**Evaluation of TURF-reserve effectiveness in Mexico**

**Proposers**

*Latin American Fisheries Fellowship*

*Bren School of Environmental Science and Management*

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**Project**

*Objectives*

The objective of this project is to evaluate the effectiveness of TURF-reserves established as collaboration between fishermen communities along Mexico and Comunidad y Biodiversidad (COBI). We aim to understand the degree to which management actions have achieved the goals and objectives –social, ecological, and economical- of each TURF-reserve. By combining this information, we will create a framework that allows COBI to better understand which communities are more suitable for the implementation of a successful TURF-reserve. Thus, the project will focus on answering the following questions:

1. Environmentally, what is the state of the established TURF-reserves?
2. What are the economic costs / benefits related to establishing a TURF-reserve, and how long does it take for the benefits to out-top the costs?
3. Into what extent have the goals been met in each community, and how much time has it taken?

*Significance*

Marine ecosystems around the world sustain significant anthropogenic impacts from activities such as overfishing, habitat deterioration, destructive fishing practices, pollution, and climate change (Halpern *et. al.*, 2008; McCauley *et al.,* 2015). From them, overfishing and unsustainable fishing practices represent a large portion of the deterioration. Multiple solutions have been proposed in order to manage fisheries and restore marine environments. Two of the most widely used management strategies are Territorial Use Rights for Fisheries (TURFs) and Marine Reserves (MRs), which are usually implemented separately (Afflerbach *et al.,* 2014). Nevertheless, there are cases when both strategies are used together, thus creating TURF-reserves (Costello and Caffine, 2009).

TURFS are areas where exclusive extraction of natural resources is granted to a person or group of people, in this case fishers (Christy, 1982). The ownership of an area incentivizes fishers to sustainably manage their resources (Afflerbach *et al.,* 2014). MRs are areas from which extraction is null or limited. While MRs have proven to increase biomass (Lester *et al.,* 2009), enhance resilience of the bounded region (Micheli *et al.,* 2012), and preserve genetic diversity (Munguía-Vega *et al.,* 2015) it is not uncommon to find sites with poor management. Thus, the combination of two of the most effective management strategies seems plausible to obtain better results.

In Mexico, marine reserves had been traditionally established as no-take zones within a marine protected area. Nevertheless, a 2014 regulation (NOM-049-SAG/PESC-2014) now allows the establishment of no-take zones under the name of “Fishing Refugees”. Until the last years, TURF-reserves established by TURF owners had no legal support, and were only recognized as so by the owners. This scheme did not allow a correct enforcement of the areas, and thus threatened the potential of recovery. This new regulation enables TURF owners to establish a legally supported MRs within their granted area.

COBI is one of the largest marine conservation and sustainable fisheries promoter NGO’s in Mexico, and has devoted 15 years to collaborate with coastal communities. A large part of their work has been devoted to establish TURF-reserves with coastal communities. COBI recognizes that the initial costs of closing a fishing area to establish a TURF-reserve may be relatively high for communities, as this initially represents a decrease in fishing and income. Providing an assessment of the performance of these reserves will not only provide COBI with knowledge on the characteristics that make a successful TURF-reserve, but also allow them to better select other communities. This, along with the recent regulations to establish TURF-reserves, would allow COBI to promote the use of TURF-reserves amongst fishers, in order to build a network.

*Background*

Working tightly with coastal communities, COBI has established TURF-reserves: a coupling between Territorial User Rights for Fisheries and Marine Reserves. These TURF-reserves have been established in fisherman communities in three main regions: the Pacific Ocean, Gulf of California, and the Caribbean. Amongst these regions, COBI works with a total of 15 communities, where at least one TURF-reserve has been established.

Some of the reserves have been established for up to 10 years, and recovery has been observed in some TURF-reserves (*e.g.* Micheli *et al.,* 2012, Villaseñor-Derbez *et al.,* 2015). Yet, COBI lacks a national approach that comprehensively describes the effectiveness of each TURF-reserve and condenses it in a framework that enhances effectiveness.

