

# Community responses to Marine Protected Areas in the context of Social-Ecological-Systems in the Gulf of California, Mexico

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## 1 Part I: Static Analysis - Collective action

The resource appropriated from the Gulf of California constitutes a diverse array of more than 80 commercial species of fish, sharks, and marine invertebrates. The fisheries are regulated by the federal government and exploited by the coastal communities surrounding the Gulf. The natural boundaries of the system are defined by semi-enclosed sea surrounded by the states of Baja California, Baja California Sur, Sonora, and Sinaloa, Mexico. The institutional boundaries correspond to the geographic range the fishery co-op can access as well as to the political boundaries of the state. This particular study makes a comparison of two communities in the northern Gulf of California (Puerto Peasco and Bahia de Kino) that were involved in some way in the development and establishment of a marine protected area in their fishing grounds.

### 1.1 The Commons Dilemma

The GOCs year-round high productivity makes it a region of extremely high economic importance for Mexico. It produces approximately 50% of the landings and 70% of the value of national fisheries in Mexico (Carvajal et al. 2004; Ulloa et al. 2007). Both large and small-scale commercial fishing constitute the predominant economic activities in the region, with the small-scale fishery sector being operated by 50,000 fishers and 250,000 boats, while the large-scale, industrial fishery sector is comprised by 10,000 fishers and 1,300 boats (Cisneros-Mata. 2010). The commercial activity of these fisheries dates back to the 1920-1930s, but the small-scale fishery sector has grown dramatically to become a high-impact harvest activity in the past 50 years (Bahre et al. 2004; Cudney-Bueno 2000; Saenz-Arroyo et al. 2005; Saenz-Arroyo et al. 2006). This sector has also become increasingly multi-specific as there is an enormous diversity of fishery resources, with at least 80 importantly commercial species being targeted (Moreno-Baez et al. 2012). Under the present harvesting levels and lack of strict regulation, it is not uncommon for an appropriation of the resources to allow the resource to be locally over-harvested at any given time. Eventually, a specific resource (i.e. a species or group of species) becomes locally depleted, and the users simply switch to another one. Regardless, the general perception among fishers is that catches keep declining overtime.

## 1.2 Biophysical Context (IAD)

- **Natural infrastructure:**

The resource unit here is multi-specific as there is an enormous diversity of fishery resources, with at least 80 importantly commercial species being targeted (Moreno-Baez et al. 2012). These species range from ray-finned fish (e.g. leopard grouper, yellow snapper, spotted sand bass), to cartilaginous fish (e.g., hammerhead shark and diamond stingray), to arthropods (e.g., swimming crab, blue shrimp, and spiny lobster), to mollusks (e.g., octopus and rock scallop), to echinoderms (e.g. sea cucumber). The Gulf of California spans 34,000 ha of semi-enclosed ocean harboring habitats such as deep ocean basins, steep slopes, geothermal vents, numerous islands, mangroves, coastal lagoons, rocky and sandy shores, coral and rocky reefs, seagrass beds, bays, and estuaries (Ulloa et al. 2007). The high richness in biodiversity is mostly due to the remarkably wide range of habitats, temperate latitude, complex oceanography that includes tidal currents, sea surface temperature variations, and constant tidal and wind-driven as well as seasonal upwelling systems (Ulloa et al. 2007).

- **Human-made infrastructure:**

Human-made soft infrastructure includes the decision to establish a Marine Protected Area. In the case of Puerto Peasco, the hookah (air compressor) diving sector took the decision at the operational level to take a more precautionary behavior given the evident decline in availability of benthic resources, specially the black murex snail (Cudney-Bueno et al. 2009). In 2000, the divers convened to discuss future management guidelines and petitioned the federal government to establish a season closure for black murex snail at the collective-choice level (formally granted in 2001). In 2001, the divers set an informal temporary refuge covering 3km of coastline at San Jorge Island (SJI) (30 km southwest of Puerto Peasco) without waiting for government recognition. In 2002, divers established a network of 3 reserves (SJI and 2 coastal areas) to cover 18 km of coastline. These were agreed to be closed for 3 years, after which they would re-assess future management efforts. In the case of Bahia de Kino, the federal government had the initiative to re-categorize the existing terrestrial reserve in the Island of San Pedro Martir into a biosphere reserve that would encompass a core zone and a buffer zone in the marine environment surrounding the island.

