



# HUMAN-PREDATOR COEXISTENCE IN THE OCEANS: RESOLVING THE GROWING DEPREDATION CONFLICT IN GLOBAL FISHERIES

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PhD 2023-2026 (Funding by PPR Océan et Climat)

Co-supervised by

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(UMR CNRS-Sciences Po CEVIPOF)

**Paul Tixier**

(UMR MARBEC IRD)

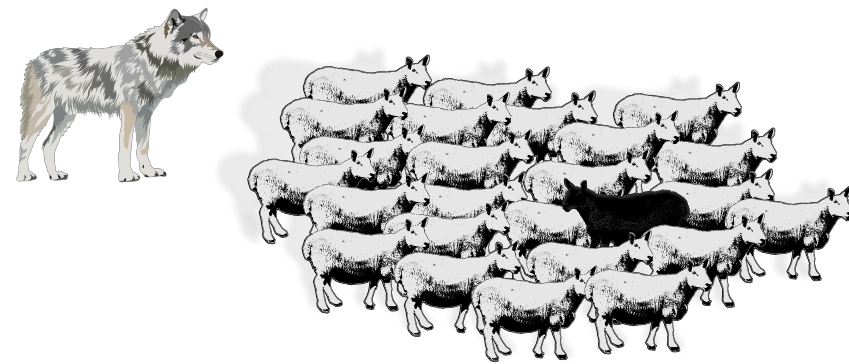
In collaboration with Mary-Anne Lea, Mark A. Hindell, Dirk Welsford, Sophie Gourguet and John P. Y. Arnould

# COMPETITION FOR SPACE AND RESOURCE

## ↳ HUMAN-WILDLIFE CONFLICTS

“Human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife.” (Madden, 2004)

In terrestrial environment



Attacks on livestock



Crop raiding

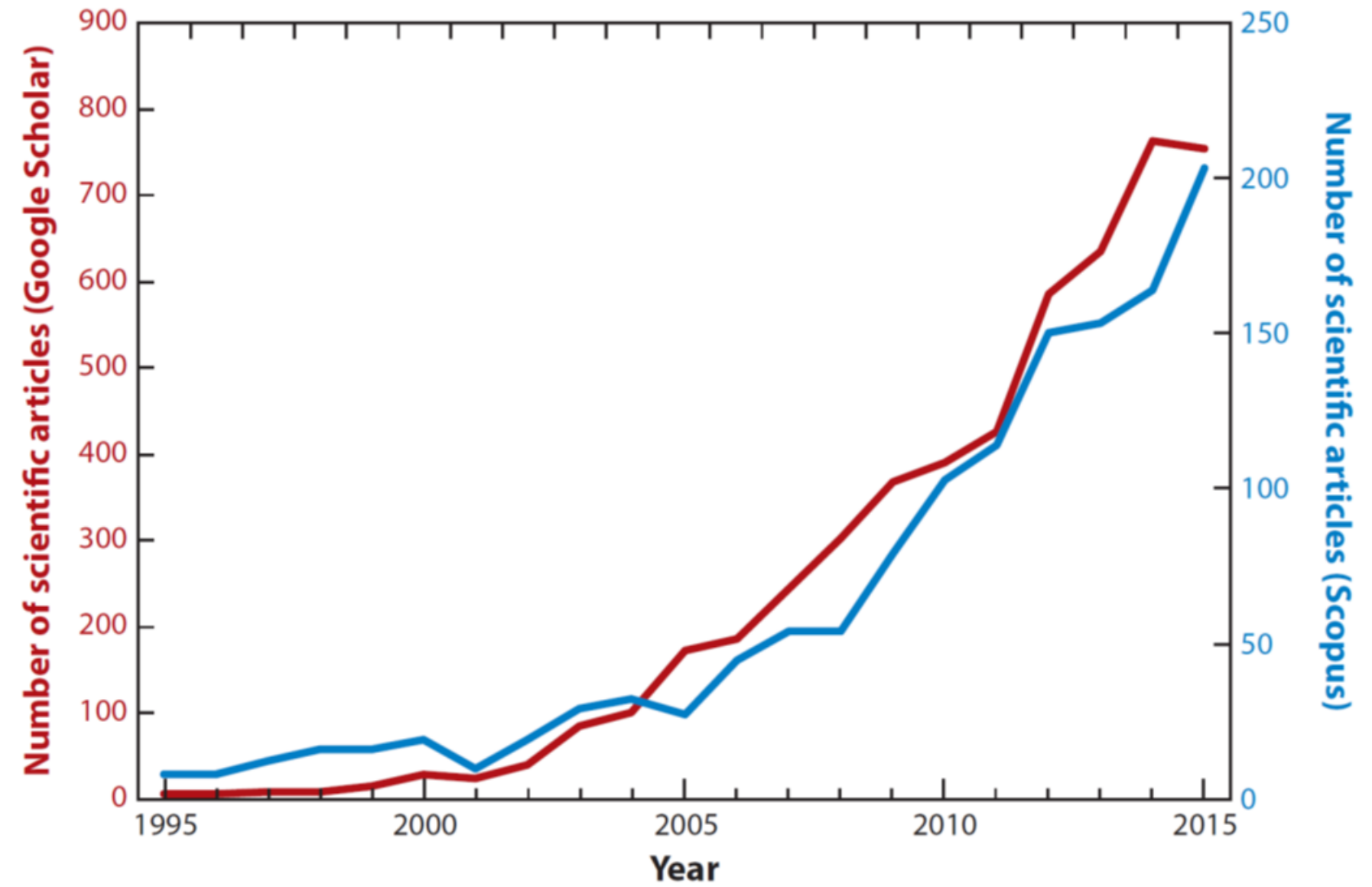


Socio-economic, ecological and conservation impacts

Inskip & Zimmermann, 2009. *Oryx*  
Treves et al. 2006. *Human Dimensions of Wildlife*  
Thirgood, Woodroffe, & Rabinowitz, 2005. *Conservation Biology*

# COMPETITION FOR SPACE AND RESOURCE

## ↳ HUMAN-WILDLIFE CONFLICTS

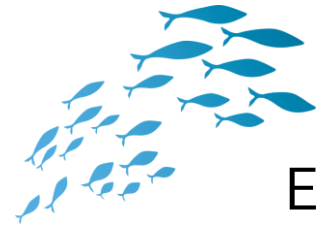


Nyhus, 2016

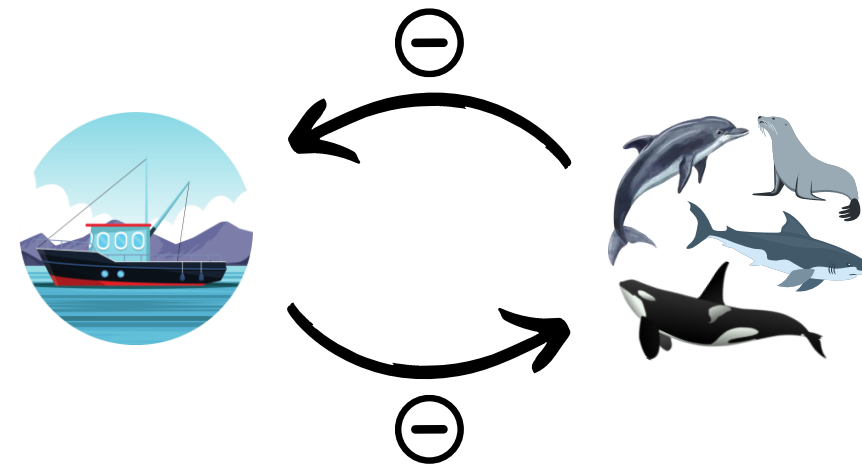
Limited in the marine environment : an emerging issue ?

# COMPETITION FOR SPACE AND RESOURCE

## HUMAN-WILDLIFE CONFLICTS



Expansion and intensification of fishing activities combined with a decline in fish stocks increased frequency and severity of conflicts



### Competition for resources



### Direct interactions



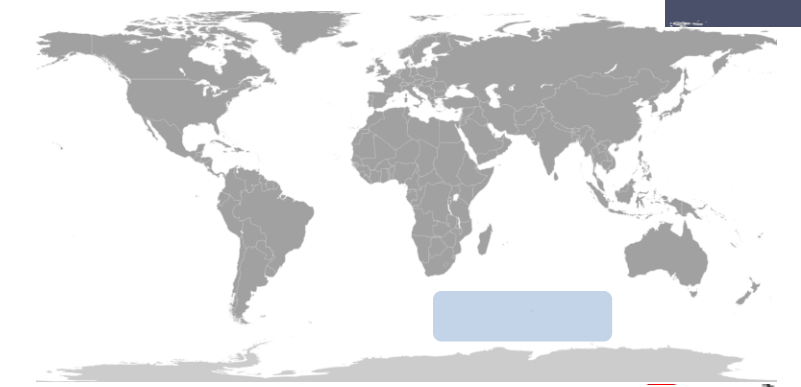
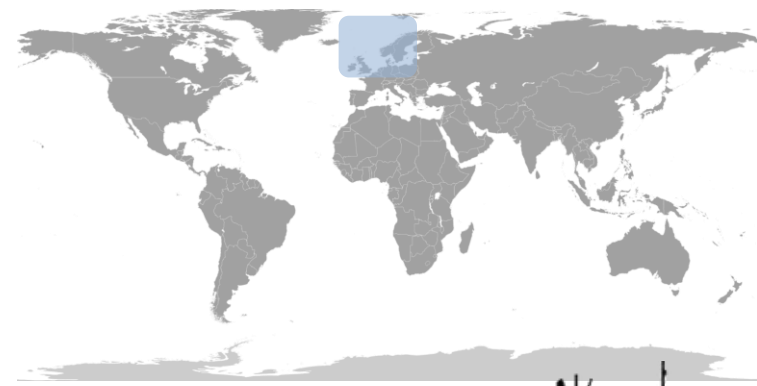
Bycatch



