Marine reserves are no panacea: Scaling global principles to regional analyses of reserve efficacy under a social-ecological-systems perspective

Dissertation Prospectus

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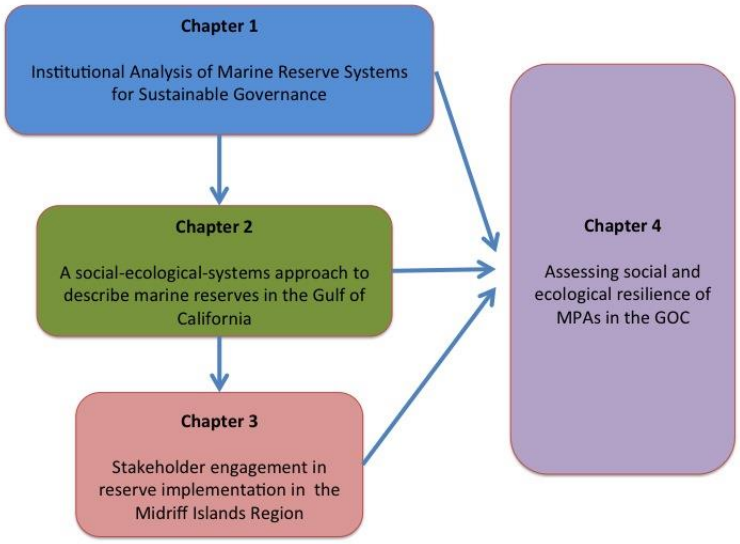
1. Abstract

Marine protected areas (MPAs) have become a widely-used approach to protect marine biodiversity and promote sustainable fisheries. But they are no panacea: few studies have examined how reserves influence human use, and how such use in turn influences the resources that the reserves are intended to protect. Furthermore, the planning stages for MPAs often fail to explicitly consider the institutional, social, economic, and political context of the area in which the MPA is established. These shortcomings can lead to non-compliance by people being affected by the establishment of the MPA. When combined with weak enforcement capabilities, failure to consider the human dimensions of MPAs undermines reserve objectives. For my dissertation research, I seek to understand the conditions under which MPAs are likely to succeed in achieving both ecological and social benefits. To develop a theoretical and empirical foundation for understanding interactions between social and ecological systems, I will follow general frameworks for the study of social-ecological-systems (SES) to diagnose the determinants of reserve efficacy on a global to regional scale. I will then use this framework to examine how feedbacks in relevant social, economic, and political contexts mediate those interactions at both the local and regional-scale. The structure of the dissertation scales from a general understanding on the conditions that have been proven necessary to ensure MPA effectiveness in case studies around the world, to a regional case-study analysis of small-scale fishing communities in the Gulf of California (GOC), in Mexico and their interactions with MPAs (Figure 1). In Chapter 1, I will carry out a global analysis on the concept of a "successful marine reserve" by identifying the most relevant variables to consider when going from the theory of MPA planning and implementation to action at a regional and local scale (Chapter 2). In Chapters 1 and 2, I will use the Institutional Analysis and Development (IAD) and coupled-infrastructure systems frameworks to guide a comparative analysis of case studies. In chapters 3 and 4, I will test the hypotheses developed in Chapters 1 and 2 about the weaknesses and vulnerabilities of MPA systems to socio-economic shocks through an empirical study at the local level. Collectively, this body of work will elucidate the relevant social and ecological variables that determine MPA efficacy.

2. Summary and goals



Chapter one: *Institutional Analysis of Marine Reserve Systems for Sustainable Governance.* Through a review of both primary and secondary literature containing data-rich case studies of established marine reserves implemented and monitored around the world, I will explore the following questions: A) What is the evidence that marine reserves around the world benefit both nature and people? B) What are the biophysical, social, and economic variables that are most relevant to ensuring the efficacy of a marine reserve from a coupled human-ecological reserve system's perspective?

Chapter two: *Qualitative case-study analysis of the use of marine reserves in the Gulf of California through a Social-Ecological-Systems lens.* I will characterize the system dynamics, weaknesses and vulnerabilities of 5-10 marine-reserve systems in the GOC. For each case study, I will explore the following questions: A) What are the key system vulnerabilities and how are these vulnerabilities affected by the institutional structure that governs the operation of small-scale fisheries in Mexico?, and B) To what extend do feedbacks within this system hinder a reserve system that benefits humans and nature?

Chapter three: *Perceptions of MPA regulations and rule compliance in the GOC.* I will combine empirical data with case-specific coupled-infrastructure-systems analysis to conduct a detailed study of the interactions between the operational and the collective-choice levels in the GOC system. I will use these data to address the following questions: A) What is the level of understanding and support for MPAs among five stakeholder groups?, and B) How does this support vary among these stakeholders?.

Chapter four: *Assessing social and ecological resilience of MPAs in the GOC.*
Building on general principles (Ch. 1), system dynamics (Ch. 2), and empirical data on stakeholder engagement (Ch. 3), I will synthesize the challenges and opportunities in MPA management in the GOC. In particular, I will examine the following questions: A) In what ways do stakeholder perceptions, preferences and interactions influence MPA efficacy as fishery management strategies?, B) How do these factors scale up to the region of the GOC?, and C) Who wins and who loses after the establishment of a marine reserve in the GOC?.

Taken together, this work will provide an approach to conservation planning that incorporates ecological, economic and social objectives while accounting for human perceptions to policy changes in order to achieve more robust policies without unintended consequences.

3. Introduction

A. Background and significance

The world's oceans and coasts have been recognized as vital social and economic components of the planet's natural capital. In addition to harboring a wide diversity organisms, the marine environment includes habitats and species that support commercial activities and ecosystem services (e.g., tourism, recreation, fishing) (UNEP et al. 2012). Human dependence on coastal and oceanic environments is rooted in the sectors of small-scale fisheries (SSFs), aquaculture, and industrial fisheries, and their importance to food security and poverty alleviation is increasingly relevant in the developing world (FAO 2014). This heavy dependence on marine fishery resources has undoubtedly led to a number of threats menacing their long-term provision and resilience, the biggest one being overexploitation, which reduces both the economic and social benefits provided by these resources. It is now widely accepted that the decline in world fish stocks is due to mismanagement (Costello et al. 2008, Worm et al. 2009, Costello et al. 2012, FAO 2014).

Fisheries, classified under the concept of common-pool-resources (CPRs) of high subtractability (i.e. one fisherman using the resource prevents it being available to others) and low excludability (i.e. it is difficult to exclude users from getting access to the resource), have been traditionally considered as inevitably subject to the "tragedy of the commons" scenario in

which everyone aims at gaining maximum individual benefits leading to the collective outcome of everyone losing due to overexploitation (Gordon 1954, Hardin 1968, Ostrom 1990). Conventional government management approaches such as licenses, catch quotas, temporal controls on catch or effort, gear restrictions, size limits, taxes, subsidies, or rights allocation are often employed simultaneously in a given area with no strategic coordination (Holland and Brazee 1996, Abdullah et al. 1998, Chu 2009, Sanchirico et al. 2010). Furthermore, the complex governance of marine resources is a good example of how objectives coming from the ecological preservation perspective of maximum biological production and the protection of ecosystems and non-target species often come into conflict with the social, economic, and political objectives of achieving maximum employment yield, economic efficiency, and conflict avoidance, respectively (Hilborn 2007).

