Integrating eDNA surveys into 3D conservation planning for deep-sea fish biodiversity

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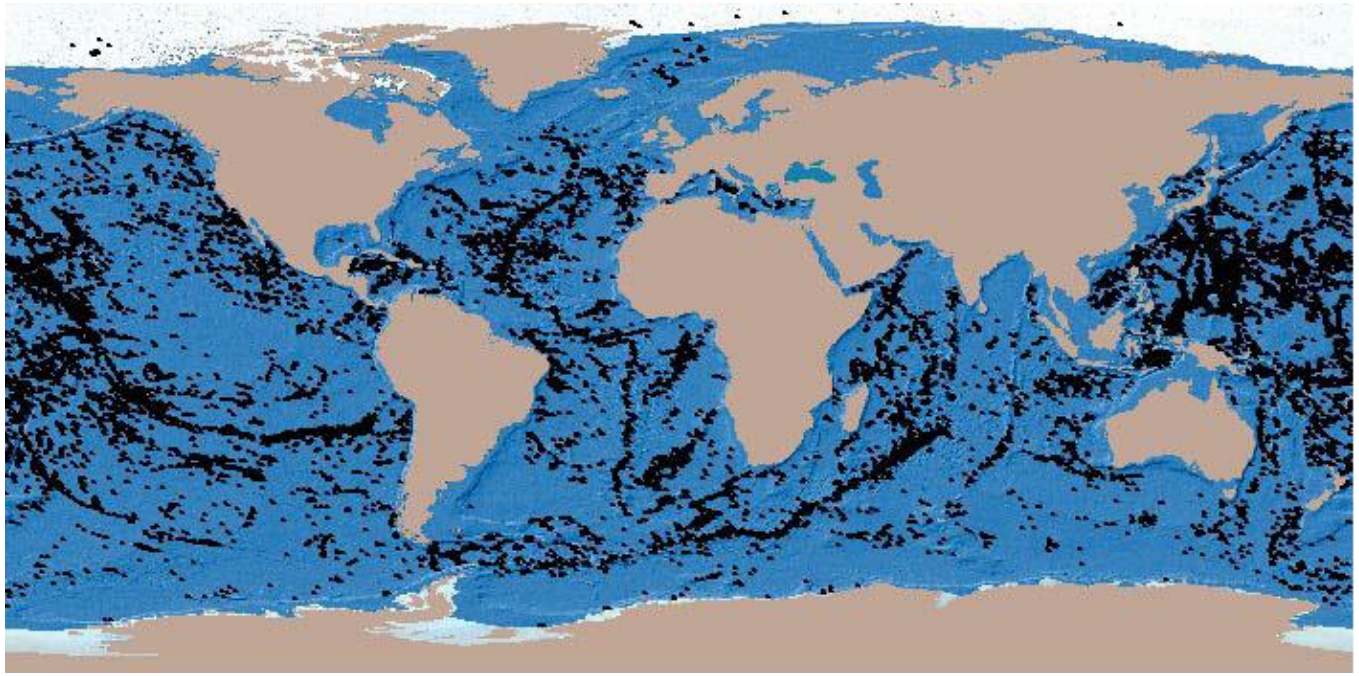
2nd Australian & New Zealand
ENVIRONMENTAL DNA
CONFERENCE

Threats to fish communities

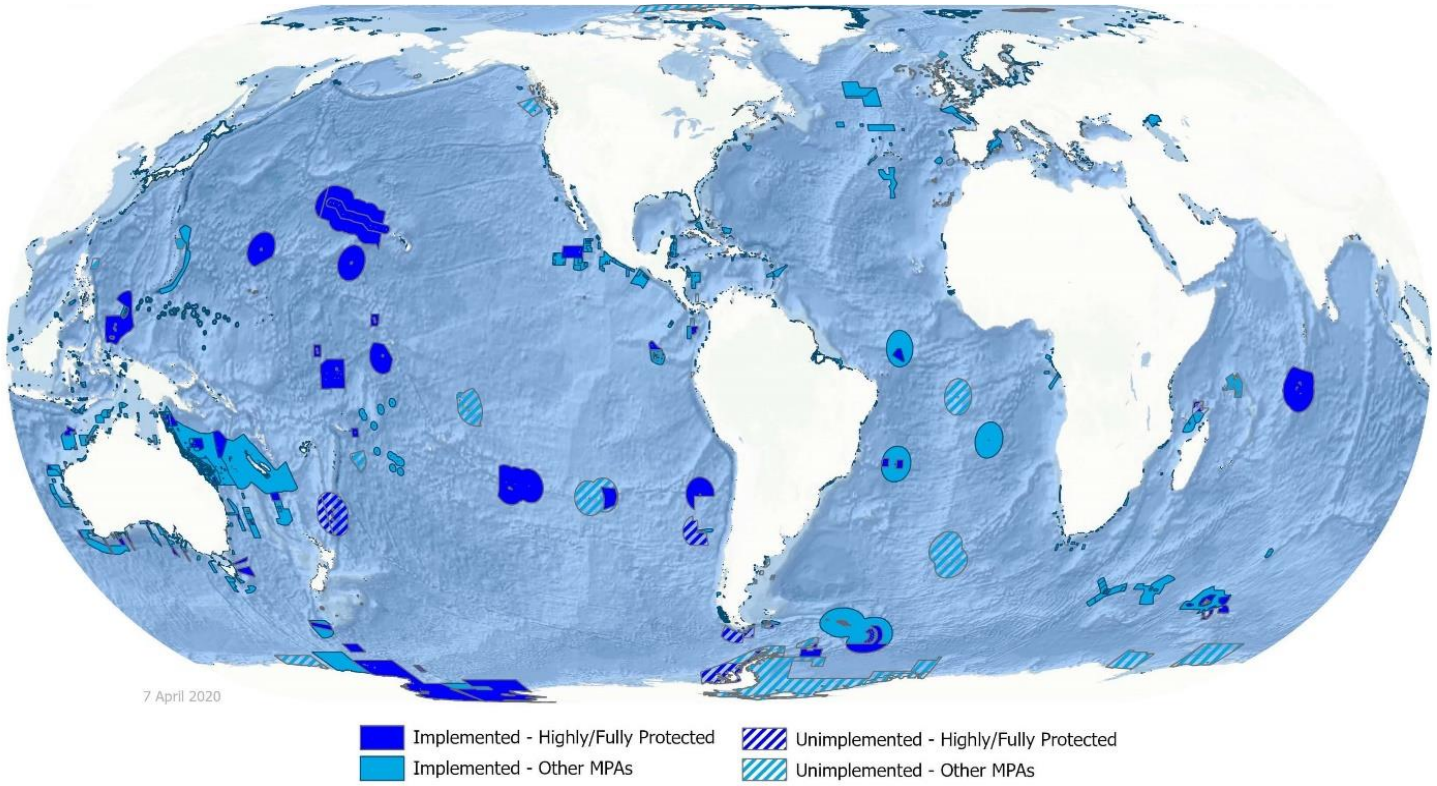
Lin et al. 2021 - Pacoureau et al. 2021 - Sharma et al. 2022 – Monteil et al. 2020