## 1.3 Attributes of the Community (IAD)

- **Human infrastructure:**

Both large and small-scale commercial fishing constitute the predominant economic activities in the region, with the small-scale fishery sector being operated by 50,000 fishers and 250,000 boats, while the large-scale, industrial fishery sector is comprised by 10,000 fishers and 1,300 boats (Cisneros-Mata. 2010). Most fishers economically depend on the resource year-round, and much of the catch is exported to U.S. and Asian markets. All fished with 4 main different methods: diving, gillnets, longline, traps, hand fishing line. The resource users constitute members of the community of Puerto Peasco (40,000 pop.) in the state of Sonora with 230 small-scale fishing boats and 120 large-scale shrimp trawler boats, and of Bahia de Kino (5,000 pop.), where in addition to local small-scale fishers and large-scale fishers, there are sport fishers mostly from the U.S.

The federal government constitutes the main public infrastructure provider for regulating the states fisheries. All marine fisheries regulation is shared by two federal agencies: SEMARNAT (Secretary of the Environment and Natural Resources), and SAGARPA (Federal Agency for the Protection of the Environment). SEMARNAT is the agency in charge of regulating species listed only under special protection. It also houses the enforcement body called PROFEPA (Federal Agency for the Protection of the Environment). SAGARPA houses the National Fisheries Commission (CONAPESCA), which is in charge of enforcing regulations that fall under SAGARPAs jurisdiction, issuing licenses for fishing in the form of permits, concessions, or authorizations. The Navy is allowed to provide enforcement aid if needed to both CONAPESCA and PROFEPA. SAGARPA also houses a National Commission of Natural Protected Areas (CONANP), which is in charge of the establishment and management of MPAs.

Multiple NGOs and academic institutions have heavily participate in conservation and resource management efforts apart from government organizations. These include NGOs like Comunidad y Biodiversidad (COBI, A.C.), GECEI (Grupo de Ecología y Conservacion de las Islas), and CEDO (Centro Intercultural de Estudios de Desiertos y Oceanos), with the help from academic institutions such as Prescott College Center for Cultural and Ecological Studies and the University of Arizona. These institutions have played an important role in empowering stakeholders, facilitated obtaining funds for monitoring as well as designing monitoring techniques, trained divers for ecological data acquisition, and all while also producing data and proposals with scientific backup that can help bridge and validate fishers local ecological knowledge and actions with policy actions at the higher local and federal government entities (Cudney-Bueno et al. 2009).

- **Social Infrastructure:**

The hookah (air compressor) diving sector of Puerto Peasco formed a cooperative that was at the forefront of community initiatives to establish refuges and networks of marine reserves with the aim of allowing the recovery of benthic marine organisms for harvesting. Their agreements were less respected after constant re-structuring of the federal and local fisheries administration, which brought in new personnel unfamiliar with the current community agreements on the closures.

## 1.4 Rules in Use (IAD)

### Position Rules:

- Small-scale fisheries including ray-finned fish, cartilaginous fish, mollusks, arthropods, and echinoderms
- Members of cooperatives.
- Local representatives of the federal fisheries department (CONAPESCA), PROFEPA, CONANP.

### Boundary Rules:

- Capture is illegal inside the core zone of a legally-established MPA (e.g. in San Pedro Martir Island)

- Capture may be restricted, depending on the season inside the buffer zone of a legally-established MPA
- All fishermen must have the fishing permits necessary for harvesting various categories of marine life (except when fishing for subsistence or domestic consumption).
- All boats and gear must be registered by paying a minimal fee.
- Capture must be legally registered and certified by CONAPESCA officials upon landing for the transportation of the product to the market.
- Receipts for tax payment are necessary to obtain a permit for shipping, and these are checked at various checkpoints along the highway.

