biodiversity is less important than in the past due to markets globalization.
- High biodiversity ensures the exploitation of marine resources all year round.
- Fishers do not perceive their impact on marine biodiversity.
- Temporal fishing bans should be extended.
- Marine predators threaten biodiversity and hence their catches should be favored.

Rating each statement from strongly disagree (-4) to strongly agree (+4).

	Strongly disagree -4	-3	-2	-1	**Neutral** 0	+1	+2	+3	**Strongly agree** +4
Fishing is unsustainable or destructive.	○	○	○	○	○	○	○	○	○
Marine ecosystems are mostly impacted by climate change, rather than fisheries.	○	○	○	○	○	○	○	○	○
Oceans are so vast and fishery resources are so resilient, that there are no reasons to think they could be impacted and/or depleted by human activities.	○	○	○	○	○	○	○	○	○
Native and indigenous species are living parts of our natural heritage.	○	○	○	○	○	○	○	○	○
We should increase species-specific fishing ban to protect the spawning and recruitment season of commercial species.	○	○	○	○	○	○	○	○	○
New Marine Protected Areas should be established in order to protect marine resources.	○	○	○	○	○	○	○	○	○
An increase in biodiversity is not always something desirable.	○	○	○	○	○	○	○	○	○
The cultural value of marine species is more important than the economic one.	○	○	○	○	○	○	○	○	○
Some marine species are more important than others.	○	○	○	○	○	○	○	○	○
The absence of generational turnover among fishers prevents the perception of the ecological value of marine species.	○	○	○	○	○	○	○	○	○
Sustainable exploitation of marine resources could be achieved through a lower production and a higher value of landings.	○	○	○	○	○	○	○	○	○
Marine species have only a commercial value.	○	○	○	○	○	○	○	○	○
The extinction of a species is not a big issue.	○	○	○	○	○	○	○	○	○
Stakeholders representing the sectors operating in the coastal areas are not interested in marine conservation.	○	○	○	○	○	○	○	○	○
No additional restrictions are needed for the fishery sector, what is lacking is the surveillance and the inspection of their compliance.	○	○	○	○	○	○	○	○	○
Marine biodiversity is less important than in the past due to markets globalization.	○	○	○	○	○	○	○	○	○
High biodiversity ensures the exploitation of marine resources all year round.	○	○	○	○	○	○	○	○	○
Fishers do not perceive their impact on marine biodiversity.	○	○	○	○	○	○	○	○	○
Temporal fishing bans should be extended.	○	○	○	○	○	○	○	○	○
Marine predators threaten biodiversity and hence their catches should be favored.	○	○	○	○	○	○	○	○	○

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Fishing is unsustainable and/or destructive.

Marine ecosystems are mostly impacted by climate change, rather than fisheries.

Ocean are so vast and fishery resources are so resilient, that there are no reasons to think they could be impacted and/or depleted by human activities.

Native and indigenous species are living parts of our natural heritage.

We should increase species-specific fishing ban to protect the spawning and recruitment season of commercial species.

New Marine Protected Areas should be established in order to protect marine resources.

Increase in biodiversity is not always something desirable.

The cultural value of marine species is more important than the economic one.

Some marine species are more important than others.

The absence of generational turnover among fishers prevents the perception of the ecological value of marine species.

A sustainable exploitation of marine resources could be achieved through a lower production and a higher value of landings.

Marine species have only a commercial value.

The extinction of a species is not a big issue.

Stakeholders representing the sectors operating in the coastal areas are not interested in marine conservation.

No additional restrictions are needed for the fishery sector, what is lacking is the surveillance and the inspection of their compliance.

Marine biodiversity is less important than in the past due to market-globalization.

High biodiversity ensures the exploitation of marine resources all year round.

Fishers do not perceive their impact on marine biodiversity.

Temporal fishing bans should be extended.

Marine predators threaten the biodiversity and hence their catches should be favoured.

Lecture 1

- Who I am
- A bit of history
- Key definitions & concepts

Who I am

2008

MSc in Marine Biology and Oceanography

2009

Scholarship

2010-2013

Research Grants

CNR
IRBIM
ISTITUTO PER LE RISORSE BIOLOGICHE E LE BIOTECNOLOGIE MARINE

2013-2018

Researcher (temporary)

Who I am

2016

PhD in Marine Biology and Ecology

2018-current

Researcher (permanent)

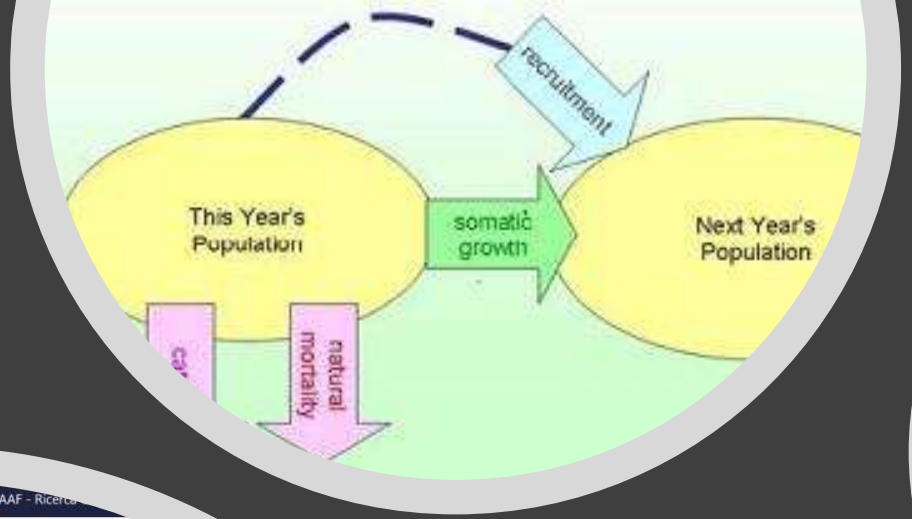
Food and Agriculture Organization of the United Nations

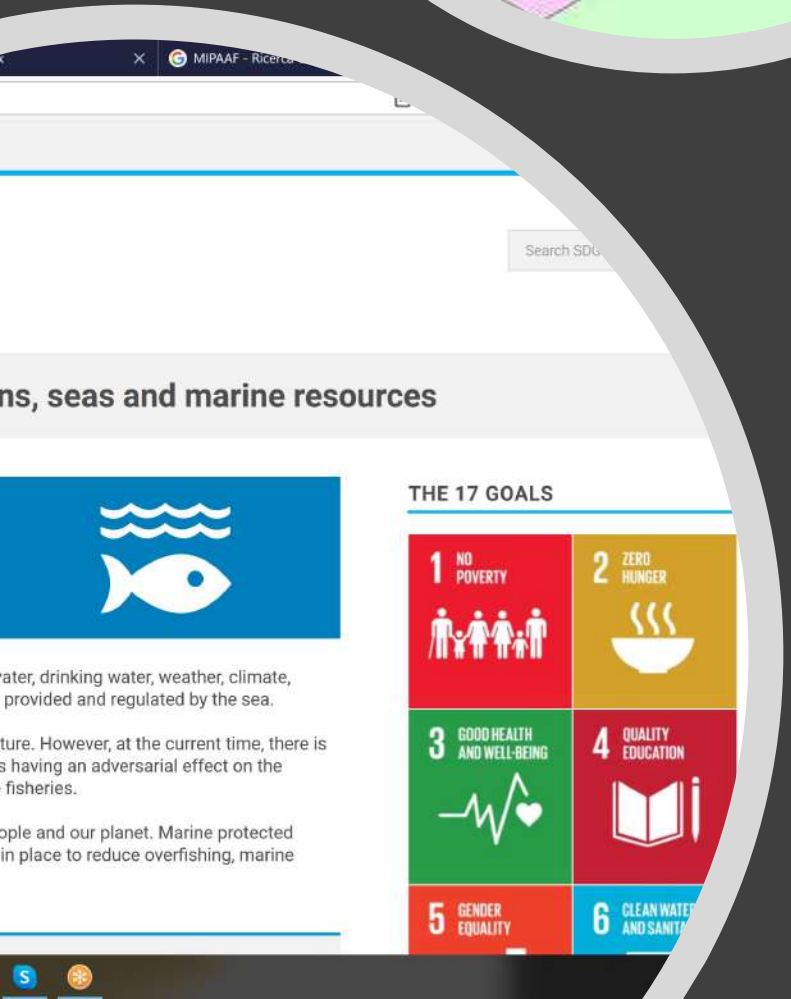
2016; 2018

FAO consultant

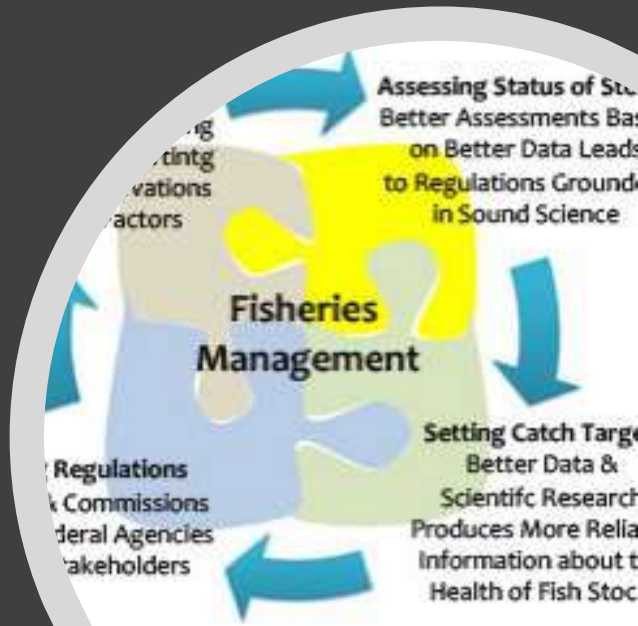
2020-current

FAO-GFCM National Focal Point (Recreational Fisheries Pilot Study; Blue Crab Programme)

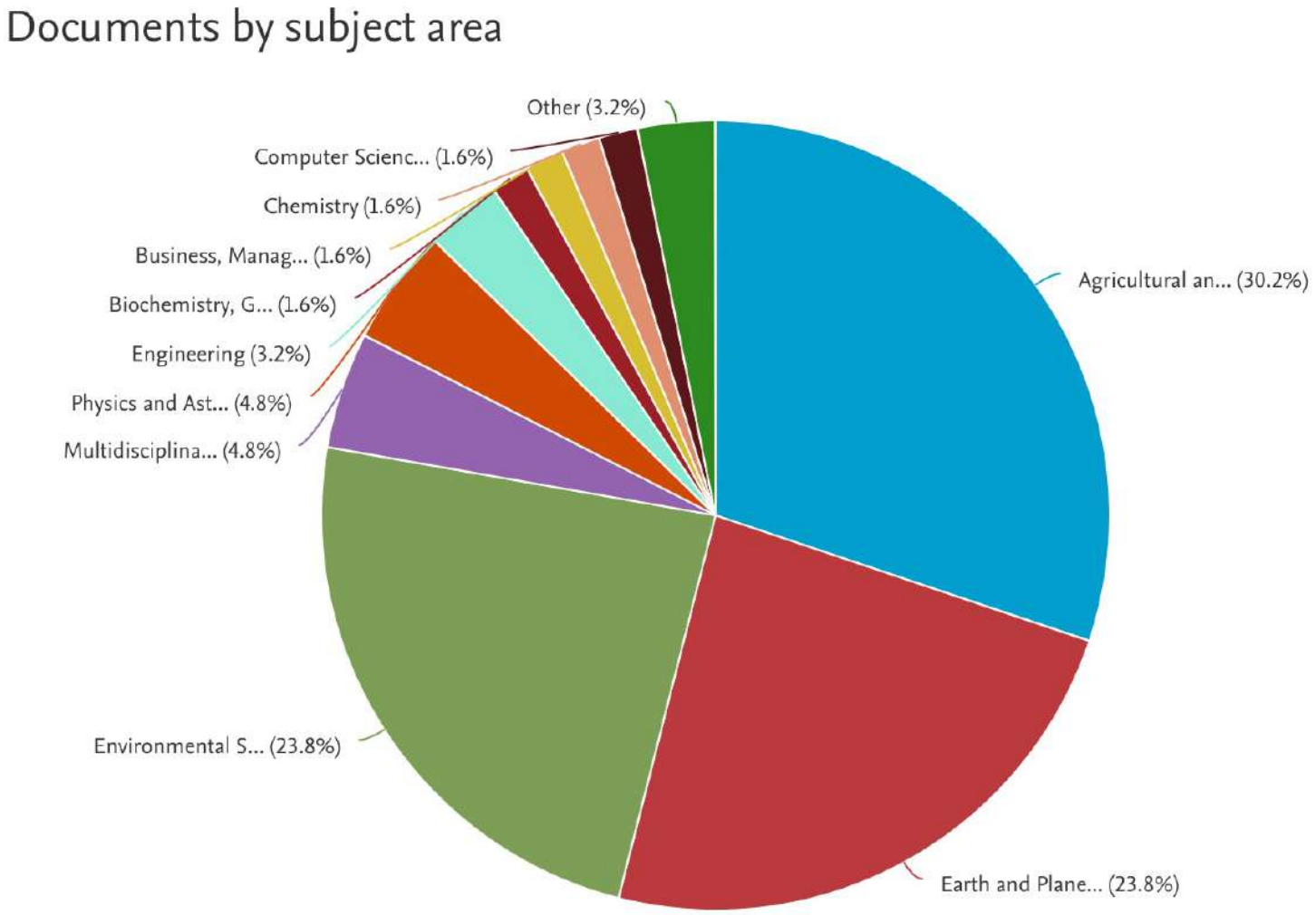




Field of interest



Scientific production



Scientific production

This author's *h*-index

11

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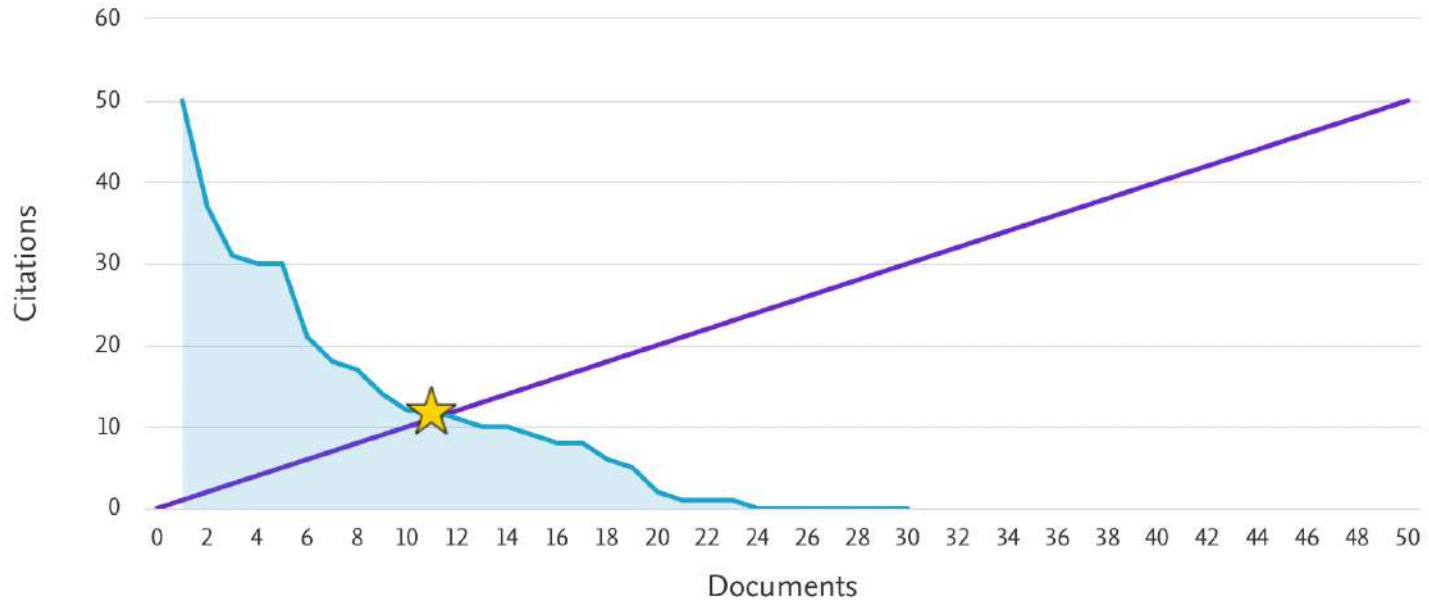

Scientific production

frontiers in Marine Science | Marine Fisheries, Aquaculture and Living Resources

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Preliminary Estimation of Marine Recreational Fisheries (MRF) in the Time of COVID-19 Pandemic: The Marche Region Case Study (Adriatic Sea, Italy)

Luca Bolognini[1]*, Fabio Cevenini[1,2], Valentina Franza[1], Stefano Guicciardi[1], Andrea Petetta[1,3], Laura Santangelo[1], Martina Scanu[1,3] and Fabio Grati[1]

sustainability

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Maritime Spatial Planning for Sustainable Fisheries

Guest Editor:

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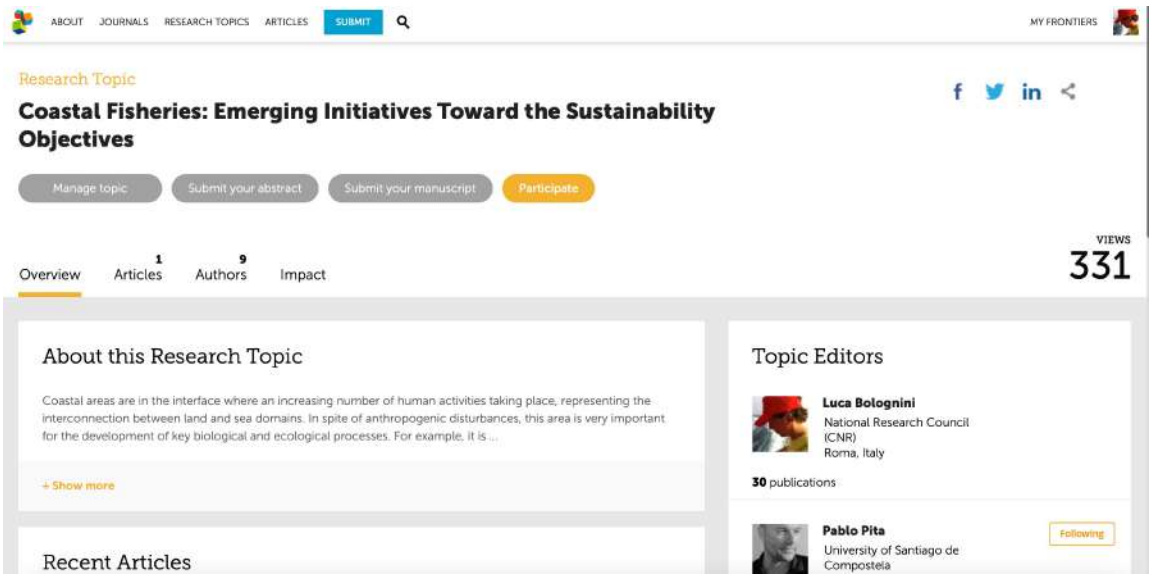
Deadline for manuscript submissions:
1 December 2020

Message from the Guest Editor

Dear Colleagues,

The aim of this Special Issue is to assemble a set of science-based papers reporting how the maritime spatial planning process, in all its aspects, could enhance fisheries' sustainability. Priority will be given to papers that include novel tools and approaches that will be useful to facilitate maritime spatial planning for the fishery sector. Papers are invited from all countries and could describe specific case studies that can contribute to better understand how to move forward in maritime spatial planning for sustainable fisheries.

Dr. Luca Bolognini
Guest Editor



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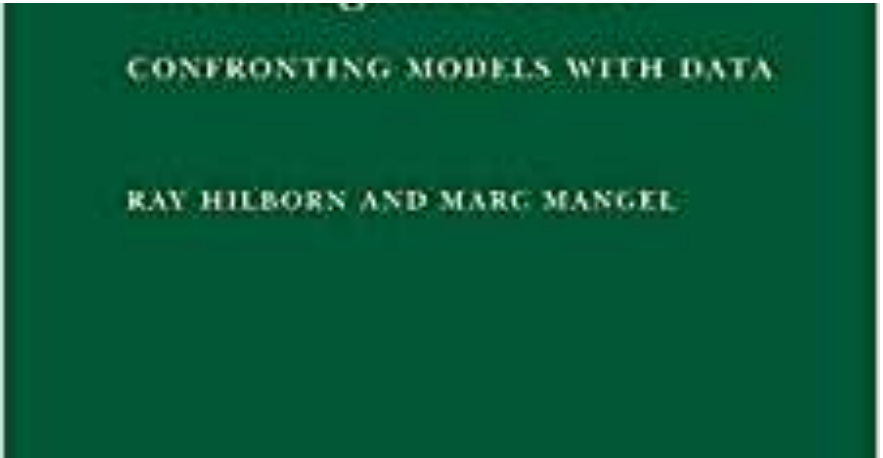


The reserch idea in the field of fisheries biology

“Mostly, you see fish only when they're caught… So if you study fish populations, you tend to get little pieces of information here and there. These bits of information are like the tip of the iceberg; they're part of a much larger story. Our job is to try to put the story together. We are a kind of detective, really, who assembles clues into a coherent picture.”

The ecological detective, 1997

Outline Lecture 1

- A bit of history
- Key definitions & concepts

A medieval view of fishing, by Peter Brueghel the Elder (1556).

The current view ?

https://sustainablefisheries-uw.org/ray-hilborn-on-seaspiracy/

A bit of history

The Paleolithic mans', with his great desire for knowledge and discovery, started fishing. The first hooks were made of wood. In the age of copper and bronze, hooks changed material to become built with iron.

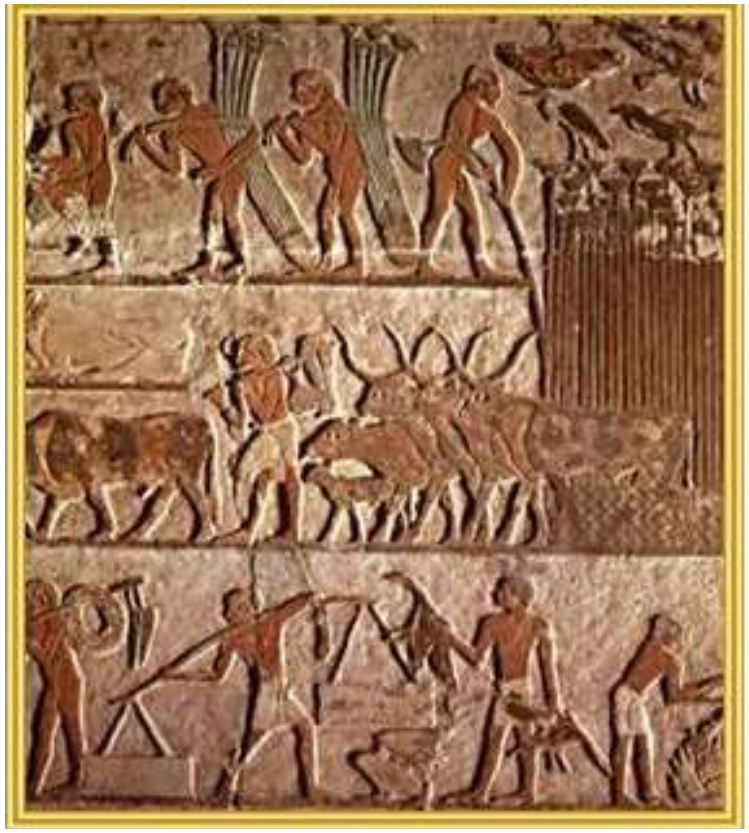
Native Americans used hawk claws and bones from various animals to make their hooks.

A bit of history

- In the past knowledge of currents, winds, depths, migratory habits of fish, are essential for fishing at sea. Over time, man has discovered new materials and new fishing techniques.

A bit of history

- Fish has always been present in the human diet along with cereals, seeds, fruit and vegetables and represented one of the main supply sources of for the communities that inhabited the coastal areas and along the rivers. We find it in all the civilizations of the Mediterranean basin.



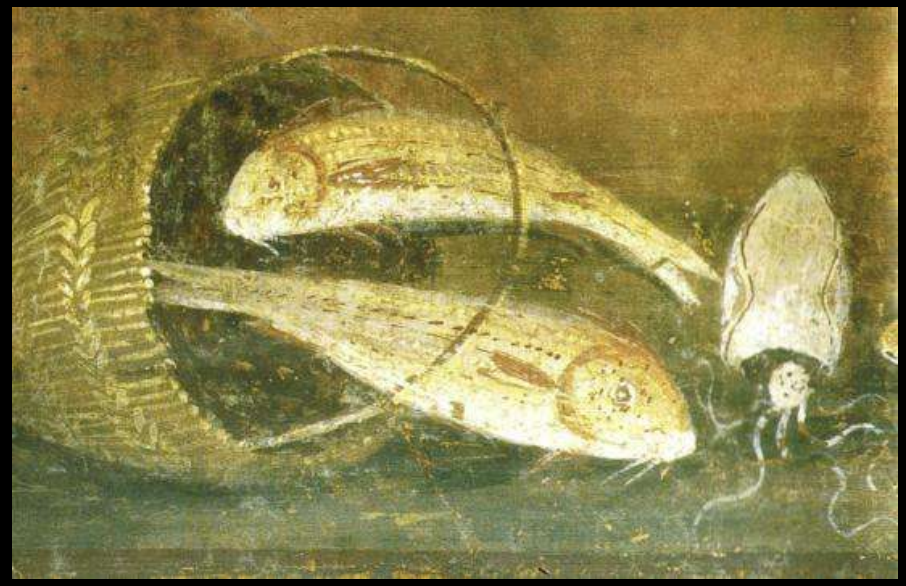
A bit of history

In prehistoric times, fish was caught and eaten fresh, due to the warm climate of Mediterranean countries, or subjected to rudimentary drying processes

A bit of history

Cefalù (Sicily, Italy, Mandralisca Museum)

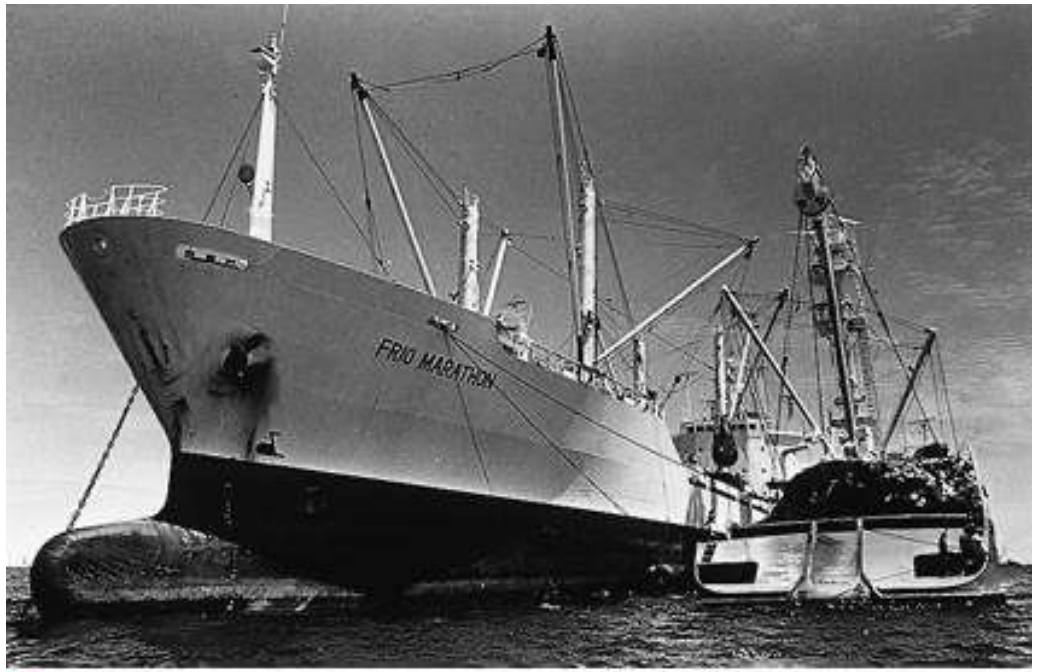
Ostia (Italy)



Naples (Italy, National Archeologic Museum)

A bit of history

The range of fishing boats increased rapidly with the advent of the industrial revolution. Yields increased 4 times compared to sailing boats. Other innovations such as rail transport transformed fishing into an industry.. With the advent of diesel engines, large ships were able to remain at sea for months following the large seasonal abundances of fish species. This led to the development of the fishery called "Distant water" which developed on a global scale.



b Jennings, Kaiser, Reynolds
Marine Fisheries Ecology

b Jennings, Kaiser, Reynolds
Marine Fisheries Ecology

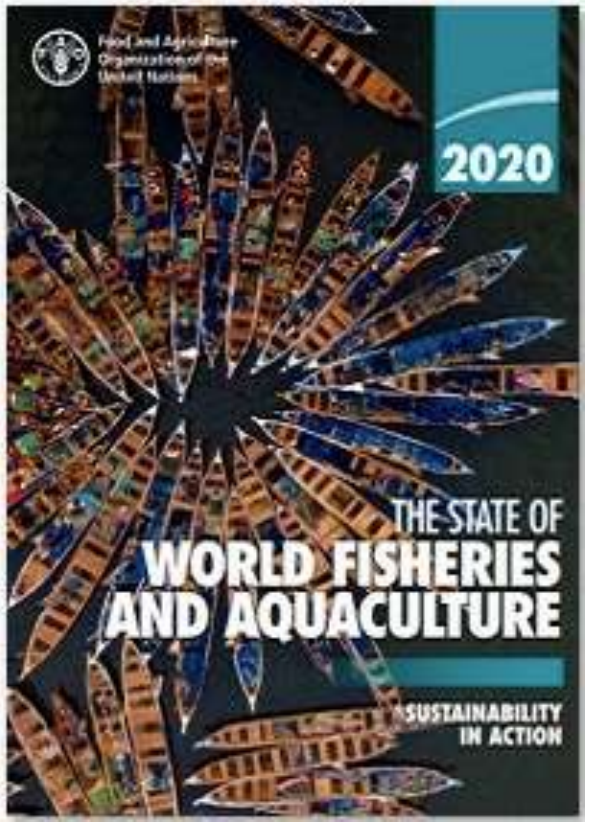


TABLE 1
WORLD FISHERIES AND AQUACULTURE PRODUCTION, UTILIZATION AND TRADE[1]

	1986–1995	1996–2005	2006–2015	2016	2017	2018
	Average per year					
	(million tonnes, live weight)					
Production						
Capture						
Inland	6.4	8.3	10.6	11.4	11.9	12.0
Marine	80.5	83.0	79.3	78.3	81.2	84.4
Total capture	**86.9**	**91.4**	**89.8**	**89.6**	**93.1**	**96.4**
Aquaculture						
Inland	8.6	19.8	36.8	48.0	49.6	51.3
Marine	6.3	14.4	22.8	28.5	30.0	30.8
Total aquaculture	**14.9**	**34.2**	**59.7**	**76.5**	**79.5**	**82.1**
Total world fisheries and aquaculture	**101.8**	**125.6**	**149.5**	**166.1**	**172.7**	**178.5**
Utilization[2]						
Human consumption	71.8	98.5	129.2	148.2	152.9	156.4
Non-food uses	29.9	27.1	20.3	17.9	19.7	22.2
Population (*billions*)[3]	5.4	6.2	7.0	7.5	7.5	7.6
Per capita apparent consumption (*kg*)	13.4	15.9	18.4	19.9	20.3	20.5
Trade						
Fish exports – in quantity	34.9	46.7	56.7	59.5	64.9	67.1
Share of exports in total production	*34.3%*	*37.2%*	*37.9%*	*35.8%*	*37.6%*	*37.6%*
Fish exports – in value (*USD billions*)	37.0	59.6	117.1	142.6	156.0	164.1

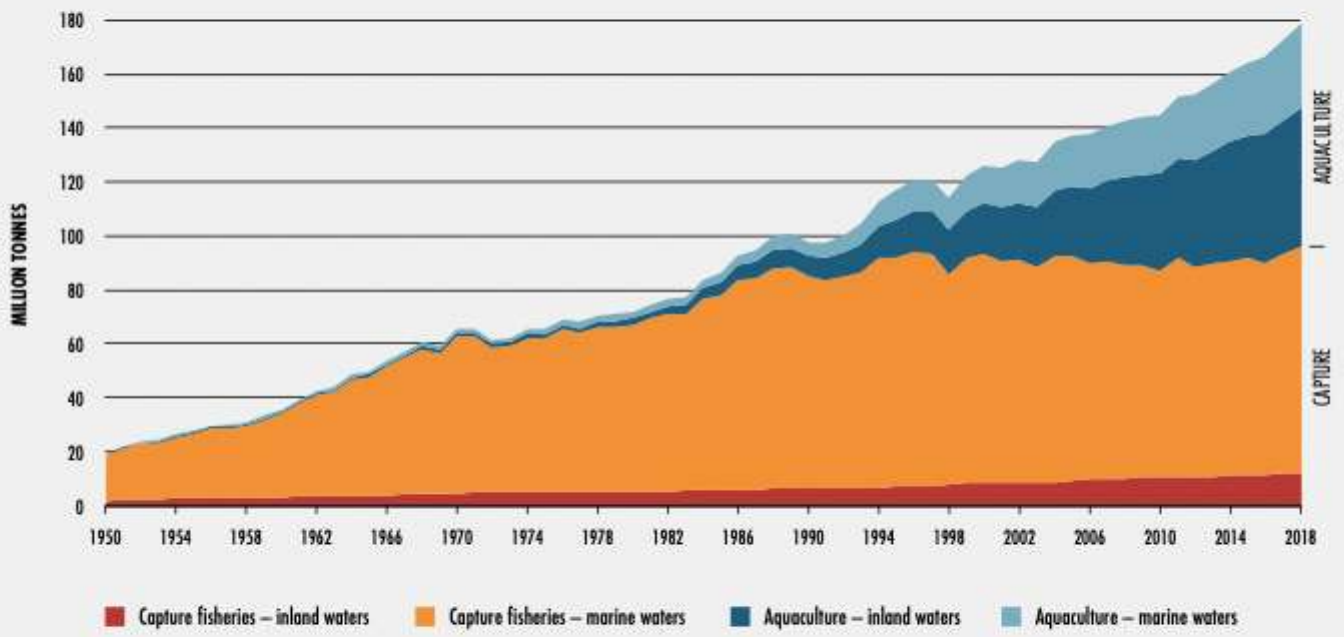
[1] Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants. Totals may not match due to rounding.
[2] Utilization data for 2014–2018 are provisional estimates.
[3] Source of population figures: UN DESA, 2019.

Notes on the economic importance of the fishing sector

Global food fish consumption increased at an average annual rate of 3.1 percent from 1961 to 2017, a rate almost twice that of annual world population growth (1.6 percent) for the same period, and higher than that of all other animal protein foods (meat, dairy, milk, etc.), which increased by 2.1 percent per year. Per capita food fish consumption grew from 9.0 kg (live weight equivalent) in 1961 to 20.5 kg in 2018, by about 1.5 percent per year.

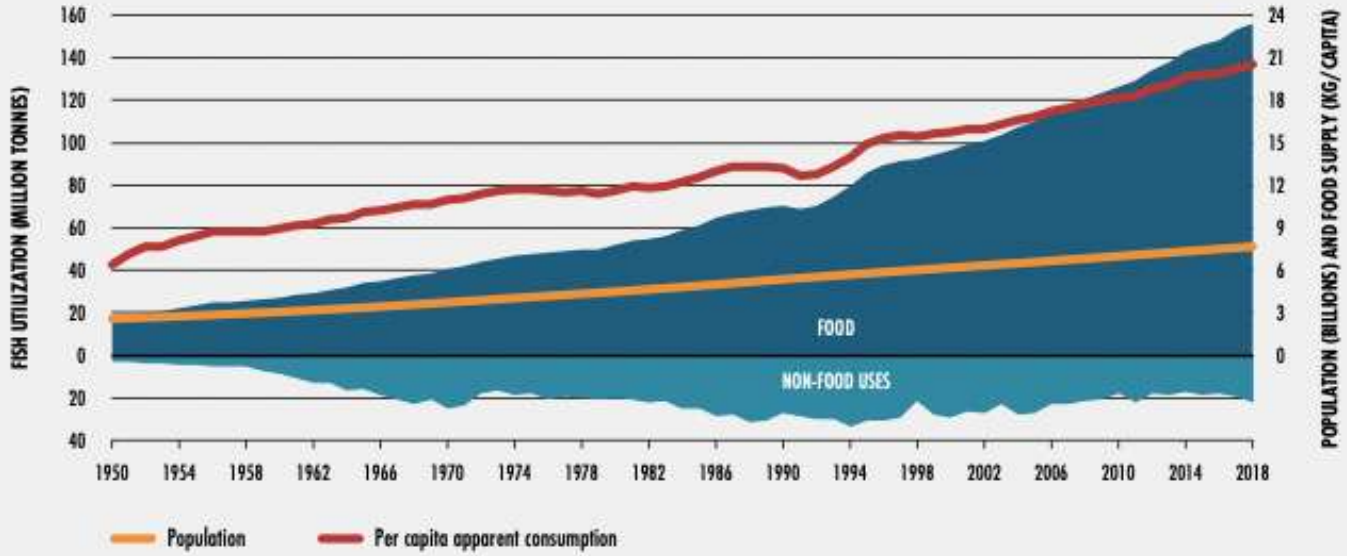
Notes on the economic importance of the fishing sector

FIGURE 1
WORLD CAPTURE FISHERIES AND AQUACULTURE PRODUCTION



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.
SOURCE: FAO.

FIGURE 2
WORLD FISH UTILIZATION AND APPARENT CONSUMPTION



NOTE: Excludes aquatic mammals, crocodiles, alligators and caimans, seaweeds and other aquatic plants.
SOURCE: FAO.

