A framework to evaluate the effectiveness of no-take marine reserves in Mexico

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BACKGROUND

No-take marine reserves are often implemented to recover overfished stocks. The extent to which these reserves have met their objectives is unclear. Current methods for reserve evaluation are not standardized and rely solely on biological data, excluding the socioeconomic and governance dimensions. Existing frameworks do not provide a tool to perform the analysis.

Existing frameworks provide a list of possible indicators to evaluate the effectiveness of MPAs, but they are not specific to no-take reserves and do not describe how to select indicators based on reserve objectives nor provide a tool to analyze these indicators.

Where are these no-take Marine Reserves?

Comunidad y Biodiversidad promotes marine conservation by involving fishers in the design and management of marine reserves in Mexico.

GOAL AND STEPS

Develop a general approach for evaluating the effectiveness of marine reserves, and create a user-friendly tool to conduct the evaluation.

1. Identify Objectives
2. Define Indicators
3. Determine Analyses
4. Create a Guidebook
5. Develop Web App

RESULTS

1 We reviewed legislation, management plans, and decrees to identify commonly-stated management objectives, which were grouped into seven main categories. These objectives were matched to a set of 29 biophysical, socioeconomic, and governance indicators.

2 Indicators were selected to match the objectives and based on data availability and a literature review. These were reviewed in a workshop with managers, fishers, and academics.

Biophysical Indicators

1. Total Biomass
2. Objective Species Biomass
3. Total Density
4. Objective species density
5. Density of mature organisms
6. Mean trophic level
7. Richness
8. Shannon diversity index
9. Natural disturbance

Socioeconomic Indicators

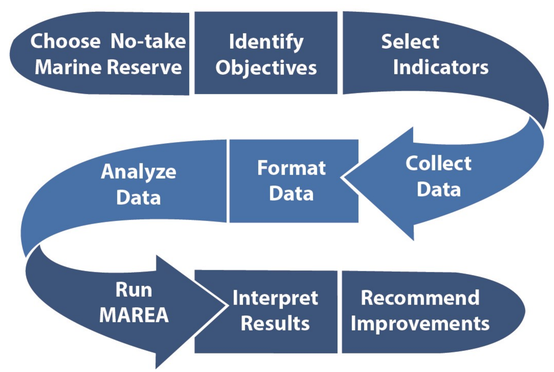
1. Income from total landings
2. Income from obj. species landings
3. Total landings
4. Obj. species landings
5. Alternative economic opportunities

Governance Indicators

1. Access to the fishery
2. Illegal harvesting
3. Internal regulation
4. Legal recognition of the reserve
5. Management plan
6. Membership to fisher organizations
7. Number of fishers
8. Perceived effectiveness
9. Reasoning for reserve location
10. Representation
11. Reserve enforcement
12. Reserve type
13. Size of the reserve
14. Social impact of reserve
15. Type of fishers organizations

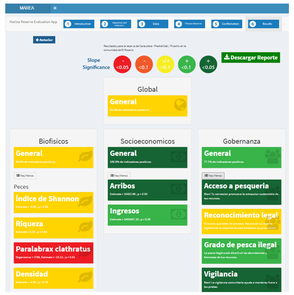
3 Biophysical indicators are evaluated with a Difference-in-Difference analysis, estimating the net effect of the reserve. Linear regression models are fitted to socioeconomic indicators through time, testing for the difference in trends before and after the implementation of the reserve. Governance indicators are analyzed based on literature, identifying common governance structures and their associated effectiveness.

4 We created a guidebook that walks fishers and managers through our framework. The guidebook describes how to match the objectives of their reserves with our proposed indicators. It then describes how users can collect and analyze data for each indicator, interpret results, and provides recommendations for how to improve reserve effectiveness.



5 We developed an open source application named MAREA (Marine Reserve Evaluation Application) that automates the framework and provides the user with results that are simple to interpret.

MAREA



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CONCLUSIONS

- This framework will be used by COBI and fishers to evaluate existing and future marine reserves.
- Mexican fisheries management agencies are interested in adopting our framework as the go-to way of evaluating marine reserves in Mexico.
- Though our framework is designed for Mexican marine reserves, we believe that the methodology of how to select indicators, collect data, and perform appropriate analyses can be applied to no-take marine reserves worldwide.
- The provided list of biophysical, socioeconomic, and governance indicators, and the real-world examples of how to evaluate reserve success based on these indicators are applicable to other reserves across the globe.

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