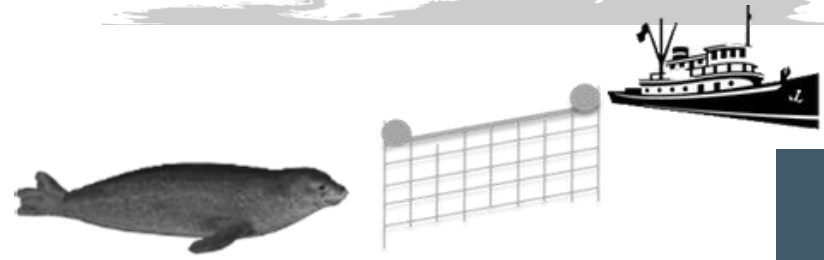
Depredation

North Atlantic

# CONFLICTS ASSOCIATED WITH DEPREDATION BEHAVIOUR

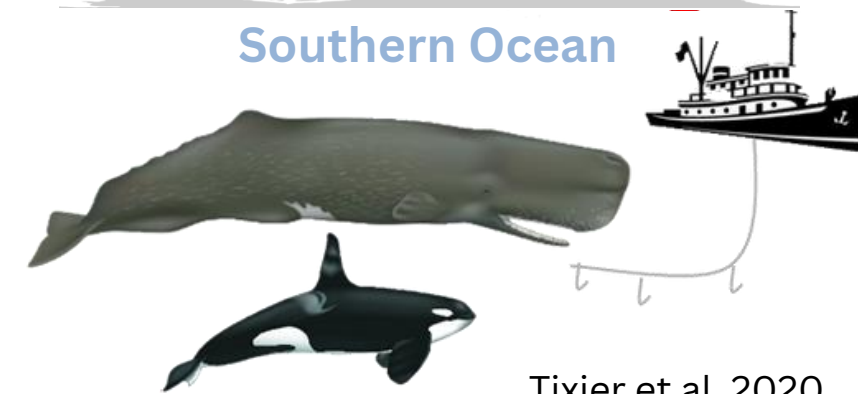


Southern Ocean



Königson et al. 2009

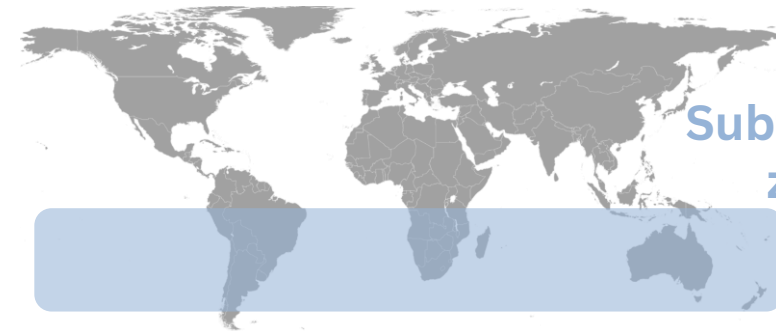
## Pinnipeds



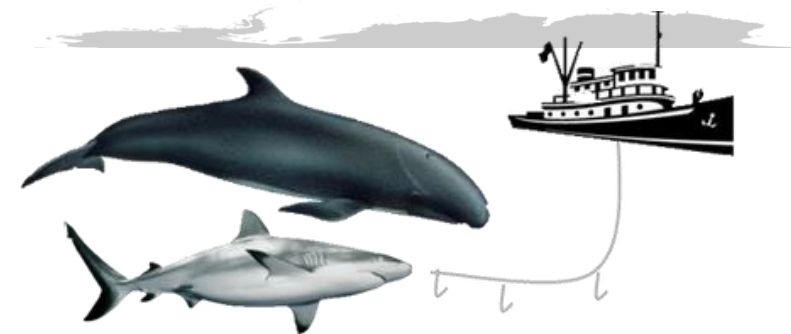
Tixier et al. 2020



## Odontocetes



Subtropical zone



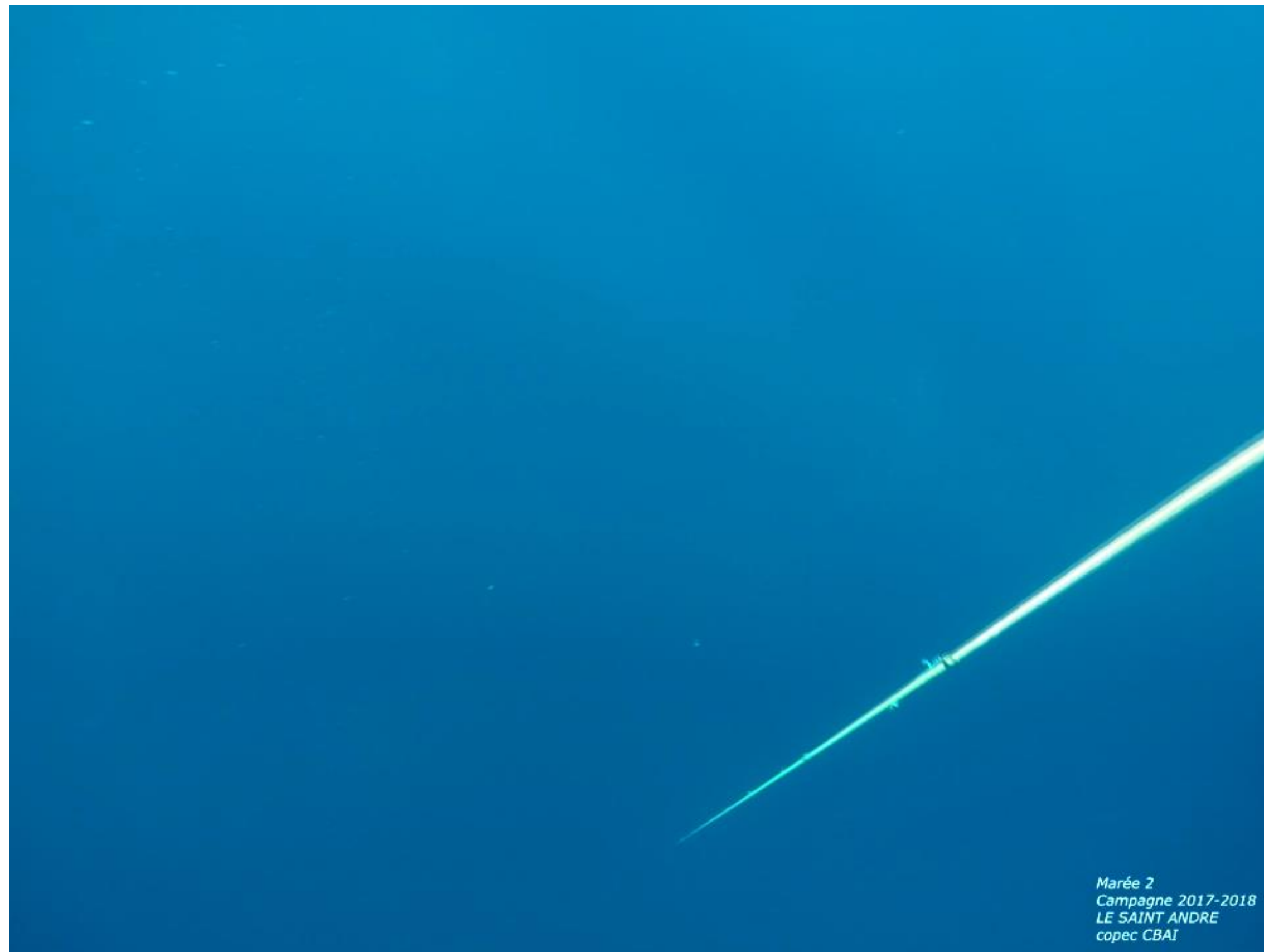
Rabearisoa et al. 2018  
Mollier et al. 2024



