Comparative assessment of life History Traits in small Pelagic Fish communities in High-Productivity Coastal Systems

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INTRO / BACKGROUND

- **Small pelagic fish** (SPF) communities play a crucial role in **marine food webs**, serving as a **central link** between primary producers and higher trophic levels[2].
- The abundance of SPF populations in high boundary productivity systems experiences **strong variations**, making their dynamics **difficult** to **predict**[1].
- Understanding the dynamics of SPF populations and their **responses** to **environmental factors** can aid in **sustainable resource exploitation**, ensuring the long-term viability of both the fish populations and the marine ecosystems they inhabit.

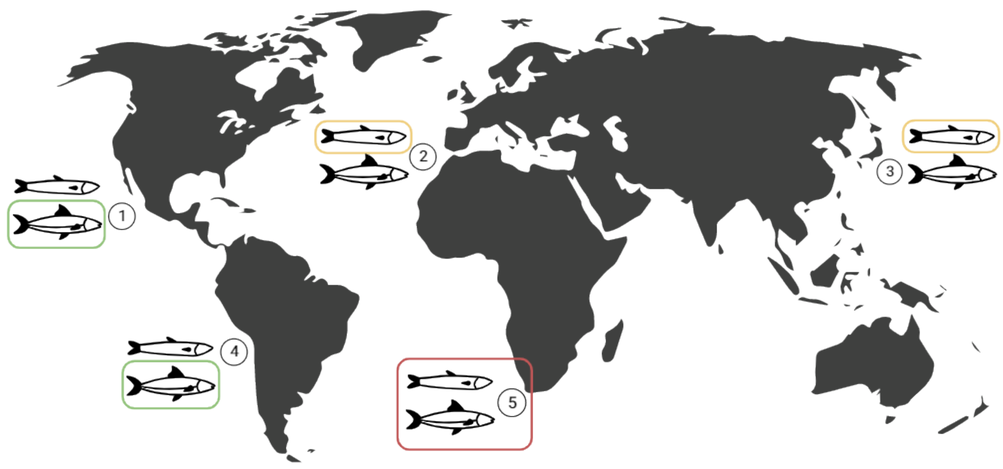
RESEARCH QUESTION

How can we explain the **variations** in **biological traits** (development, growth, reproduction) observed among **small pelagic species** (*Engraulis* spp., *Sardina pilchardus*, *Sardinops sagax*, *Sardinella* spp.) that are abundant in highly productive coastal ecosystems?

OBJECTIVES

- Enhance understanding of the **variability of individual SPF** responses to environmental factors
- Better understand the role of the **bottom-up forcing** and the impact of **bioenergetic characteristics** on these variations
- Provide insights into the **mechanisms** driving the **fluctuations** in SPF populations in high-productivity systems

