

# *Mediterranean marine biodiversity: an endangered treasure*



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Institute  
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Sciences

**ICM**



**CSIC**

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

**MedRecover**  
MARINE BIODIVERSITY CONSERVATION GROUP

April 26th, 2017 @GIFT EGU Vienna

# **Results from a team effort**

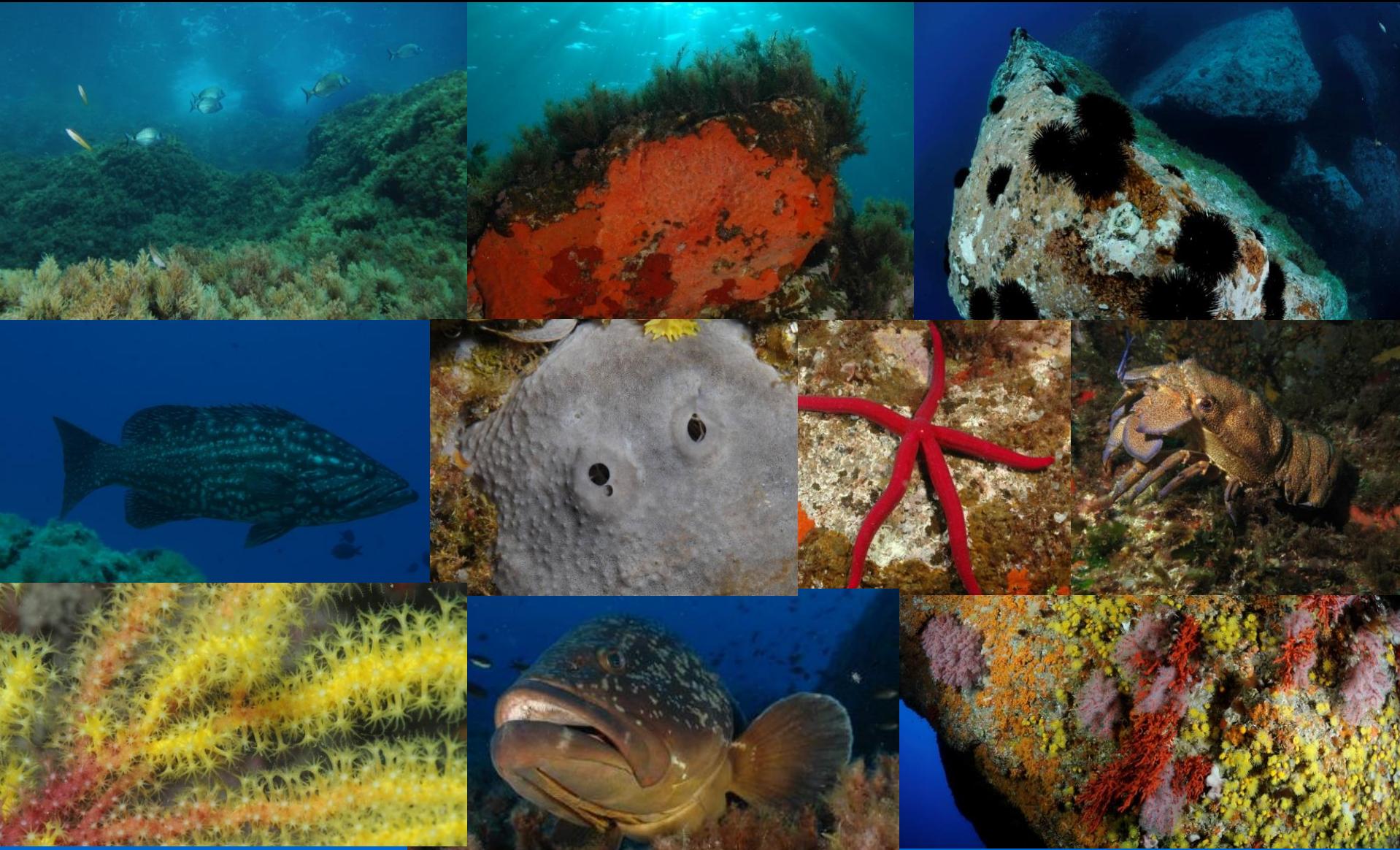
## **From research institutions in Spain and France**



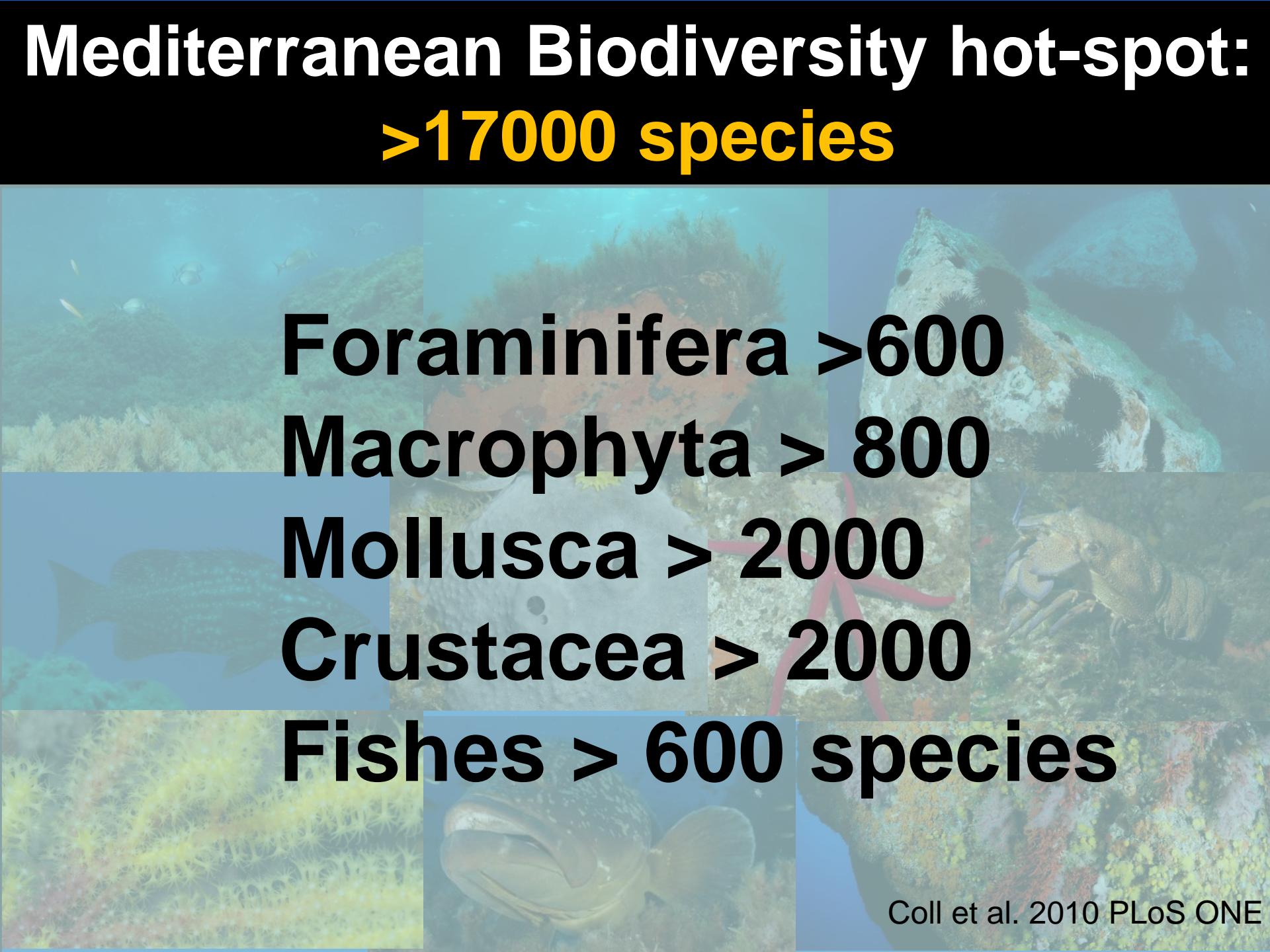
**Cristina Linares, J.B. Ledoux, Ignasi Montero, Pierre Drap  
E. Cebrian, Mikel Zabala..... and many more**

**Researchers, MPA managers, Postdocs, Technicians,  
PhD students, master students**

# Mediterranean Biodiversity hot-spot: **>17000 species**



# Mediterranean Biodiversity hot-spot: **>17000 species**

A composite underwater photograph showing a variety of marine life. It includes a large fish on the left, a red starfish in the center, a crab on the right, and various smaller fish and coral reefs in the background.

**Foraminifera >600**  
**Macrophyta > 800**  
**Mollusca > 2000**  
**Crustacea > 2000**  
**Fishes > 600 species**

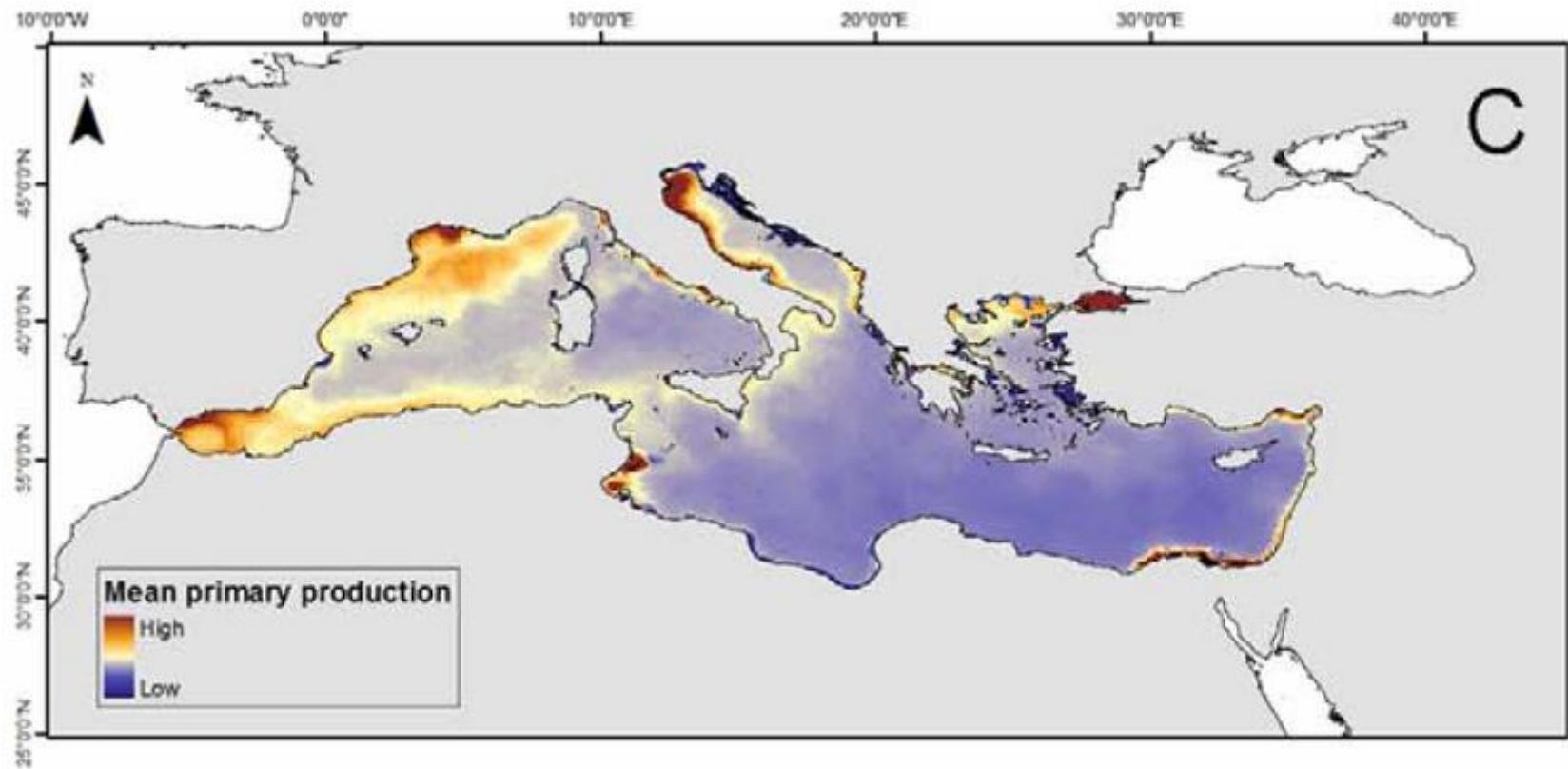
# Mediterranean Biodiversity hot-spot: **>17000 species**

**10% marine species in less than  
0,1 % ocean's surface**

## **Why?**

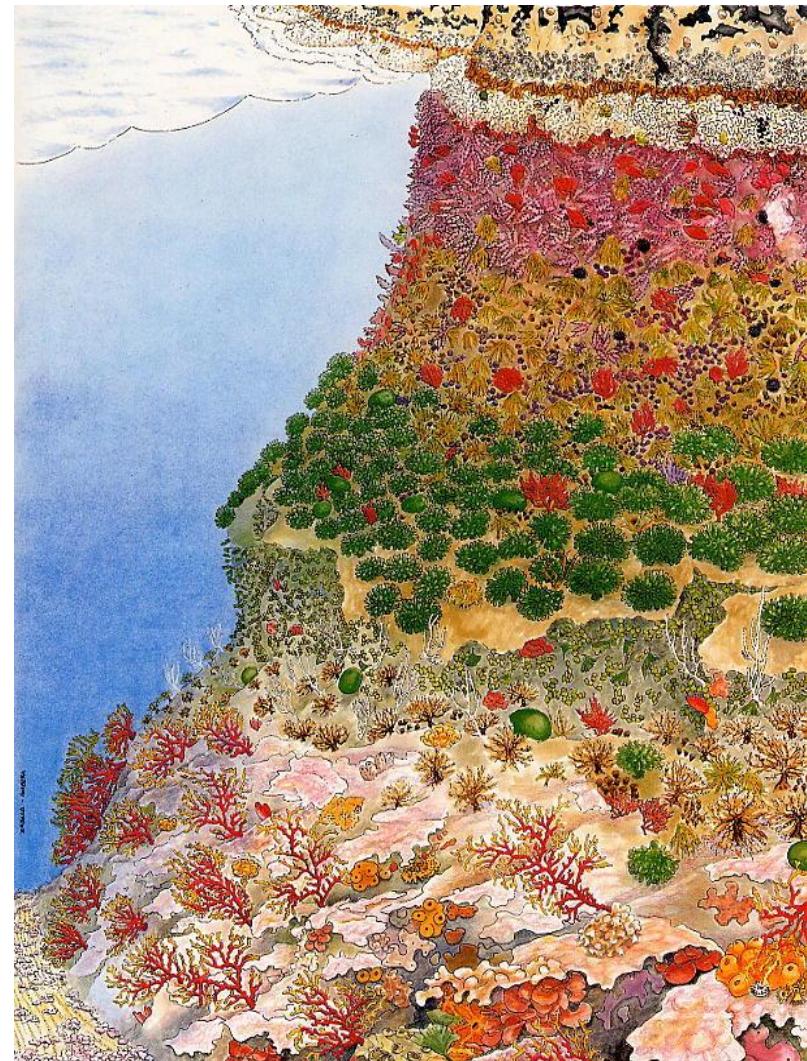
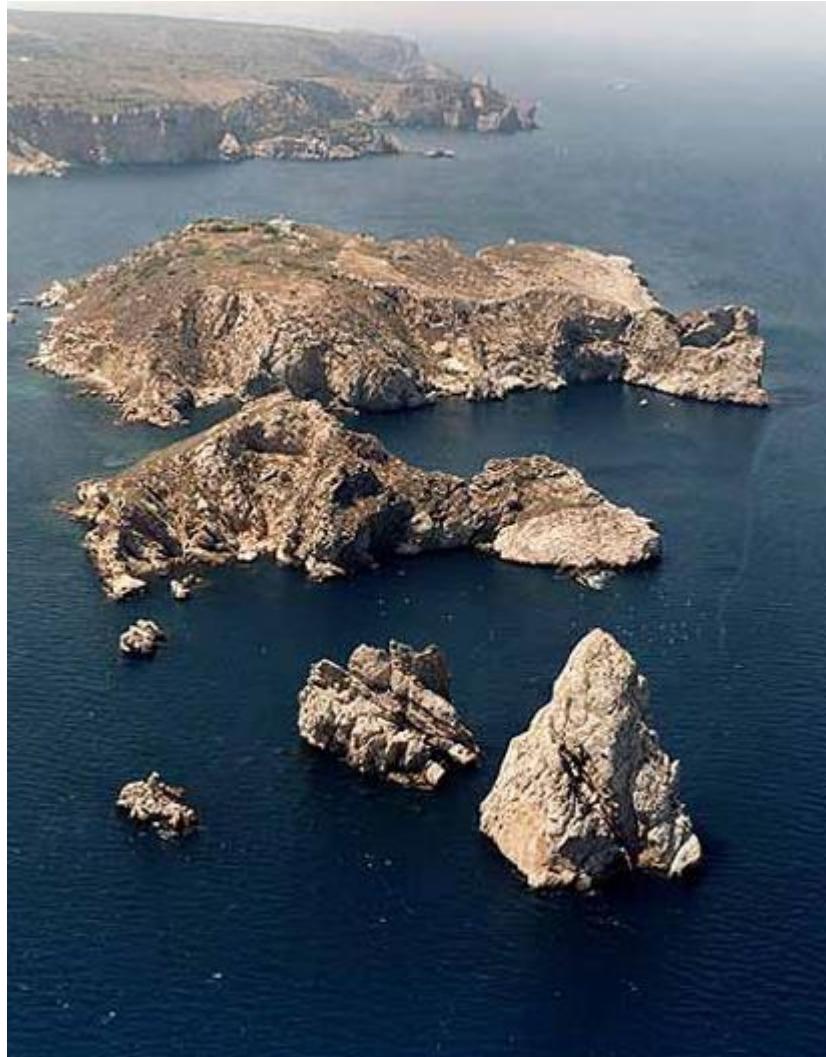
- Historical/Geological factors**
- Geomorphology**
- Environmental gradients**

