marbec

MARINE BIODIVERSITY EXPLOITATION & CONSERVATION

Small pelagics fisheries crisis in the the Gulf of Lion: a consequence of ecosystem shift due to climate change?

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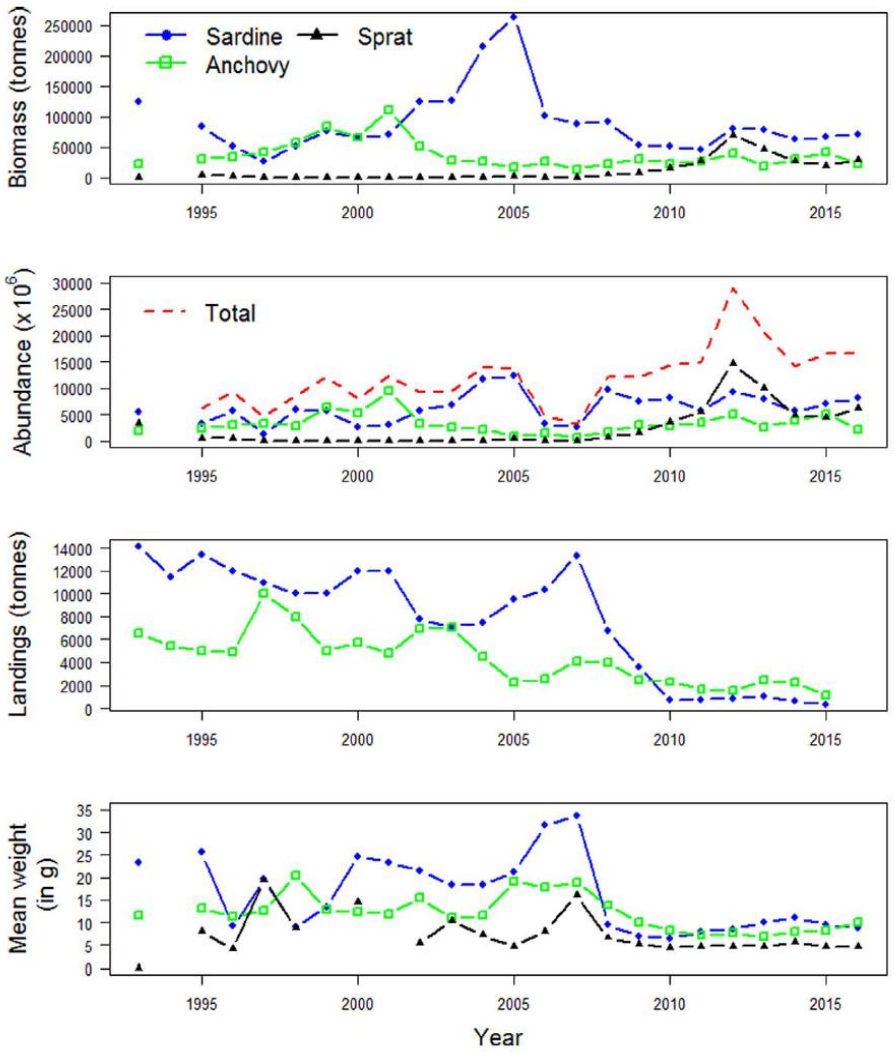
What are the underlying processes of the small pelagic crisis in the Gulf of Lions?

CONTEXT

- Pelagic fisheries crisis since 2008
- Small pelagic fish, especially sardine, small and skiny, not saleable for more than 10 years…
- Unknown situation from a scientific viewpoint

