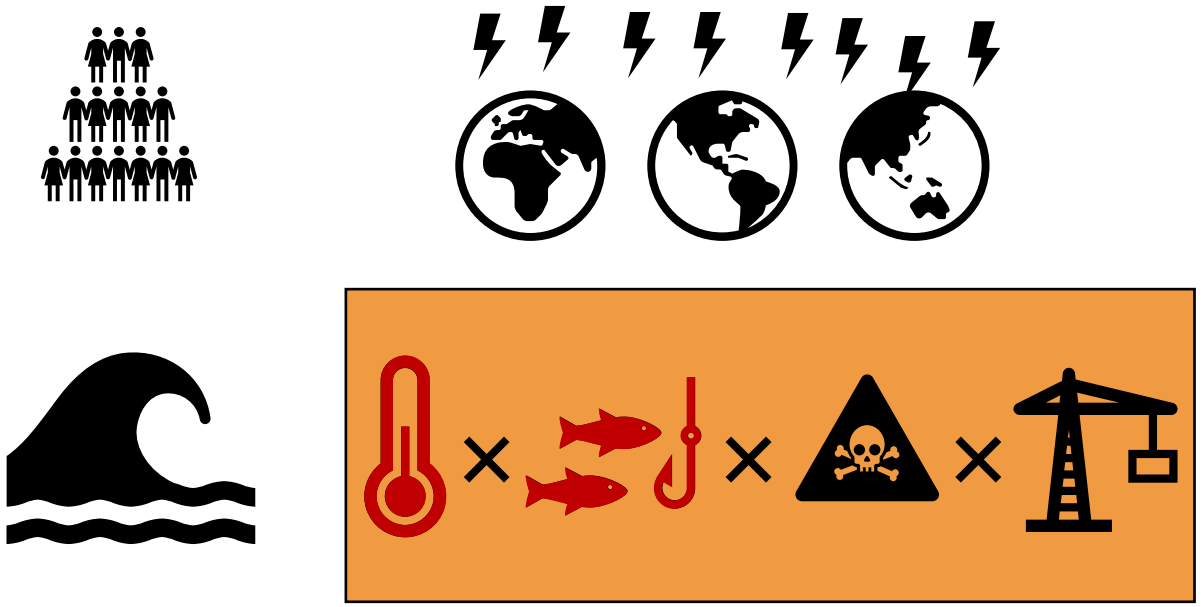
Stronger together: fisheries enhance pressure on Mediterranean regions and pelagic species already impacted by climate change

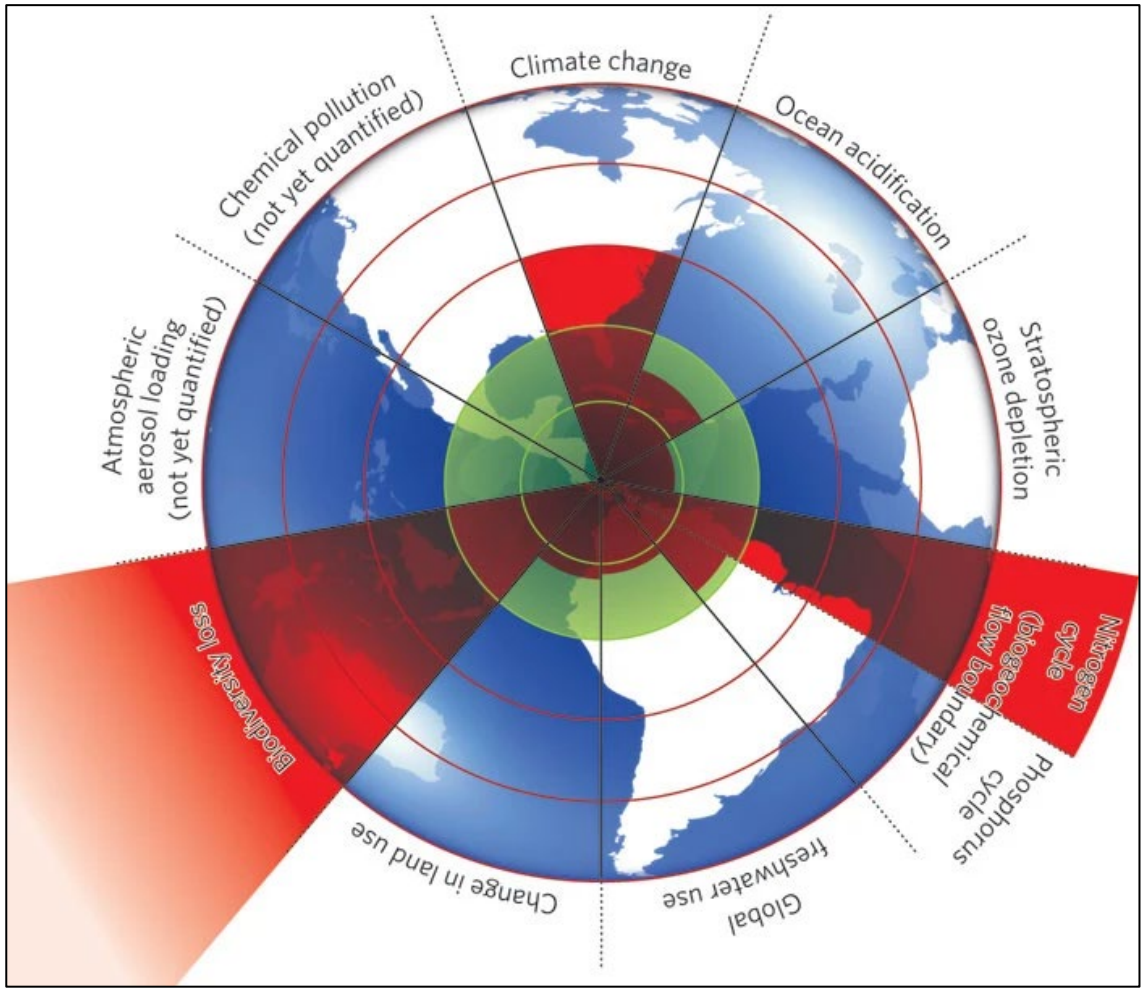
Jazel Ouled-Cheikh, Marta Coll, Lluís Cardona,
Jeroen Steenbeek, Francisco Ramírez