## Sharks

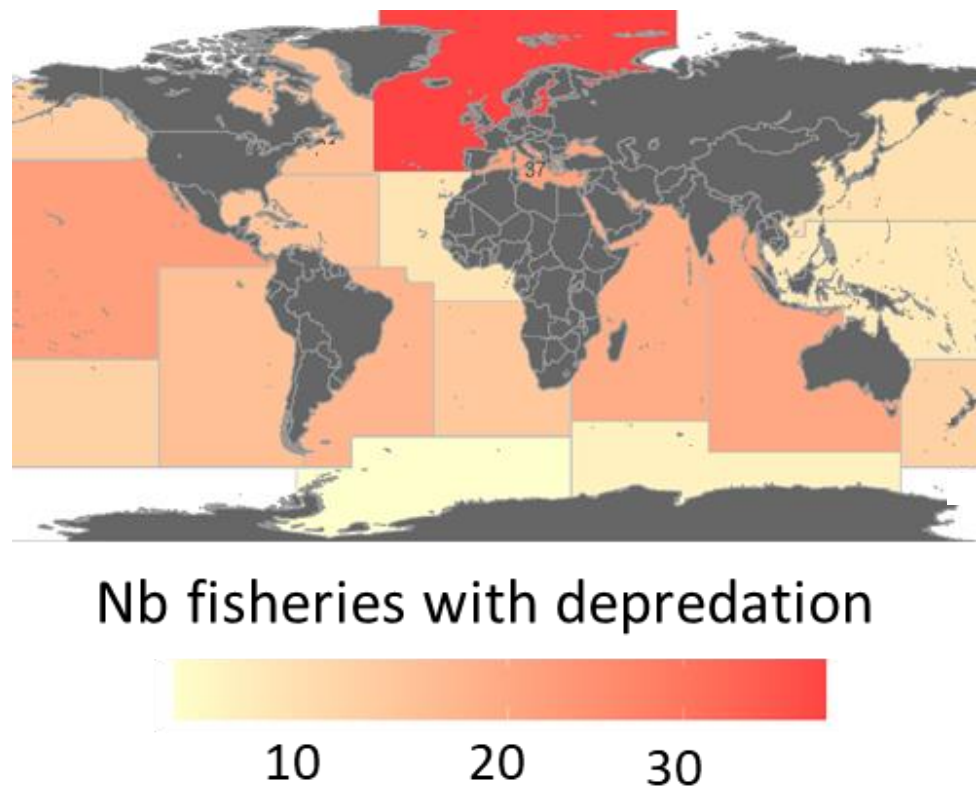


# KILLER WHALE DEPREDATION ON LONGLINE CATCHES IN THE SOUTHERN OCEAN

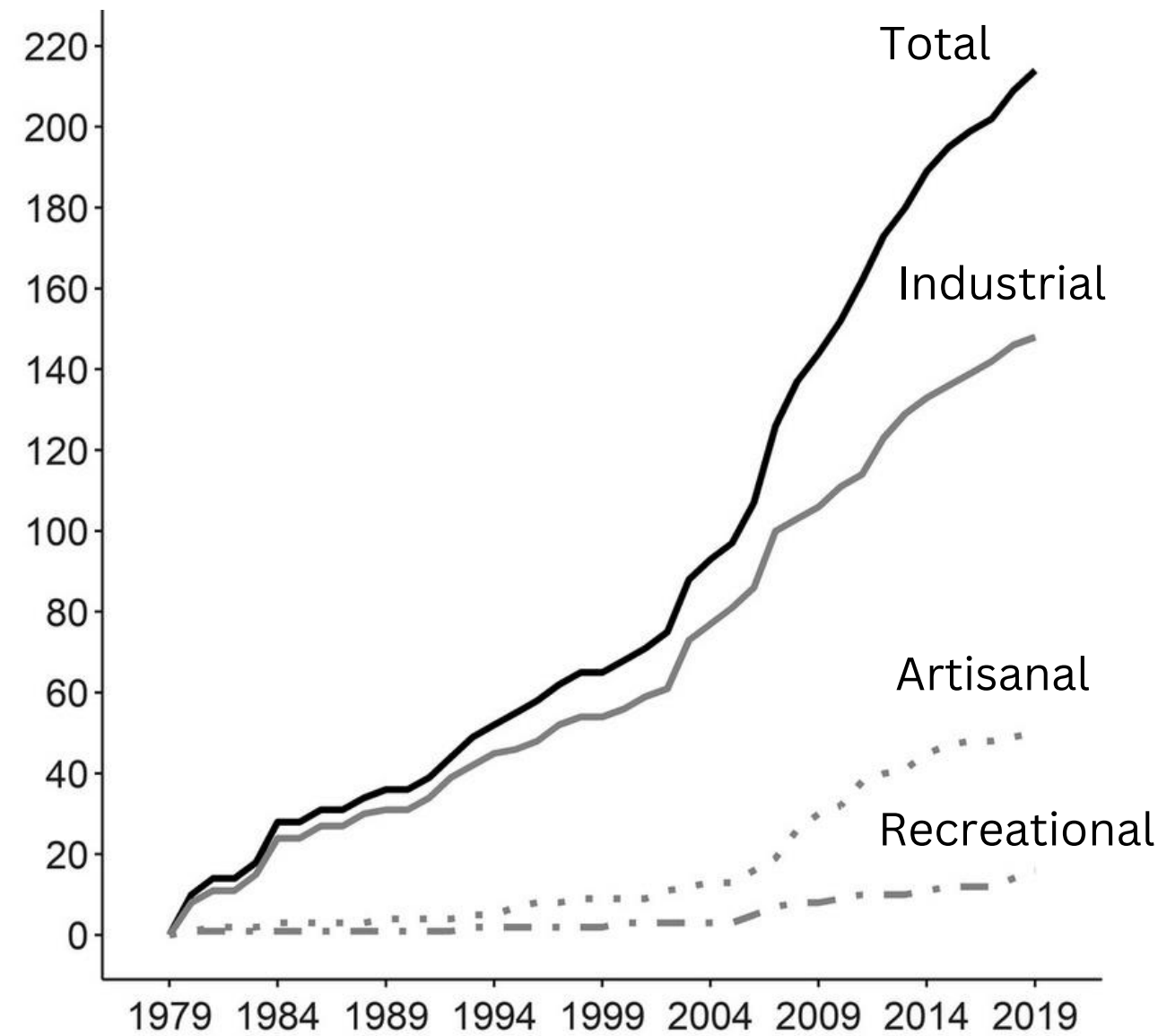


# DEPREDTION ON FISHERIES CATCHES

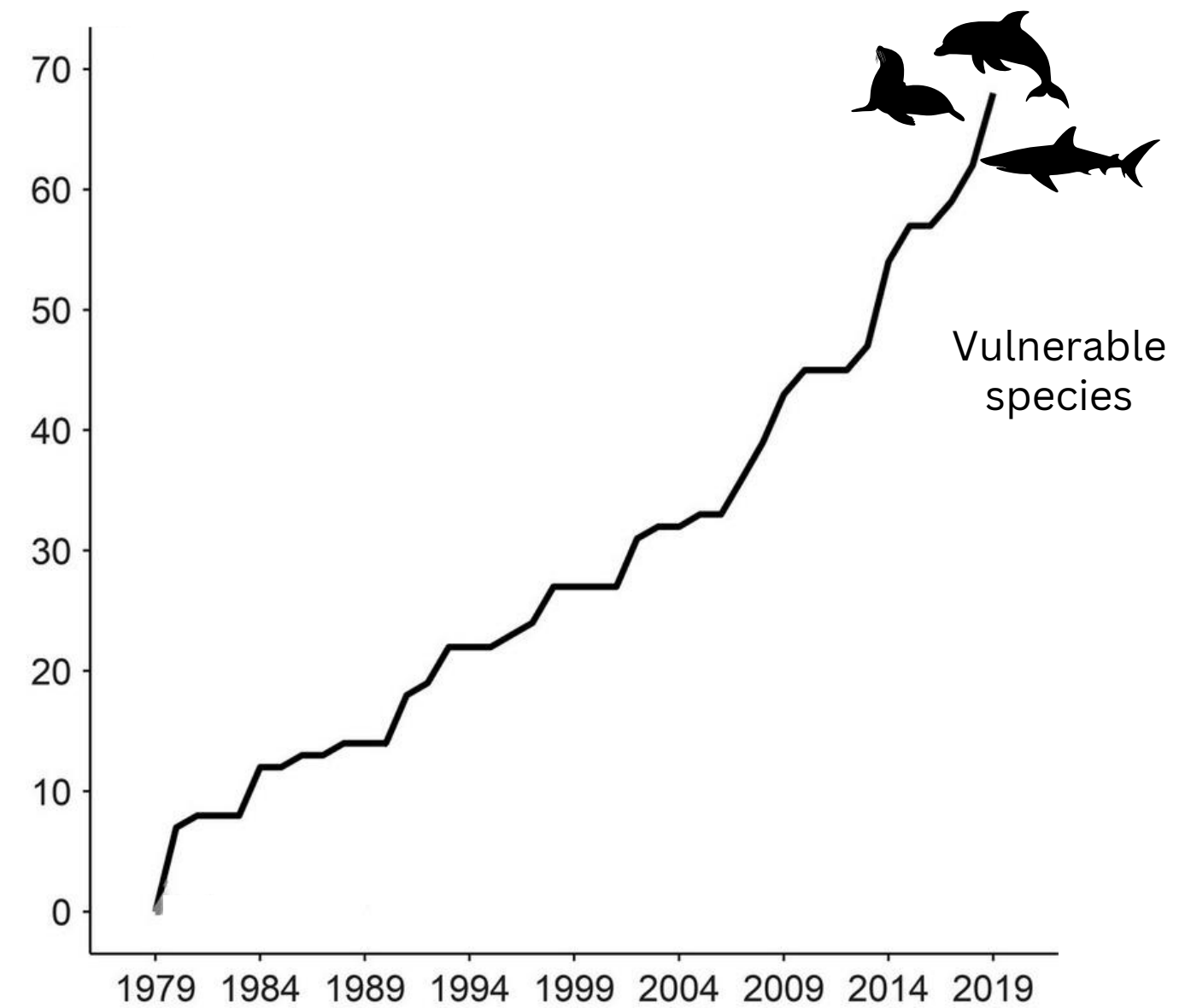
A growing issue worldwide



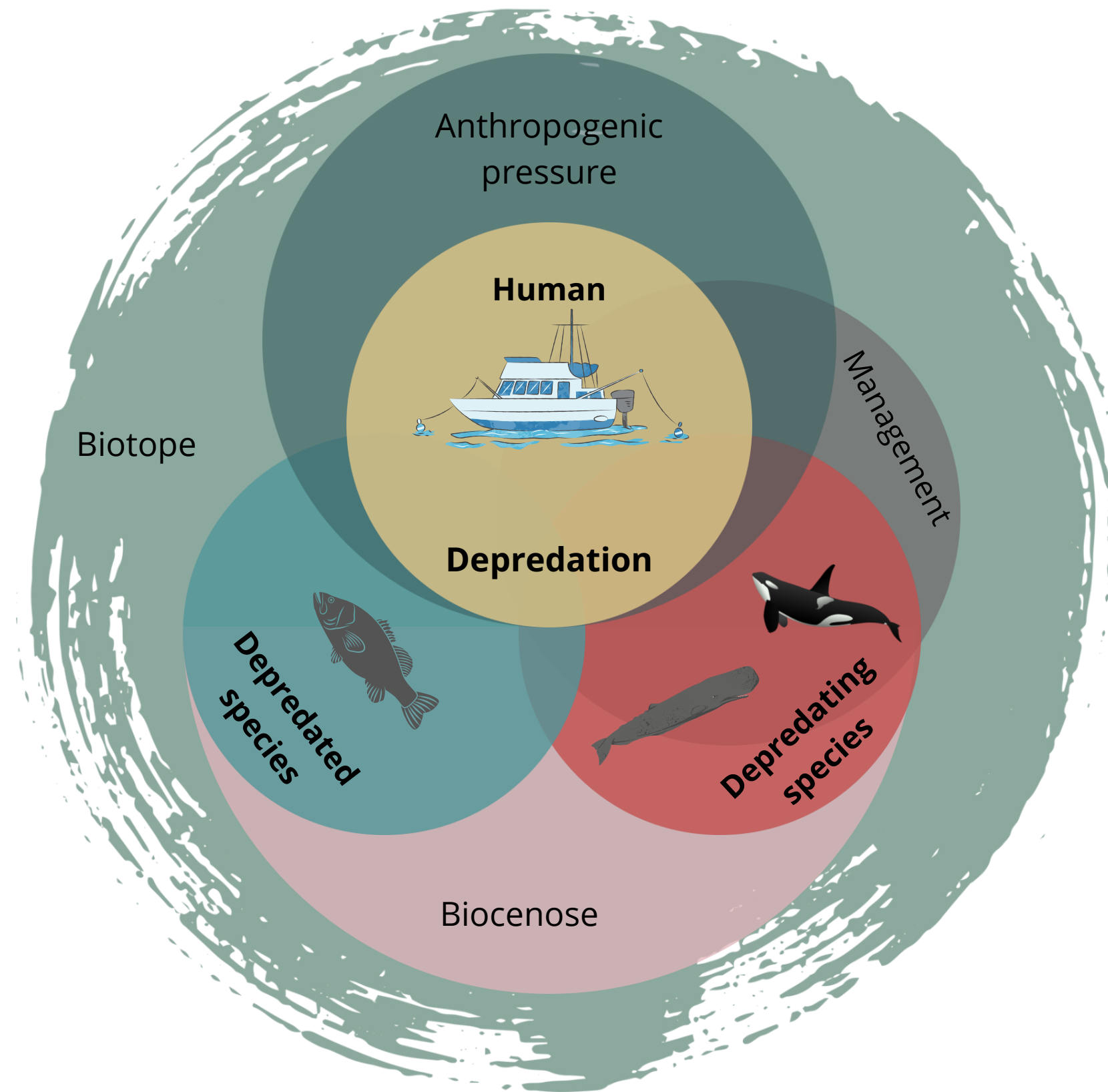
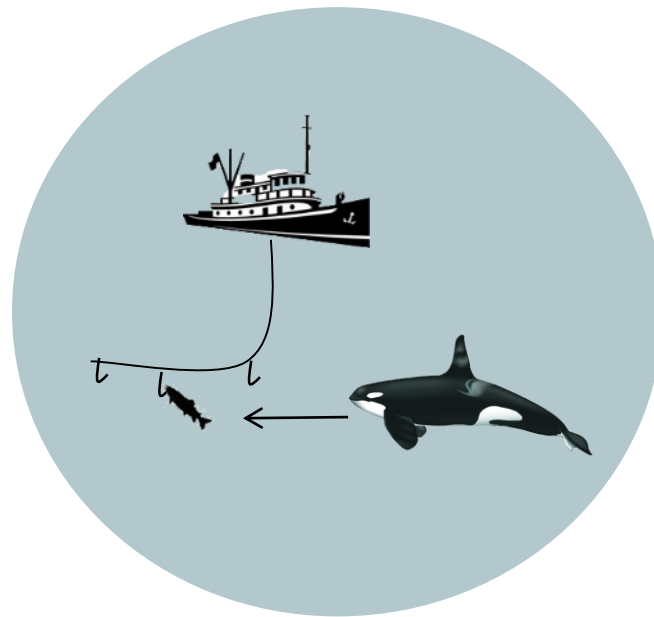
### Number of impacted fisheries