# Mediterranean environmental gradients: Primary production



# Coastal areas high biodiversity:

Examples from rocky coasts



# Coastal areas high biodiversity: Small-scale forests

>200 species in 0,5 m<sup>2</sup>



# MEDITERRANEAN MONK SEAL

## *Monachus monachus*



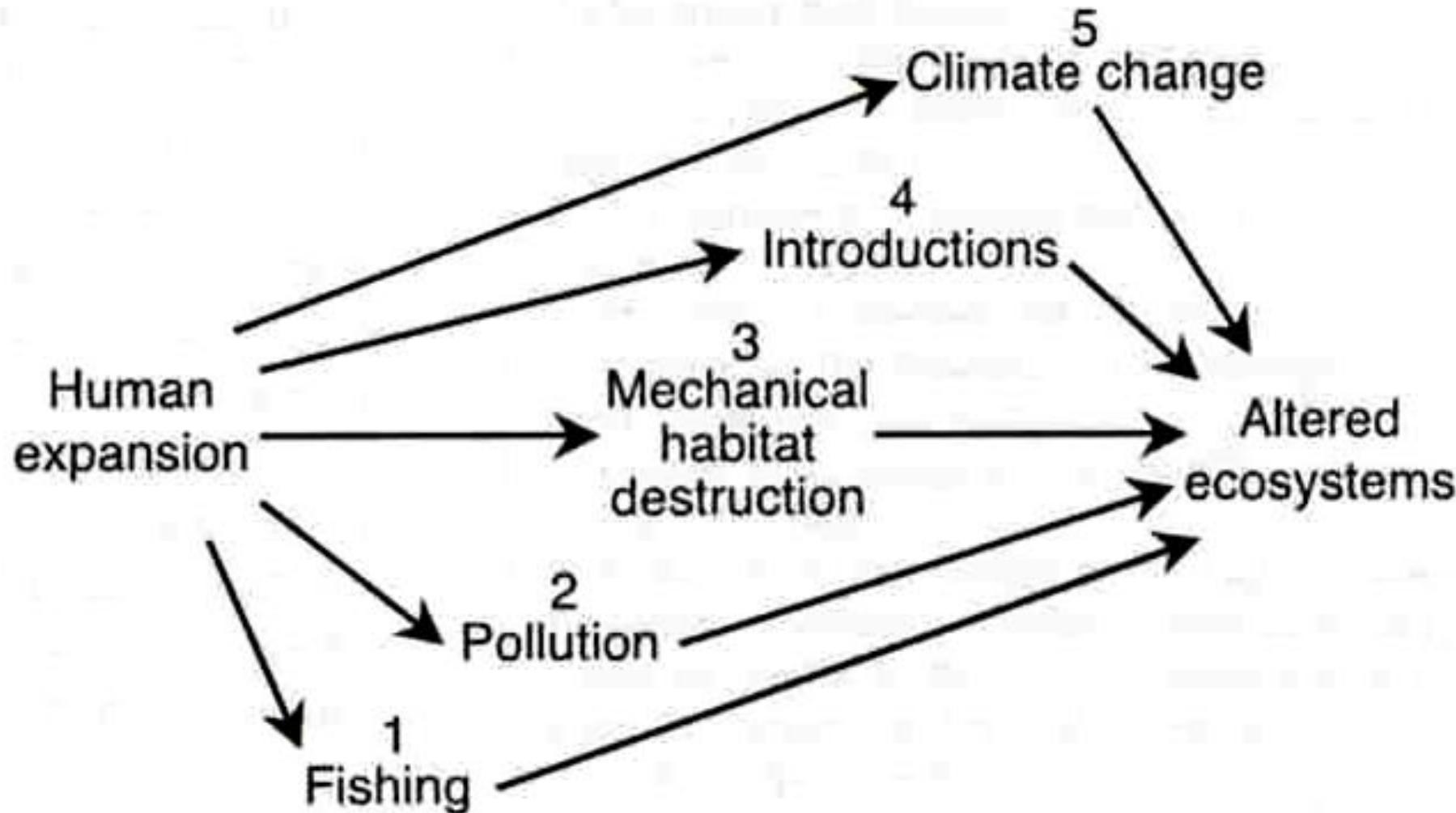
**Biodiversity underestimated**

Foto: Zafer Kızılkaya

# DRIVERS OF CHANGE

# Sequence of human disturbances

Jackson et al. 2001 Science



“Then” ..... “Now”

# ERA OF CHANGE

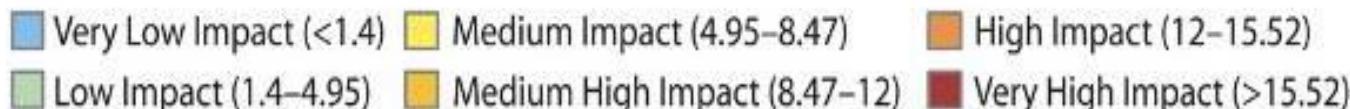
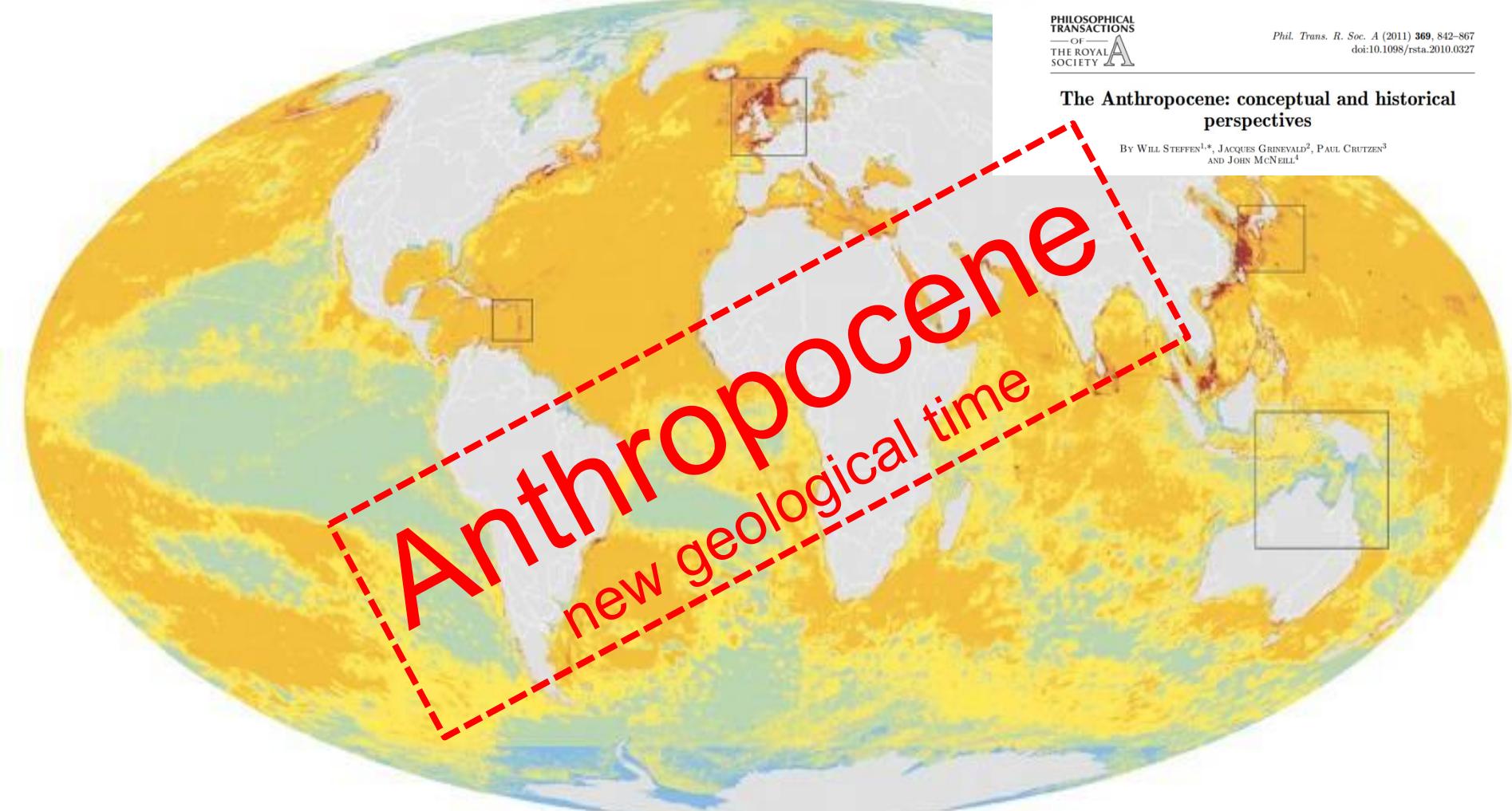
## Human disturbances impacts

PHILosophical  
TRANSACTIONS  
—OF—  
THE ROYAL  
SOCIETY A

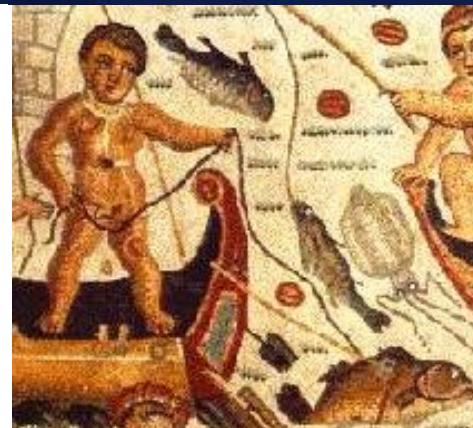
Phil. Trans. R. Soc. A (2011) 369, 842–867  
doi:10.1098/rsta.2010.0327

### The Anthropocene: conceptual and historical perspectives

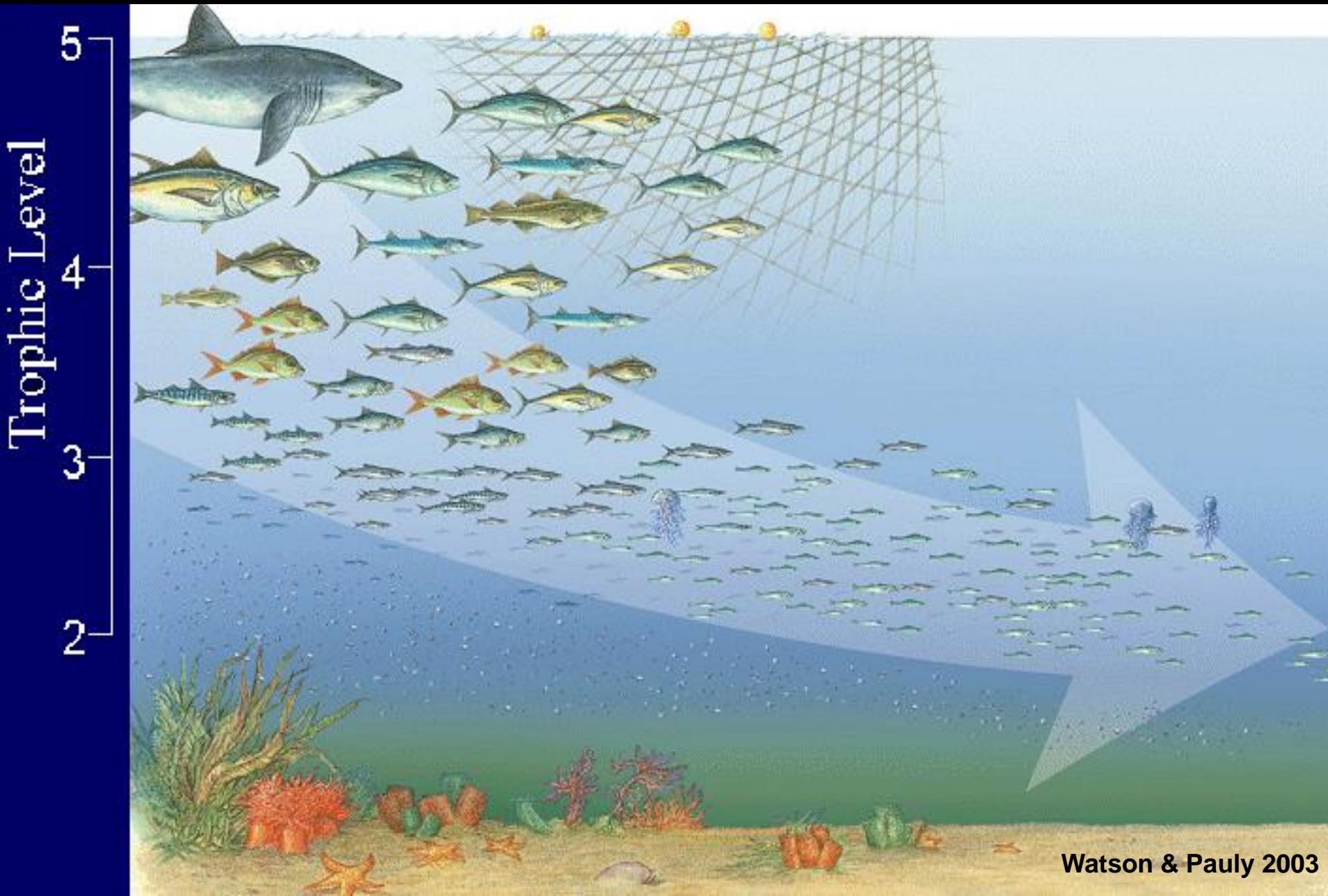
By WILL STEFFEN<sup>1,\*</sup>, JACQUES GRINEVALD<sup>2</sup>, PAUL CRUTZEN<sup>3</sup>  
AND JOHN McNEILL<sup>4</sup>