### **Scope Rules:**

- CONAPESCA grants species-specific fishing concessions as a form of exclusive fishing access rights within specific areas. Fishers from the nearby community would be given preferential access to the area and the reserve would give a legal means to control access of highly impacting fishing activities such as bottom fish trawling. Mexico's environmental law states that communities within and/or near reserves have special access rights to these areas.

### **Choice Rules:**

- Any fisherman can fish anywhere they chose to except inside the core zone of a legally established MPA.

## **1.5 Summary**

Marine protected areas remain as one of the most popular tools for the conservation and management of natural resources in marine ecosystems. However, risks have been identified with the urgency to establish MPAs without the adequate resources, governance structure, or institutional conditions. For instance, mere establishment of MPAs without the proper design, management, or enforcement tools may give a false sense of security that such MPAs will be enough to sustain marine resources (Rife et al. 2012). The Gulf of California (GOC), also known as Sea of Cortez, in Mexico, has received a great deal of attention from international and national private foundations, governmental and non-governmental (NGOs) organizations, and academics and universities over the past 20 years as a region where conservation and resource management efforts are badly needed, the measurable outcomes of such efforts, both in terms of marine resource sustainability and socio-economic well being, still leave much to be desired.

## **2 Part II. Dynamic Analysis - Robustness**

### **2.1 Shocks, Capacities, Vulnerabilities**

**...to and of the Public Infrastructure Providers (link 8 to PIP):**

In the case of public external social, economic, or political shocks, because of the complicated institutional network in charge of regulating access to fishery resources, any unanticipated

socio-political disturbance (via Link 8) can throw the system off balance. For instance, with changes in the Presidential Administration in 2000, there was constant re-structuring of both the federal (going from a Secretariat to a Commission) and local fisheries administration (change of directorship that brought personnel from outside the region who were unaware of existing local institutional arrangements in the community of PP, and thus were less supportive of the fishers management initiatives). Problems that followed included budget reductions, confusion as to which agency was held accountable, and basic inefficiencies in the bureaucratic processes (Cudney-Bueno et al. 2009).

**...to and of the Resource Users (link 8 to RU):**

Another serious vulnerability is the distinctive time lag between community initiatives and federal action. Community initiatives operate on very different time frames than those of the government, and a slow response might actually lead the community to stop believing in the seriousness of the federal government to address their concerns and suggestions. In the case of Bahia de Kino, the formal recognition of the new biosphere reserve took over 2 years to be published in the Federal Register, even though this was a federal initiative. Furthermore, the official management program for the reserve was not authorized nor published until 2007, almost 5 years after the MPA was formally established, which prevented many of the regulations to be properly enforced during that time. This time lag represents a weakening of Link 3 that in turn can weaken Link 2 as well as Link 6 in a positive feedback than can quickly lead to local overharvesting of the resources and a deterioration of the trust relationships between resource users and government public infrastructure providers. For instance, in the case of Puerto Peasco, information traveled quickly on the informal refuge the diving sector had set up in San Jorge Island (SJI) which led divers from the community of Bahia de Kino (600 km south by road and 8h away by boat) to take advantage and harvest rock scallops. Given the weakness in Link 3 with respect to federal recognition of the reserves and the quick spread of the word on harvest refuges, divers from Puerto Peasco also headed to the island in frenzy to harvest as many rock scallops as possible and collectively fish on the island before others would continue free-riding on their efforts. (Cudney-Bueno et al. 2009).

## **2.2 Robustness Summary**

Natural resource managers who have been working in the GOC hypothesize that people are likely to do nothing with respect to their resources being overharvested until they see a clear crisis at their doorstep. This begs the question on whether new approaches can be used to better understand the underlying causes for community discouragement and resistance to compliance. A closer look at specific case studies of different communities in the GOC might shed some light into what specific components are most likely to be affected by new policy tools such as MPAs, and which components should be maintained strong to facilitate success.