There exist, however, empirical studies of CPR management, including fisheries, in which the resource users self-organize to prevent resource overexploitation that can lead to the "tragedy of the commons" (Ostrom 1990). Among those are studies involving small-scale fisheries (SSFs) where resource users themselves make use of specific institutional and collective choice arrangements in line with their cultural and ecologically specific needs (Ostrom 1990). Within the realm of fisheries management and policy development, SSFs are considered to be CPRs of enormous global economic, ecological, and social importance (Smith et al. 2010, FAO 2014). These are characterized by the use of small craft, simple gear and low capital investment, and they play a vital role in income development as they support local and national economies, and supply protein-rich fish products high in nutritional value (UNEP et al. 2012). SSFs are also closely tied to coastal communities and are relatively immobile, which in combination with weak governance and lack of alternative sources of income, can easily lead to overexploitation of fish resources (Allison 2001, Cinner 2007). Furthermore, the variability and diversity of SSFs makes them unsuitable for traditional top-down command and control management approaches (UNEP et al. 2012). The importance of sustainable SSFs practices in their wider societal roles towards addressing the challenges of overfishing and increasing environmental pressures is being recognized (Allison 2001), and this comes hand in hand with appropriate governance reform and effective institutions that lead to ecosystem-based approaches to SSFs (UNEP et al. 2012).

B. MPAs as resource management strategies and the problem of "paper protected areas"

The challenge of overexploitation requires understanding the conditions that enable small-scale fishing communities to limit the access to their fishing grounds and prevent overfishing (Basurto et al. 2012). One example of a resource management approach that is common among SSFs is marine protected areas (MPAs), which work by either fully restricting some human uses such as fishing and scuba-diving, or allowing a combination of uses within a spatial zoning plan (Claudet 2011). In recent years, marine protected areas (MPAs) have become a central tenet of marine conservation and remain one of the most popular tools for the conservation of biological diversity in the sea (Allison et al. 1998). There is now a burgeoning literature demonstrating the benefits of MPAs for protecting species, habitats, ecosystems, and recovery of fish and invertebrate populations (Jones 2007). However, marine reserves are no panacea. Indeed, establishing an MPA without consideration of institutional, socio-economic, and political settings can undermine its stated objectives (Fujitani et al. 2012).

MPAs work by either allowing multiple human uses, restricting some such as fishing and scuba-diving, or combining a set of uses within a spatial zoning (Claudet 2011). MPAs may control commercial or recreational fishing by limiting extraction seasonally or in a given section, regulating the gear types used, or establishing catch limits (Agardy et al. 2011). A marine reserve is a specific type of MPA where all extractive uses are prohibited (i.e. a no-take zone or a fully protected area), some not even allowing non-extractive uses such as swimming or boating (Claudet 2011).

In contrast to conventional fisheries management strategies, MPAs arguably provide an effective regulatory mechanism for sustainable management of marine fisheries (Fraschetti et al. 2011). An important benefit of MPAs is that they provide a mechanism for building up resource biomass inside the reserve that would then spill over into unprotected areas for harvesting, consequently benefitting the surrounding waters through species movement and enhanced recruitment (Kareiva 2006, UNEP 2011). Indeed, the popularity of MPAs as conservation tools is such that international efforts, such as the Convention of Biological Diversity, have called for the protection of at least 10% of the world's marine and coastal areas through the establishment of networks of MPAs by the year 2020 (CBD 2010).

However, management strategies do not always consider how the resource users respond to MPA establishment as well as what incentives drive their fishing behavior (Sanchirico and Wilen 2001, Smith and Wilen 2003, Sanchirico et al. 2006). Most management efforts to

preserve marine resources also assume that the required institutional structure is already in place. However, harvest practices often do not adhere to the formal laws established in legislation, and managers assuming resource users make use of the government rules in place may develop management strategies based on faulty information rather than the reality of the situation in the field (Ostrom 1990, Ostrom et al. 1994). Establishing an MPA without consideration of institutional and socio-economic-political settings and governance structure can undermine its objectives and give a false sense of security that such reserves will be enough to sustain marine resources (Fujitani et al. 2012, Rife et al. 2013). Such "paper protected areas", in which established MPAs fail to effectively restrict access and exploitation, do not contribute to the recovery of the protected resource (White and Courtney 2004, Rife et al. 2013). Furthermore, there is concern for indiscriminating support of MPAs despite the existing knowledge gaps in both the ecological and socioeconomic aspects of MPA design, which can raise unattainable expectations, lead to a neglect of other effective techniques for fisheries management, and allow inefficient financial expenses on MPA creation and maintenance (Hilborn et al. 2004, Sale et al. 2005).

Some of the most obvious reasons for frequent MPA failures include lack of understanding what drives the use of ocean space and resources, lack of enforcement capabilities leading to disregarding of established rules and regulations (Mora et al. 2006), insufficient funds towards monitoring and enforcement (Rife et al. 2013), non-compliance and disapproval among the community members affected by the closure (Guidetti et al. 2008), and potential vulnerabilities of MPAs to external shocks (Hughes et al. 2003). This is particularly true for developing countries with high levels of poverty and where capacity for enforcement is often lacking, which drives to resource abuse (McClanahan 1999, Christie et al. 2003, Christie 2004, McClanahan et al. 2006). Furthermore, their limited success can be attributed to the lack of attention to incorporating the socio-economic context of conserving marine resources into the planning and management of MPAs (McClanahan 1999, Christie et al. 2003, Christie 2004, Cinner 2007). Socioeconomic factors can be crucial for the success of MPAs because they can influence whether the resource users comply with regulations and how they respond to the corresponding restrictions (Cinner 2007).

Very little work has been done on the application of a systematic analysis that not only considers the biology of the marine resources and the economic conditions in which the

management strategies are being applied, but also the governance and institutional contexts. Even though the social and economic benefits of tools like MPAs have been recognized to improve community well-being via increased income from fisheries or tourism, there is a lack of research on governance structures allowing successful implementation of MPAs and how and when the benefits from MPA establishment flow back towards the fishing communities (Cudney-Bueno et al. 2009).

C. Governance of Social-Ecological-Systems

I adopt the concept of social-ecological-systems (SES), as developed by (Ostrom 2007, 2009) and (Anderies 2004, Anderies and Janssen 2013), which encompasses the interactions between the biophysical elements of a resource system, humans, and the built-in human-made "hard" and "soft" infrastructure. A significant number of valuable insights that have been gained from applying frameworks that stem from this concept towards understanding the importance of institutions – rules, norms, and strategies that humans use to dictate their interactions- to engage in collective action in order to avoid scenarios of resource overexploitation (Becker and Ostrom 1995, Basurto and Coleman 2010).