# Mediterranean a threatened sea



# Simplification of ecosystems

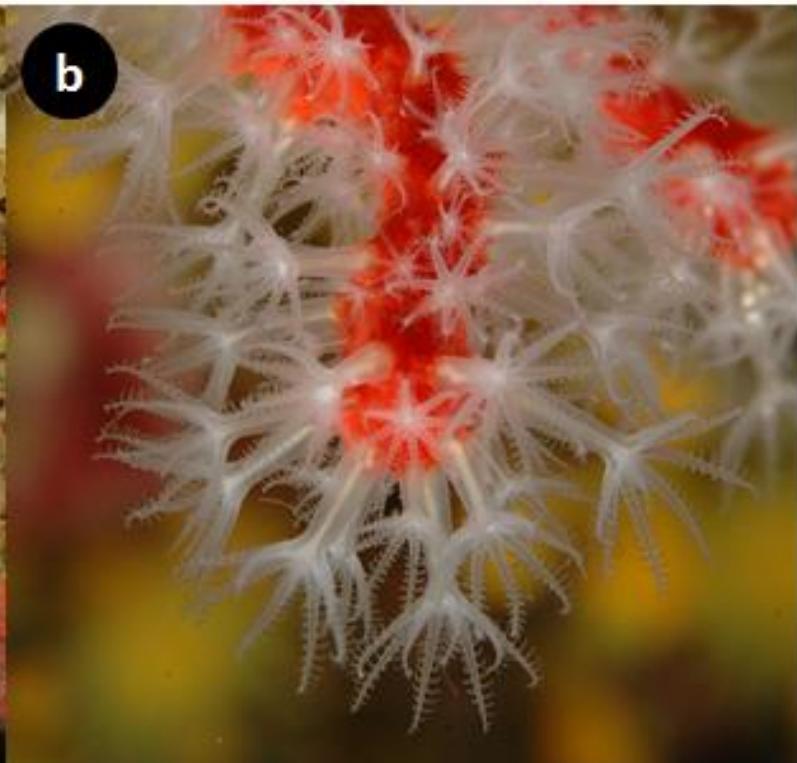


# **IMPACTS**

# Red coral *Corallium rubrum*



a



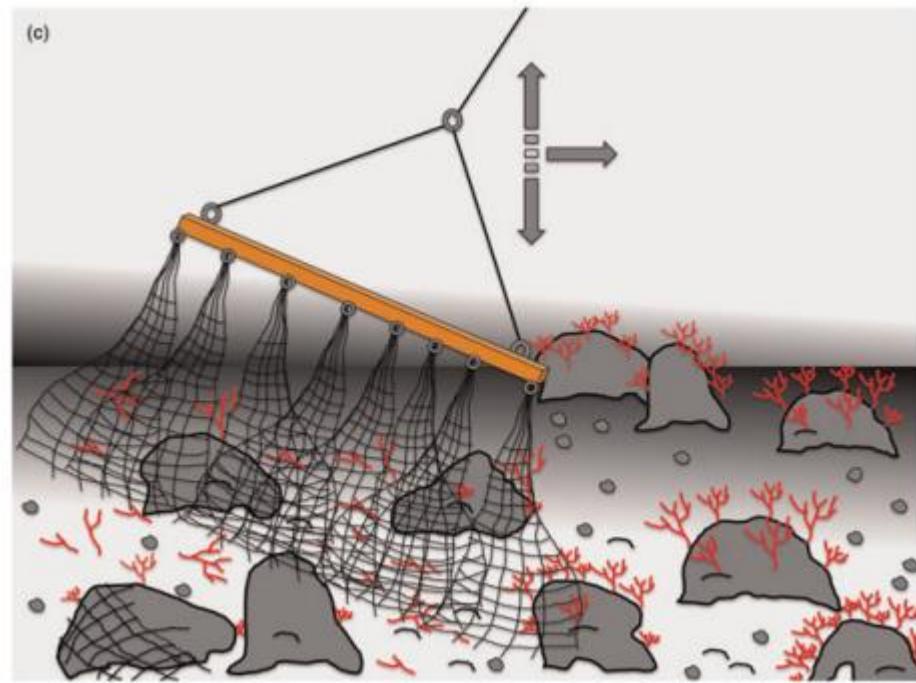
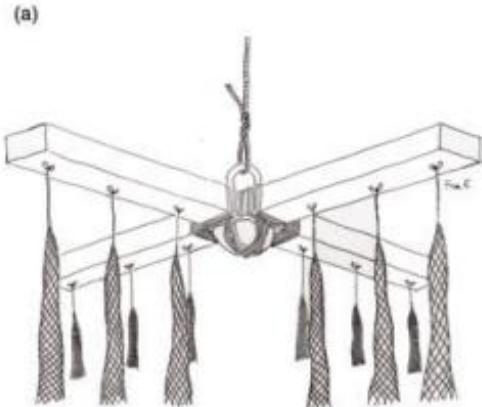
b

# Red coral *Corallium rubrum*: Exploitation for use for jewelry



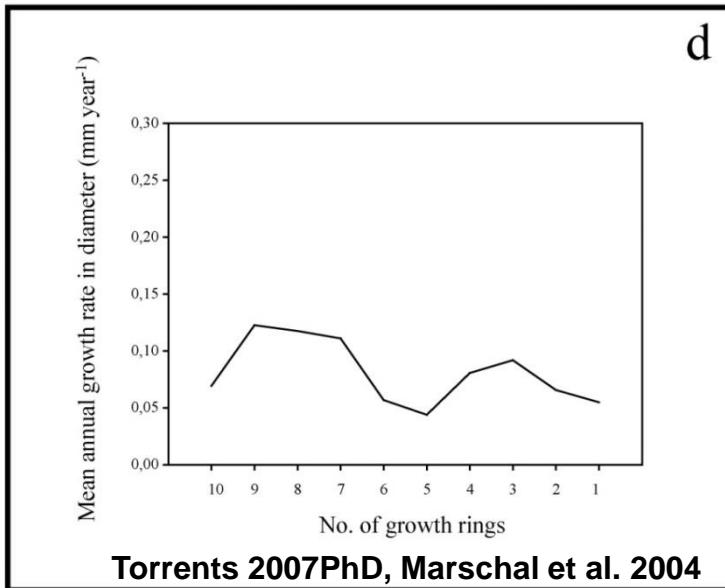
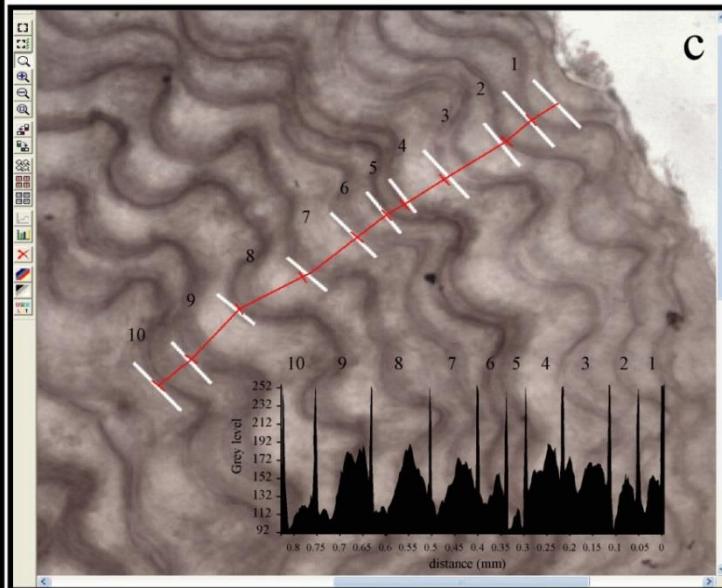
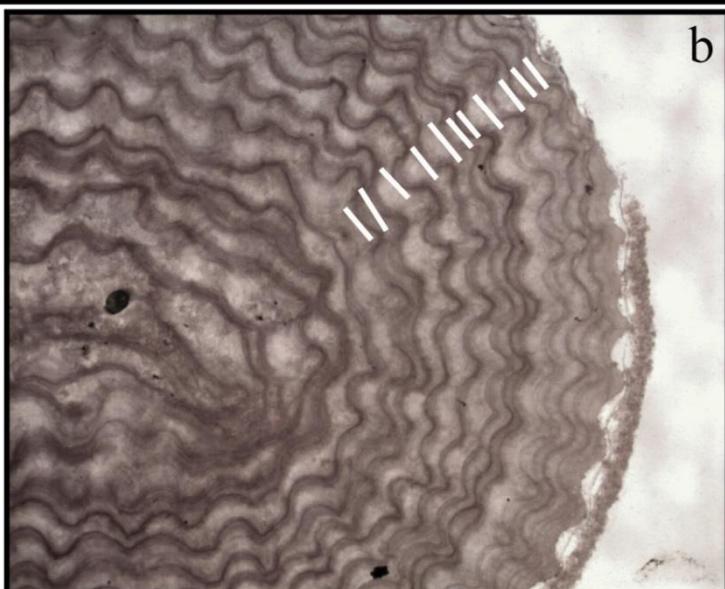
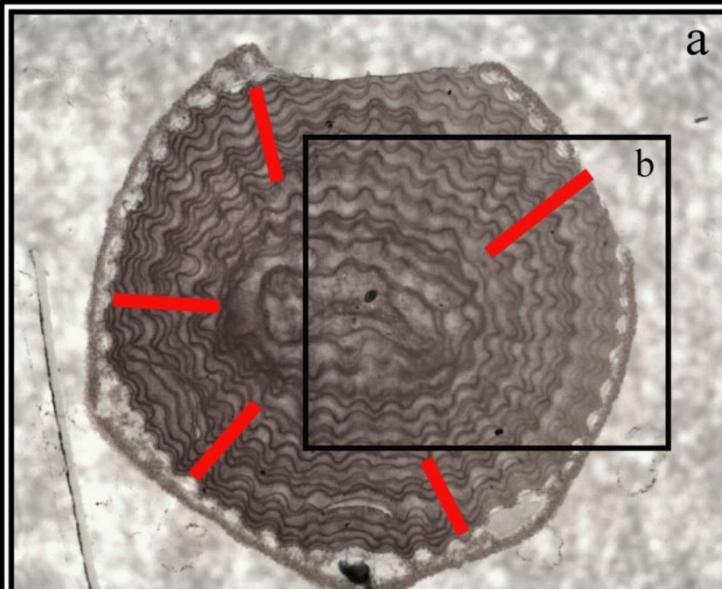
# Fishing gears