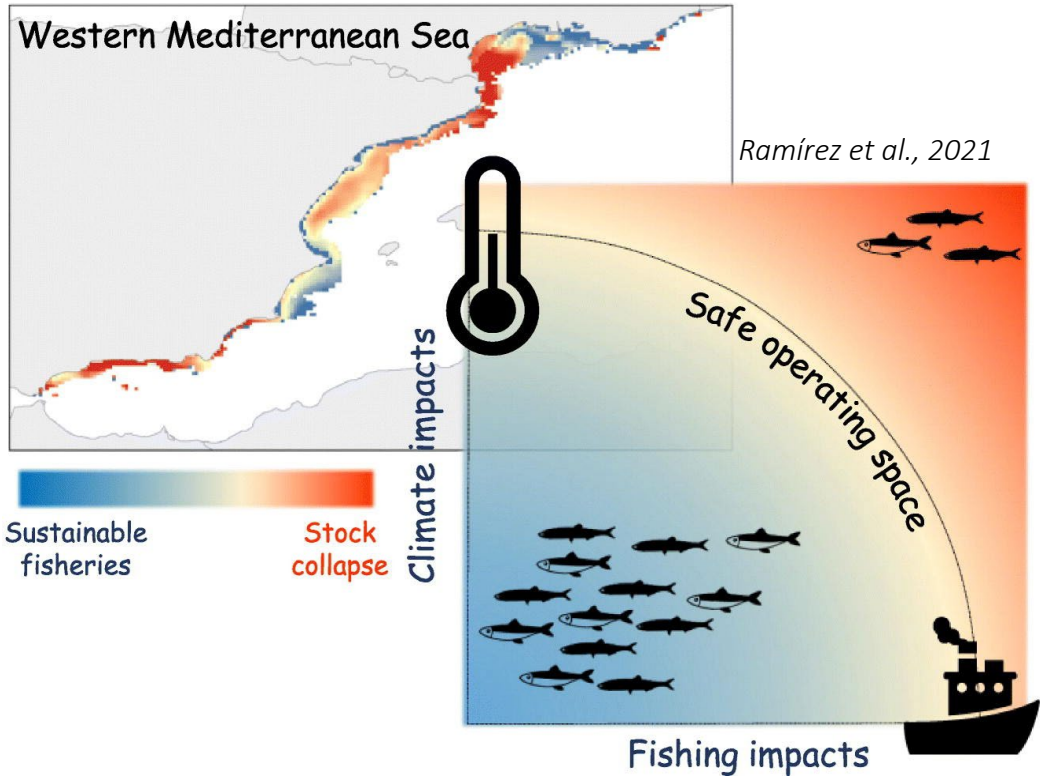
Introduction – Impacts on the marine environment



Introduction – Safe Operating Space (SOS)

Rockström et al., 2009





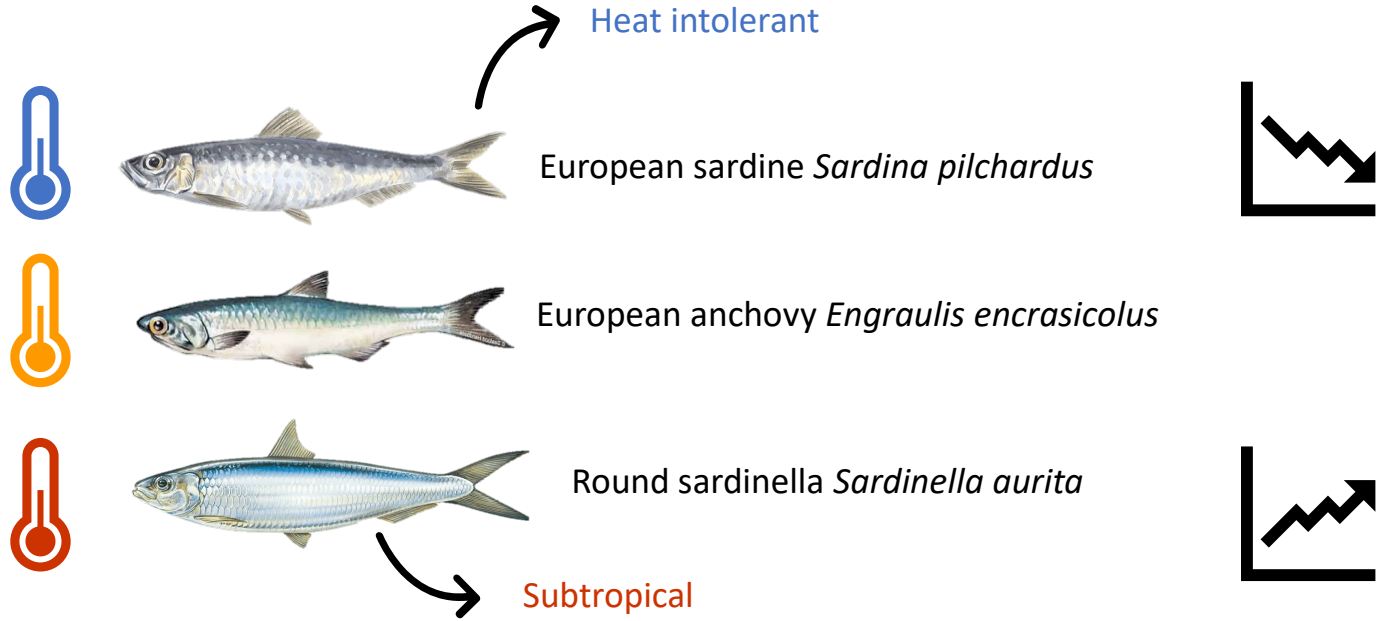
Ramírez et al., 2021

Common features:

- Rapid life cicles
- Planktonic larval stages
- High fishing pressure due to high commercial values (> 50% of the total fish catches in the basin) *(FAO, 2020)*

But...

