SPANISH MARINE PROTECTED AREAS

Raquel Goñi Beltrán de Garizurieta

Centro Oceanográfico de Baleares
Instituto Español de Oceanografía

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

DEFINITIONS

RESERVE
or
PROTECTED AREA

- **<u>A marine protected area</u> (MPAs) is**

  *IUCN: **'any area of littoral or infra-littoral terrain with its overlying water, flora, fauna and associated historical and cultural features that has been protected by law or by any other effective means'***

- **'<u>Marine reserves</u>'**

  Scientific literature***: MPAs (or zones within MPAs) that are protected against all extractive activities*** (= no-take areas)

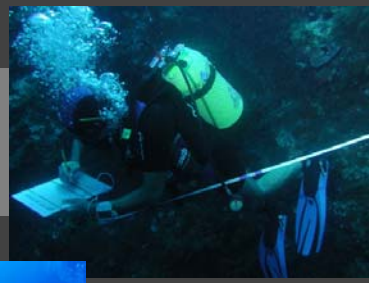
PLANNING & DESIGN

Direct impacts of extractive activities (commercial or recreational) controlled or eliminated

Generally forbiden:

Mobile gear (bottom trawling, dredging) & spear fishing

Indirect impacts not controlled (e.g., pollution, warming, introduced spp.)



Zoning

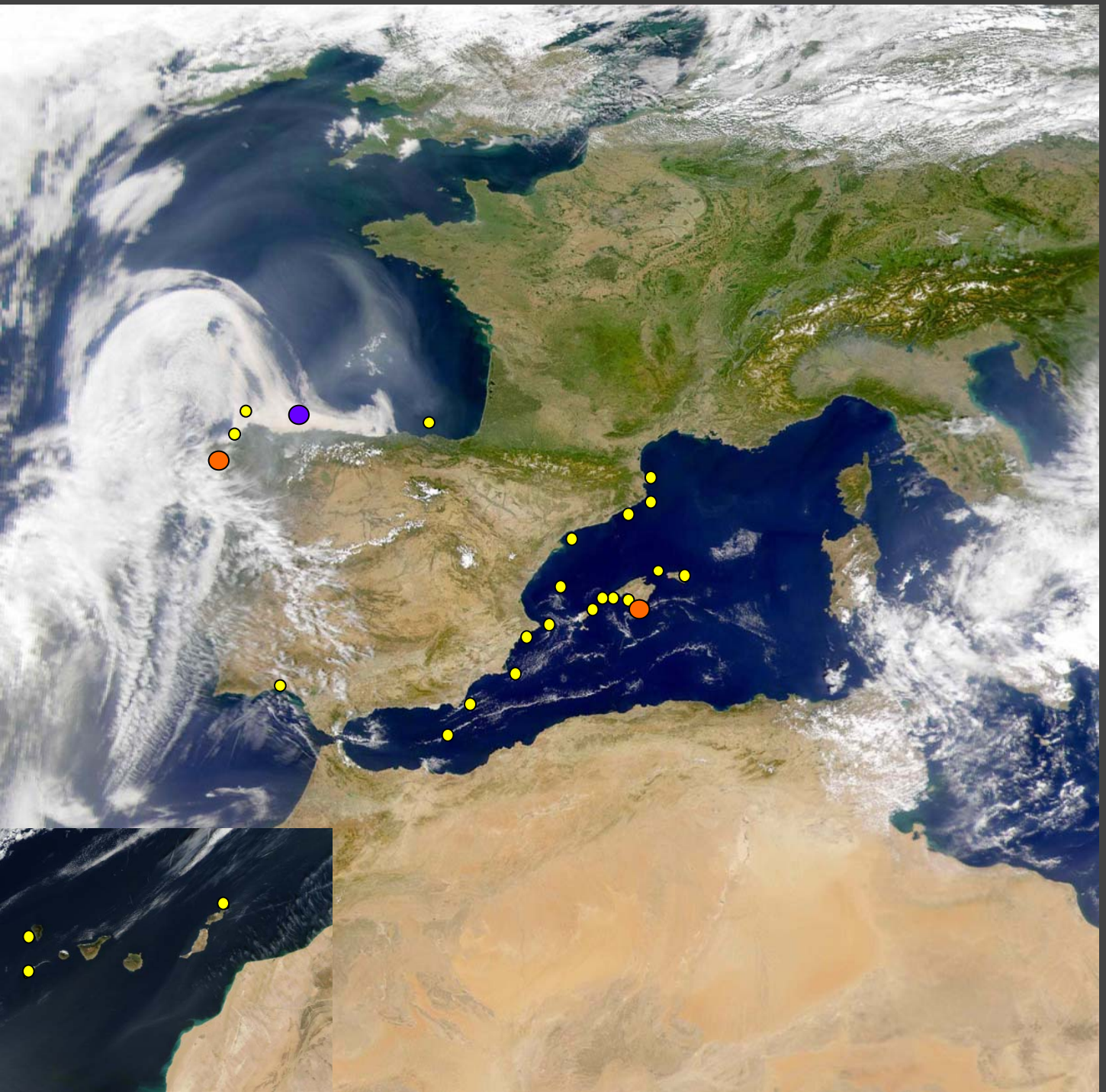
- **Integral reserves:** Areas closed to all human activities (exc.research/surveillance)

- **Buffer or restricted use areas:**

  - Non-consumptive activities (diving, swimming, ..)

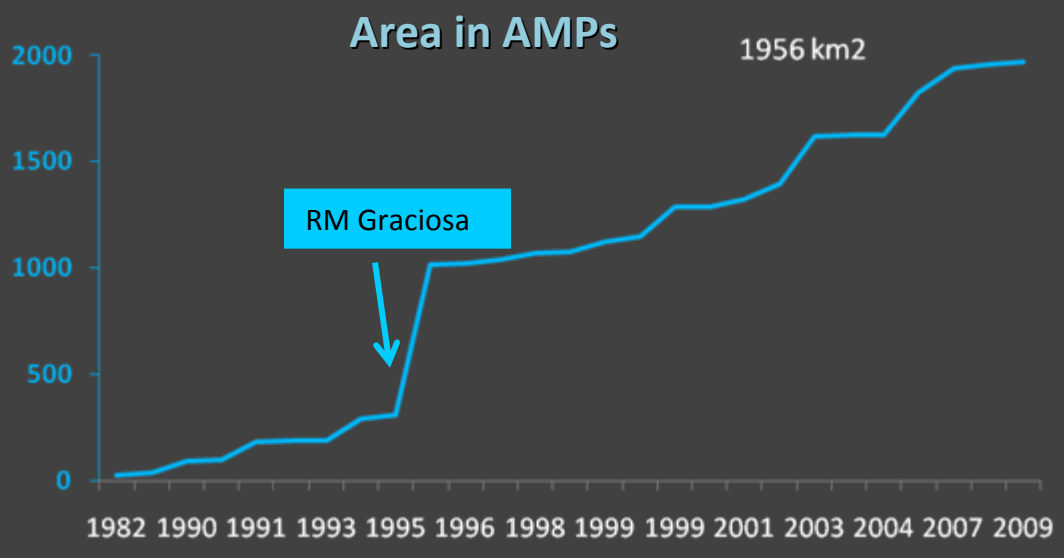
  - Some fishing activities (e.g. artisanal or recreational)

SPANISH MPAs

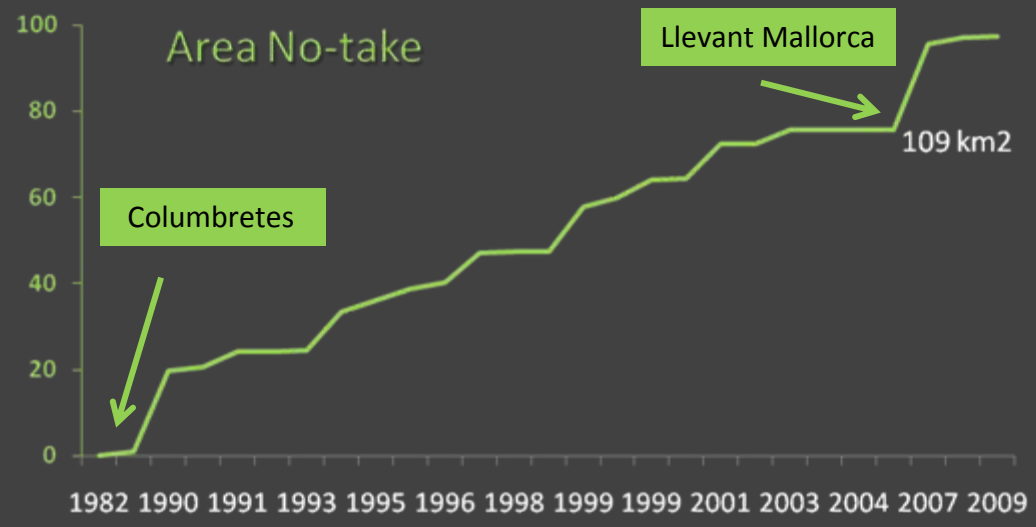


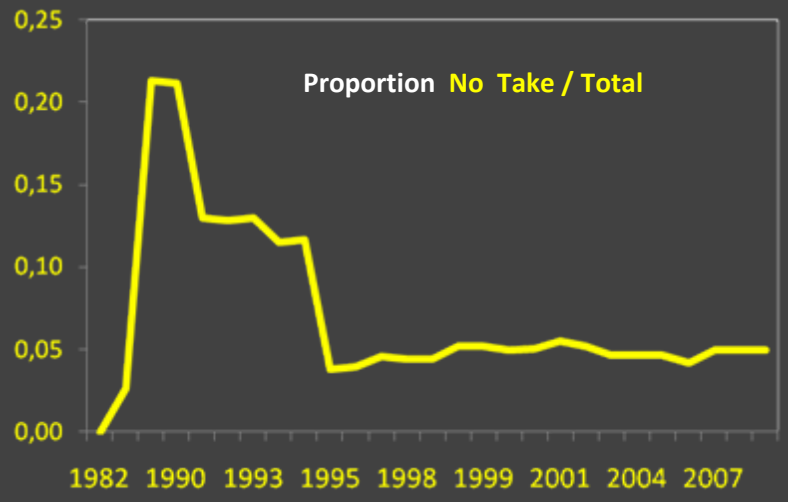
- State / Autonomic MPA
- National Park
- OSPAR MPA