Based on the concept of SESs, Ostrom (1990) developed a set of eight design principles that characterize the efficacy of multiple types of rules and sets of rules in a given common-pool-resource situation (see Appendix A, Table 1). These institutional design principles are a product of extensive empirical analysis of case studies from around the world related to how long-enduring and locally-managed regimes manage CPRs. They include variables that describe the system's structure, the history of the actors and the organizations involved, the resource's characteristics and usage level, and the rules in use (Cox et al. 2010). In chapter 1, I will incorporate an analysis that identifies the contextual variables underlying the design principles for a set of case studies around the world in which MPAs are an important management strategy.

The study of coupled SESs has also been informed by the use of the Institutional Analysis and Development (IAD) framework, which suggests a way of understanding the

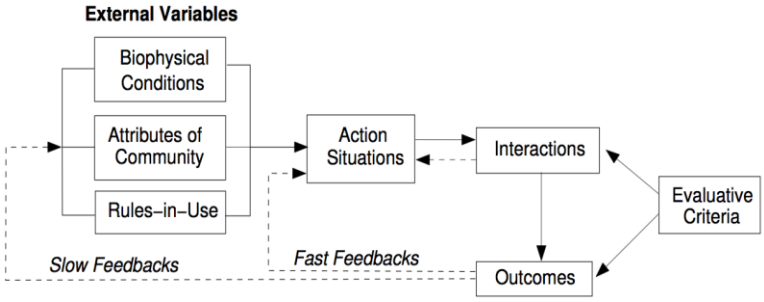


Figure 2. The Institutional Analysis Framework (Ostrom (2011), adapted in Anderies (2014)).

process of policy-making through a systematic approach for analyzing institutions governing action as well as the outcomes of arrangements of collective action. The IAD framework is designed as a conceptual map that identifies a common set of structural variables that are present in an institutional arrangement but that vary across different types of institutional arrangements (Ostrom 2011) (Figure 2). These key structural variables can be extremely useful when used to evaluate the role of institutions in shaping decision-making processes and social interactions. In chapter 2, I will apply Ostrom (2011) IAD framework to obtain general insights on the general attributes of the GOC study system.

In addition to the IAD framework and Ostrom's design principles, I will adopt the Coupled-Infrastructure Systems (CIS) framework, which studies the robustness of SESs from an institutional perspective (Anderies et al. 2004) (Figure 3). The focus of this framework is to understand the broad structure of the components of an SES, their connections, and how their interactions affect the SES's long-term robustness (i.e. it's ability to cope with uncertainty and disturbances from both inside and outside of the system), which enables it to handle environmental, social, political, and economic shocks (Anderies et al. 2004, Anderies and Janssen 2013).

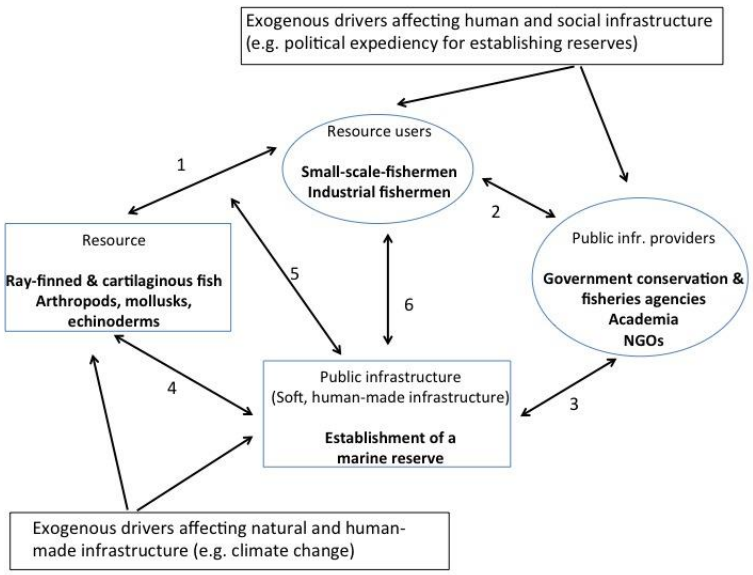


Figure 3. The Coupled-Infrastructure-Systems framework adapted to a system of marine reserves in the GOC. The numbers represent the different links between components.

The CIS framework is an extension of the IAD framework highlighting the dynamic interactions between the exogenous variables identified in the IAD framework (i.e. the biophysical context, the actors, and the rules in use) and emphasizes the interactions between the operational and collective-choice levels of an SES over time by (Anderies et al. 2004). In chapters 2 and 3, I will adopt the CIS framework to analyze the interactions between the operational and collective-choice levels within the context of MPAs at a regional and local scale.

4. *Chapter One:* Institutional Analysis of Marine Reserve Systems for Sustainable Governance

The burgeoning literature on marine reserves includes ample data on the benefits of using MPAs, what works with regards to their design and maintenance, and key challenges in achieving objectives. Previous experience has also led to some negative perceptions amongst stakeholders, especially when it comes to resource users. Most of the research, however, has occurred within the realm of ecological theory and less so from the social sciences' perspective. Indeed, MPAs occur within a particular socioeconomic and historical context that limits what can be accomplished by using MPAs. Human behavior is the focus of fisheries regulations as it is the resource users who are the agents of change and will be directly affected by the regulations (Jentoft et al. 2007). MPAs regulate people directly by restricting their access to the designated areas (Fujitani et al. 2012). Therefore, any MPA design and implementation strategy is likely to be more accepted and successful when including the ecological, cultural, institutional, and socioeconomic characteristics and operating conditions of the system and a careful consideration of who directly benefits from MPAs (Agardy et al. 2003).

Types of MPAs, their goals, objectives, and management actions vary extensively depending on the location and specific circumstances under which they are established. Some of them will have conservation of biodiversity and critical habitats as their main motivation, whereas others might focus on the achievement of sustainable harvest of important species for traditional, subsistence, or commercial use. Large-scale MPAs can also be part of ecosystem-based management strategies, in which they may be designed to achieve a broad range of objectives (Fernandes et al. 2005). MPAs can be located throughout a wide range of biophysical regions. The design of an MPA can also vary in size as well as connectedness, from single protected areas to networks of strategically-placed MPAs (Gerber et al. 2014). MPAs can formed

via top-down (i.e. via government initiatives), bottom-up processes (i.e. via local community arrangements), or a combination of both, and their governance modes can also vary from centralized to de-centralized systems. This variability in needs and strategies is a product of the biological, socioeconomic, institutional, and cultural site-specific conditions surrounding every particular coupled SES. In other words, context matters.

Given the diversity of MPA design and management strategies worldwide, it is clear that there is no single model for MPAs that can fit all circumstances and be universally applicable (Agardy et al. 2003), and in continuing to search for such a model we risk having conflict if the context in which MPAs function well is not carefully considered (Jentoft et al. 2007). The "one size fits all" approach can lead to MPA establishment often without a clear understanding of the socioeconomic, cultural, and institutional complexities behind them, which may lead to the limited success of MPAs (Agardy et al. 2003). The efficacy of MPAs at achieving their objectives thus depends on what contextual and historical factors are incorporated into the planning, establishment, and continual assessment of MPAs.

