

RULES AND SUSTAINABLE RESOURCE USE: CASE STUDIES OF SMALL-
SCALE FISHERIES IN THE NORTHERN GULF OF CALIFORNIA, MEXICO

by

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ABSTRACT

Understanding how institutions affect or shape fisheries performance is an important part of providing practical insights for the development of management strategies that promote sustainable fishing. In the Gulf of California there is widespread evidence of declines in fish stocks upon which small-scale fisheries depend and these declines are largely attributed to policy failures. Using methods commonly used in social sciences, I investigated the formal and informal rules regulating resource use by small-scale fishers from two fishing communities in the Northern Gulf of California (NGC), Bahía de Kino and Bahía de los Ángeles, Mexico, and their effects on fisheries sustainability.

Some of the main results are summarized below:

- a) The percentage of fishers holding fishing rights and actually using them to report and commercialize catch was quite small in both communities (fishing rights are usually in the hands of absentee operators).
 - b) Current policies and policy changes do not reach the fishers in a direct and formalized way in any of these communities, and these policies are shaped with no participation of local fishers.
 - c) Current policy tools show poor performance in practice and have been ineffective (at the moment) in promoting sustainable fishing practices by fishery stakeholders.
- Neither community has been able to manage their resources sustainably.

Results also suggest some potentials that could lead to more sustainable fishing practices in both communities:

- d) The presence of informal rights (fishers' sense of ownership) over the fishing grounds in the surroundings of their home communities. Generally, local fishers do not conform to or enforce the individual boundaries of the fishing rights they hold (or work under), but they do care about and defend an area that they perceive as belonging to their community as a whole, particularly when there are "outsiders" coming in.
- e) The presence of strong support from the fishers for implementing improved regulatory measures for local fisheries.

Specific recommendations for each case study are provided with the aim of enhancing rules legitimacy and improving management outcomes.

INTRODUCTION

The problem and its global context

The State of the World's Fisheries: Where do Small-scale Fisheries Stand?

The current status and trends of global fisheries has been a subject of intense debate over the years. Nonetheless, it is now well recognized that the majority of the world's fish stocks are intensively exploited and that the impact of fisheries (and other human activities) on marine ecosystems has been profound (Hilborn et al. 2003; Norse and Crowder 2005; FAO 2009; Worm et al. 2009). While many of the world's major fisheries continue to produce substantial yield, a number have been severely overfished, and many more stocks appear to be heading toward depletion (Hilborn et al. 2003). The United Nations Food and Agriculture Organization (FAO) estimated that 19% of stocks were overexploited and 9% depleted or recovering from depletion in 2007 (FAO 2009). More recent estimations (based on a sample dominated by valuable industrial fisheries with some form of management in developed countries)¹ suggest that marine ecosystems are currently subjected to a range of exploitation rates, resulting in a mosaic of stable, declining, collapsed, and rebuilding fish stocks and ecosystems (Worm et al. 2009). These authors also assert that despite the long history of overexploitation in most fisheries, management actions have achieved measurable reductions in exploitation rates

¹ Information on other fisheries like small-scale or recreational fisheries is scarcer, less accessible, and more difficult to interpret than industrial or large-scale fisheries' data (Berkes et al. 2001; Worm et al. 2009).

in some regions, suggesting that there is room for recovery if the right mechanisms (for each context) are in place.

Although there is no universal definition of small-scale fishery (SSF), SSFs generally involve small boats and catches, and mechanized and manual fishing gears (Panayotou 1982; Berkes et al. 2001). SSFs around the globe are socially and economically very important (Berkes et al. 2001; FAO 2009). However, due to the high level of informality, complexity and heterogeneity of this fishing sector, estimating its magnitude is highly challenging and estimates vary greatly. Berkes et al. (2001) suggested that SSFs worldwide comprise over 50 million fishers of a total of 51 million considering large and small-scale fisheries. More recent estimations suggest that this fishing sector comprises 12 million fishers compared with 0.5 million in industrialized fisheries (Pauly 2006). Even with these large differences, the relative importance of SSFs compared with large-scale fisheries remains noticeably high. The great majority of these fishers reside in developing countries, which produce a significant amount of the world's harvests² (Berkes et al. 2001; Pauly 2006).