## *St. Andrews cross*



# Aging methods for red coral

Annual growth rings. Growth rate  $0,25 \text{ mm year}^{-1}$



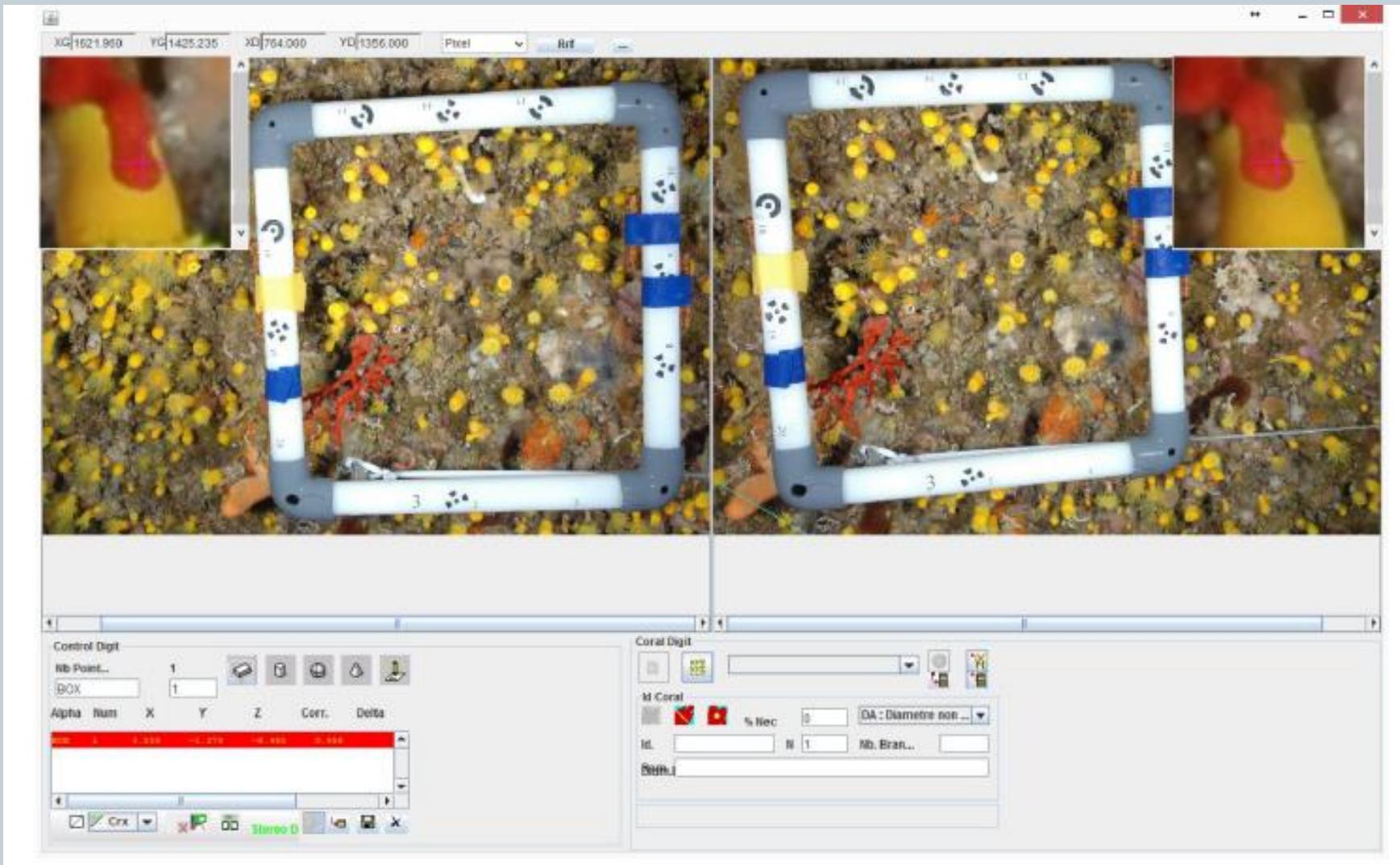
# Monitoring permanent plots

## Photogrammetric methods



# Monitoring permanent plots

## Photogrammetric methods



# Growth rates: Height 1 mm year<sup>-1</sup>

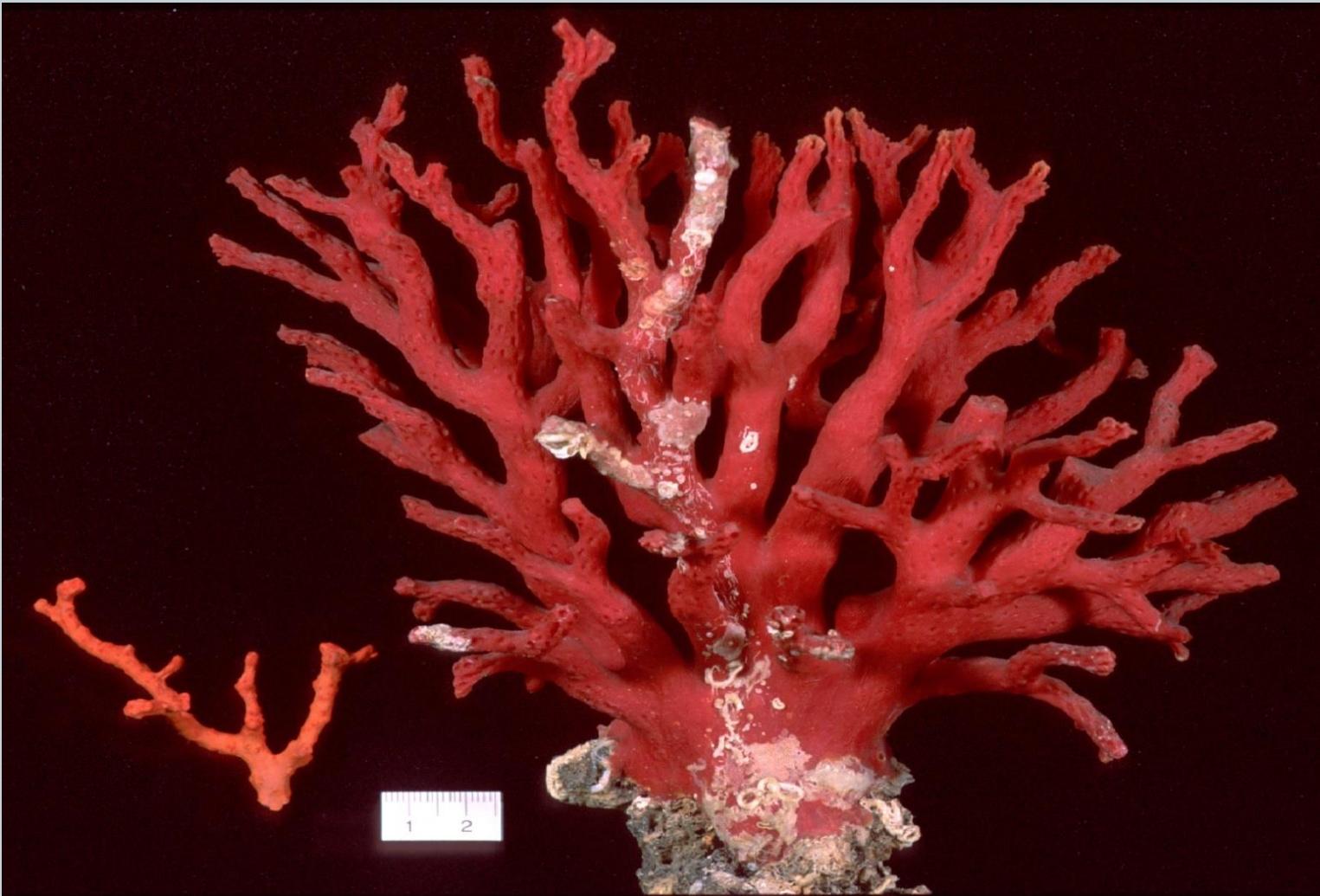
2006



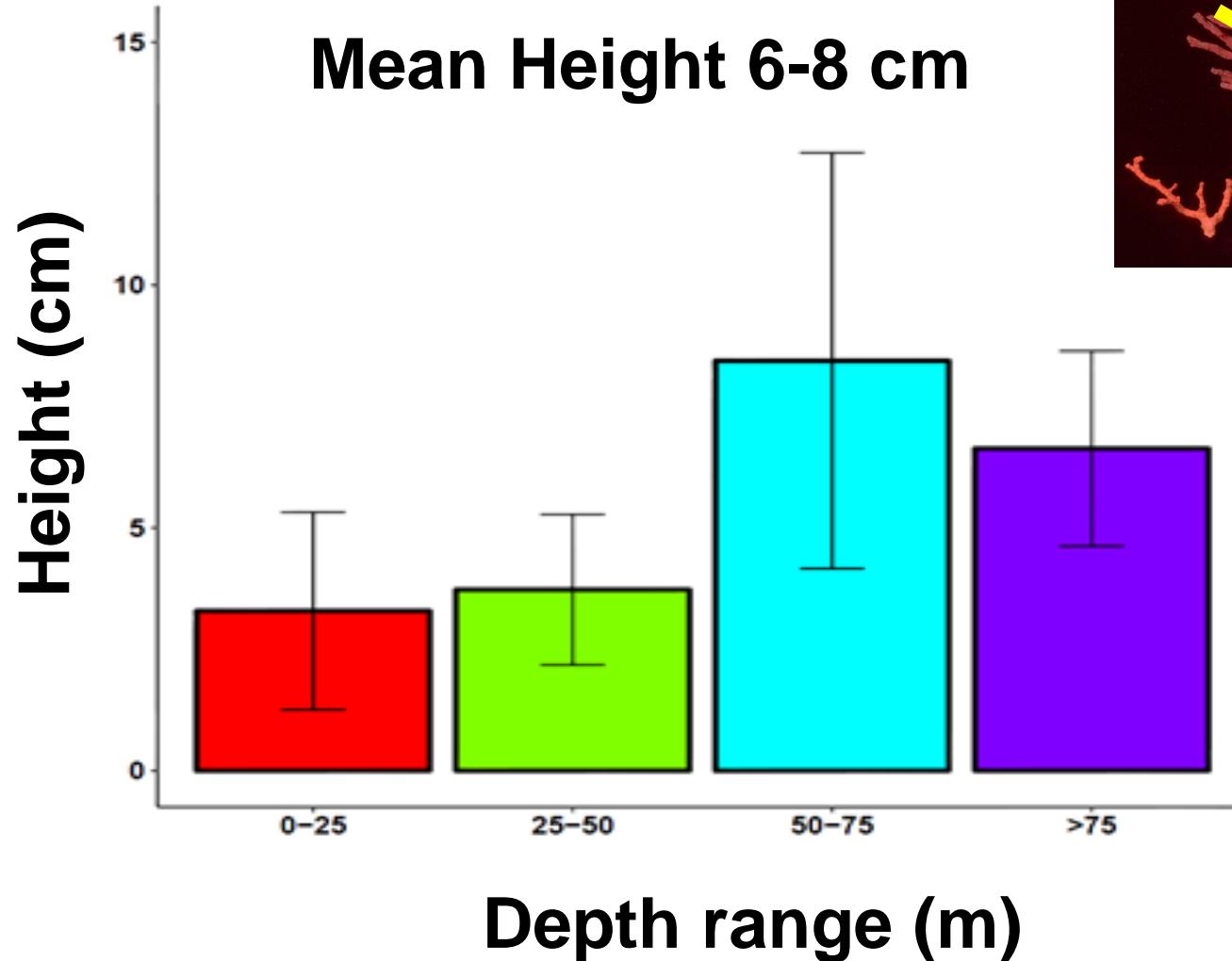
2010



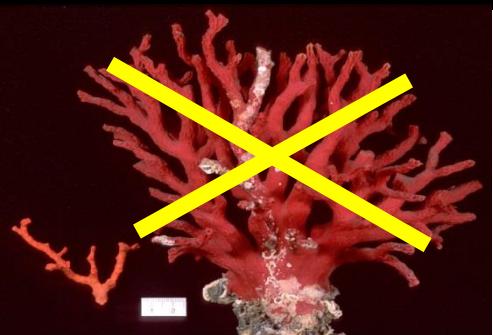
# Life span: Colonies > 200 years



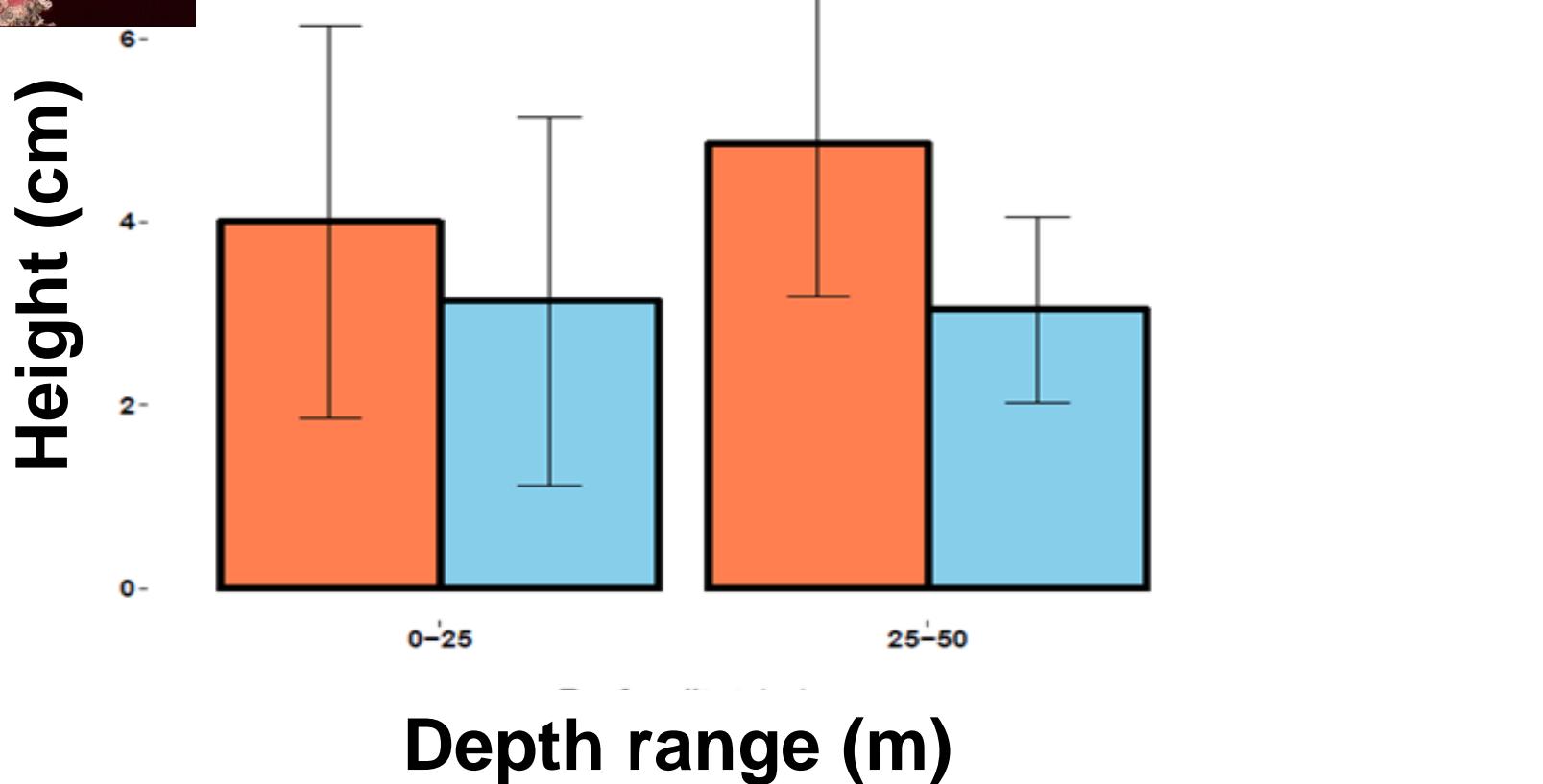
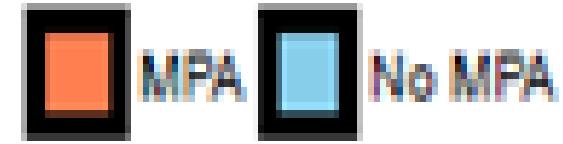
# Studied red coral populations: Colony size along depth



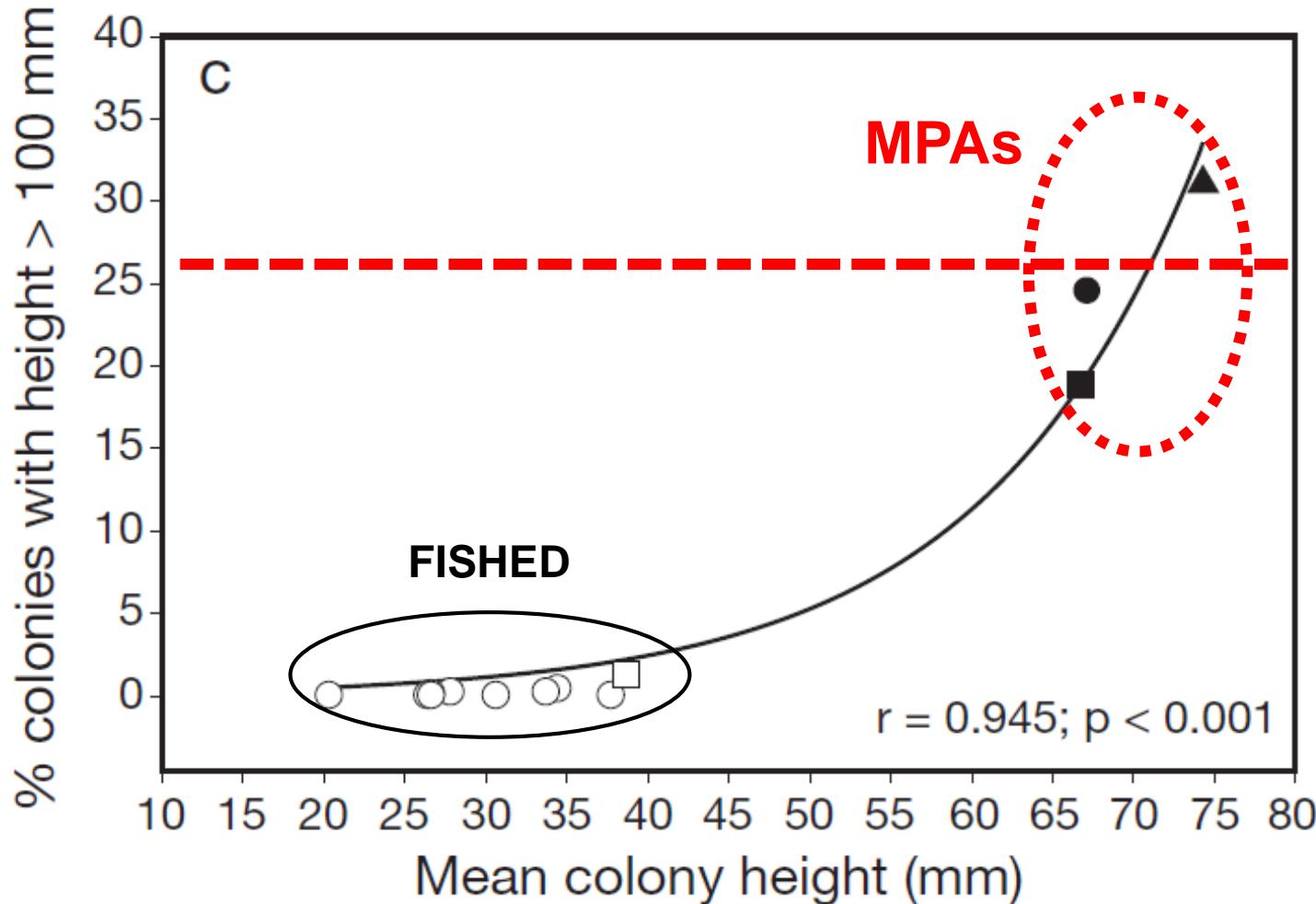
# Studied red coral populations: Effect of protection