MPA goals are often stated under ecological terms with socioeconomic goals and human benefits being listed as secondary consequences of achieving the former (Jentoft et al. 2007). This immediately raises the issue on what the implications are for the different groups that are affected by MPAs since there may be those who have more to loose than gain, or to whom the immediate cost of a closure exceeds the delayed benefits that are to be accrued. The aim of this chapter is to contribute to the literature concerned with MPA efficacy by looking at MPAs from a governance perspective and addressing basic institutional principles that occur in well-functioning MPAs. In order to do so, I will tackle two main questions: A) What is the evidence that marine reserves around the world benefit both nature and people? B) What are the biophysical, socio-economic, and institutional variables that are most relevant to ensuring the efficacy of a marine reserve from a coupled human-ecological reserve system's perspective?

Jentoft et al. (2007) define MPAs from a governance perspective as "complex social institutions that aim to influence human behavior", and as such, they are part of a larger social system with institutions, rules, norms, and values of its own. Within the CPR governance literature, Ostrom (1990) defines a successful system as that in which institutions "enable individuals to achieve productive outcomes in situations where temptations to free-ride and are present". Through a review of both primary and secondary literature on established marine

reserves implemented and monitored around the world, I will first identify in-depth case studies (n=30 to 40 cases) rich in biological and social data (preferably both) that describe how MPAs have been used to manage fisheries as CPRs. These cases will be used to identify 3-5 measures of success that are relevant to systems of marine protected areas for resource governance and that include both ecological and social successes (i.e. relevant to a functioning of the system with respect to the provision of both social and ecological benefits). I hypothesize that the resulting measures of success would encompass the following issues: a) the overall integrity of the resource and the biological system (whether it targets higher resource stocks or healthier ecosystems), b) fairness and equity in terms of costs and benefits to the affected parties, c) the efficacy with which collective-choice arrangements are established given the existing public infrastructure, etc.

Once the measures of success have been carefully defined, I will carry out a comparative analysis of case studies that spans the many forms that an MPA can take in order to identify the biophysical and institutional contextual factors that are present in both successful and non-successful cases. I will partly follow the methodology followed by (Cox et al. 2010) as well as Ostrom's original guide for classifying case studies, which was originally developed to evaluate the empirical evidence of the presence or absence of Ostrom's institutional design principles (Appendix A, Table 1) in CPR case studies. However, this framework provides a detailed guide on how to extract relevant contextual characteristics of CPR systems. I will use this as a departure point to formulate my own set of questions and criteria that are relevant, and specific, to the use of MPAs as fisheries management tools to classify MPA systems according to the following attributes:

1) *Biophysical context* such as spatial structure, species of concern, population dynamics, recruitment patterns, distribution of the resource will be synthesized and examined with respect to level of success or failure.

2) *Soft public infrastructure*, such as the nature of the infrastructure the MPA system is embedded in, nested enterprises in charge of resource management, and top-down vs. bottom-up management approaches.

One way to assess the capacity of a SES to with uncertainty and change (i.e., robustness) is to assess the presence of Ostrom's design principles (Anderies (2004). I employ this methodology here, in order to evaluate what makes MPAs systems robust to social, ecological,

political, and institutional changes. I expect to find substantial gradients of success depending on the attributes of the biophysical context as well as the institutional, public infrastructure context. The ultimate goal here is to create a typology of classes of MPAs that work well because of their biophysical context and the nature of the public infrastructure and the public infrastructure providers (see Figure 3).

There have been few empirical studies looking to identify the most important socioeconomic factors that related to the efficacy of MPAs on a global scale. For instance, Pollnac et al. (2010) analyzed ecological and socioeconomic data on marine reserves around the world and found site-specific positive and negative associations between increased fish biomass inside marine reserves and human population density and compliance with marine reserve rules. Their study exemplifies the complexity behind the social dynamics of coupled social-ecological reserve systems beyond just enforcement capabilities. However, the state of contextual variables (i.e. those that remain constant for a given analytical study but not across studies) can affect the impact of the variables being explicitly studied in real world situations (Agrawal 2003).

Most of the research on the human dimensions of MPAs consists of small-scale case studies over a specific geographical area. There is a great body of literature that focuses on examining the social context in which long-enduring sociocultural institutions (e.g. customary marine tenure systems that implement spatial or temporal closures) limit marine resource use in coastal communities. These small-scale studies have looked at questions on social processes influencing traditional closures (Cinner et al. 2005), the acceptance of MPAs (Charles and Wilson 2009), the relationships of socioeconomic factors and marine tenure (Cinner 2005), the effectiveness of community-based resource management approaches to MPAs (Aswani and Weiant 2004, Crawford et al. 2004, Cinner 2007), and informal institutions and traditional management practices (Colding and Folke 2001). In coral reef regions, it has been demonstrated that "bottom-up" community-based fishery management without permanent MPAs but with temporal restrictions on fishing effort is more effective than "top-down" government established MPAs (Kareiva 2006, McClanahan et al. 2006). Despite the existing plethora of case studies, a detailed analysis of long-enduring and well-functioning systems of marine reserves as coupled social-ecological-systems is lacking.

This chapter will provide a demonstration of principle that explores MPAs from a governance perspective to classify MPA systems with respect to their success for sustainable

resource governance. I expect the findings to contribute to the literature by highlighting attributes that make MPA systems more efficient from a socio-ecological perspective and what we can learn from the existing successful cases. To my knowledge, this will be the first extensive evaluation of MPA systems in the context of the grammar of institutions. Finally, this study can be extended to a formal analysis on the probability of success of an MPA system given the presence or absence of some of the design principles.

5. *Chapter Two:* A social-ecological-system approach to describe marine reserves in the Gulf of California

I will use the global analysis described above (Chapter 1) as a departure point to examine the mechanisms underlying system linkages in the Gulf of California (GOC) in Mexico. I focus on the GOC as a case study because there have been negligible conservation outcomes associated with the tremendous efforts to establish MPAs in this region. An analysis of the social, institutional, and ecological contextual variables will help to elucidate weak links in this system (Figure 3).

The GOC's 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). Fishing predominates in the region as an important economic activity, which involves ~26,000 SSF vessels and ~1,000 large-scale fishing vessels (Cisneros-Mata 2010). There are at least 80 importantly commercial species being targeted in the region, ranging 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) (Moreno-Baez et al. 2012). Most fishermen economically depend on the resource year-round, and much of the catch is exported to U.S. and Asian markets. The main 4 fishing methods are diving, gillnets, longline, traps, hand fishing line.

In terms of the public infrastructure providers, 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, in charge of regulating species listed only under 'special protection', 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 SAGARPA's 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 (Cinti et al. 2014).