### Number of species involved



# MAIN COMPONENTS OF SOCIO-ECOLOGICAL SYSTEMS STRESSED BY DEPREDATION CONFLICT

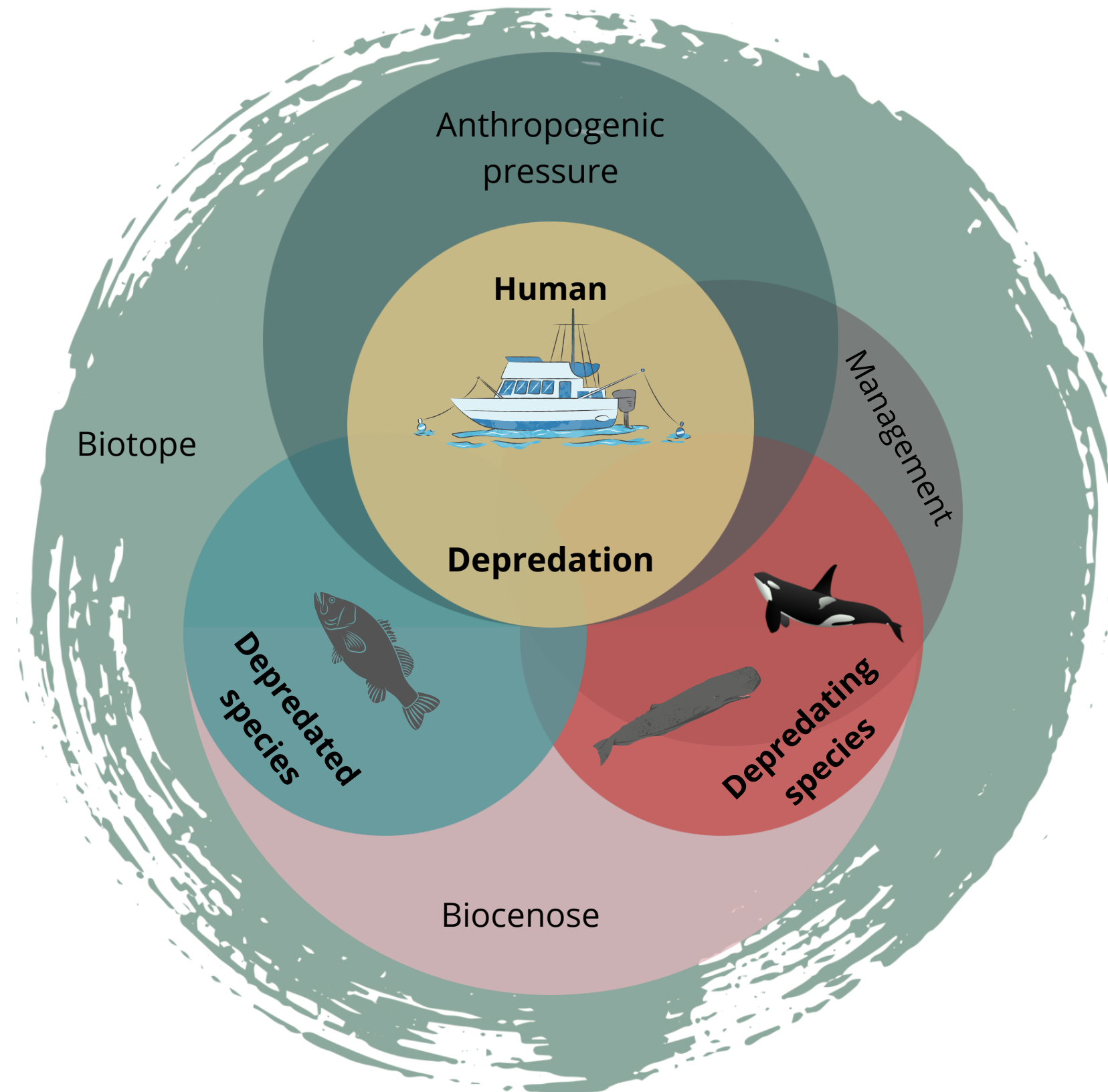




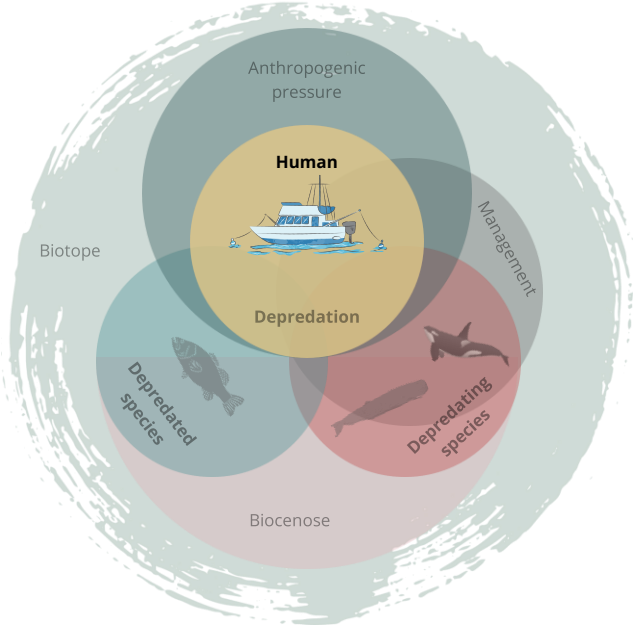
# MAIN COMPONENTS OF SOCIO-ECOLOGICAL SYSTEMS STRESSED BY DEPREDATION CONFLICT

## Impacts on fishermen and fishing activities

Reduced yields  
Damage to gears  
Extra effort to compensate for losses



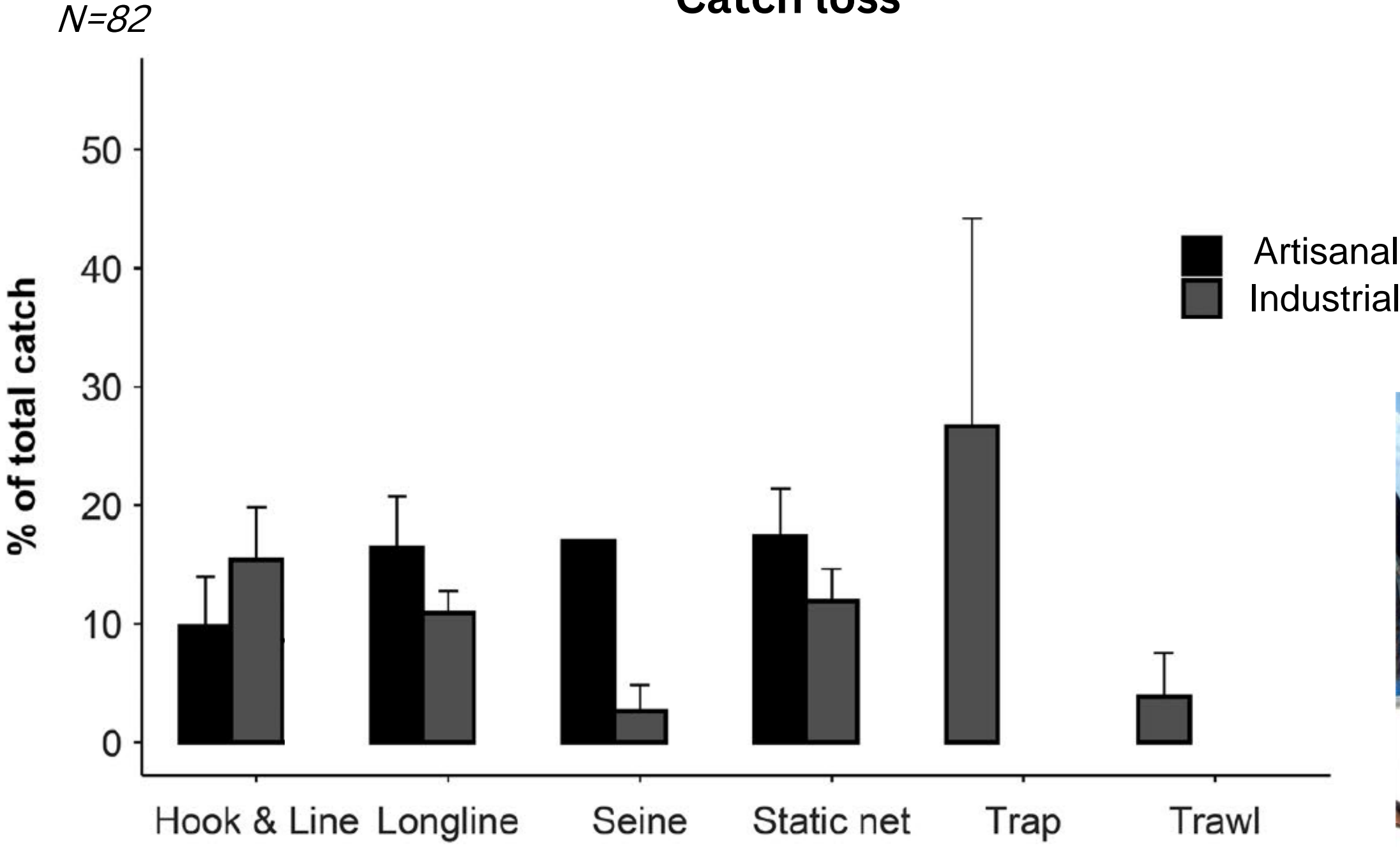
# SOCIO-ECONOMIC IMPACTS



**Impacts on fishermen and fishing activities**

**Reduced yields**  
 Damage to gears  
 Extra effort to compensate for losses

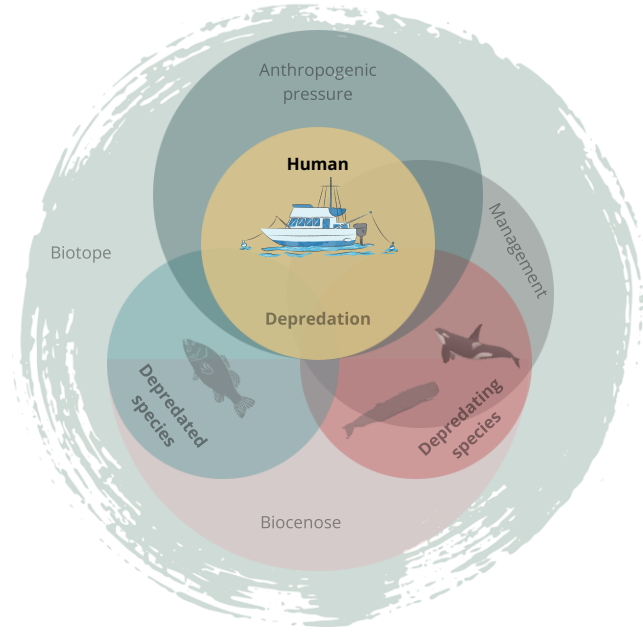
## Catch loss



→ Underestimation of catch losses



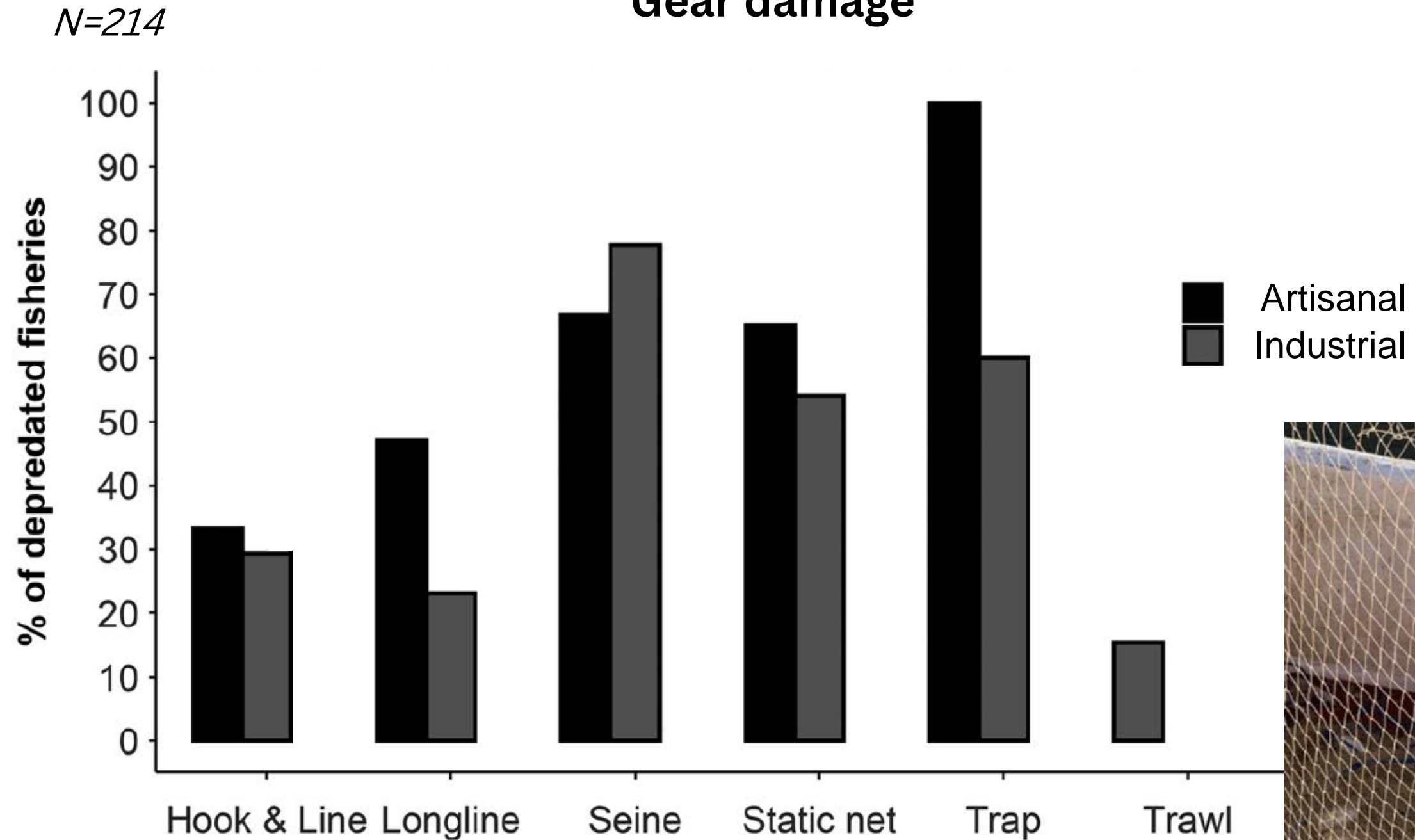
# SOCIO-ECONOMIC IMPACTS



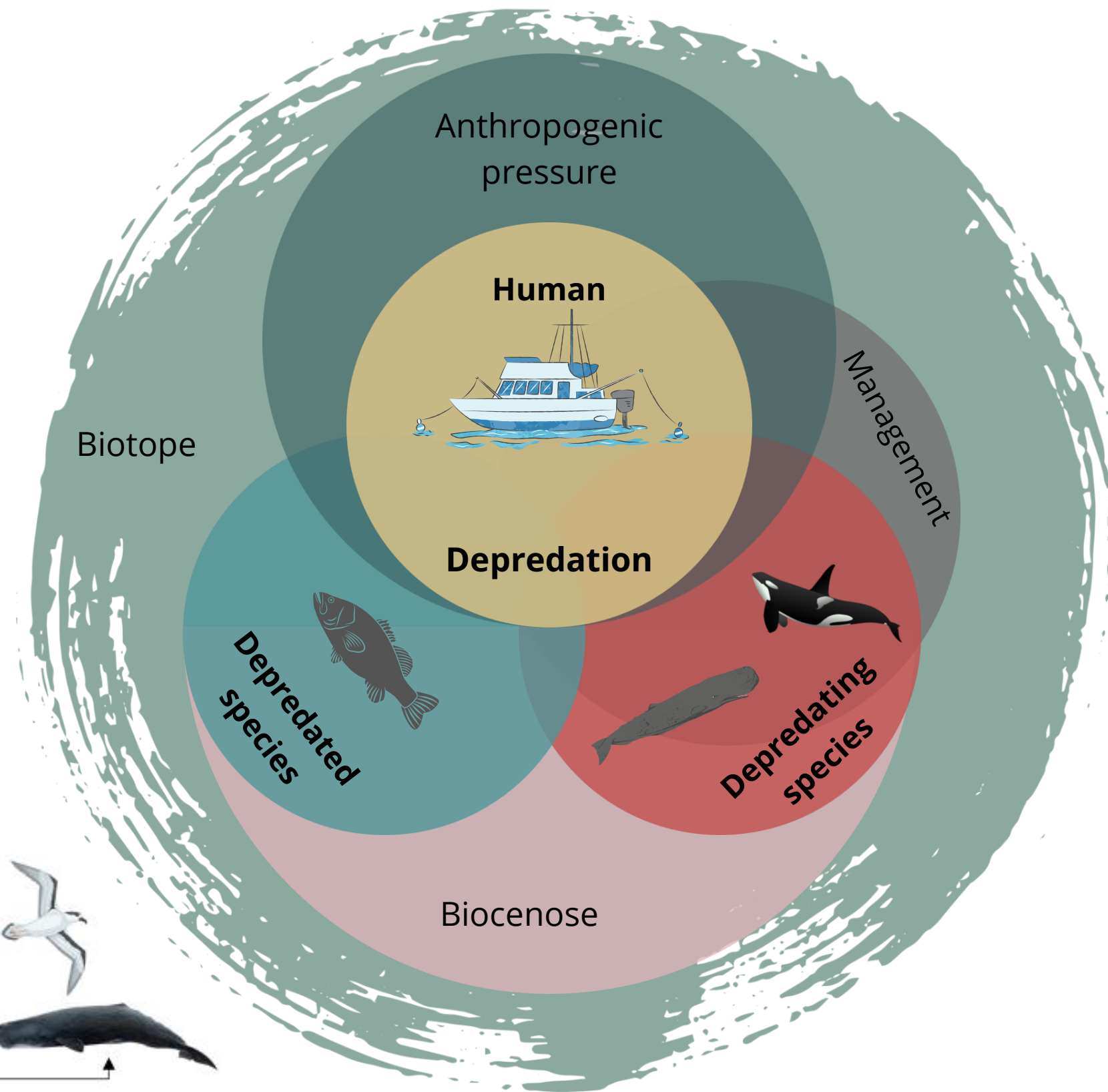