Responses to climate (biomass and distribution) & fishing pressure vary between species.



Introduction – Pelagic fish

Sardina pilchardus

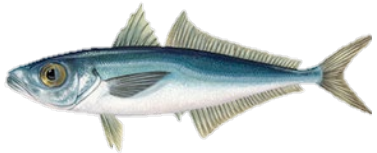
Engraulis encrasicolus

Sardinella aurita

Scomber colias

Trachurus trachurus

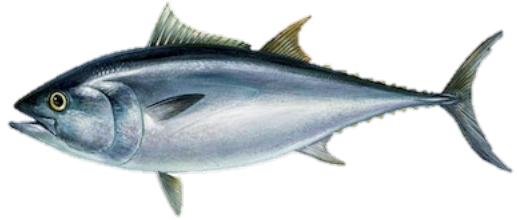
Trachurus mediterraneus



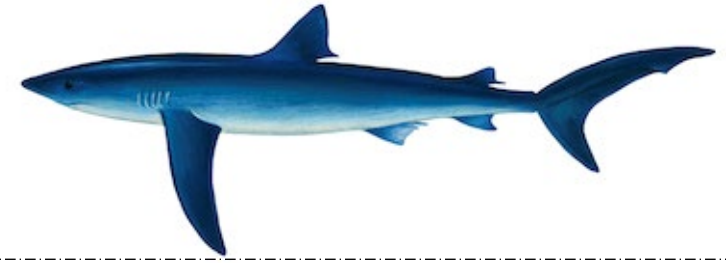
Lepidopus caudatus

Sphyraena sphyraena

Little tunny



Prionace glauca



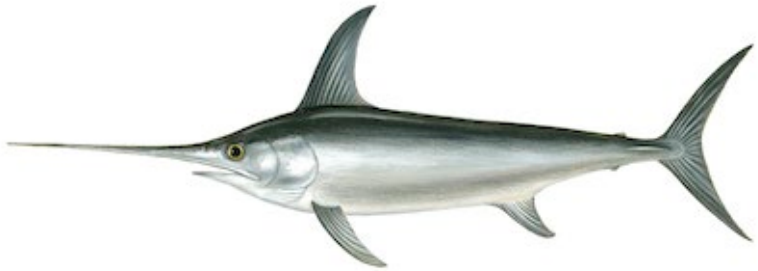
Mobula mobular

Katsuwonus pelamis

Sarda sarda

Thunnus thynnus

Xiphias gladius

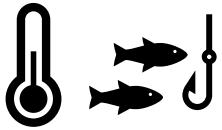


Pictures from: https://conxemar.com

Research questions

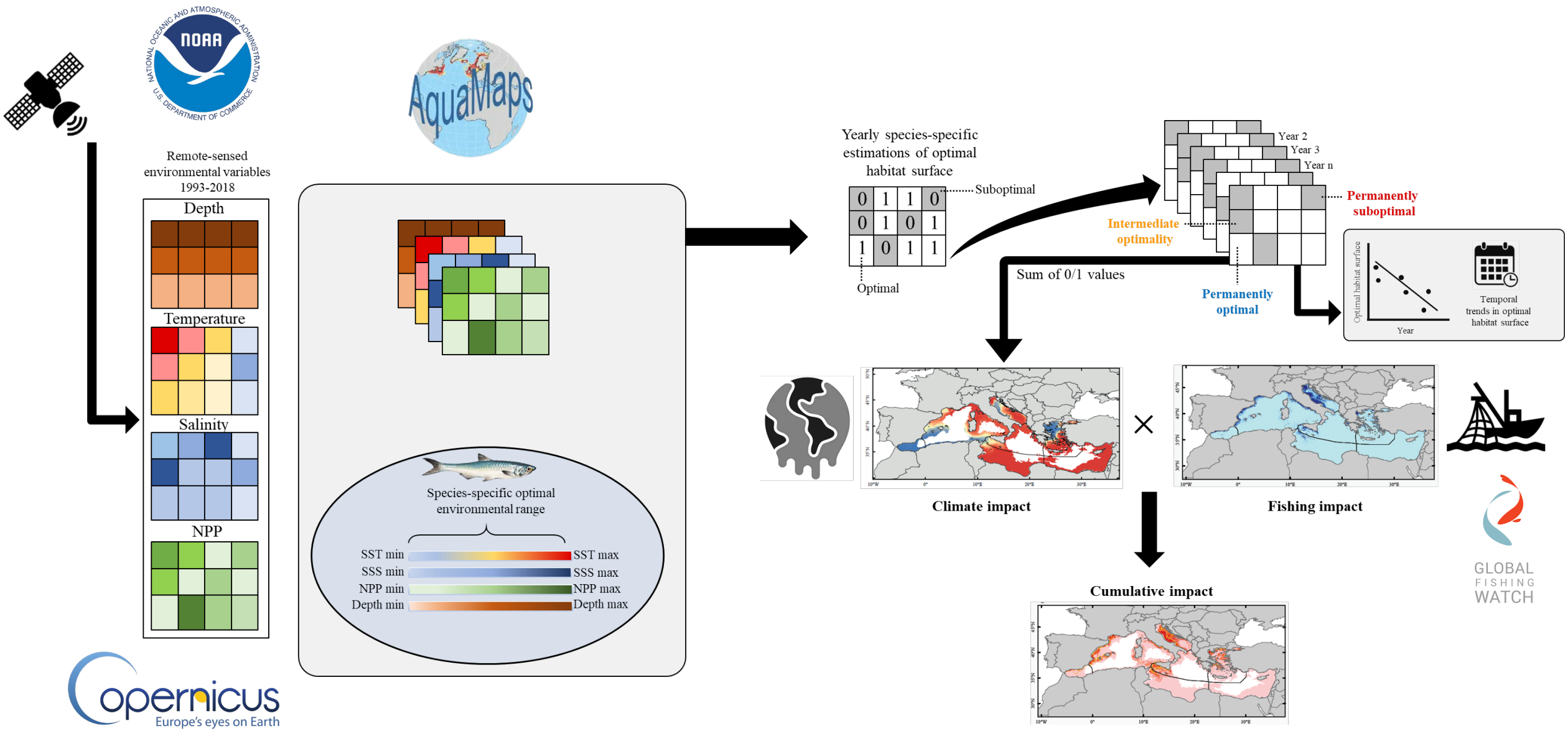
- How has the availability of optimal habitat evolved in the last two decades for the species of the Mediterranean pelagic fish community?