Figure 4. Current MPAs in the GOC

The region has seen seven marine planning exercises in the last ten years, which have lead to multiple conservation plans that identify more or less the same general priority areas on a coarse scale, but identify important biological and ecological differences among them on a finer scale (Alvarez-Romero et al. 2013). However, when it comes to actual, measurable outcomes in which the already identified priority conservation sites are set aside for total protection or strict regulation, or in which the already established regulations remain strong to allow user compliance, resource management efforts are met with little success.

As of 2012, the GOC has 10 existing multi-use MPAs covering 23,304 km^2 (9% of the total marine area, see Figure 4) (Rife et al. 2012). Nonetheless, they have generally been unsuccessful in meeting either their fisheries or conservation objectives. One of the most important reasons being that enforcement is extremely low throughout the region. For instance, in the Northern Gulf of California alone, evidence has been

found that at least ten communities utilize 79% of the total area established for MPA year- round (Moreno-Baez et al. 2012). Furthermore, it is perceived that often times implementation of an MPA happens in response to different sociopolitical contexts and/or pressing environmental issues, (i.e., out of political expediency or opportunistically).

In this chapter, I will explore the types of relationships between resource users, government agencies, and conservation agencies that have prevailed in the GOC as the existing MPAs have been established, as well as the level of involvement of each stakeholder group in the process. More specifically, I will address the following questions: A) What are the key system vulnerabilities and how are these vulnerabilities affected by the institutional structure that governs the operation of small-scale fisheries in Mexico?, and B) To what extend do feedbacks within this system hinder a reserve system that benefits humans and nature?

I will begin with a review of published primary and gray literature documenting the trajectories of the establishment MPAs in the GOC, specifically no-take zones. However, since a lot of this useful information is not published, I will complement this literature review with a short survey-interview process with key informant local experts (including community members, government agencies, and scientific researchers well familiarized with the area) of the various communities in the GOC that have been associated with the establishment of an MPA. The number of case studies analyzed will depend on the amount information and level of detail available through either of these two methods.

In order to unpack the social, economic, institutional, and ecological factors that are relevant to the interactions between the use of MPAs as management tools and their efficacy in addressing their stated objectives at both a regional and local scale, I will carry out a qualitative analysis on communities (the number contingent upon data availability) of the GOC that have been involved or affected by the establishment of an MPA (Table 1). I will first apply the IAD framework to evaluate case studies that have strikingly different trajectories with respect to MPA establishment in order to outline the variables that give general insights on the general attributes of my study system and that are relevant to the problem of "paper protected areas" in the GOC.

Table 1. MPA systems in the GOC

Case study #	*MPA systems*	*Year decreed*
1	Isla San Pedro Martir Biosphere Reserve	2002

2	Los Angeles Bay, Canal de Ballenas y Salsipuedes Biosphere Reserve	2007
3	Loreto Bay National Park	1996
4	Upper Gulf of California and Colorado River Delta	1993
5	Cabo Pulmo National Park	1995
6	San Lorenzo Archipelago National Park	2005
7	Espiritu Santo Archipelago National Park	2007

Within the IAD framework, the focal unit of analysis is called an *action situation*, which is a space where actors can exchange information, goods and services, solve problems, make decisions, etc. (i.e. interact). As the actors interact, they can be affected by three exogenous variables: the biophysical conditions of the system (e.g. natural infrastructure like the type and characteristics of a particular ecosystem, or hard human-made infrastructure like boats and docks), the attributes of the community (e.g. social infrastructure like class systems within a community, or human infrastructure like the size and heterogeneity of a community), and the rules of the current institutional context (e.g. soft, public, human-made formal written rules and informal norms, like who can participate in a situation). This characterization of the *action situation* can be used to describe, analyze, and explain the likely behavior of the actors in such a structure (Ostrom 2011) and can set the stage for further evaluation of the current institutional arrangements governing fisheries management. This framework has been used in the context of Mexican institutions in the case of the the Quintana Roo lobster and scaly-fish fishery in the Caribbean, and in Cinti et al. (2014) to explain the existing formal and informal rules-in-use that regulate access and resource use of small-scale fisheries in the communities of Bahia de Kino and Bahia de los Angeles in the GOC. This chapter, however, will focus on the MPA system as a functional system with formal organization, lines of authority, a plan of operation, and a defined role structure (Boudon 1981), and the relevant variables under analysis will be those that directly affect the interactions between the stakeholders and the MPA.

I will then employ the coupled-infrastructure-systems framework (Anderies et al. 2004, Anderies 2014) to identify the chosen MPA systems' system dynamics, weaknesses, and vulnerabilities to external shocks (Figure 3). In this framework, the main entities include the following components: the actors, which include the *Resource Users* and the *Public Infrastructure Providers*; and the infrastructure, which includes the *Resource* itself and the *Public Infrastructure*. The framework emphasizes the relationships between the actors and the infrastructure, as well as their relationship with outside natural or socio-political and economic disturbances. Components such as the size of the resource system, the cost of enforcement of

fishing regulations, the physical pressure on exploitation given the resource user population, and the static or mobile nature of the resource itself (e.g. benthic organisms vs. migratory fish) are all considered key elements that determine the system's governance structure (Dolšak and Ostrom 2003). This framework is considers the resource, the governance system, and the associated infrastructure as a coupled system with important design elements for robust SESs, and it considers both the ecological system and the rules between the actors as dynamic. The goal here is to present a conceptual roadmap that provides insights into the contrasting levels of success of different approaches to establishing MPAs in the GOC region and highlights the importance of contextual variables when analyzing coupled SESs. Once the system of the GOC has been characterized in this way, I will be able to hypothesize what the weak links of the system are and what areas of the system need to be more carefully explored.

Preliminary analyses of some of the communities of the GOC already highlight some of the major weak links specific to the system in which marine reserves operate in the region (see Figure 3; (Mancha-Cisneros and Gerber in press.)). A weak relationship between the various public infrastructure providers such as CONAPESCA, CONANP, and NGOs, and the small and large-scale fishermen (via link 2) when establishing MPA regulations (via link 3), seems to affect the efficacy of a marine reserve to influence fishermen behavior (link 5). A weak level of stakeholder support of MPA regulations (via link 6) is another important contributing factor; I will focus on these interactions at a local scale in chapters 3 and 4.

6. *Chapter three:* Stakeholder engagement in reserve implementation in the Midriff Islands Region.

Failure to include local communities in the design and implementation of MPA management regulations is a common oversight in MPA design processes. Furthermore, when these groups are somewhat included into the planning process, members of the communities are often treated as a homogenous group with respect to their views and actions, which can lead to a partial capture of information that can instigate resistance to implementation and subsequent conflict (Ferse et al. 2010). However, stakeholder involvement from the start is essential to foster long-term interest in MPAs (Lundquist and Granek 2005).