**Impacts on fishermen and fishing activities**

- Reduced yields
- Damage to gears**
- Extra effort to compensate for losses

## Gear damage



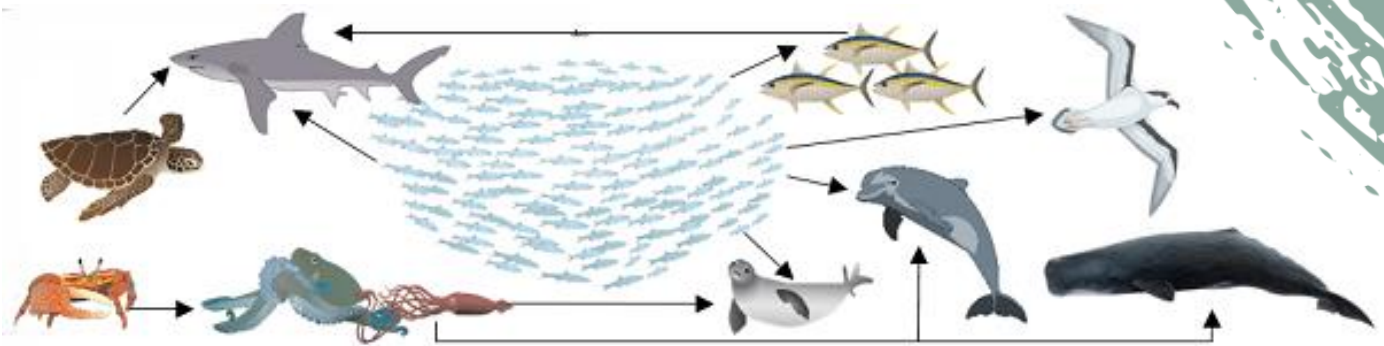
# MAIN COMPONENTS OF SOCIO-ECOLOGICAL SYSTEMS STRESSED BY DEPREDATION CONFLICT



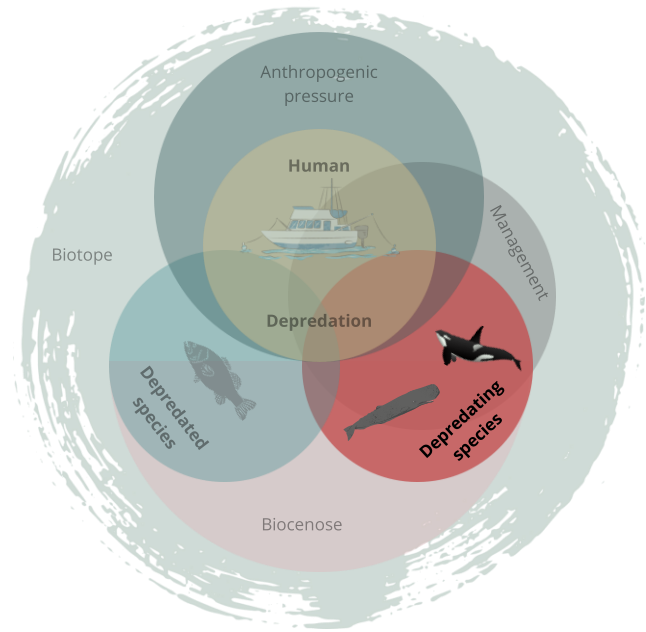
## Impacts on predators and associated ecosystems

Risk of injury/death on gears  
 Lethal practices  
 Alteration of trophic interactions and predation pressure

~ 80% of species caught accidentally or killed intentionally



# ECOLOGICAL EFFECTS

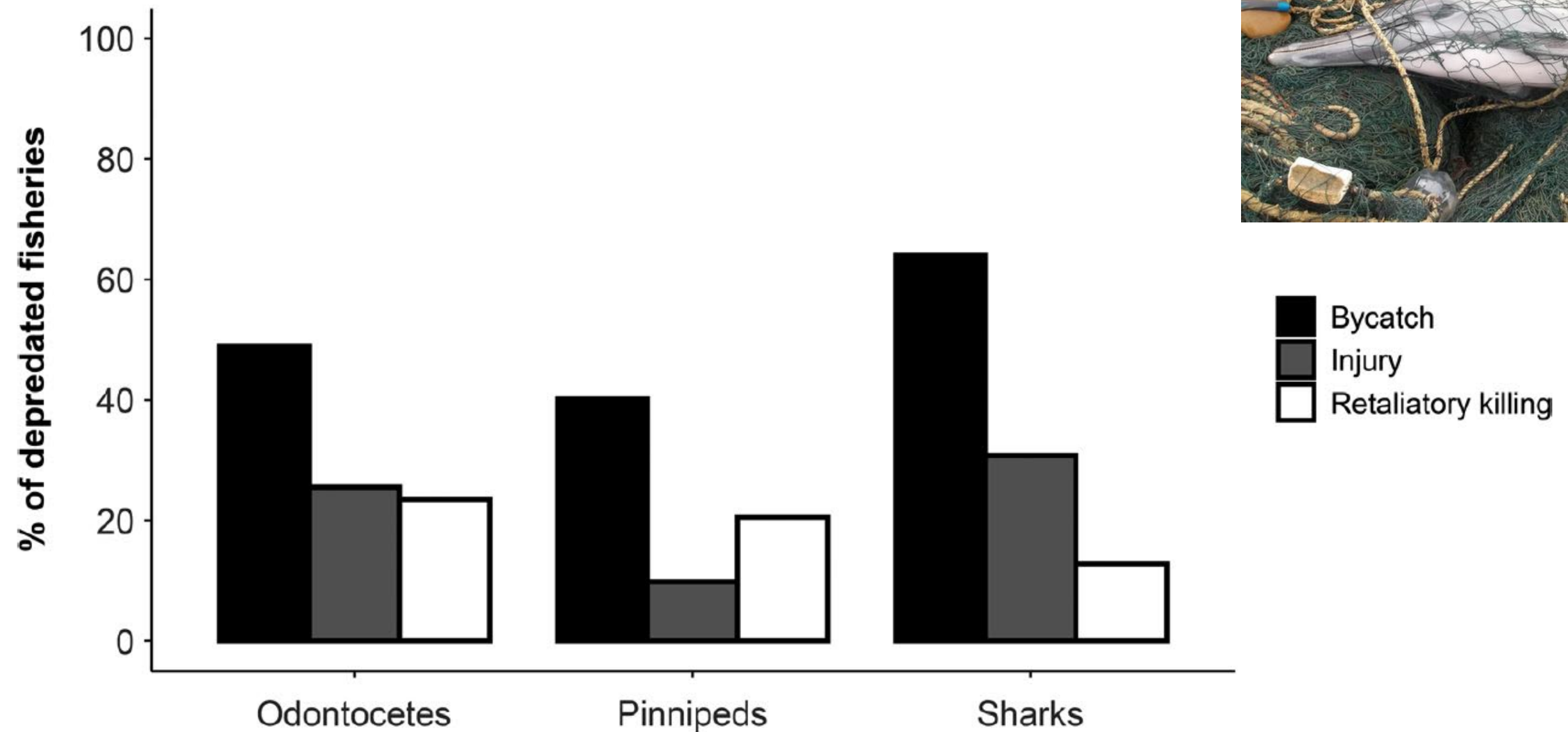


**Impacts on predators and associated ecosystems**

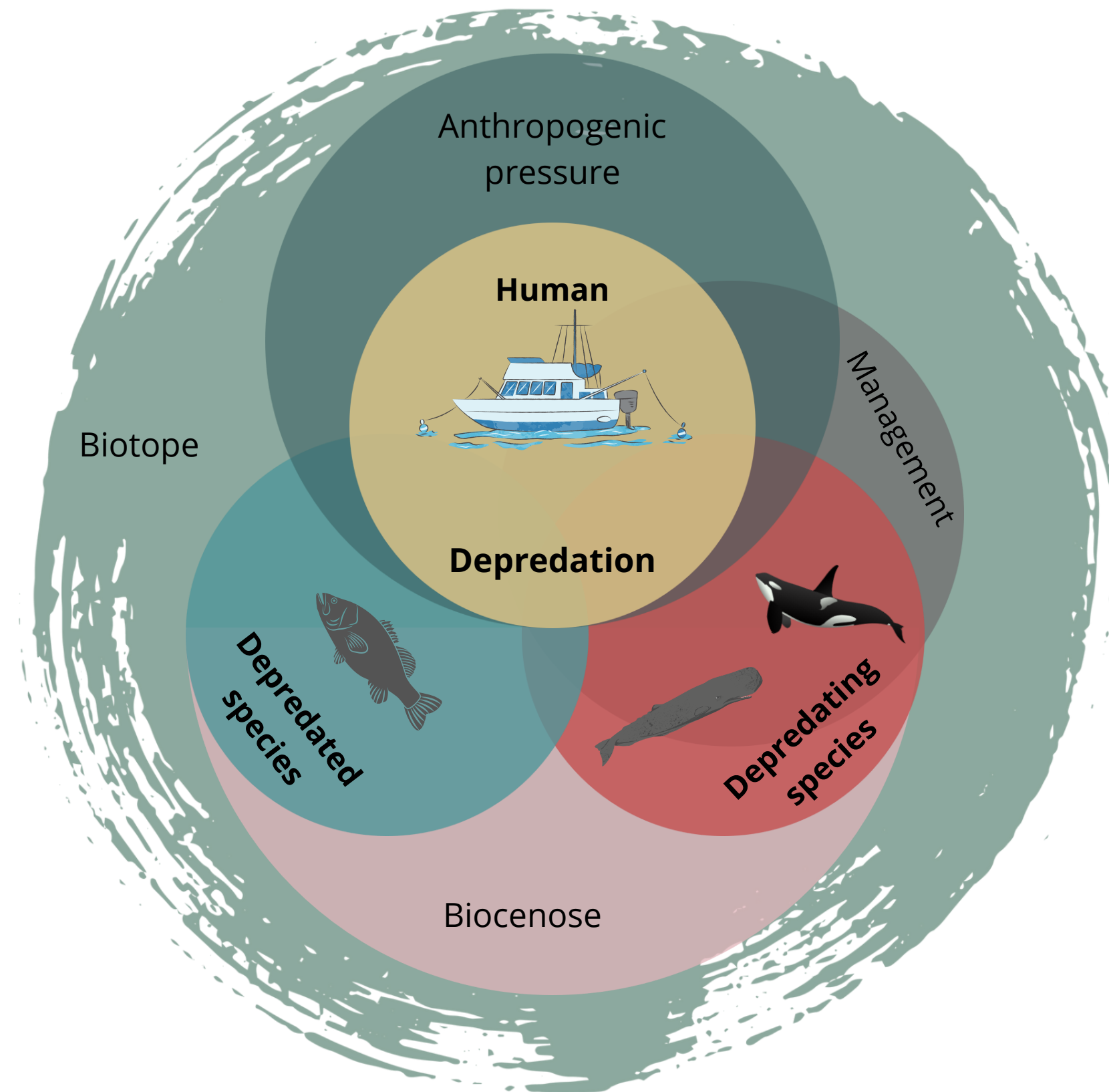
**Risk of injury/death on gears**  
 Lethal practices  
 Alteration of trophic interactions and predation pressure