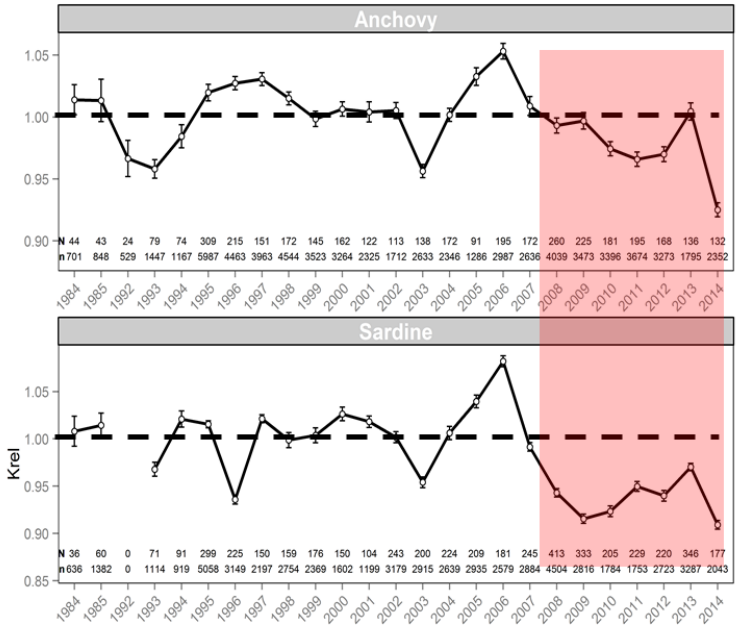


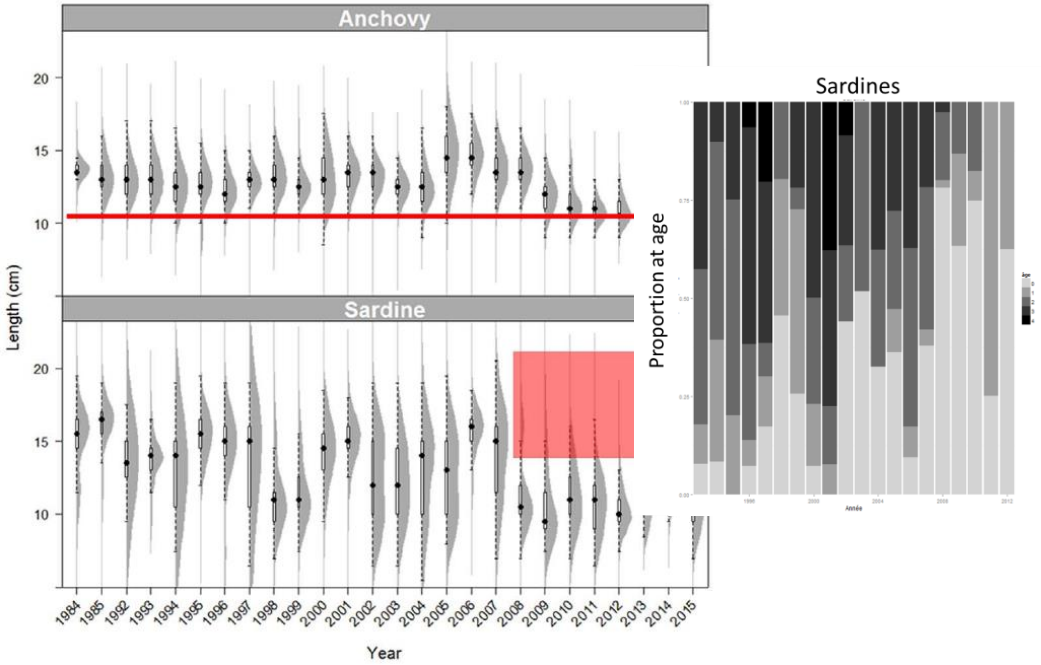
Two research projects:

- **EcoPelGol (2012-2016)**
- **Mona Lisa (2017-2021)**

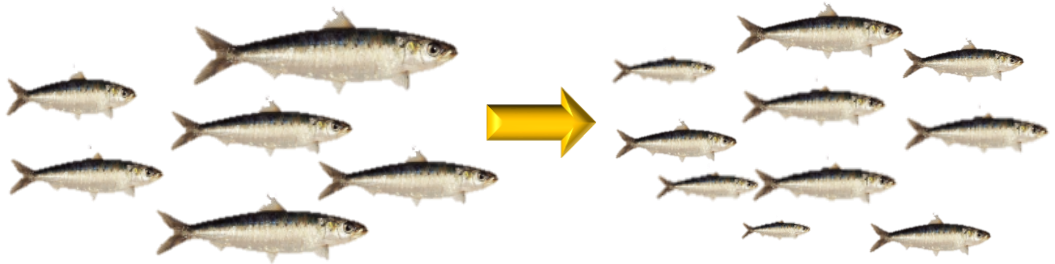
What are the underlying processes of the small pelagic crisis in the Gulf of Lions?