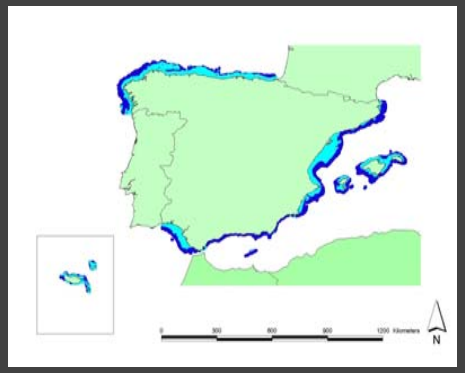
SPANISH MPAs



nº= 27	Mean surface (km^2)	Total surface (km^2)
MPA	73	1956
No take	4	109

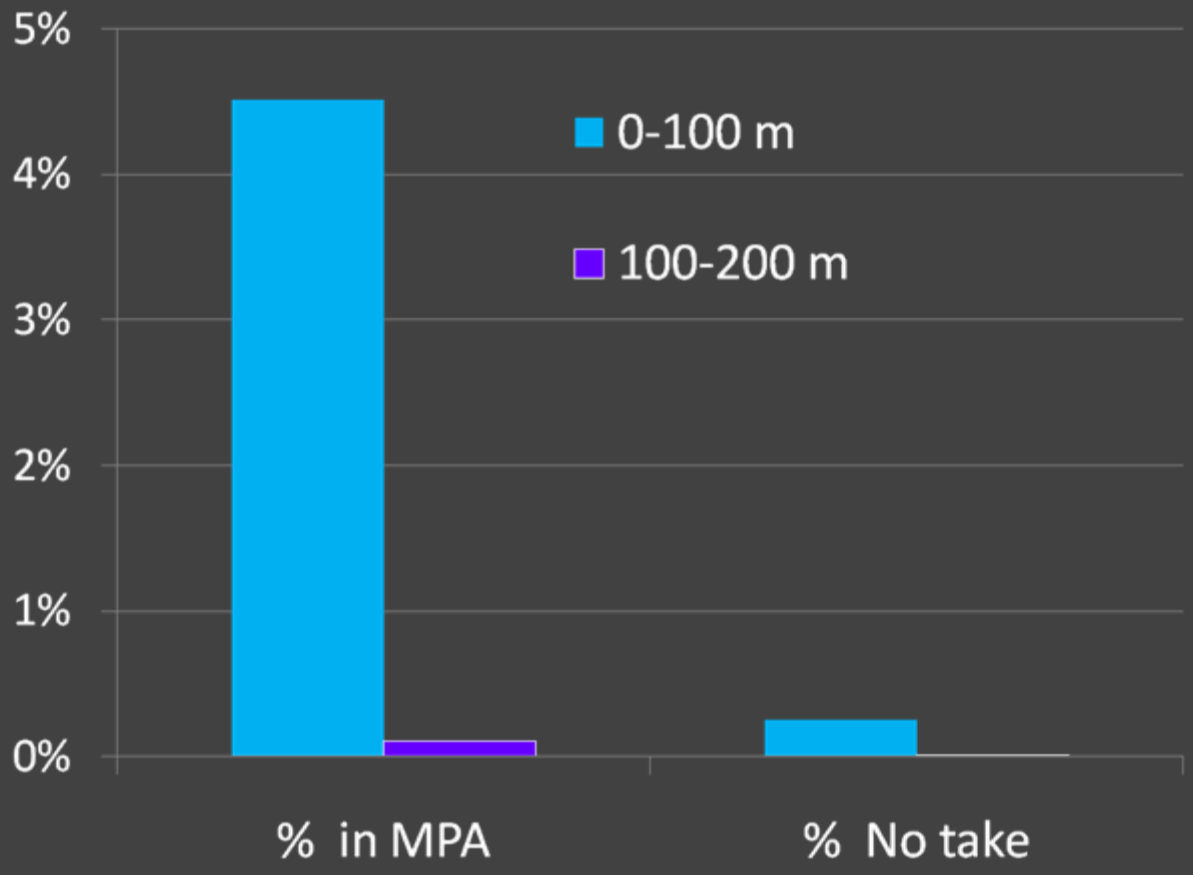




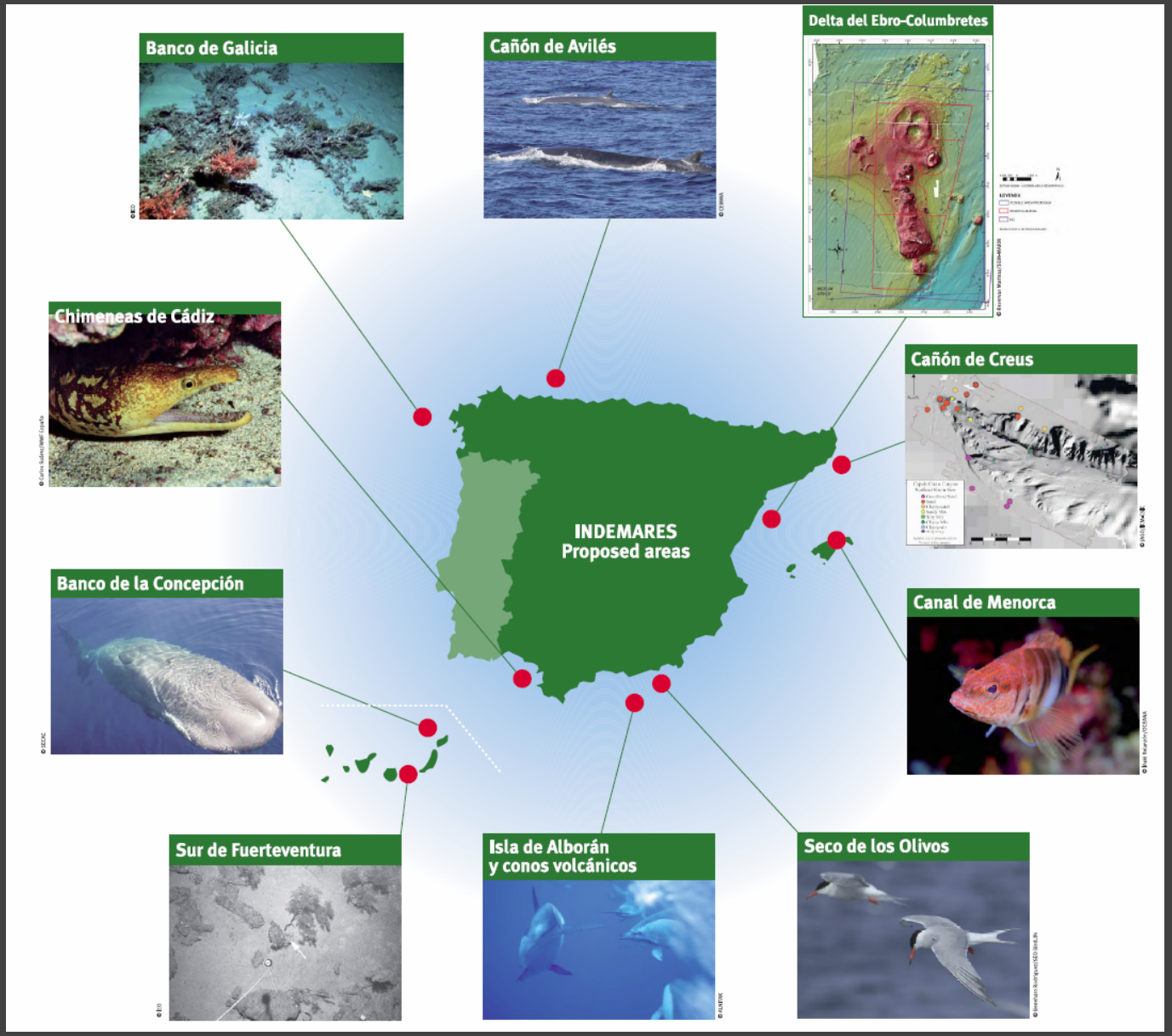


SPANISH MPAs

PERCENT OF CONTIENTAL SHELF PROTECTED



LARGE OFFSHORE MARINE PROTECTED AREAS



THE COLUMBRETES ISLANDS MPA

THE LOBSTER CASE STUDY

Raquel Goñi Beltrán de Garizurieta
David Díaz Sandra Mallol

Research financed by the IEO – SGM

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
RESERVAS MARINAS DE ESPAÑA
MINISTERIO DE MEDIO AMBIENTE, Y MEDIO RURAL Y MARINO
SECRETARÍA GENERAL DEL MAR

Columbretes Islands MPA - Location

Columbretes Islands Marine Reserve

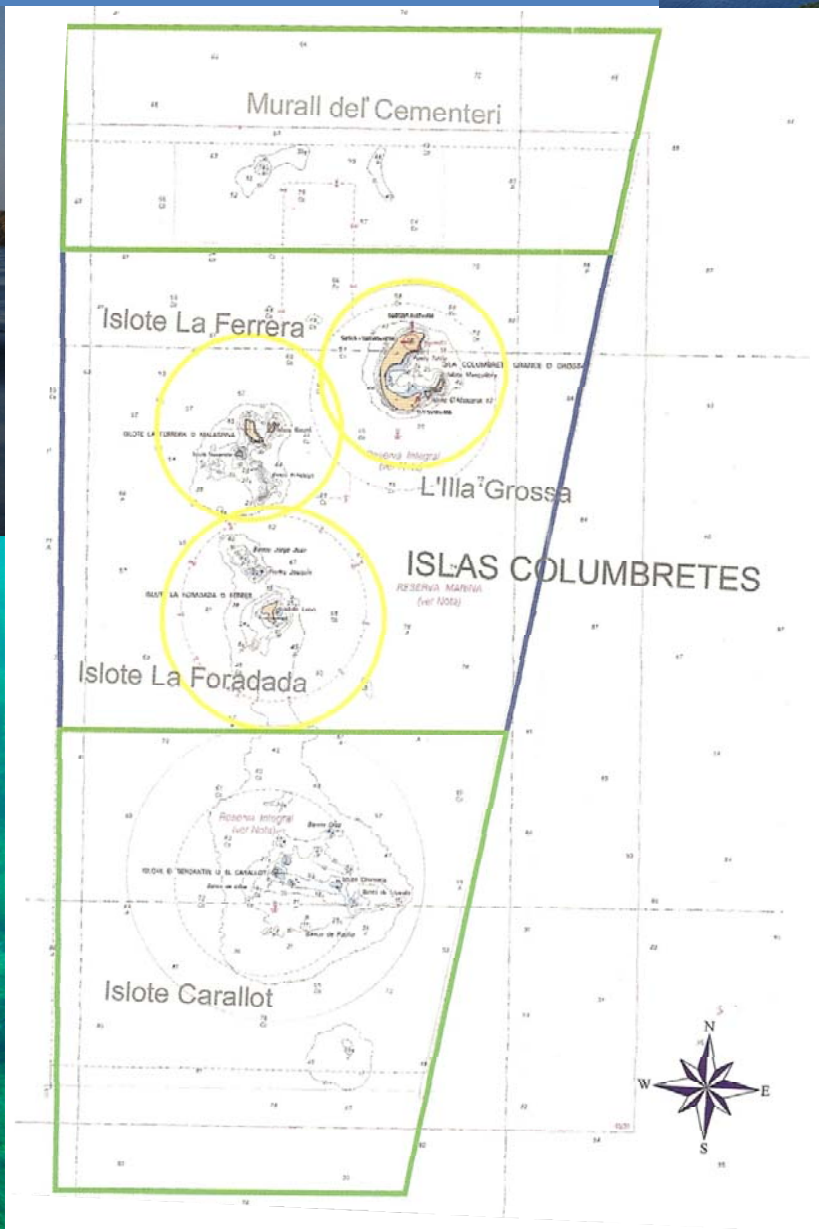
In 1990 a 'Marine Reserve' was established