Notes on the economic importance of the fishing sector

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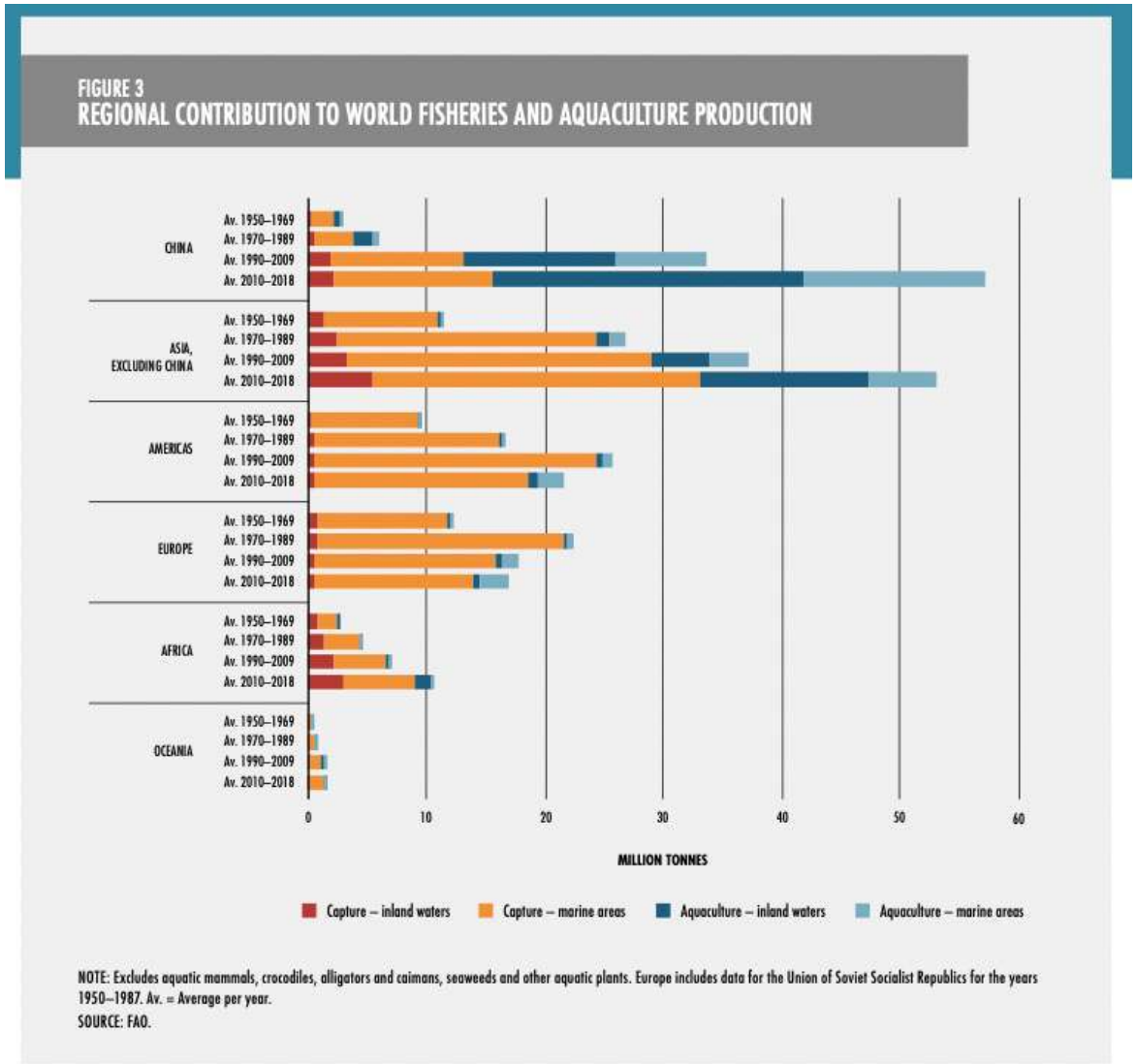
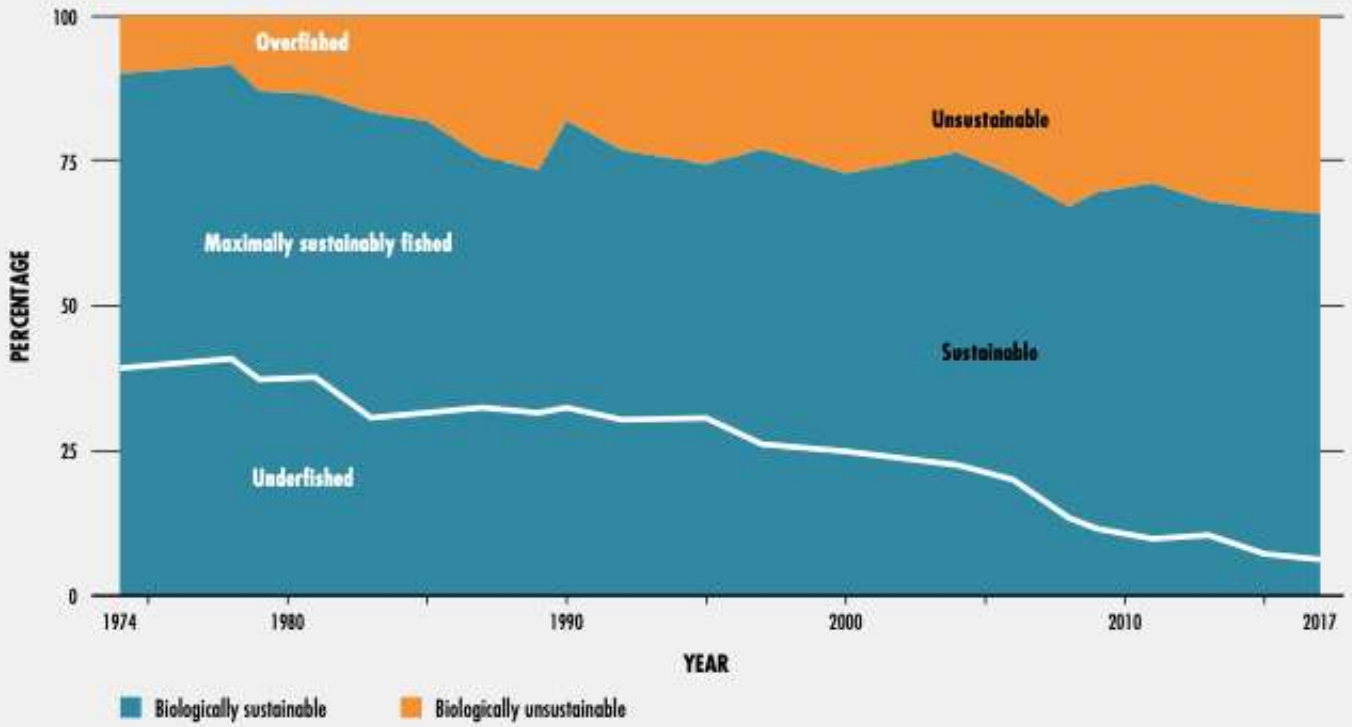


FIGURE 19
GLOBAL TRENDS IN THE STATE OF THE WORLD'S MARINE FISH STOCKS, 1974–2017



SOURCE: FAO

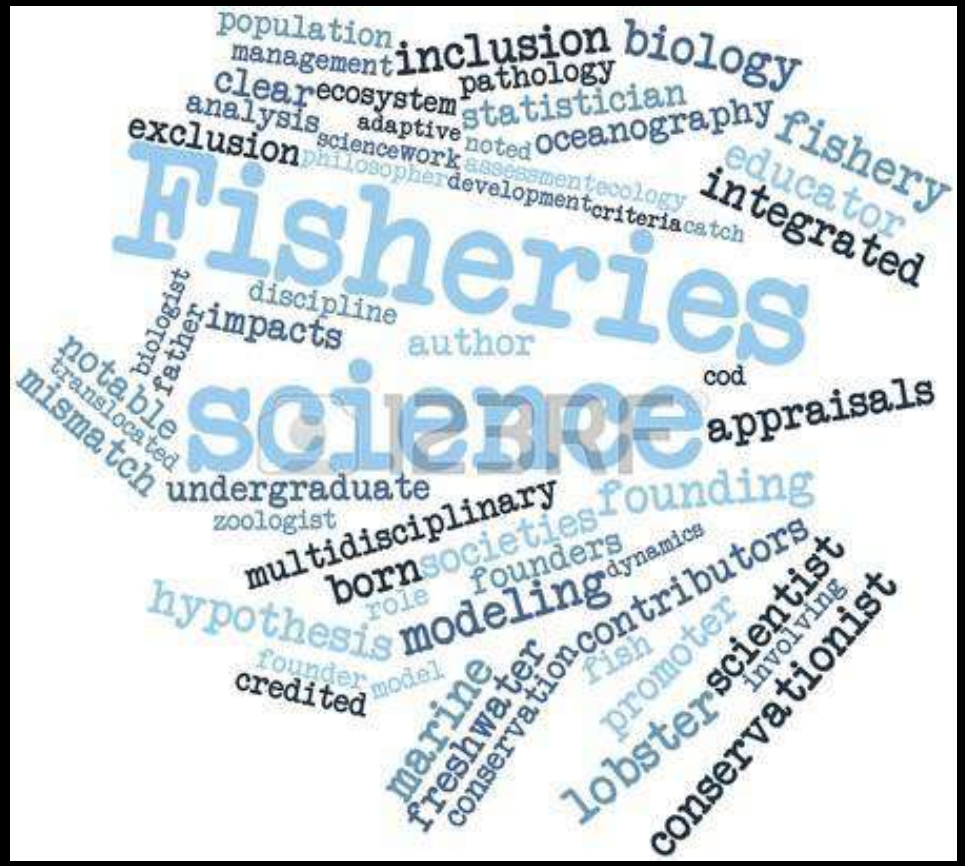
Notes on the economic importance of the fishing sector

Outline Lecture 1

- A bit of history
- Key definitions & concepts

Fisheries science

Fisheries science is the academic discipline of managing and understanding fisheries. It is a multidisciplinary science, which draws on the disciplines of limnology, oceanography, freshwater biology, marine biology, meteorology, conservation, ecology, population dynamics, economics, statistics, decision analysis, management, and many others in an attempt to provide an integrated picture of fisheries.



Notable contributors

Halieutic production definition

The halieutic production is the exploitation of the aquatic alive resources. It includes the various modes of exploitation and management (fishing, fish farming) of alive species (vegetable or animal) exercised in all the aquatic circles (sea and river).

Halieutic resources

Demersal

Living in close relation with the bottom and depending on it.

Pelagic

Fish that spend most of their life swimming in the water column with little contact with or dependency on the bottom.

Small pelagic: (Anchovy, *Engraulis encrasicolus;* sardine, *Sardina pilchardus*),

Large pelagic: Tuna (*Thunnus thynnus* and other), Swordfish (*Xiphias gladius*)**,** etc.

Edible molluscs

e.g.: Bivalv mollusc, Baby clam (*Chamelea gallina*), Mussel (*Mytilus galloprovincialis*)

Fisheries diversity

- Artisanal
- Traditional
- Small-scale
- Recreational
- Commercial
- Industrial
- Subsistence
- Coastal
- Offshore
- Distant waters

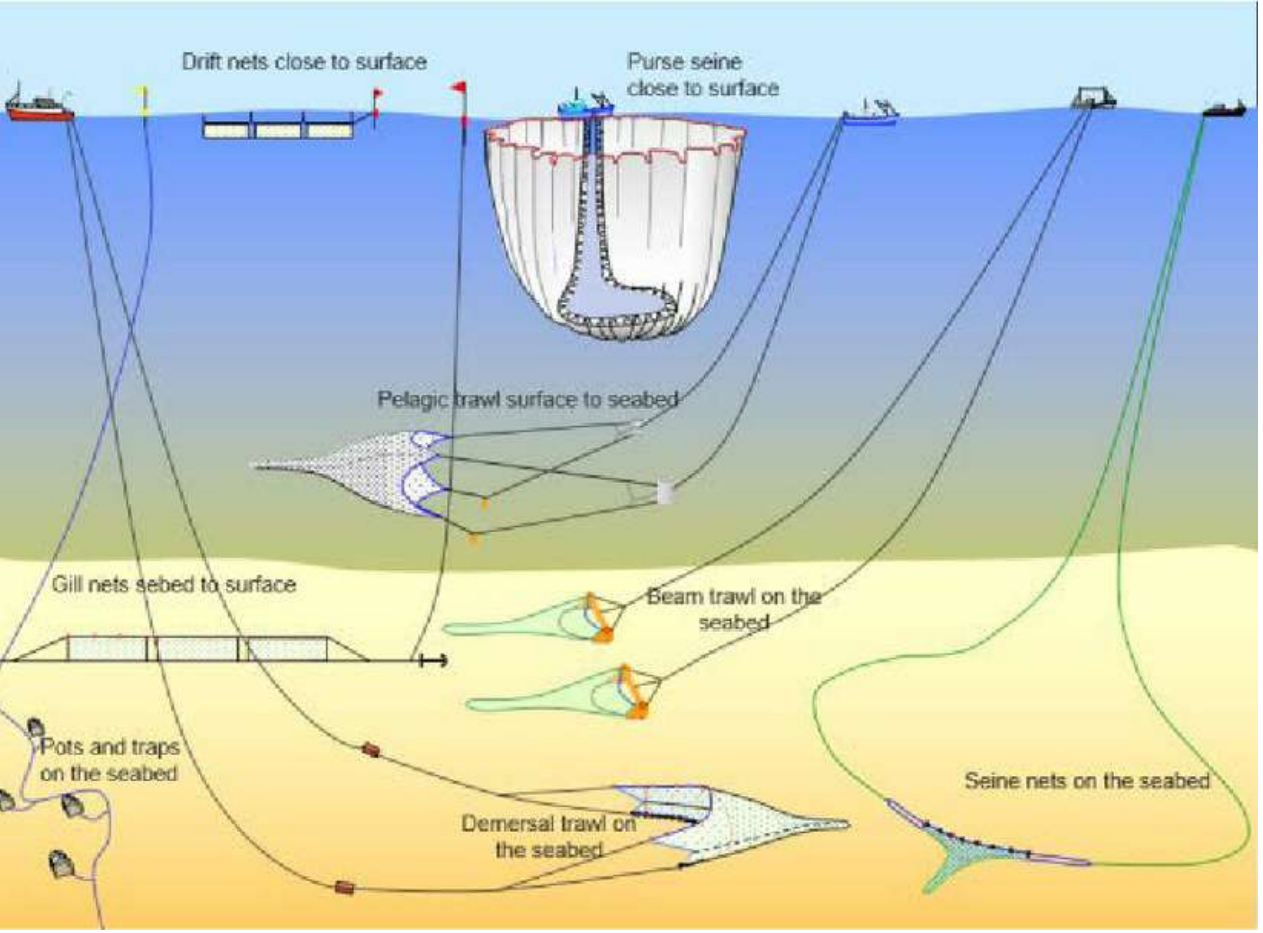
(a)

(b)

(c)

(d)

Fig. 1.6 The diversity of fisheries. (a) Fish traps set in the Lupar Estuary in Sarawak to catch prawns and small fish (see Blaber, 1997), (b) cast-netting for prawns in a small estuary near Mukah, Sarawak, (c) a tuna purse seiner trans-shipping catches to a freezer vessel in the Seychelles, and (d) tuna fishing from a small boat off Cape Verde Islands (d). Photographs copyright S. Blaber (a, b), S. Jennings (c), M. Marzot (FAO photo, d).



Fishing gears

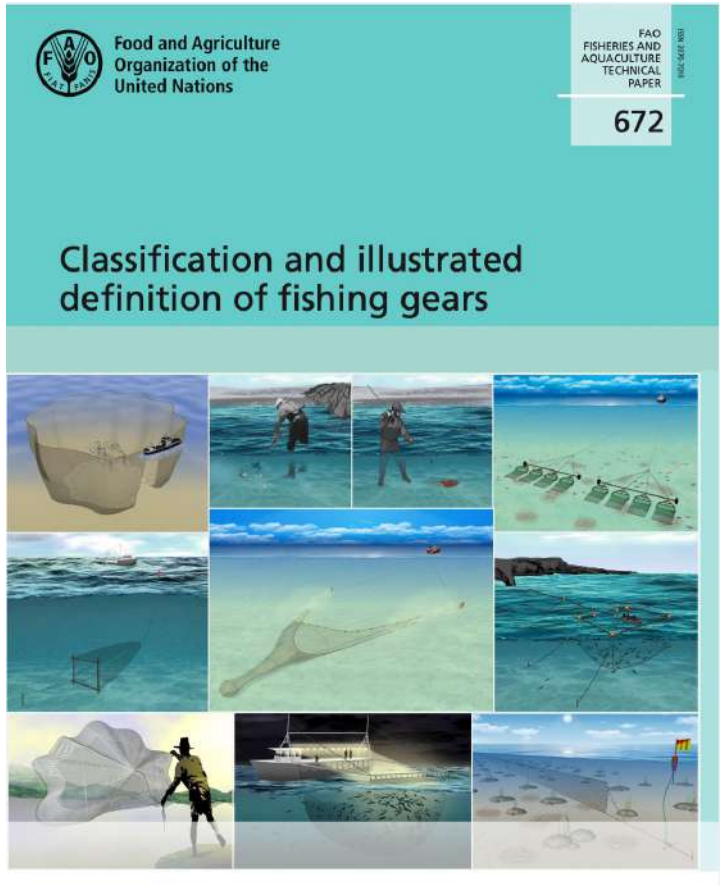
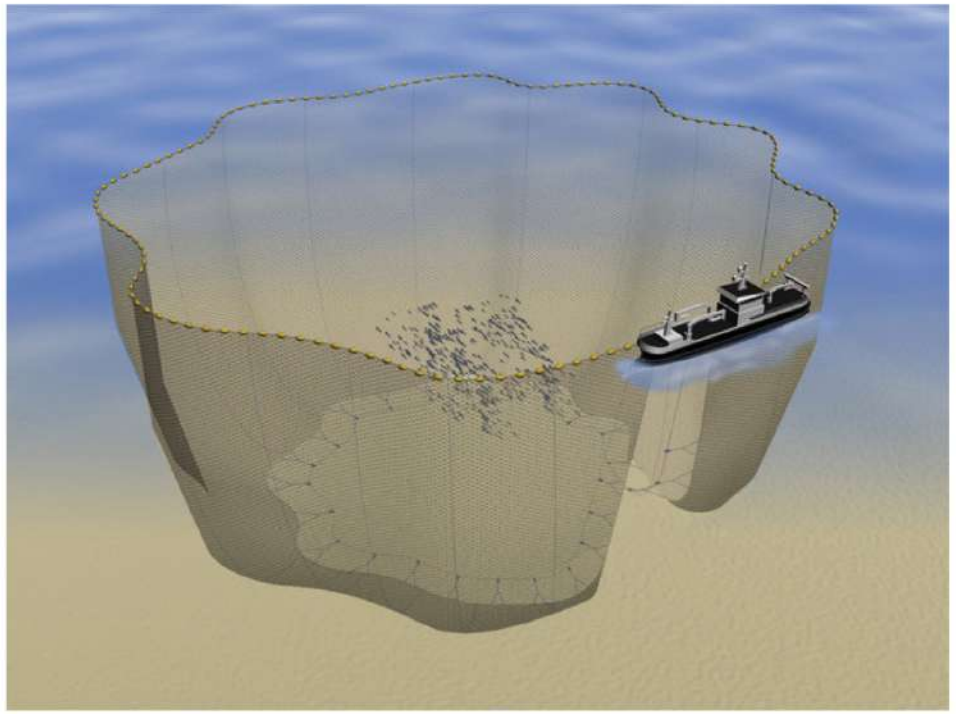


FIGURE 3
Modern purse seine (PS 01.1) encircling a free-swimming fish school

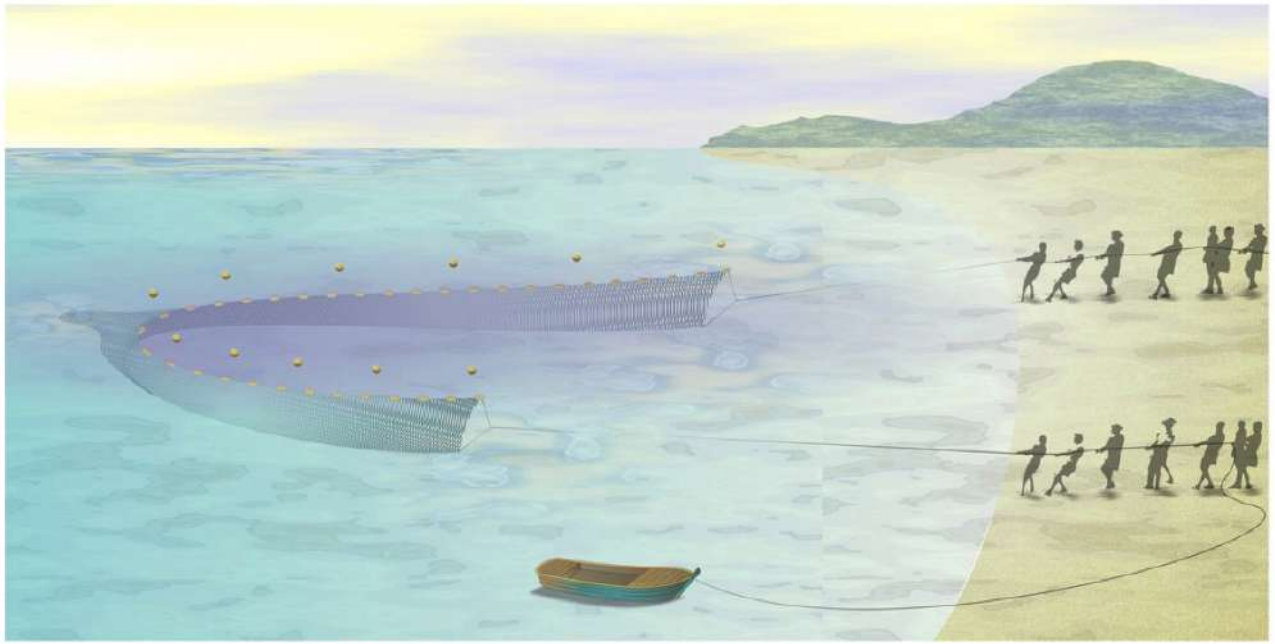


Source: Seafish, 2021.

Fishing gears: purse seine

Fishing gears: beach seine

FIGURE 6
Beach seine (SB 02.1) with a codend, pulled by hand to the beach

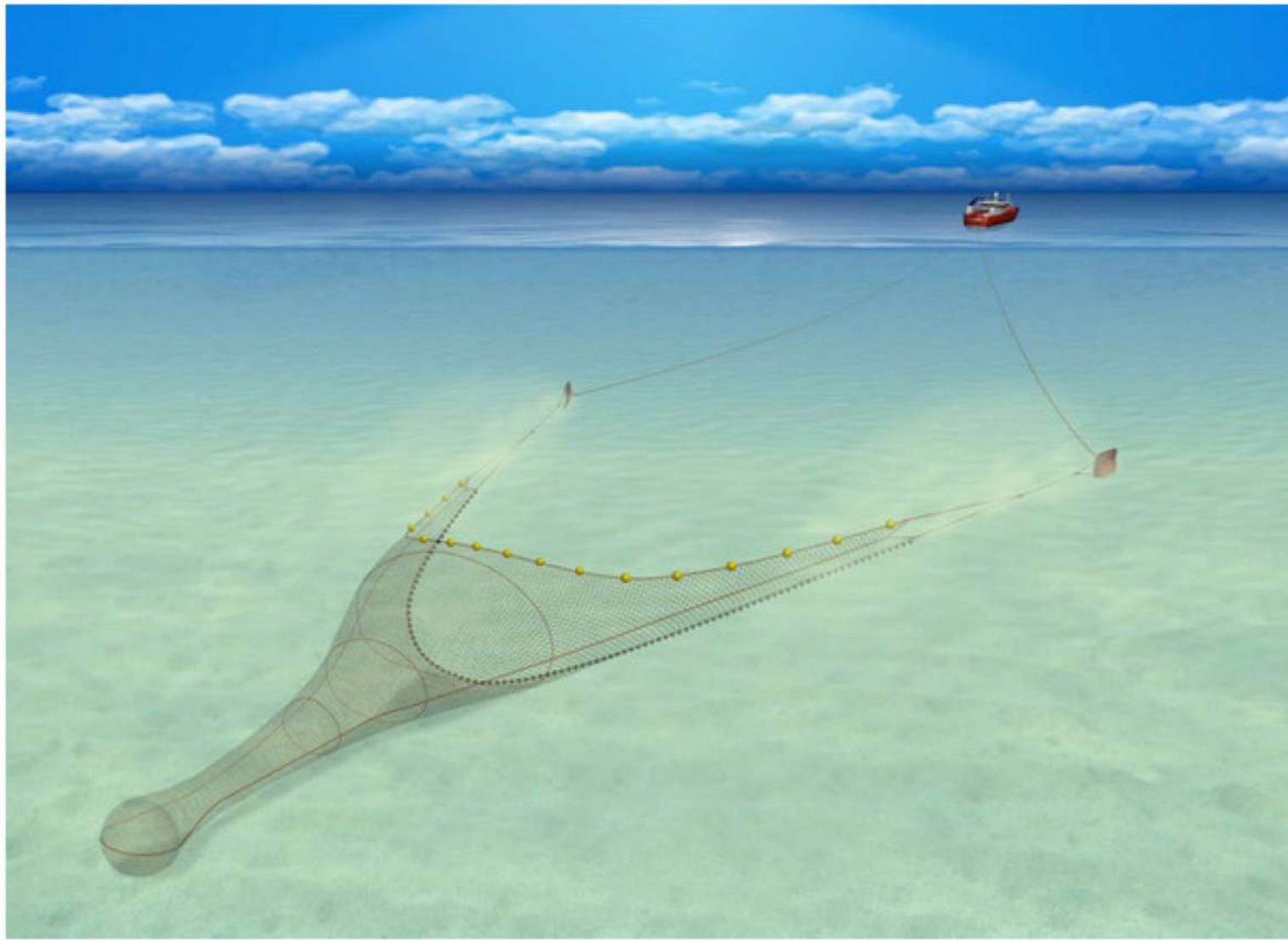


Source: Seafish, 2021.

Fishing gears: otter trawl

FIGURE 12

A single boat otter trawl (OTB 03.12) in operation. The trawl is towed behind one boat and is expanded horizontally by a pair of otter boards



Source: Seafish, 2021.

FIGURE 13

Components and terms of a typical single boat bottom otter trawl (OTB 03.12). Details of examples of different types of otter boards and groundgear (footrope) can be seen in Figure 14 and Figure 15

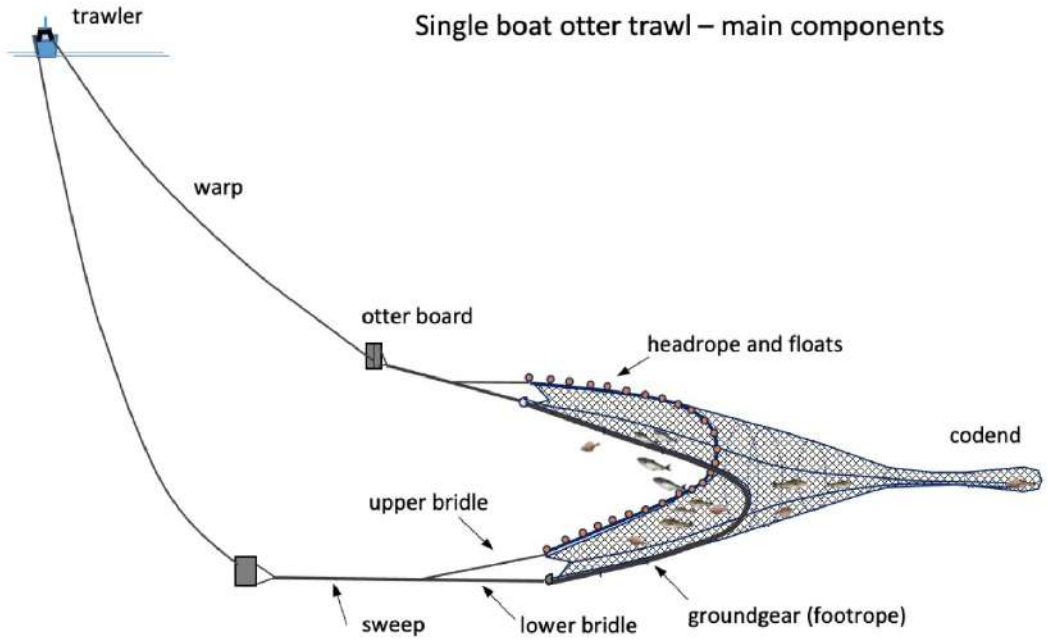
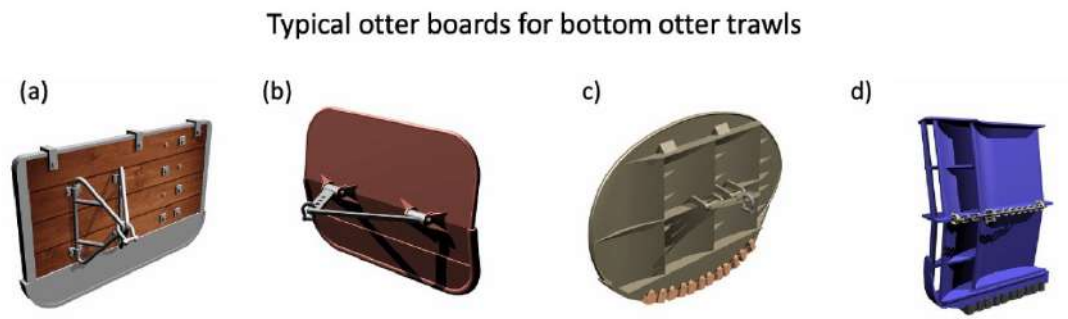


FIGURE 14

A representative selection of otter boards in use in single boat bottom otter trawls (OTB 03.12) around the world. (a) slotted cambered otter board wooden rectangular otter board, (b) V-shaped otter board, (c) slotted oval otter board, (d)

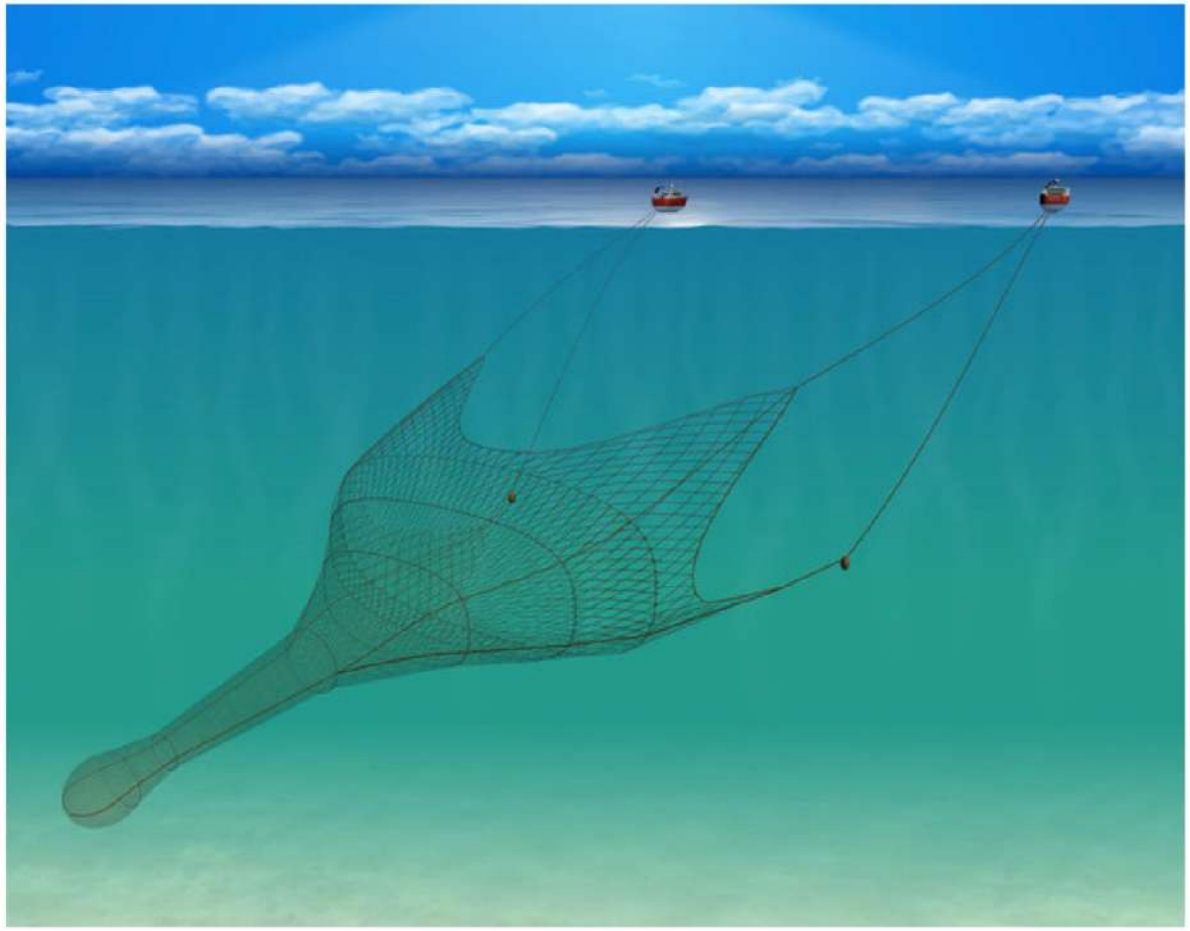


Source: Seafish, 2021.

Fishing gears: bottom otter trawl

Fishing gears: midwater pair trawl

FIGURE 21
A midwater pair trawl (PTM 03.22) with two warps from each vessel



Source: Seafish, 2021.

Fishing gears: hydraulic dredge

FIGURE 25

A mechanized hydraulic dredge (DRM 04.3)

A compressor onboard the vessel pushes high pressure water jet through a hose (thick line) to fluidize the substrate and wash out bivalves in the sediment, allowing the cage-like dredge to collect the animals (bottom right)

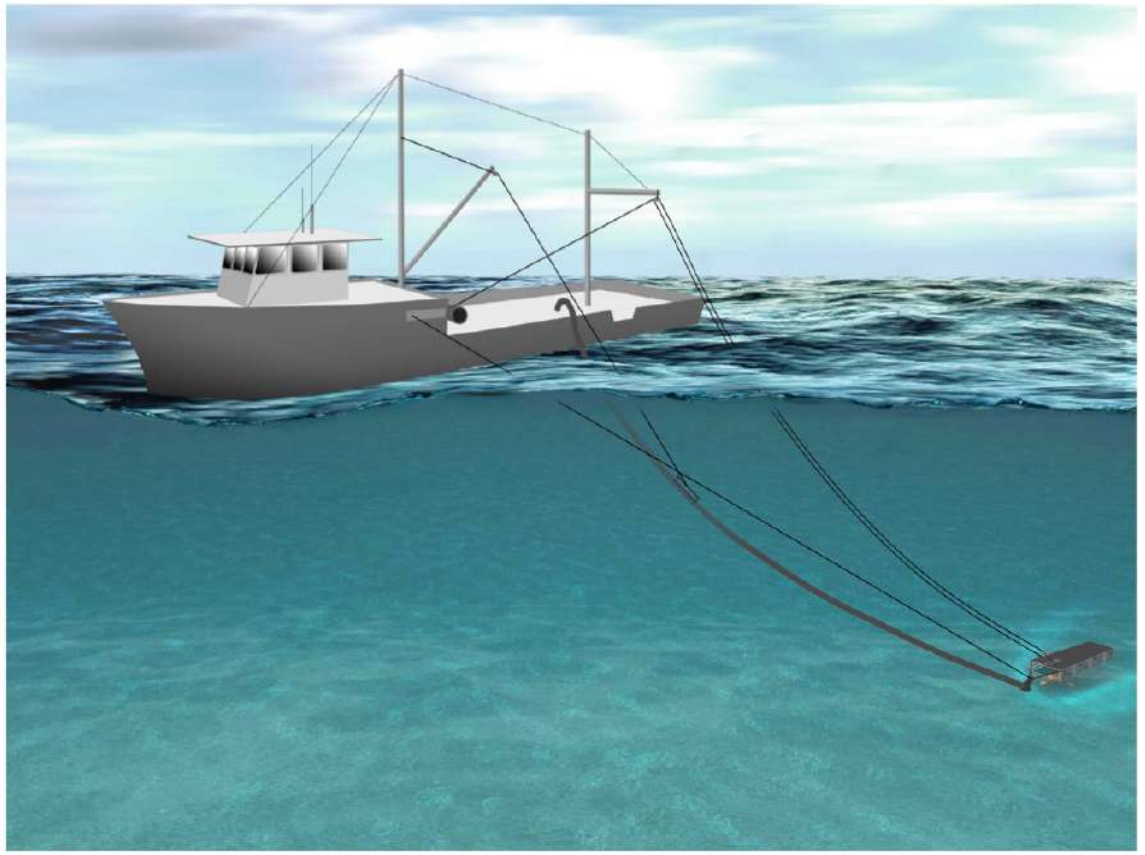
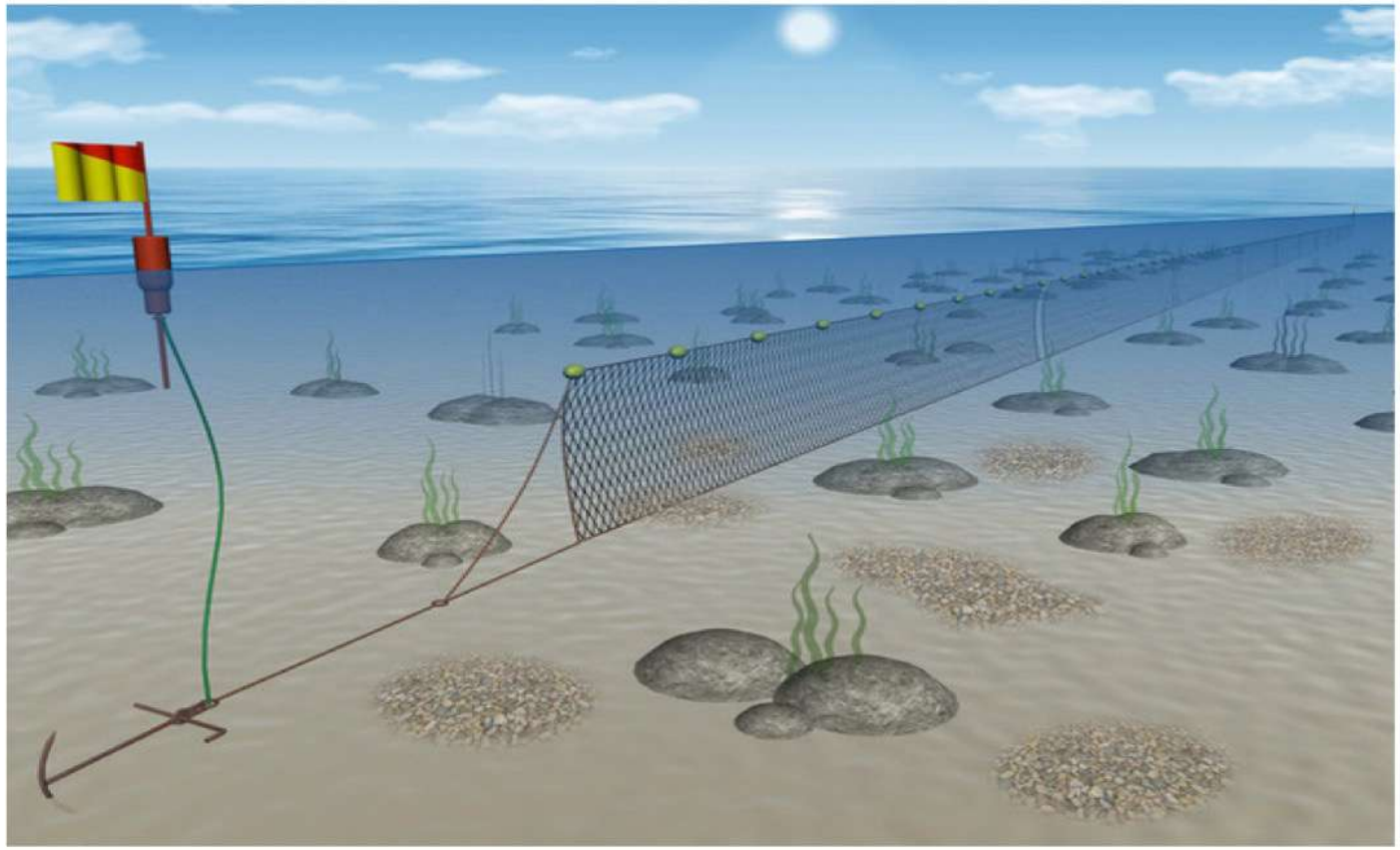


FIGURE 32

A fleet of set gillnets (GNS 07.1) set on the bottom with anchors at each end, and buoys and highflyers on the surface



Source: Seafish, 2021.

Fishing gears: gillnets

Fishing gears: trammel net

FIGURE 37
A trammel net (GTR 07.5) and its fish-catching mechanism
(a) The white netting indicates large-mesh outer layer nets, and the dark small-mesh netting indicates the inner layer net. (b) Fish catch mechanism. The black line represents the inner layer small mesh, while the mesh-like blue lines represent the two large-mesh outer layers. Fish are pocketed when the small mesh layer is pushed through one of the large-mesh layers

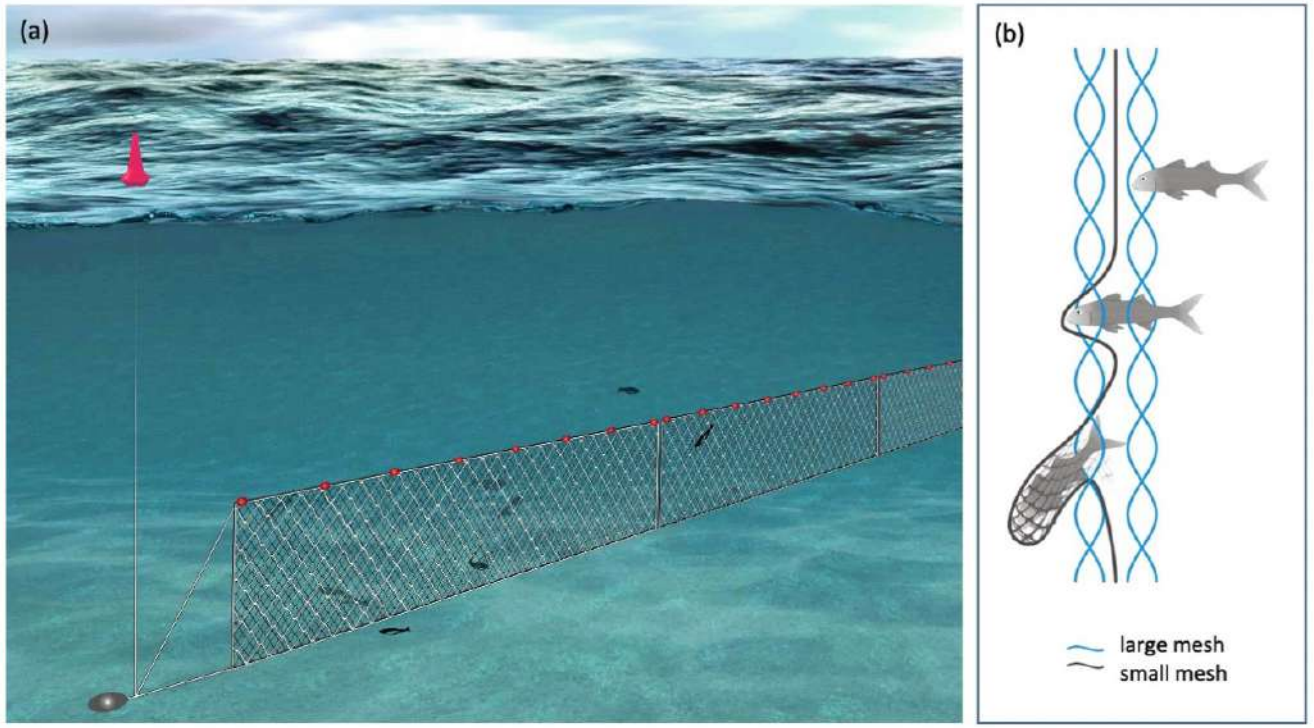
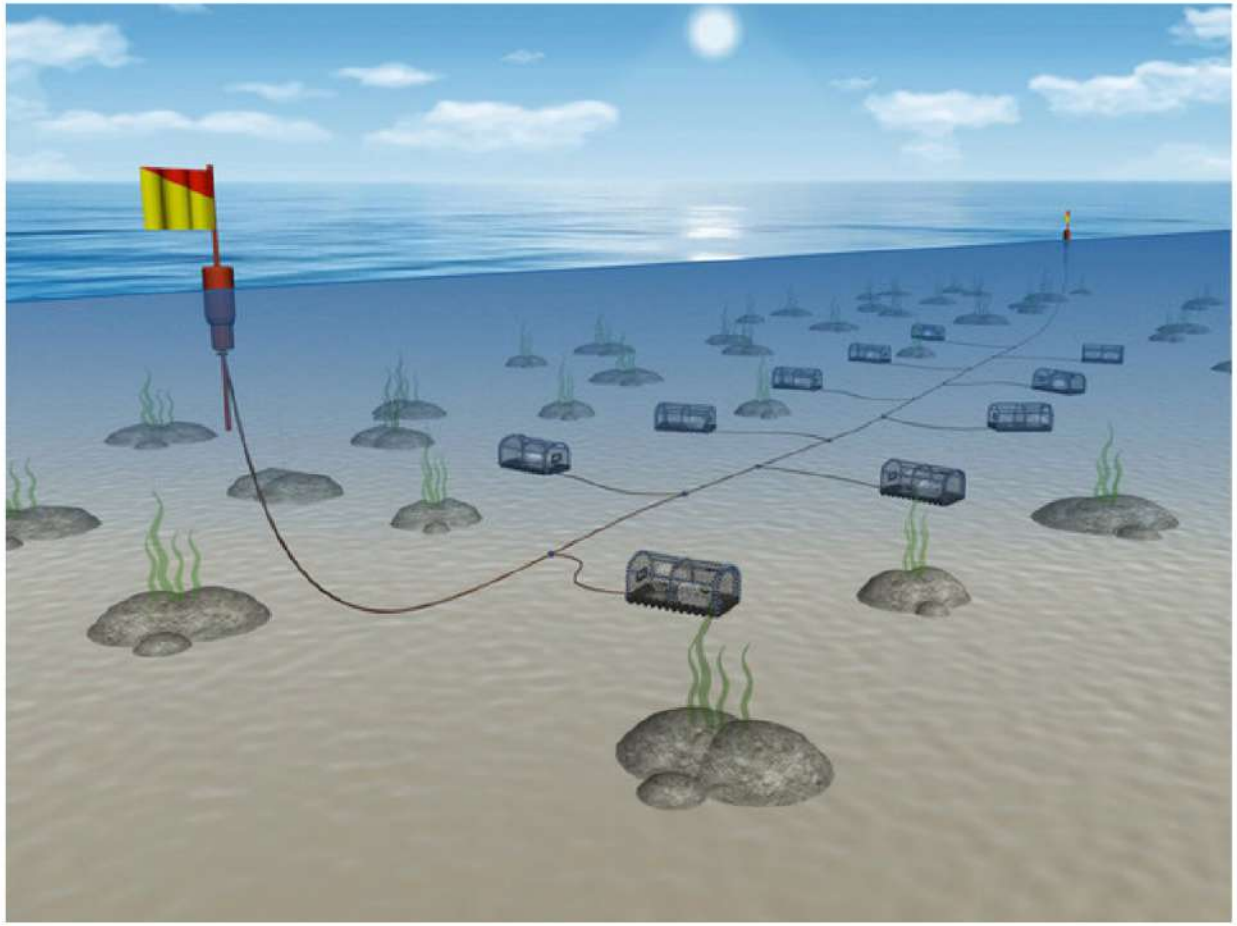


FIGURE 43
A fleet of pots (FPO 08.2) set on the seabed

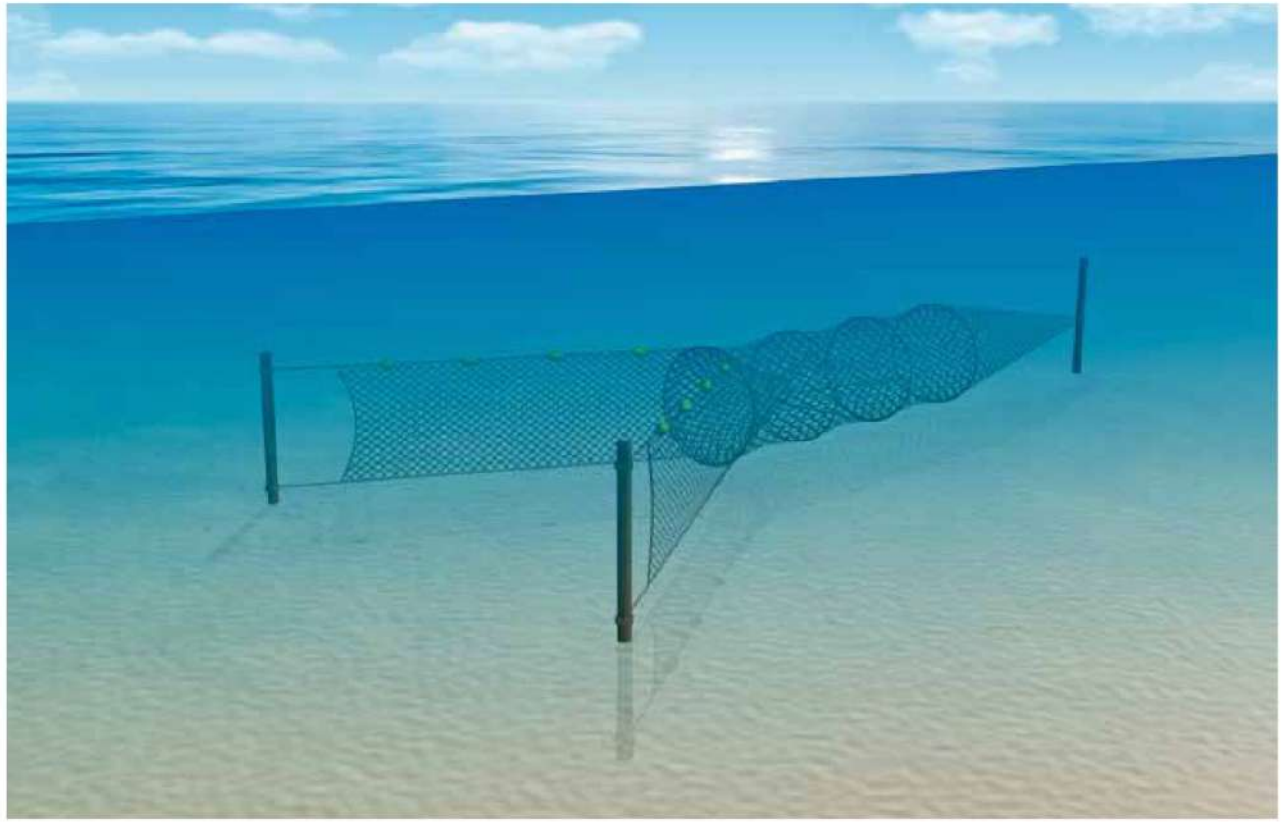


Source: Seafish, 2021.