MPA = MARINE PROTECTED AREA

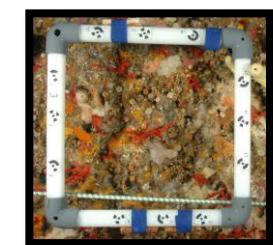


# Conservation status populations: % large colonies



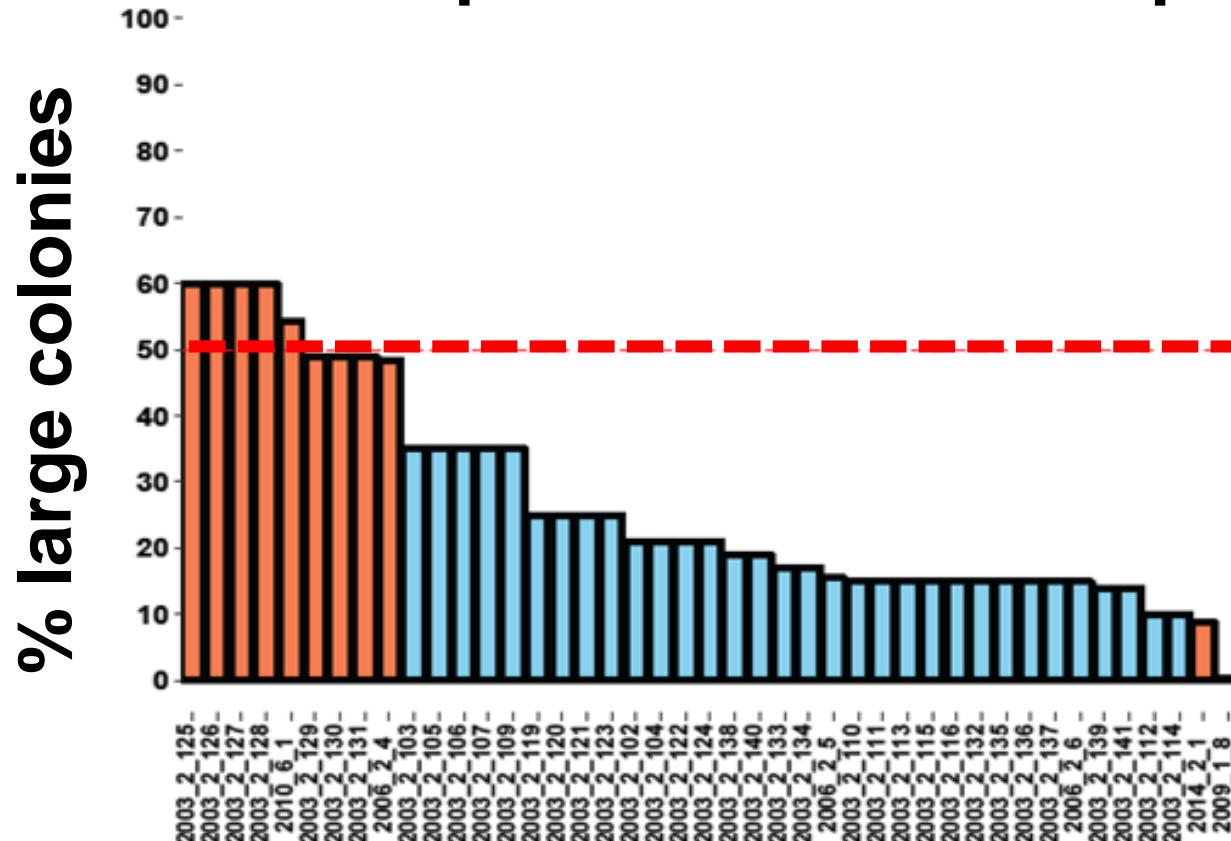
MPA = MARINE PROTECTED AREA

Linares et al. 2010 MEPS



# Conservation status populations: Only 10% good status

Populations < 50 m depth



Populations

# Overfishing effects

Changes in size and abundance of species



1942



2000

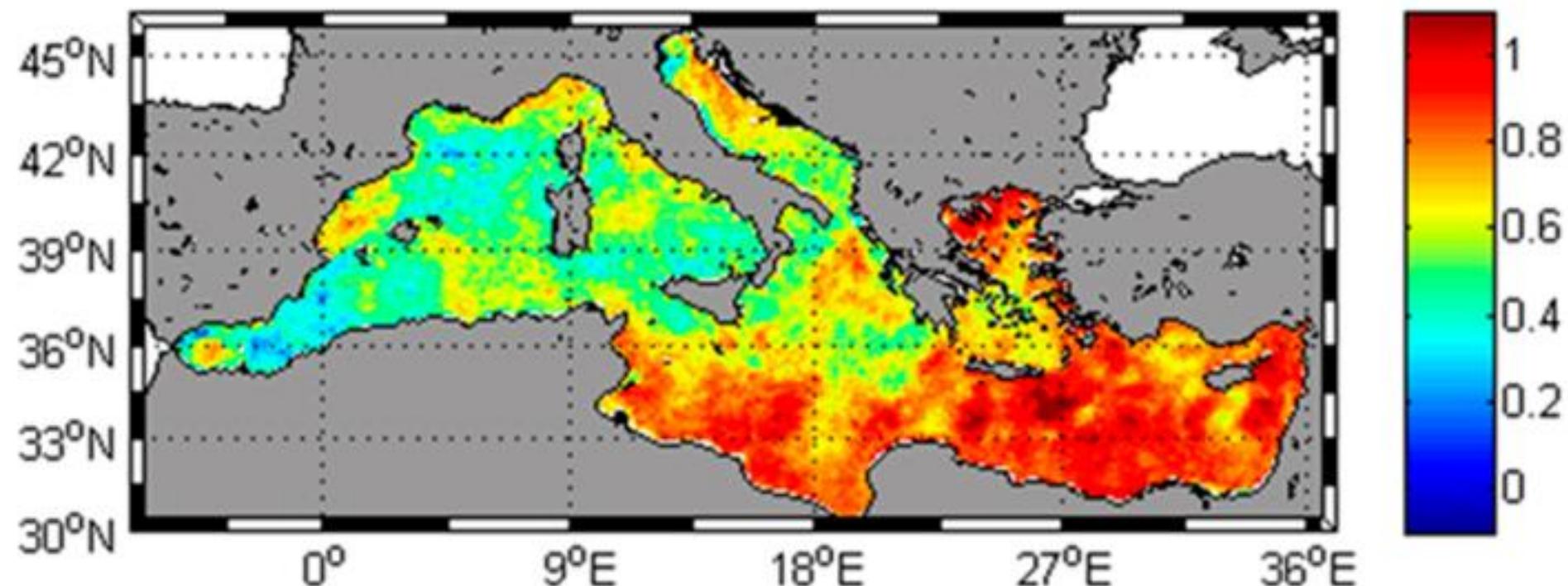
Fotos: E. Ballesteros

Fishing in Catalan Coast (Spain)

# Climate Change hot-spot

Warming SST in the Mediterranean

SST anomalies 2005to2009 - 1985to1989 (°C)

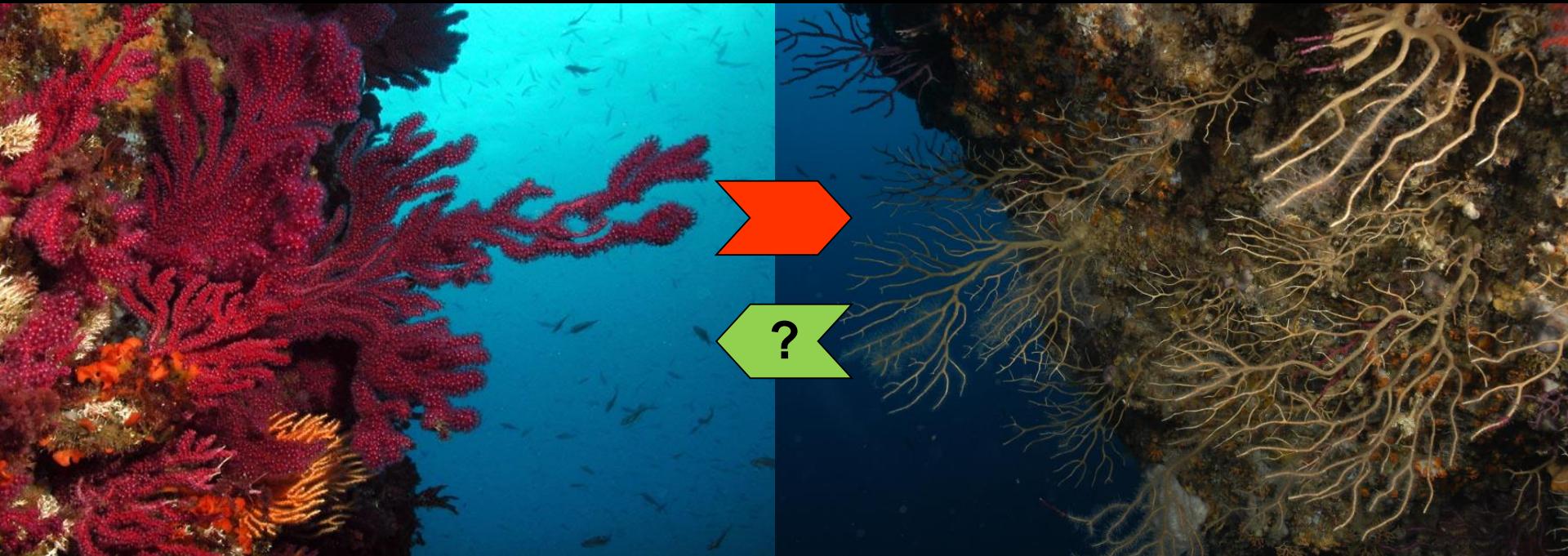


Overall = +0.37 °C / decade

Western = +0.26 °C / decade

Eastern = +0.42 °C / decade

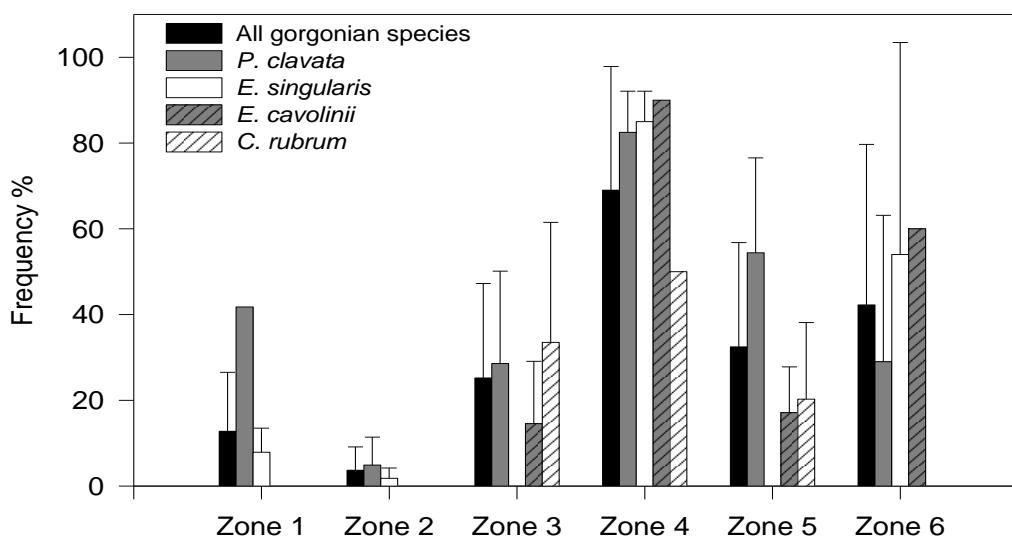
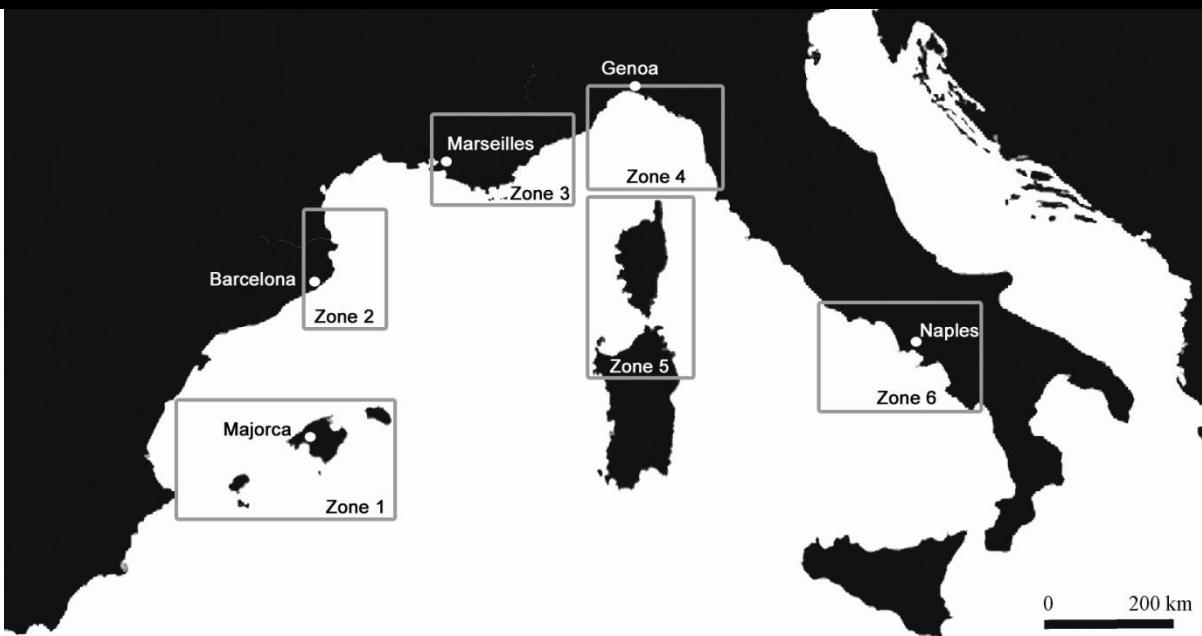
# Warming is related with unprecedented mass mortality events



- Large scale events (>1000 km)
- About 30 affected species, 6 phyllums
- Concomitant with high temperatures