The insights gained from preliminary institutional and CIS framework analyses for some of the communities in the GOC (chapter 2) indicate potential weak links on how fishermen (resource users) and management agencies (public infrastructure providers) behave with respect to the establishment of an MPA (soft, human-made infrastructure) (Figure 3). In order to analyze these interactions at a local scale, I will carry out an empirical study on stakeholder engagement and perceptions towards MPAs for three local communities in the GOC. I will use these data to examine following questions: A) What is the level of understanding and support for MPAs among five stakeholder groups?, and B) How does this support vary among these stakeholders?.

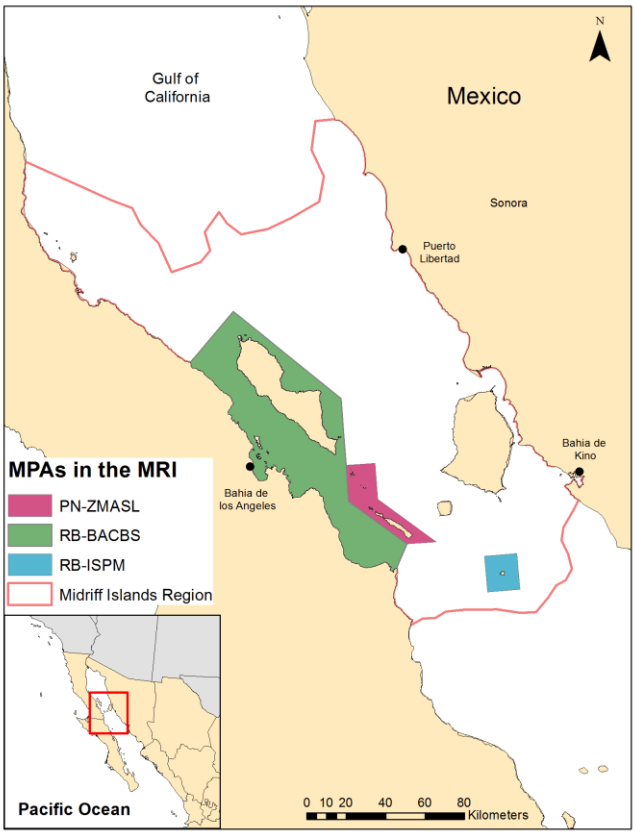


Figure 5. MPAs in the Midriff Islands Region of the GOC.

To describe the perceptions of different stakeholder groups with respect to the use of MPAs for conservation of biodiversity and management of fisheries, I will conduct structured interviews for three local communities in the GOC. My study area is the Midriff Islands Region, which is an archipelago of 45 islands and islets of high levels of biodiversity and productivity in terms of fisheries. The region encompasses three MPAs (Figure 5, Table 2). The communities to be interviewed include the villages of Bahia de Kino and Puerto Libertad, which are both on the mainland state of Sonora, as well as the village of Bahia de Los Angeles in the eastern shore of the Baja California Peninsula in the state of Baja California.

Field work will take place between October 2014 to March 2015 in collaboration with *Comunidad y Biodiversidad A.C.* (hyperlink). During this time, we will administer the interview to the following stakeholder groups: small-scale-fishermen, commercial fishermen, members of government conservation agencies, members of government fisheries management agencies, and members of the local community in general. The interview (shown in Appendix B) forms part of

a 3-year project to design a network of marine reserves in the Midriff Islands Region in the GOC. The interview consists of 30 questions, including 4 participatory mapping questions. A pilot study was implemented in Bahia de Kino in July 2014 with representatives from the general communities, conservation agencies, and small-scale fishermen.

Table 2. MPAs in the Midriff Islands Region in the GOC (Rife et al. 2013).

MPA	*Abbrev.*	*Total area (km^2)*	*Total no-take zone (km^2)*	*Year decreed*	*Year management plan*	*Year management plan published & implemented*
Isla San Pedro Martir Biosphere Reserve	RB-ISPM	301.65	11.1	2002	2007	2011
San Lorenzo Archipelago National Park	PN-ZMASL	584.43	88	2005	None	n/a
Los Angeles Bay, Canal de Ballenas y de Salsipuedes Biosphere Reserve	RB-BACBS	3,879.56	2.10	2007	None	In review (2013)

Interview respondents will be asked specific questions on the following general topics:

- Perception of current state and threats for biodiversity and fisheries management, as well as suggested tools for both purposes.
- Level of understanding with respect to MPAs and their uses, including awareness of existing MPAs and their level of success in the Midriff Islands Region. Respondents will also be asked on their perceptions towards the process of establishing MPAs.
- Perceived benefits of MPAs and to whom those benefits accrue.

The interviews will be transcribed and coded at ASU in order to analyze the relationships between prominent themes. As part of the stakeholder engagement phase, COBI will be carrying out capacity-building workshops in all three communities on the topic of marine reserves in general. In order to control for the effect of newly acquired knowledge on the concept of marine reserves as a result of these workshops, interview respondents will be asked about their previous participation and how had their perceptions changed.

In addition, respondents will be asked to answer spatially-explicit questions with respect to their opinion on the most important sites in terms of natural capital, their preference on which of these sites should be protected, and for which of these sites would they agree to have a marine reserve established. A fourth spatial question tailored specifically to the commercial and

industrial fishermen will ask for a depiction on the 5 most important fishing sites for the respondent at a regional scale (i.e. from the perspective of the whole GOC). The information collected for the spatially-explicit questions will be compared to a previous exercise in which a team of academic experts designed a network of marine reserves for the MRI considering the most up-to-date data for the region (including species and habitat distribution as well as fishing effort distribution from 2005-2006). The objective here will be to identify major discrepancies between the two exercises for the selection of suitable sites for the establishment of marine reserves.

I anticipate that this chapter will elucidate the current level of stakeholder understanding and support for the use of MPAs as a strategy for both biodiversity conservation and fisheries management in the GOC. By determining commonalities and significant differences among the stakeholder groups and the different communities, this fine-scale analysis will set the stage for assessing putative management options (chapter 4) .

7. Chapter four: Assessing social and ecological resilience of MPAs in the GOC

In this chapter, I will integrate insights on the on the regional system dynamics (chapter 2), with empirical data on stakeholder engagement (chapter 3), and additional empirical data on fishermen behavior to answer the following questions: A) In what ways do stakeholder perceptions, preferences and interactions influence MPA efficacy as fishery management strategies?, B) How do these factors scale up to the region of the GOC?, and C) Who wins and who loses after the establishment of a marine reserve in the GOC?.

To address these questions, I will first carry out a quantitative analysis of empirical data from the interviews to further characterize the potential factors that hinder MPA efficacy in the MRIs region. The variables for the statistical analysis of interview responses are summarized in Table 3. The SSF and industrial fishery stakeholder groups will be asked on fishing effort including spatial location, species, gear used, average catch levels, and commercial value of the species fished. Additionally, fishermen will be asked about their access to the fishery (i.e. whether they work as individuals, members of a cooperative, or as permit holders. I also have access to a separate dataset from 2005-2006 on the operation of SSFs in the Northern Gulf of California (NGC), and a log-book database from SSFs based on the mainland side of the MRI.