N=249

## Impacts on predators



# MAIN COMPONENTS OF SOCIO-ECOLOGICAL SYSTEMS STRESSED BY DEPREDATION CONFLICT



**Impacts on the resource**

Uncertainty in stock assessments

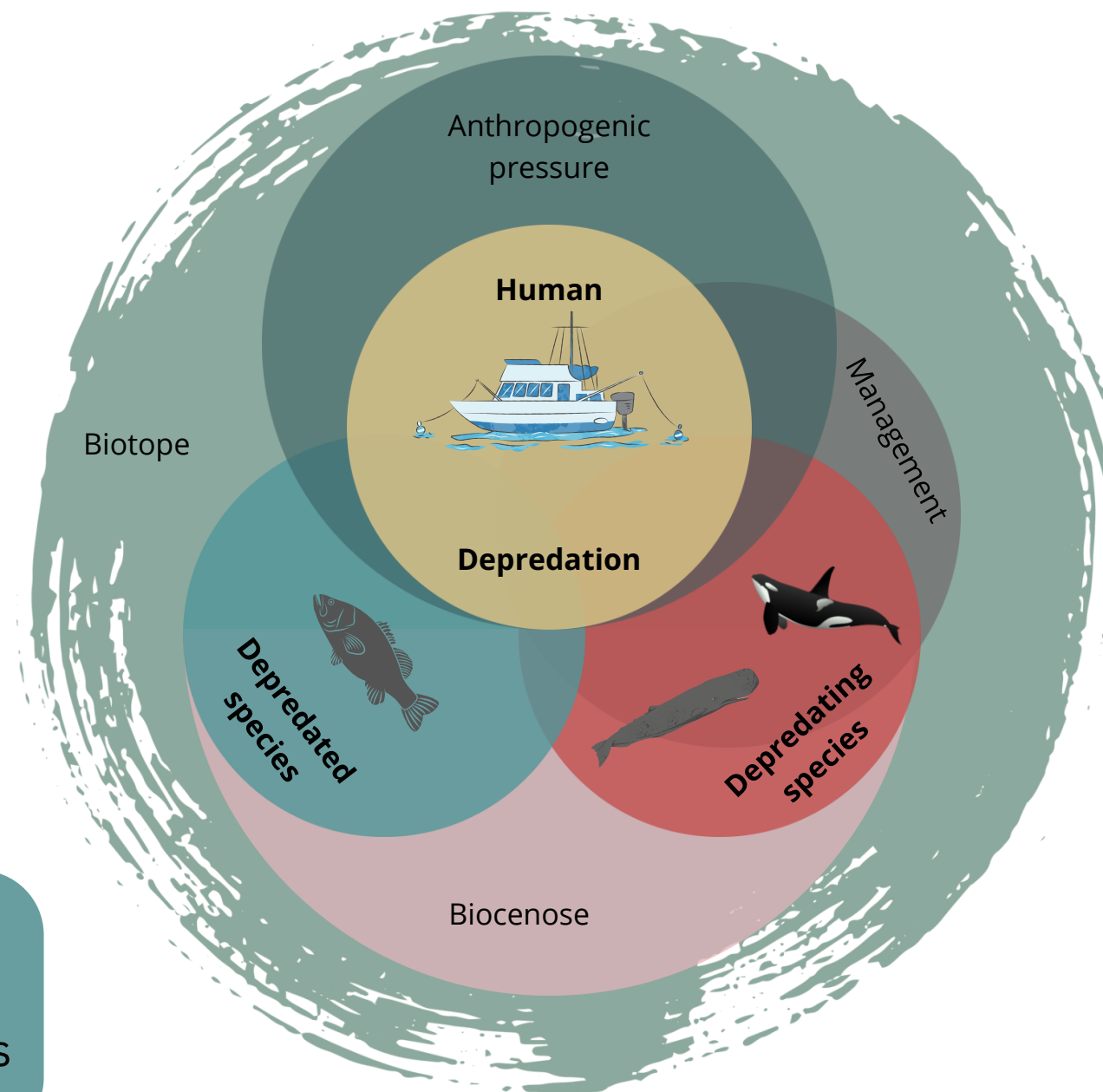
# A CASE OF CONFLICT WITH COMPLEX ISSUES

## Impacts on fishermen and fishing activities

Reduced yields  
Damage to gears  
Extra effort to compensate for losses

## Impacts on the resource

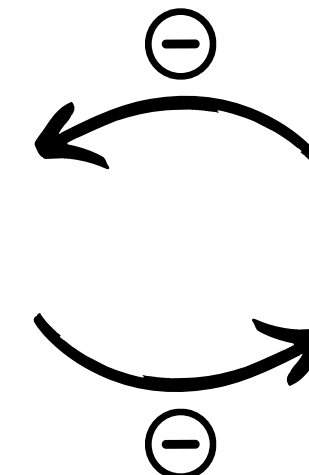
Uncertainty in stock assessments



## Impacts on predators and associated ecosystems

Risk of injury/death on gears  
Lethal practices  
Alteration of trophic interactions and predation pressure

Socio-economic issues



Ecological issues



## Coexistence ?



Solutions to conflicts ensuring the socio-economic viability of human activities and the conservation of marine predators

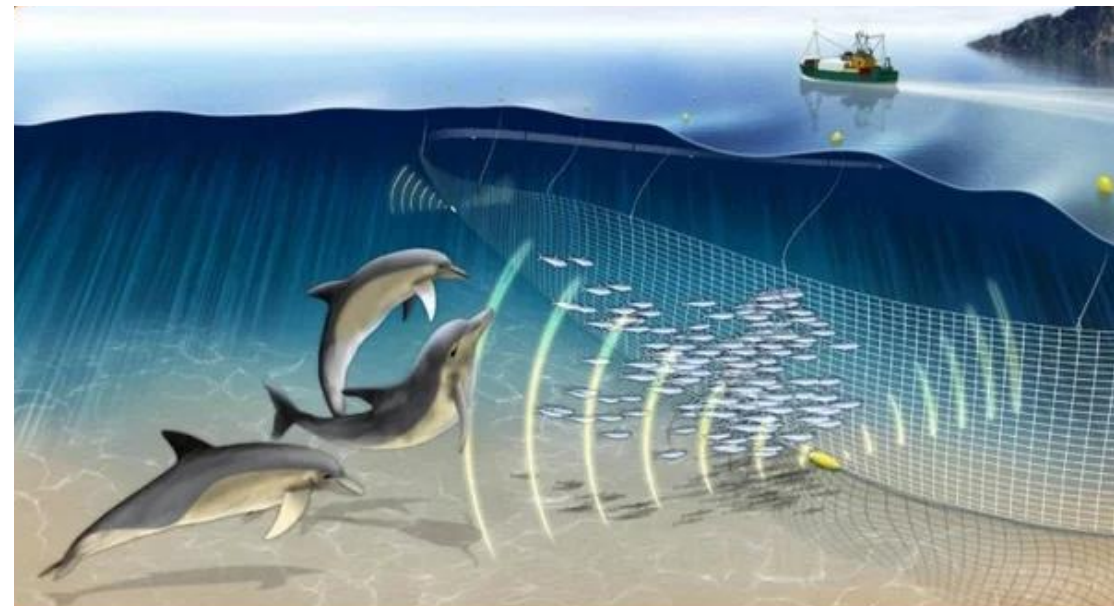
# MITIGATION ATTEMPTS

## Technological approach

**Protection  
of catches**

**Deterrents**  
acoustic, chemical,  
electrical,...

**Changes in fishing techniques**





# MITIGATION ATTEMPTS

## Technological approach

**Protection of catches**

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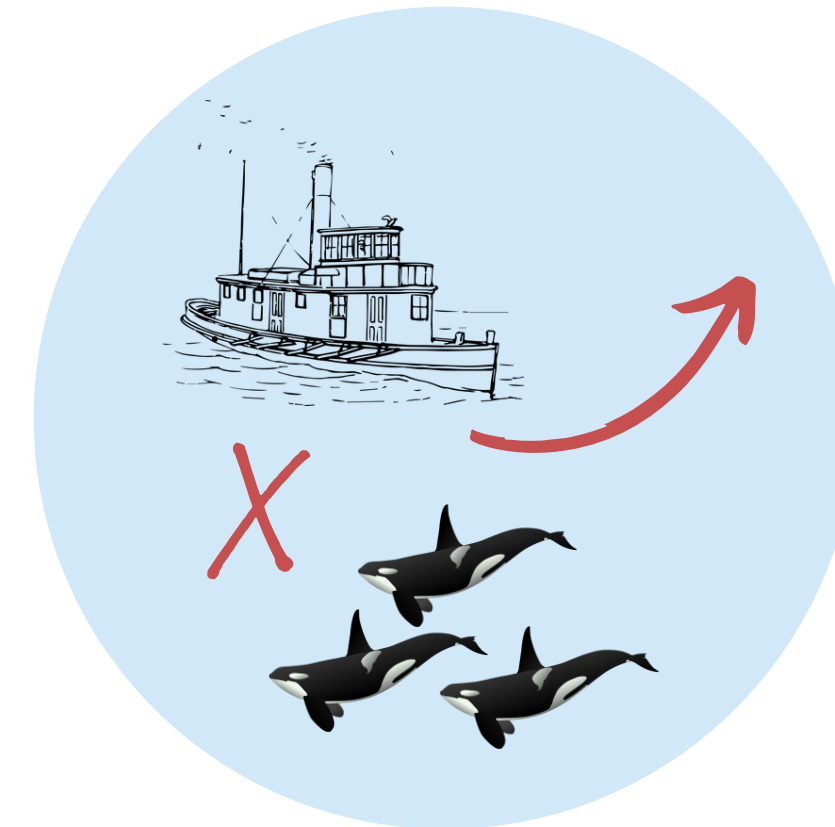
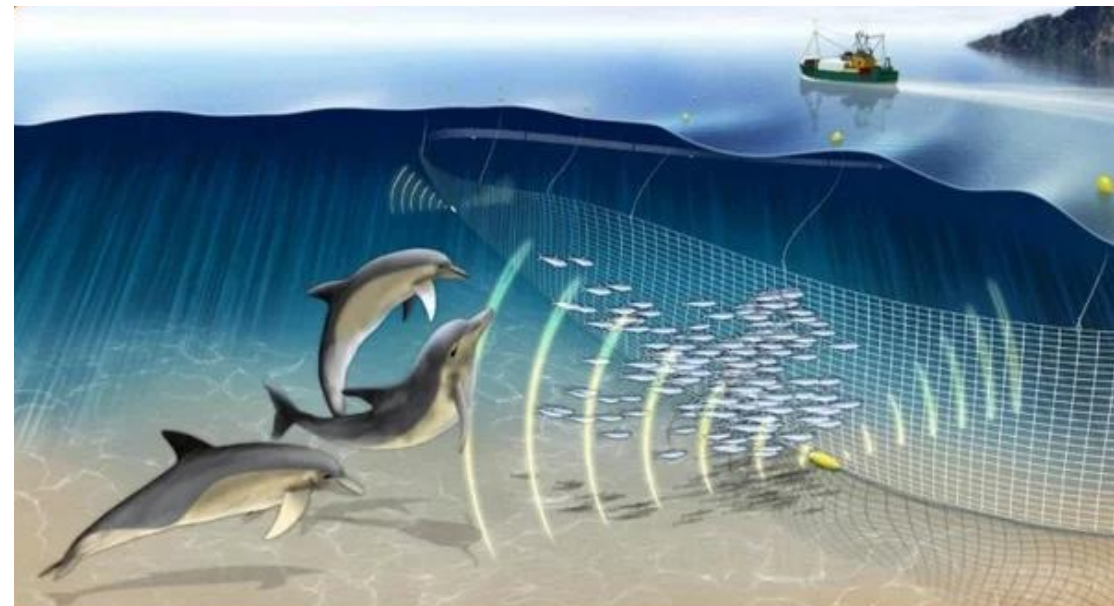
**Changes in fishing techniques**