- Where are suboptimal habitats most persistent in time within the basin?

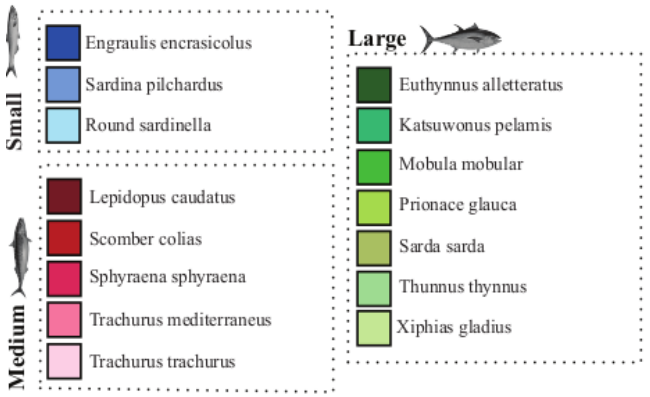


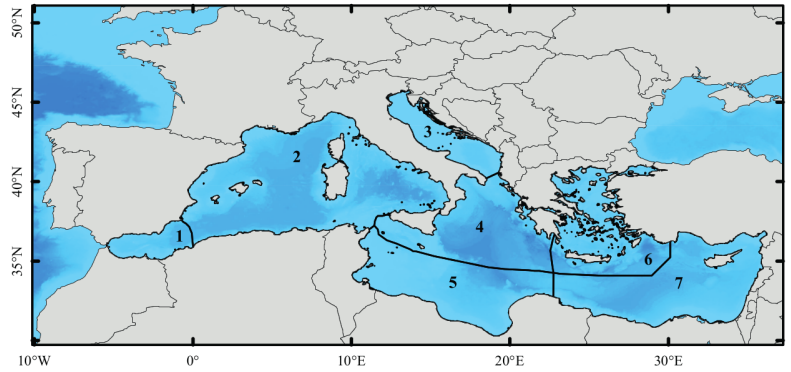
- Where do persistently suboptimal habitats overlap the most with intense fishing activities?