Fishing gears: pots

Fishing gears: fyke net

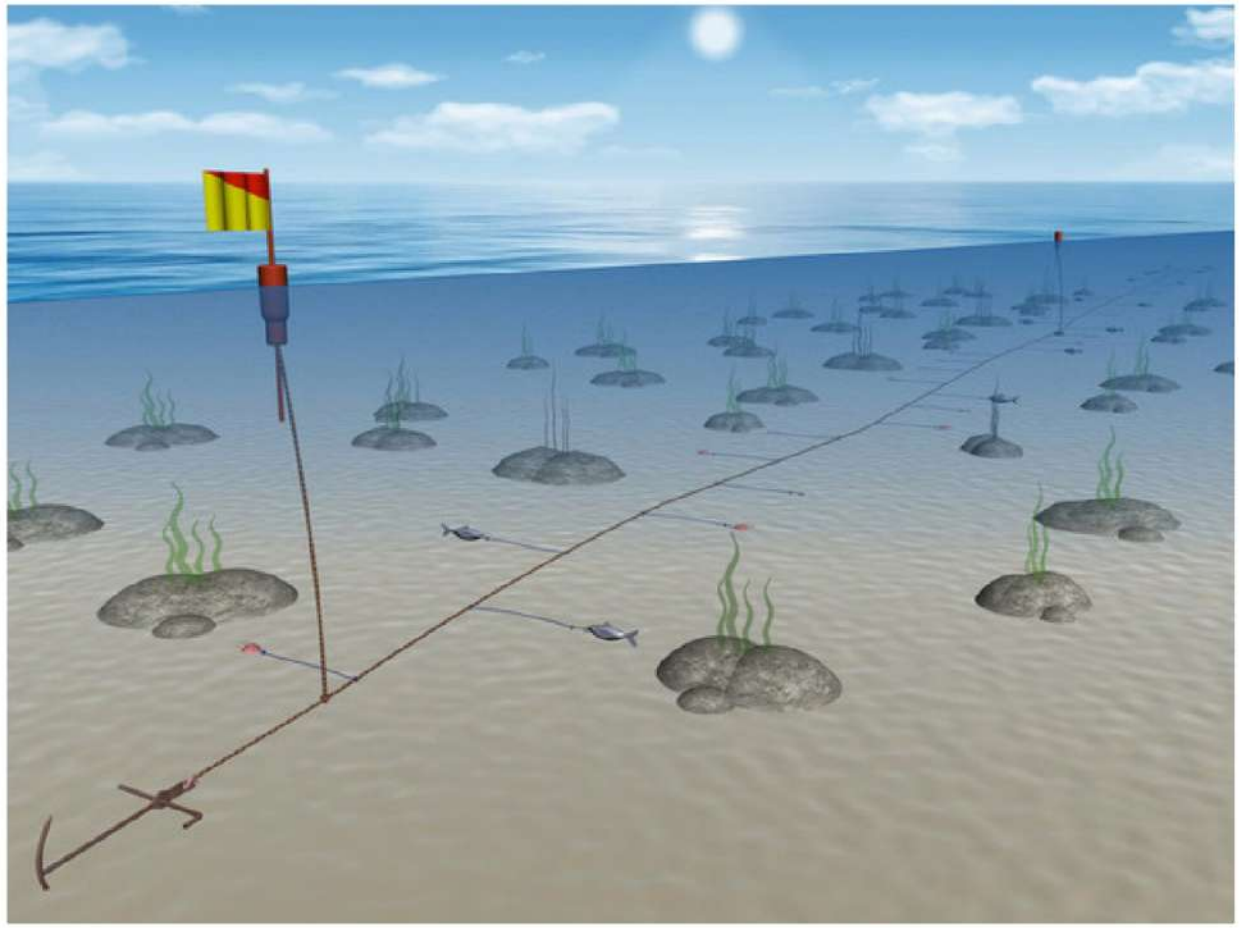
FIGURE 45
A fyke net (FYK 08.3)



Source: Seafish, 2021.

FIGURE 52

A fleet of set longlines (LLS 09.31) deployed on the bottom for catching demersal fish

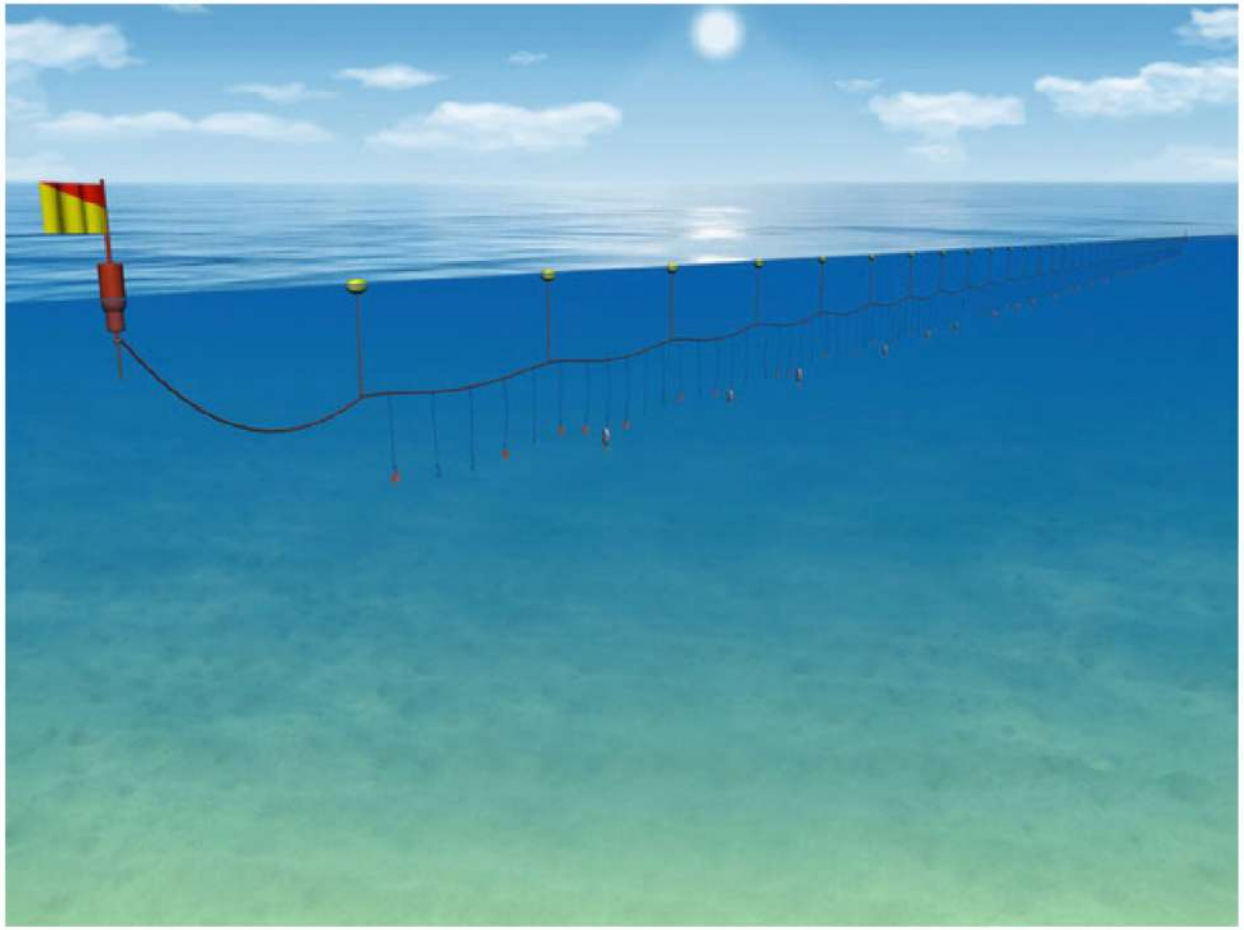


Source: Seafish, 2021.

Fishing gears: longlines (demersal)

Fishing gears: longlines (pelagic)

FIGURE 54
A fleet of drifting longlines (LLD 09.32) set near the surface



Source: Seafish, 2021.

Fishing gears: classification

TABLE 1
Revised International Standard Classification of Fishing Gears (ISSCFG), Rev.1 (2016)

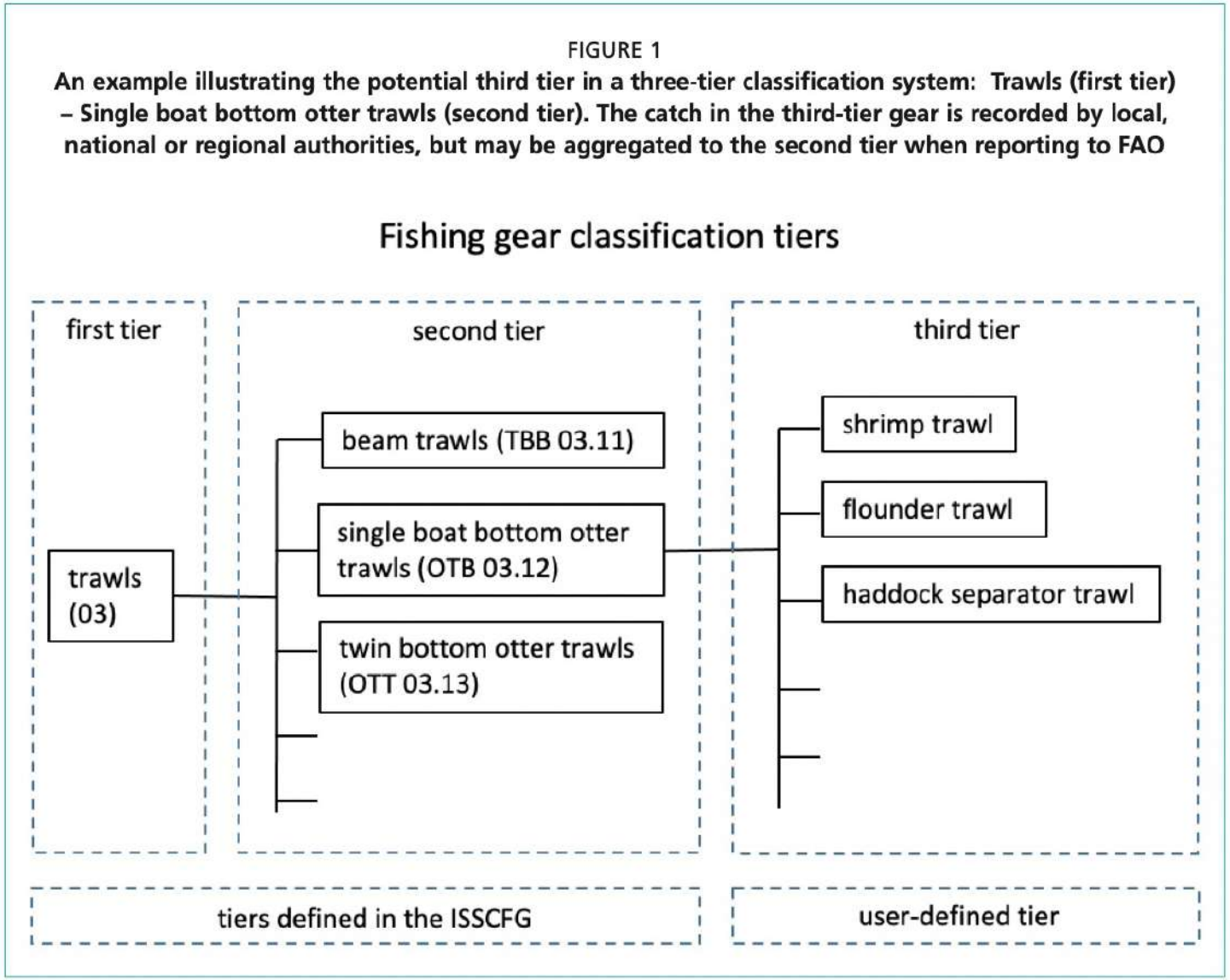
Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
SURROUNDING NETS			01
	Purse seines	PS	01.1
	Surrounding nets without purse lines	LA	01.2
	Surrounding nets (nei)	SUX	01.9
SEINE NETS			02
	Beach seines	SB	02.1
	Boat seines	SV	02.2
	Seine nets (nei)	SX	02.9
TRAWLS			03
	Beam trawls	TBB	03.11
	Single boat bottom otter trawls	OTB	03.12
	Twin bottom otter trawls	OTT	03.13
	Multiple bottom otter trawls	OTP	03.14
	Bottom pair trawls	PTB	03.15
	Bottom trawls (nei)	TB	03.19
	Single boat midwater otter trawls	OTM	03.21
	Midwater pair trawls	PTM	03.22
	Midwater trawls (nei)	TM	03.29
	Semipelagic trawls	TSP	03.3
	Trawls (nei)	TX	03.9
DREDGES			04
	Towed dredges	DRB	04.1
	Hand dredges	DRH	04.2
	Mechanized dredges	DRM	04.3
	Dredges (nei)	DRX	04.9
LIFT NETS			05
	Portable lift nets	LNP	05.1
	Boat-operated lift nets	LNB	05.2
	Shore-operated stationary lift nets	LNS	05.3
	Lift nets (nei)	LN	05.9
FALLING GEAR			06
	Cast nets	FCN	06.1
	Cover pots/Lantern nets	FCO	06.2
	Falling gear (nei)	FG	06.9

Gear categories (First tier)	Subcategory (Second tier)	Standard abbreviations	ISSCFG code
GILLNETS AND ENTANGLING NETS			07
	Set gillnets (anchored)	GNS	07.1
	Drift gillnets	GND	07.2
	Encircling gillnets	GNC	07.3
	Fixed gillnets (on stakes)	GNF	07.4
	Trammel nets	GTR	07.5
	Combined gillnets-trammel nets	GTN	07.6
	Gillnets and entangling nets (nei)	GEN	07.9
TRAPS			08
	Stationary uncovered pound nets	FPN	08.1
	Pots	FPO	08.2
	Fyke nets	FYK	08.3
	Stow nets	FSN	08.4
	Barriers, fences, weirs, etc.	FWR	08.5
	Aerial traps	FAR	08.6
	Traps (nei)	FIX	08.9
HOOKS AND LINES			09
	Handlines and hand-operated pole-and-lines	LHP	09.1
	Mechanized lines and pole-and-lines	LHM	09.2
	Set longlines	LLS	09.31
	Drifting longlines	LLD	09.32
	Longlines (nei)	LL	09.39
	Vertical lines	LVT	09.4
	Trolling lines	LTL	09.5
	Hooks and lines (nei)	LX	09.9
MISCELLANEOUS GEAR			10
	Harpoons	HAR	10.1
	Hand implements (Wrenching gear, Clamps, Tongs, Rakes, Spears)	MHI	10.2
	Pumps	MPM	10.3
	Electric fishing	MEL	10.4
	Pushnets	MPN	10.5
	Scoopnets	MSP	10.6
	Drive-in nets	MDR	10.7
	Diving	MDV	10.8
	Gear nei	MIS	10.9
GEAR NOT KNOWN			99
	Gear not known	NK	99.9

Fishing gears: classification

FIGURE 1

An example illustrating the potential third tier in a three-tier classification system: Trawls (first tier) – Single boat bottom otter trawls (second tier). The catch in the third-tier gear is recorded by local, national or regional authorities, but may be aggregated to the second tier when reporting to FAO



Why manage fisheries?

Because the resources are **not unlimited** and poor management has led over the centuries / years to the collapse of some stocks and to the general state of **overfishing** of most stocks (at the Mediterranean and global)

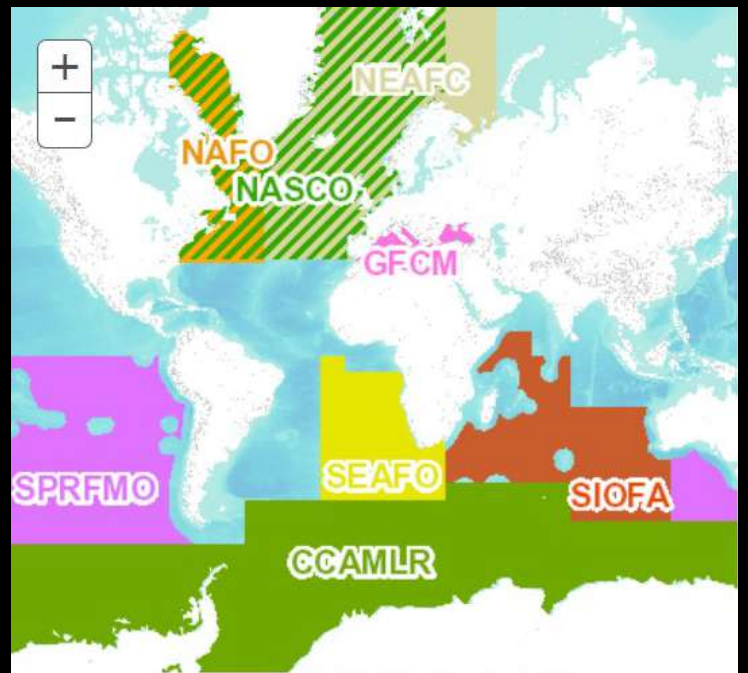
Because some types of fishing have a strong impact on the environment and contribute to the fragmentation and / or destruction of the habitat and the loss of biodiversity.

Table 1.1 Objectives of fishery management. Based on Clark (1985).

Objective	Biological	Economic	Social	Political
Protect habitat	*			
Increase selectivity	*			
Prevent mortality of rare species	*			
Prevent ecosystem shifts	*			
Rebuild overexploited stock	*			
Reduce discarding	*			
Maximize protein supply	*		*	
Maximize income		*		
Maximize profit		*		
Maximize employment			*	
Keep prices low		*		
Minimize variability in catch			*	*
Minimize variability in income		*	*	
Reduce overcapacity			*	
Raise government revenue		*	*	*
Improve catch quality		*		
Increase exports		*		
Do not upset lobby groups			*	*
Do not upset fishers			*	*
Do not upset conservationists			*	*
Preserve status quo			*	*
Reduce conflicts			*	*
Boost sport fisheries			*	

Why manage fisheries?

Fisheries science provides important information to the managing authorities, in the case of Italy the **MIPAAF** and at the highest level to the **FAO**
Italy, like all Mediterranean countries, are also managed by the **GFCM** = General Fisheries Commission for The Mediterranean which is an RFMO = Regional fisheries management organization



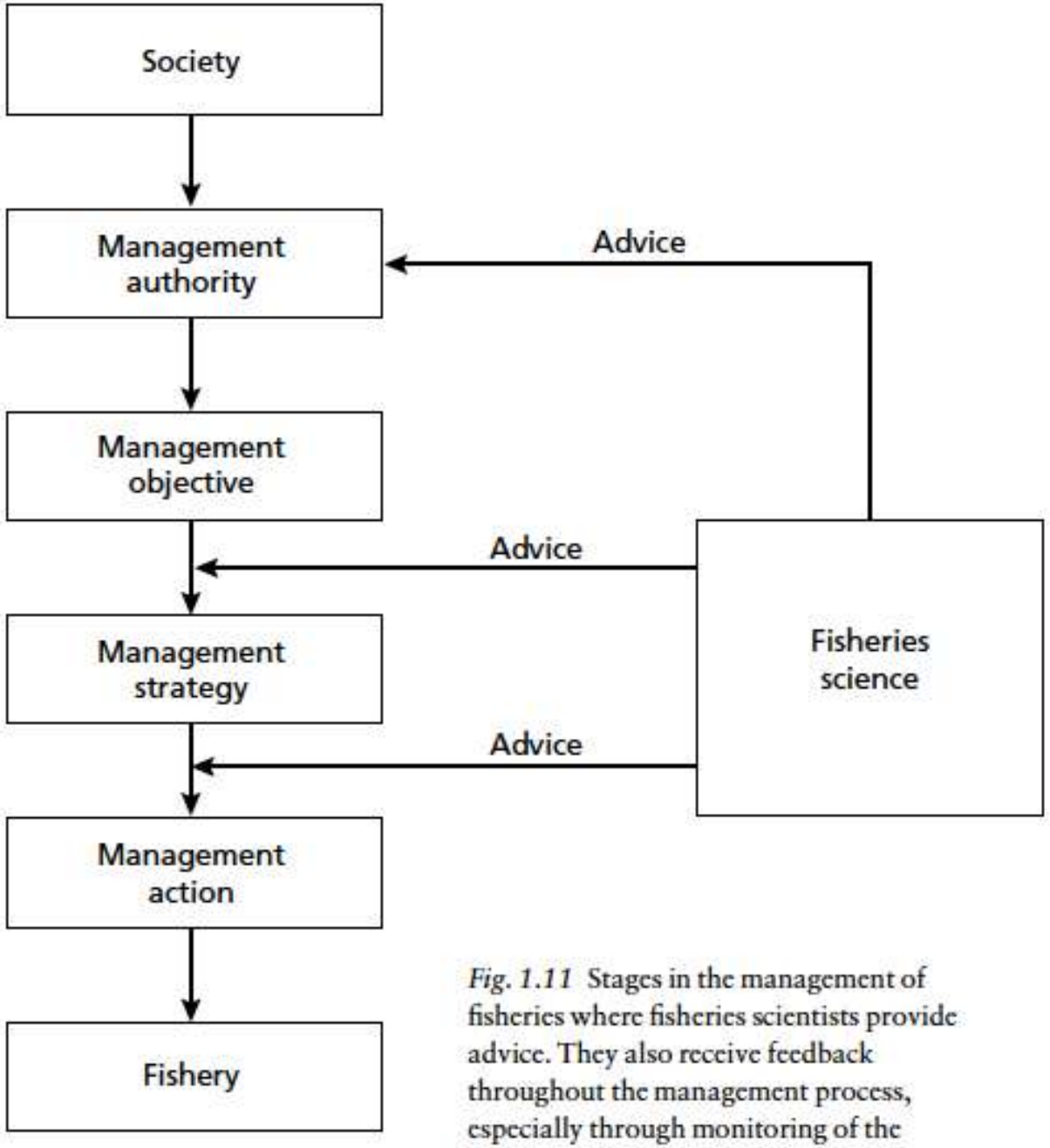
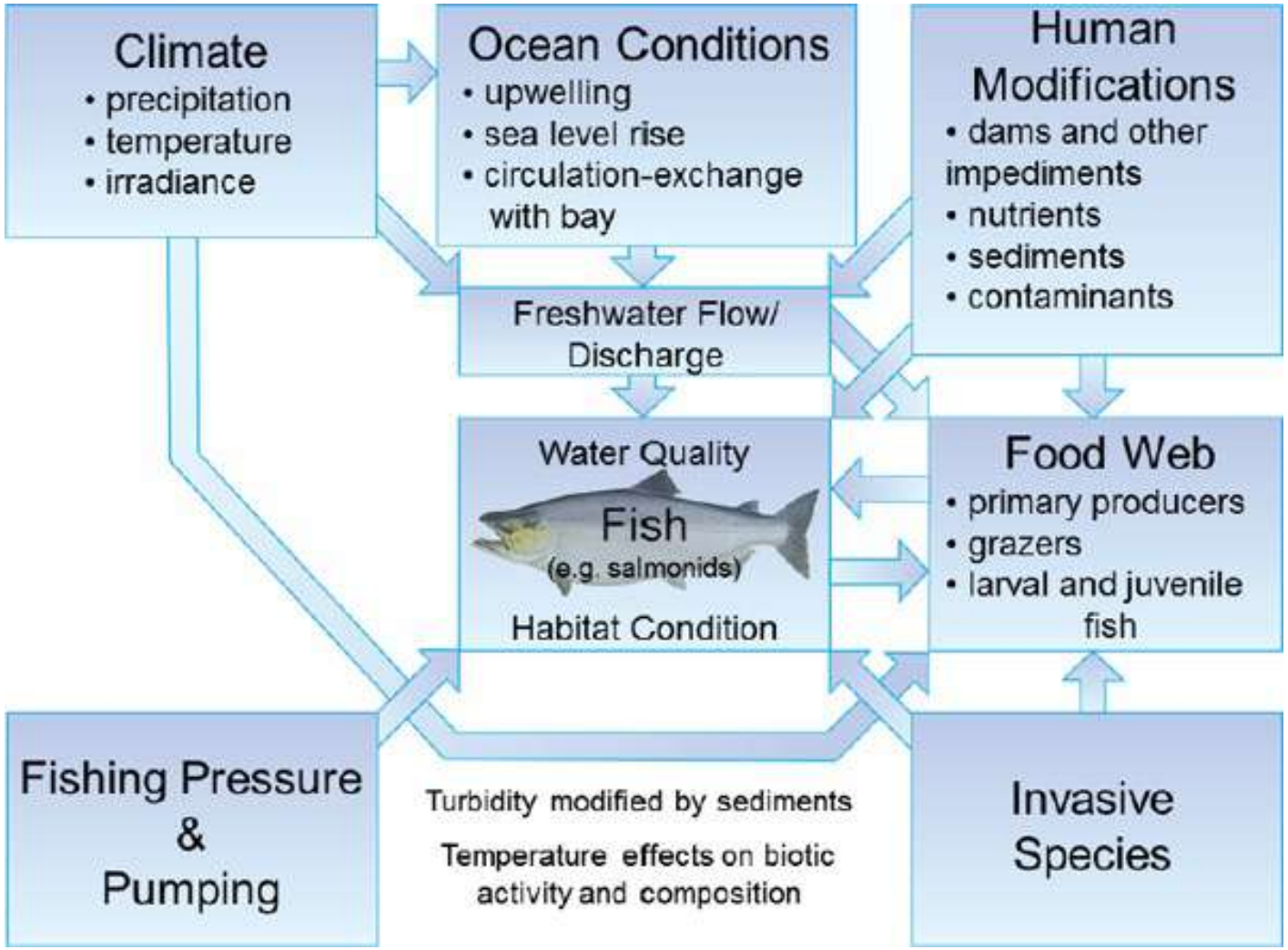


Fig. 1.11 Stages in the management of fisheries where fisheries scientists provide advice. They also receive feedback throughout the management process, especially through monitoring of the fishery.

Other aspects:




Any
Questions

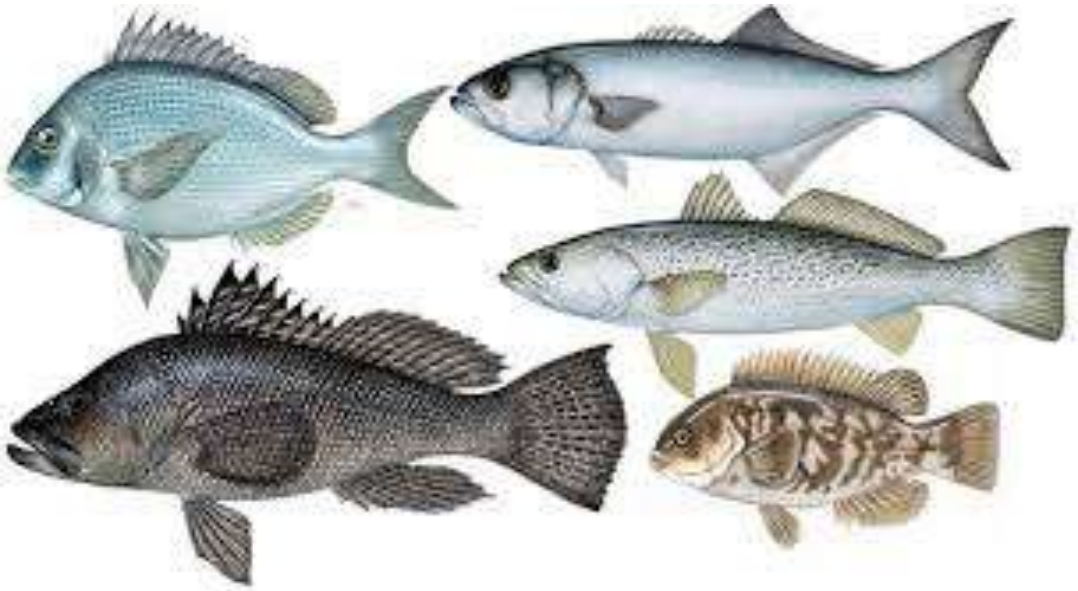
Teaching Week 2024

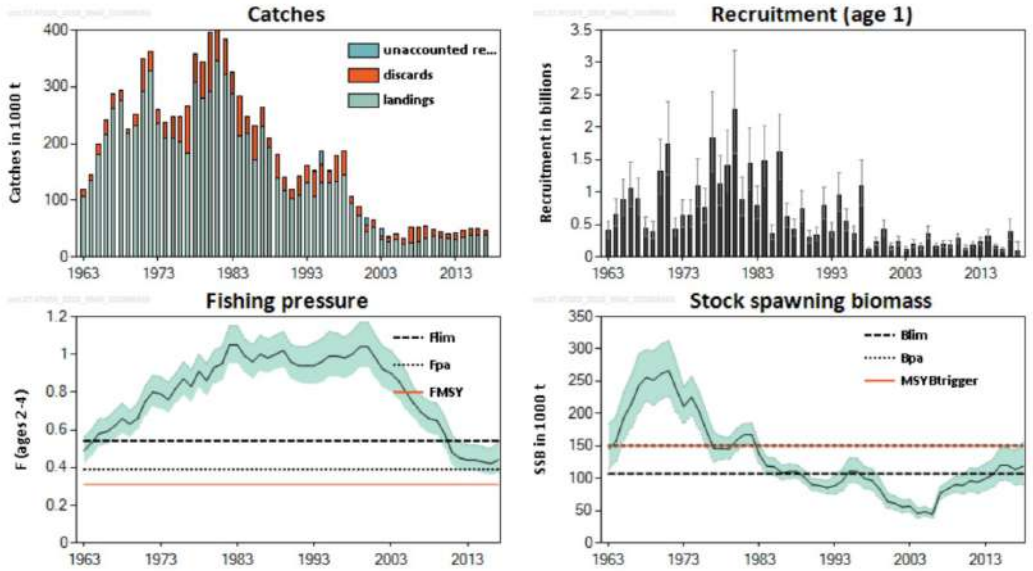
Key Concepts in Fisheries Biology - the Management Toward Sustainability

Fano Marine Center, 27 February 2024

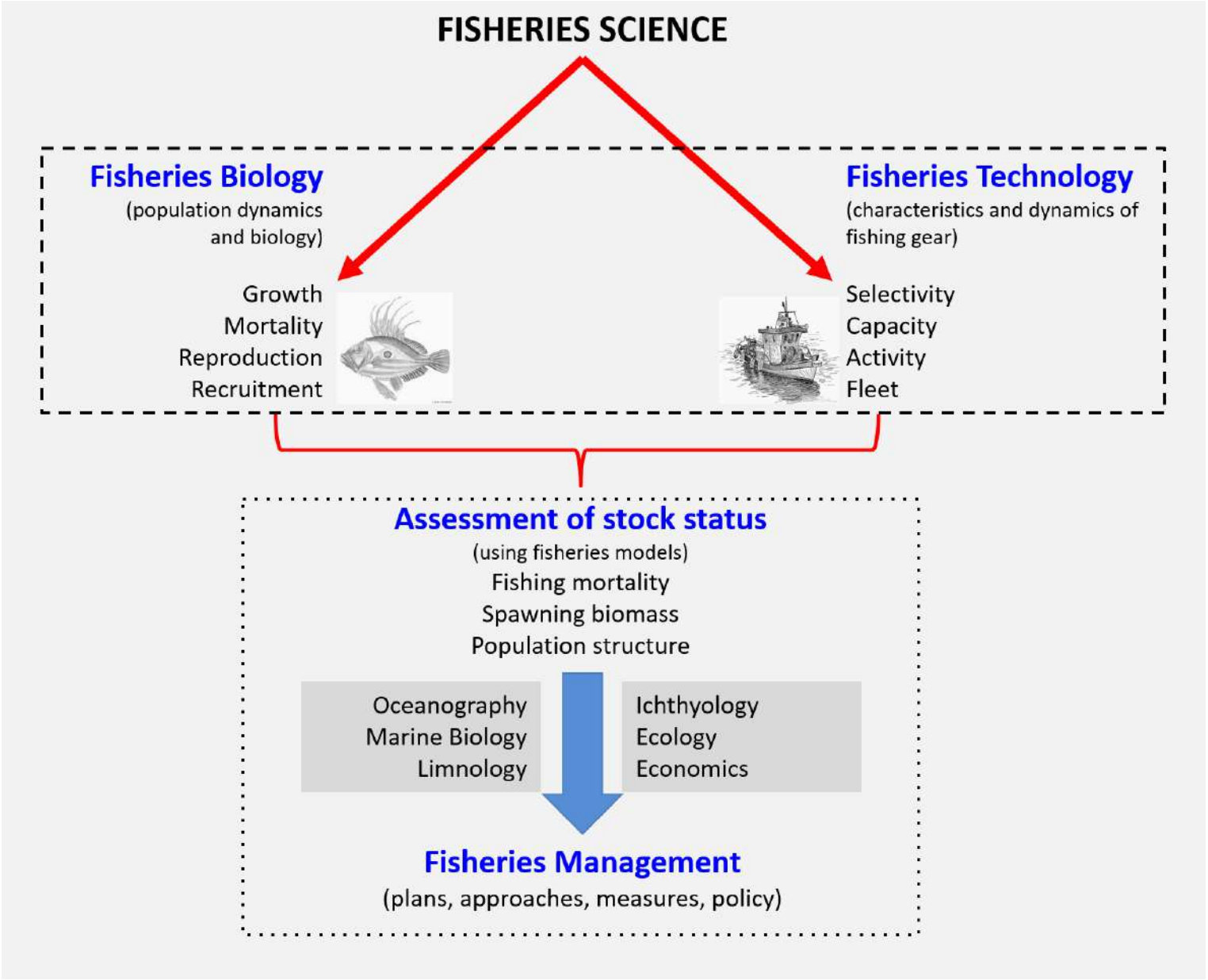
Fisheries in the Adriatic Sea: management toward sustainability

Teaching Week 2024





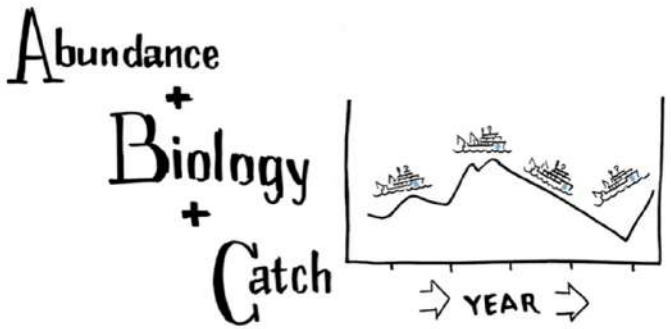
Resource evaluation

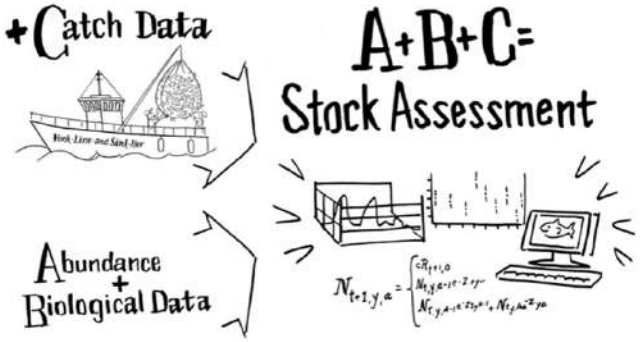


How many fish in the sea?

How many fish in the sea?