Seamounts are important biodiversity areas



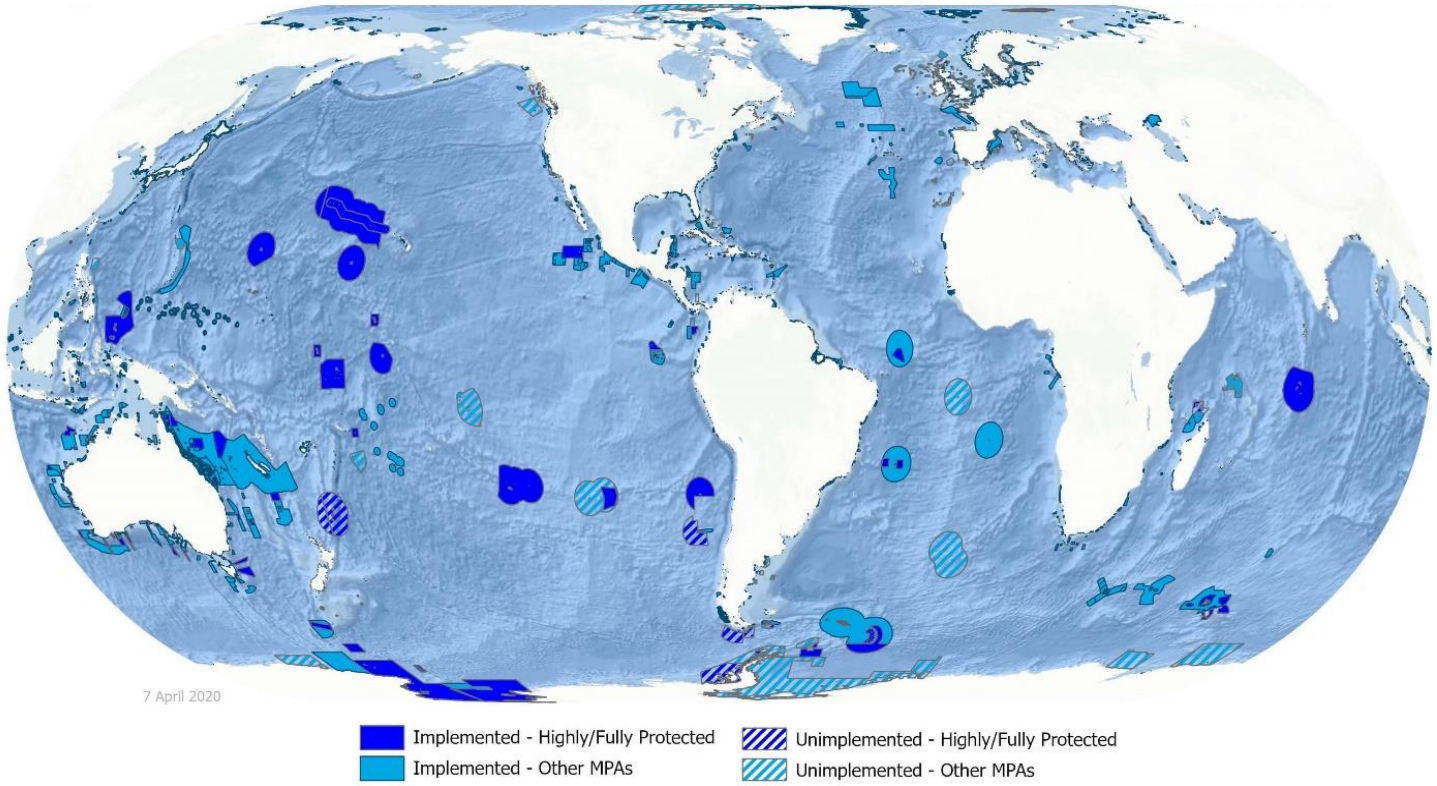
Kitchingman and Lai (2005)