Material and methods - Workflow

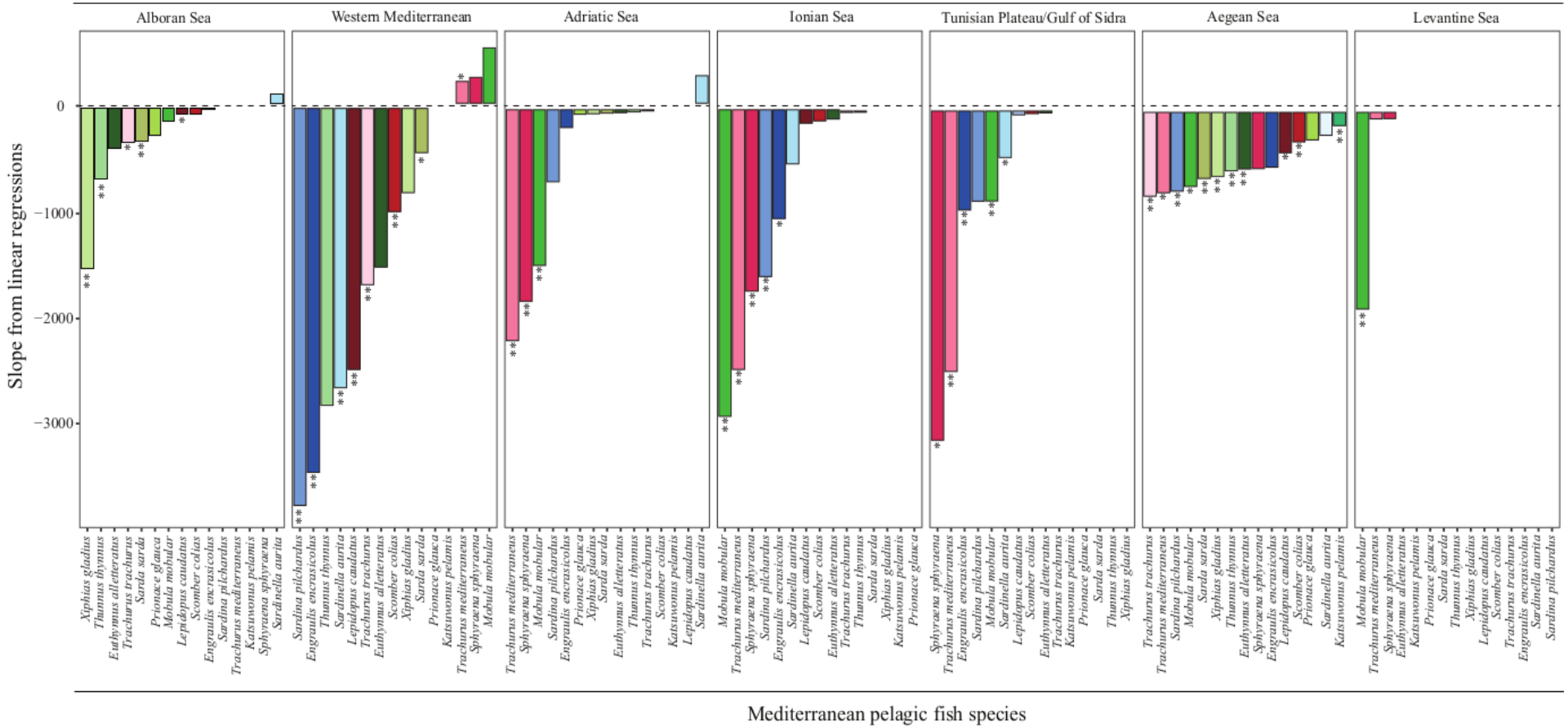


Results & Discussion – Temporal trends

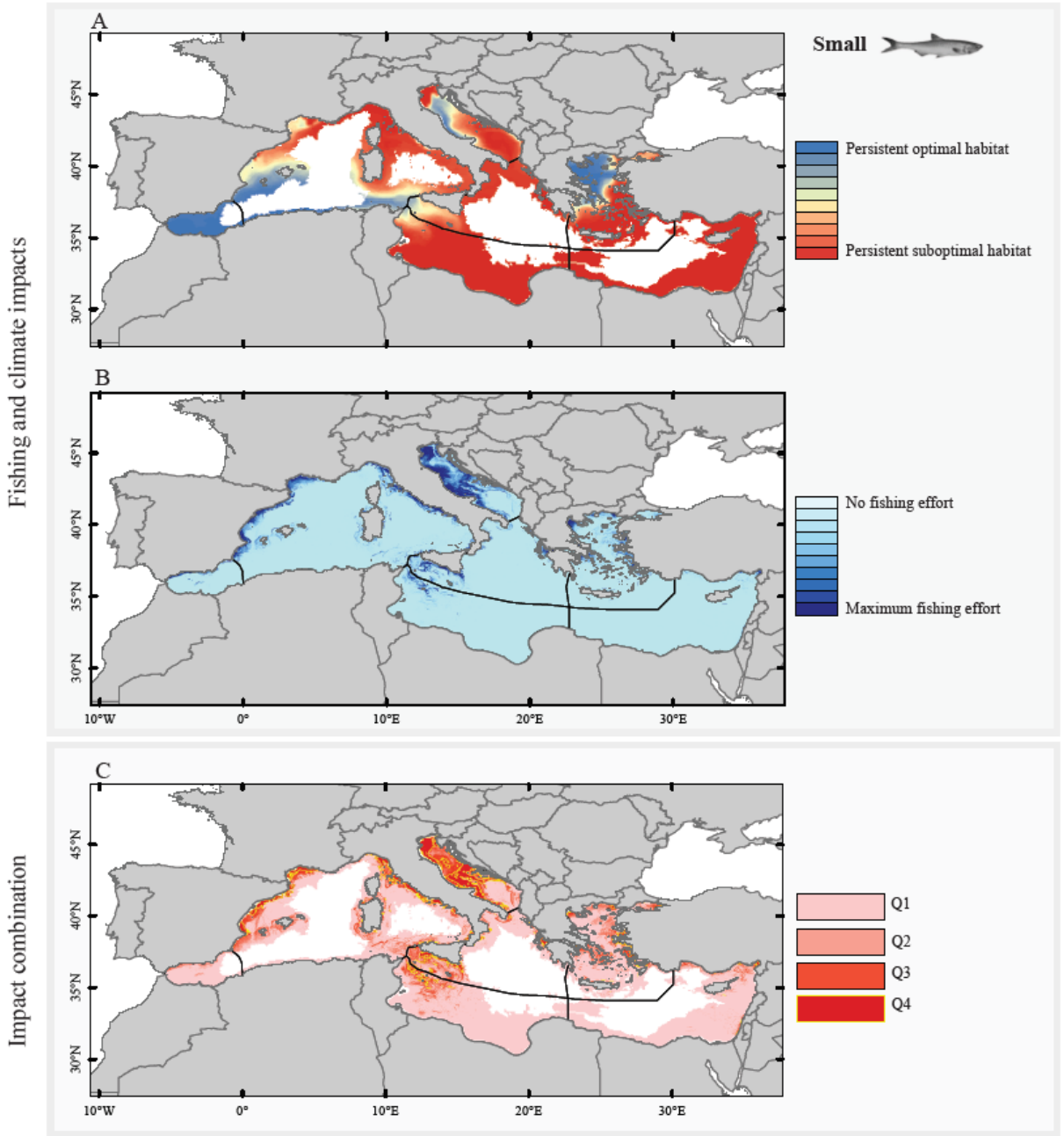




Mediterranean Marine Ecorregions



Results & Discussion – Small pelagic fish

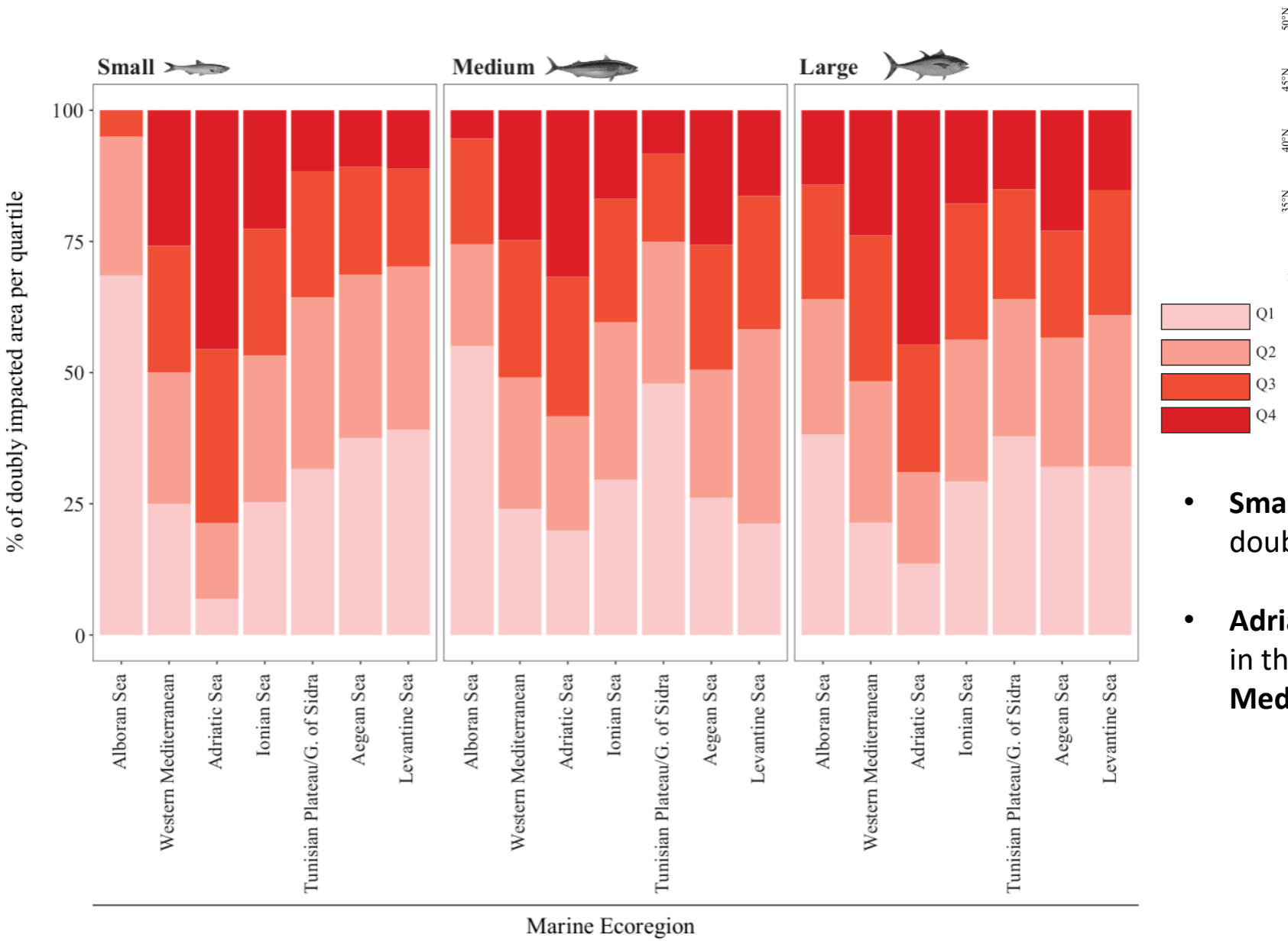


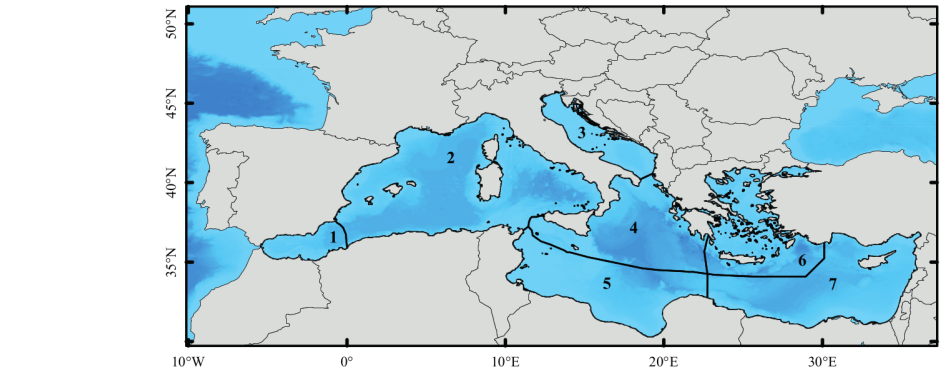
- **Permanently suboptimal areas**: suboptimal 1993-2018
- **Intermediate optimal habitat persistency**: deterioration of environmental conditions along study period.
- **Permanently optimal areas**: optimal 1993-2018.

- Purse seiners and trawlers.
- **Highest in** Eastern Spain, Western italy, Sicily Strait, Adriatic Sea, Northern Aegean.

- **Permanently suboptimal areas**: generally not doubly impacted.
- Environmental deterioration **not accompanied by the necessary reduction of fishing pressure**, like in the coast of Spain.
- **Doubly** impacted areas in coast of Spain, Gulf of Lions, Sicily strait, Adriatic Sea.

Results & Discussion – Impact Surface by Ecoregion





- **Small pelagics** have the largest proportion of doubly impacted areas.
- **Adriatic Sea** most impacted marine ecoregion in the three groups. Followed by **Western Mediterranean.**

Management perspectives – SOS framework

- Our spatially-explicit assessment within the SOS framework contributes to the identification of highly impacted marine areas and species where fisheries can be regulated or reduced to keep species and ecosystems resilient to climate change.

- Recently, it has been suggested that fisheries could be reallocated to low-impacted, 'resilient' areas where "oceanographic processes drive range expansion opportunities that may support sustainable growth in the medium term" (i.e., climate change 'bright spots'; Queirós et al., 2021).

- Our approach, based on risk assessment methods within a SOS framework, can be applied globally to contribute to the conservation and sustainable exploitation of marine ecosystems.