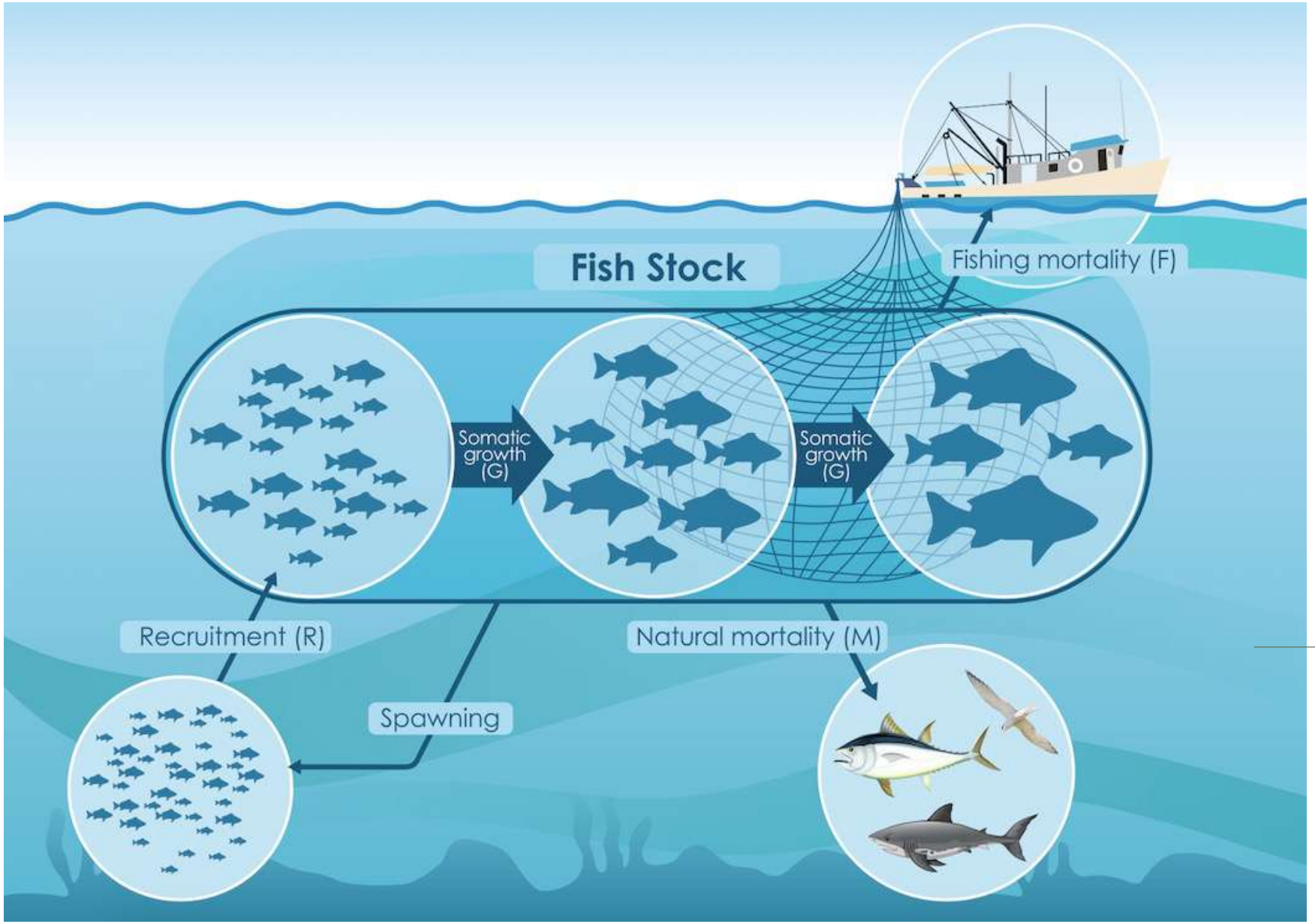
In reality and in connection to the society and economy, this is the package of stock assessment and ecosystem management





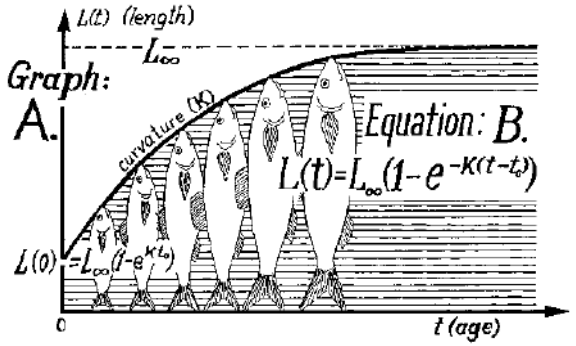
Fish stock

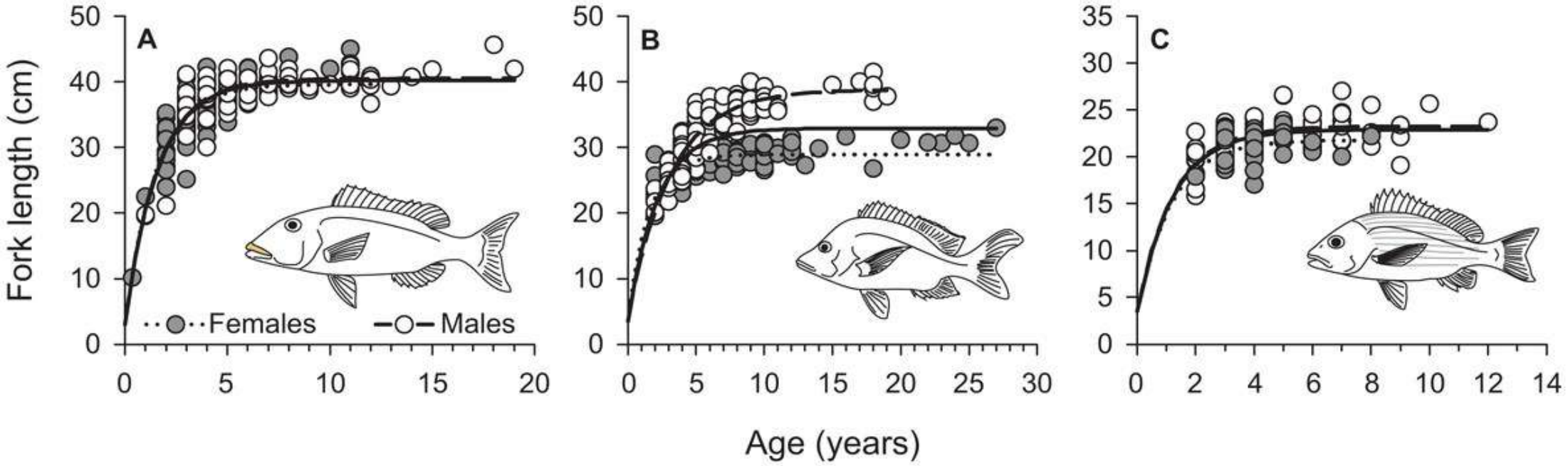
The living resources in the community or population from which catches are taken in a fishery. Use of the term fish stock usually implies that the particular population is more or less isolated from other stocks of the same species and hence self-sustaining.



Population dynamics and processes

The von Bertalanffy growth equation





Population processes used in fisheries biology

Age
Lifespan, longevity and age determination methods

Growth
Length-weight relationships, growth parameters, interrelationships and methods

Reproduction
Size at maturity, onset and duration of spawning, fecundity

Mortality
Natural, fishing, total and methods of estimation

1. For studying the biology of marine organisms even of non-commercial ones

2. Assessing the stock status using single-species approach and methods

Usually stock are assessed using **age-based methods** that require the estimation of all biological parameters (**length-weight relationships, growth parameters, length at maturity, natural mortality**) by age or by length, which is then converted to age using an inverse von Bertalanffy equation

Often not available

Age
Lifespan, longevity and age determination methods

Growth
Length-weight relationships, growth[illegible]eters, interrelationships and methods

Reproduction
Size at maturity, onset and duration[illegible]

Mortality
Natural, fishing, total and methods of esti[illegible]

[illegible]anisms even of non-commercial ones

[illegible]sessing the stock s[illegible]e-species approach and methods

Usually stock are assessed using **age-based methods** that require the estimation of all biological parameters (**length-weight relationships, growth parameters, length at maturity, natural mortality**) by age or by length, which is then converted to age using an inverse von Bertalanffy equation

Available data used in fisheries biology

Catches
Landings by species, by year, statistics, discards

Effort
Number of vessels, number of days at sea

CPUE
Abundance data from survey or from commercial data

Expert knowledge
Changes in fishery regualtion, resiliance of a species

1. To understand the status of a stock in term of Fishing mortality and Biomass

2. To allow management procedures.

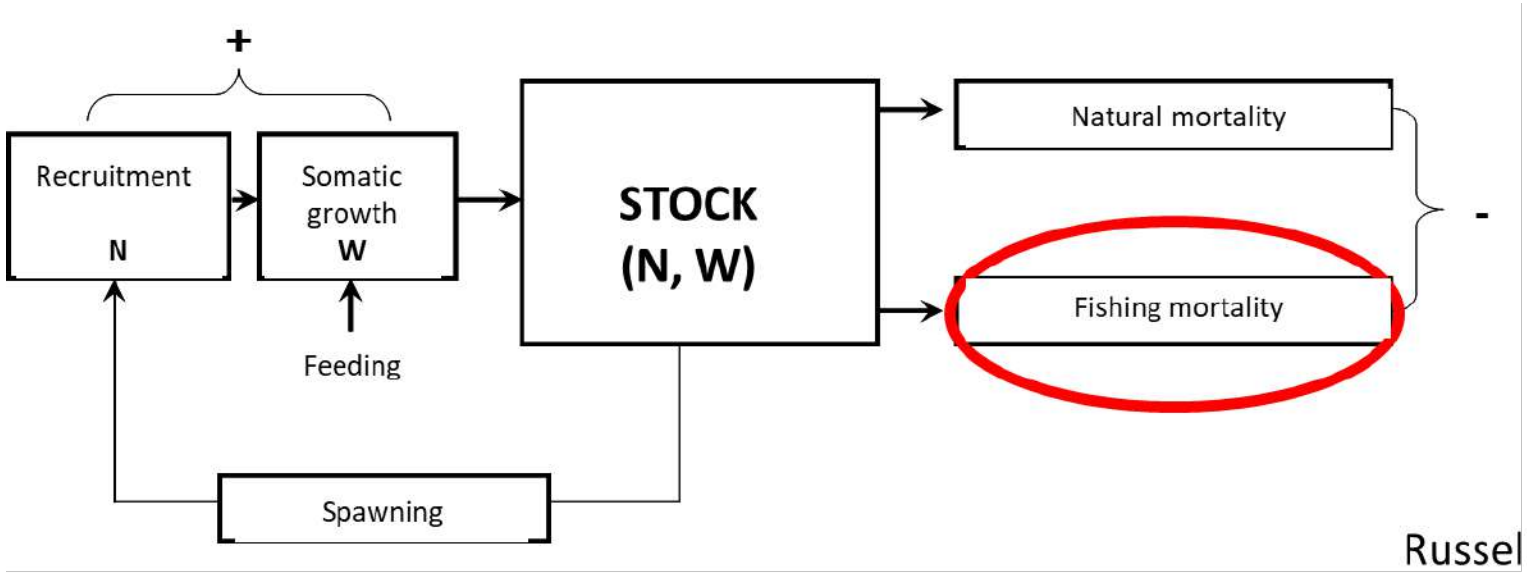
Usually stock can be assess with **production models** that does not require the estimation of all biological parameters by age or by length, but only fishery statistics

MSY and reference points in fisheries

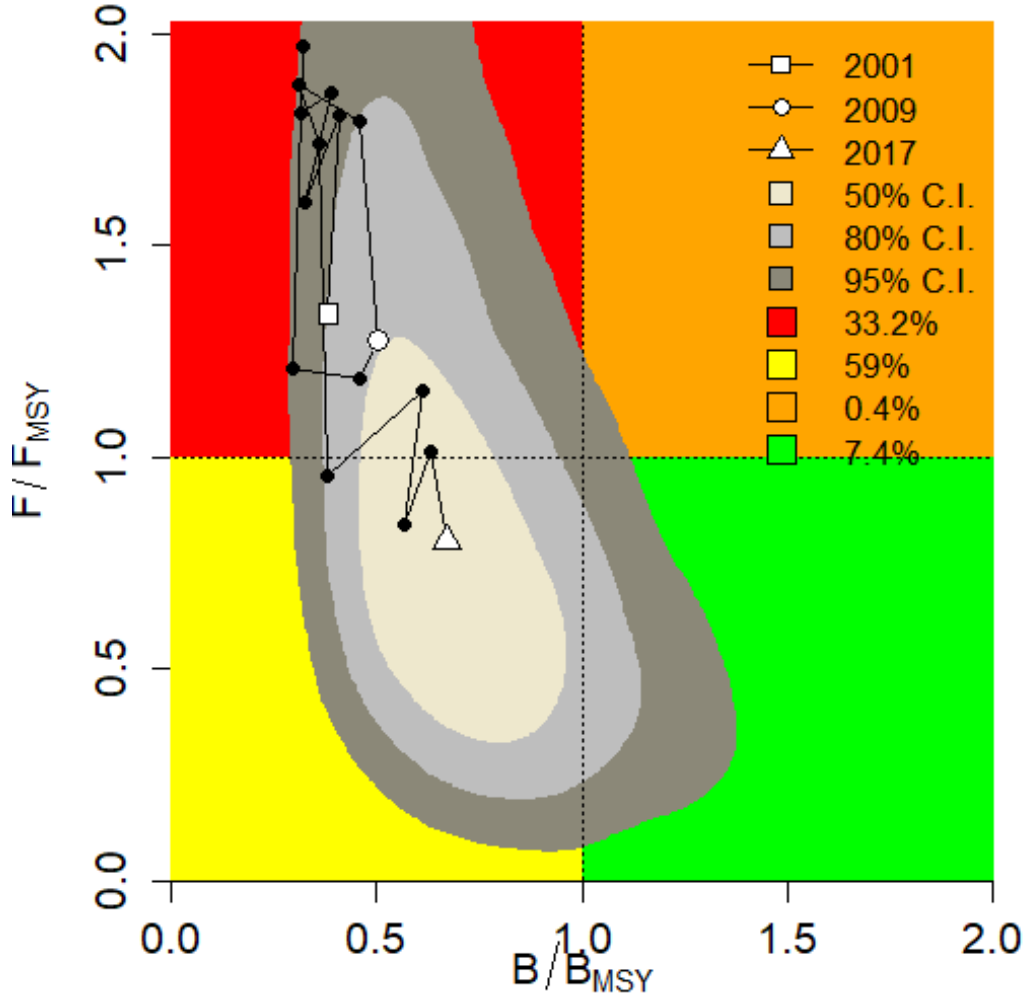
Maximum sustainable yield (**MSY**) is one of the fundamental concepts in fisheries science

It refers to the removal of the largest possible biomass without risking the collapse of a stock

«Live on the interest and not the capital»

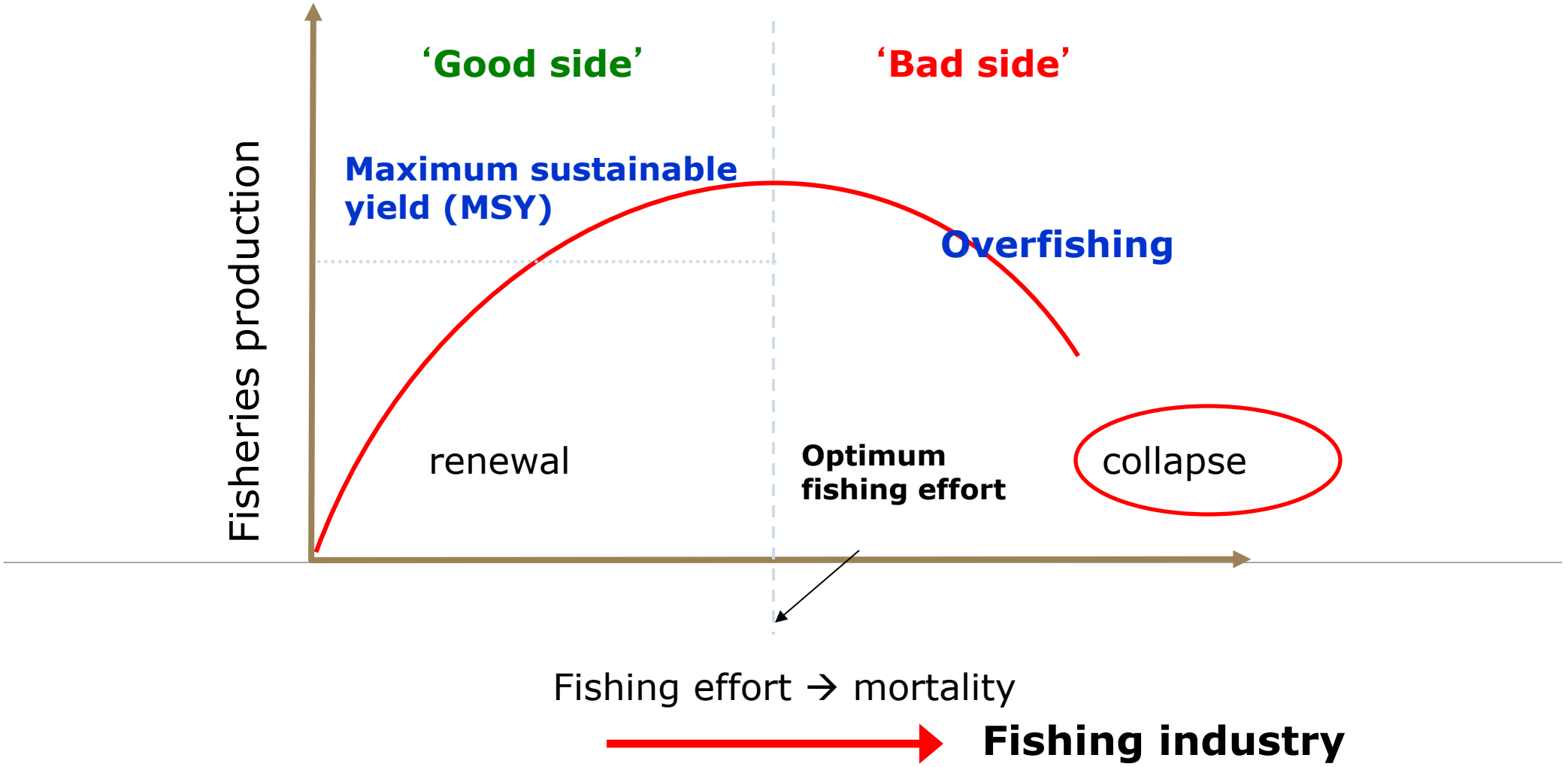


Russell 1931

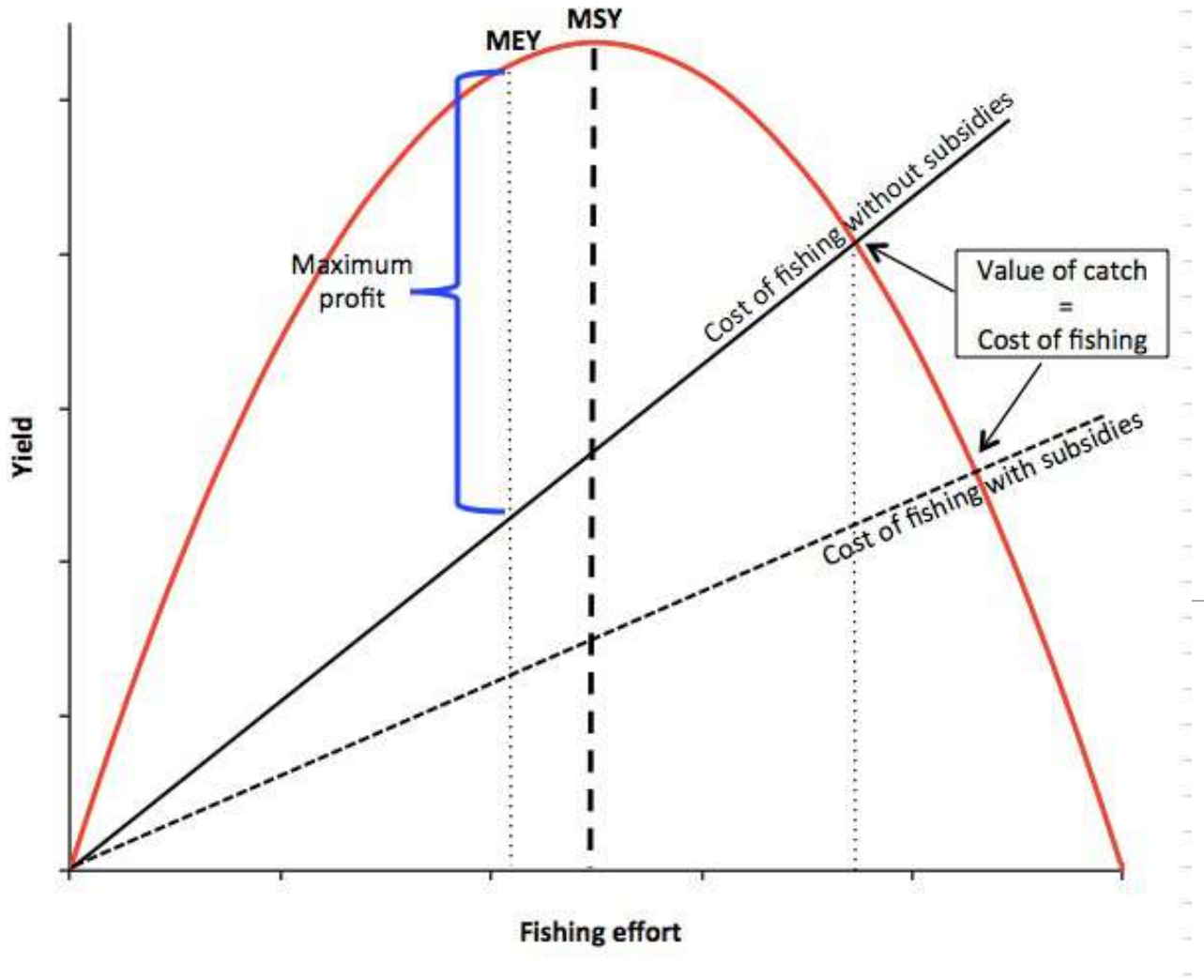


Assessing stock status

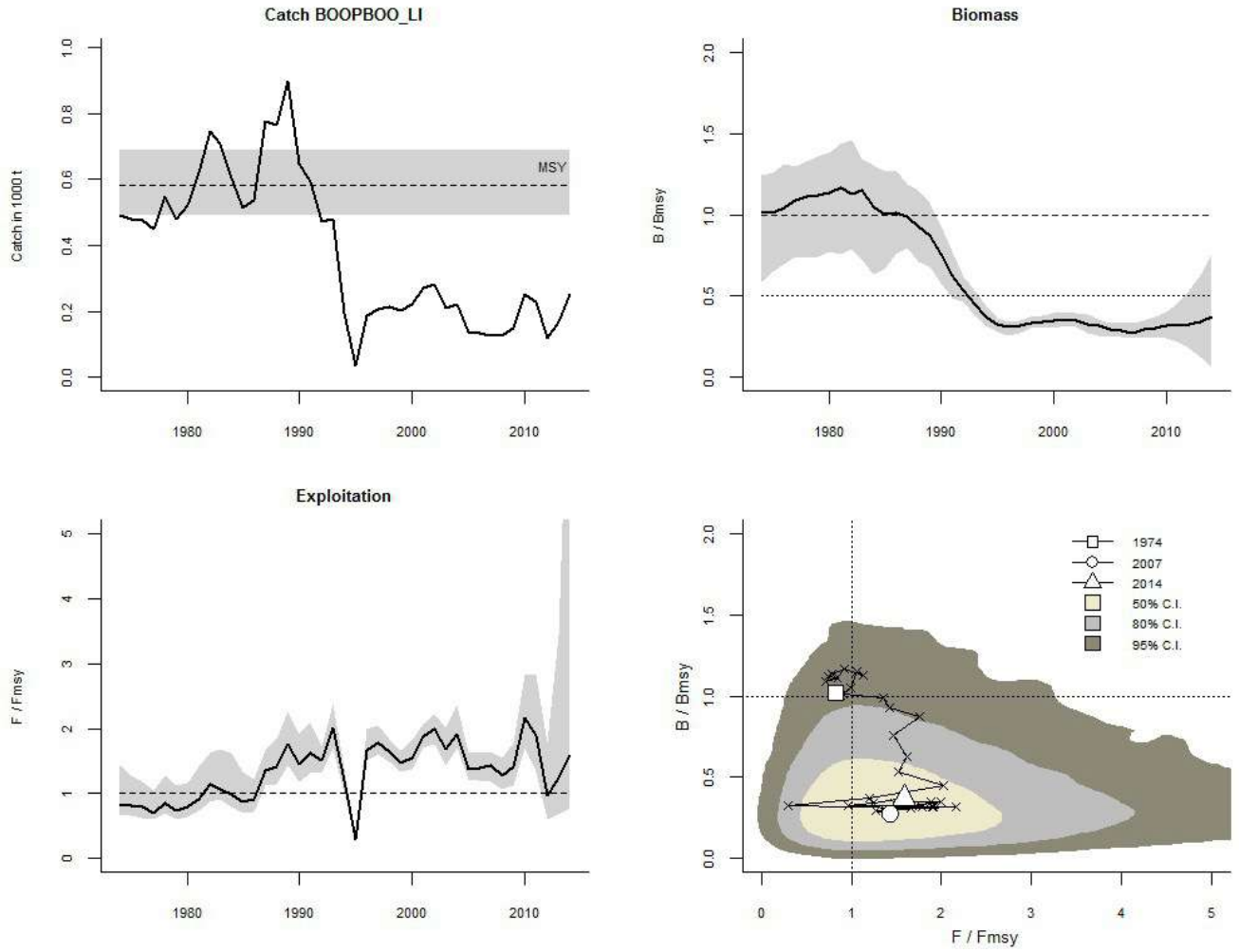
The classic curve in fisheries science



Profit for fishers is also maximized near MSY



Assessing stock status



Fisheries management

Management decisions are (ideally) based on **fisheries reference points** that are related to:

1. the intensity of fishing **F** (fishing mortality, fishing effort, fishing pressure)

Common reference point: F/Fmsy

Should be low to ensure stock renewal.

2. the state of the stock **B** (biomass, abundance)

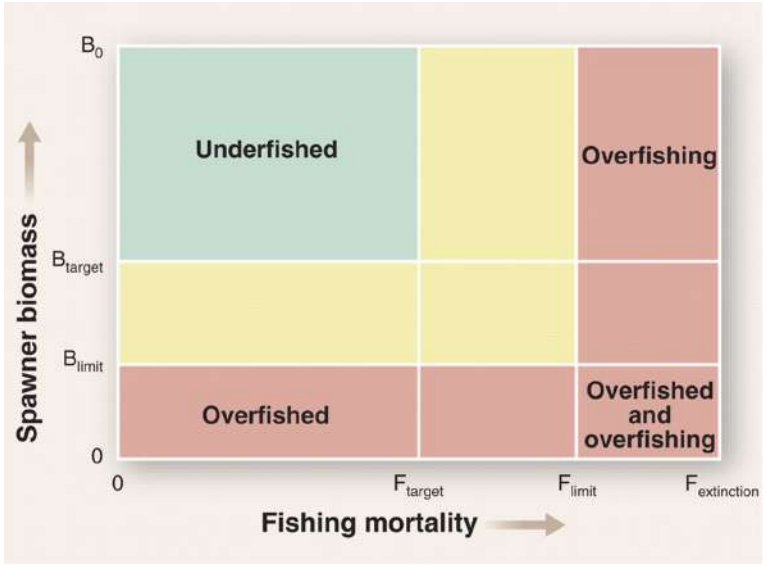
Common reference point: B/Bmsy

Should be high to ensure high catches.

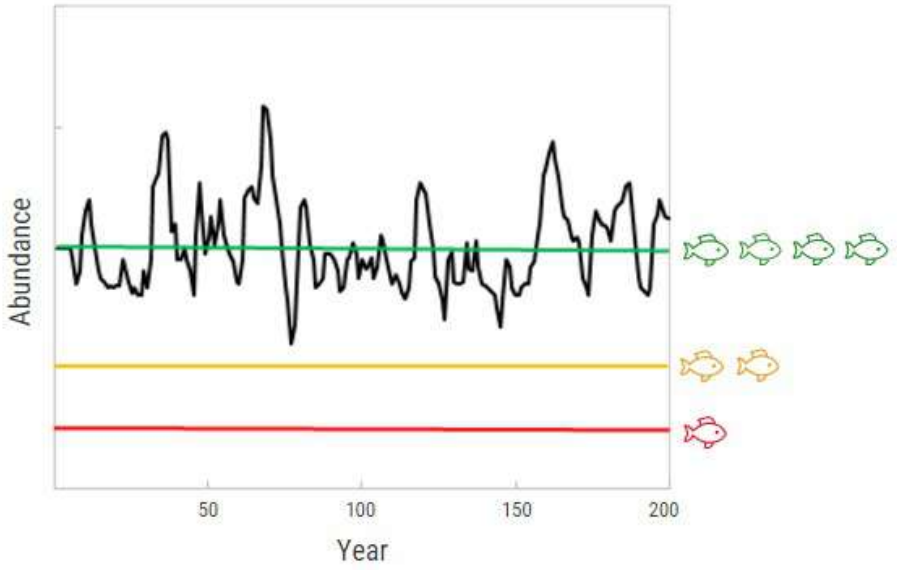
3. the age and stock structure of the population

Common reference point: L/Lopt

Should be as close to unexploited stock conditions.



Fisheries management



Management target

For a healthy fishery, we want fish stocks to fluctuate around this level .

Soft limit

If a fish stock falls below this level, we manage it to rebuild it. For example, we reduce the total amount of fish that fishers can catch.

Hard limit

If a stock falls below this level, we consider it 'collapsed'. We may close the fishery to rebuild it.

Fisheries reference points

Stock status and exploitation are two different terms that are often confused

Stock status refers to the biomass (B) of a stock compared to the biomass that corresponds to the MSY (B_{MSY}) – *it is a **biological** concept and depends on the population characteristics of a species*

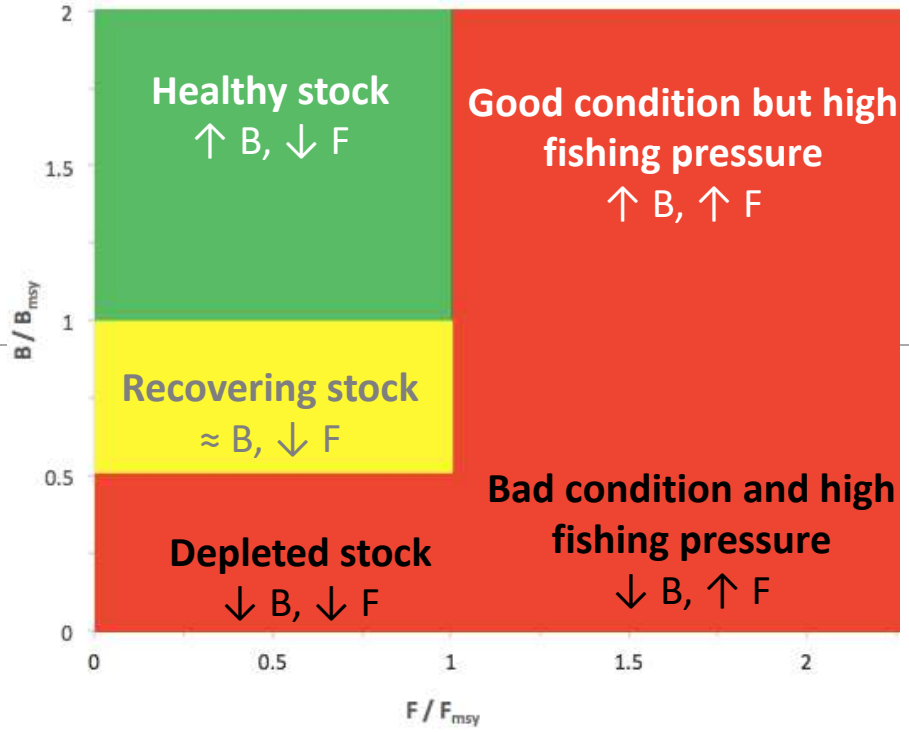
It has to be high ($B > B_{MSY}$)

Exploitation refers to the fishing pressure (F) Applied to a stock compared to the one that ensures MSY (F_{MSY}) – relates to the fleet and fishing intensity

It has to be low ($F < F_{MSY}$)

A stock is **healthy** only when **both** conditions apply at the same time

(+ a third one related to the size and age structure of a population))

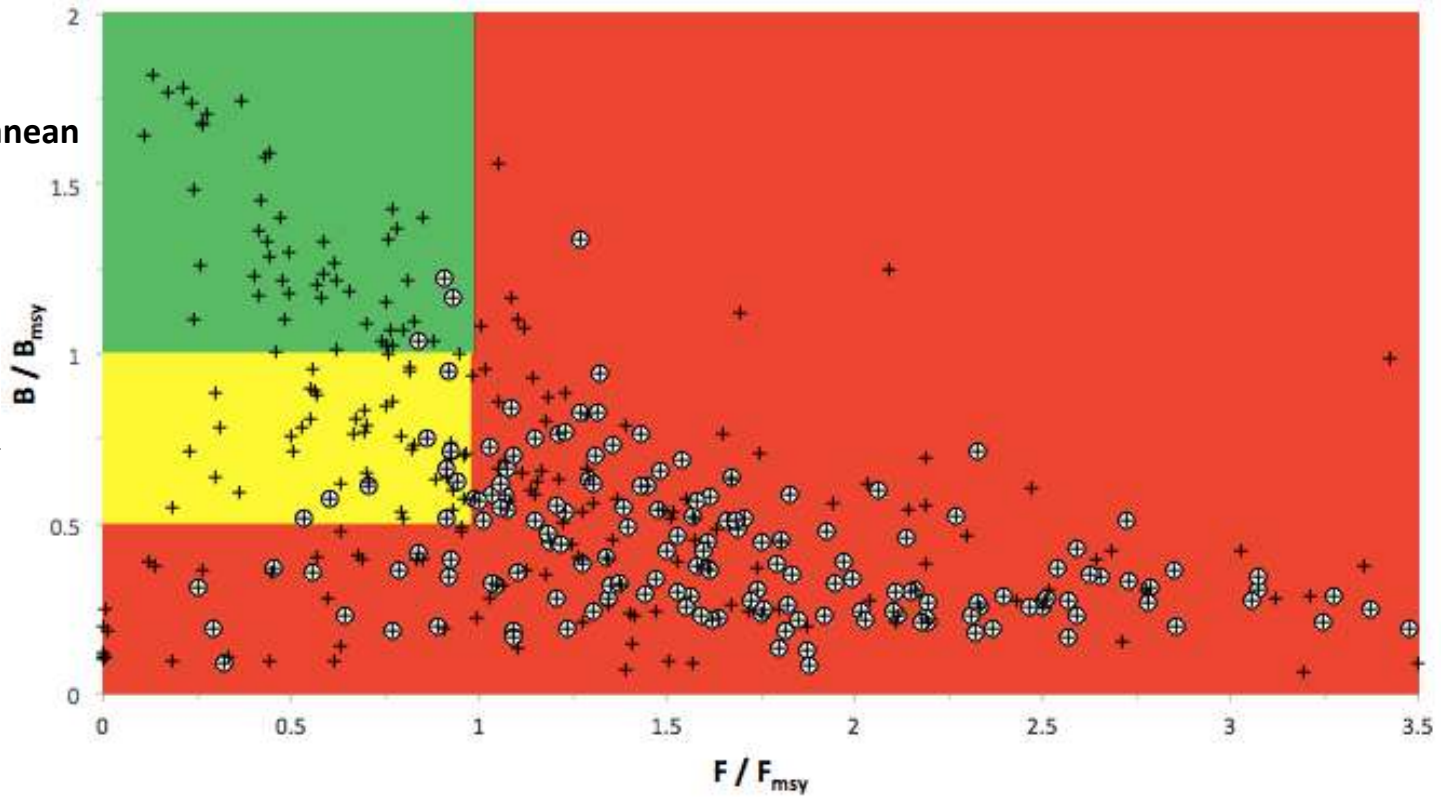


Fisheries reference points

The NE Atlantic stocks are in better condition compared to the Mediterranean ones that are concentrated in the **RED** area of the plot

+ : Atlantic

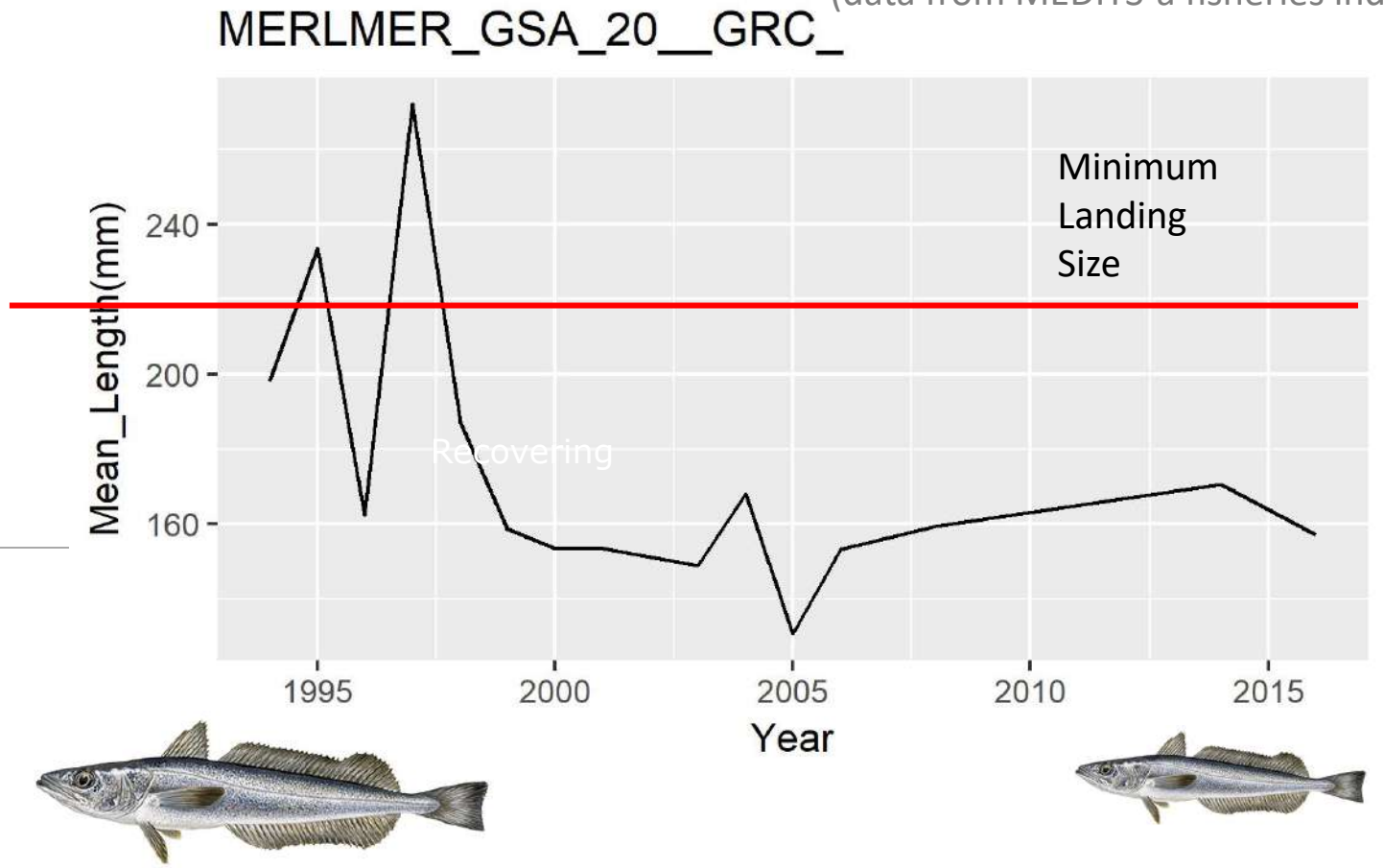
⊕ : Mediterranean



The third condition is even worst for most commercial stocks

The mean length of hake in the Ionian Sea declines since 1998

(data from MEDITS-a fisheries independent survey)

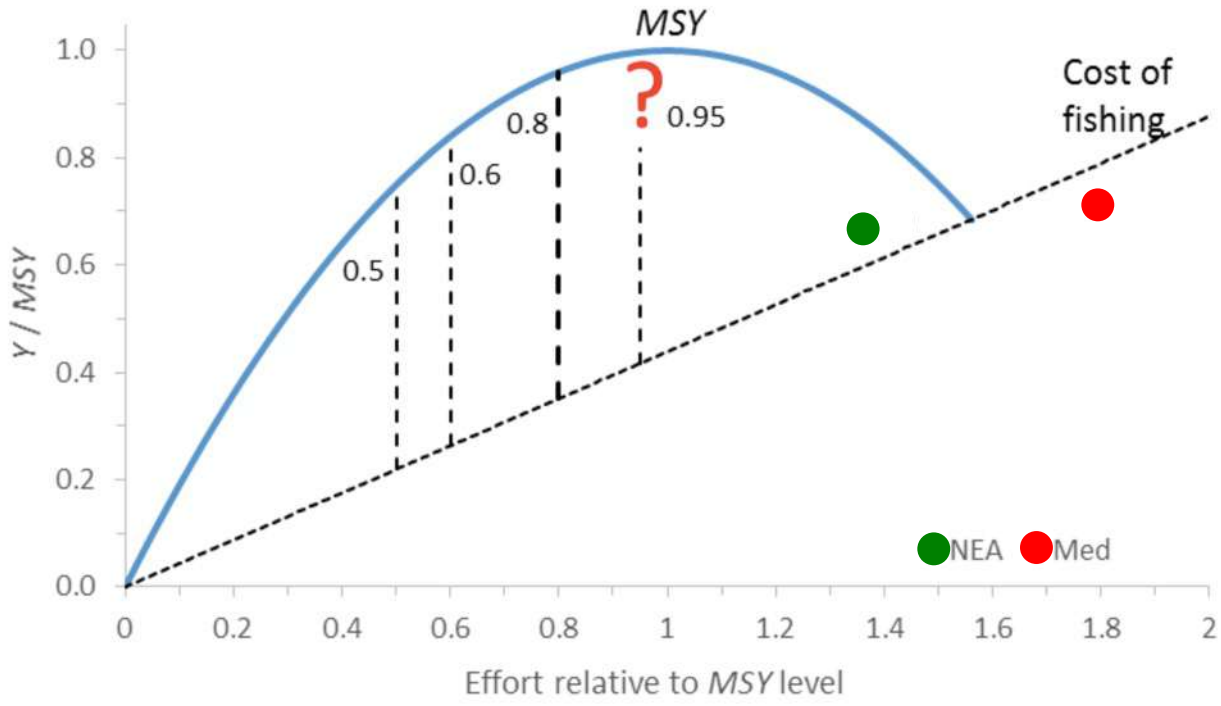


Time to start saving!