Insufficient protection of the oceans



Marine Protection Atlas

Insufficient protection of the oceans



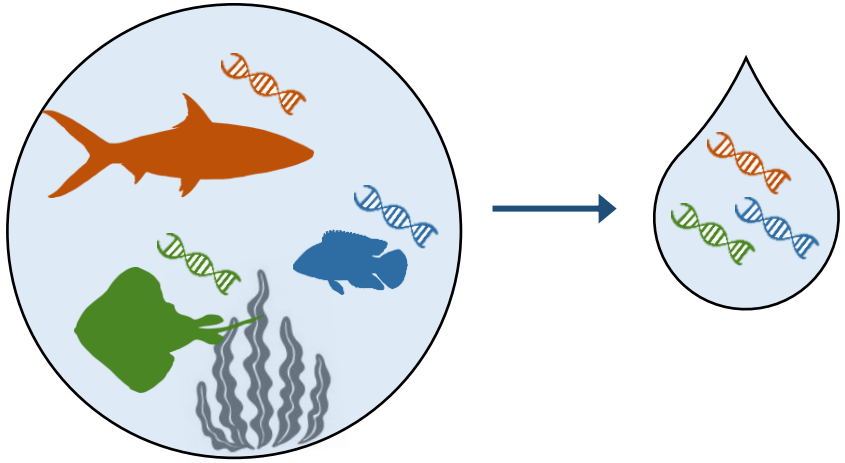
Marine Protection Atlas

Need for a framework to study the distribution of diversity and select important areas to protect, including deep-sea features

Conventional monitoring methods




Environmental DNA metabarcoding



Objectives

1. Use a combination of methods to study fish diversity on seamounts and deep slopes

2. Model several community and individual metrics (richness, abundance, biomass) in pelagic and benthic areas

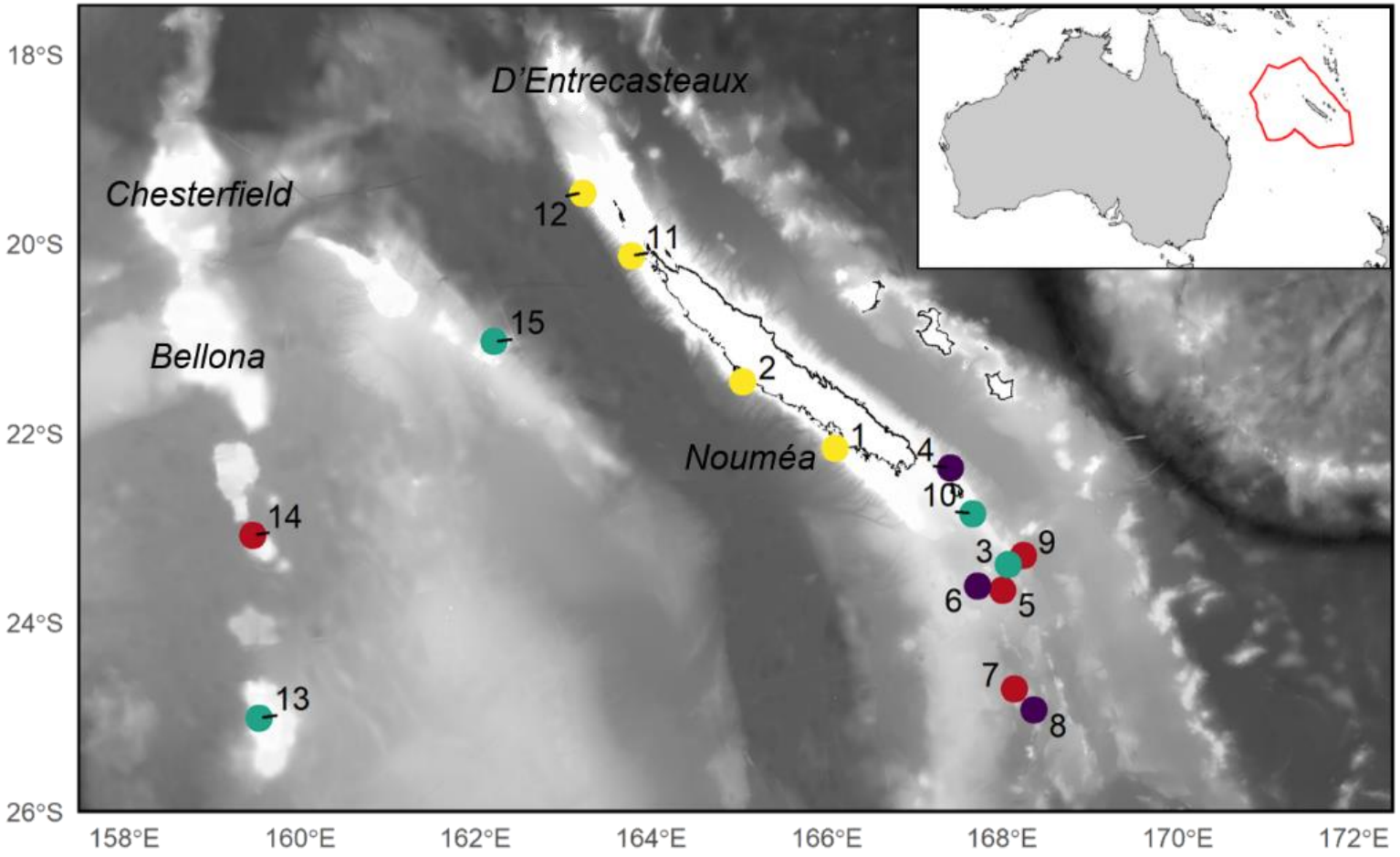
3. Integrate these data into 3D conservation planning