ELEMENTA Science of the Anthropocene

Ouled-Cheikh, J, et al. 2022. Fisheries-enhanced pressure on Mediterranean regions and pelagic species already impacted by climate change. *Elem Sci Anth*, 10: 1. DOI: https://doi.org/10.1525/elementa.2022.00028

RESEARCH ARTICLE

Fisheries-enhanced pressure on Mediterranean regions and pelagic species already impacted by climate change

Jazel Ouled-Cheikh[1,2,*], Marta Coll[1,3], Luis Cardona[2], Jeroen Steenbeek[3], and Francisco Ramírez[1]

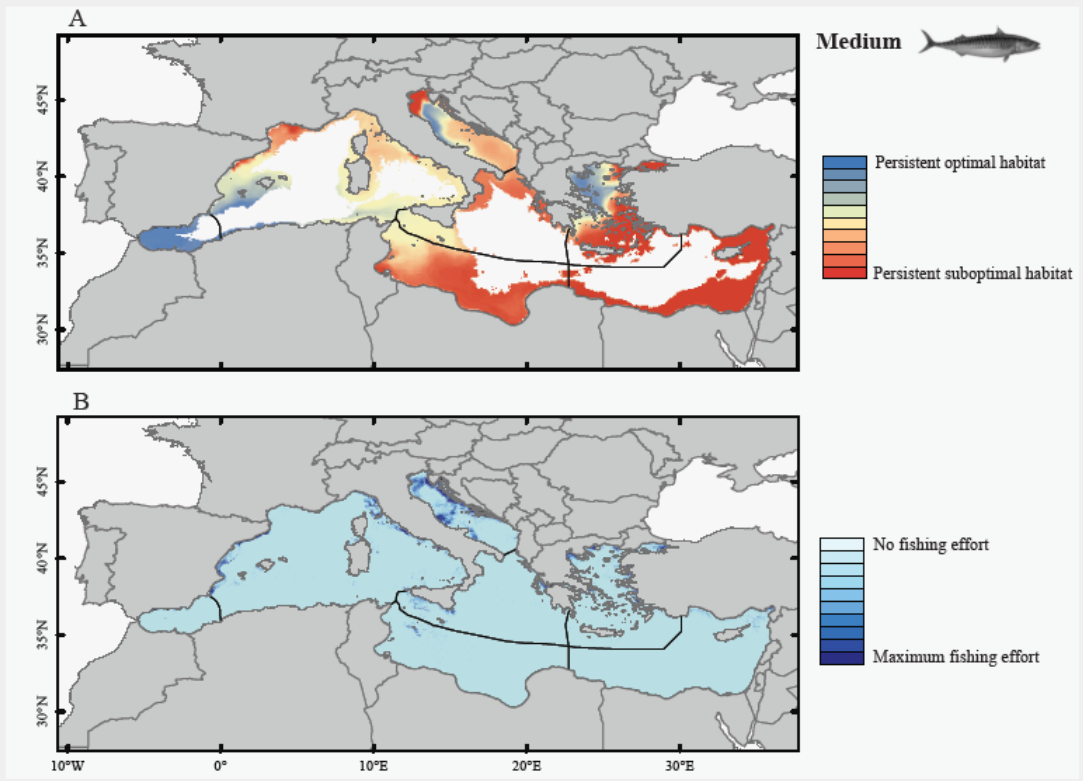
@jazelouled

jazelouled@gmail.com

Thanks! Questions?

Results & Discussion – Medium pelagic fish

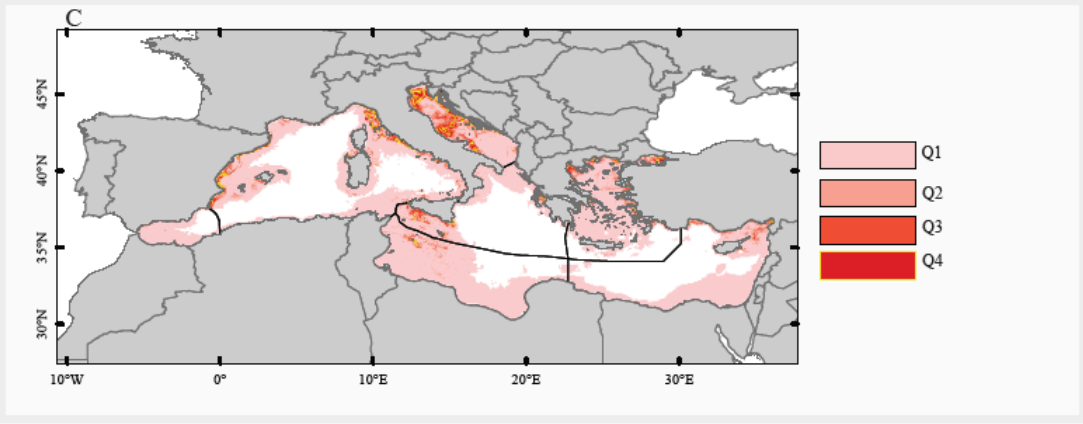
Fishing and climate impacts



- **Intermediate optimal habitat persistency**: more extense than in small pelagics.
- **Contrasting trends**: *Trachurus trachurus, Scomber colias, Lepidopus caudatus;* *Trachurus mediterraneus, Sphyraena sphyraena.*
  - *Trachurus trachurus, Scomber colias, Lepidopus caudatus;* → Cold water species
  - *Trachurus mediterraneus, Sphyraena sphyraena.* → Thermophilic (species replacement?)