Objective: *'create areas of integral reserve and of restricted use for maritime fishing and the protection of the autochthonous marine resources'*

Total area: Initial 44 km^2; 2009: 55 km^2
No commercial fishing
Very limited recreational fishing
Fishing prohibitions well enforced

Zoning


No-take: 31 km²
Restricted use area: 24 km²


Murall del Cementeri
Islote La Ferrera
L'Illa Grossa
ISLAS COLUMBRETES
Islote La Foradada
Islote Carallot
N
W
E
S

MPA harbours traditional fishing grounds of the spiny lobster *Palinurus elephas*

Fisheries

The most important commercial spiny lobster species in NE Atlantic and Mediterranean.

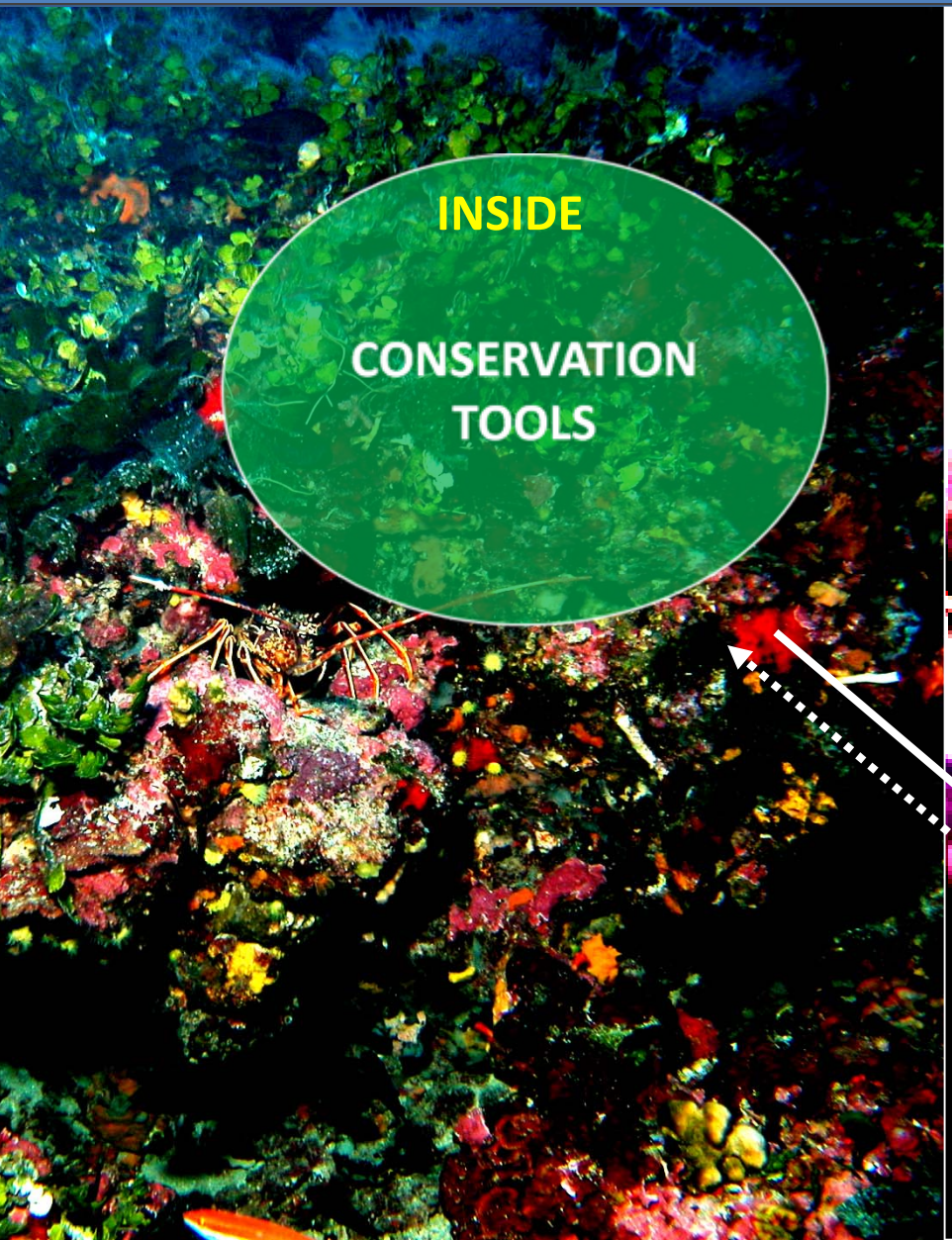
Populations depleted in the NE Atlantic and overfished in Mediterranean

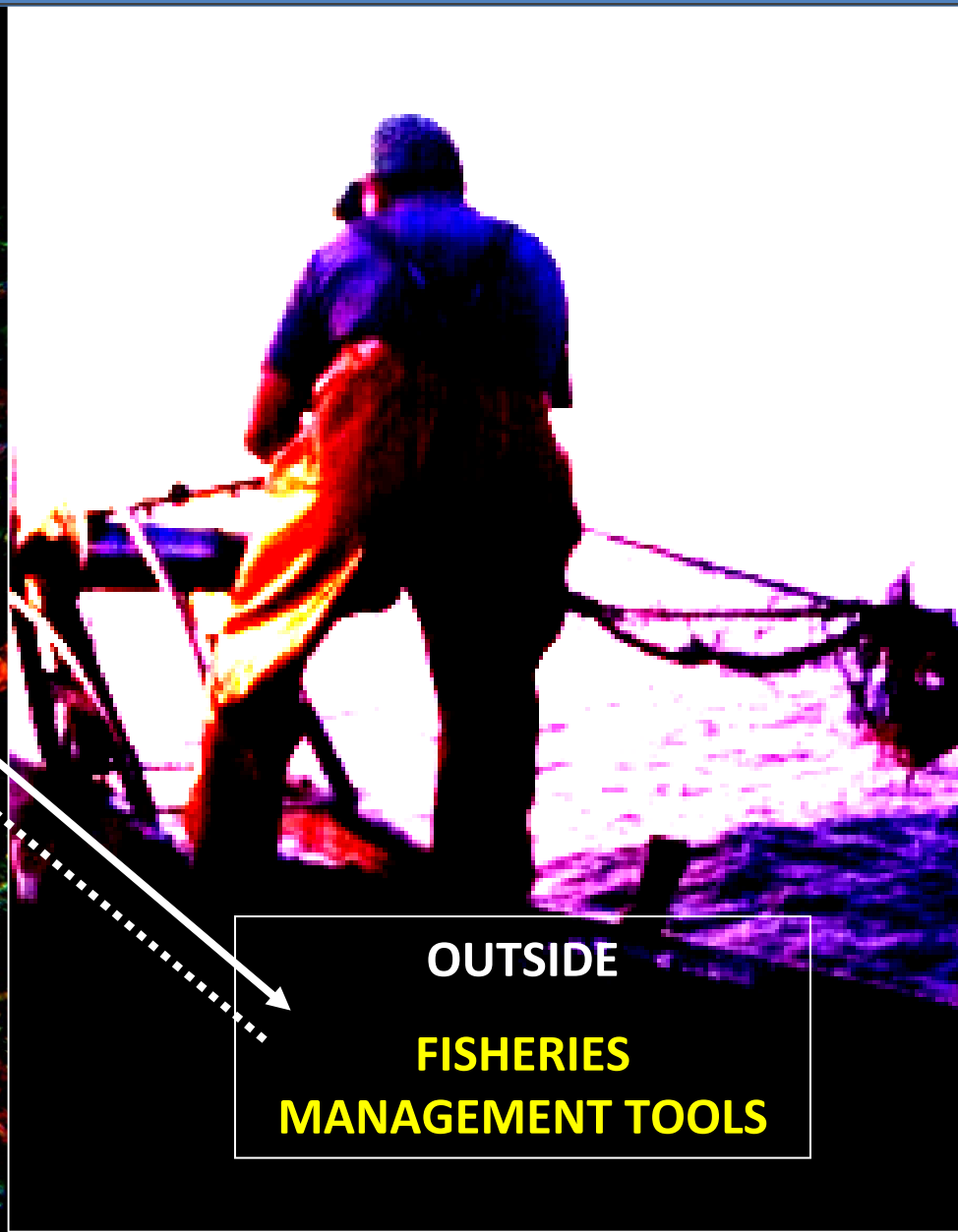
Directed fisheries (artisanal):
mainly in archipelagos and islands

P. elephas fisheries regulated by MLS, closed season during egg bearing period, and the prohibition of landing ovigerous females.

Spanish Mediterranean: 600 boats & 1100 fishermen; estimated landings: 200-400 t/year (≈12-24 million €).