- Methods -

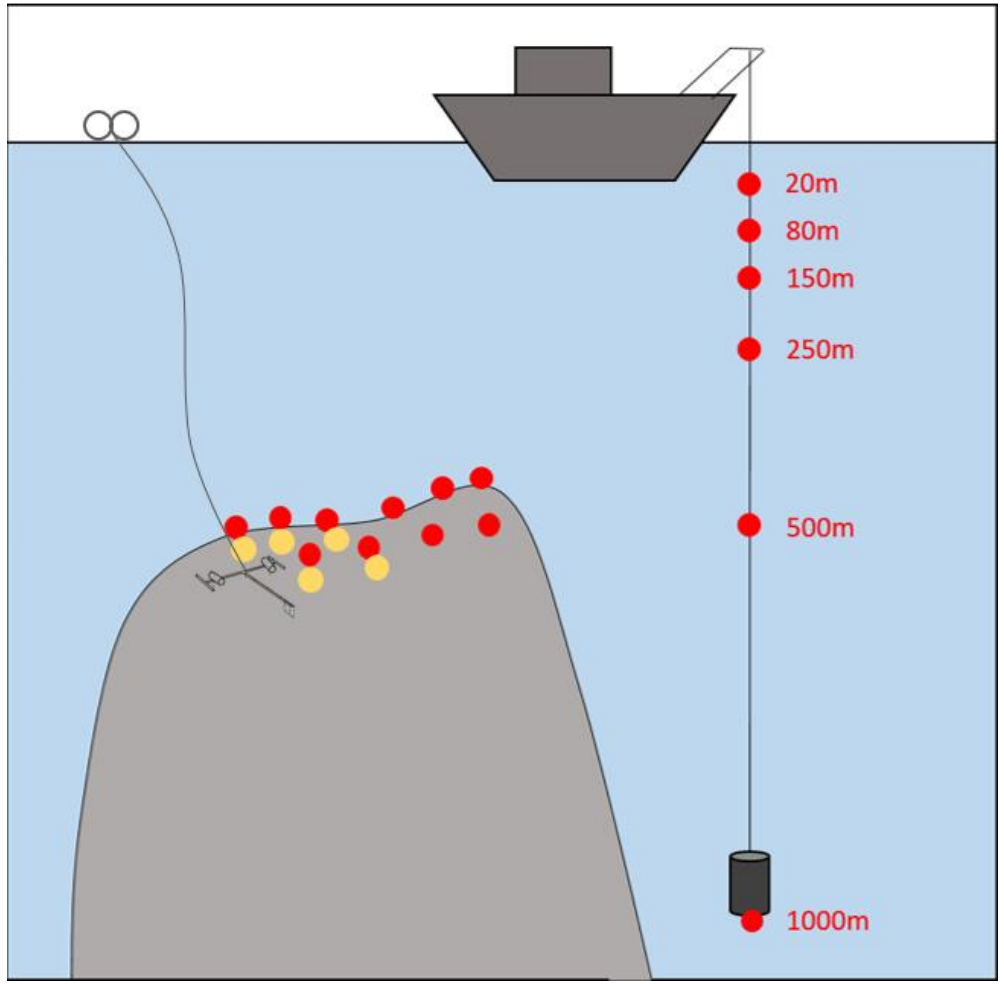
Sampling, modeling and planning

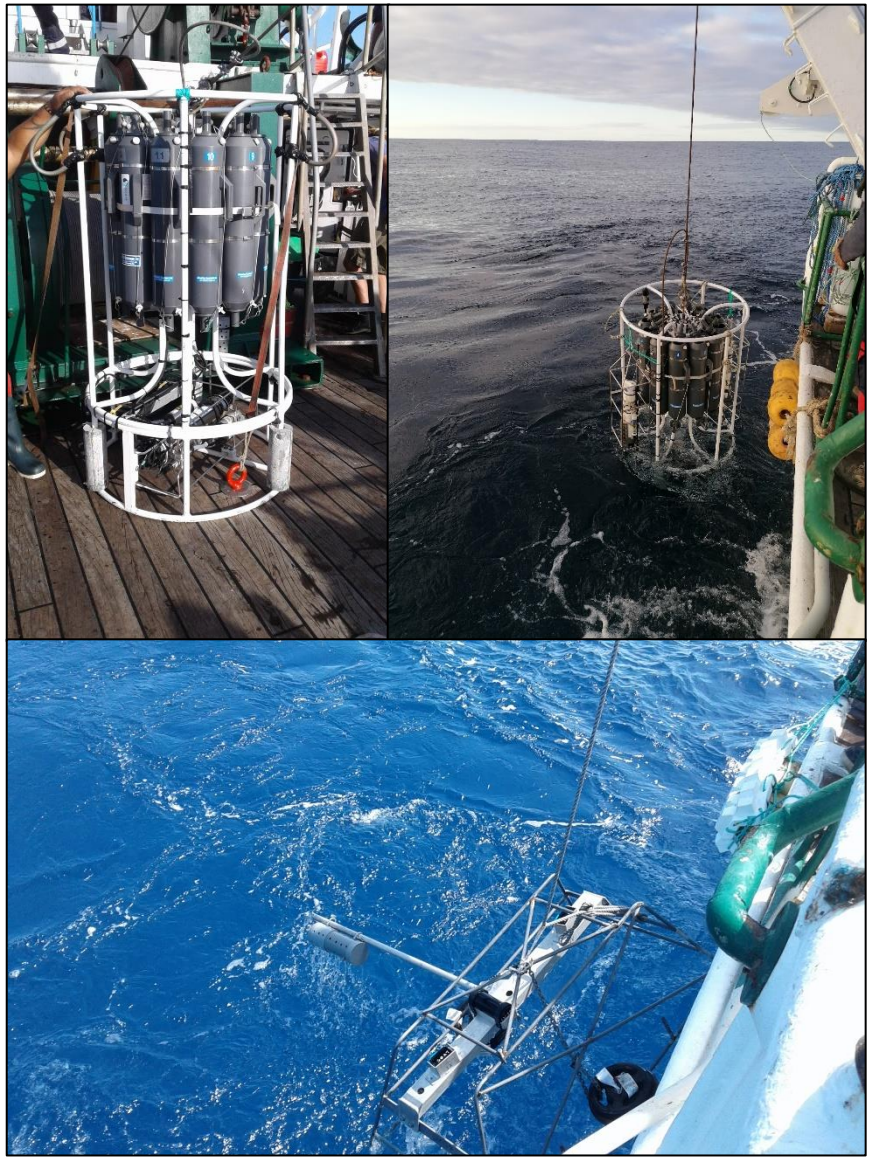
Sampling

- Summit 50m
- Slope 150m
- Summit 250m
- Summit 500m

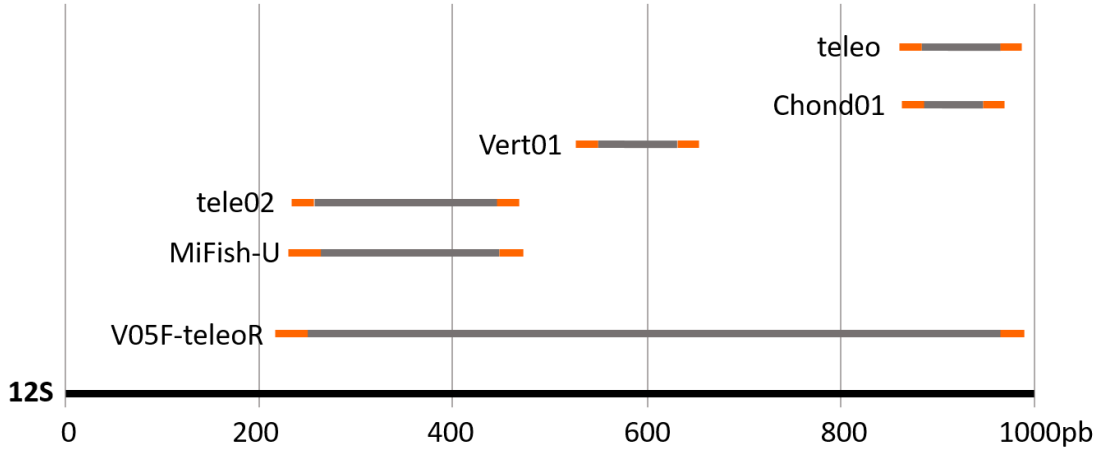


Sampling