## Behavioural approach

**Fishing practices**

Avoiding interactions

Reducing depredation



# MITIGATION ATTEMPTS

## Technological approach

Protection of catches

**Deterrents**  
acoustic, chemical, electrical,...

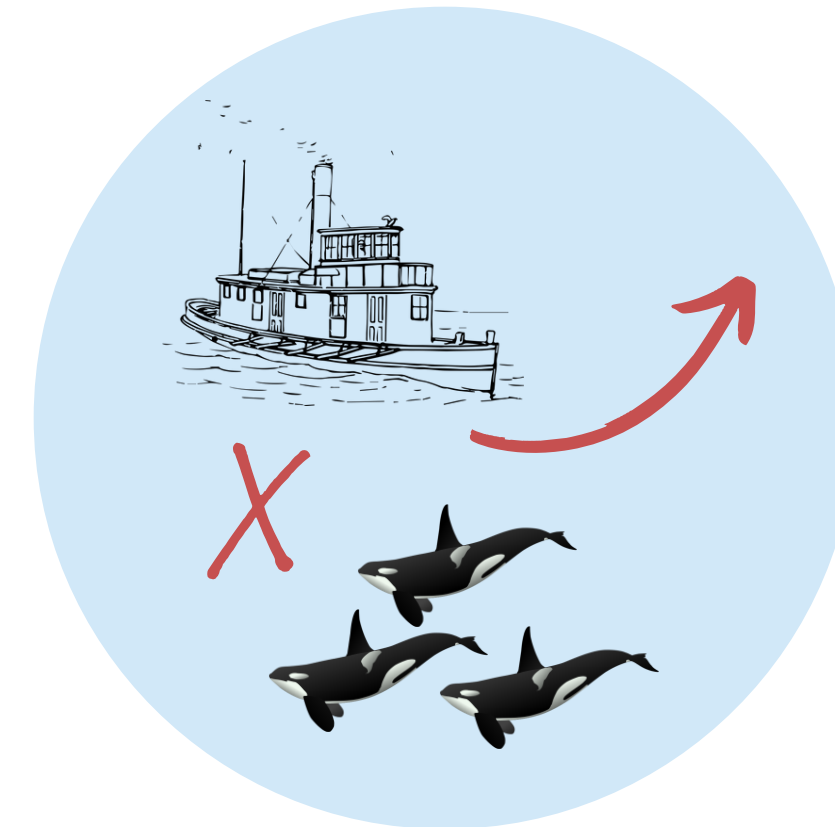
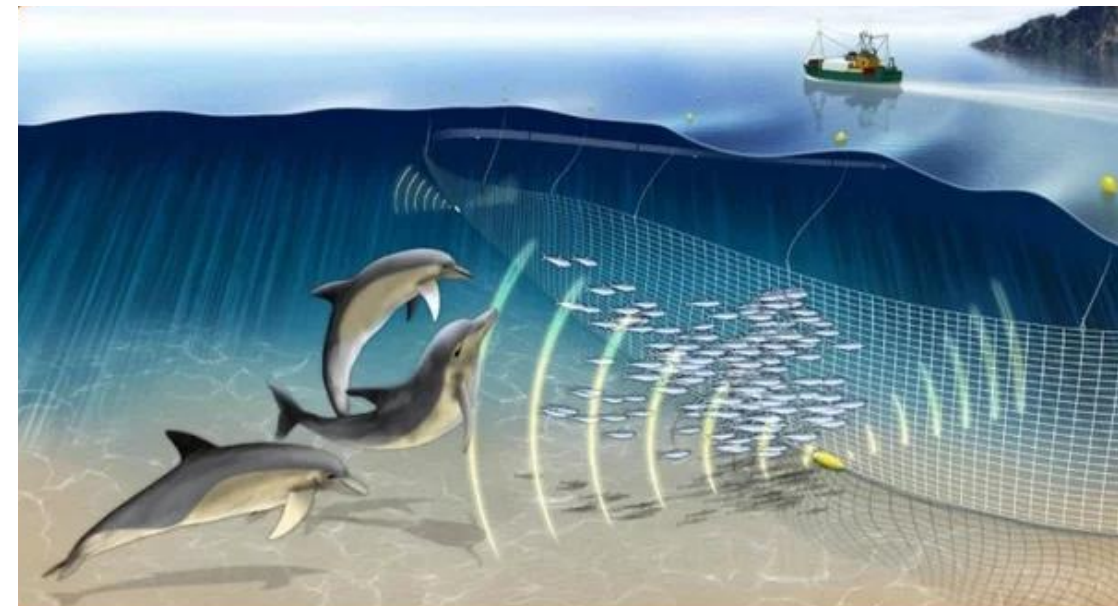
Changes in fishing techniques

## Behavioural approach

Fishing practices

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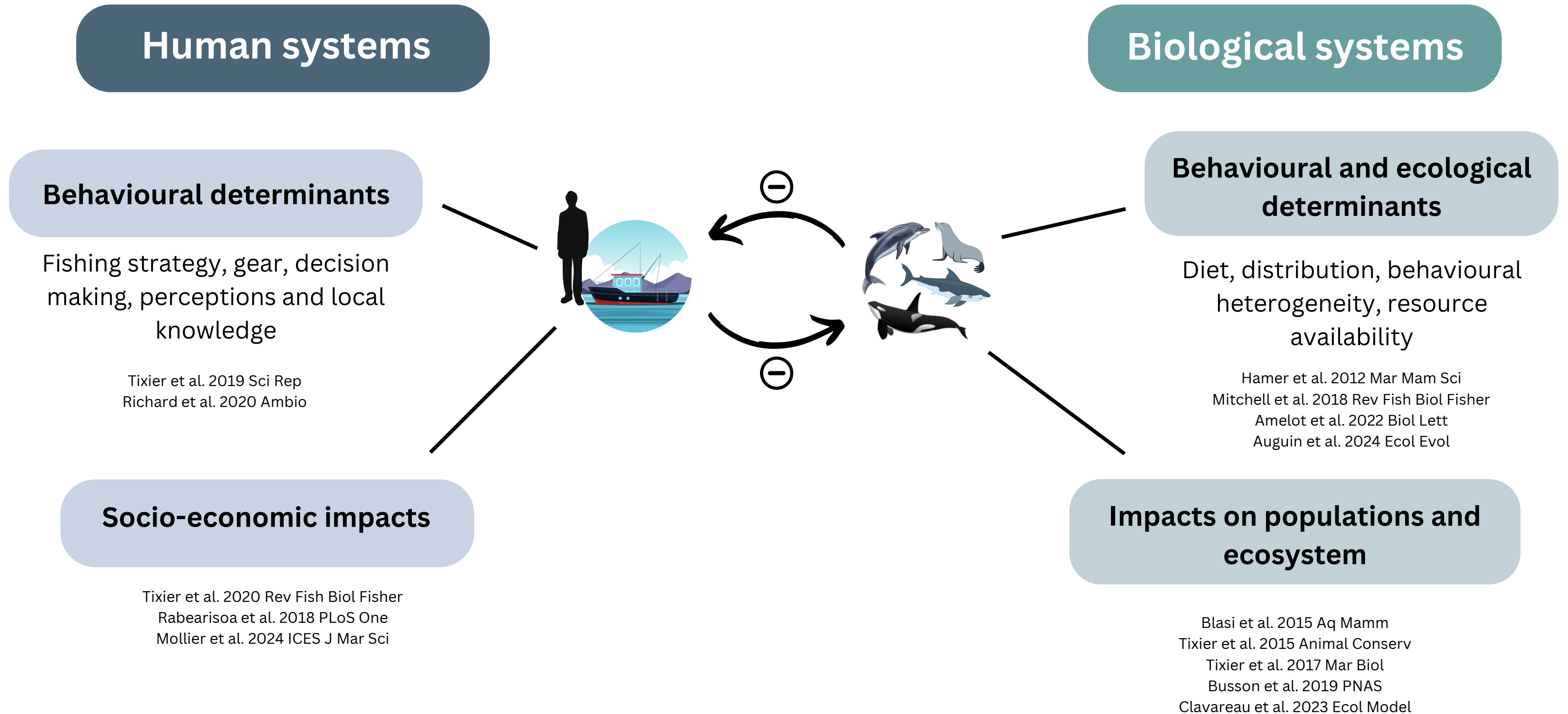
Reducing depredation



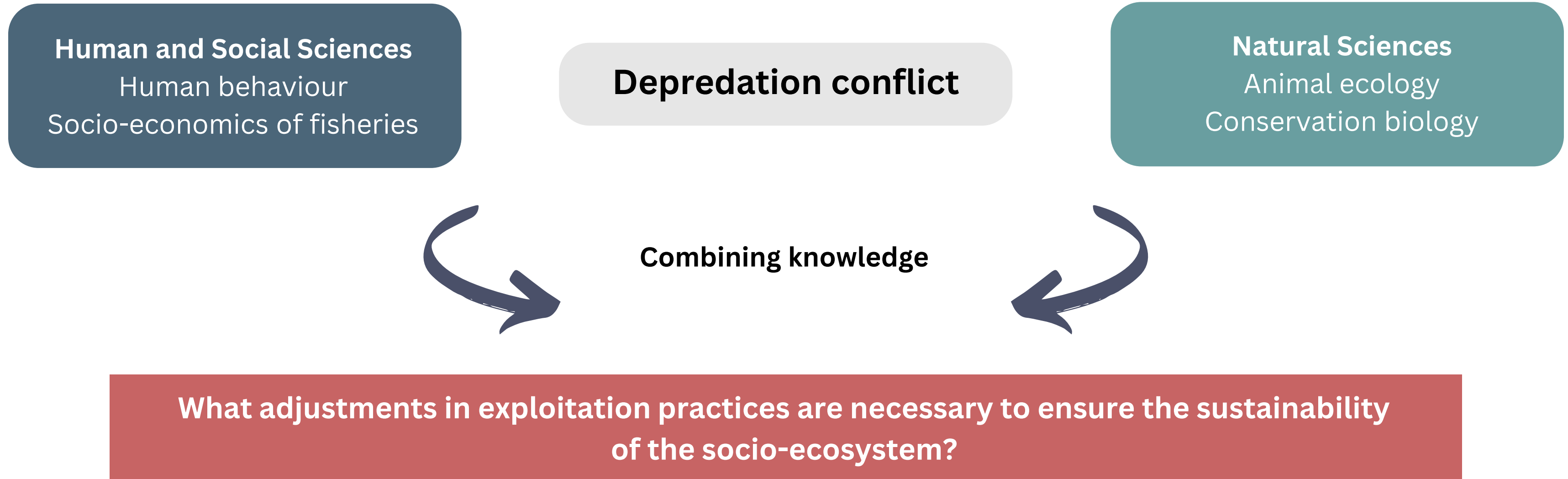
**Lack of knowledge**

**Socio-ecological causes and consequences of conflict**

# Understanding the socio-ecological mechanisms of **human-large marine predator conflicts** associated with depredation in fisheries