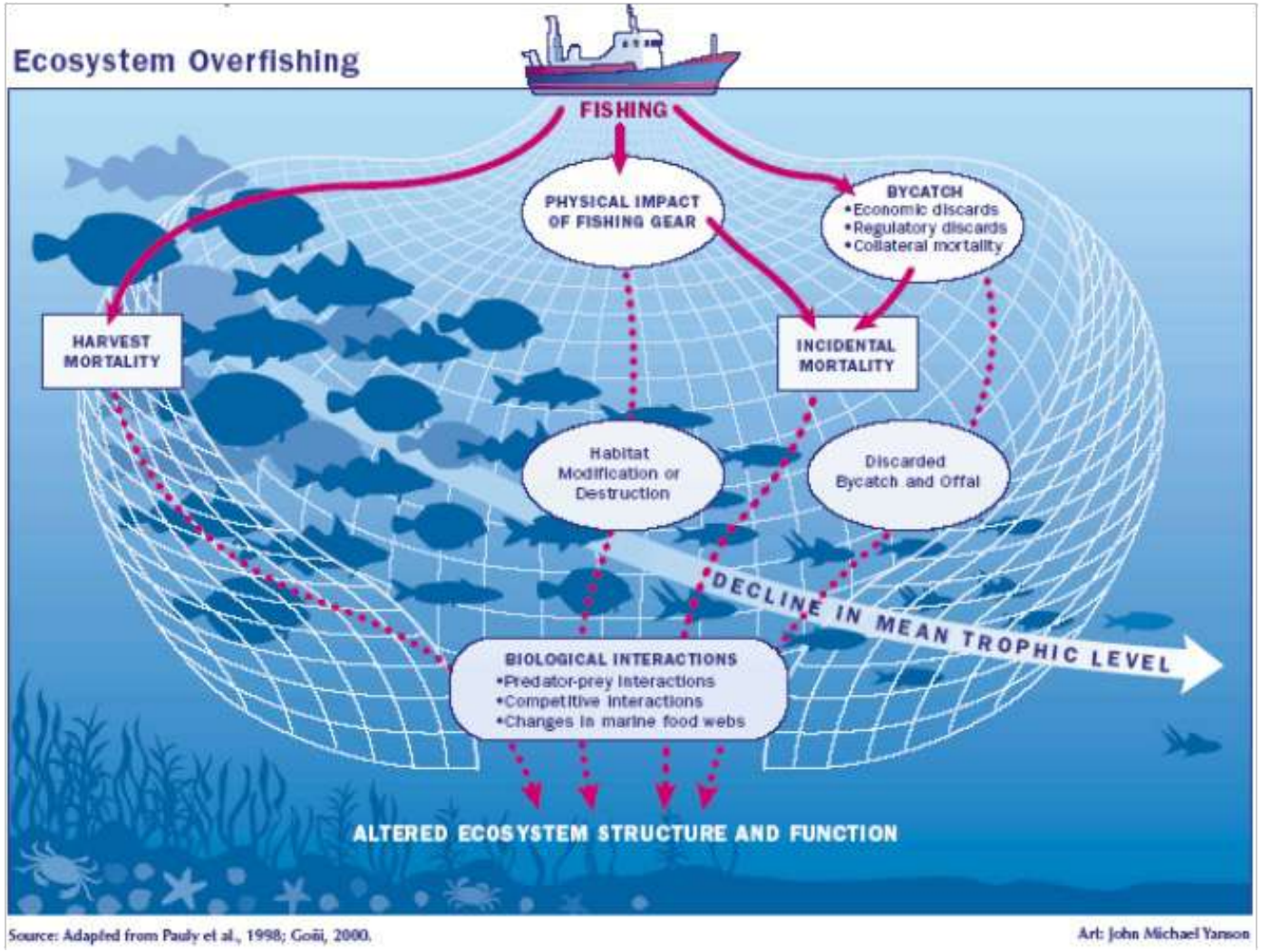
The illusion that *higher fishing effort results in higher profits*...

Only **cost** is linearly related to fishing effort

Profit is maximized **ONLY** when stocks are sustainably exploited.

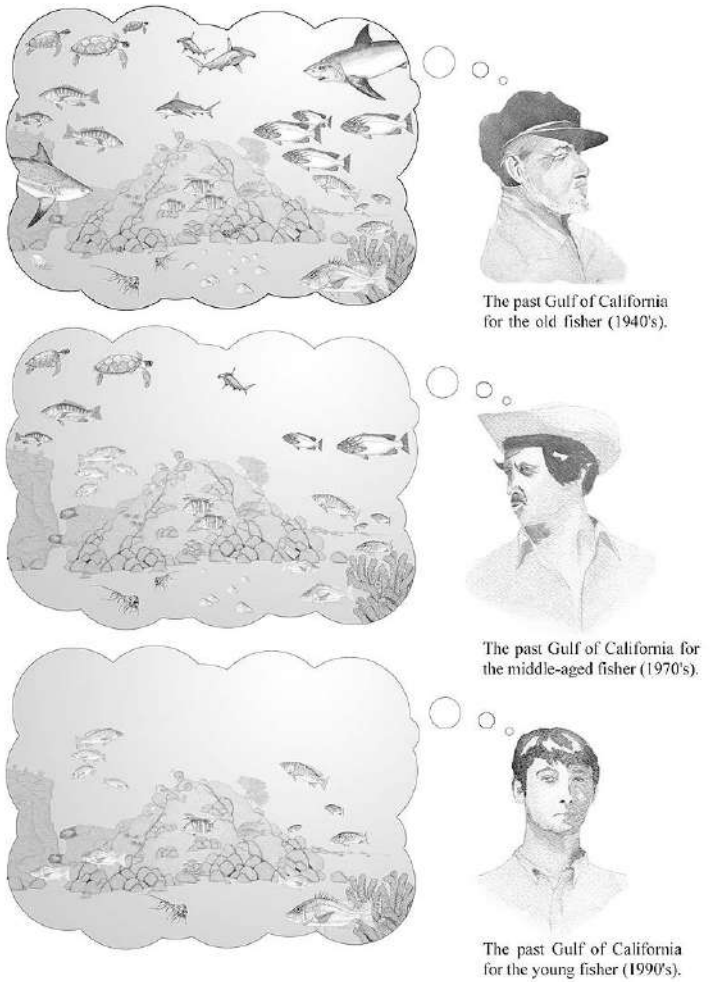


Ecosystems malfunction and become less resilient to external pressures (e.g. climate change)

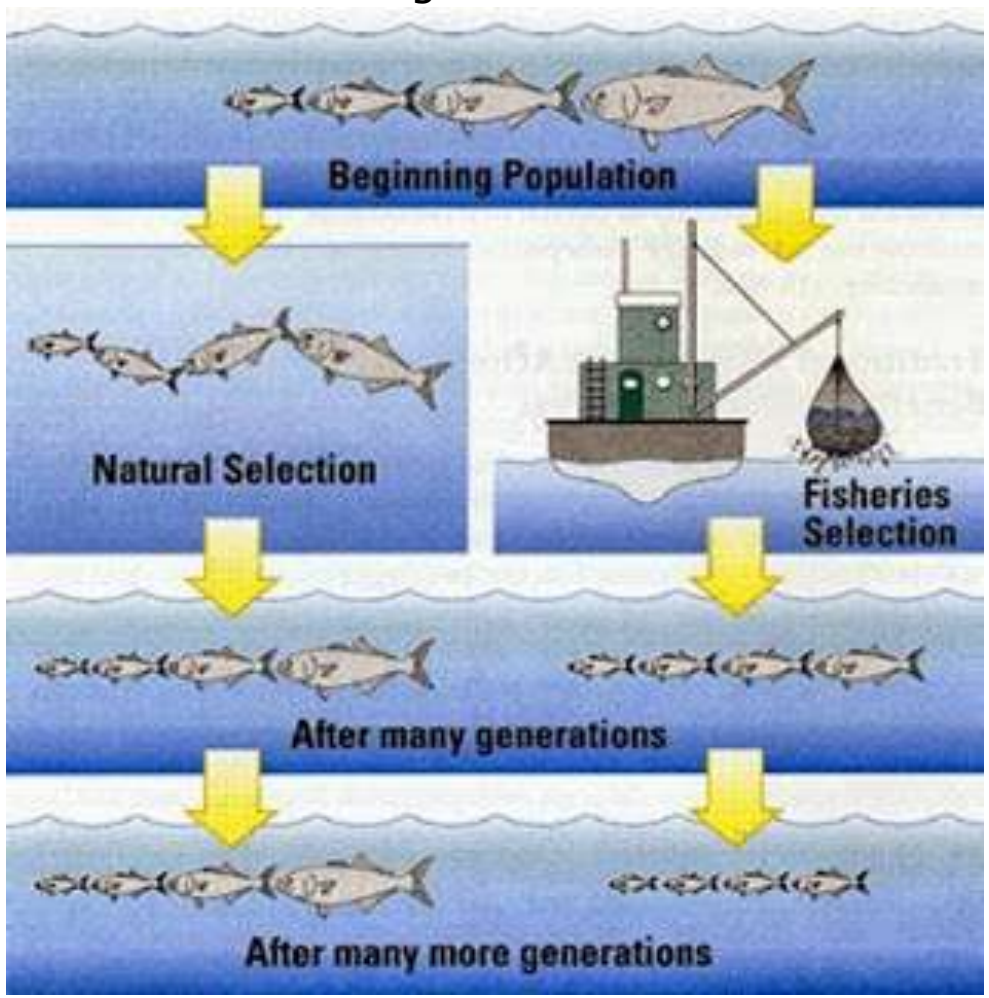


(Stergiou & Tsikliras 2015)

Shifting the baseline syndrome



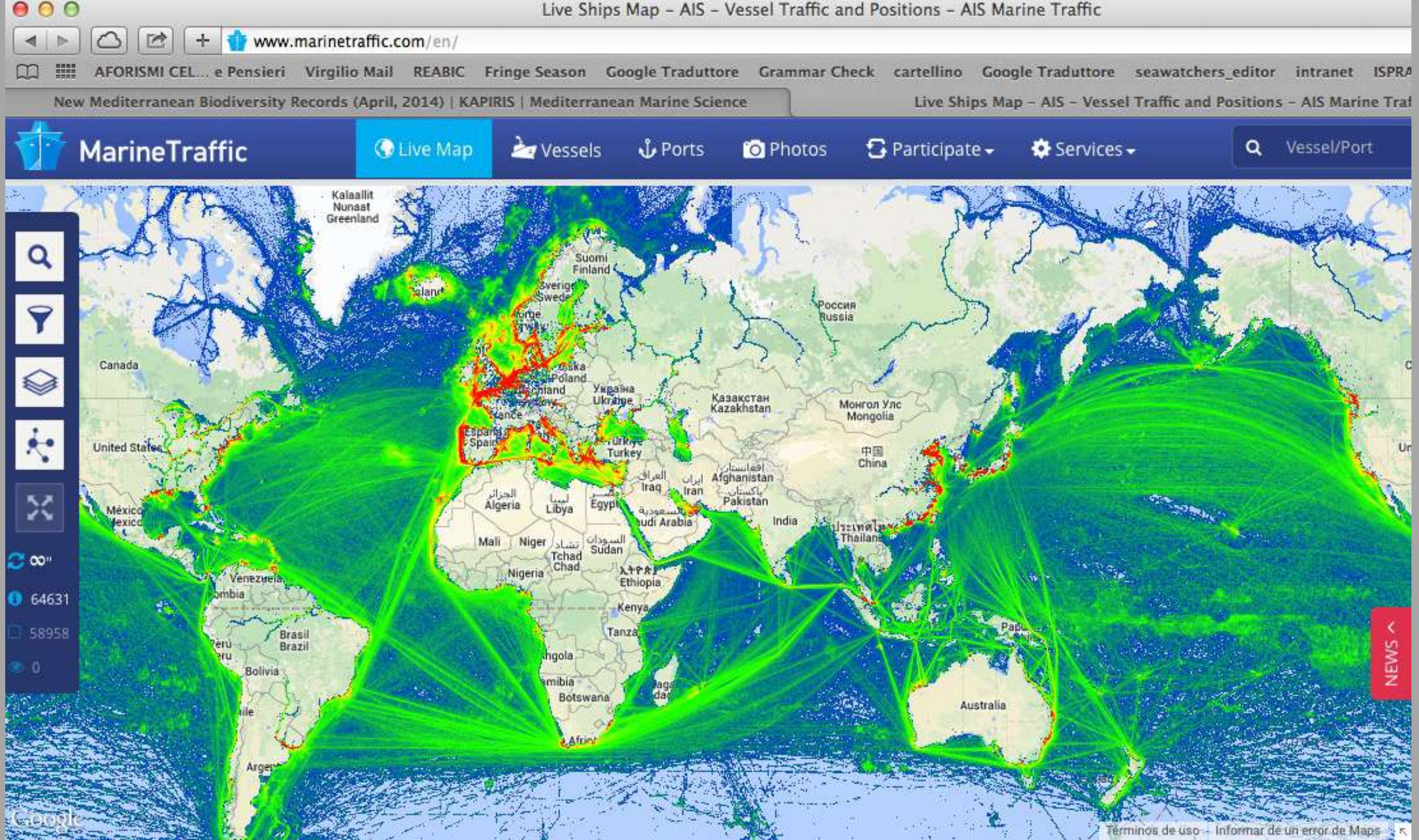
Fish used to be larger




Any
Questions

Aliens in the Adriatic sea!

The problem:


Live Ships Map – AIS – Vessel Traffic and Positions – AIS Marine Traffic
www.marinetraffic.com/en/
AFORISMI CEL... e Pensieri
Virgilio Mail
REABIC
Fringe Season
Google Traduttore
Grammar Check
cartellino
Google Traduttore
seawatchers_editor
intranet
New Mediterranean Biodiversity Records (April, 2014) | KAPIRIS | Mediterranean Marine Science
Live Ships Map – AIS – Vessel Traffic and Positions – AIS Marine Traf
MarineTraffic
Live Map
Vessels
Ports
Photos
Participate
Services
Vessel/Port
Kalaallit Nunaat Greenland
Suomi Finland
Sverige Sweden
Россия Russia
Canada
Polska Poland
Україна Ukraine
Казахстан Kazakhstan
Монгол Улс Mongolia
United States
España Spain
Türkiye Turkey
中国 China
العراق Iraq
ایران Iran
افغانستان Afghanistan
پاکستان Pakistan
الجزائر Algeria
ليبيا Libya
مصر Egypt
السعودية Saudi Arabia
India
Mali
Niger
تشاد Tchad
السودان Sudan
Nigeria
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Kenya
Tanzania
Brasil Brazil
Bolivia
Botswana
Australia
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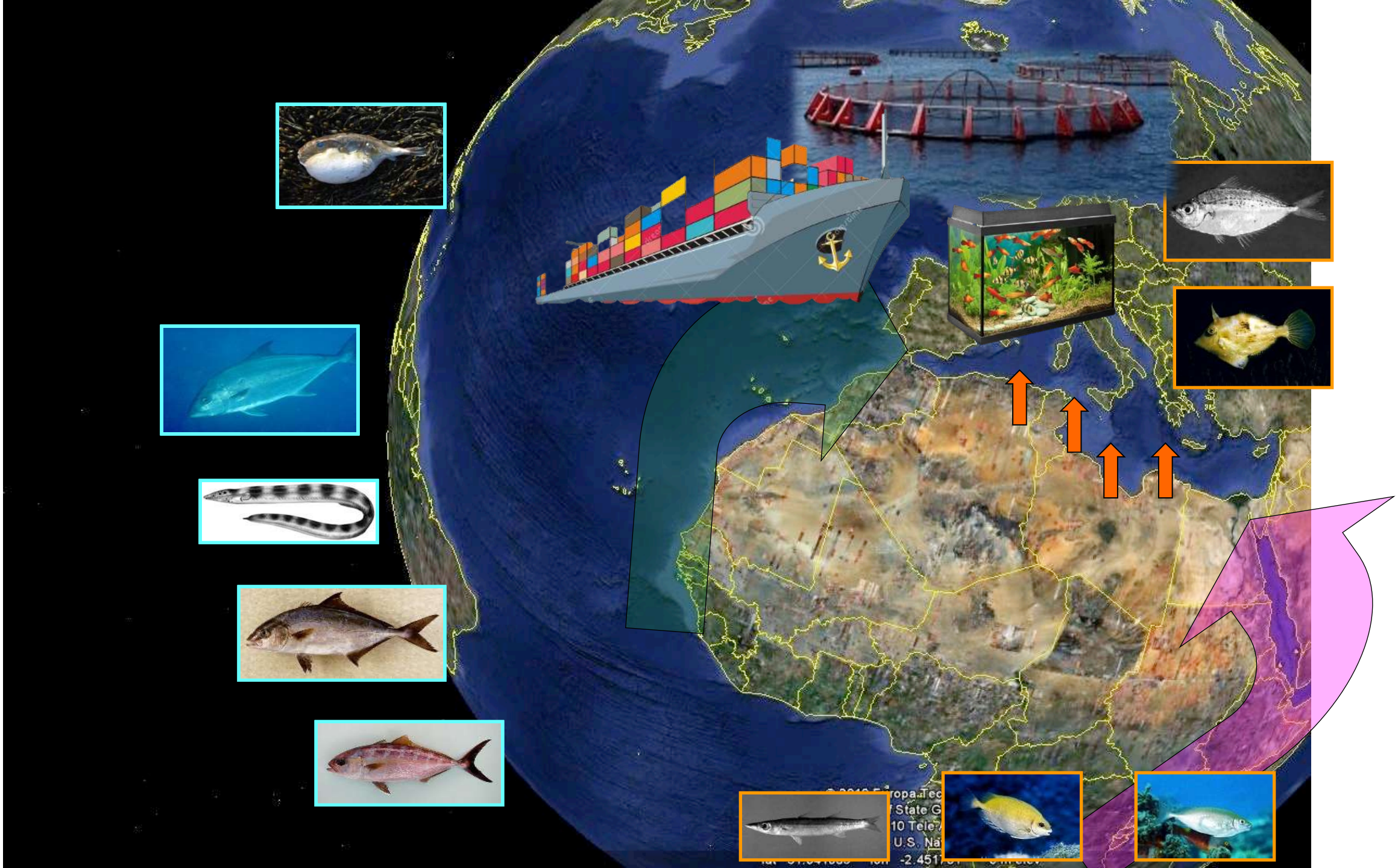
NEWS
Google
Términos de uso
Informar de un error de Maps



Journal of Fish Biology (2000) **56,** 1545–1547
doi:10.1006/jfbi.2000.1263, available online at http://www.idealibrary.com on IDEAL®

First record of the bluespotted cornetfish from the Mediterranean Sea

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(*Received 21 January 2000, Accepted 6 March 2000*)

Three specimens of the Indo-Pacific Bluespotted cornetfish *Fistularia commersonii* are recorded for the first time from the Mediterranean. The presence of this species in the Mediterranean is due to migration from the Red Sea *via* the Suez Canal

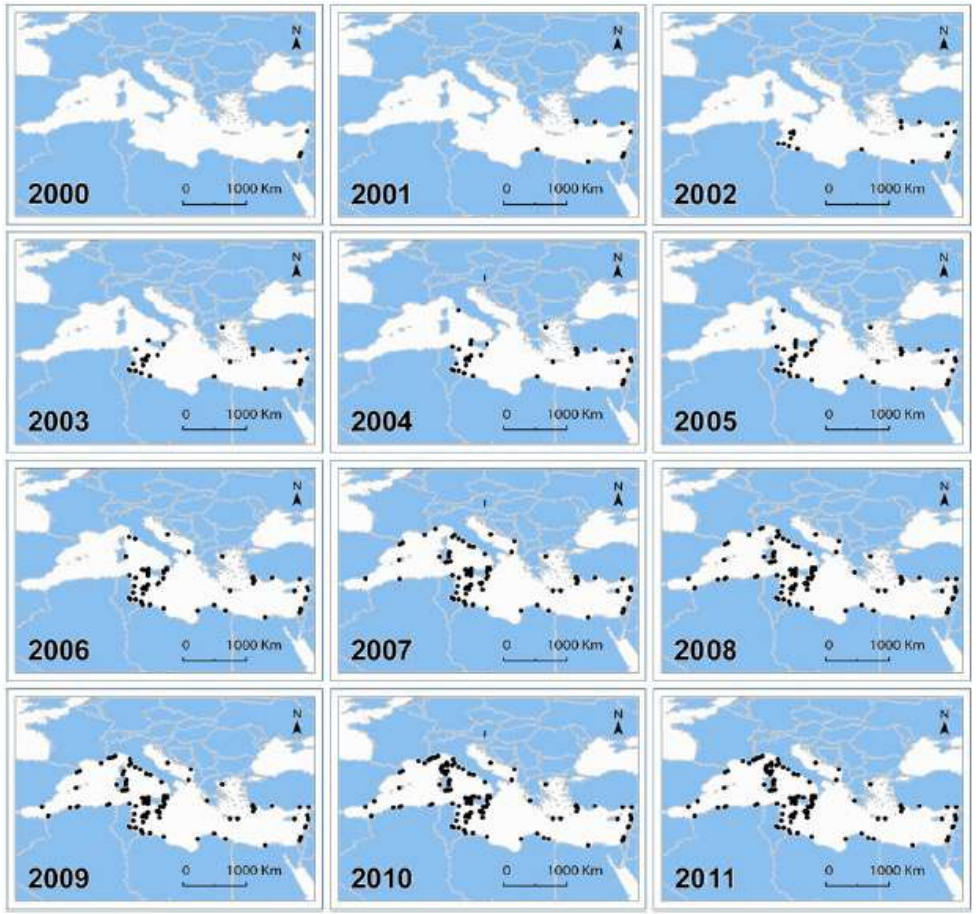


Fig. 1 Cumulative occurrences of *F. commersonii* in the Mediterranean Sea from December 2000 to October 2011. Data consisted of 191 georeferenced records pooled from both bibliographic sources and other confirmed observations

Azzurro et al., 2013 Biol. Inv.

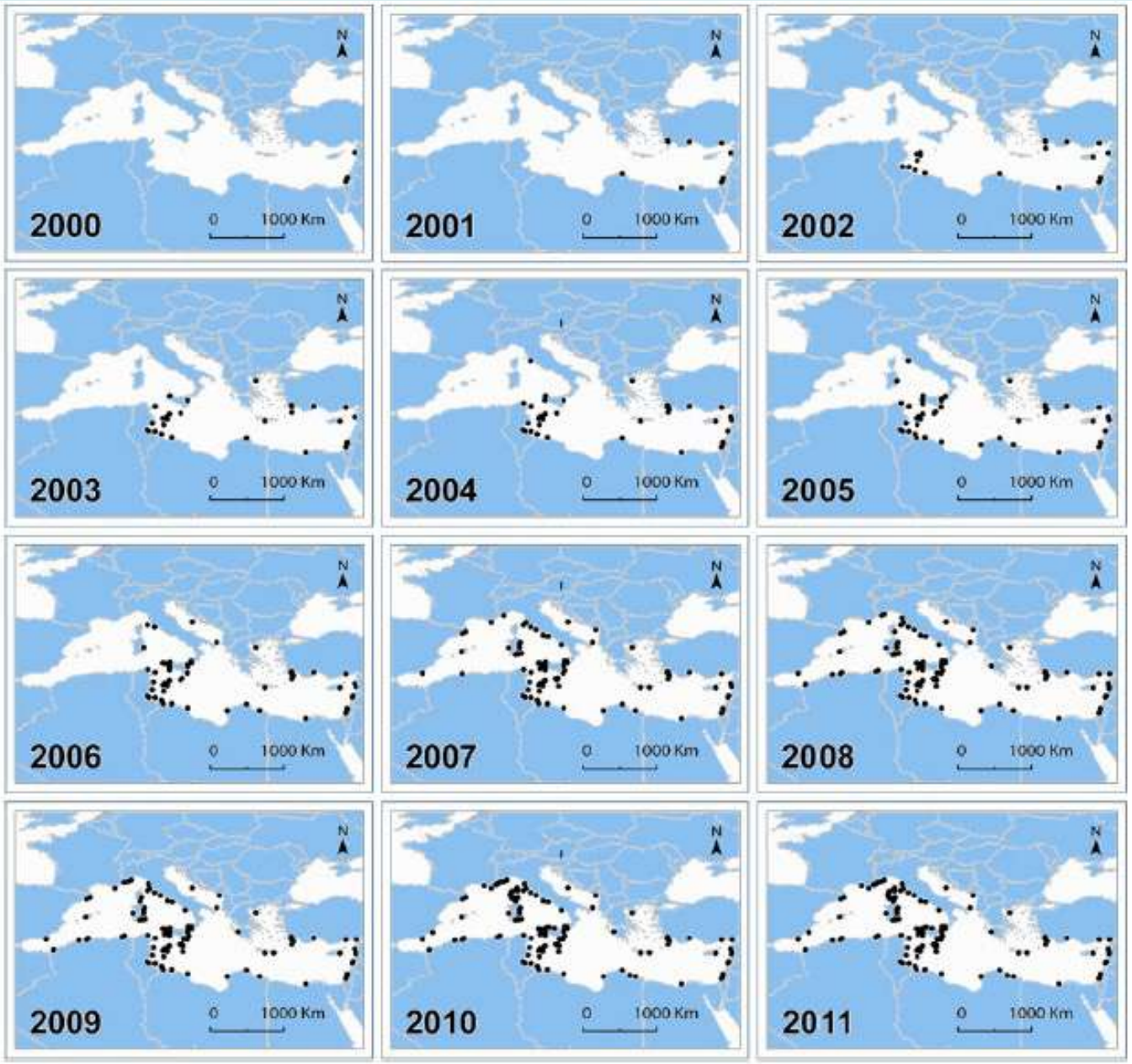
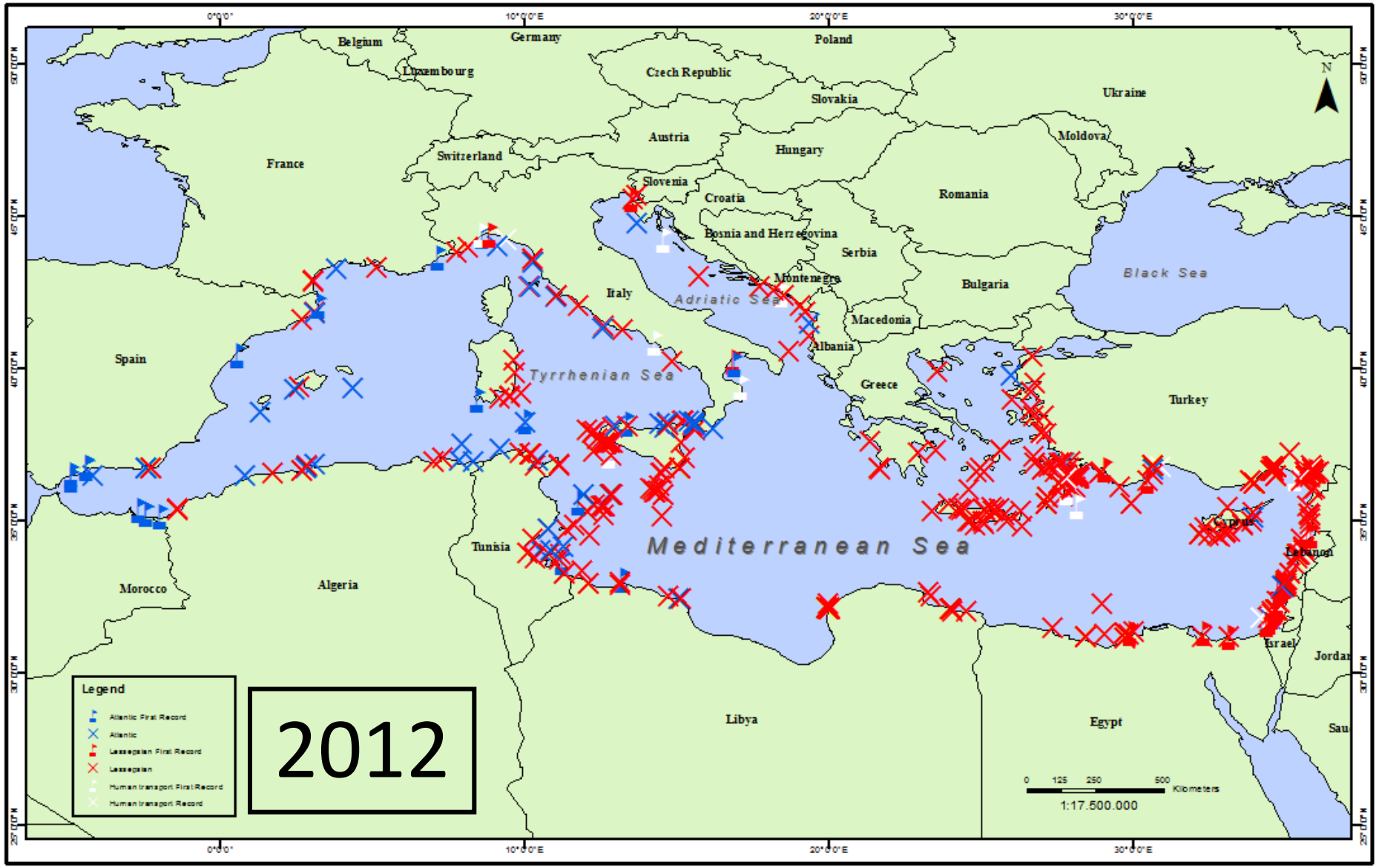


Fig. 1 Cumulative occurrences of *F. commersonii* in the Mediterranean Sea from December 2000 to October 2011. Data consisted of 191 georeferenced records pooled from both bibliographic sources and other confirmed observations

The ORMEF database
Azzurro et al., 2013

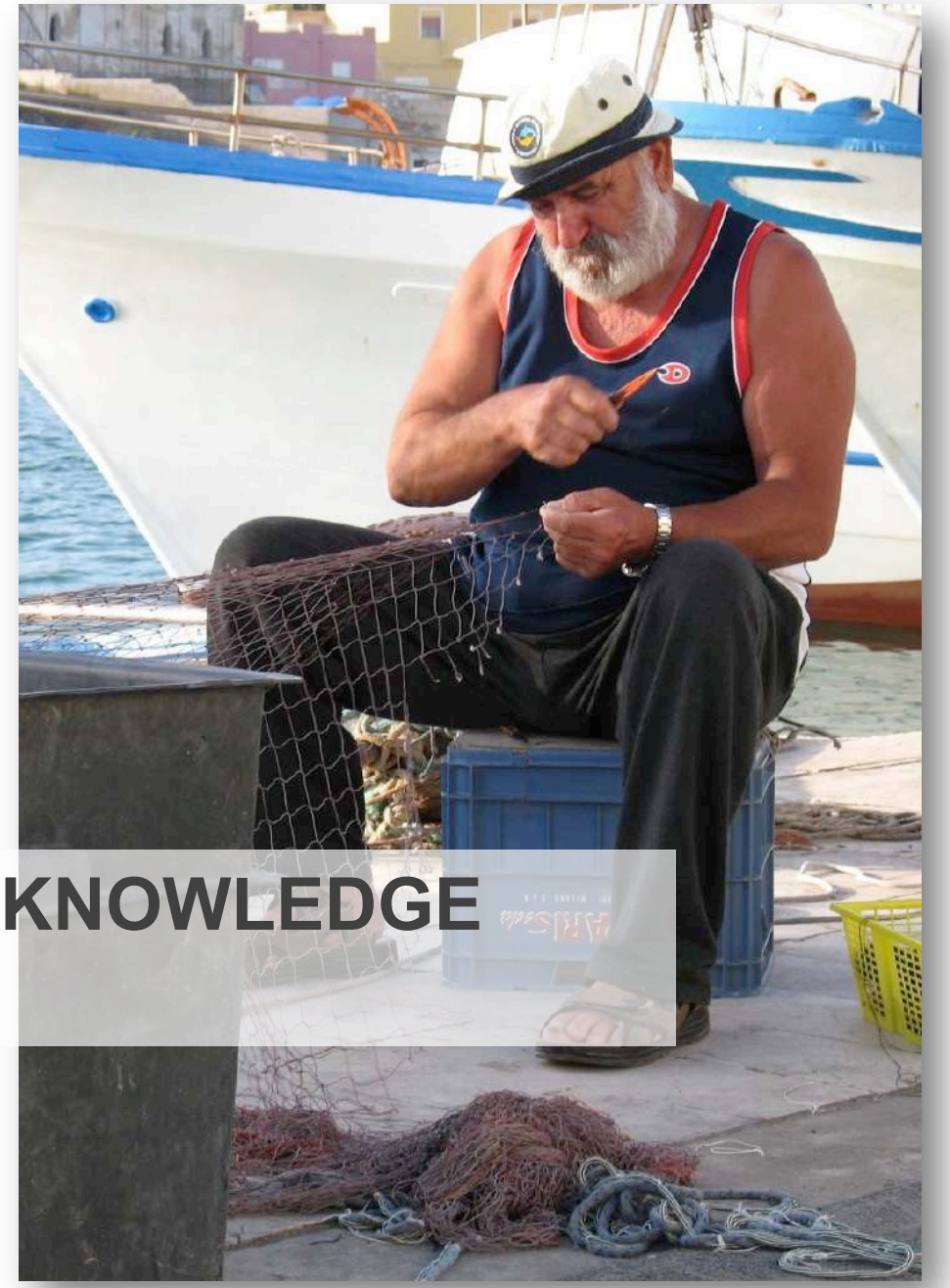


Animation provided by ORMEF database

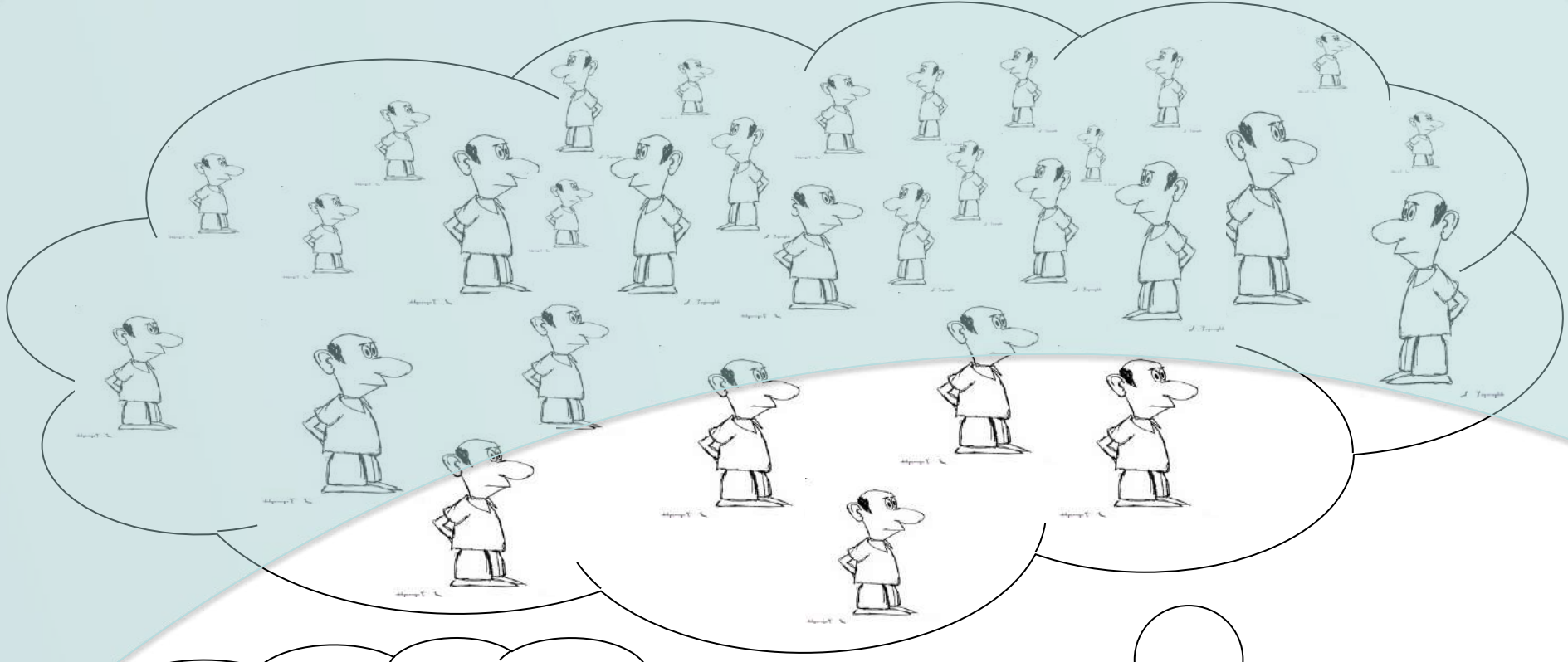
Azzurro et al. "Exotic fish species in the Mediterranean Sea: analysis of occurrence records." *Rapp Comm Int Mer Médit* 40 (2013): 508.

The approach:

LOCAL ECOLOGICAL KNOWLEDGE (LEK)

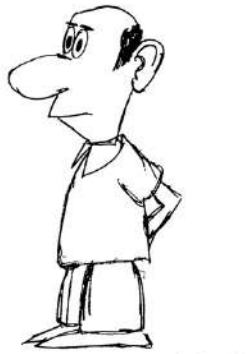


WHY INVOLVE LOCAL PEOPLE IN THE MONITORING PROGRAMS?



BECAUSE THEY ARE EVERYWHERE AND AT ANY TIME

PROVIDE THE FIRST DETECTIONS

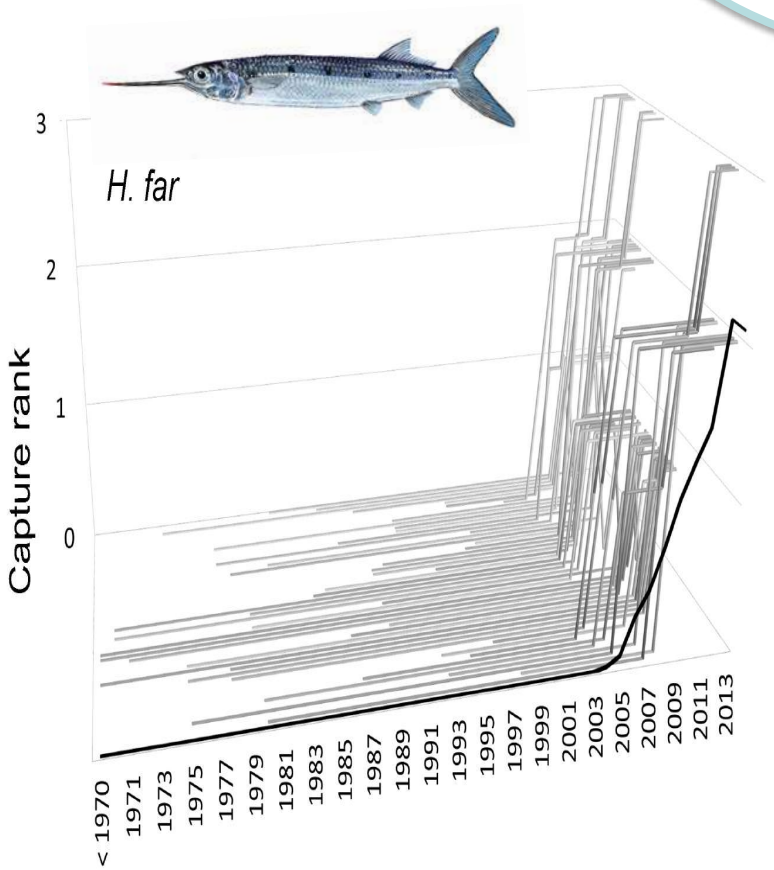


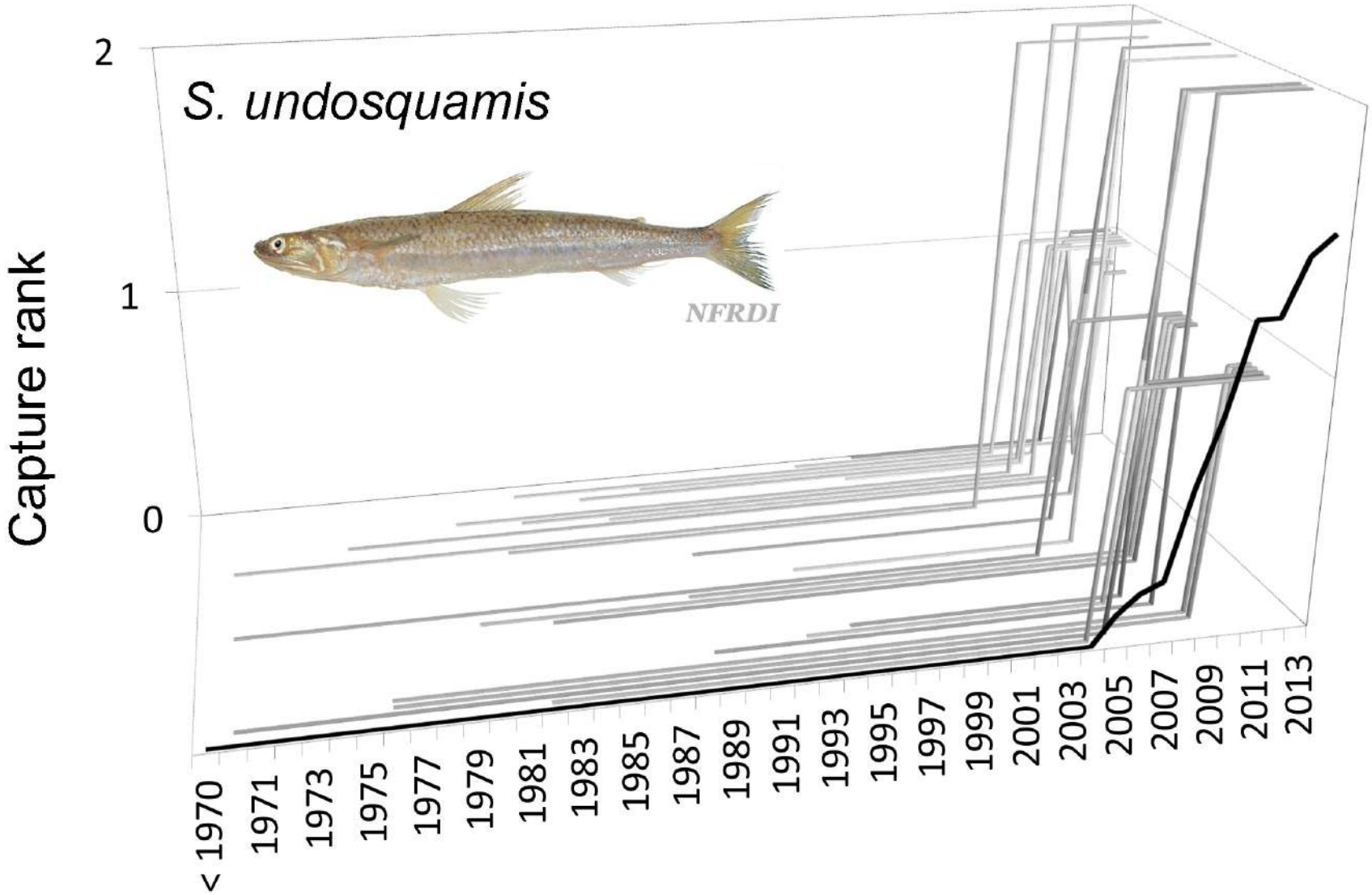
Ask to the fishermen

CIESM
The Mediterranean Science Commission

ARE THERE SPECIES THAT HAVE APPEARED IN THE LAST YEARS THAT WERE NOT THERE BEFORE?

HOW FREQUENTLY DO THEY APPEAR IN CATCHES?