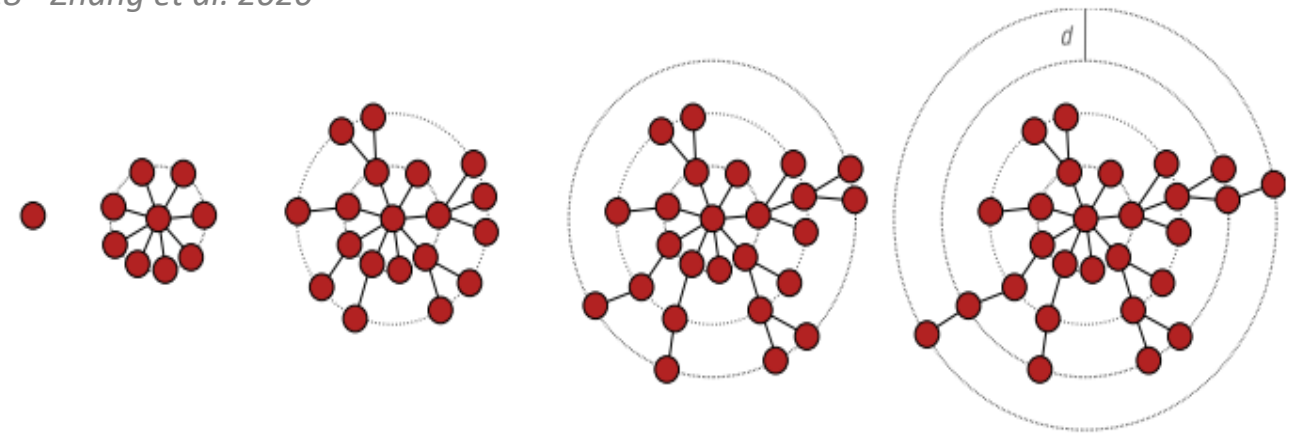




eDNA processing



Bylemans et al. 2018 - Zhang et al. 2020



Methodology

① Index

- Benthic species richness, abundance & biomass
- Pelagic and benthic MOTUs richness
- Pelagic and benthic acoustic biomass