*Available data*

Thanks to the yearly monitoring program at each location, COBI has an extensive database. The data includes fish count and size structure, invertebrate count data, algal cover, and habitat heterogeneity. It is important to mention that all locations were sampled before the implementation of the TURF-reserves, thus providing us with a base line. There is ecological data available for each TURF-reserve and its respective control zone. Databases will allow us to evaluate the recovery of the TURF-reserves, and may be made available to the group as soon as needed.

*Possible approaches*

Due to the environmental differences between the regions where COBI has established reserves, databases have slight differences between them. The first step will be to standardize databases into a common format that allows the group to work more efficiently. The evaluation will be done at a regional level, to take into account differences in ecosystems, ecological stressors, and social structure of the communities in each region. Our approaches are directly linked to our objectives, and enumerated in the same order.

1. Evaluating the recovery of TURF-reserves
   1. To evaluate the recoveries of the TURF-reserves, biomass (fish) and abundance (invertebrates) will be compared between each TURF-reserve and its corresponding control zone. Rather than looking at absolute numbers, we will follow Caselle *et al.,* (2015) and compare trends over time, for each area (*i.e.* TURF-reserve and control area). By focusing on temporal variations, we can evaluate the recoveries in a way that is less susceptible to biases related to MPA location (e.g. MR established in a fish abundant / poor area).
   2. Understanding how a community is structured may also provide insight of recovery. Sometimes total fish biomass may not change over time (*e.g.* when a large number of small fish are replaced by few large fish) and other approaches might be necessary. Thus, we will also focus in community structure, with special attention to trophic levels.
   3. Furthermore, we will look into specific species of interest (*i.e.* threatened or important to fisheries) and evaluate their independent recovery.
2. Economic costs / benefits
   1. We will estimate the costs of not fishing that are related to the area where fishers have decided to establish the no-take zone. We will then estimate the net value of the TURF-reserve as a) what would happen if fishing was suddenly allowed and the resources were harvested, and b) what is the value of the spillover from the area. All this will be made taking into account time to recover, time to harvest, and time of investment (*i.e.* not fishing).
3. Effectiveness of the TURF-reserves
   1. To evaluate the effectiveness of the TURF-reserves, the client has suggested to use IUCN’s “How is your MPA doing?” framework. This guide is based on a set of natural and social indicators that allow evaluating the effectiveness of Marine Protected Areas (Pomeroy *et al.,* 2008), and is currently used by the Mexican Commission of Natural Protected Areas (CONANP).
   2. While IUCN provides a comprehensive framework, we might have to incorporate other approaches than are more suitable for specific regions or components of the project.

*Deliverables*

In addition to the final written report, poster, and oral presentation required by Bren School, our client has required us to provide at least one peer-reviewed article in which we report and summarize the major findings. We will also provide a translated and summarized version of the final report, as an internal document for COBI.

Additionally, we will develop a tool (*e.g.* software or platform) for COBI to feed with data. This will be an automated version of the framework developed in our project, and will provide a detailed evaluation of the effectiveness of the TURF-reserve(s). The framework and platform will also allow for an *a priori* evaluation of potential communities with which COBI is interested in collaborating. Thus, the tool could provide insights the probability of success of a project, helping COBI to better administrate its resources. On either scenario, the tool will provide recommendations that will help COBI enhance the effectiveness and obtain better results. These recommendations will be aligned with COBI’s current strategic areas (leadership empowerment, sustainable fisheries, public policy, and marine reserves).

*Internships*

COBI will provide at least one summer internship in Mexico for one of the students of the project. The intern(s) will work at one of COBI’s offices (Guaymas, La Paz, or Puerto Morelos). They will work in the Marine Reserves project, under direct supervision of the regional Marine Reserves Manager (Alvin Suárez, Arturo Hernández, or Stuart Fulton, respectively). Financial support covering travel expenses may be available.

**Supporting Materials**

*References*

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*Budget and justification*

We do not expect the project’s basic operations during the school year to exceed the stipend provided by the Bren School ($1,300.00).

*Client letter of support*

Carta firmada por Jorge