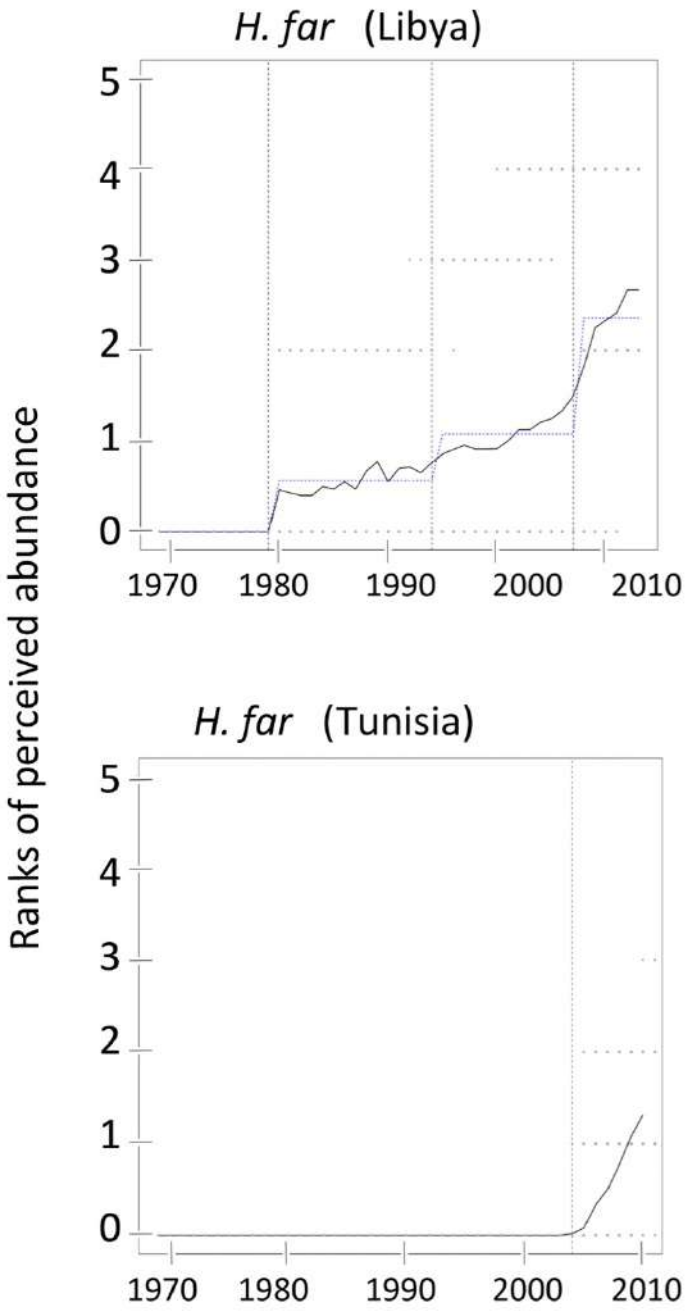


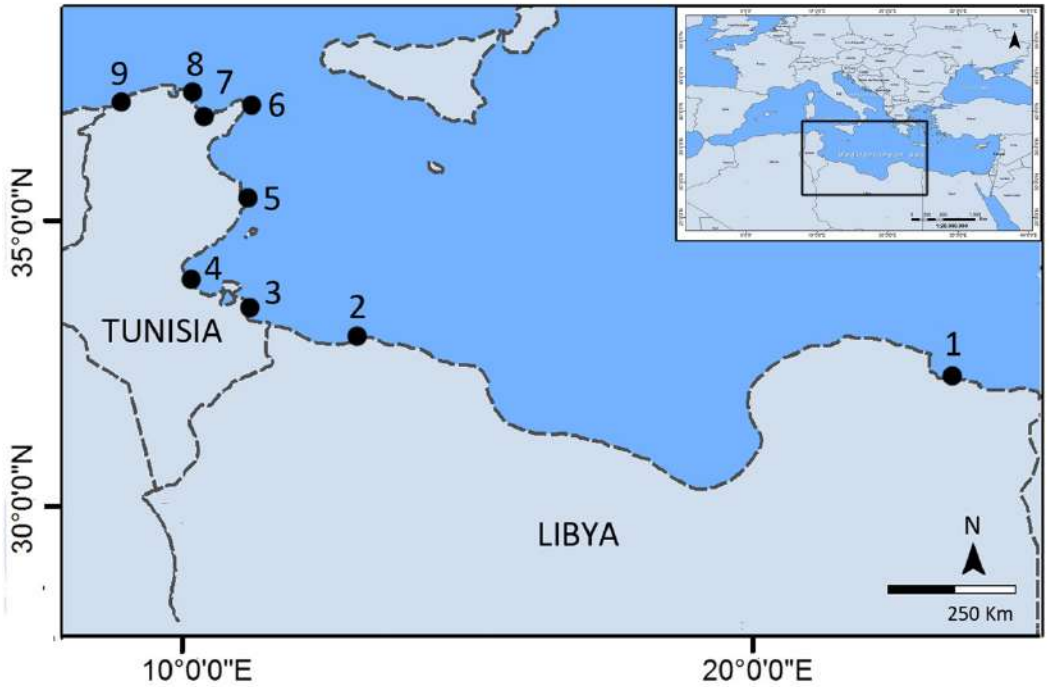


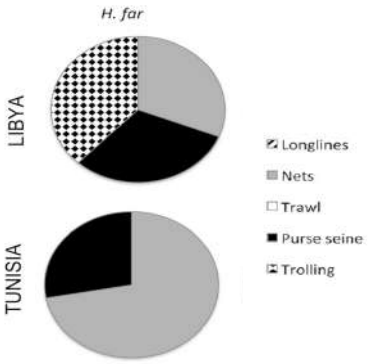
Boughedir et al., 2015 (submitted)

0 =ABSENT; 1 =RARE (once in a year); 2= OCCASIONAL (sometimes in a fishing period); 3=COMMON (regularly in a fishing period); 4 =ABUNDANT (regularly in a fishing period and abundant); 5=DOMINANT (always in a fishing period and with great abundances).

CIESM
The Mediterranean Science Commission



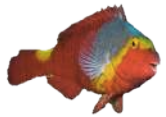
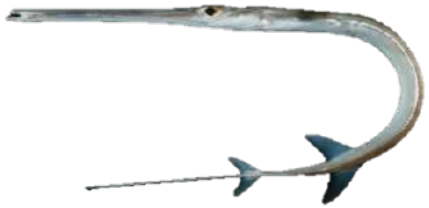


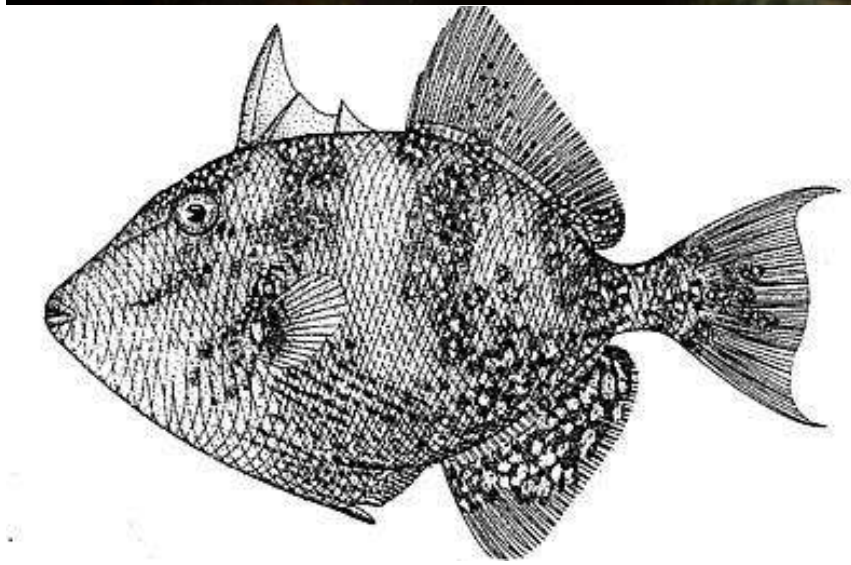


Boughedir et al., 2015 (submitted)

The questionnaire:

Target species

Group	Species	PICTURE
FISH	*Lagocephalus sceleratus*	
FISH	*Lichia amia*	
FISH	*Pomatomus saltator*	
FISH	*Sardinella aurita*	
FISH	*Siganus luridus*	
FISH	*Siganus rivulatus*	
FISH	*Sparisoma cretense*	
FISH	*Sphyraena viridensis*	
FISH	*Trachinotus ovatus*	
ALGAE	*Caulerpa racemosa*	
ALGAE	*Caulerpa taxifolia*	
ALGAE	*Sargassum muticum*	
ALGAE	*Undaria pinnatifida*	
CRUSTACEA	*Callinectes sapidus*	
CRUSTACEA	*Dyspanopeus sayi*	
CRUSTACEA	*Palaemon macodactylus*	
	FOTO (CARLO)	
CRUSTACEA	*Calappa granulata*	
FISH	*Balistes capriscus*	
FISH	*Coryphaena hippurus*	
FISH	*Fistularia*	

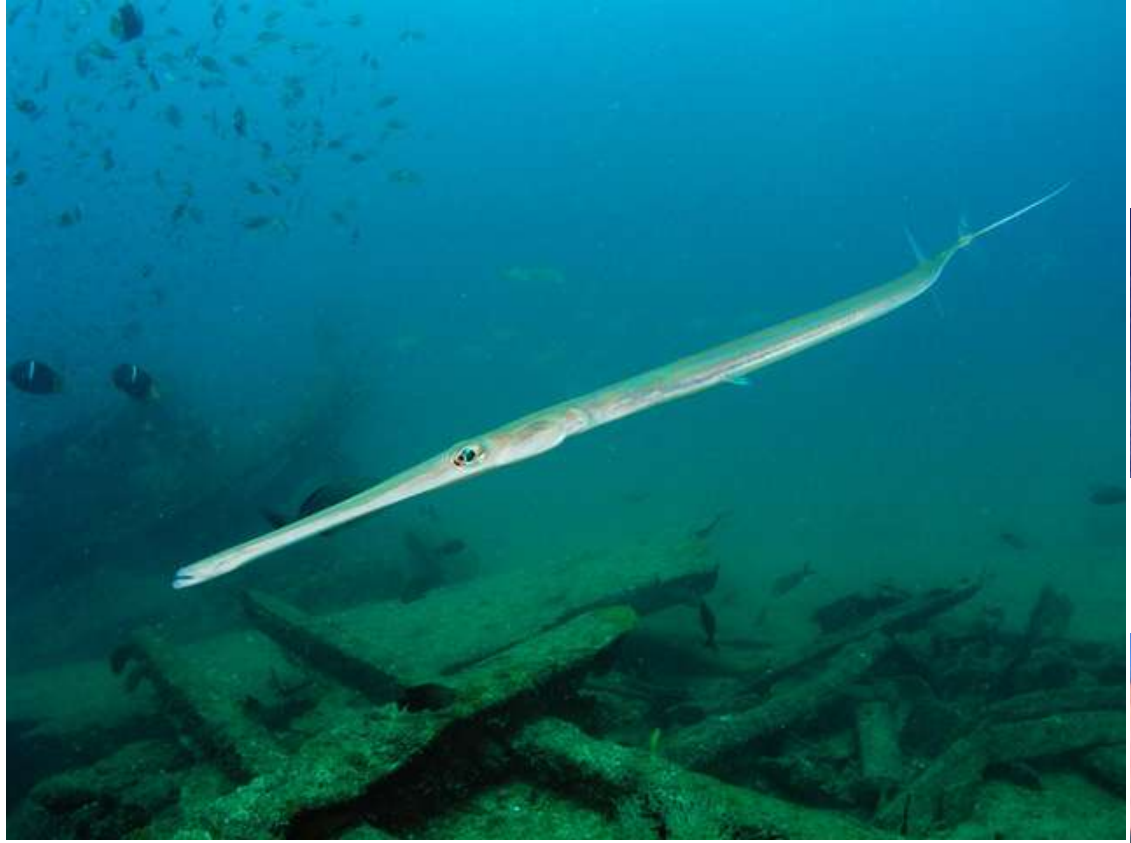


Balistes capriscus

«Pesce Balestra»

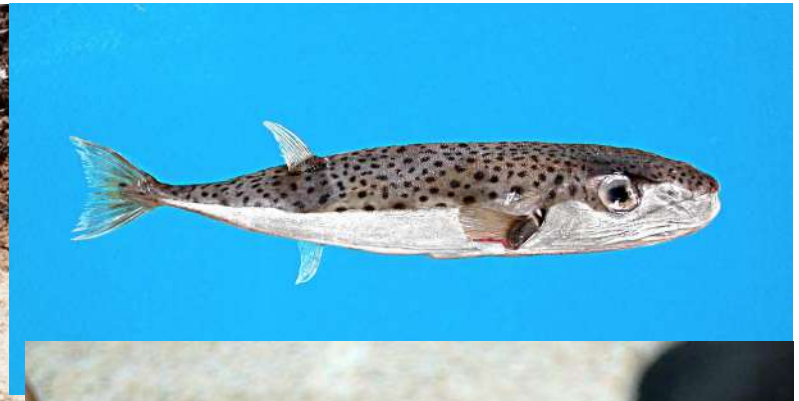
Coryphaena hippurus

«Lampuga»



Fistularia commersonii

«Pesce Flauto»



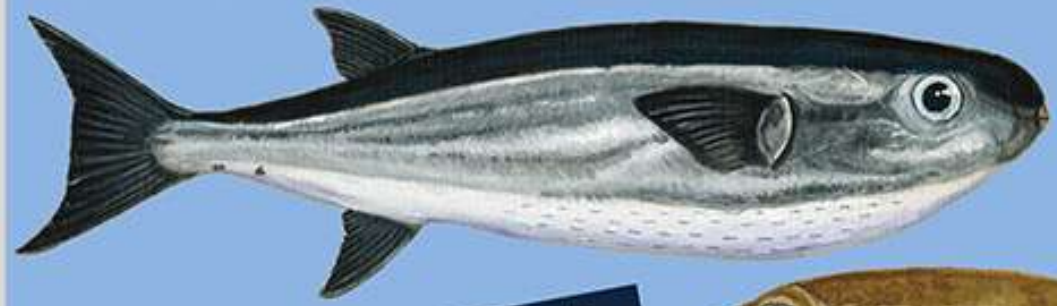
Lagocephalus sceleratus

«Pesce Palla»

Pesce palla maculato - *Lagocephalus sceleratus*
MOLTO TOSSICO al consumo - potenzialmente mortale

La tossina mantiene le sue proprietà anche dopo la cottura

I pesci palla sono tutti tossici al consumo e per questo ne è vietata la commercializzazione. Si riconoscono facilmente per la pelle senza squame e per le mandibole provviste di due grandi denti molto taglienti. Le specie potenzialmente catturabili in acque italiane sono almeno tre.



Lagocephalus lagocephalus
TOSSICO al consumo

Sphoeroides pachygaster
TOSSICO al consumo

HAI CATTURATO UN PESCE PALLA ?

- ✓ **SEPARALO** DALLE ALTRE CATTURE
- ✓ **EVITA** IL CONSUMO
- ✓ **FAI UNA FOTO**
- ✓ **SEGNALACI LA TUA OSSERVAZIONE**

Email: pescepalla@isprambiente.it **Tel + 39 0650074035/34; 091 6114044**

Campagna promossa dall' ISPRA in collaborazione con la Direzione Generale della Pesca Marittima e dell'Acquacoltura, il Reparto Pesca Marittima del Corpo delle Capitanerie di Porto e l' ICM-CSIC di Barcellona che coordina il progetto *Seawatchers* www.seawatchers.org

The project is co-funded by the European Union
Instrument for Pre-Accession Assistance
REPUBLIC OF SLOVENIA
GOVERNMENT OFFICE FOR DEVELOPMENT AND EUROPEAN COHESION POLICY

ISPRA Istituto Superiore per la Ricerca e Protezione Ambientale

ATTENZIONE al pesce palla maculato è tossico e non va mangiato !

Il pesce palla maculato, *Lagocephalus sceleratus* è entrato in Mediterraneo nel 2003 attraverso il Canale di Suez. E' una specie tropicale tra le più invasive dei nostri mari, ha colonizzato buona parte del bacino orientale ed è attualmente in espansione geografica. La sua presenza in acque italiane è stata registrata per la prima volta nel 2013, nell'isola di Lampedusa. Da allora, altri esemplari sono stati catturati nel canale di Sicilia, nel mar Adriatico ed in Spagna. Si distingue facilmente da altri pesci palla per la presenza di macchie scure sul dorso.

Molto rara Occasionale Comune

Pesce palla maculato - *Lagocephalus sceleratus*

MOLTO TOSSICO al consumo - potenzialmente mortale

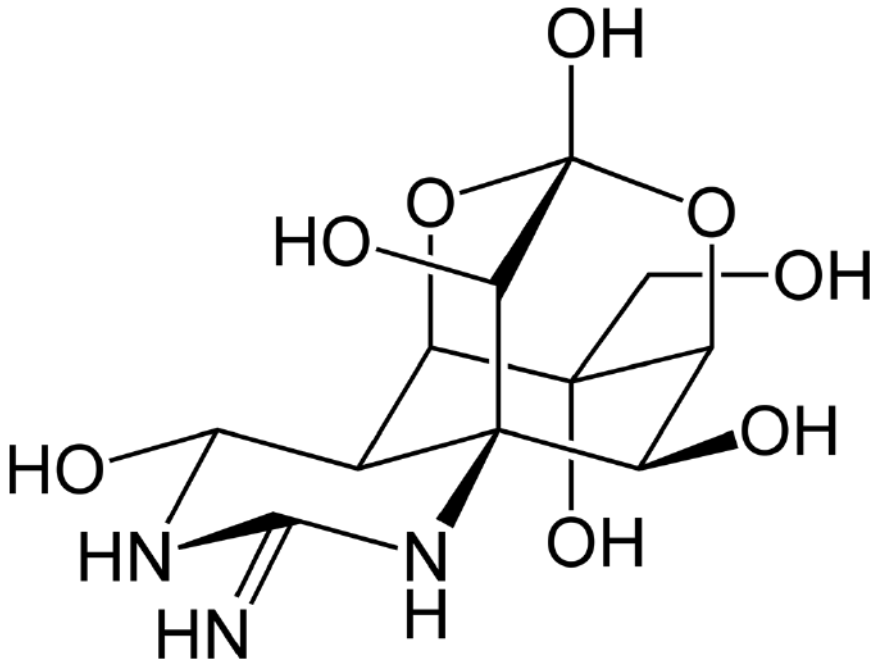
La tossina mantiene le sue proprietà anche dopo la cottura

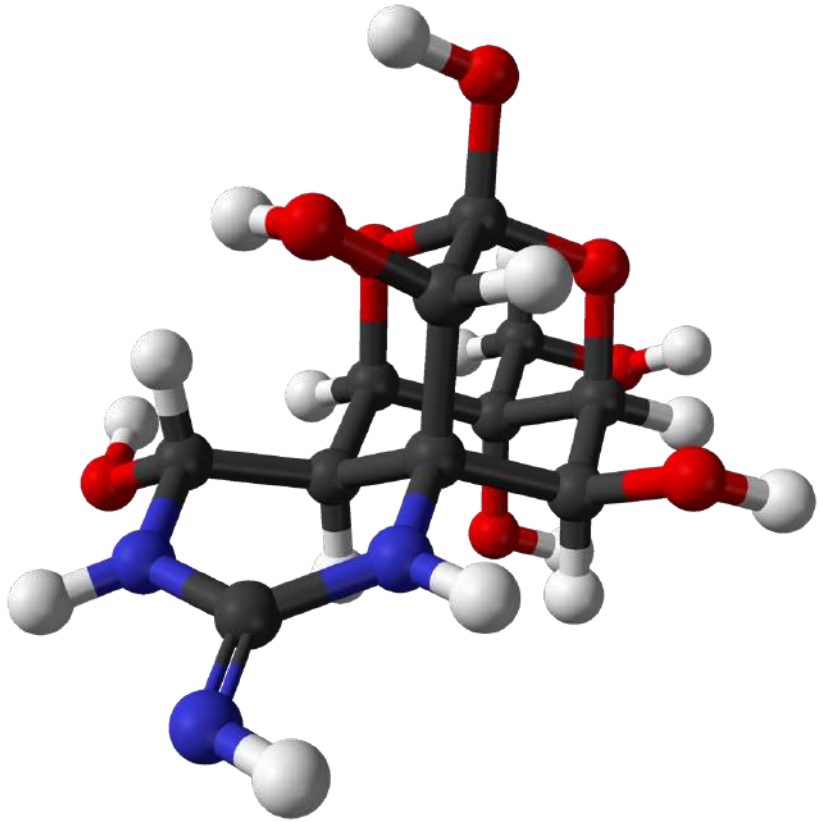
The project is co-funded by the European Union
Instrument for Pre-Accession Assistance
REPUBLIC OF SLOVENIA
GOVERNMENT OFFICE FOR DEVELOPMENT AND EUROPEAN COHESION POLICY

TETRADOTOXIN

4*R*,4a*R*,5*R*,6*S*,7*S*,8*S*,8a*R*,10*S*,12*S*)-2-azaniumilidene-4*R*,6*S*,8*S*,12*S*-tetraidrossi-6*S*-(idrossimetil)-2,3,4*R*,4a*R*,5*R*,6*S*,7*S*,8*S*-ottaidro-1*H*-8a*R*,10*S*-metano-5*R*,7*S*-(epossimetanoossi)chinazolin-10*S*-olato

$C_{11}H_{17}N_3O_8$

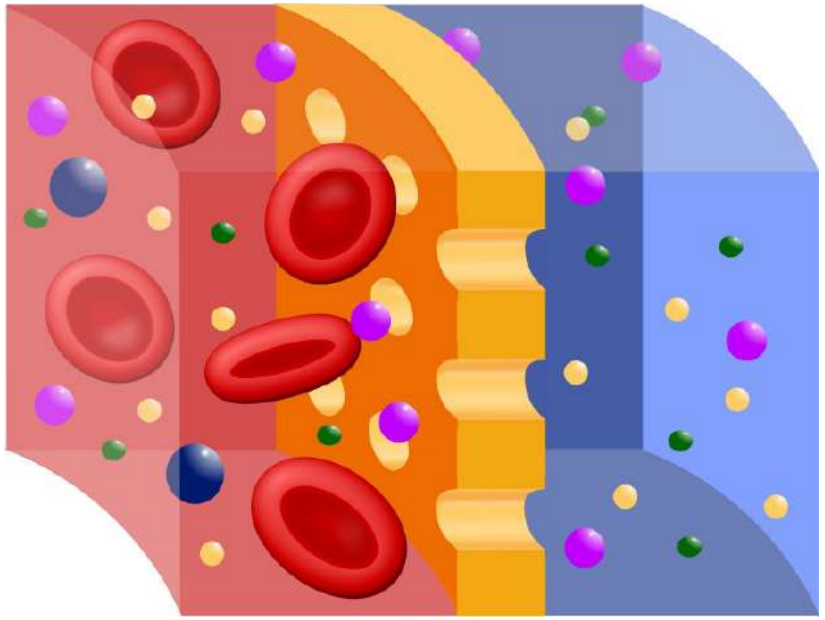


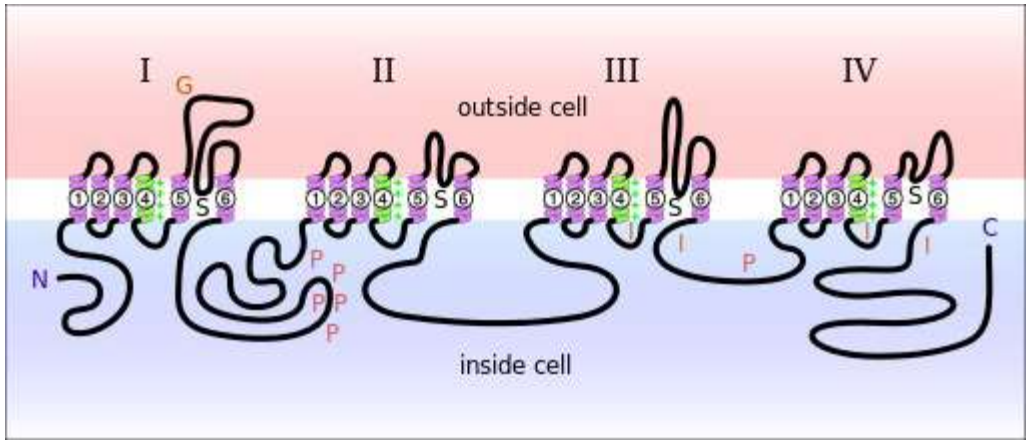


TETRADOTOSSINA (TTX):

- Neurotossina
- Fam. *Tetraodontidae* (pesci palla)
- Isolata per la prima volta nel 1909 (*Yoshizumi Tahara*)
- 100 volte più tossica del cianuro di potassio (25 mg sufficienti ad uccidere)!
- Primo avvelenamento registrato nel diario di bordo del capitano James Cook (avvelenamento della ciurma e delle riserve alimentari viventi…i maiali)
- Sintomi: mancanza di fiato, ottundimento, «testa leggera», dispnea, cianosi, ipotensione, paralisi, aritmia cardiaca, convulsioni
- Assenza di terapia medica!

Biochemistry of the TETRADOTOXIN:





Toshio Narahashi & John Moore (Duke University) demonstrate the "Selective block of the sodium channel" (1964)

Fugu

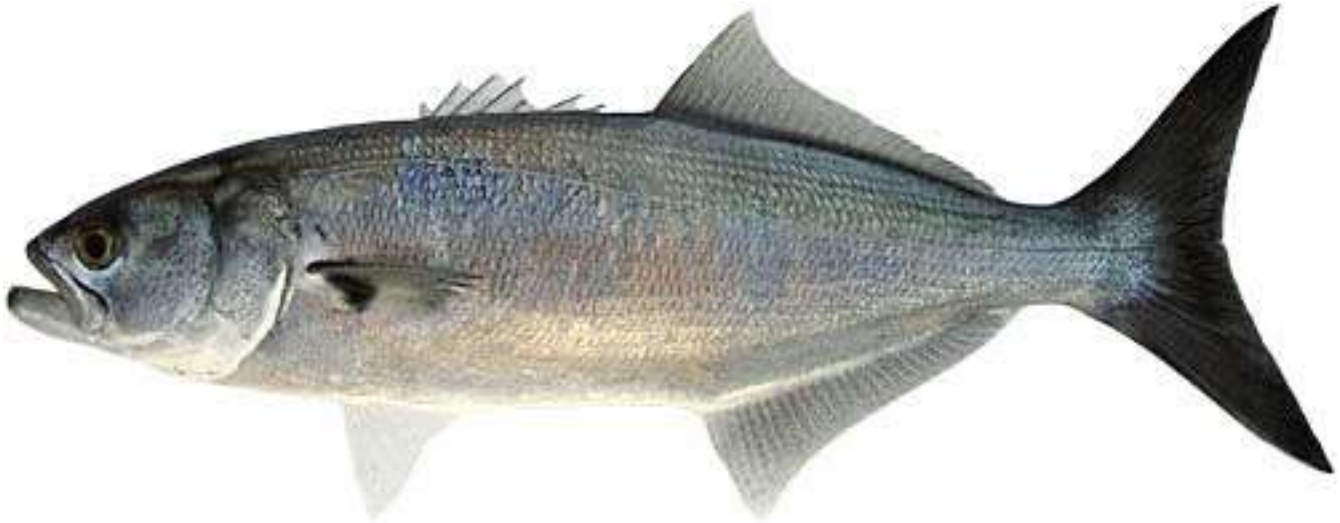
Fugu:

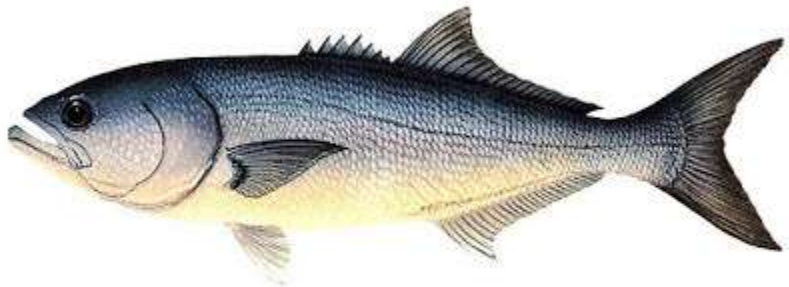
- ***Served in Japan (qualified cooks who know how to extract poison from meats). Sometimes a little enough toxin is left to give a slight euphoria and a little tingling to the lips and tongue!***
- ***In Italy it has been prohibited since 1992***
- ***In Japan between 1996 and 2006 there were 44 cases of poisoning (6 deaths/year)***
- ***Wade Davis (Harvard University) in 1984 managed to obtain in Haiti the "zombizing" powder used by voodoo sorcerers: TETRADOTOXIN***

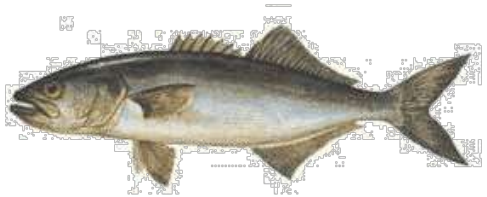
(in small doses leads to a trance-like state)

Lichia amia

«Leccia»

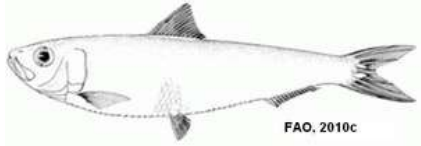






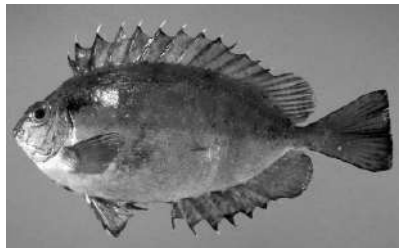
Pomatomus saltatrix

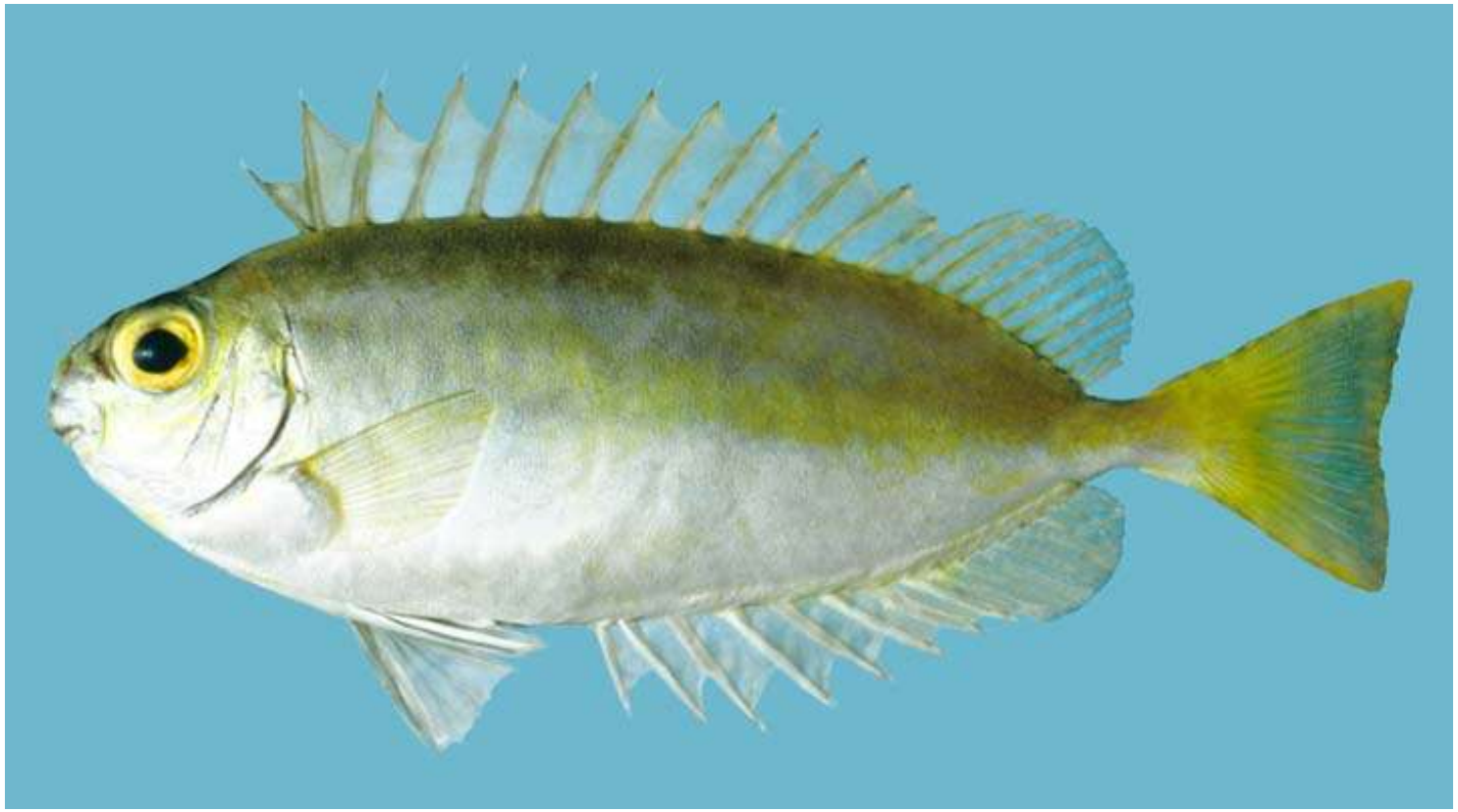
«Pesce serra»

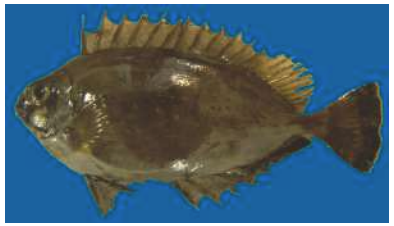


Sardinella aurita

«Alaccia»







Siganus luridus

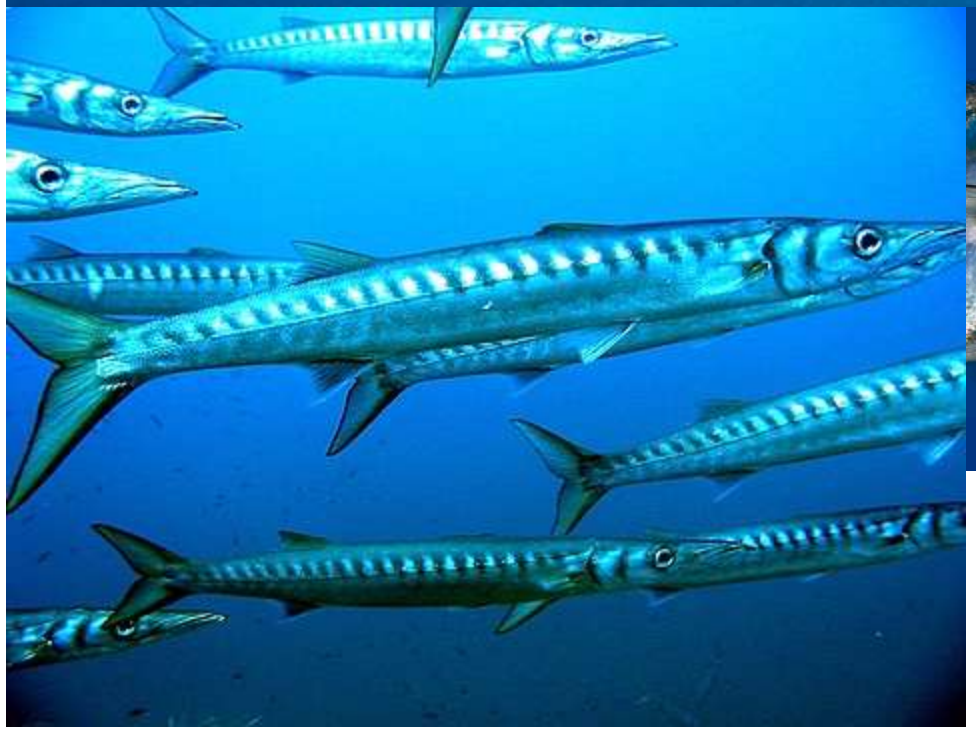
«Pesce Coniglio»

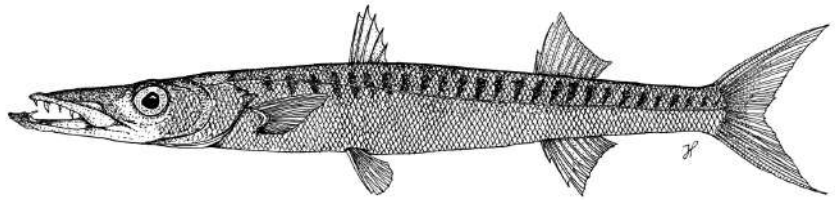
Siganus rivulatus

«Pesce Coniglio Marmorizzato»

Sparisoma cretense

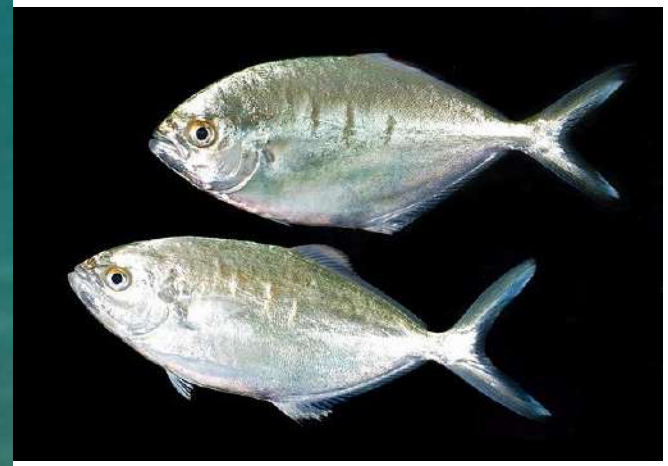
«Pesce Pappagallo»

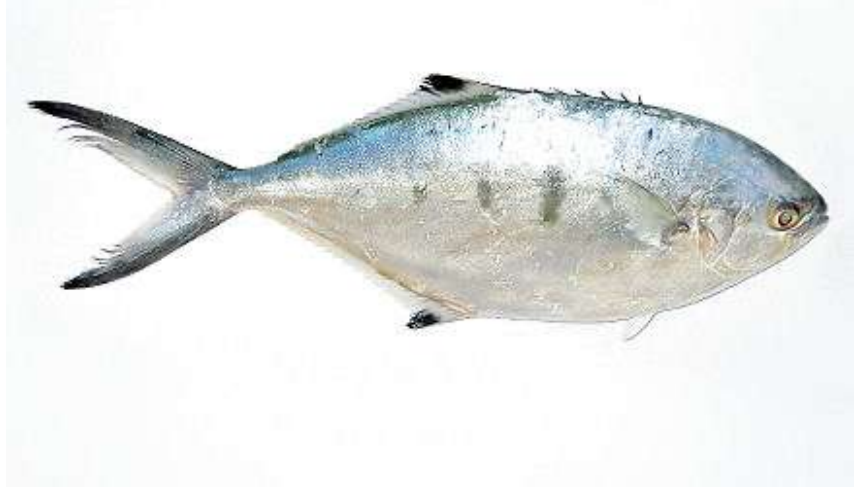




Sphyraena viridensis

«Barracuda Boccagialla»



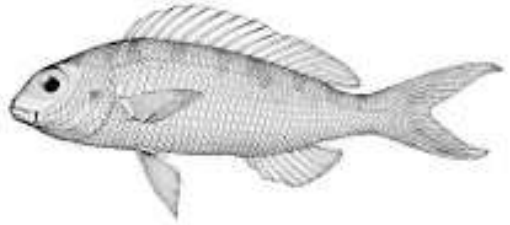


Trachinotus ovatus

«Leccia stella»

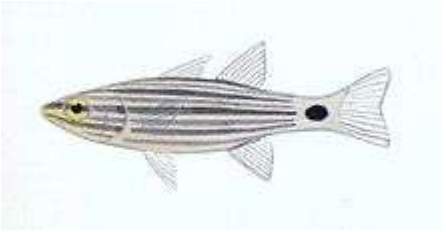
Plotosus lineatus

«Pesce gatto dei coralli»

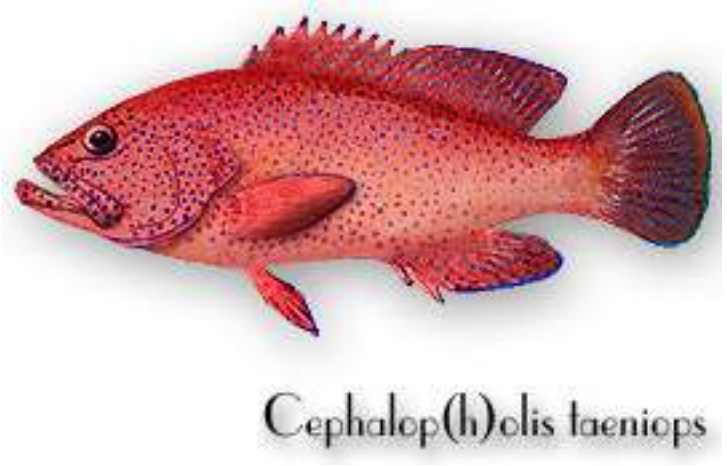


Nemipterus randalli

«Nemiptero»



Cheilodipterus novemstriatus

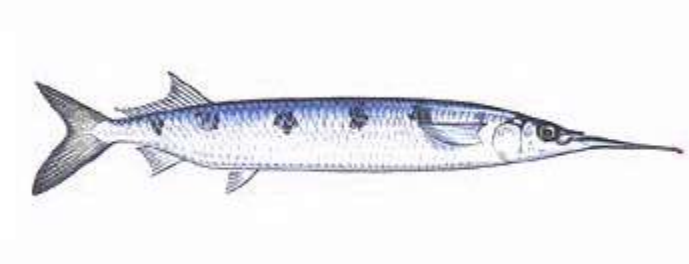


Cephalopholis taeniops

«Cernia atlantica»