- Abundance of most occurrent species
- Reads abundance of most occurrent MOTUs

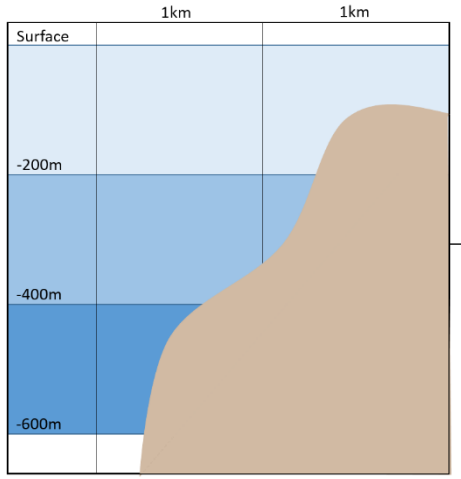
② Models

BRTs

GJAMs

③ Predictions

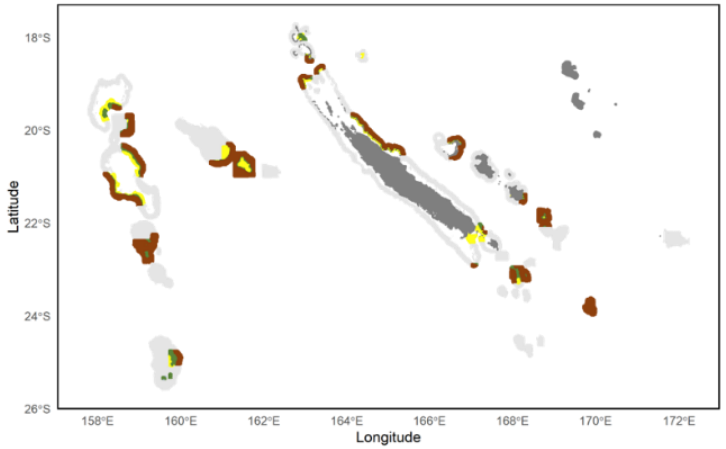
Community indices



MOTUs and species

④ Planning

3D conservation planning to protect 30% of each index



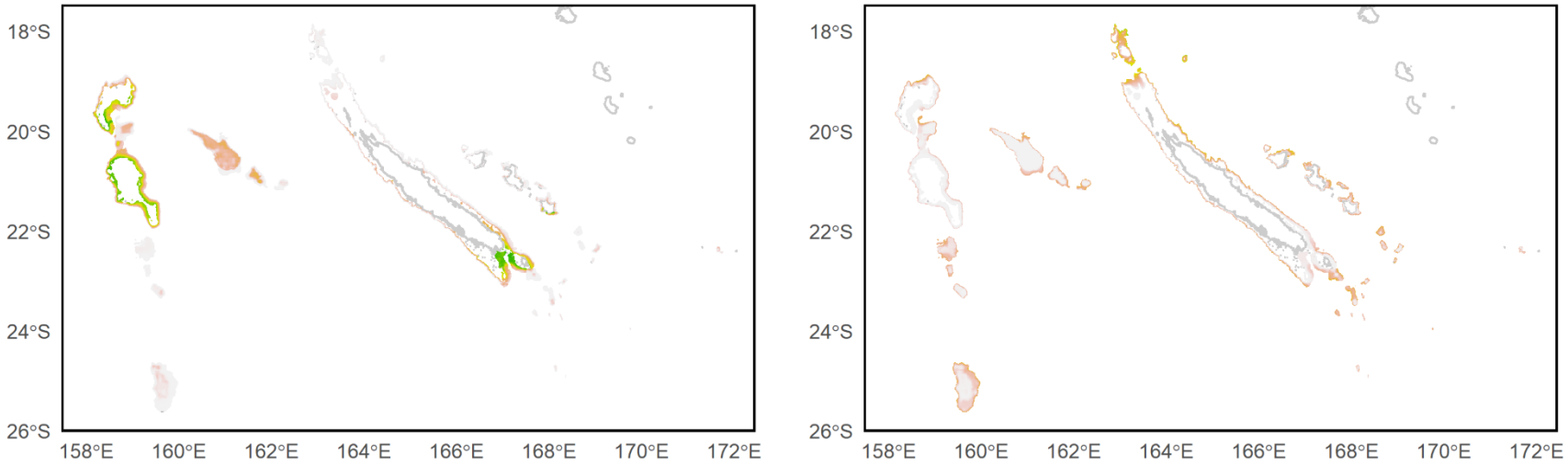
- Results -

3D biodiversity modeling and prioritization

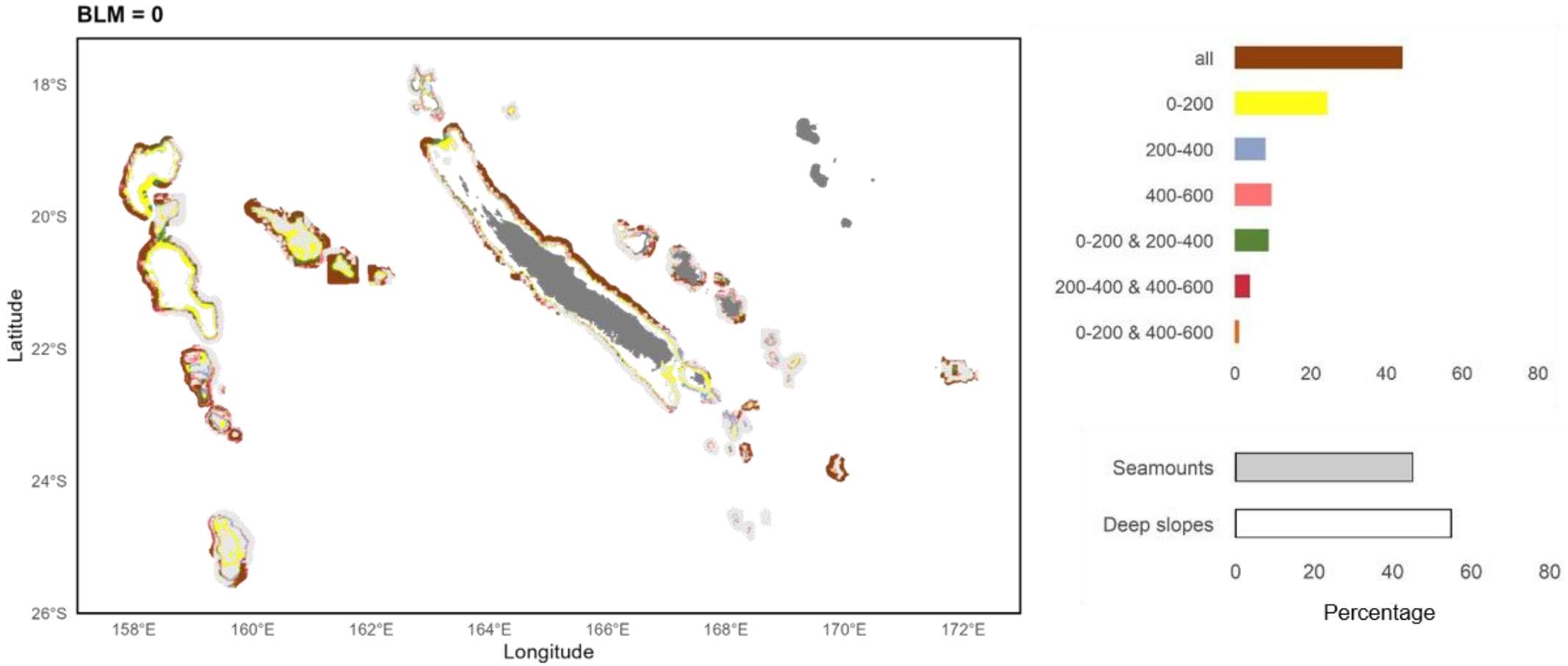
Predictions of individual species abundances