MPAs as conservation & fisheries management tools

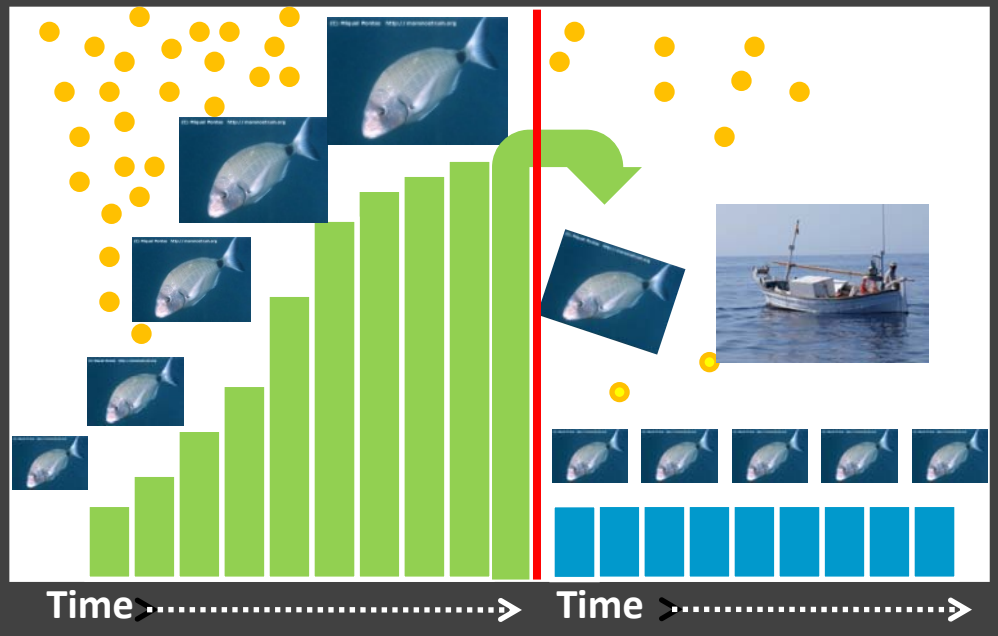




Expected MPA effects inside and outside

MPA

↑ Population density
Demographic recovery
↑ Egg production

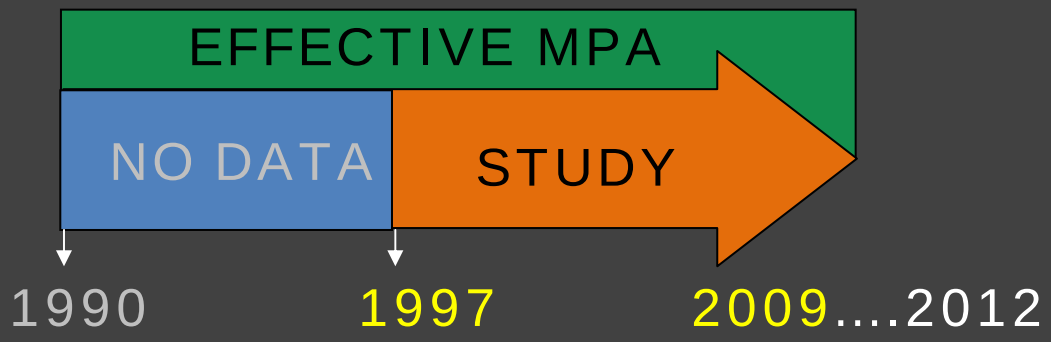


ADJACENT GROUNDS

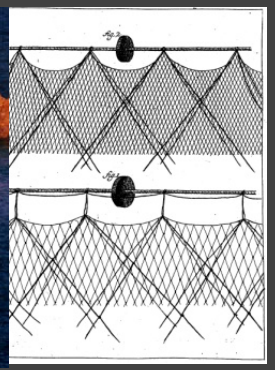
Spillover of biomass

Export of eggs and larvae

LOBSTER study in the Columbretes MPA



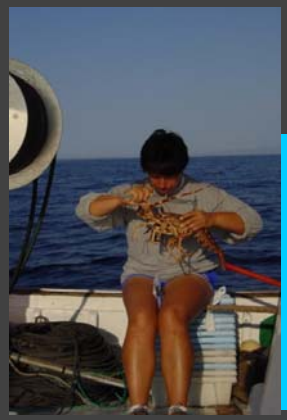
Columbretes lobster study: DATA collection - I



MPA

Experimental fishing surveys

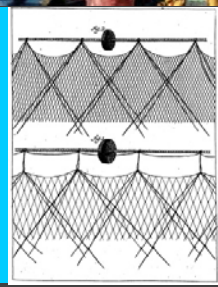
Annually: 1997-2007



FISHING GROUNDS

Onboard sampling fishery

Annually: 1997 - 2007



Columbretes lobster study: DATA collection - II

MPA

Tag & Recapture

Annually: 1997-2007

FISHING GROUNDS

Recapture

(no tagging)

Annually: 1997-2007

PROTECTION effects on lobster inside MPA

MPA

Population density
Demographic recovery
Egg production

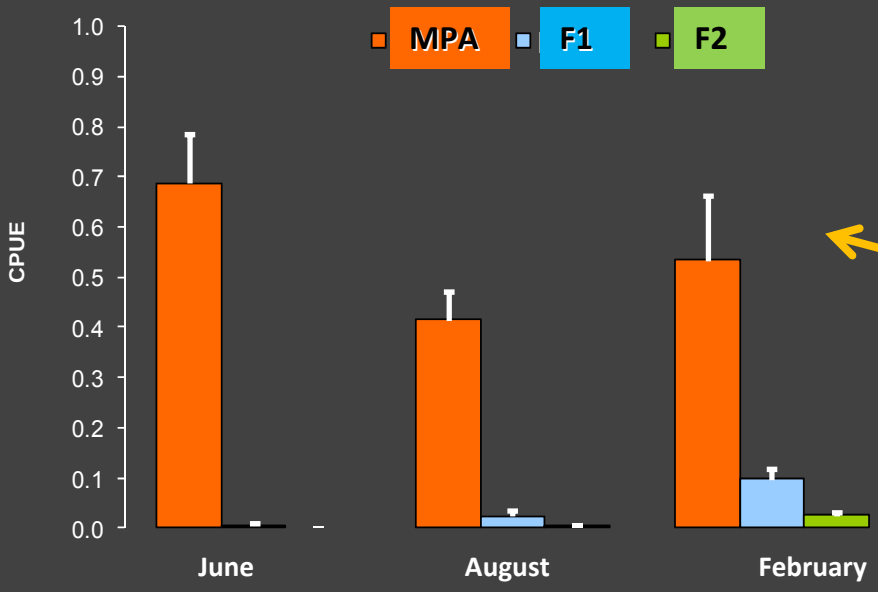
Initial studies - Spatial comparisons of:

Abundance

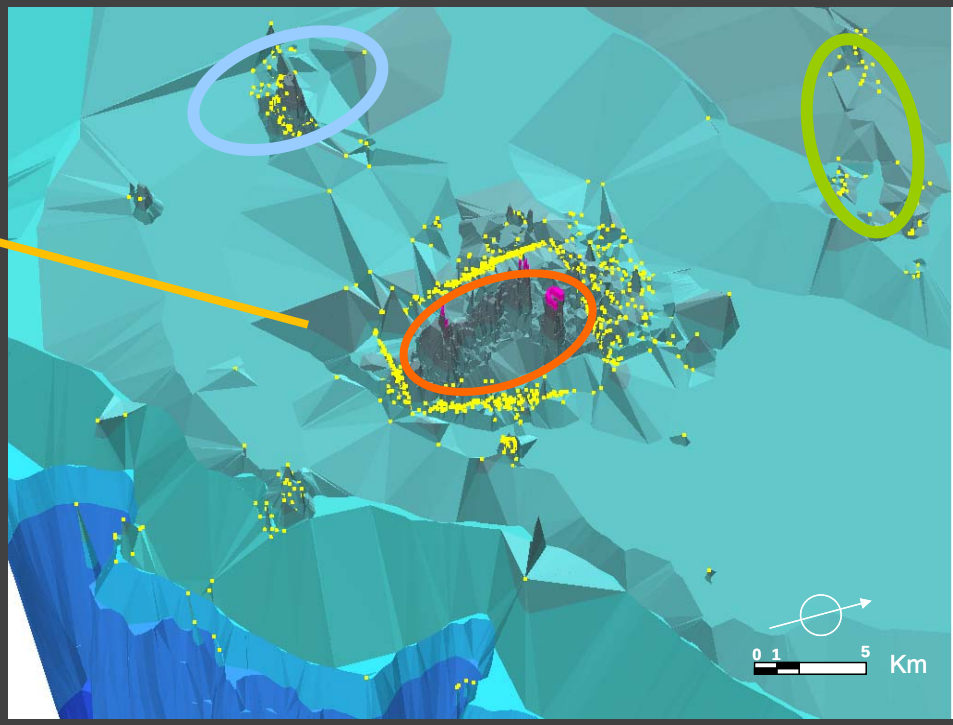
Reproductive potential

Abundance 5-20 times greater in MPA than in fished grounds

AFTER 9 YEARS OF PROTECTION

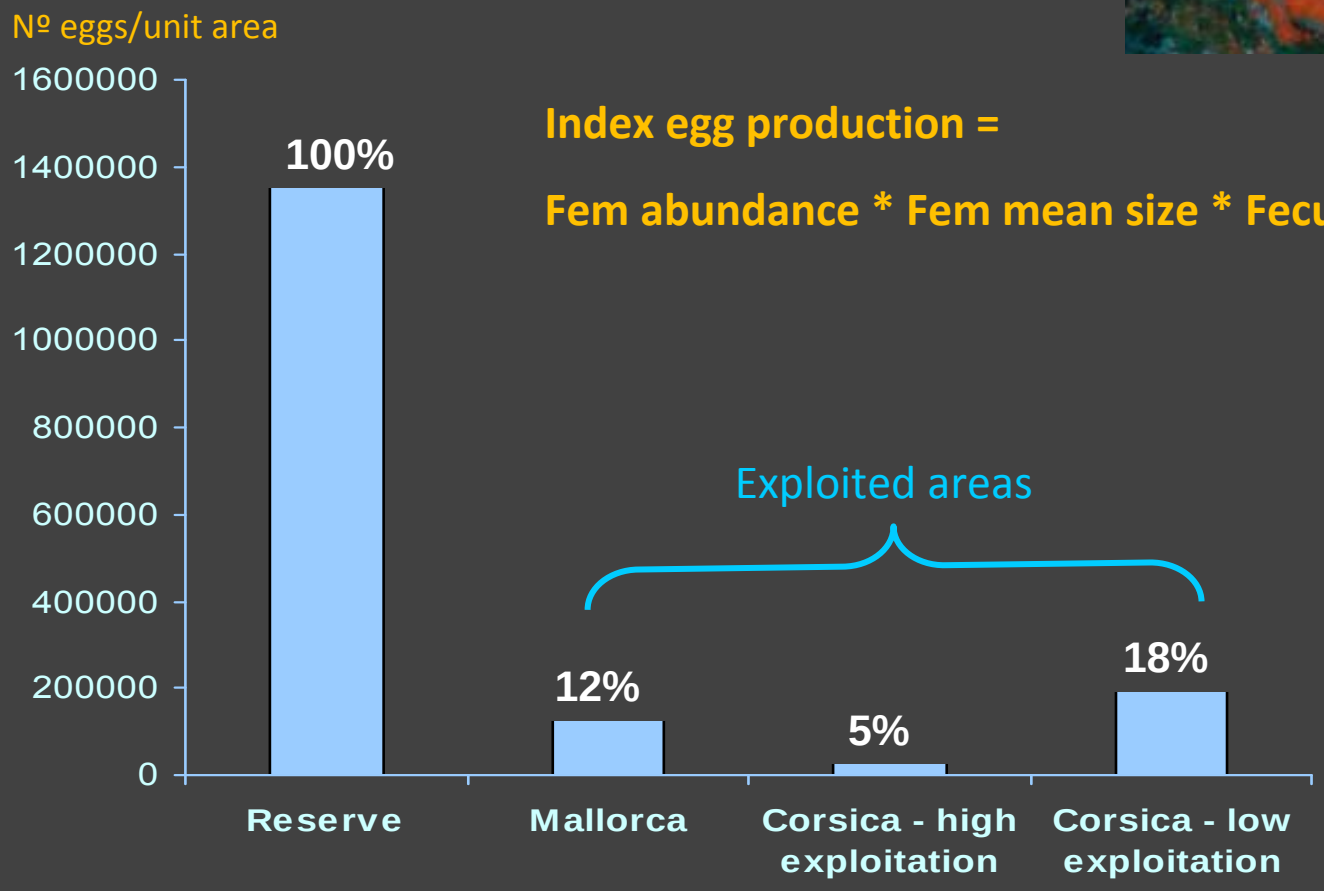


Abundance indices: 3 seasons



Egg production 6-20 times greater in MPA

AFTER 9 YEARS OF PROTECTION



Index egg production =

Fem abundance * Fem mean size * Fecundity at size

PROTECTION effects on lobster inside MPA

MPA

↑ Population density
Demographic recovery
↑ Egg production

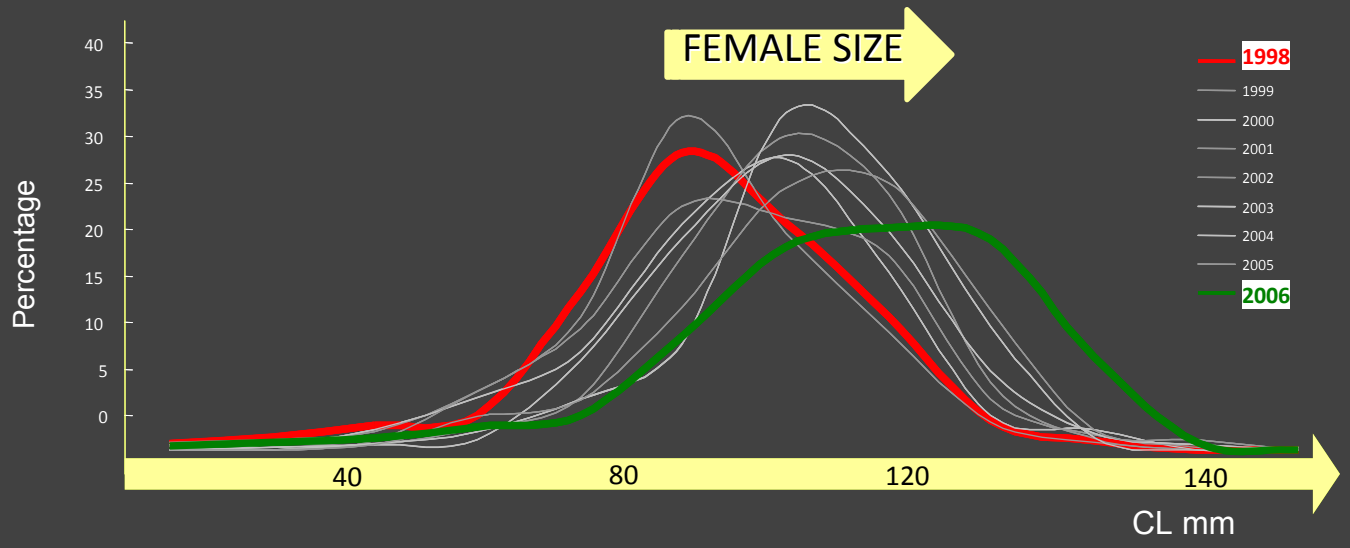
Long-term studies - Evolution of:

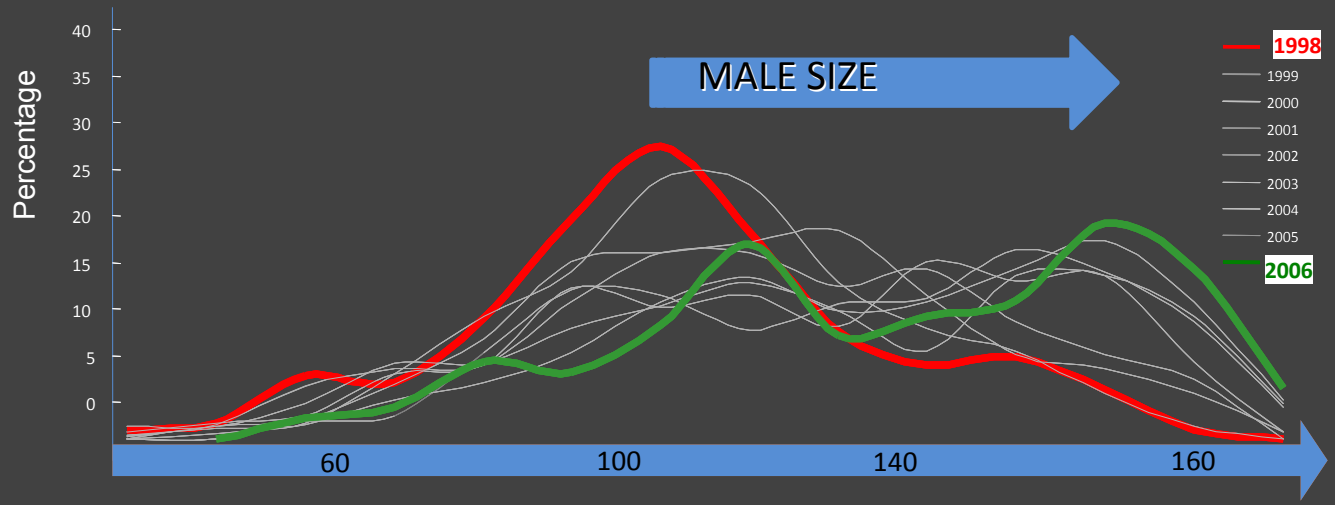
Demographic structure

Population abundance

Demographic evolution towards naturalization

8 to 16 YEARS OF PROTECTION

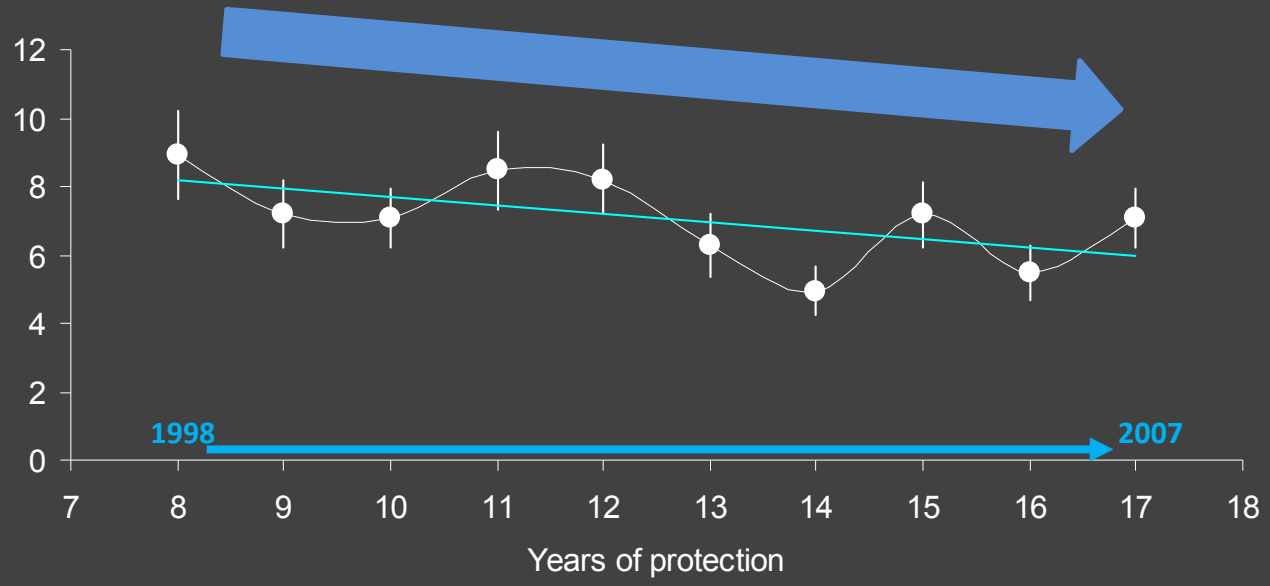




Declining abundance trend in MPA

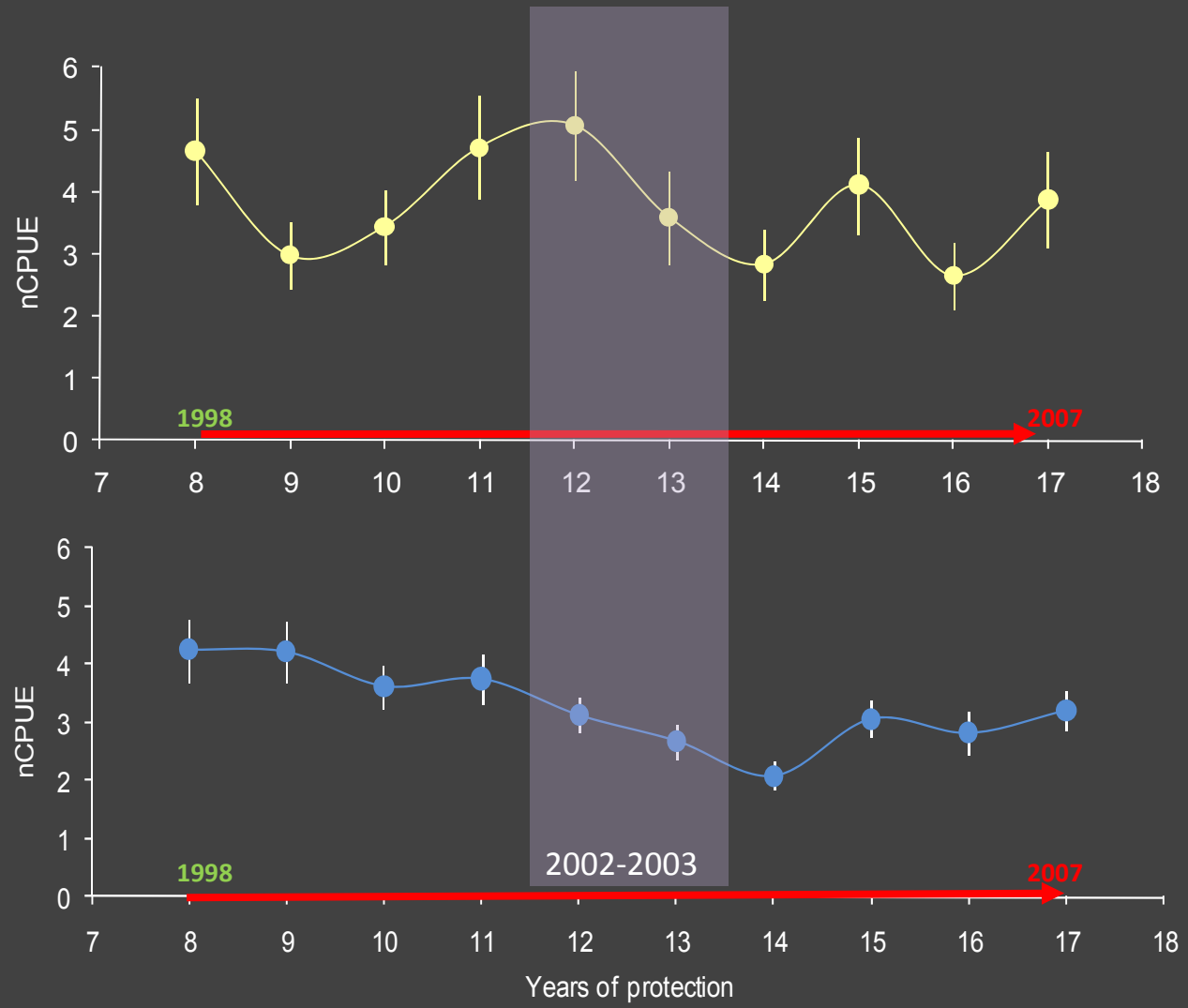
8 to 17 YEARS OF PROTECTION

Abundance index ± SE



Main abundance decline in 2002-2003

8 to 17 YEARS OF PROTECTION



FEMALES

MALES

Why is the lobster population in the MPA declining?

settlement failure?

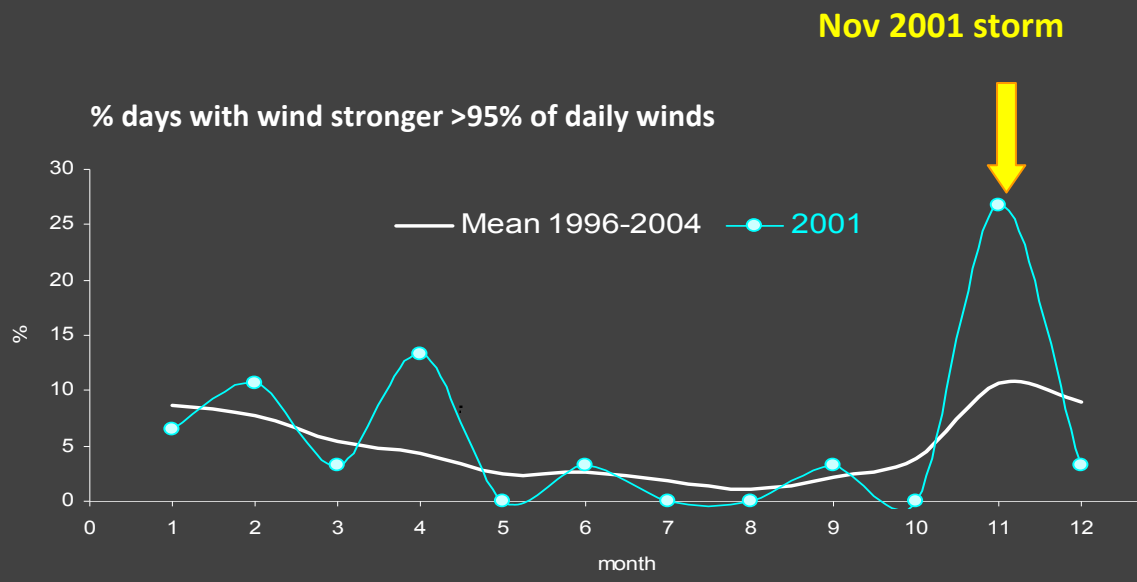
Increased natural mortality in the MPA?

Increased fishing mortality in the adjacent fishery?

2001 decadal storm caused massive emigration?

Diario de Tarragona
4 April 2002

ntsià 10/04/02 se pagaron en la lonja 6.000 euros.