Body condition



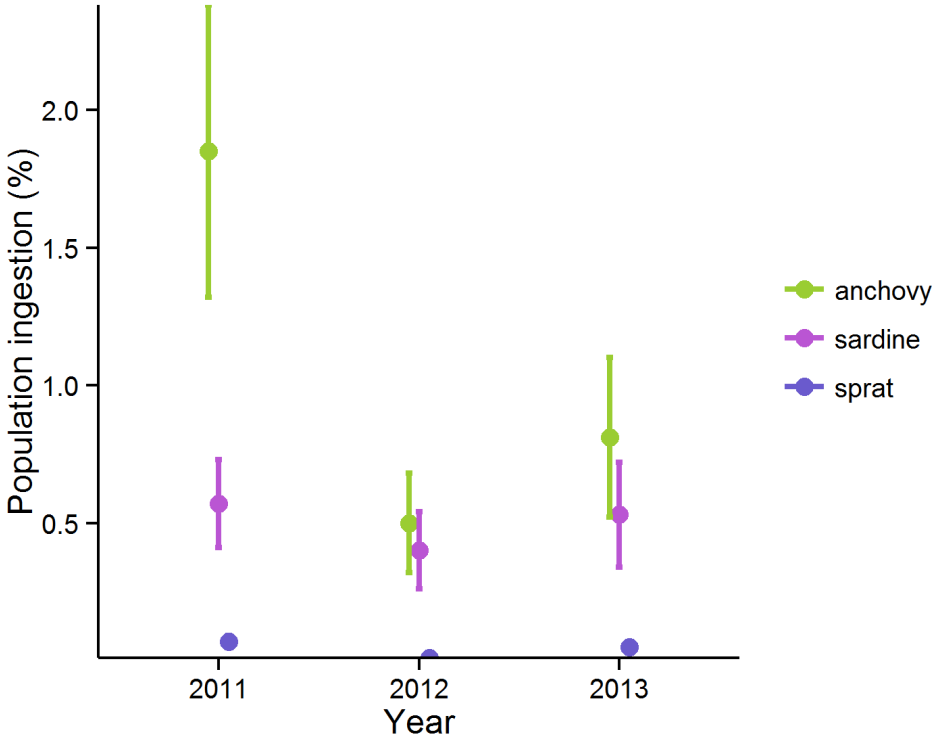


- Higher abundance, but poor condition
- Diappearance of bigger and older fish
- Change in growth (sardine)