Pristipomoides filamentosus

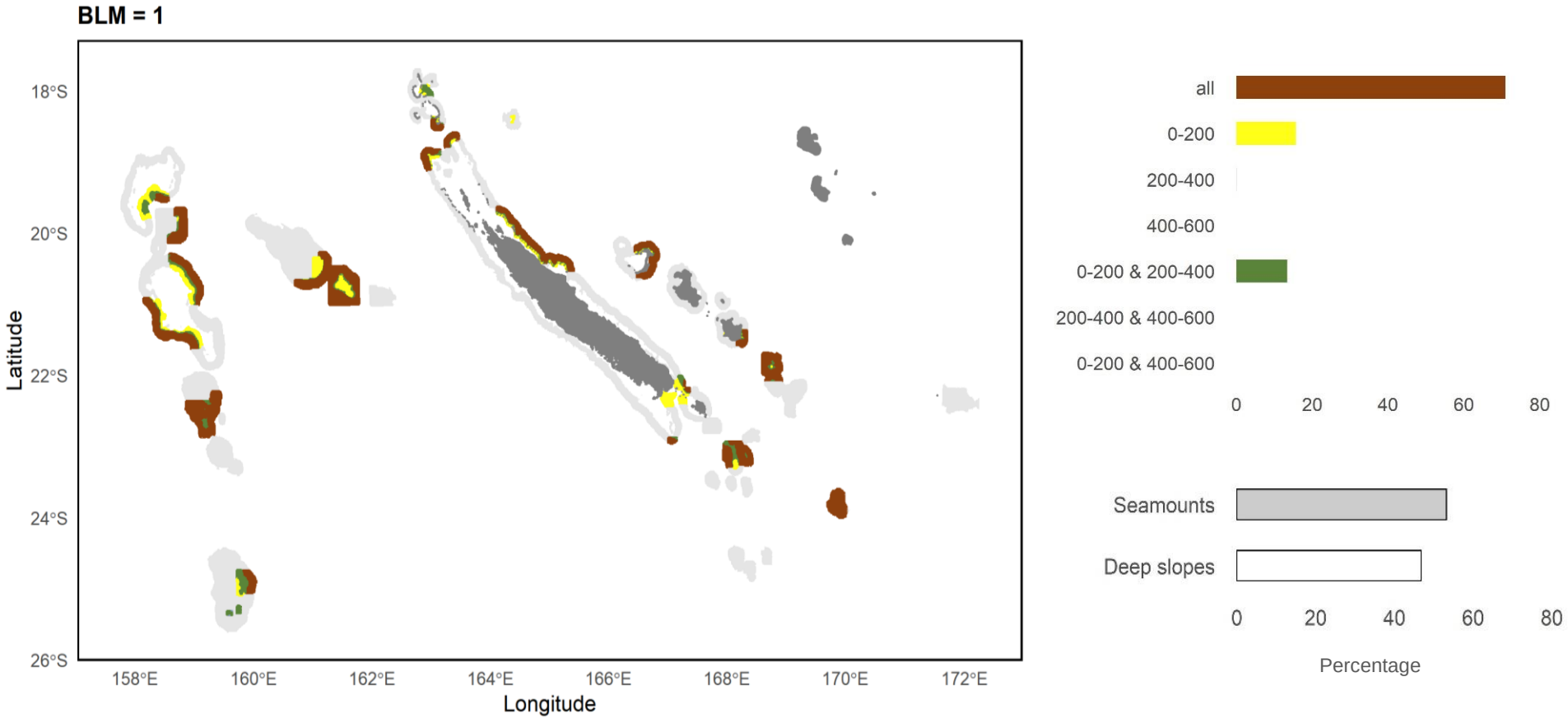
Squalus megalops



Scenarios of conservation planning



Planification de conservation



➡ Protège 30% de la biodiversité et 30% du domaine spatial considéré

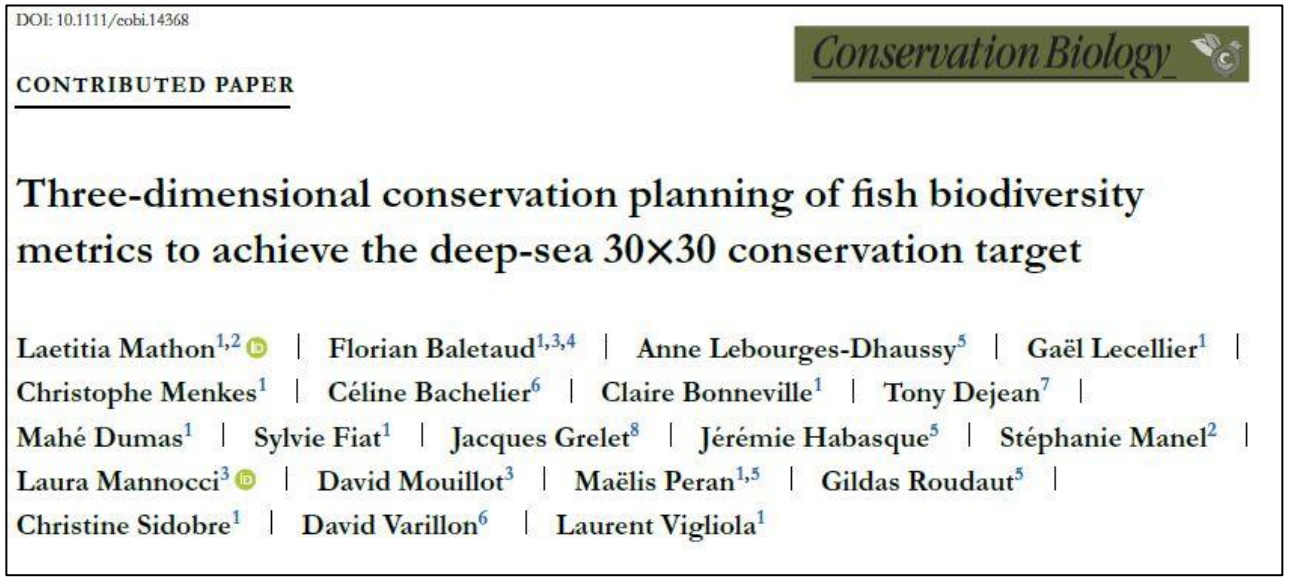
- Discussion -

Synthesis, Limits, Perspectives

Conclusions

- Combining several methods allows for a more complete census of the biodiversity
- Biodiversity strongly structured by depth and distance to human impacts

⇨ 3D solution can protect areas of high biodiversity, including deep sea features, over 30% of the spatial domain



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Conservation Biology