- Purse seiners
- **Lower** than for small pelagics, similar areas

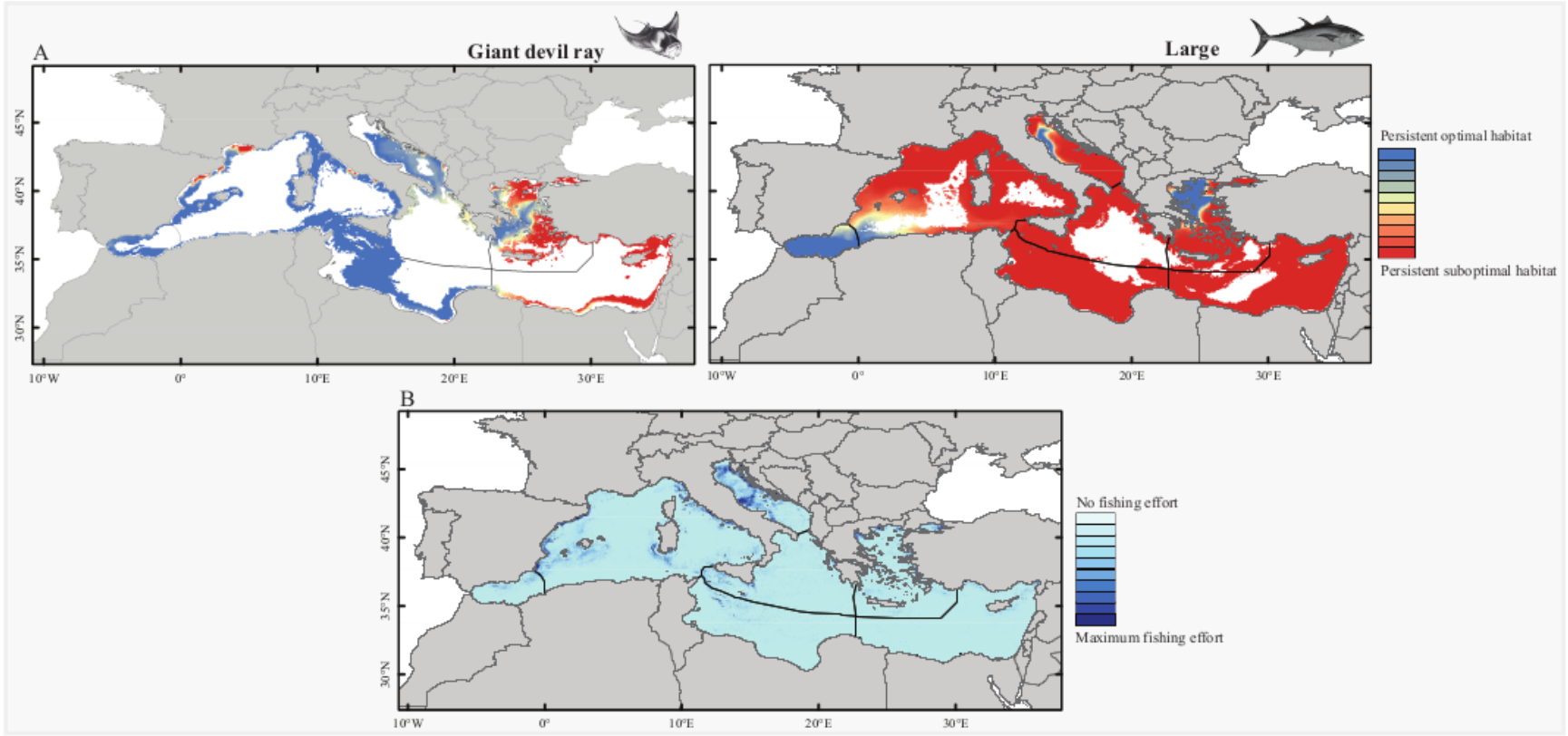
Impact combination



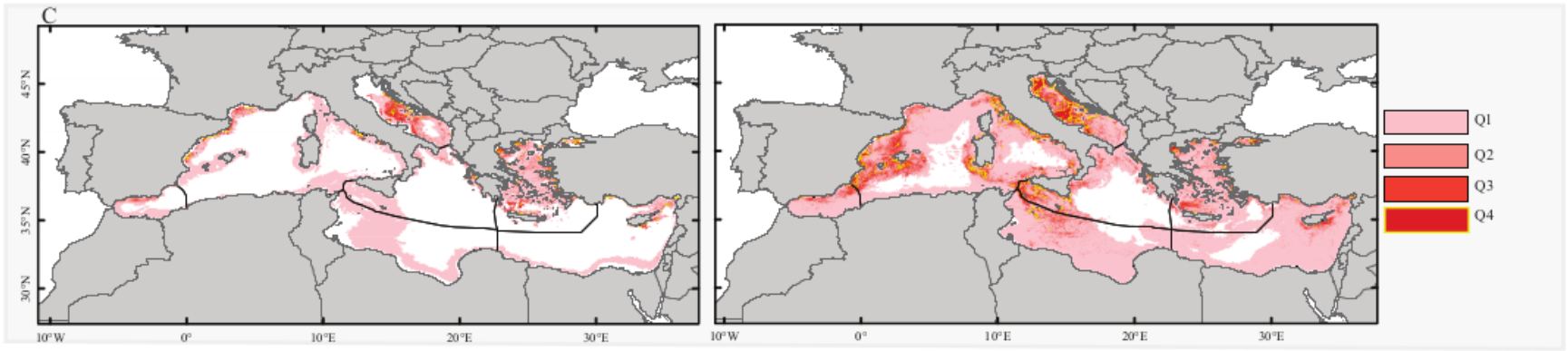
- **Less** highly, doubly impacted basin surface than for small pelagics.

Results & Discussion – Large pelagic fish

Fishing and climate impacts



Impact combination



- **Massive losses** of optimal habitat surface for most of the investigated species, except for the giant devil ray.
- Habitat reduced for large pelagic fish with **high trophic position** in the Mediterranean.

→ Major changes in marine pelagic food webs

- Purse seiners, drifting long liners, fixed gear.
- Less impact than small pelagics, more than medium.

- Doubly impacted area tunas & blue shark >> giant devil ray.
- Highlighted zones similar to small pelagics