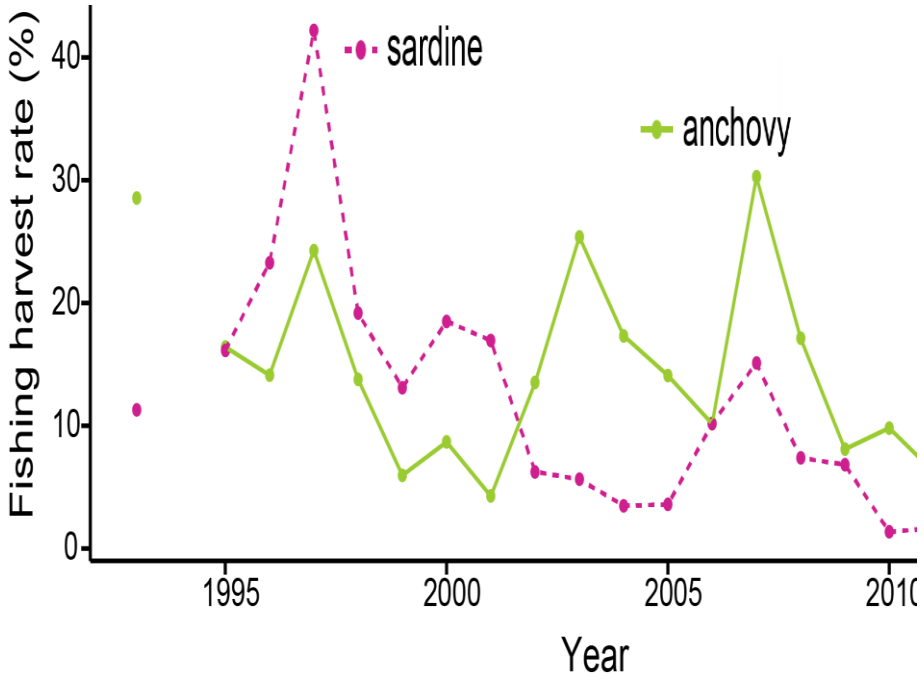


Potential Drivers

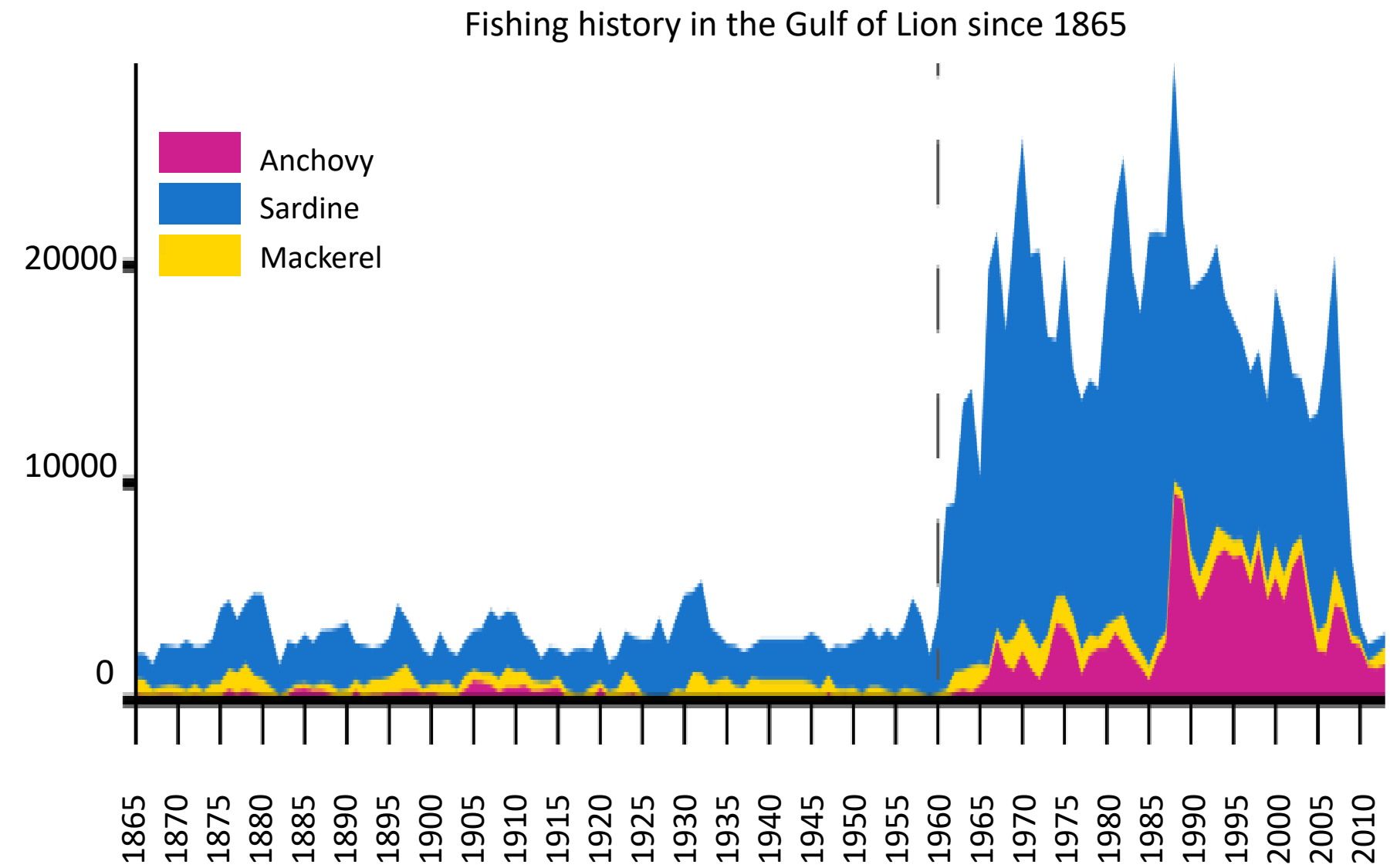
Tuna Predation
(DEB model + a lot of various data)