Table 3. Variables to be used in statistical analysis of interview responses

Variable	*Measurement*	*Type*
Agreement with establishment of MPAs	Whether the respondent is willing to establish a marine reserve on selected sites	Binary
Knowledge of the concept of MPAs	Whether the respondent knows what an MPA is	Binary
Awareness of existing MPAs	Whether the respondent is aware of the existing MPAs	Binary
Stakeholder's perception on current compliance with MPA regulations (per MPA in the MIR)	Whether the respondent perceived non-compliance to be non-existent (0) to extremely high (4)	Ordinal (0-4)
Stakeholder's response to observed non-compliance	Category of responses to observing non-compliance	Ordinal (0-3)
Perception of benefits from MPAs	Whether the respondent perceives himself, others, a combination, or no one to benefit from MPAs	Ordinal (0-3)
Alternative livelihood	Whether the respondent has another occupation	Binary
Years fishing	Number of years fishing (exclusively for SSF and industrial fishermen	Continuous
Family members who fish	Whether the respondent has other family members who fish	Binary
Relationship with conservation / fisheries management organizations	Whether the respondent has a positive or negative relationship with conservation / fisheries management organizations working in the area	Binary
Agreement with objectives from organizations	Whether the respondent feels to be in agreement with the objectives from conservation / fisheries management organizations working in the area	Binary
Intensity of collaboration with organizations	Level of intensity with which the respondent collaborates with conservation / fisheries management organizations working in the area	Ordinal (0-4)
Reciprocity with organizations	Level of reciprocity the respondent perceives between him and conservation / fisheries management organizations working in the area	Ordinal (0-4)
Trust level with organizations	Trust level the respondent perceives between him and conservation / fisheries management organizations working in the area	Ordinal (0-4)

Based on my preliminary analysis in chapter 2, I hypothesize that negative and weak relationships between the public infrastructure providers and the resource users, widespread noncompliance to existing MPA regulations, and weak levels of stakeholder buy-in with respect to MPAs are most important in determining whether marine reserves are likely to be successful in the region. I will then relate the results from these case studies back to the conclusions of chapter 1 with respect to cases of successful MPAs around the world.

Finally, I will provide a spatial characterization of alternative fishing sites for the SSF interview respondents to postulate and characterize who would be the winners and losers of the establishment of a network of marine reserves in the MRI region. For this, respondents will be asked about the top fishing sites in the whole region from their perspective. Their responses will

be analyzed as proxies for individual preferences for future re-allocation of effort in the case of the establishment of a network of marine reserves.

8. Appendix A

Table 1. Institutional design principles as modified by (Cox et al. 2010)

Principle	Description
1A	User boundaries: Clear boundaries between legitimate users and nonusers must be clearly defined.
1B	Resource boundaries: Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.
2A	Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.
2B	Appropriation and provision: The benefits obtained by users from a common-pool resource (CPR), as determined by appropriation rules, are proportional to the amount of inputs required in the form of labor, material, or money, as determined by provision rules.
3	Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.
4A	Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.
4B	Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.
5	Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.
6	Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7	Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.
8	Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Appendix B

Interview to identify the degree of acceptance towards the implementation of a network of marine reserves (no-take zones) in the Midriff Islands Region, Gulf of California, Mexico

Interview code_____

Date _____

Start time _____ End time _____

Name of interviewee: _____

Community: _____ Birth place: _____

Name of interviewer: _____

Age: _____ Education: _____

Sector: Community member _____ Artisanal fishing _____ Industrial fishing _____

Government conservation agency _____ Government fisheries agency _____

Years performing economic activity (fishing/government agency) _____

If you are a fisherman, do you work as: cooperative Permit holder free other

Do you carry out another economic activity? Yes - No Such as?

Do you have family members who fish? Yes - No Where?

Do you work as a "promoter"? Yes - No With who? _____

Introduction: The Midriff Islands Region in the Gulf of California (interviewer makes use of a map of the area), given its spectacular beauty, diversity and site productivity, is recognized as a priority for conservation at international, national and local levels. It is also an excellent site for industrial fisheries (e.g. sardine, hake, shrimp), artisanal fisheries (e.g. snappers, groupers) and sports fishing (e.g. mackerel, dorado, groupers). However, its biodiversity (species and ecosystems / habitats) and fisheries (commercial species) are threatened by climate change (i.e. a change in the average climate conditions or in its variability that persists for an extended period of time, this change may be due to natural or persistent anthropogenic changes to the atmopshere's composition or to land use) and by fishing unsustainable activities (e.g. overexploitation of resources, habitat destruction). To cope with the negative effects of these threats, the establishment of marine reserves or no-take zones (areas where fishing is prohibited) have been proposed. This interview is intended to identify the benefits and the costs of establishing a network of marine reserves in order to protect and restore the natural capital (natural resources viewed as means of production of goods and ecosystem services) within the Midriff Islands Region.

1. General context

1.1. What is your perception of:

- 1.1.a - The current state of marine biodiversity (species/habitats/ecosystems) in the Midriff Islands Region?
  Very bad (4) - Bad (3) - Stable (2) - Good (1) – Very good (0)
- 1.1.b - The current state of fisheries (commercially valuable species) in the Midriff Islands Region?
  Very bad (4) - Bad (3) - Stable (2) - Good (1) – Very good (0)

1.2 - What factor(s) (or threat(s)) can affect (or are already affecting) the following:

- 1.2.a - Marine biodiversity (species/habitats/ecosystems) in the Midriff Islands Region?
- 1.2.b - Fisheries (commercially valuable species) in the Midriff Islands Region?

1.3 - What methods or management tools would you suggest to:

- 1.3.a - Achieve the protection (conservation) of natural resources (biodiversity - species/habitats/ecosystems-) in the Midriff Islands Region?
- 1.3.b - Achieve the maintenance of species with commercial value (sustainable fishing) in in the Midriff Islands Region?

1.4.1 - Do you know which are the Marine Protected Areas in the Midriff Islands Region?

1.4.2 - Do you consider them to be successful for the conservation of biodiversity?
Yes (2) – I don't know (1) – No (0)

1.4.3 - Do you consider them to be successful for the maintenance of fisheries?
Yes (2) – I don't know (1) – No (0)

Table 1.4 - Answers to be written by the interviewer:

Marine Protected Area	**1.4.1.(A-C) Aware of existence**	**1.4.2.(A-C) Biodiversity conservation**	**1.4.3.(A-C) Maintaining fisheries**
	Yes (1) – No (0)	Yes (1) – I don't know (1) – No (0)	
A - Parque Nacional Archipiélago de San Lorenzo			
B - Reserva de la Biosfera Bahía de los Ángeles y Canales de Ballenas y Salsipuedes			
C - Reserva de la Biósfera Isla San Pedro Mártir			

1.4.4 - Why?

1.5 – For each of the Marine Protected Areas that you know exist in the Midriff Islands Region:

1.5.1 – How frequently do you fish within 1km off the border of the marine reserve?
Never (0) – Rarely (1) – Every once in a while (2) – Often (3) – Almost always (4)

1.5.2 – Do you think there is a lack of compliance with respect to the rules of marine reserves (no-take zones)?