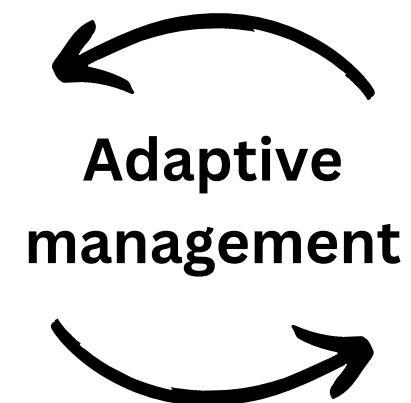
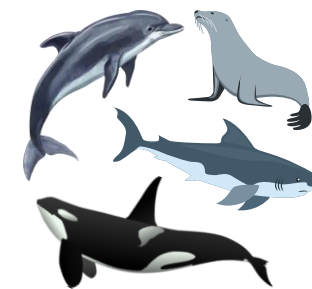
# INTERDISCIPLINARY RESEARCH AND INTEGRATED APPROACHES



Social system



Ecological system

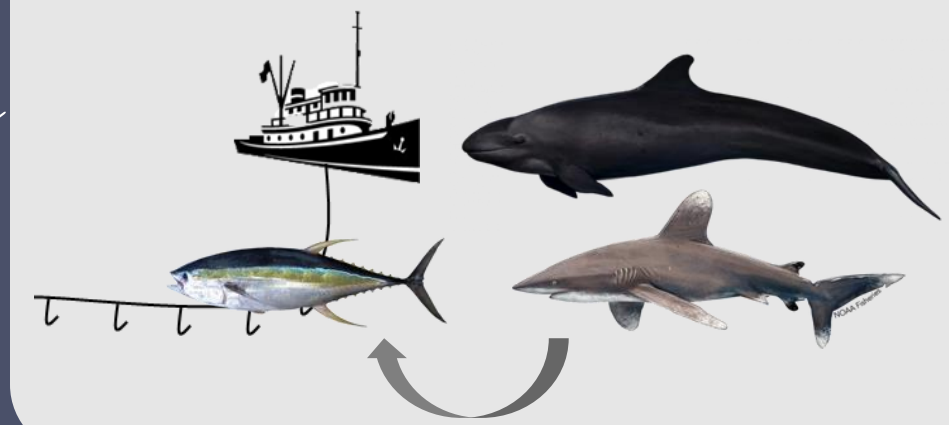


Long-term monitoring datasets from  
fishing logbooks and fisheries  
observers

## 2 CONTRASTED CASE STUDIES



### Tuna longline fishery in New Caledonia

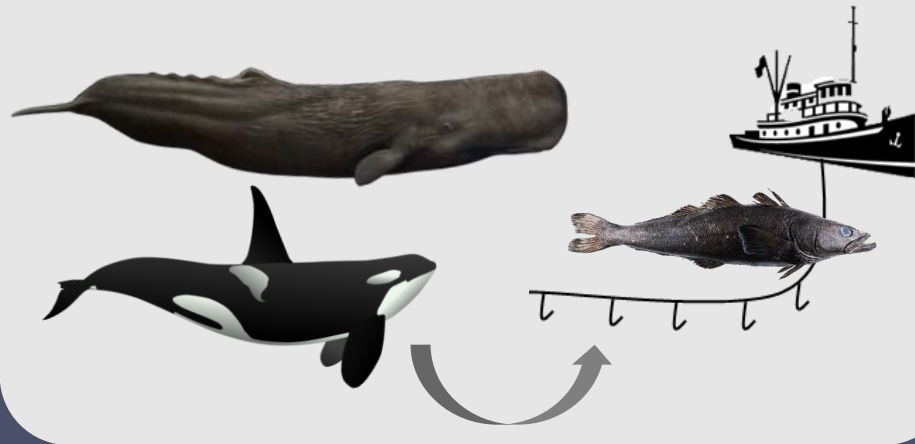


Long-term monitoring datasets from  
fishing logbooks and fisheries  
observers

## 2 CONTRASTED CASE STUDIES



### Patagonian toothfish fishery in Crozet and Kerguelen



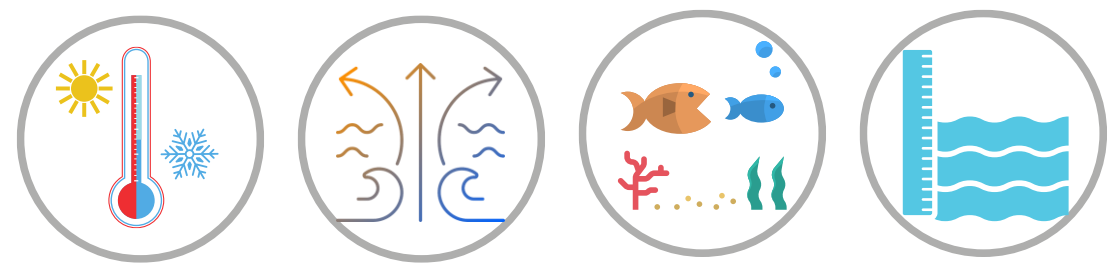
# WHAT ARE THE DRIVERS OF THE OCCURRENCE OF DEPREDATION?



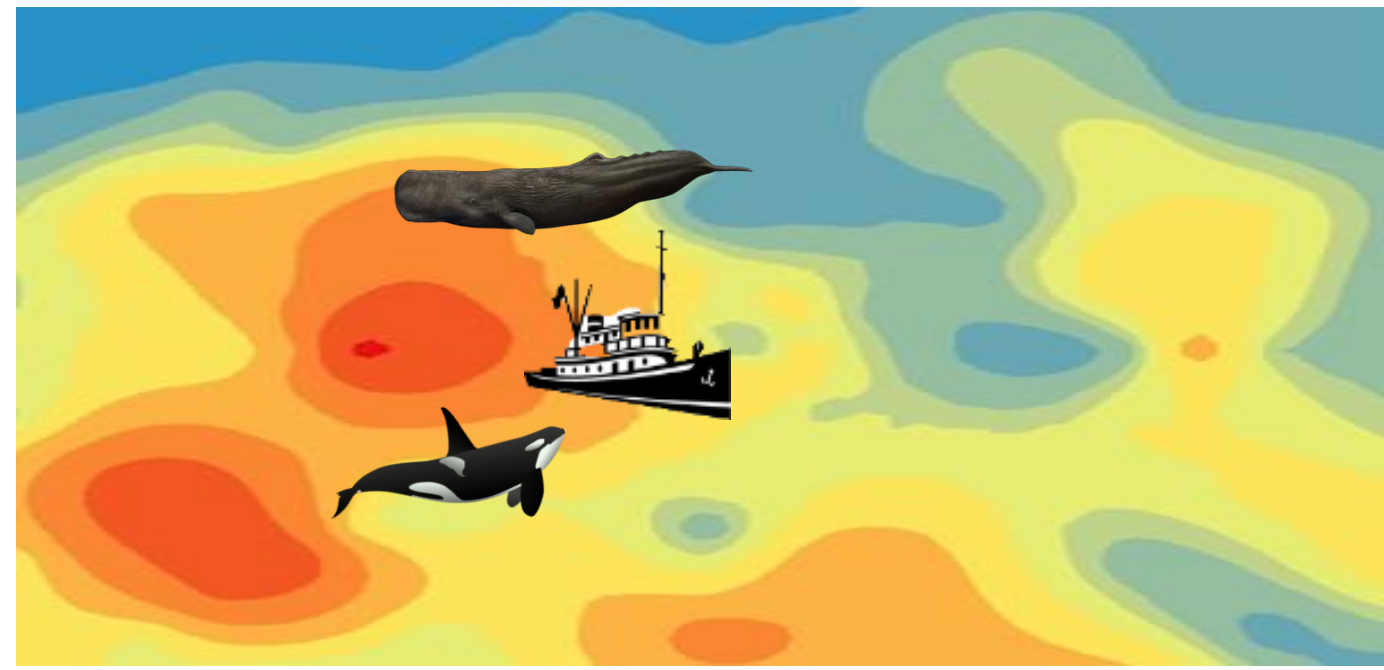
## Human systems



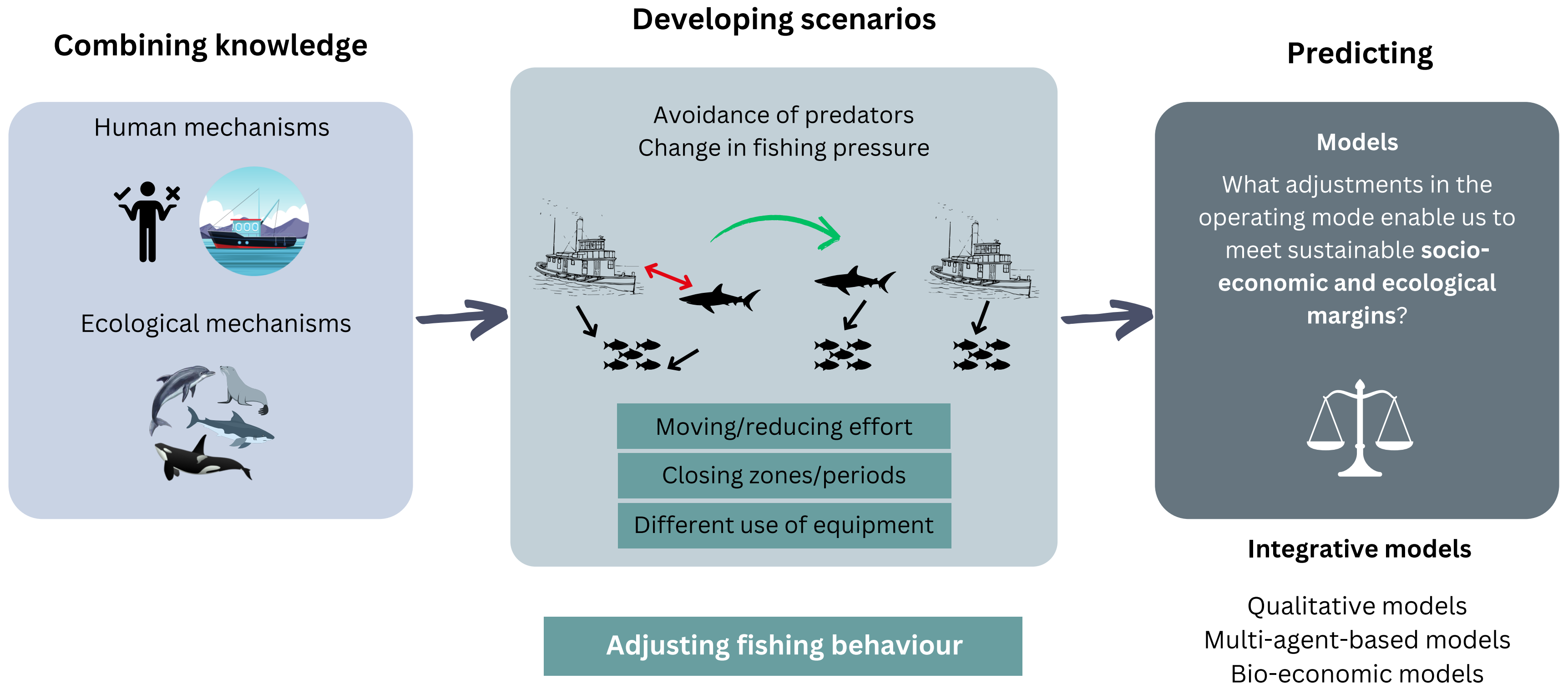
## Biological systems



Co-occurrence ?



# HOW TO IDENTIFY SOLUTIONS TO DEPREDATION CONFLICT BY ADJUSTING FISHING PRACTICES





THANK YOU FOR YOUR ATTENTION



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