Fishing



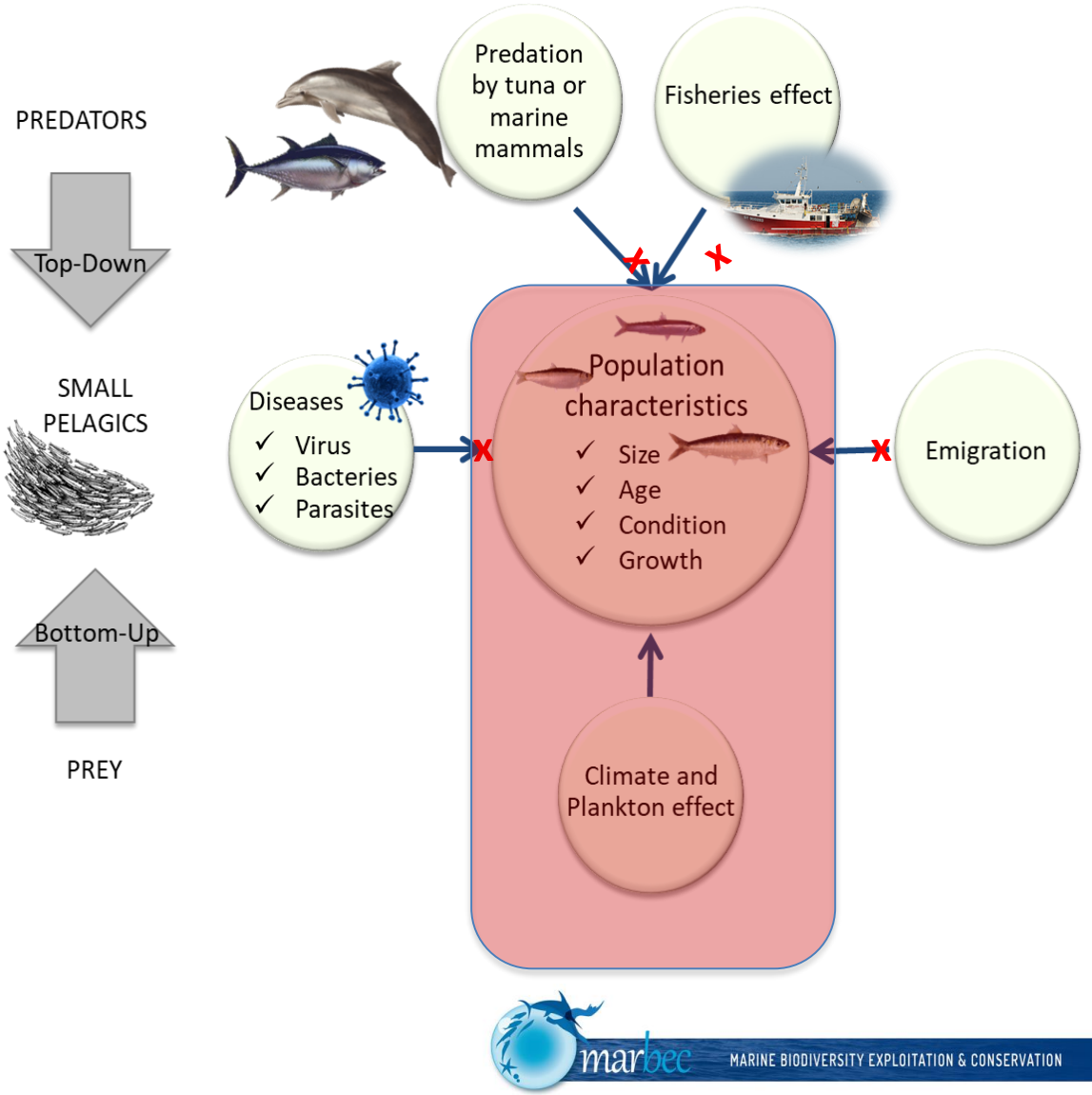
Potential Drivers



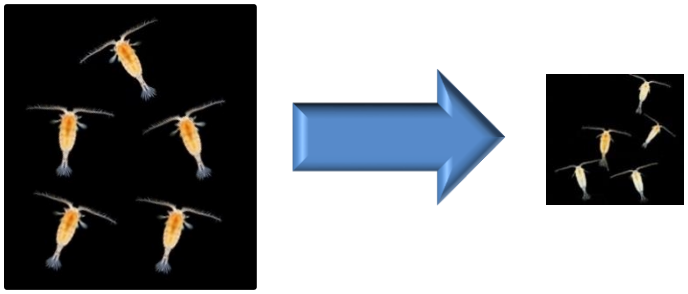
What are the underlying processes of the small pelagic crisis in the Gulf of Lions?

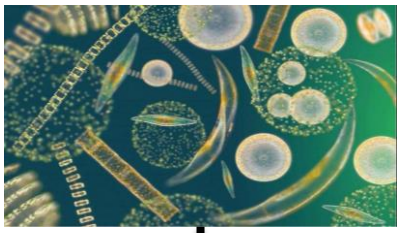
- Not related to an increasing natural predation (tuna and dolphin)
- No overfishing
- No emigration in adjacent areas
- No diseases detected

- More likely due to a change in the quantity and quality of the planktonic production



Environmental changes in in the Gulf of Lions?