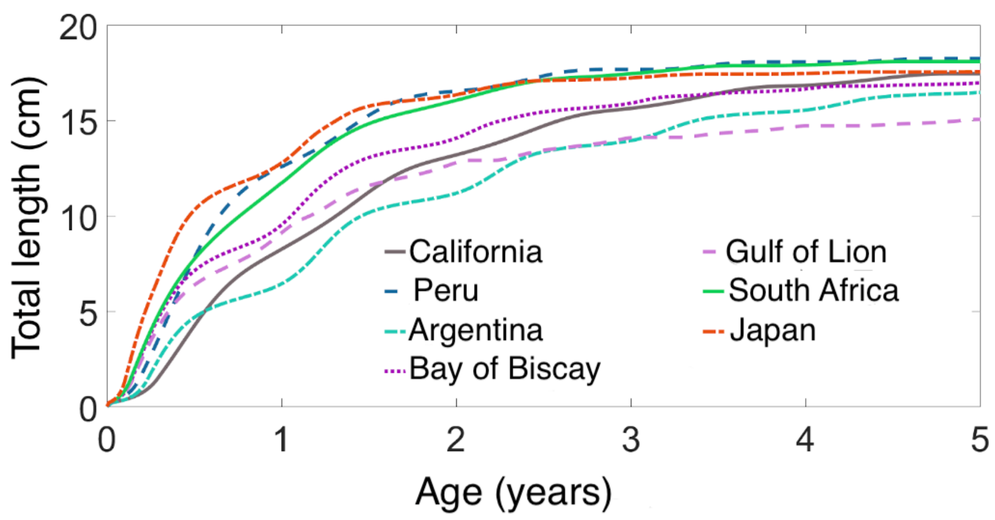
PROPOSED RESEARCH APPROACH



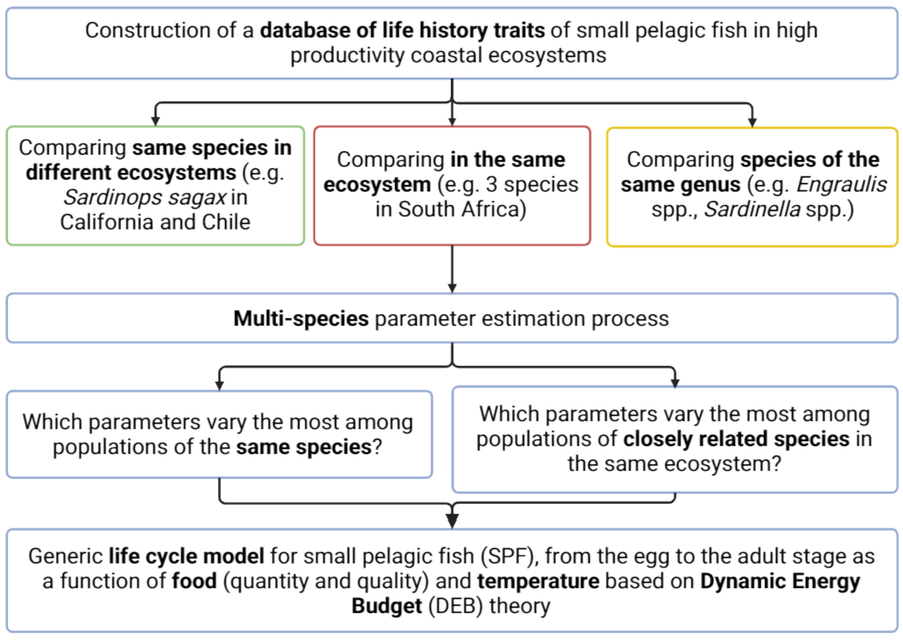
Sardine
① Pacific sardine, *Sardinops sagax*
② Pilchard, *Sardina pilchardus*
Maderian sardinella, *Sardinella maderensis*
Round sardinella, *Sardinella aurita*
③ Japanese sardine, *Sardinops melanostictus*
④ Pacific sardine, *Sardinops sagax*
⑤ Benguela sardine, *Sardinops sagax*

Anchovy
① Nothern anchovy, *Engraulis mordax*
② European anchovy, *Engraulis encrasicolus*
③ Japanese anchovy, *Engraulis japonicus*
④ Peruvian anchoveta, *Engraulis ringens*
⑤ Cape anchovy, *Engraulis capensis*

FIRST RESULTS



- 7 simulations = **7 major anchovy populations** of the genus *Engraulis* spp.
- 1 simulation = 1 average individual from a population with the **environmental conditions of its region**
- **Identical physiology**: same set of parameters for all populations



By comparing the life history traits of the most abundant species in different habitats or closely related species within the same system, the study seeks to **reduce uncertainty** due to **limited experimental data** availability and **reproductive processes** dependence on encountered environmental conditions (spawning by batch and undetermined fecundity) and obtain **more accurate parameter** sets for the model.

CONCLUSION

- Compare life history traits and reconstruct **inter-individual variability** in SPF communities in high-productivity ecosystems
- Unique and challenging comparative approach to **improve parameter estimation**
- Understand SPF life history traits, habitat characteristics, and individual responses to **environmental factors**
- Combining **ecological modeling** and field data analysis
- Advancement of knowledge in **marine ecology** and **fisheries science**, with implications for **sustainable management** of SPF populations.

REFERENCES / ACKNOWLEDGEMENTS

The work was supported by the OMEGA project, which is funded by the ISblue project, Interdisciplinary graduate school for the blue planet (ANR-17-EURE-0015), and co-funded by a grant from the French government under the program "Investissements d'Avenir" embedded in France 2030. Additionally, the work was also financed by the Laboratory of Marine Environmental Sciences (LEMAR)

1. Alheit et al. 2019. « Drivers of dynamics of small pelagic fish resources: environmental control of long-term changes ». *Deep Sea Research Part II: Topical Studies in Oceanography* 159 (janvier): 1-3 https://doi.org/10.1016/j.dsr2.2018.12.005.
2. Essington et al. 2015. « Fishing Amplifies Forage Fish Population Collapses ». *Proceedings of the National Academy of Sciences of the United States of America* 112 (21): 6648-52. https://doi.org/10.1073/pnas.1422020112.