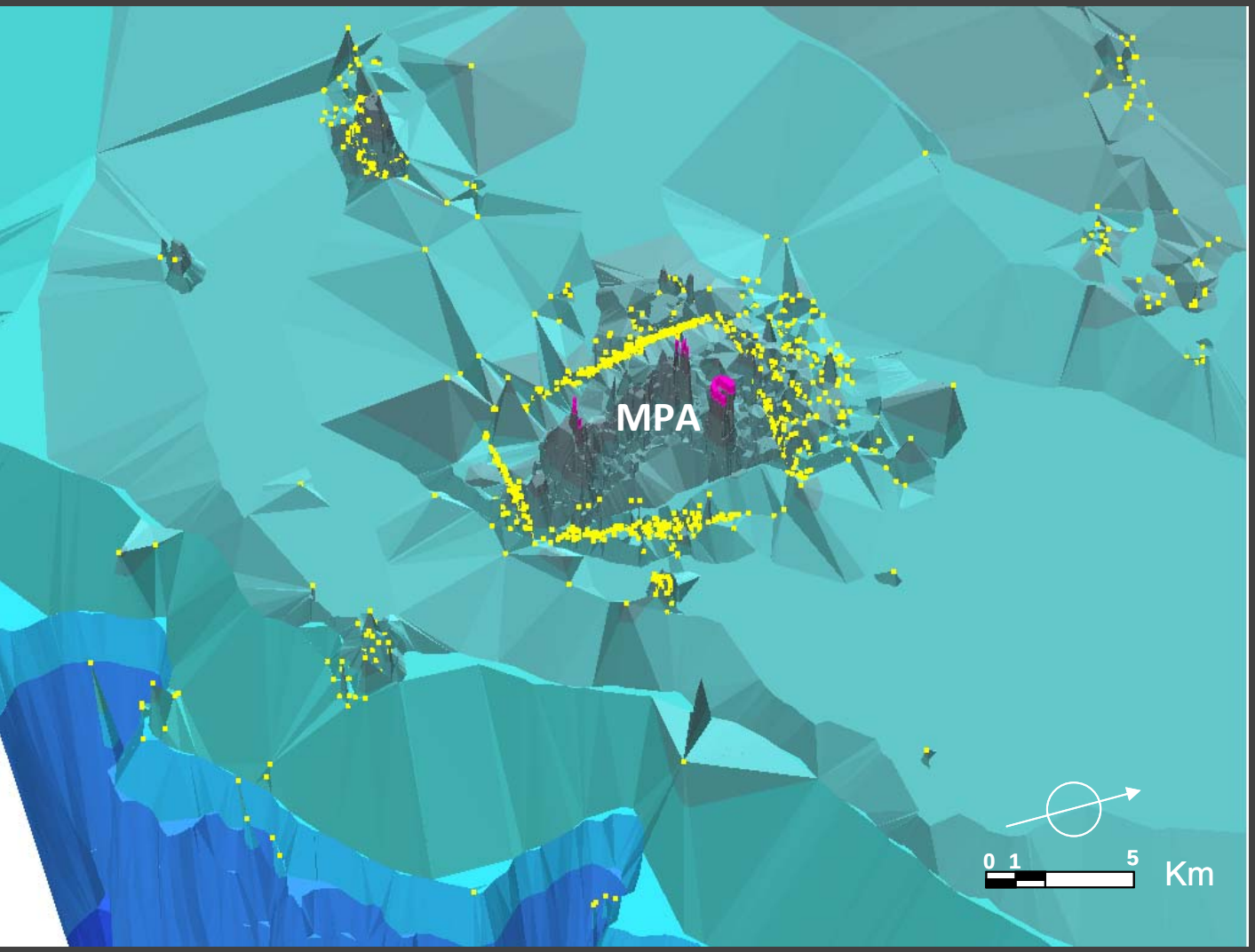
Data: Pascual & Salat, ICM

PROTECTION effects outside MPA

MPA

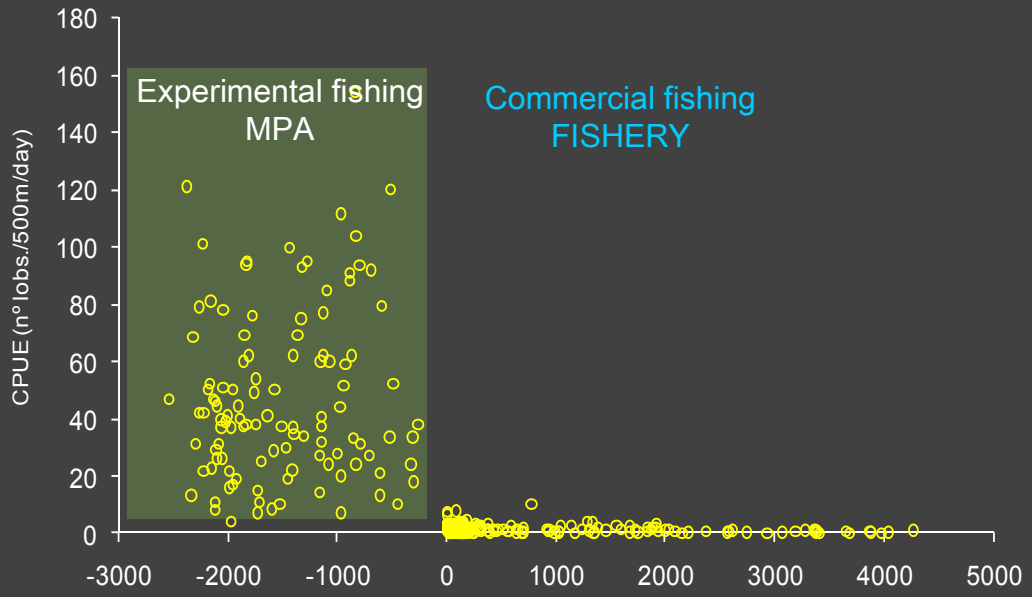
Spillover

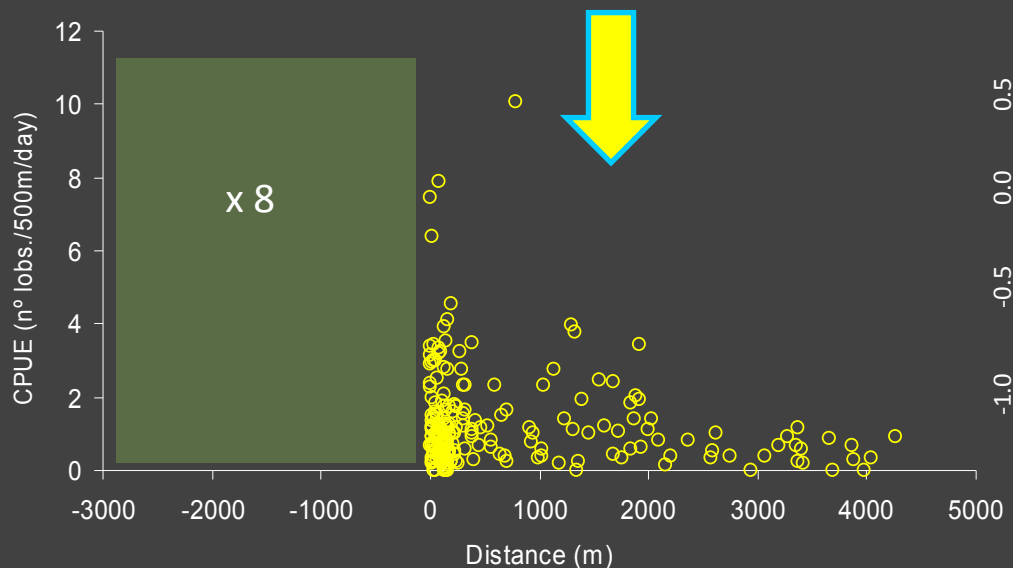
Spillover evidenced by effort concentration near MPA

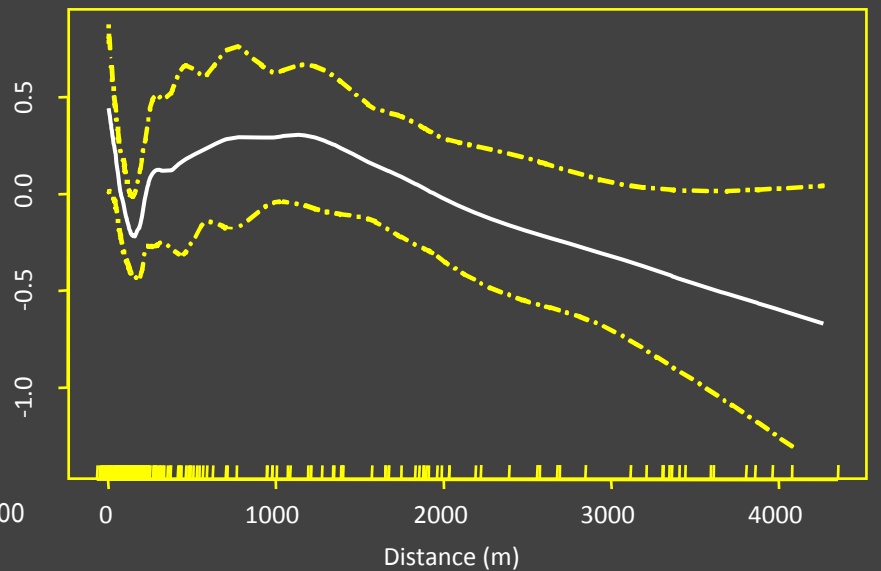


Lobster fishing occurs along MPA boundaries and up to 30 km (yellow dots). Emerged land in pink.

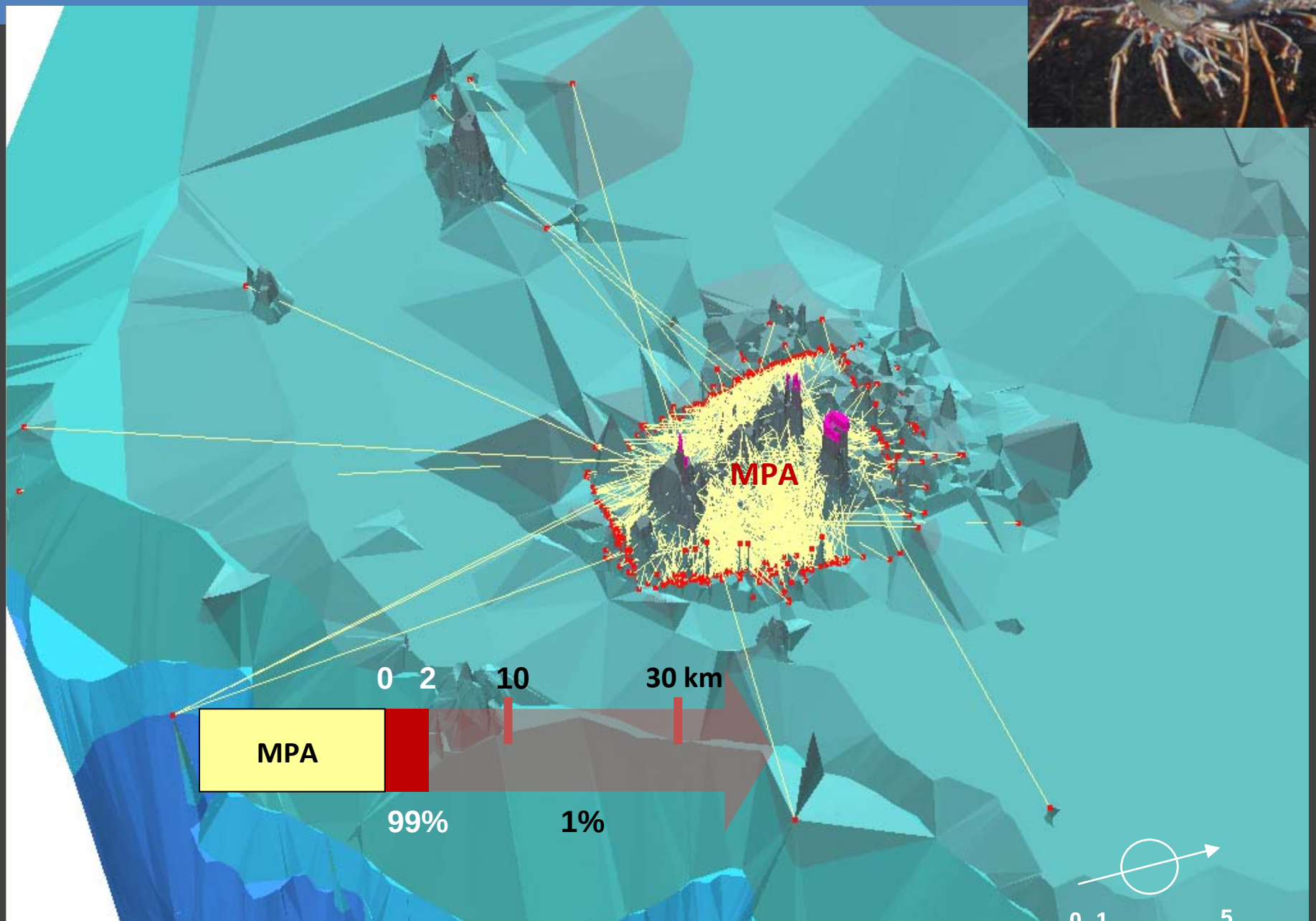
Abundance declines with distance from MPA







Recaptures from the MPA harvested < 2 km



Higher recapture rates of males and in 2002

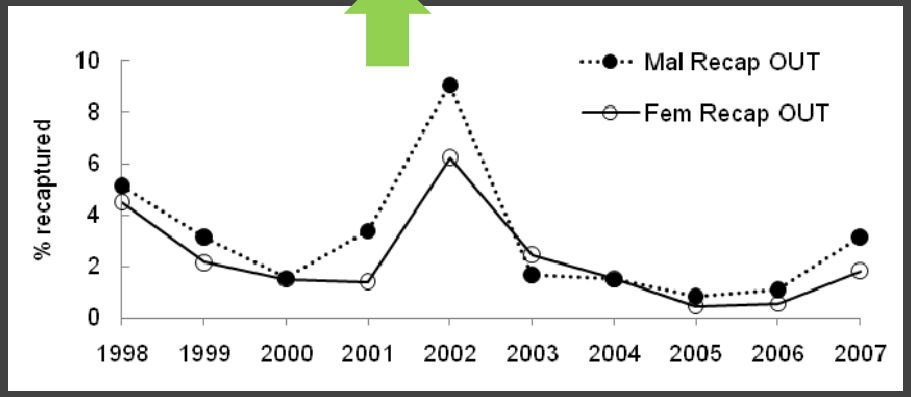
MPA
Recapture rates

Females	Males
1.8%	2.3%

Males more catchable

Males emigrate more

x3 greater emigration



ADJACENT FISHERY Recapture rates	Females	Males
MEAN 1998-2007	1.9%	3.4%
2002	6.1%	9.8%