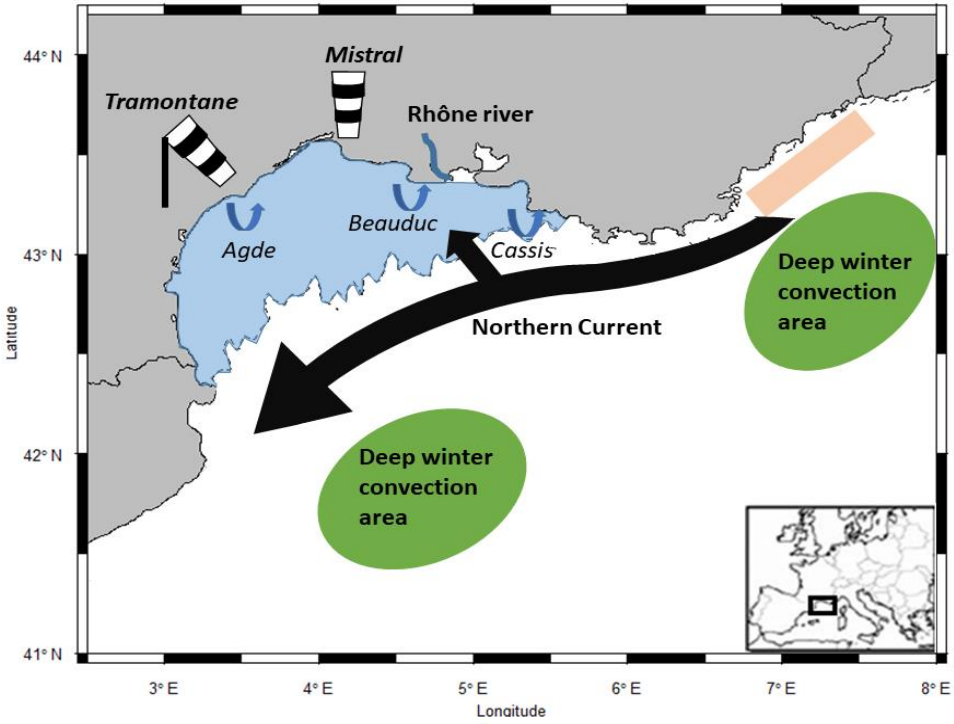




Phytoplankton

Zooplankton

Small pelagic fish



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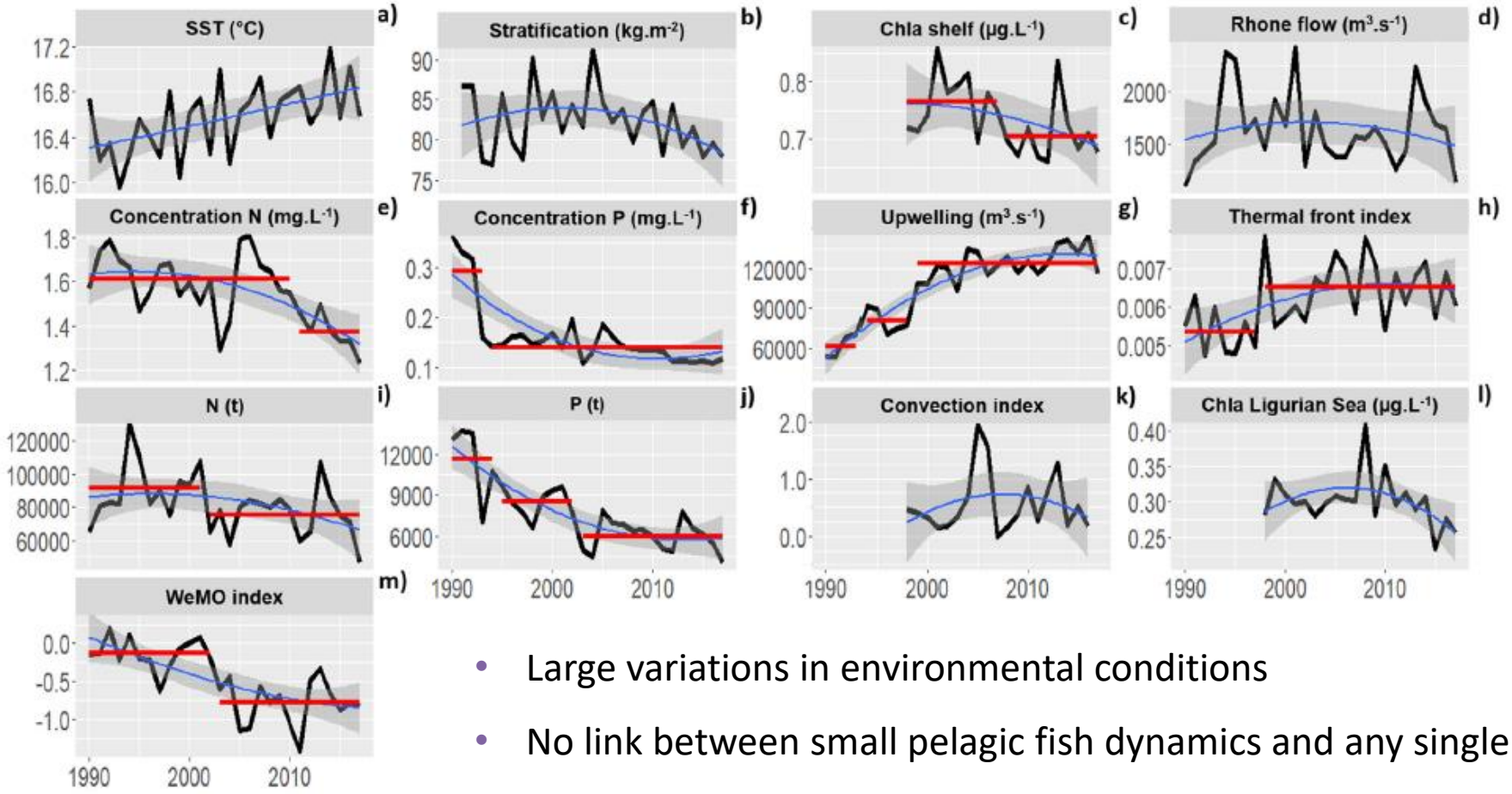
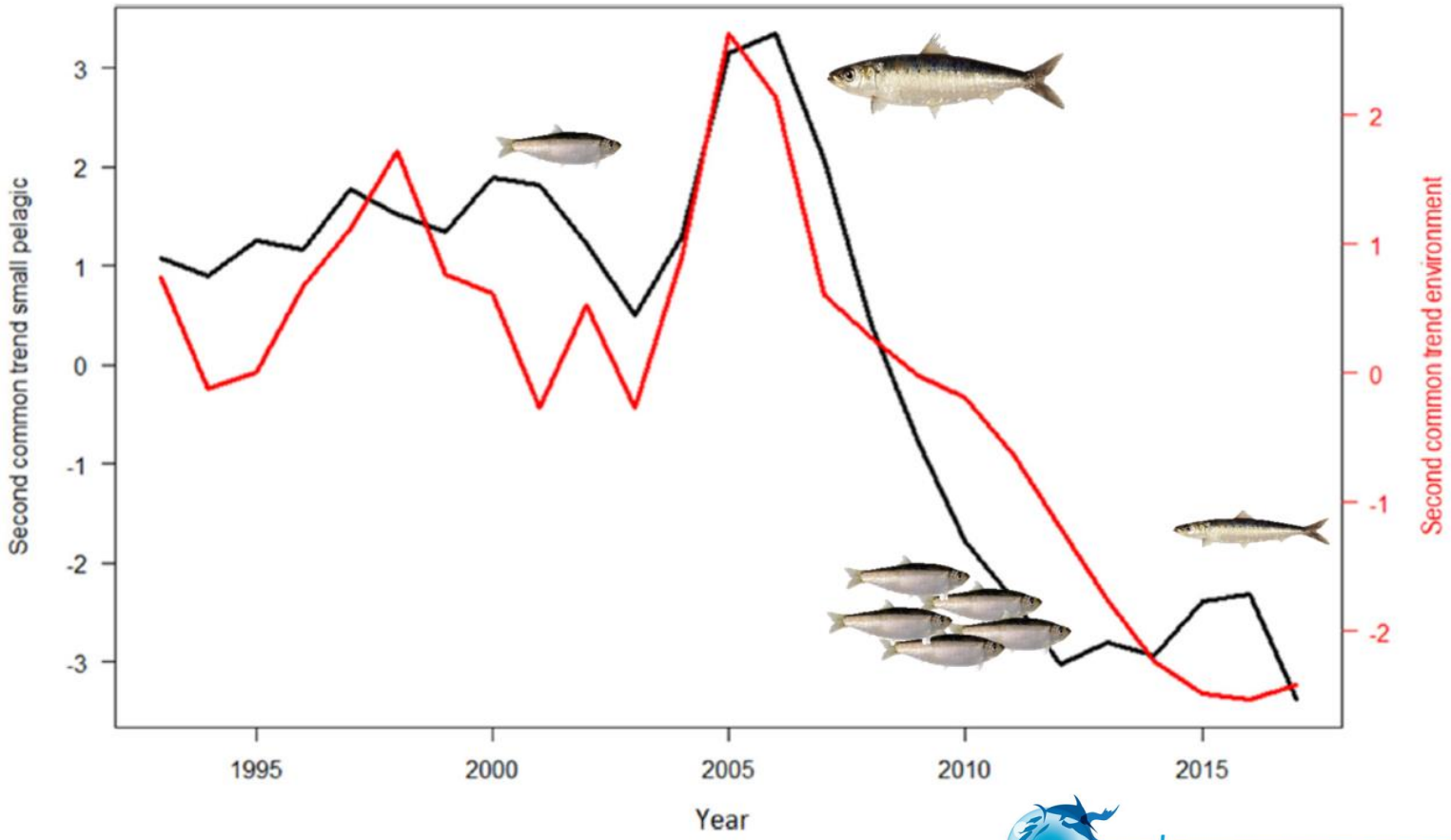