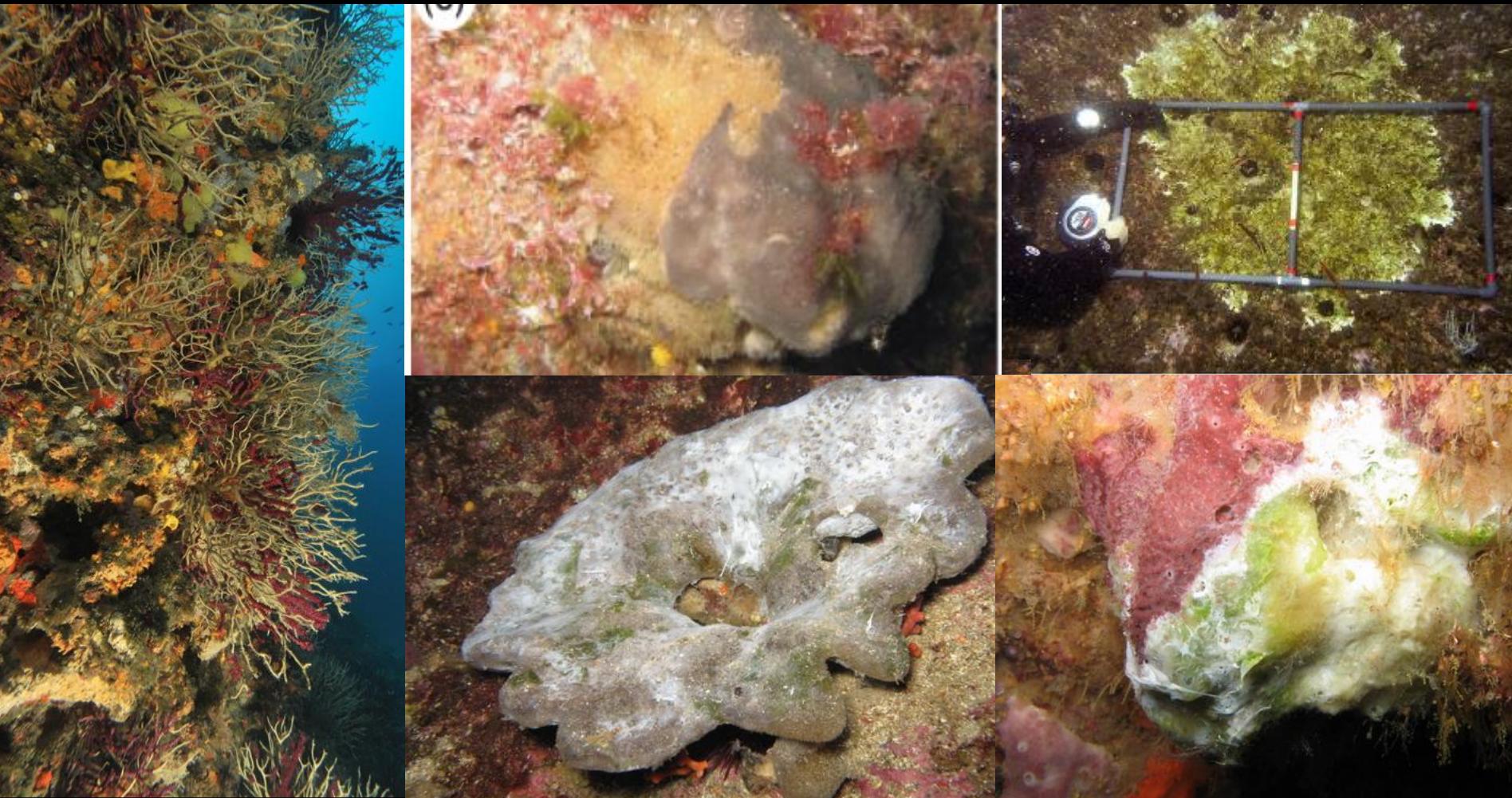
# Large scale events (> 1000km)