CONTRIBUTED PAPER

Three-dimensional conservation planning of fish biodiversity metrics to achieve the deep-sea 30×30 conservation target

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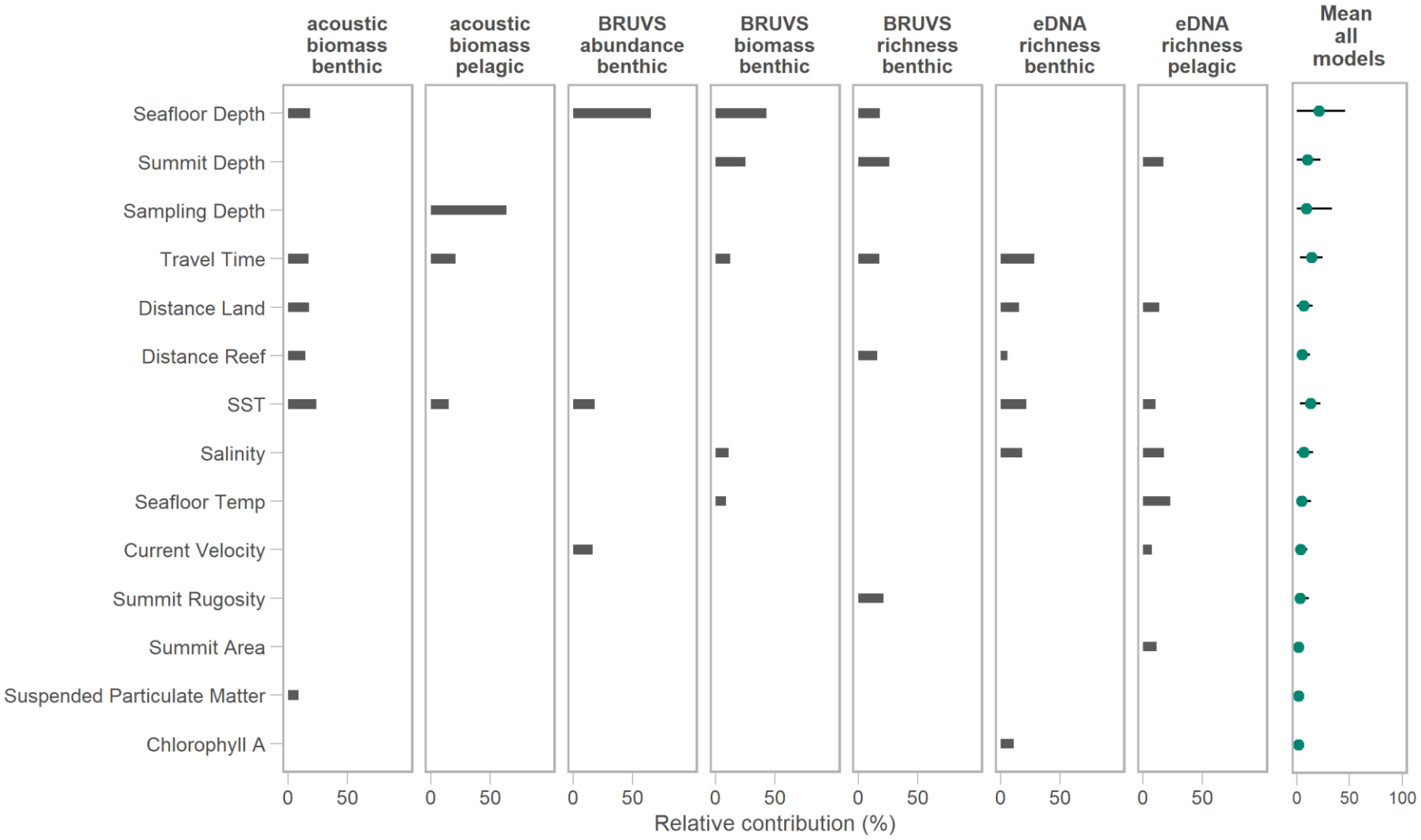
Perspectives and improvements

- Sample more deep slopes and temporal replicates
- Include more taxa in the process
- Include predictions for climate change and identify climate refugias to place MPA in climate-resilient areas
- Include a dialogue with stakeholders, managers, and decision makers to define their interests, needs, opinions, and constraints


Thank you !

Modeling of community indices



Biodiversity target selection