- Large variations in environmental conditions
- No link between small pelagic fish dynamics and any single environmental variable (GLMM)
- Strong link between Chloa and Rhone river flow

Environmental changes in in the Gulf of Lions?

Dynamic Factor Analysis (DFA)

- Major common trends in the fish and environment matrices are quite synchronous
- Regime shift around 2008-2010



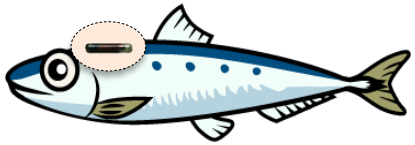
Why it is a problem for sardines?

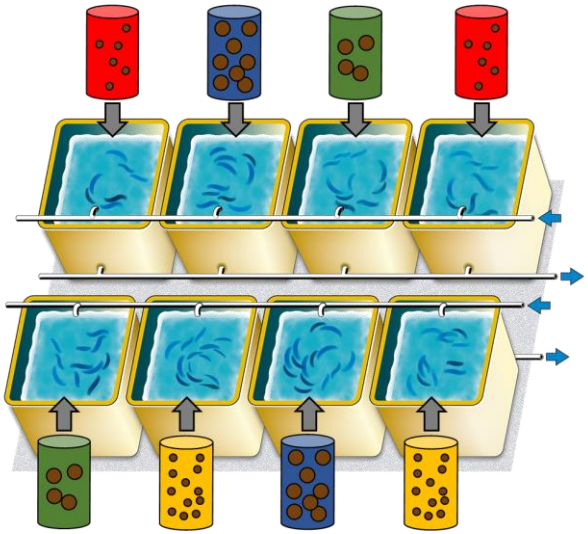
Wild sardines sauvages caught in October 2016

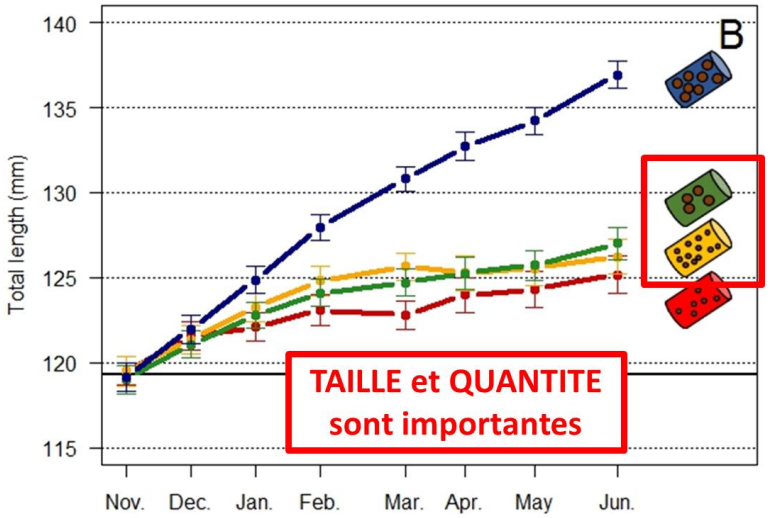
Acclimatation in 8 ponds (0.3 m^3)

Why it is a problem for sardines?