Worldwide, the management of SSFs is quite challenging both biologically and socially (McGoodwin 1990; Berkes et al. 2001; Hilborn et al. 2005; Orensanz et al. 2005; St. Martin et al. 2007). SSFs usually involve a large number of boats, highly diverse species and fishing gears, and occur in relatively small, usually isolated communities, that land their catch in multiple spots along the coasts (Mahon 1997; Berkes et al. 2001;

² According to Berkes et al. 2001, these fisheries produce 20-30 million tons per year, compared to 15-40 million tons by large-scale fleets. The best global estimate is thought to be about 21 million tons in 2000 (Pauly 2006).

McGoodwin 2002). Under these circumstances fishery information is hard to get and regulations are difficult to enforce when implemented in a top down manner (Orensanz et al. 2005; Grafton et al. 2006). Because of these characteristics, the conventional approach³ to fisheries management involving single species stock assessment, top-down administration and external enforcement, has rarely worked for managing SSFs (Mahon 1997; Berkes et al. 2001; Worm et al. 2009). Furthermore, when these fisheries are managed at all, the tendency has been to keep access to these fisheries open, with limited controls over who may exploit the resources (Berkes et al. 2001).

Small-scale fisheries as common-pool resources (CPRs): The role of institutions in fisheries performance

Institutions⁴ (like policies or locally developed rules) are widely regarded as key factors influencing the uses of natural resources by humans, whether it involves overuse or sustainable management (Ostrom 1990; National Research Council 2002). People work within a set of ecological, social, and institutional constraints to consider the costs and benefits of various behaviors and act according to perceived incentives (Ostrom 1990; Rudd 2004). Institutions are particularly important in common-pool resources (CPRs) (such as a forest or a fishing ground), which are resources from which excluding users is difficult (the exclusion problem), and one person's harvest of the resource makes this resource unavailable to others (the subtractability problem) (Ostrom et al. 1994).

³ This approach was developed for large-scale (or industrial) fisheries from the Northern Hemisphere and used elsewhere.

⁴ We refer to 'institutions' as the rules, norms and strategies adopted by individuals to organize their social interactions and resource extraction (Ostrom 1990).

In fisheries, controlling who accesses a fishing ground and how the resource is harvested by those entering the fishery are critical aspects for limiting exploitation to sustainable levels (Hilborn et al. 2003; Grafton et al. 2006). Open-access to fisheries has had disastrous social and ecological consequences worldwide. Hardin's model of the "tragedy of the commons" explains how the divergence between individual and collective rationality may cause overexploitation of resources open to all (Hardin 1968). Under freedom of fishing, the fish that is left in the water may be caught by others, and so there is no incentive to conserve. However, although Hardin's model is a coherent explanation for overexploitation in open access situations, his predictions of a guaranteed tragedy whenever resources are held in common have been widely refuted by empirical evidence (Feeny et al. 1990; Ostrom 1990; Smith and Berkes 1991). Studies conducted by social scientists over the last quarter of last century have revealed a surprising amount and variety of organizational arrangements previously ignored (e.g., informal property rights, self-governed examples), where the "tragedy" was not observed (Cordell 1984; Ruddle and Akimichi 1984; Ostrom et al. 1994; Ruddle 2007). These findings opened new alternatives for the *-de novo-* management of SSFs, involving more participatory approaches (community-based management, co-management), the use of property or use rights and other incentive-based management practices (also called rights-based tools⁵) to encourage rule compliance and self-enforcement, and an increased attention on factors affecting human behavior.

⁵ Approaches that tend to eliminate 'the race for fish' and provide incentives for fishery stakeholders to participate in management decisions and increase compliance with regulations (e.g., territorial use-rights in fisheries or TURFs, marine tenure systems, use-rights to a certain gear or to an amount of a resource granted to individuals, groups of individuals or communities) (Christy 1982; Hilborn 2005; Grafton et al. 2006).

Today, fisheries management failures are thought to be largely the product of institutional failures, the sum of the legal, social, economic and political arrangements used to manage fisheries which are directly linked to incentives (FAO 2002; Hilborn et al. 2005; Grafton et al. 2008). The existence of inappropriate incentives for sustainable management has been identified as one of the six⁶ major causes for unsustainable fisheries around the world (FAO 2002). Understanding how institutions affect or shape individual incentives and fisheries performance is therefore an important part of providing practical insights for the development of management strategies that promote sustainable fishing.