## Mass mortalities in the Mediterranean



# Large number of affected species

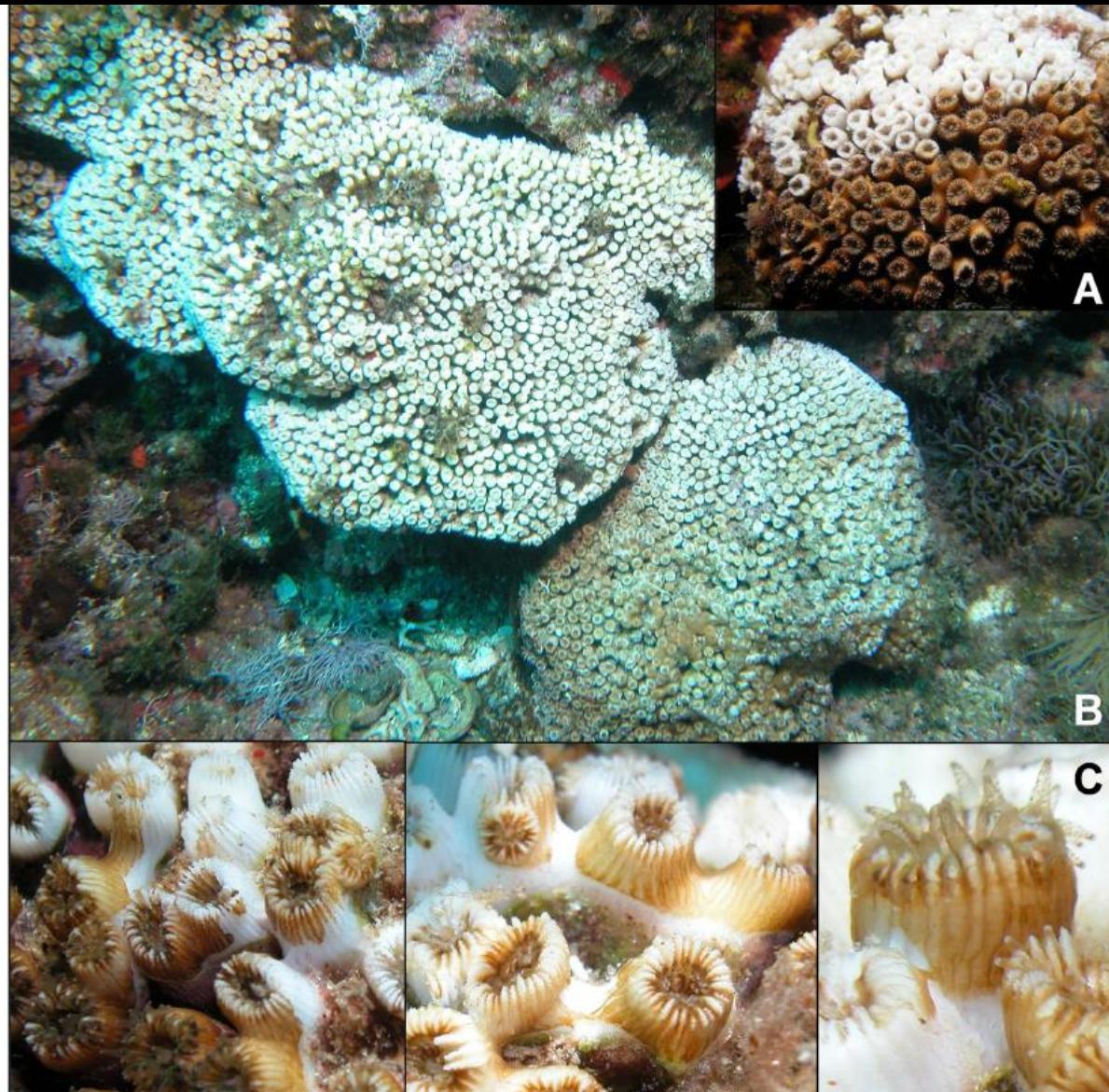
Mass mortalities in the Mediterranean



+30 species affected, 6 phyllums

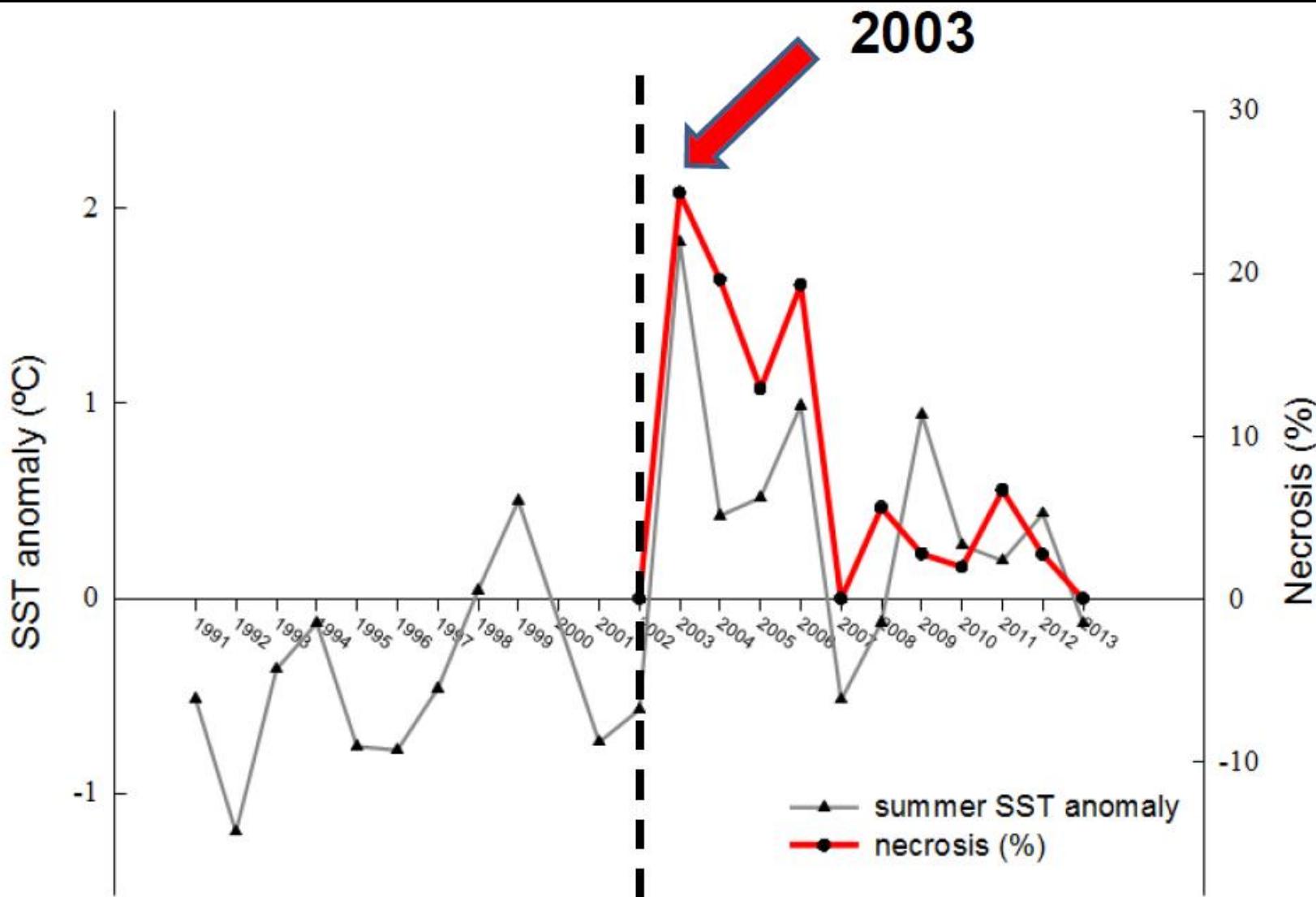
# Large number of affected species

Mass mortalities in the Mediterranean



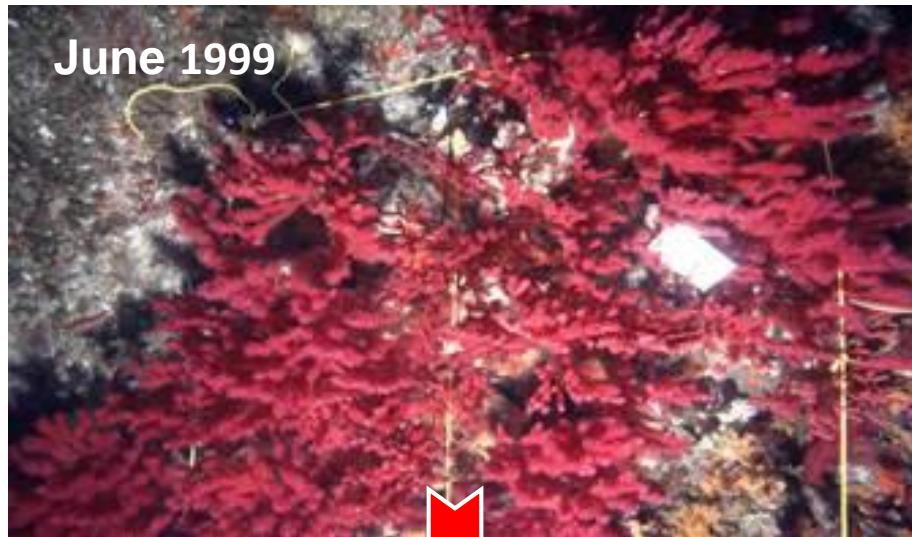
# Relationship with high temperatures

Mass mortalities of *Cladocera caespitosa* populations



# Long lasting effects

Mass mortalities in the Mediterranean



High impact

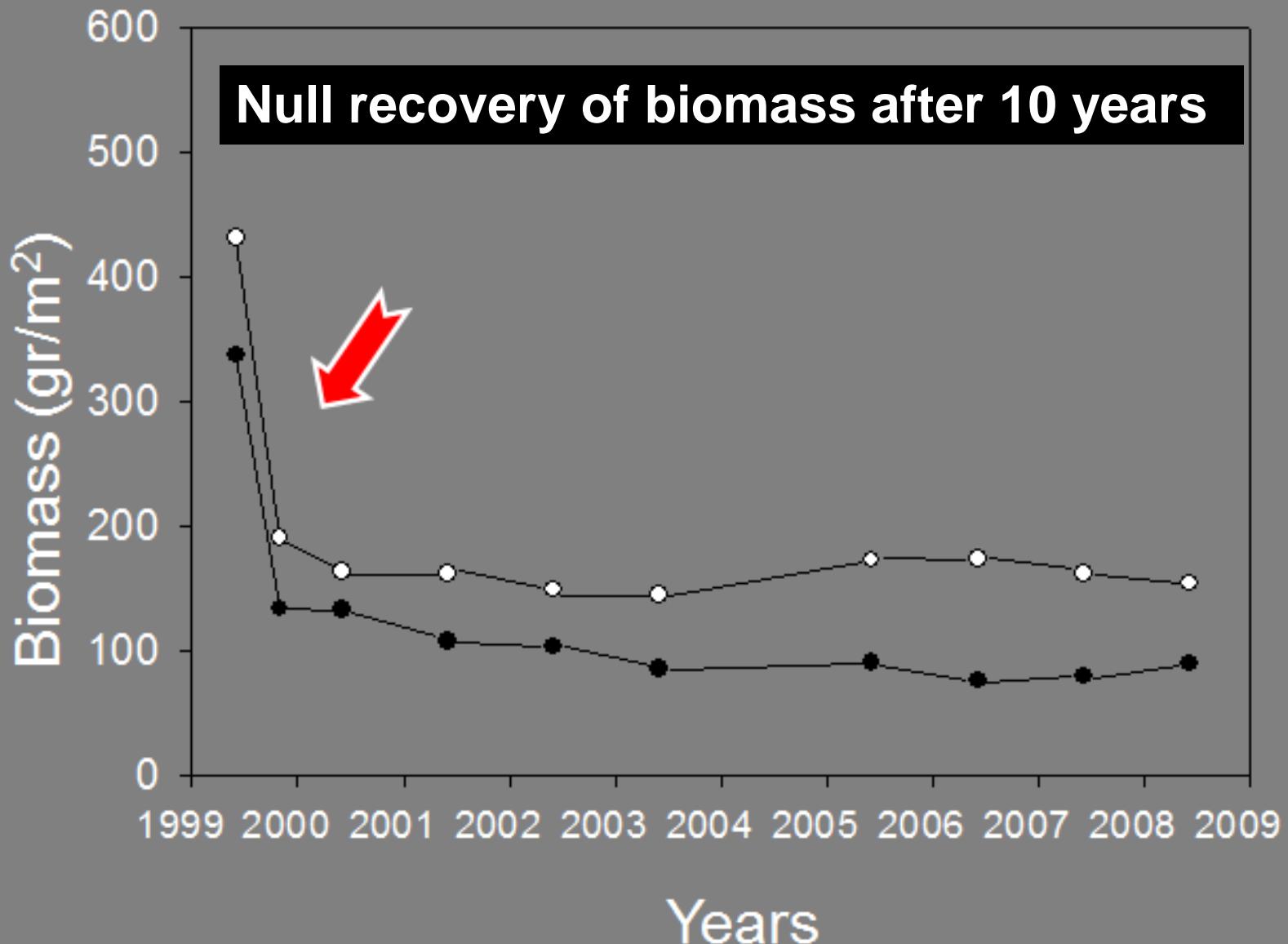
Slow dynamics

Long recovery



# Long lasting effects

Mass mortalities in the Mediterranean



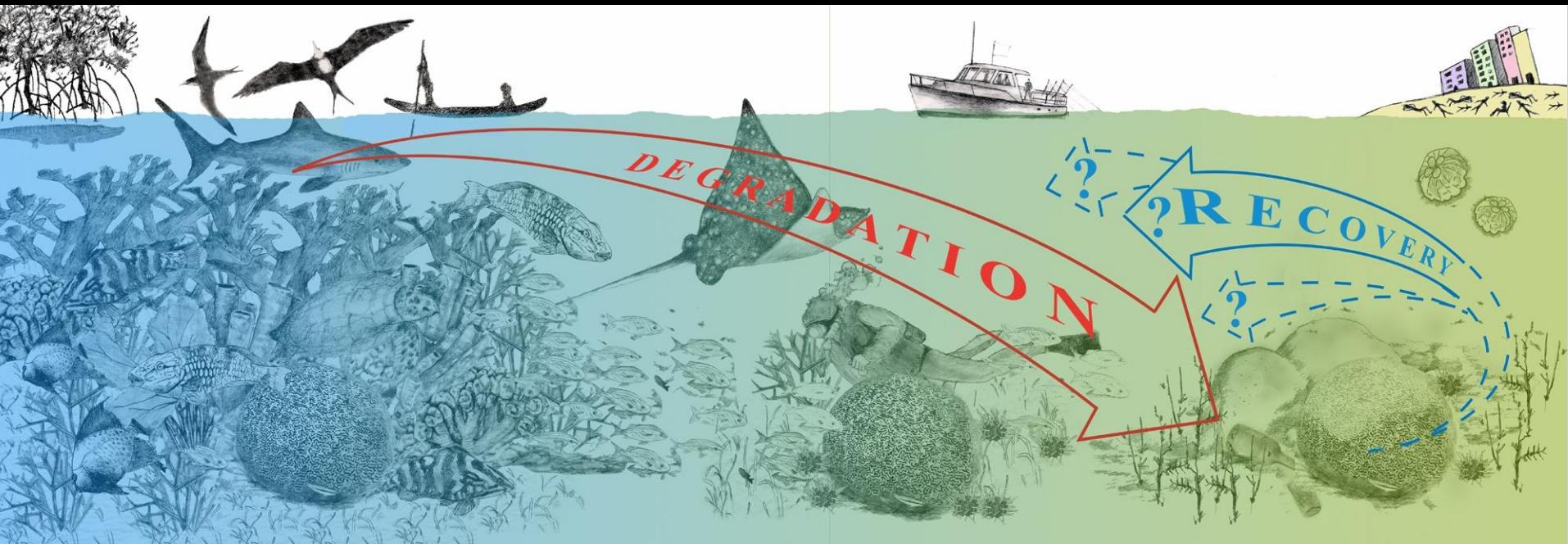
# Warming facilitate colonization invasive species

## *Siganus spp.* from the Red Sea

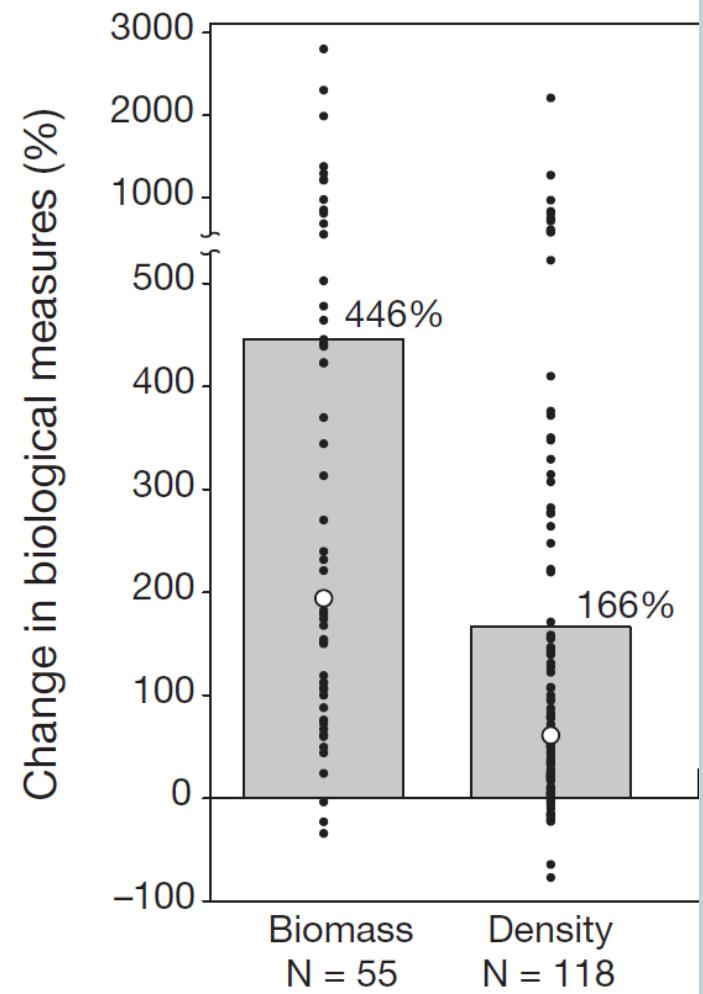
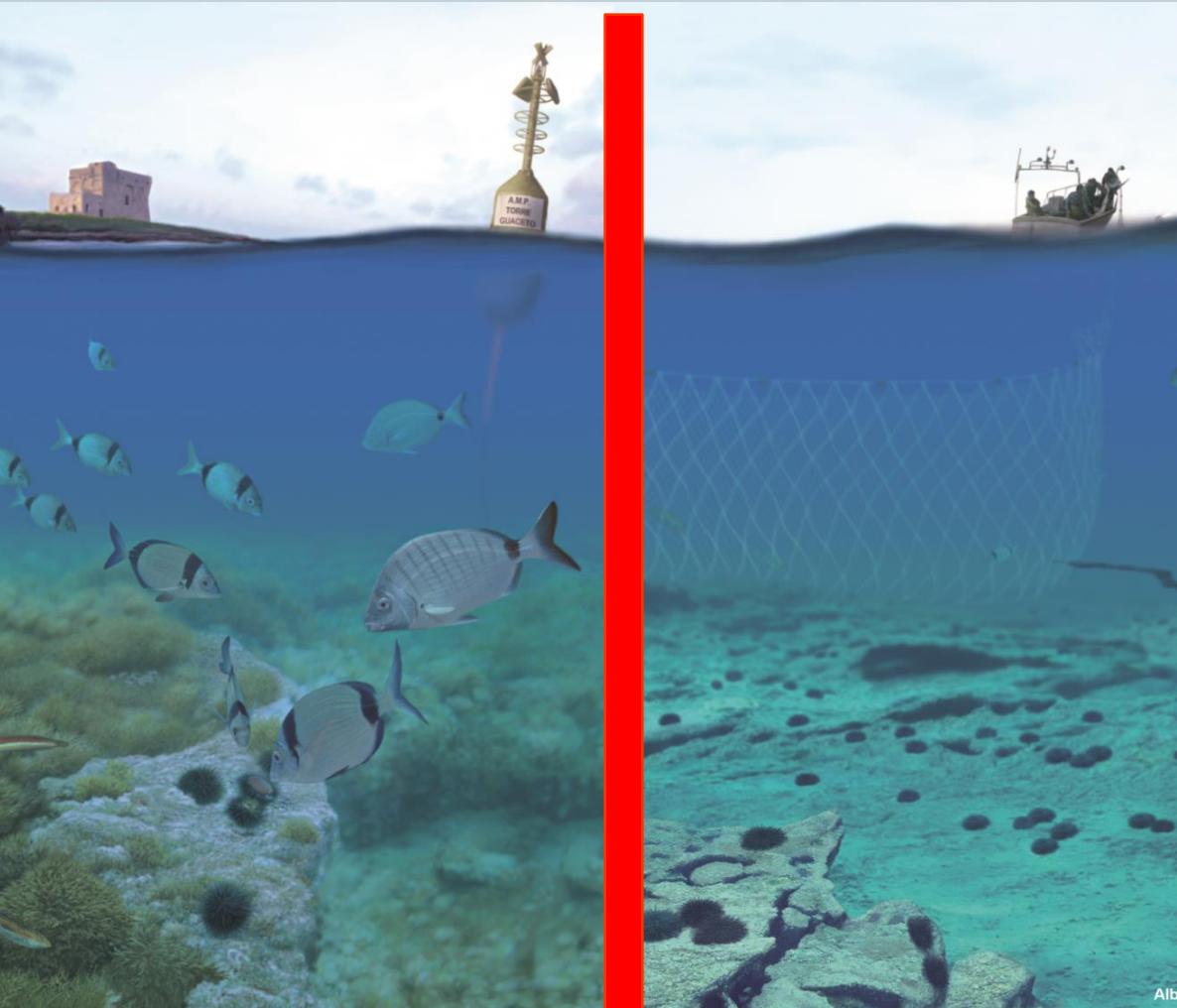


# SOLUTIONS

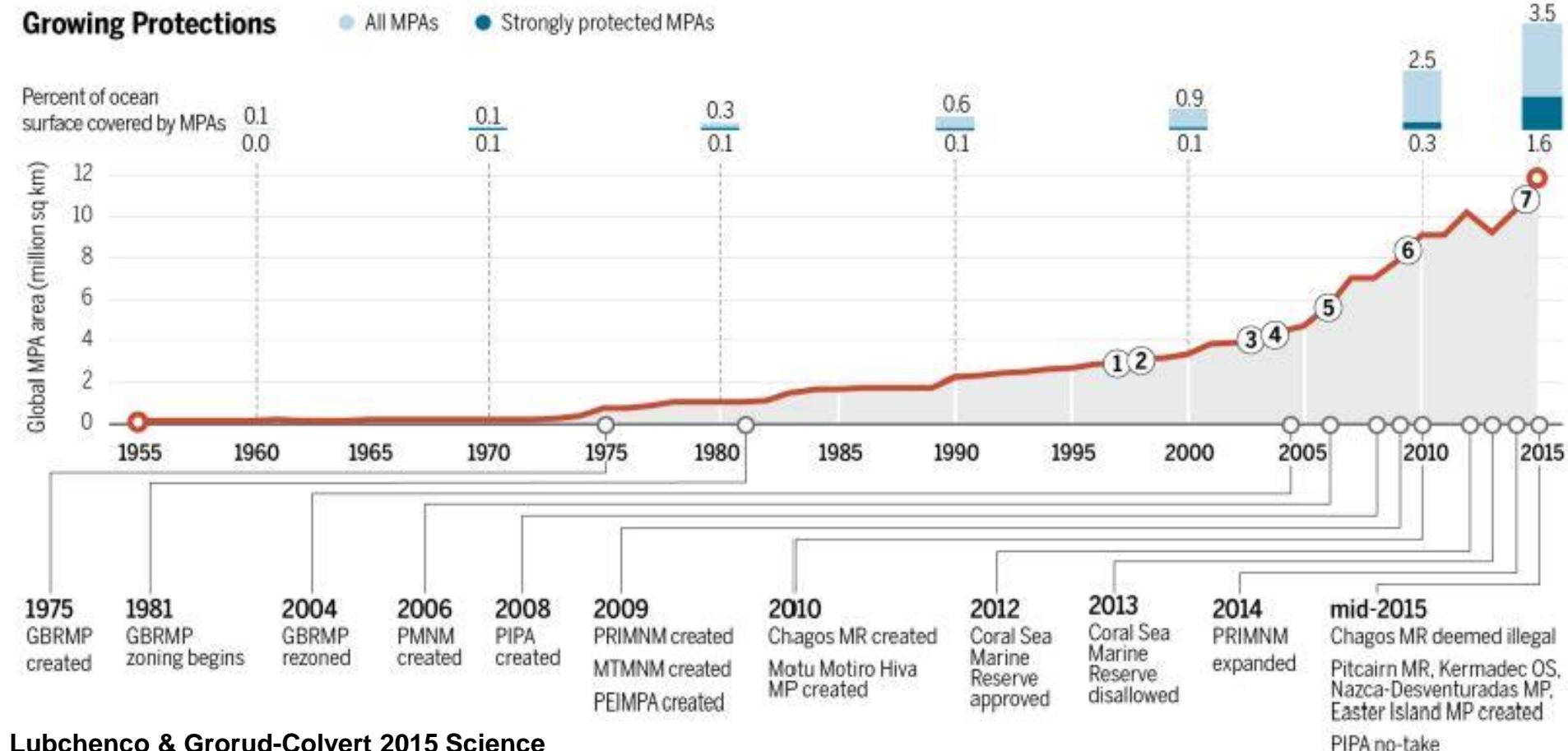
# Conservation biology: reverse the negative trend



# Marine Protected Areas work!



# Increase in global MPAs coverage over time



Lubchenco & Grorud-Colvert 2015 Science

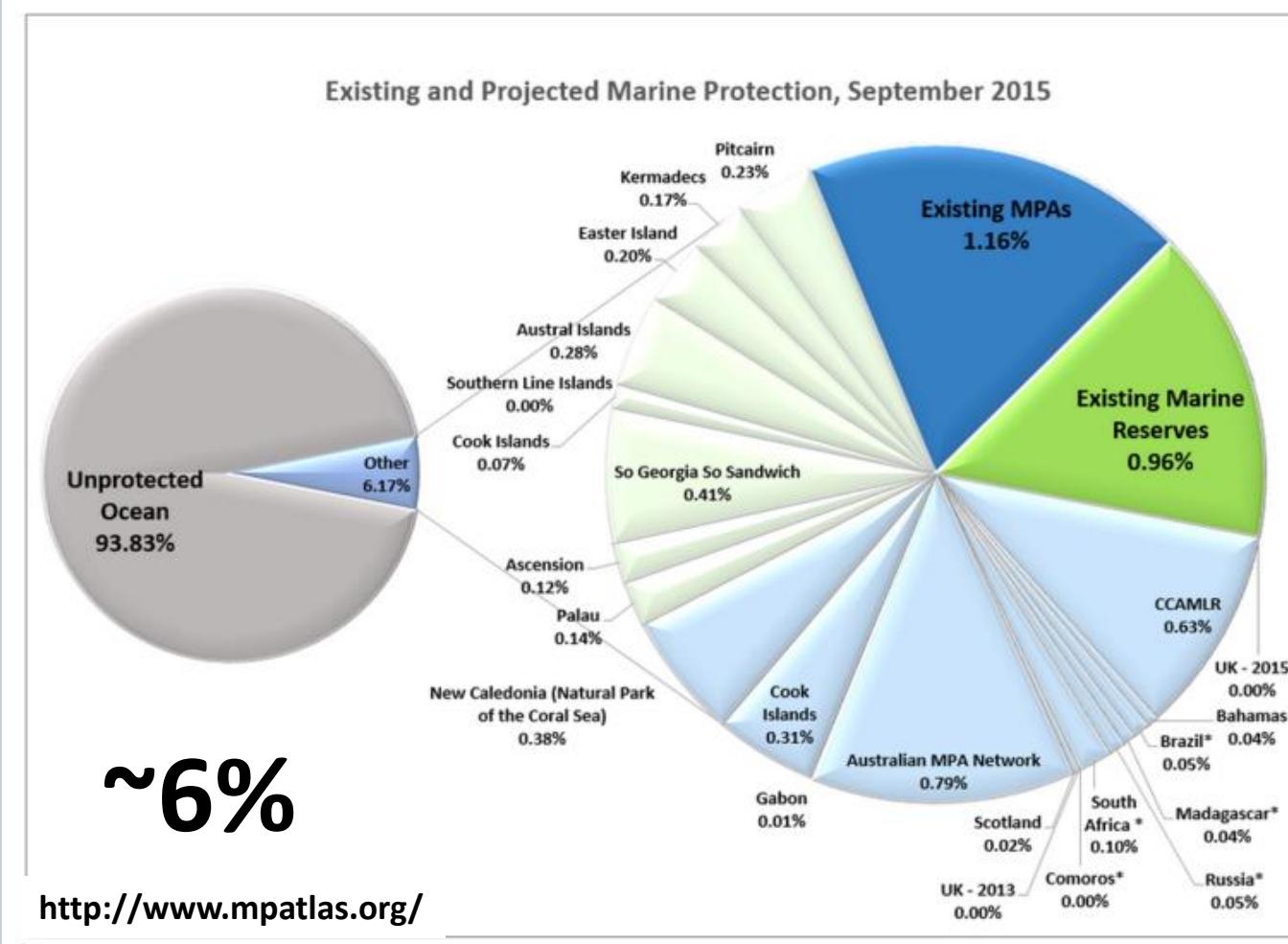
~3,5% Total  
1,6% No take

# MPAs in the Mediterranean



**7.14 - (3,6) % Total  
AND 0.04% No take zone**

# MPAs projected



Goal by 2020 at least 10% MPAs

Making progress but still a lot of work ahead



# Sea Watchers

A citizen science platform  
to involve society in marine  
research



Coordinated by:

Instituto  
de Ciencias  
del Mar

**ICM**  **CSIC**

Supported by:



**FECYT**   
FUNDACIÓN ESPAÑOLA  
PARA LA CIENCIA  
Y LA TECNOLOGÍA

WHAT IS  
SEA WATCHERS?