Experiment on 450 individuals:
4 different feeding treatments

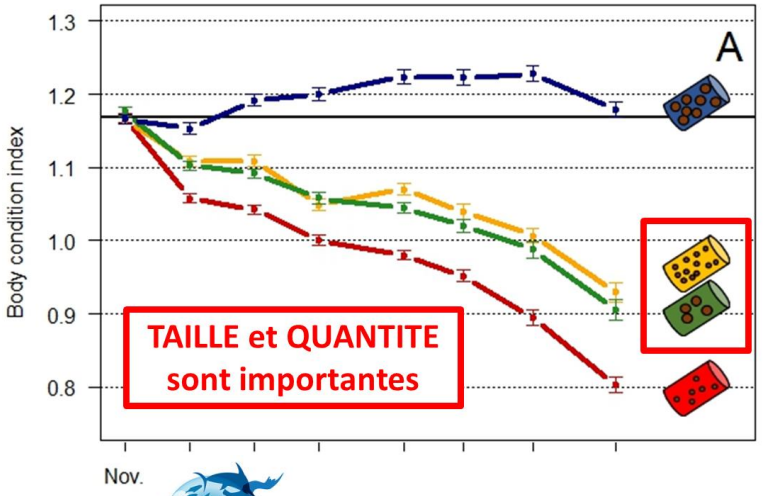






Effect on the length

Effect on body condition



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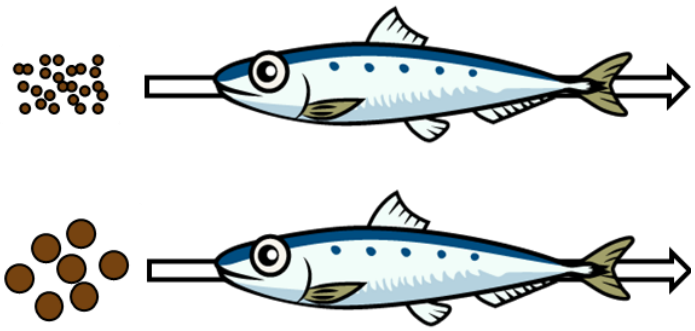
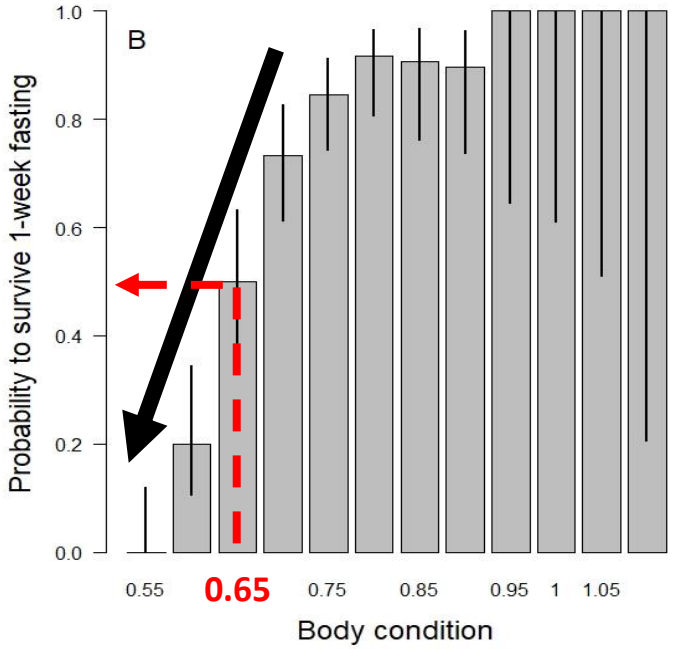


Filtering

Hunting

Hypothesis: $E_{Filtering} > E_{Hunting}$



Adaptation of the feeding behaviour according to food size

Filtering implies 2 times more energy than hunting

Decrease at 0.75 survival rate

50% survival rate at 0.65

Conclusion

- Significant environmental changes in the Gulf of Lions over the past 30 years have affected plankton production

- Food size (plankton) is a very important parameter, it plays on the feeding behavior of sardine and thus its energy expenditure

- Bottom-up hypothesis supported: excess mortality of adults after breeding resulting from poor condition

- The proportion of sardines in critical condition in the wild has increased in recent years

- Likely related to climate change, but also to the Rhone river discharge. It remains to look at pollution: thesis in progress...


Thanks for your attention