Yes (1) – No (0)

1.5.3 – How frequently do you observe that there is a lack of compliance with respect to the rules of marine reserves (no-take zones)?

Never (0) – Rarely (1) – Every once in a while (2) – Often (3) – Almost always (4)

Table 1.5 - Answers to be written by the interviewer:

Marine Protected Area	**1.5.1.(A-C) Frequency fishing nearby** (0 – 4)	**1.5.2.(A-C) Non-compliance** Yes (1) – No (0)	**1.5.3.(A-C) Frequency of non-compliance** (0 – 4)
A - Parque Nacional Archipiélago de San Lorenzo			
B - Reserva de la Biosfera Bahía de los Ángeles y Canales de Ballenas y Salsipuedes			
C - Reserva de la Biósfera Isla San Pedro Mártir			

1.5.4 – If the answer to question 1.5.2 is Yes, why do you think there is non-compliance with the rules for marine reserves (no-take zones)?

1.6.1 – If the answer to question 1.5.2 is Yes, what do you do when you observe non-compliance with the rules for marine reserves (no-take zones)?

(0) I do nothing
(1) Try to talk to those being non-compliant
(2) I comment the situation with other fishermen
(3) I report to the authorities (If so, to who?)

1.6.2 – If the answer to question 1.5.2 is Yes, and considering that there are _____fishermen in the community of _____: In your opinion, what percentage of fishermen would you say do not comply with the rules for marine reserves (no-take zones)?

1.7 - What do you think should be incorporated or improved so that the Marine Protected Areas in the Midriff Islands Region can achieve the following objectives:

- 1.5.a - Protect (conserve) the natural resources (biodiversity – species/habitats/ecosystems)?
- 1.5.b - Maintain commercially valuable species (sustainable fisheries)?

2. Marine reserves

2.1 - Do you know what is a marine reserve (no-take zone)? Yes (1) - No (0), define it.

2.2 - Do you know what is a network of marine reserves (no-take zone)? Yes (1) - No (0), define it.

2.3 – Considering the list of natural capital elements in the previous exercise, for which of those would you consider that a marine reserve (no-take zone) is an adequate tool for helping protect the natural capital (natural resources) that exist in the region you live in? Use Table 2.3 that has been provided to you:

Table 2.3 – Natural capital
(insert)

2.4 – Of those elements that you chose in Table 2.3 that you consider important, what total percentage of each one would you like to have the protection of a marine reserve? Uste Table 2.3.

2.5.1 – If in Table 2.3 you selected “commercial species”, which are these species?
2.5.2 – On average, how much (in kg) do you fish of each species?
2.5.3 – What fishing gear do you use for each species? And if your boat operates with more than one person, how many?
2.5.4 – What is the commercial value of each species?

2.5.1 - Especies	*2.5.2 – Peso (kg)*	*2.5.3 – Arte de pesca*	*2.5.4 – Valor comercial*

….

2.6 - What are the benefit(s) of protecting natural capital that you consider important in the Midriff Islands Region?

2.7.1 - Who do you think benefits from a network of marine reserves in the Midriff Islands Region?
You, but not others (3) – Others, but not you (2) – You and others (1) - Nobody (0).
2.7.2 - List the coastal communities referred to as "others".
2.7.3 - Please explain your answer in 2.7.1.

2.8.1 - Based on the presence of natural resources that you consider important, what is or what are the most important sites (both with respect to biodiversity conservation as well as for the maintenance of fisheries in the Midriff Islands Region? Use the maps provided to draw the sites (there is no need to limit the number of sites).
2.8.2 - What is the importance (as a percentage) that you would give to these sites? Using the 100 seeds provided to you, assign a number of seeds to each site based on its importance.

2.9 Using the map, indicate which of those important sites (from 2.8.1) do you think should be protected? (there is no need to limit the number of sites).

2.10 Indicate on which of those sites (from 2.9, that you think should be protected) would you be willing to establish a marine reserve (whether the reserve is managed voluntarily or through the corresponding authorities)? Use the map provided to you (there is no need to limit the number of sites).

2.11.1 - Thinking of those sites (from IIj) where you would be willing to establish a marine reserve:

- Would you be ok with the establishment of a network of marine reserves (no-take zones) in the Midriff Islands Region?
  Strongly disagree (0) – Disagree (1) – Neutral (2) – Agree (3) – Strongy agree (4)

- 2.11.2 - Why?
- 2.11.3 - How long, in years, do you think it would take to accomplish the establishment of a network of marine reserves in the Midriff Islands Region?
- 2.11.4 - How long, in years,would you like this process to take (i.e. having the network of marine reserves in the Midriff Islands Region estblished)?

2.12 - Which of these management tools do you prefer for the establishment of marine reserves? Higher to lower preference (2 – 1 - 0)

2.12.a - Marine reserves through community agreements	
2.12.b - Marine reserves through CONAPESCA	
2.12.c - Marine reserves through CONANP	

2.13.1 – From your perspective and considering the whole region of the Gulf of California, what are the top 5 sites for best fishing? Use the maps provided (2.13.A-F) to draw the sites.
2.13.2 – What importance (in percentage) do you give to each of these sites?

2.14.1 If your productive activity were to be affected (less sites for fishing) by the establishment of a network of marine reserves in the MIR, do you have the option of engaging into another way of making a living (i.e., an "alternative livlihood)?
Yes (1) - No (0).
2.14.2 - In case of the answer to 2.14.a being "Yes", What would it be?

3. Social relations

3 - List the principal organizations (government agency/academia/social civil organizations/non-governmental organizations) involved in and complete the following tables with respect to your relationship with such organizations:

(Scala: Never (0) – Rarely (1) – Every once in a while (2) – Often (3) – Almost always (4))

3.1 - Biodiversity conservation organizations (at least 3):

3.1.1 - Name	3.1.2 Type + / - (1 / 0)	3.1.3 Intensity (0 – 4)	3.1.4 Reciprocity (0 – 4)	3.1.5 Trust (0 – 4)	3.1.6 Agreement with objectives Yes (1) – No (0)

3.2 - Maintenance of fisheries organizations (at least 3):

3.2.1 - Name	3.2.2 Type + / - (1 / 0)	3.2.3 Intensity (0 – 4)	3.2.4 Reciprocity (0 – 4)	3.2.5 Trust (0 – 4)	3.2.6 Agreement with objectives Yes (1) – No (0)

3.3 – Have you ever participated in a capacity-building workshop sponsored by any conservation or fisheries management organization? Yes (1) - No (0).

If the answer to question 3.3 is Yes, how has your perception / degree of understanding about the use of marine reserves changed for:

3.3.1 – conservation of marine biodiversity?

Nada (0) - Muy poco (1) - Poco (2) - Alta (3) - Muy Alta (4)

3.3.2 – fisheries management?

Nada (0) - Muy poco (1) - Poco (2) - Alta (3) - Muy Alta (4)

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