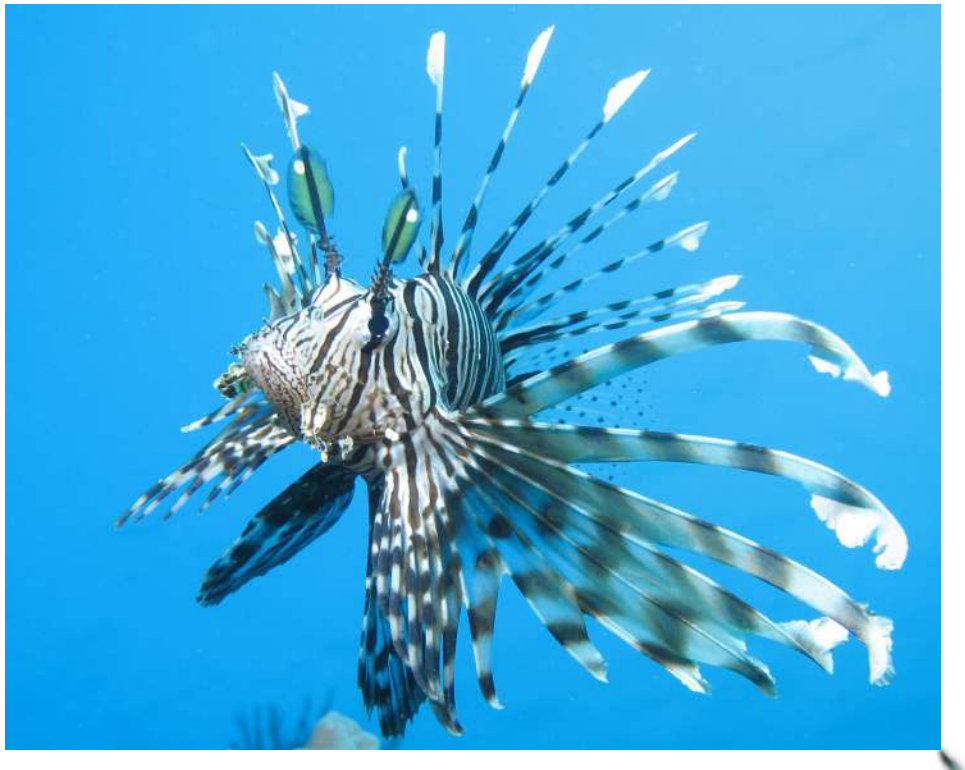
Saurida undosquamis

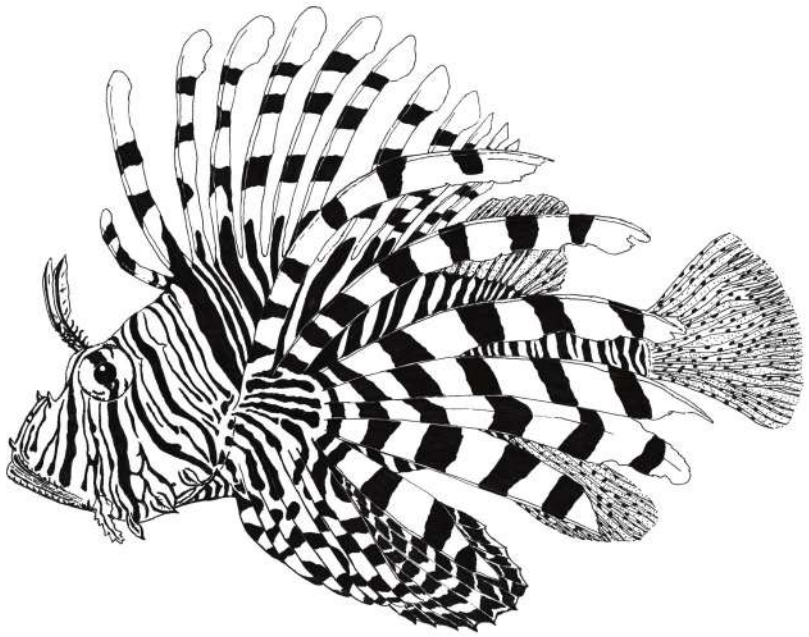
«Pesce lucertola»



Hemiramphus far

«Blackbarred halfbeak»





Pterois miles

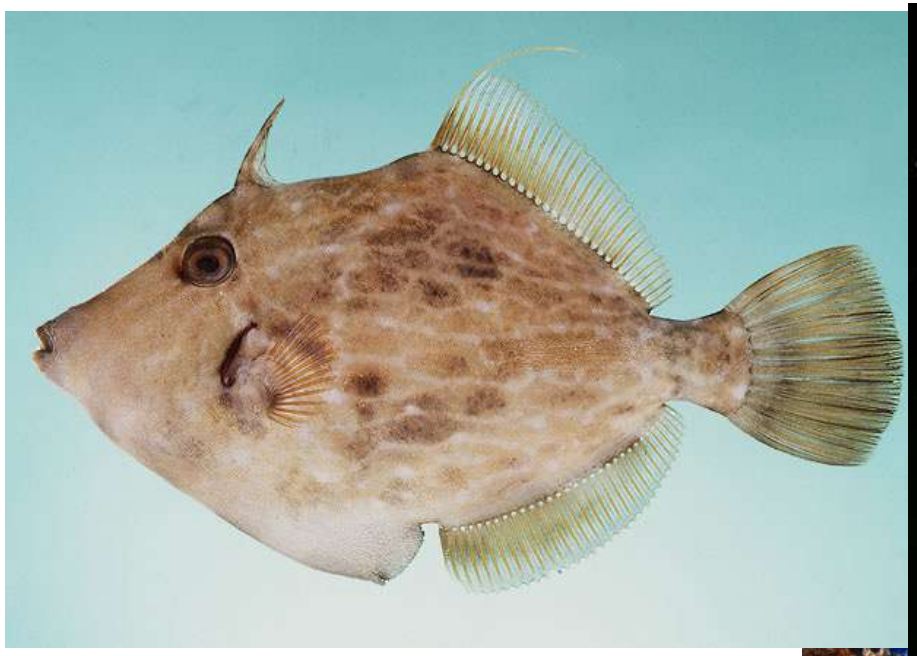
«Pesce scorpione»

Pempheris mangula

«Sweeper»

Sargocentron rubrum

«Pesce armato rosso»



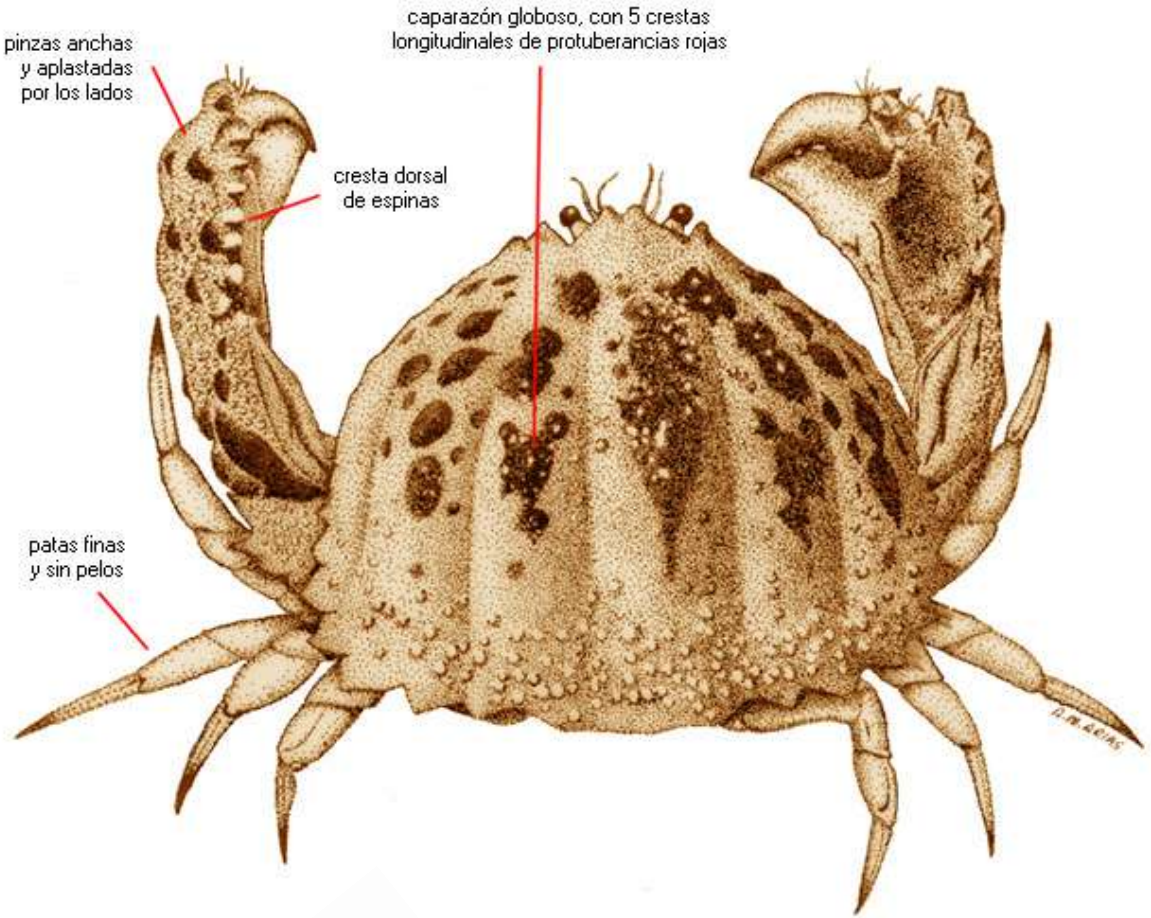
Stephanolepis diaspros

«Monacanto reticolato»

Callinectes sapidus

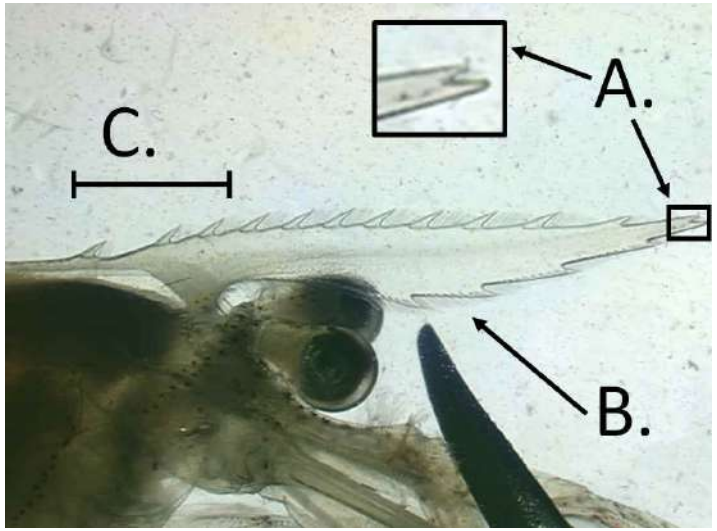
«Granchio Blu»

Dispanopeus sayi



Calappa granulata

«Granchio Melograno»



Palaemon macrodactylus

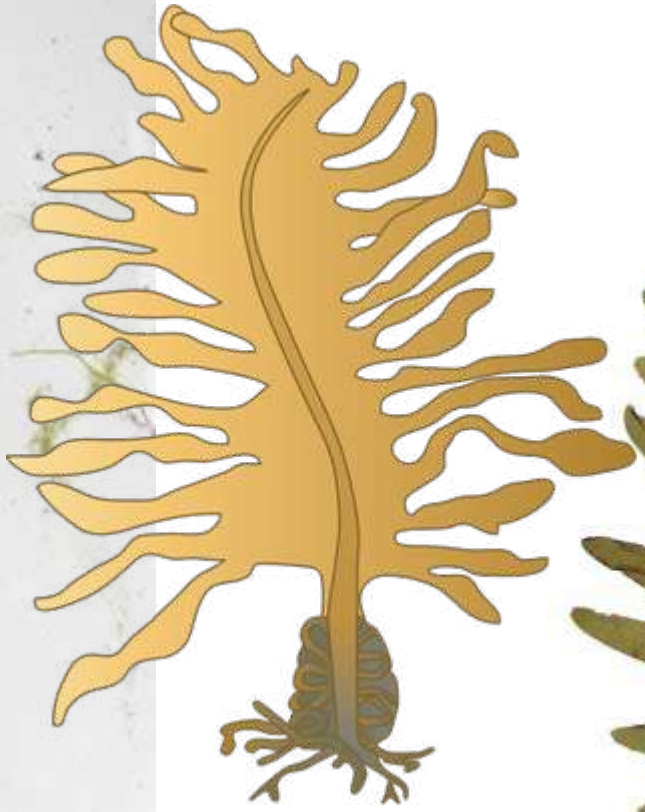
«Gamberetto Orientale»

Caulerpa racemosa

Caulerpa taxifolia

algaeBASE

Sargassum muticum

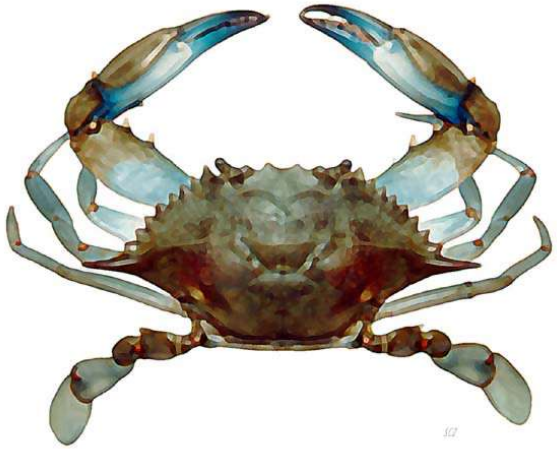


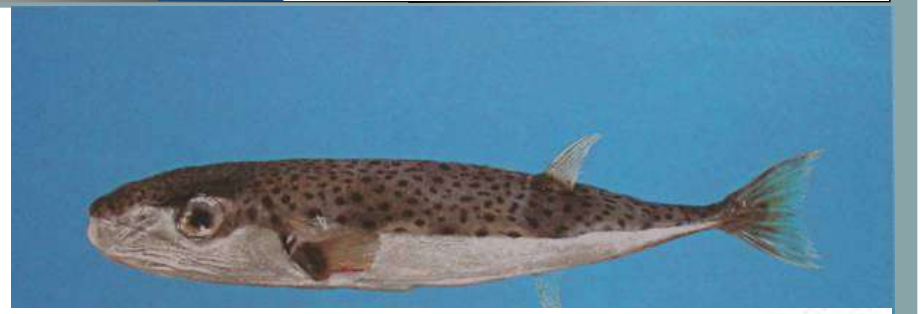
Undaria pinnatifida

For any information
or
To send photos, reports, comments:

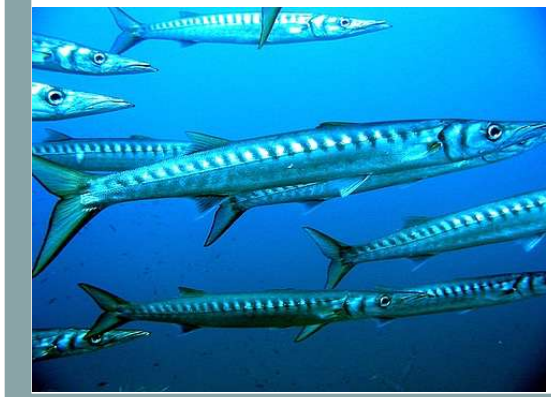
luca.bolognini@cnr.it

The project is co-funded by the European Union
Instrument for Pre-Accession Assistance
REPUBLIC OF SLOVENIA
GOVERNMENT OFFICE FOR DEVELOPMENT AND EUROPEAN COHESION POLICY





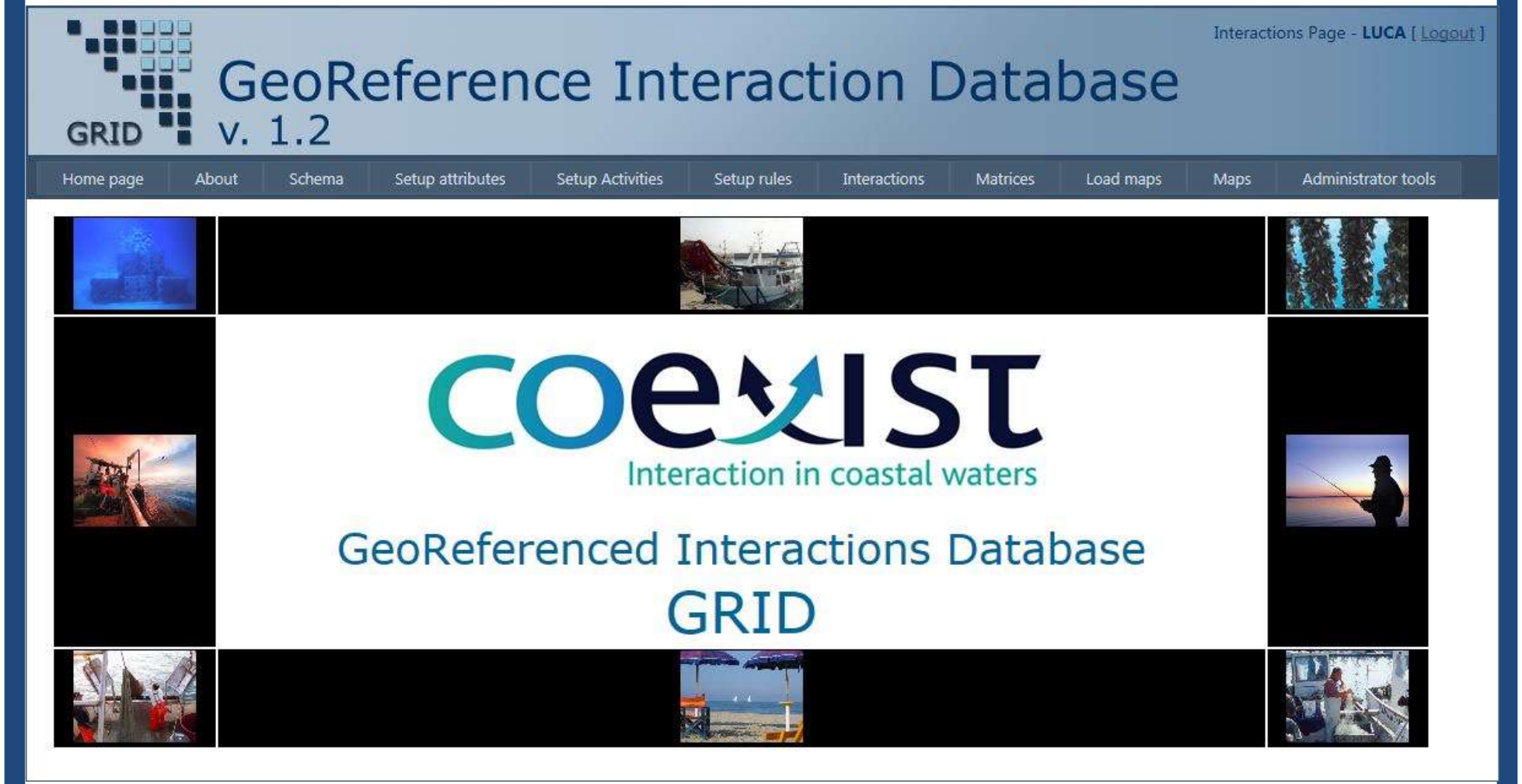
Thanks for collaboration!



…another spatial issue

Spatial distribution of fishing effort (otter, pelagic, and rapido trawls, hydraulic dredge, SSFs) and other activities (energy, aquaculture, transport) were analysed using GRID

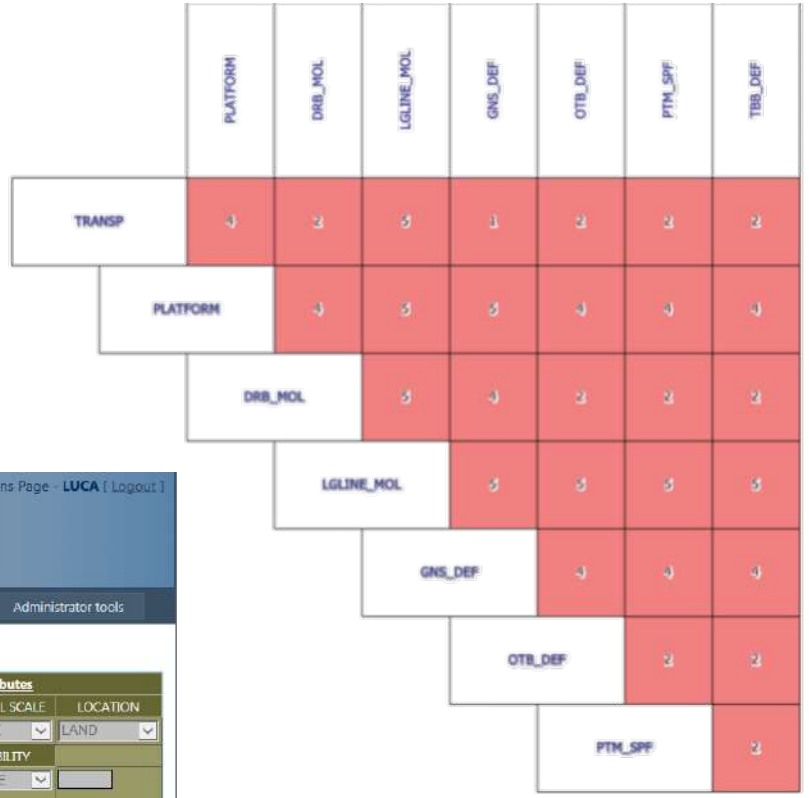
Aim: quantify spatial conflicts and test a future scenario (trawling ban inside 6 nm)

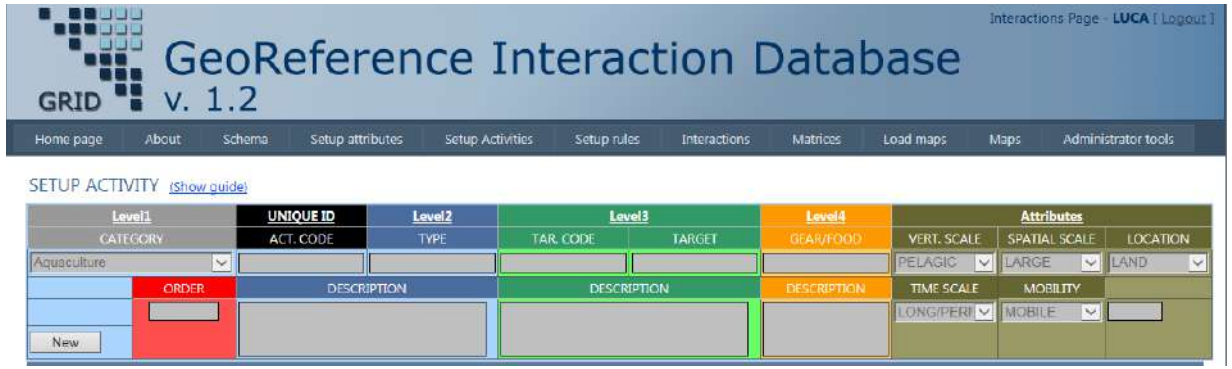


…another spatial issue

Interaction matrix showing conflict scores

Conflist scores are calculated using 5 key attributes of each activity (vertical scale, spatial scalem location, time scale and mobility) and basing on a set of rules

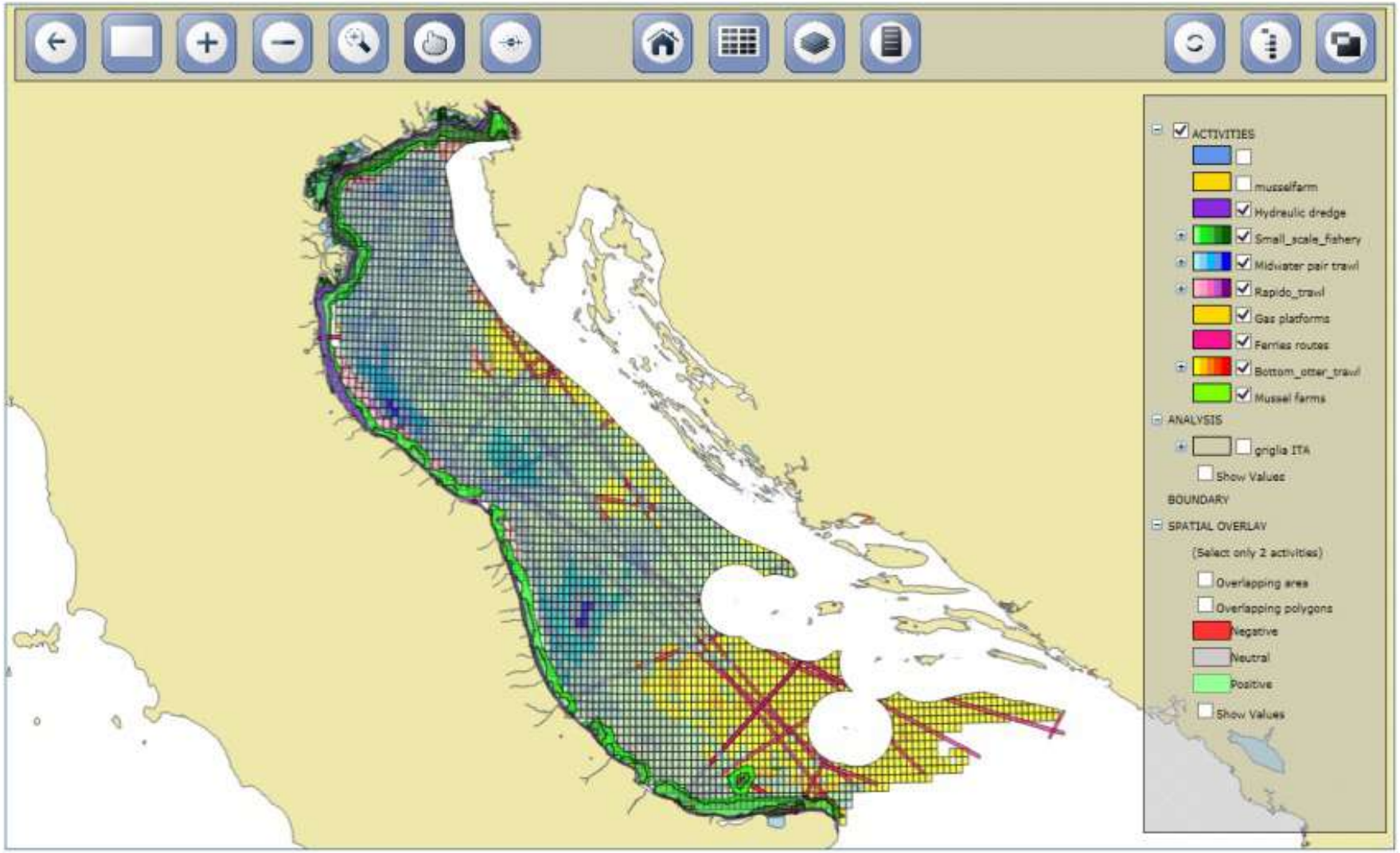




RULE NAME	DESCRIPTION	FIELD	TYPE	CONDITION	ORDER	SQL TEXT	New
							ID

RULE NAME	DESCRIPTION	FIELD	TYPE	CONDITION	ORDER	SQL TEXT	ID	
DEFRULE	DEFAULT RULE	SPACE	NEGATIVE	IF(([M1]>0) AND ([M2]>0),1,0)	3	MAX([t])+MAX([s])	9	Select
RULE1	VSCALE ARE DIFFERENT	SPACE	NEGATIVE	IF(([VS1]<>[VS2]) AND (([VS1]<>3) AND ([VS2]<>3)),1,0)	1	0	7	Select
RULE2	ACTIVITIES ARE BOTH MOBILE	SPACE	NEGATIVE	IF(([M1]=1) AND ([M2]=1),1,0)	2	MIN([t])+MIN([s])	8	Select

GRID GeoReference Interaction Database v. 1.2

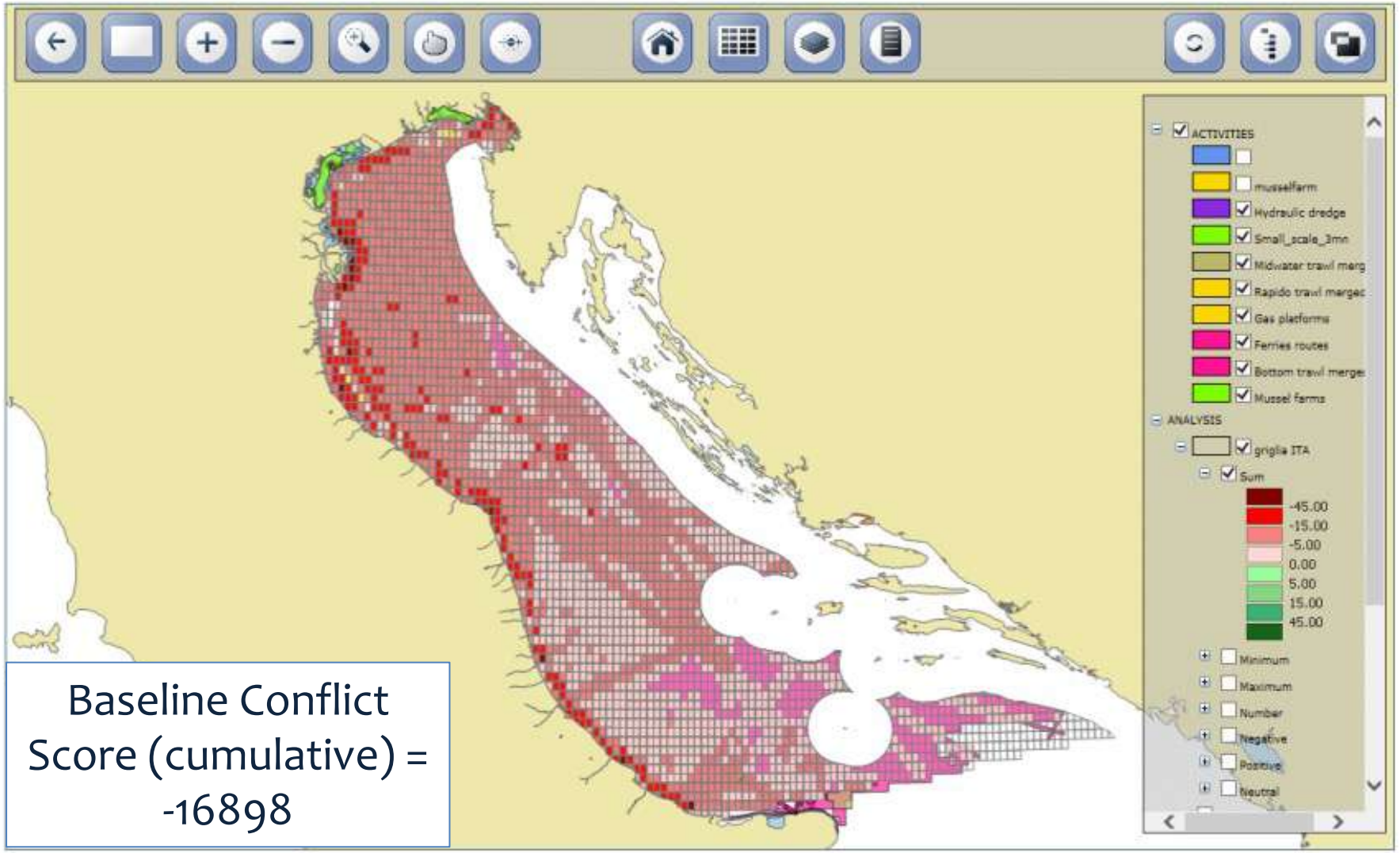


CNR Consiglio Nazionale delle Ricerche

ISMAR Istituto di Scienze Marine

… cumulative conflict score: BASELINE

GRID GeoReference Interaction Database v. 1.2

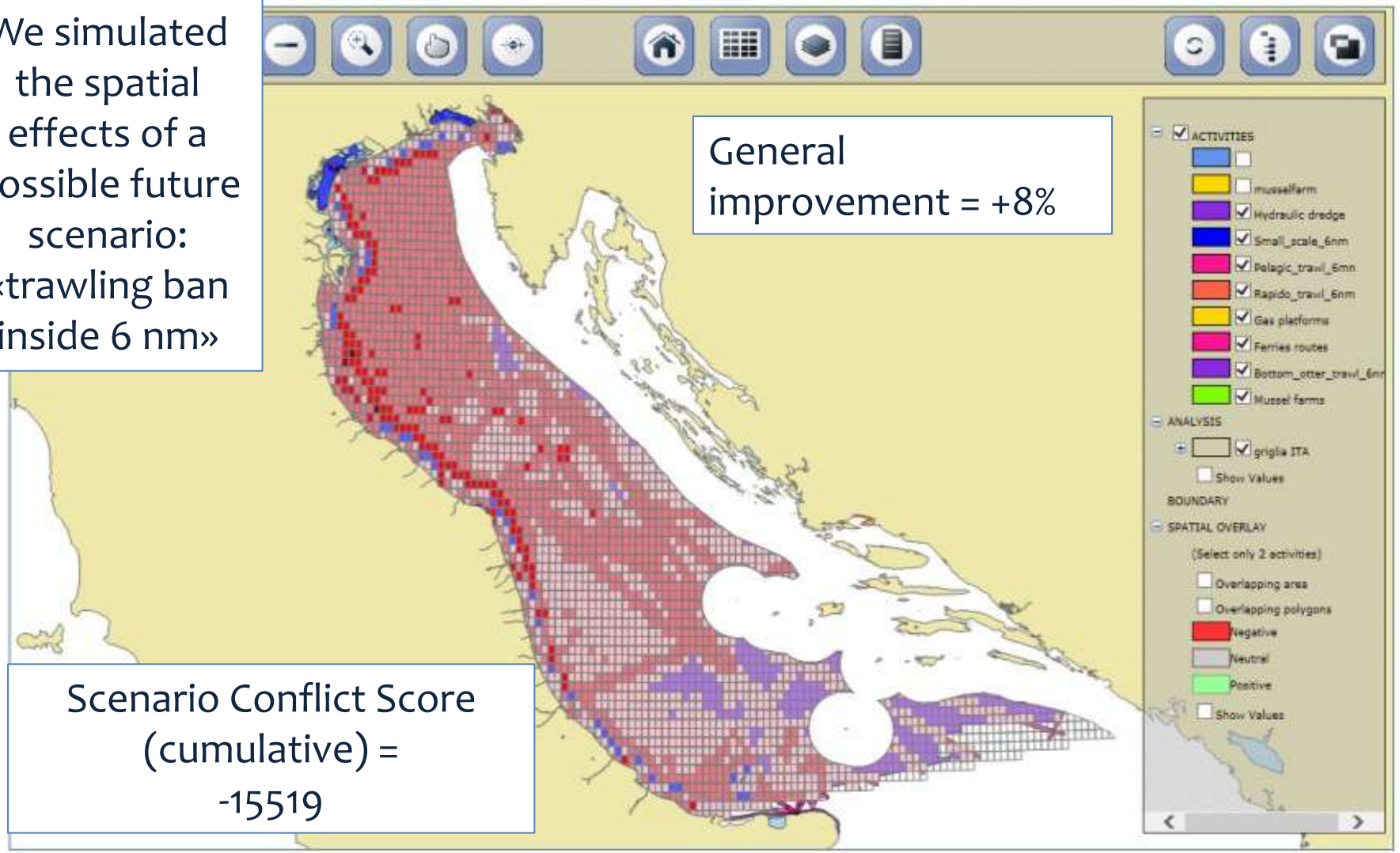


Baseline Conflict Score (cumulative) = -16898

… cumulative conflict score: SCENARIO

GeoReference Interaction Database v. 1.2

We simulated the spatial effects of a possible future scenario: «trawling ban inside 6 nm»



General improvement = +8%

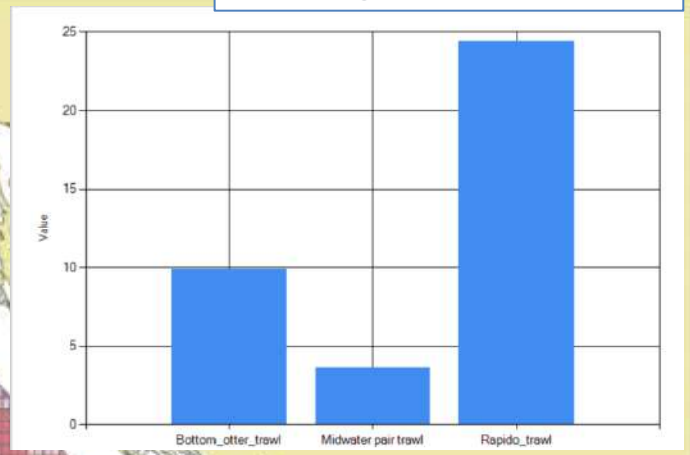
Scenario Conflict Score (cumulative) = -15519

… stress level of the SCENARIO

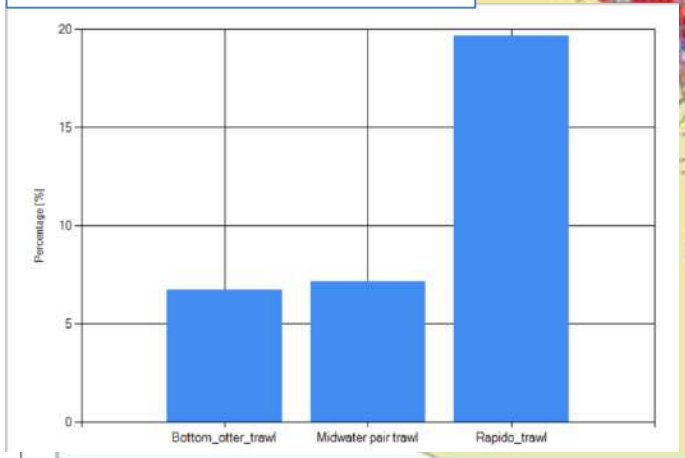
GeoReference Interaction Database v. 1.2

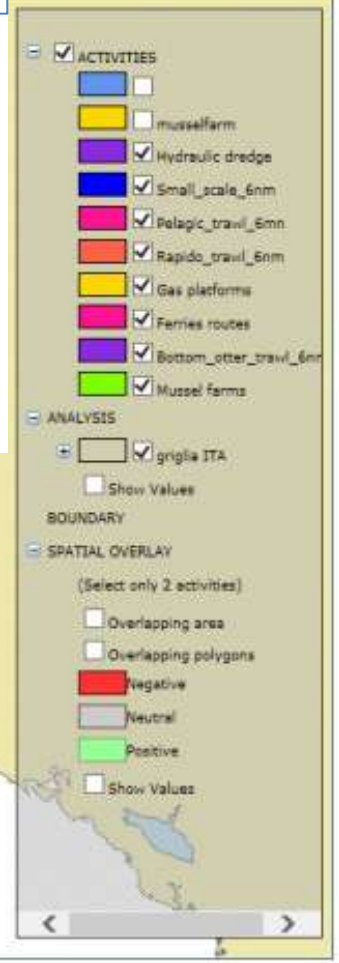
Fishing area of SSF increases of 103 %

Fishing effort lost (%)

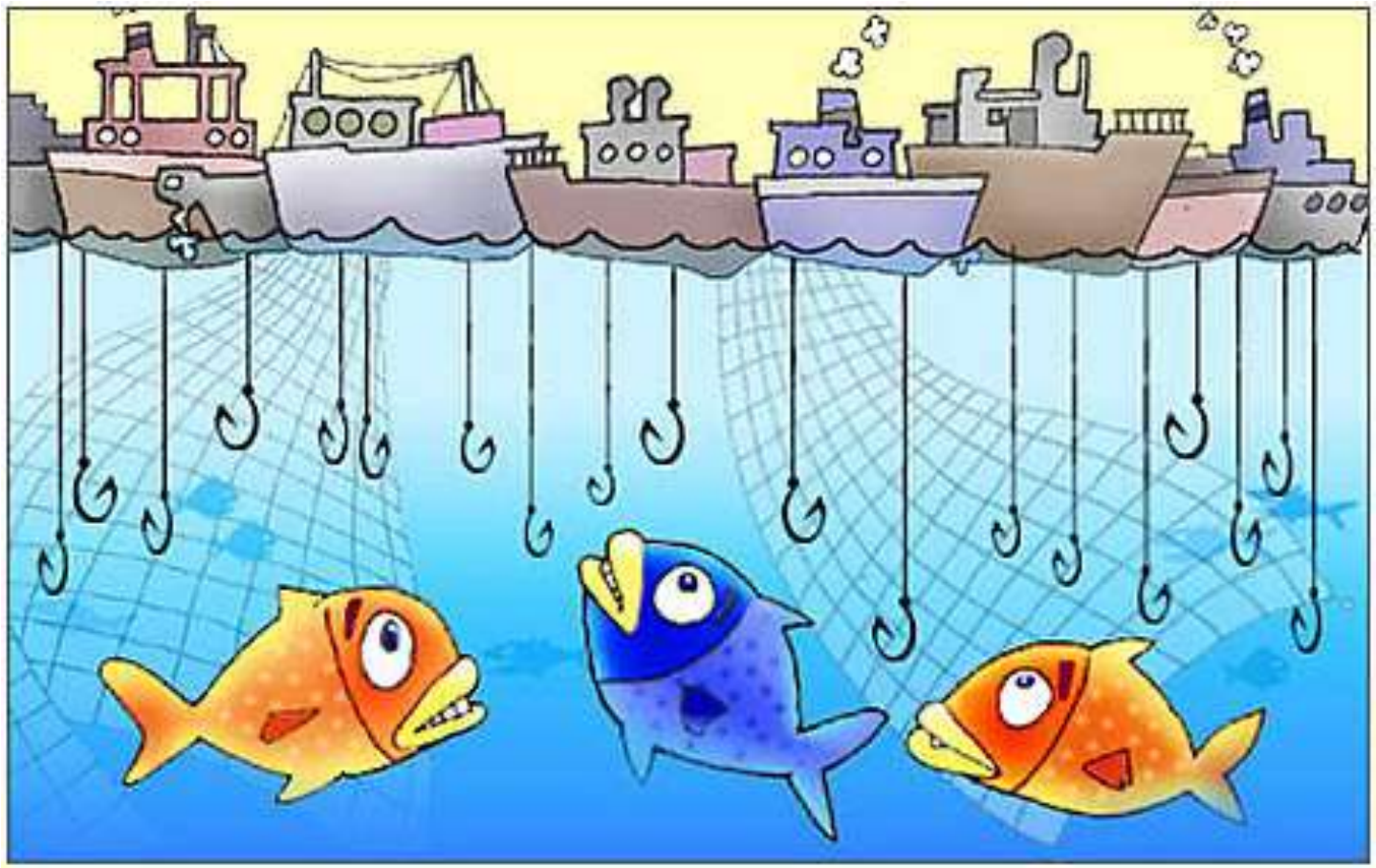


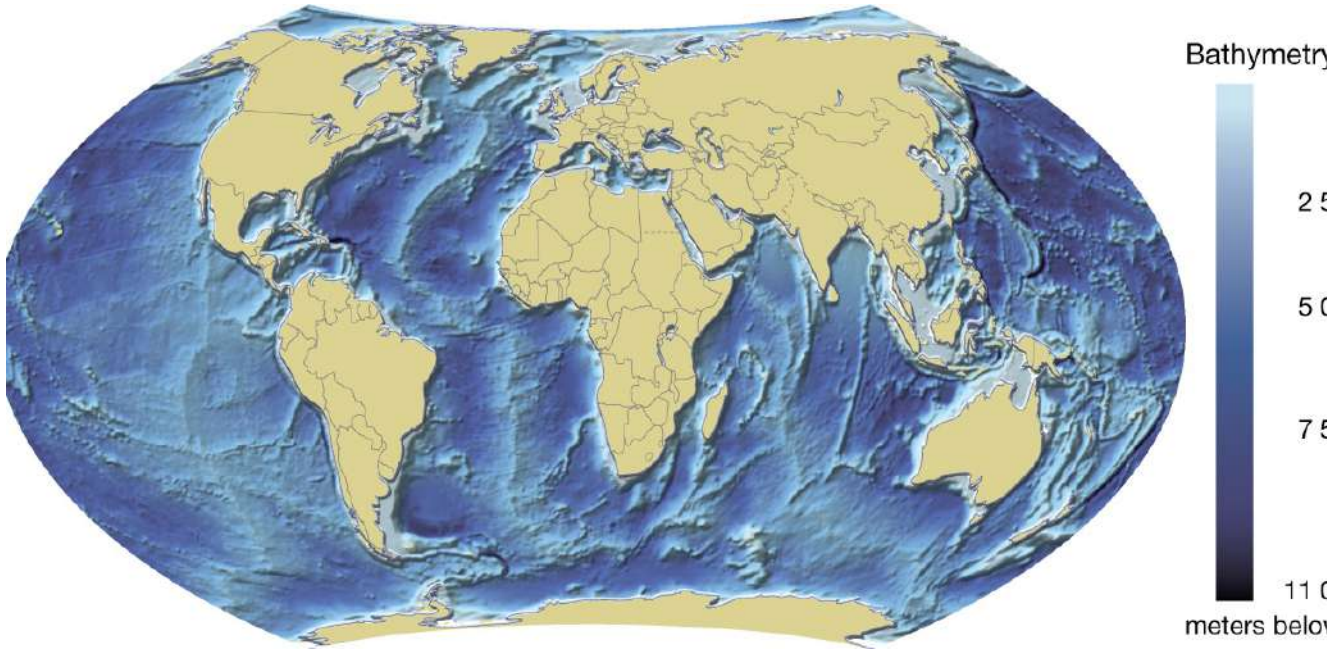
Fishing area lost (%)





Thanks for your attention!!!