6% emigrate annually and almost all are harvested

MPA

POPULATION

Spillover 6%

Net effect of spillover on the local lobster fishery

ADJACENT GROUNDS 80%

MPA
20%

Catch Nº

18 %

Net effect

- 2%

Catch Kg

33 %

+ 13%

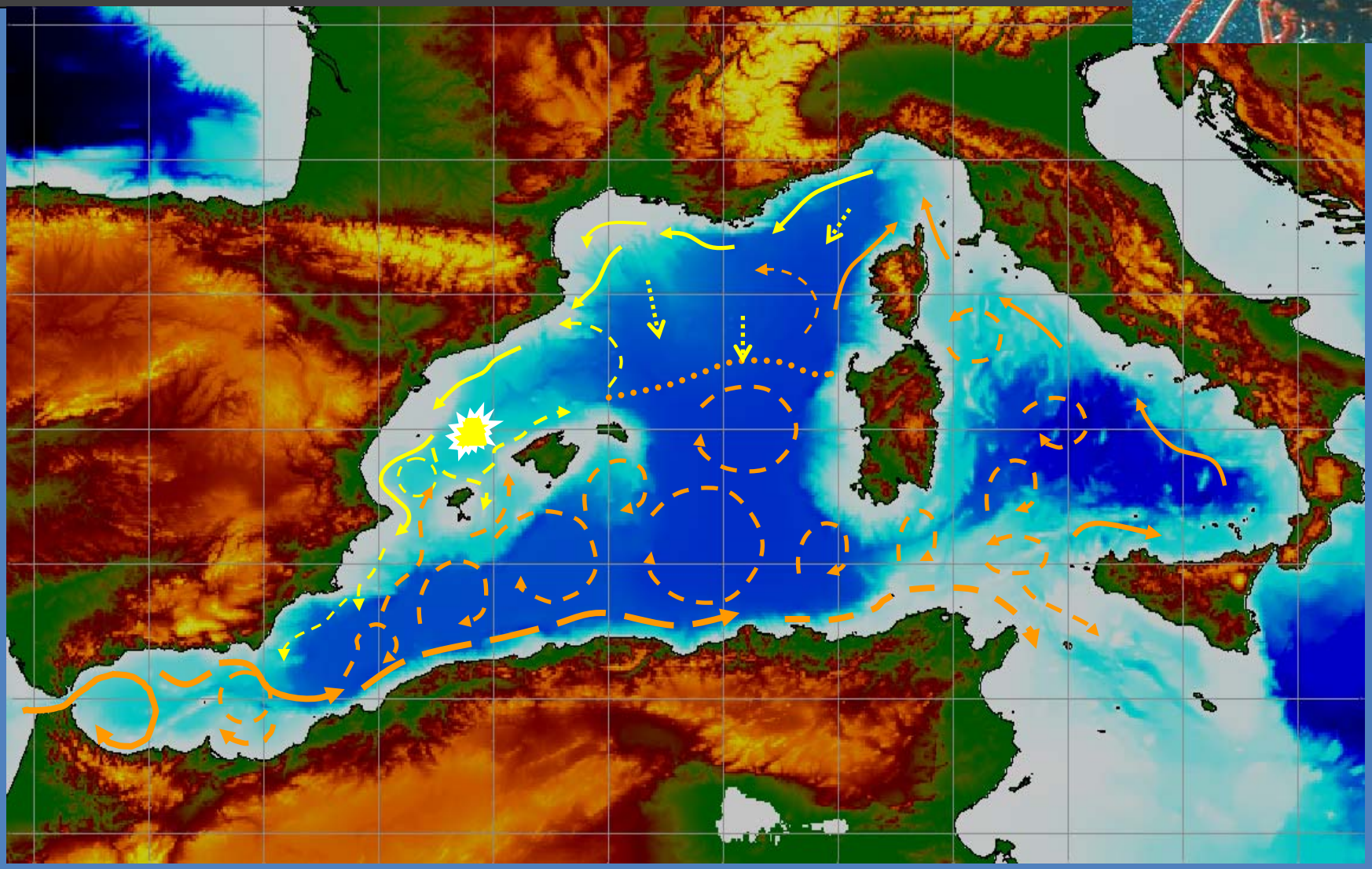
Possible causes of population decline in the MPA

'..for a mystery story is exactly what biology is'
The selfish gene.
R. Dawkins

Increased fishing mortality in the adjacent fishery from migrants exiting the MPA in 2001 caused the sharp population decline in 2002-2003.

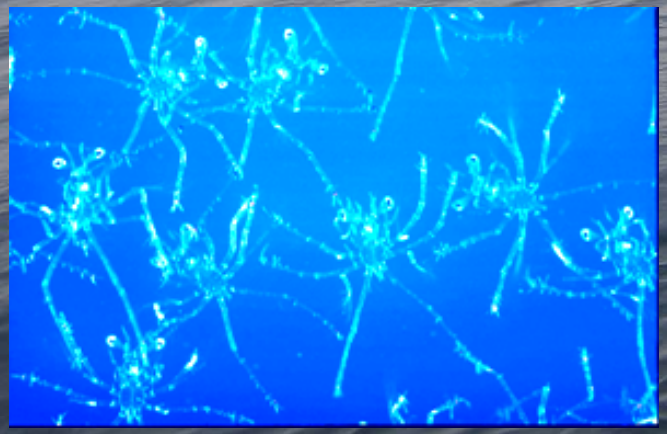
Emigration and exploitation interplay to maintain the lobster population in the MPA at its carrying capacity….

Is the MPA self-sustainable?



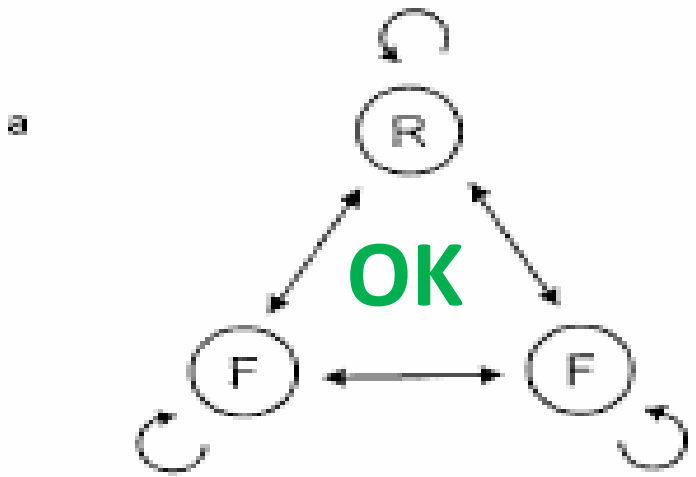
Larval dispersal from Columbretes

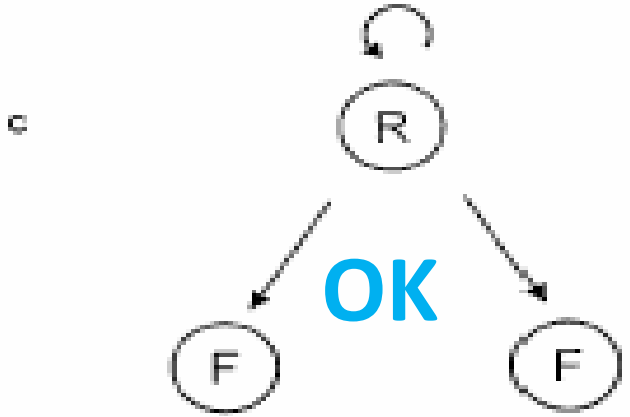
After egg hatching, pelagic phyllosoma larvae drift in ocean currents during 4-5 months (January – May)

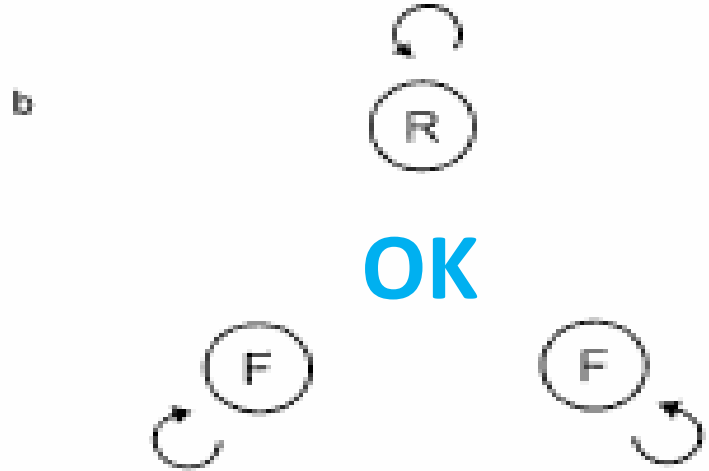


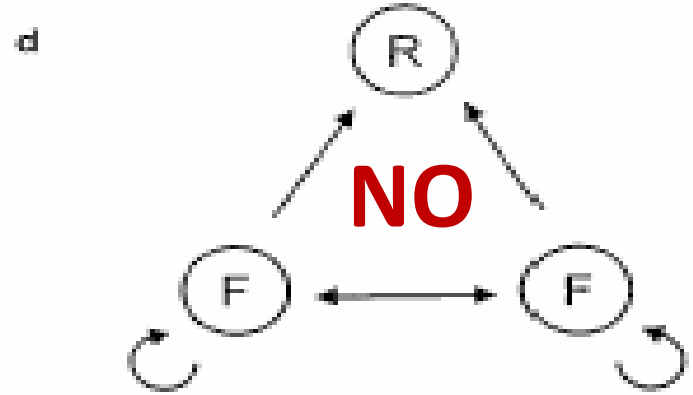
Drifting buoy with 15 m-long drogue released in the Columbretes MPA at the time of egg hatching (January)

Desirable larval connectivity patterns









RESERVAS MARINAS · ECOLOGÍA LITORAL

RESMARE · IEO

RESERVAS MARINAS DE ESPAÑA

LESSONS

- Sufficiently large, well enforced MPAs are effective at rebuilding of biomass and egg production of exploited species within its boundaries
- Effective MPAs with continuity of habitats across boundaries favor the export of biomass, potentially enhancing or sustaining local fisheries
- The spillover effect is geographically limited, partly due to high exploitation rates near the MPA which harvest at any time step all the individuals coming from the MPA

Connectivity is regarded now as foremost issue for designing effective, self-sustaining MPAs

OTHER LESSONS FROM MPAs

- MPAs with complex designs and multiple levels of spatial regulations are very difficult to enforce and may be ineffective (future large MPAs? offshore?)
- Even small levels of fishing may limit the effectiveness of MPAs for rebuilding biomass
- Very small MPAs are exposed to environmental & human actions in their surroundings - may not allow the re-establishment of permanent populations
- MPAs may be the only management tool applicable to multi-gear, multi-species fisheries (artisanal)
- Some fishers regard well enforced MPAs as more equitable management tools than quotas or MLS that some fishermen do not respect

MARINE BOARD WORKING GROUP

MARINE PROTECTED AREAS

AN INTERNATIONAL INITIATIVE

Pan-European Marine Board-ESF initiative aiming at informing/providing key insights in the implementation of the Marine Strategy Framework Directive and more particularly on MPAs.

The WG aim is

- to develop a roadmap for introducing a network of ecologically relevant and coherent network of MPAs in European Seas

- to define methods for selecting, managing and monitoring these sites as a tools to achieve Good Environmental Status and engage all users of the sea in this process.