Explore the current state of the sea and detect  
environmental changes!



The Sea Watchers platform is a site to connect citizens and scientists in order to **investigate together** the current state of our seas and oceans



It is a **citizen science platform** coordinated by the Institute of Marine Science (ICM-CSIC)



# www.seawatchers.org

Citizens and scientist explore together the conservation status  
of the sea and detect environmental changes



The screenshot shows the homepage of the seawatchers.org website. At the top, there is a banner featuring a school of barracuda fish swimming in the ocean. Below the banner is a navigation bar with links: HOME (highlighted in yellow), ABOUT US, COLLABORATE, SCIENTIFIC CHALLENGES, MAPS, RESOURCES, RANKINGS, CONTACT, LOG IN, and social media icons for Facebook and Twitter.

The main content area has two main sections:

- Left Section:** Features a large image of a coral reef with red and purple corals. Below the image is the text: "Detect global warming impacts in biology and distribution of species".
- Right Section:** A blue box with the text "NEW IMAGE" and the Sea Watchers logo.

Below these sections, there is a dark blue sidebar with the text "The citizen science web to get involved in marine research". Underneath this, there are two buttons: "SIGN UP HERE" and "UPLOAD RECORD".

At the bottom left, it says "We have now 1189 registered users and 5711 records!". Below this are various statistics represented by colored circles and numbers:

Category	Value
Users	355
Records	225
Species	814
Alerts	1144
Maps	1344
Resources	906
News	238
Events	313
Collaborations	101
Challenges	70
Publications	28
Surveys	78
Media	173

On the right side, there is a "NEWS" section with a link to "About the lionfish alert in Baleares" and a timestamp "21/7/2016". Below this is a "SEE ALL NEWS" button.

**Citizen collaboration in research  
is essential!**

**CITIZEN SCIENCE**  
**Growing discipline**



Provides a **global vision** in time and space,  
essential to knowledge advance.

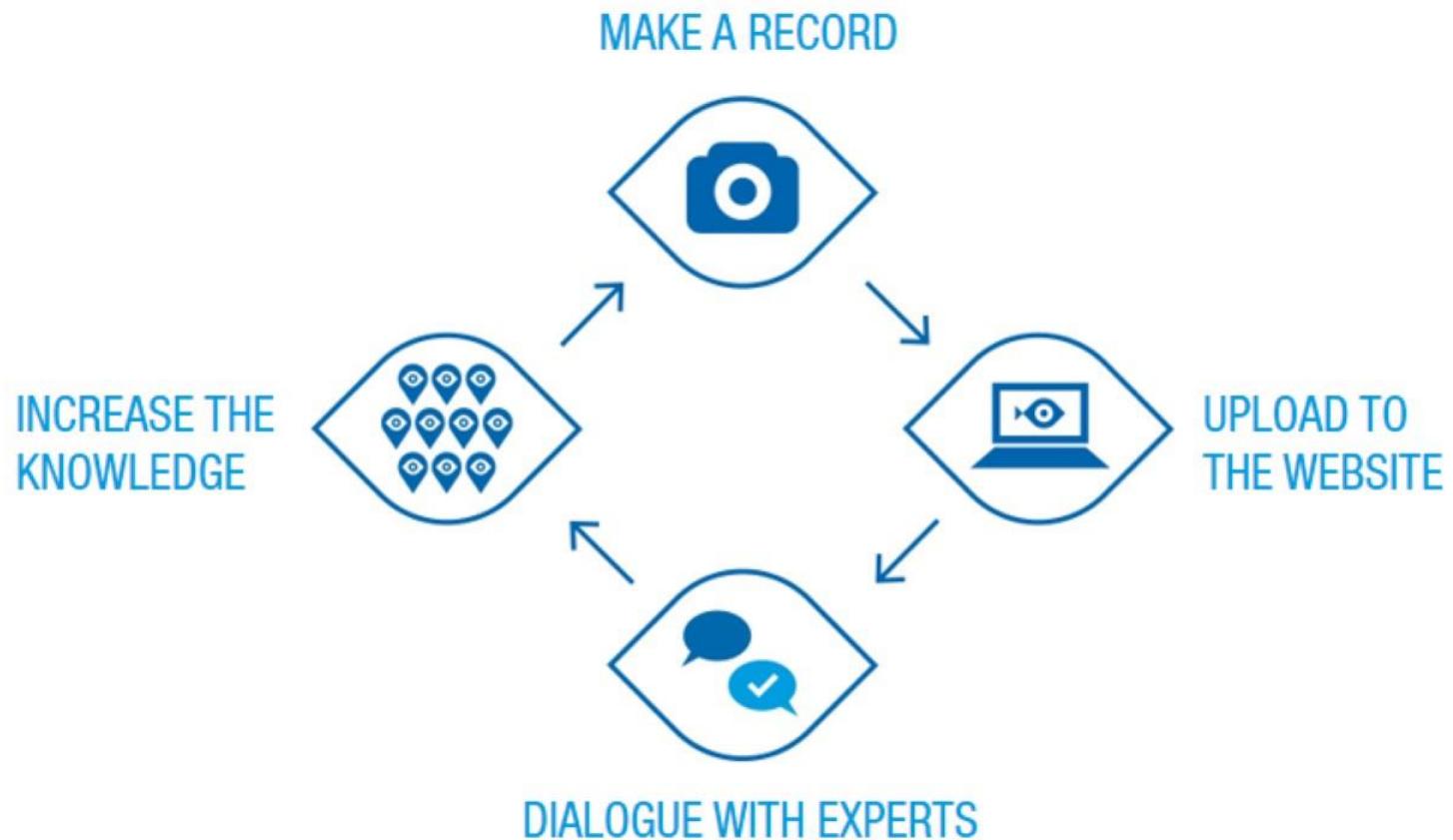


Improves **communication** between society,  
science and administration.



Represents the opportunity to **share** results  
obtained by seawatchers network with society.

## HOW IT WORKS?



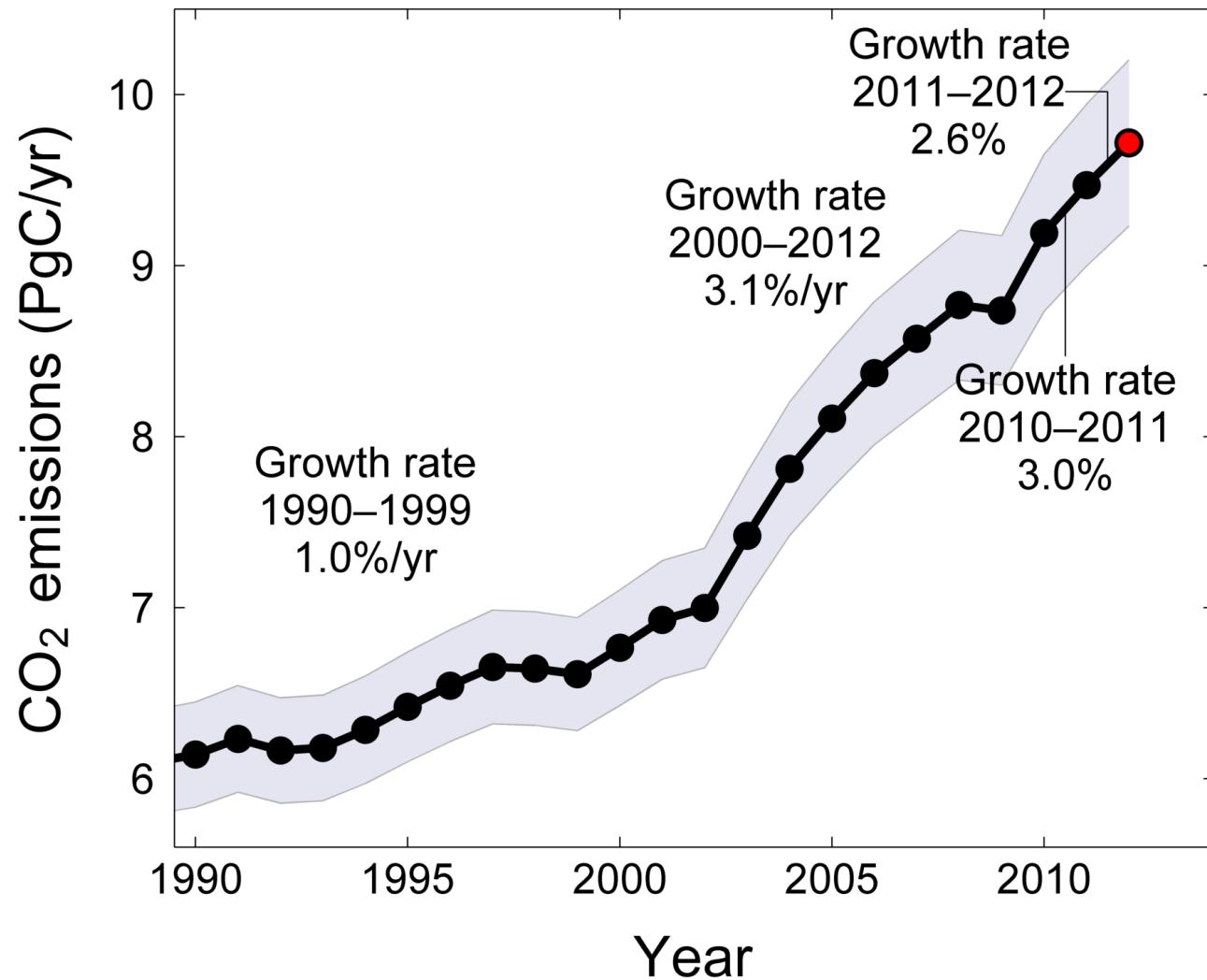
- Quantify plastics found in beaches or floating in the sea.
- Localize and classify plastics in two categories: macro and micro plastics (smaller than 5mm).

[Learn more about the Plastic 0 project](#)

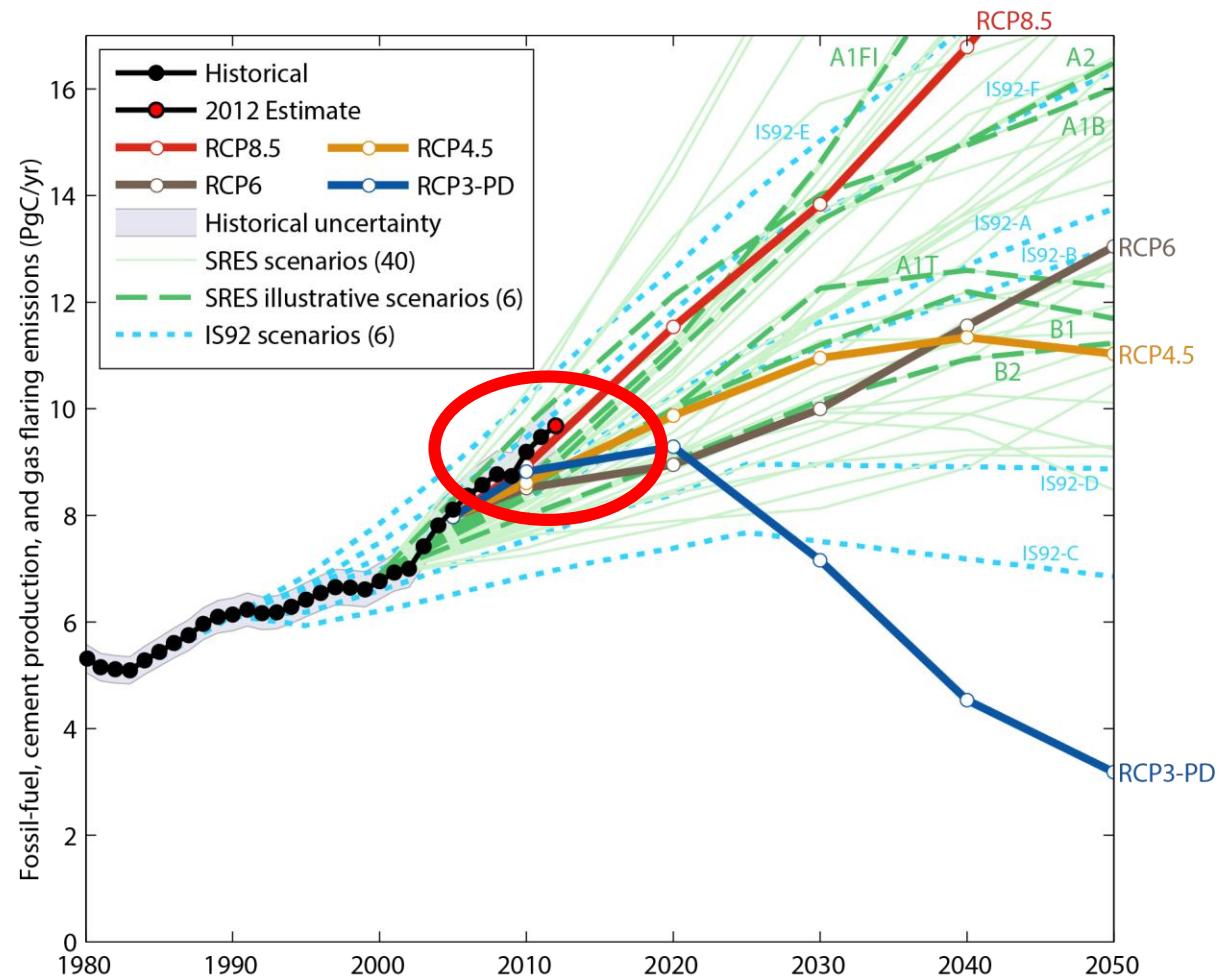


# **FINAL MESSAGE**

# CO<sub>2</sub> emissions



# CO<sub>2</sub> emissions scenarios





Thank you for your attention  
[garrabou@icm.csic.es](mailto:garrabou@icm.csic.es)  
 [@JGarrabou](https://twitter.com/JGarrabou)