Oceans' characteristics

Heterogeneous bathymetry

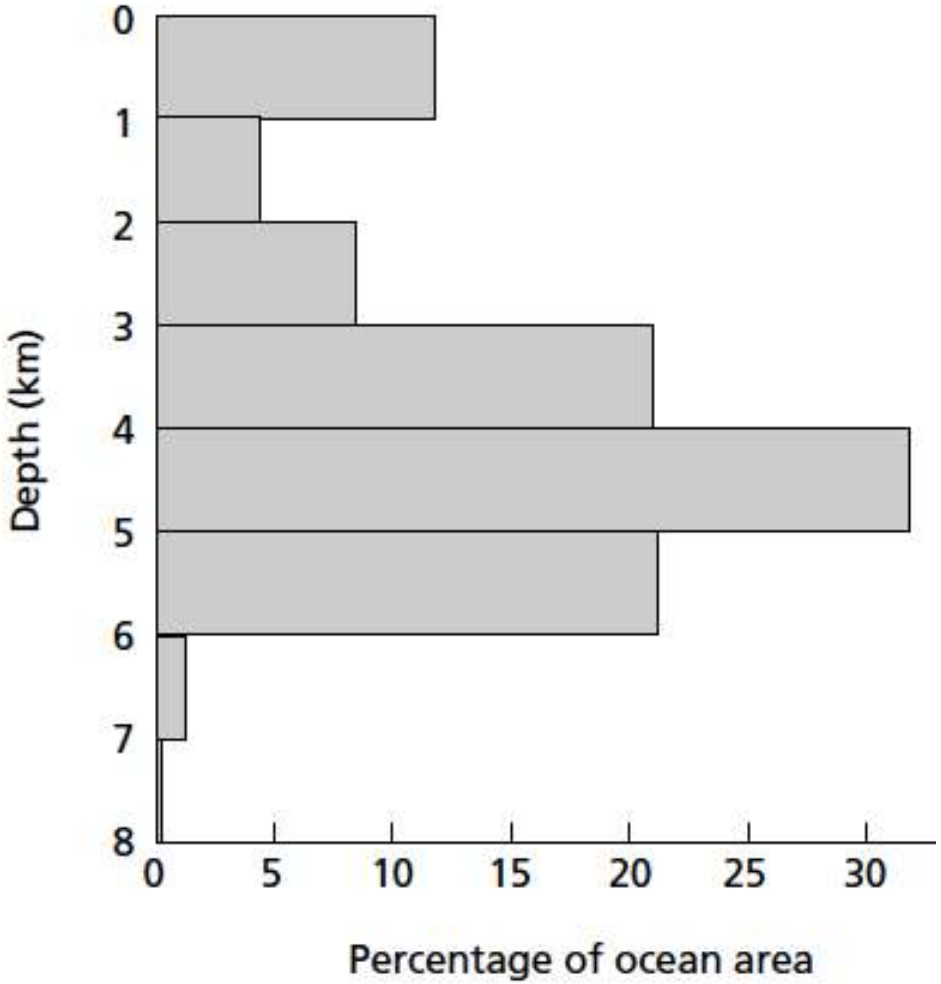
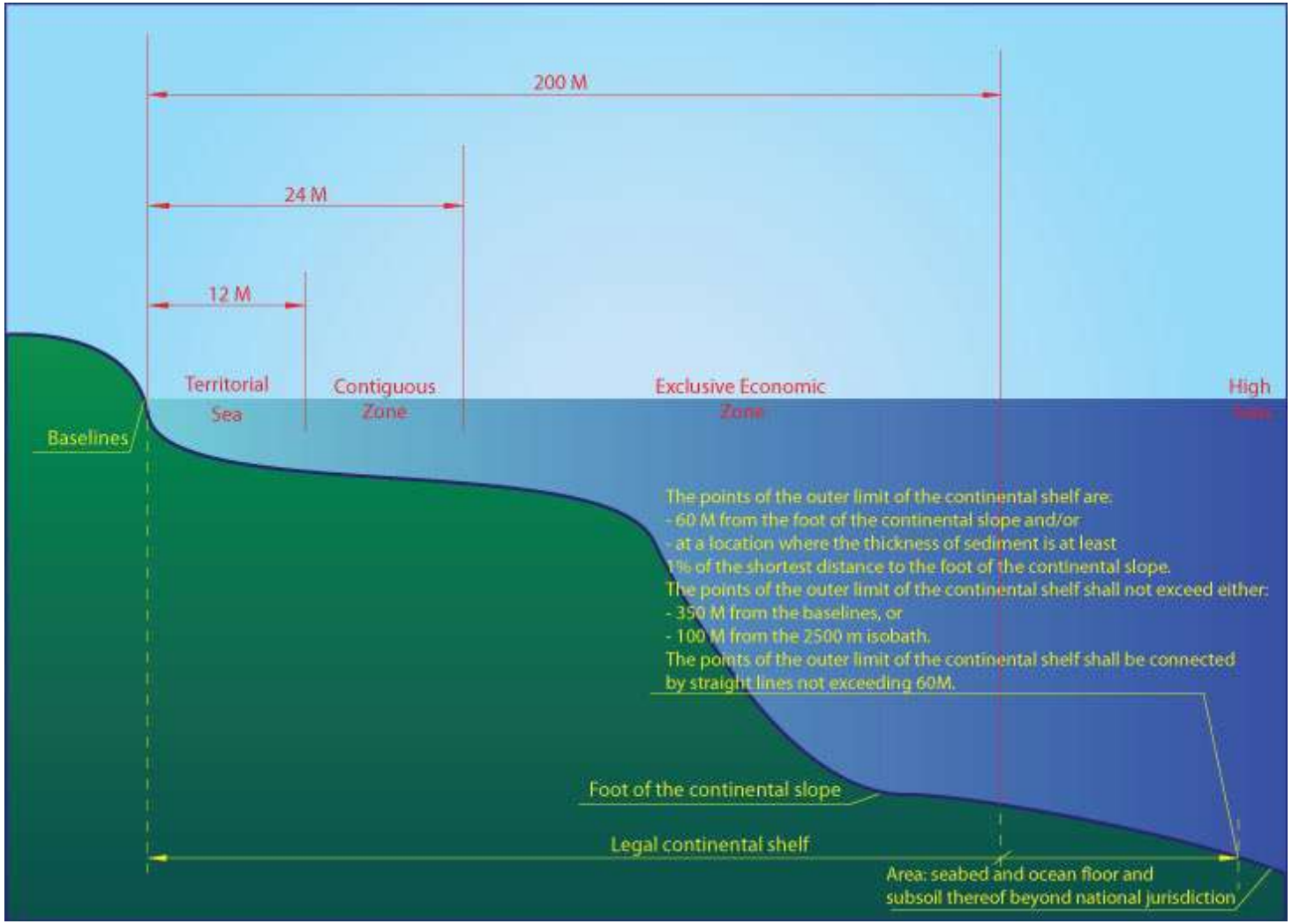


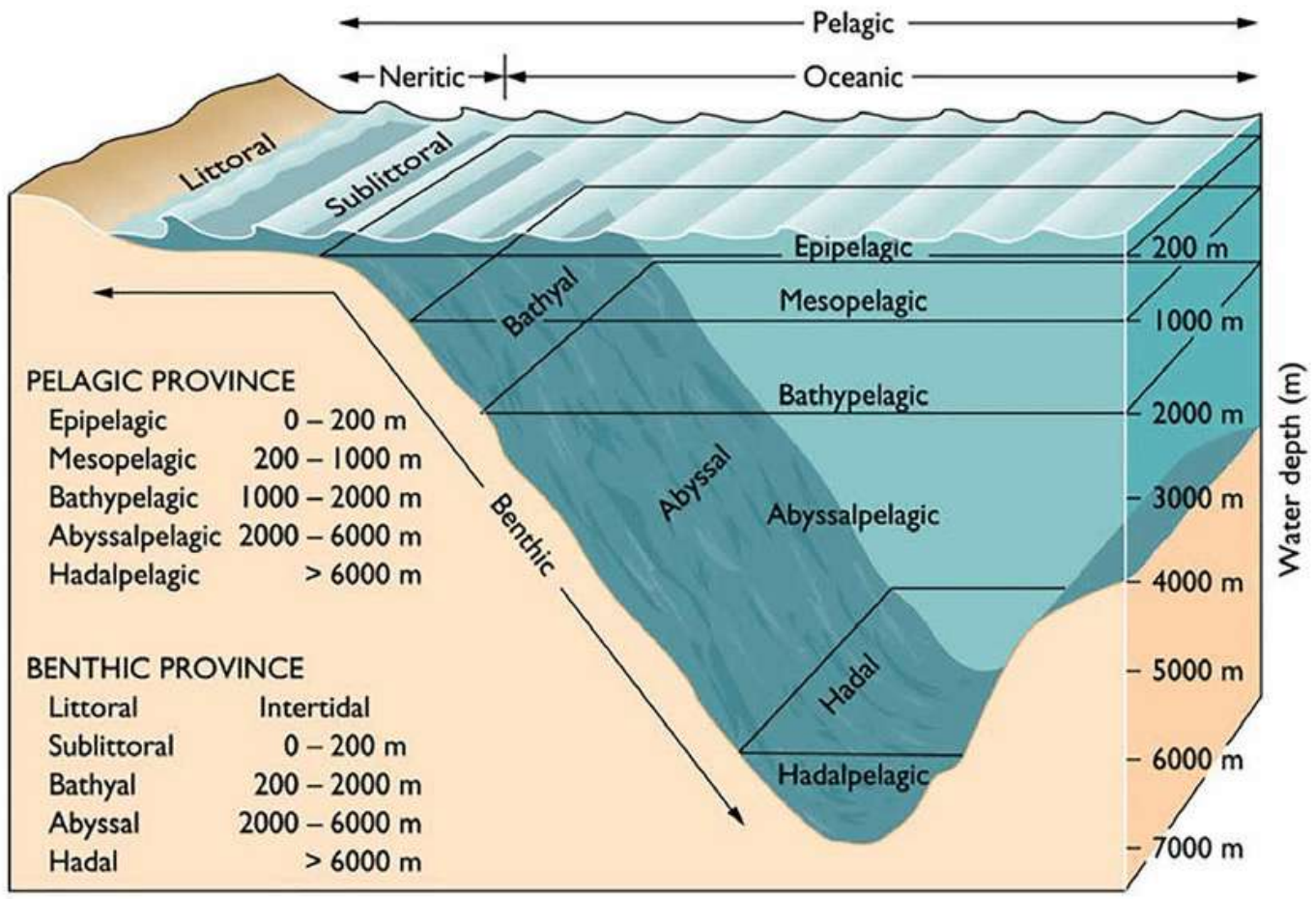
Fig. 2.1 The proportion of ocean area by depth. The mean depth of the oceans is 3.7 km and oceans cover 70% of the globe. Data from Sünderman (1986).

Other aspects:

Because each country can fish within its territorial waters and (if it has) in the so-called exclusive economic area (EEZ). The so-called ABNJ, areas beyond national jurisdiction, are "no man's lands"



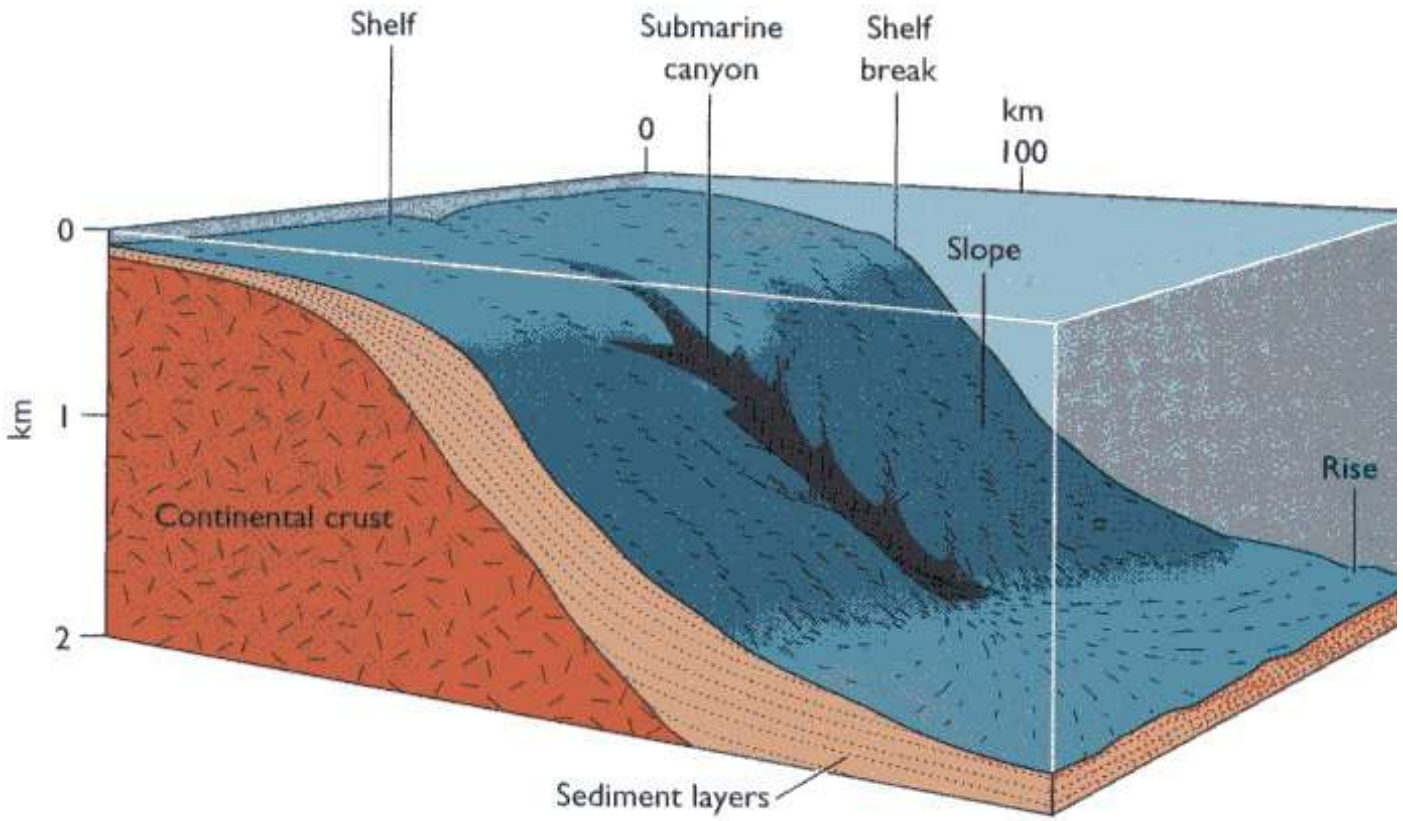
Oceans' characteristics: horizontal zonation



Oceans’ characteristics: continental shelf

Most of the fishing activities take place on the continental shelf. Small-scale fishing takes place almost exclusively on the platform.

Canyons



Professional fishing also takes place on the continental slope. In the Mediterranean the maximum limit for trawling is 1000 m of depth. Also in the Mediterranean, red shrimp fishing is carried out mainly in canyons.

Canyons

Trawl-induced and natural sediment accumulation rates in the studied submarine canyons. (Paradis et al., Sci. Rep. 2017)

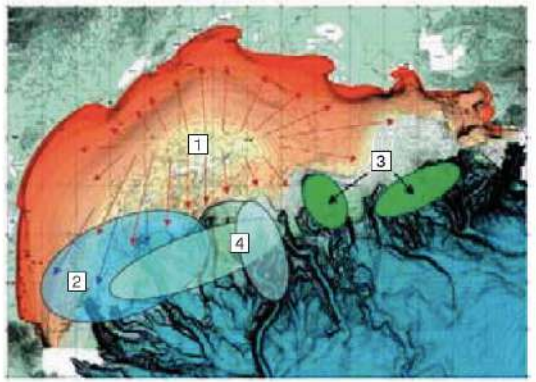
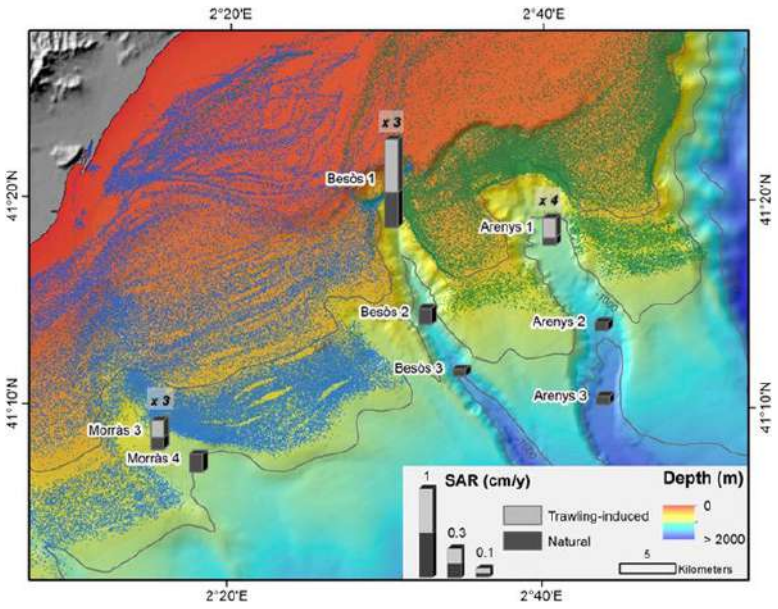
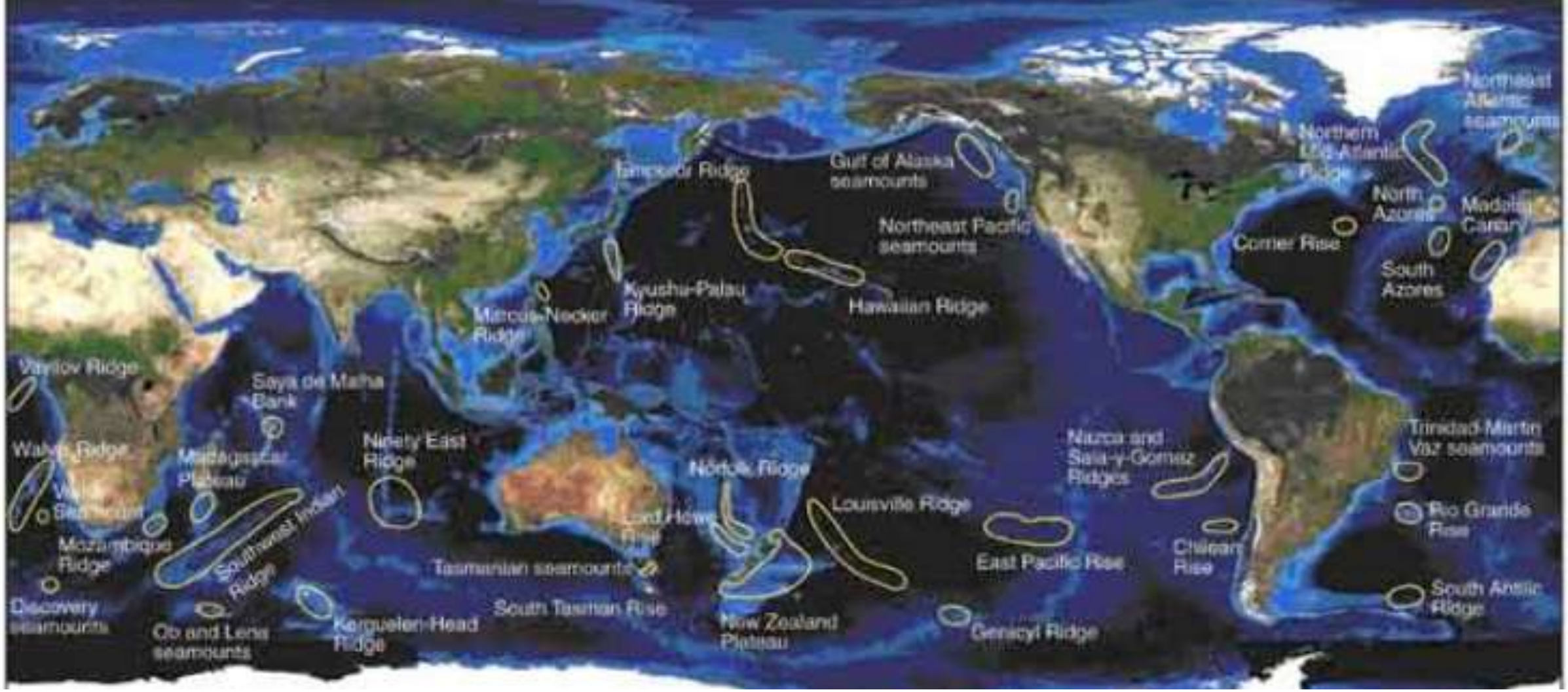


Fig. 1:
Sectors of activity of the various components of the Franco-Spanish fishing fleet exploiting halieutic resources in the Gulf of Lion.



Seamounts

- Seamount fishing is not carried out in the Mediterranean but is quite common in several ocean areas (especially the Pacific and Indian).

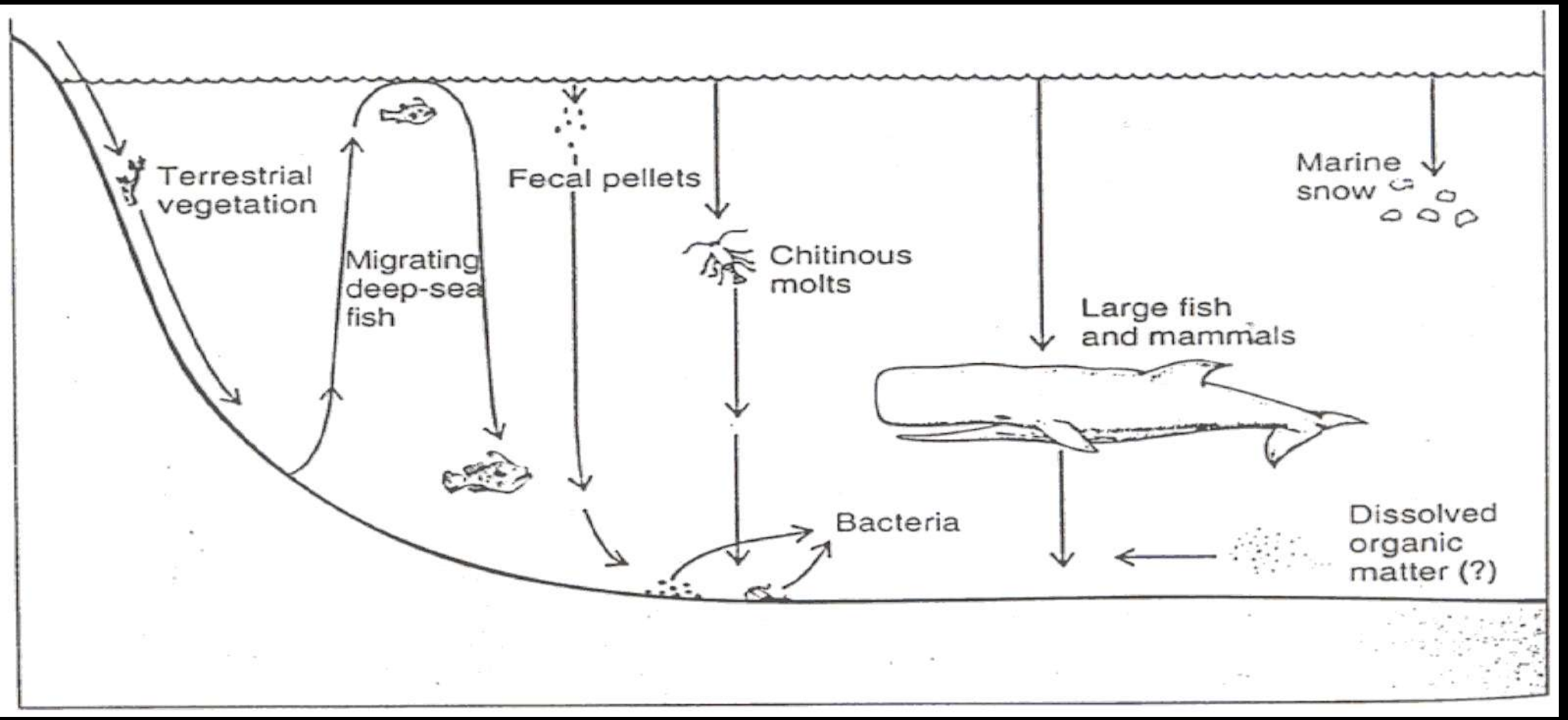

Gulf of Alaska seamounts
Northeast Pacific seamounts
Hawaiian Ridge
Kyushu-Palau Ridge
Northeast Atlantic seamounts
Northern Mid-Atlantic Ridge
North Azores
Corner Rise
South Azores
Madeira-Canary
Vavilov Ridge
Walvis Ridge
Mozambique Ridge
Discovery seamounts
Madagascar Plateau
Southwest Indian Ridge
Ob and Lena seamounts
Kerguelen-Heard Ridge
Ninety East Ridge
Tasmantid seamounts
South Tasman Rise
Norfolk Ridge
Lord Howe Rise
Louisville Ridge
New Zealand Plateau
Nazca and Sala-y-Gomez Ridges
East Pacific Rise
Chilean Rise
Genesyl Ridge
Trinidad-Martin Vaz seamounts
Rio Grande Rise
South Antilic Ridge

Seamounts

Food supply

Deep-sea fishing is limited for several reasons:

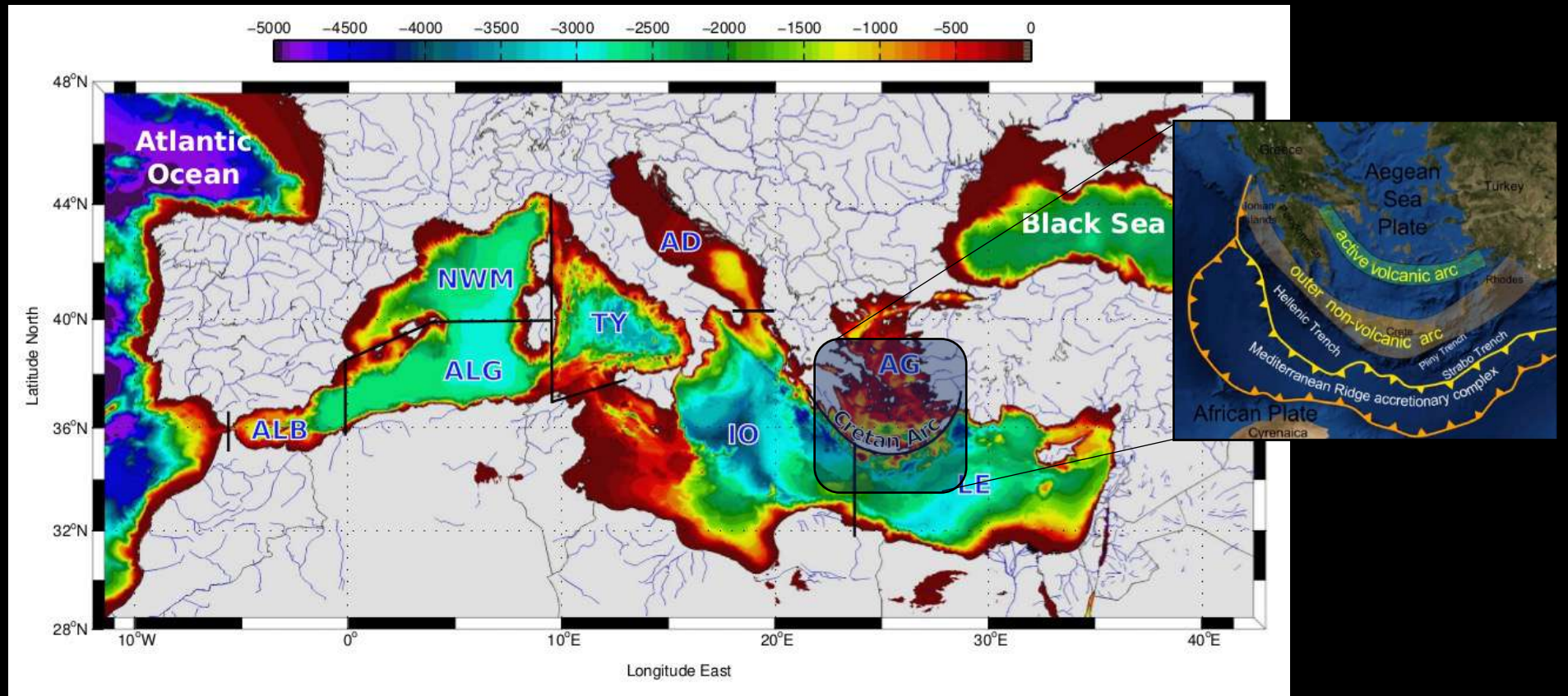
- distance from the coast (high costs for small fishermen)
- very low yields (see below), except for the environments seen above

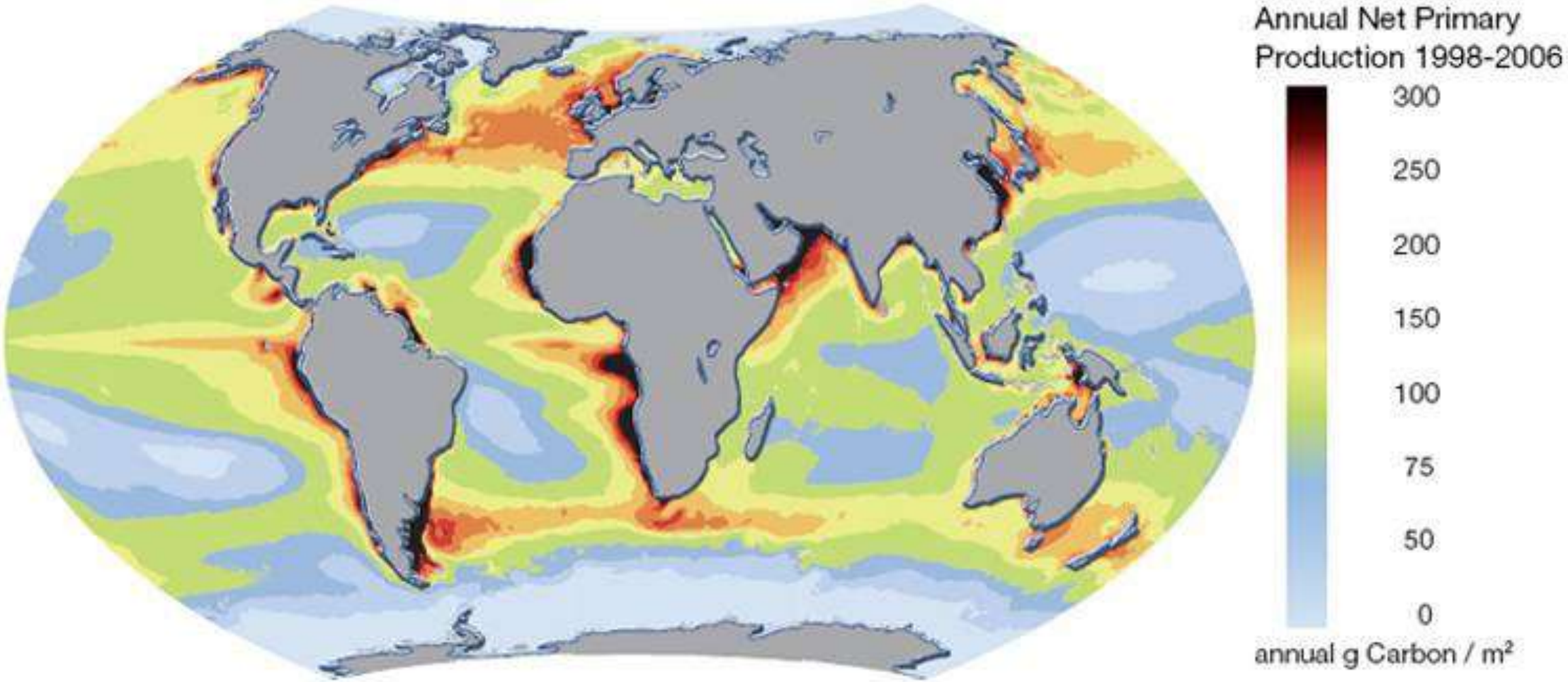


It is extremely limited (except at hydrothermal vents) organisms must survive in an environment where food is scarce and low in calories

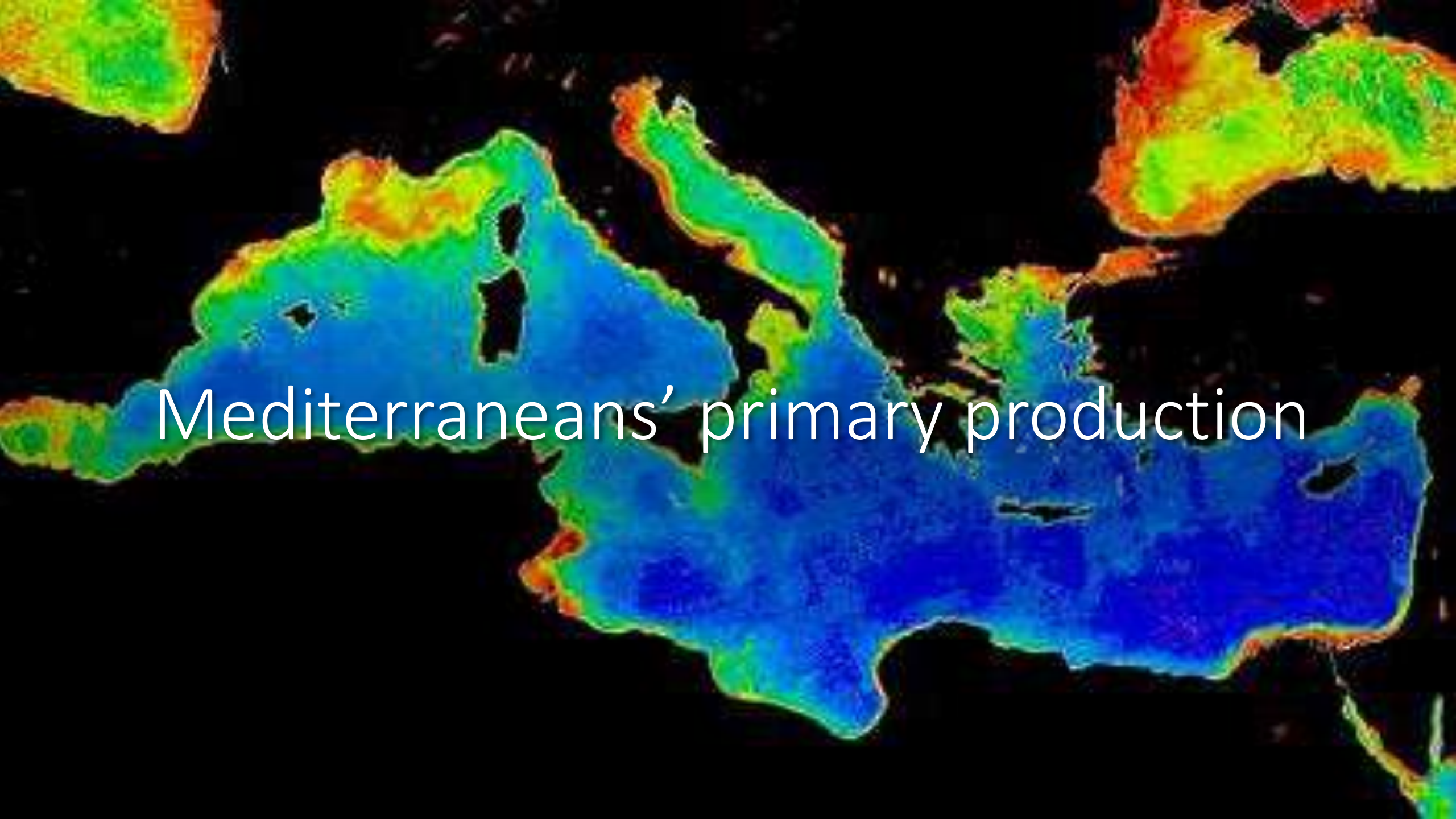
Mediterraneans' characteristics

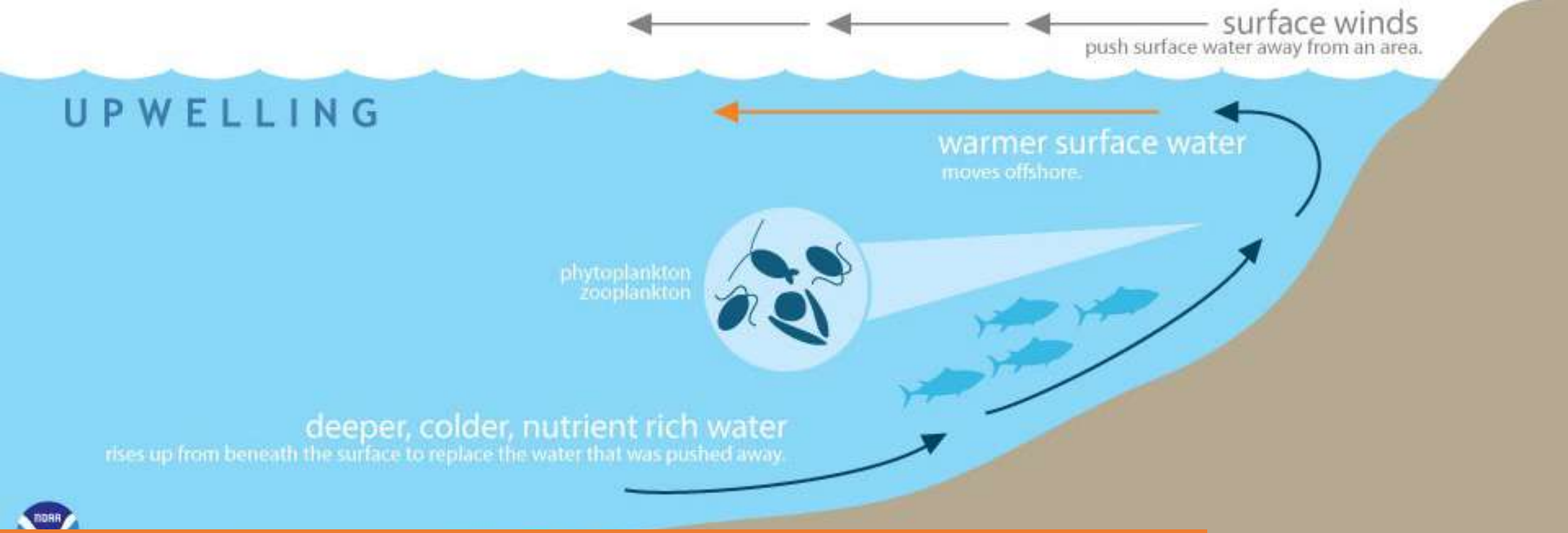
Large areas of the continental shelf (Adriatic, Sicily channel, Gulf of Lion), but also bathyal beds, up to 5000 m. The maximum depth of 5267 meters is found in the Hellenic Trench in the southern coasts of Greece (Calypso Deep). In the Mediterranean, thanks to a restriction imposed by the GFCM, trawling is prohibited below 1000 m depth.





Global primary production


Mediterraneans’ primary production



Upwellings

- **Upwelling is an oceanographic phenomenon, influenced by winds, which involves colder and denser (and nutrient-rich) water masses that rise from the depths, replacing warmer (and nutrient-poor) surface waters. They are highly productive areas.**

Upwellings

upwelling map of globe


Any
Questions