Rules on paper vs. rules in use

Rules and regulations are seldom implemented and used exactly the way they are stated. These rules may consist of externally established rules (often formalized rules, like policies or regulations) and rules developed by the users of resources (often informal arrangements or agreements). The rules and practices that are actually used in field settings are called working rules or rules in use and they may or may not closely resemble the formal laws expressed in legislation (Ostrom et al. 1994). Sometimes, rules in use may differ considerably -or even contradict- the existing formal rules. Because rules in use are not easily observable, fisheries managers and analysts may believe that formal rules and rules in use are always the same, and/or that there are no other rules in place other than formal rules (Ostrom 1992; Ensminger 1996). If managers assume that users

⁶ Together with high demand for limited resources, poverty and lack of alternatives, complexity and inadequate knowledge, lack of governance, and interactions of the fishery sector with other sectors and the environment.

automatically learn, comprehend, and make use of the government rules in place, management strategies may be based on administrative assumptions (rules on paper) rather than on what is really happening in the field.

Unfortunately, studies of rules in use and of how the fishers respond to rules and regulations are seldom addressed in studies of fishing communities (Grafton et al. 2006), leaving us without an understanding of how policies are performing on-the ground and how their implementation could be improved. This is usually the case in SSFs where rules in use (locally developed and government rules) to control access and resource use are virtually unknown to authorities, even though many of the processes governing the sustainability of SSFs take place at the local level (Christy 1982; Orensanz 2001).

This Dissertation

The goal of this dissertation is to understand the formal and informal mechanisms regulating resource use by small-scale fishers from two fishing communities in the Northern Gulf of California (NGC), Bahía de los Ángeles and Bahía de Kino, Mexico, and their effect on fisheries sustainability. By comparing the institutional performance of these case studies this dissertation aims to improve our understanding of how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders' behavior.

In the Gulf of California, there is widespread evidence of declines in fish stocks upon which small-scale fisheries depend (Cudney-Bueno and Turk-Boyer 1998; Sala et al. 2004; Sáenz-Arroyo et al. 2005; Sáenz-Arroyo et al. 2006; Danemann and Ezcurra

2007; Cisneros-Mata 2010). Despite the existence of formal policies and regulations intended to sustain fishery production, these declining stocks are largely attributed to policy failures (Alcalá 2003; Greenberg 2006; Cisneros-Mata 2010).

This dissertation is aimed to provide information to better fit current government policies to local circumstances with the goal of enhancing their legitimacy and improving management outcomes. Results from this study may also be used as a preliminary baseline in the development of ‘regional fishery ordinance plans’ and ‘species-specific management plans’ for the study area, as required by the recently enacted fisheries act in Mexico, the “Ley General de Pesca y Acuacultura Sustentables”.

The specific goals of this dissertation are as follows:

1. To assess the on-the-ground performance of existing government rules for fisheries management in Bahía de los Ángeles and Bahía de Kino.
2. To assess fishers’ knowledge and attitudes on fisheries policies in these fishing communities, and their suggestions on how these policies could be improved.
3. To assess the presence of locally developed rules or arrangements to regulate fishing behavior in these fishing communities, and their interaction (compatibility) with existing government rules.
4. To contrast the institutional performance (of government and local rules) of these communities’ SSFs and the factors (institutional and non-

institutional) potentially contributing to the outcomes observed in each case.

5. Based on the knowledge generated, to recommend how this knowledge can inform fisheries management to improve the condition of SSFs in the region.

Explanation of the dissertation format

The results of this dissertation are presented as three separate appended manuscripts (Appendices A, B, and C). The manuscripts present in-depth details of specific research questions addressed, methodology, results, and discussion. Various colleagues appear as co-authors based on our collaboration through the development of this research. However, the research design, analysis, writing, and the majority of the data collected for this research are entirely my own and the dissertation as a whole represents my original and independent work. In addition to these research articles, Appendices D-G contain copies of the survey instruments used for this research, which could be useful for anyone studying institutional aspects of small-scale fisheries in the Gulf of California, Mexico. Appendix H contains approval paperwork for the UA Human Subjects Protection Program.

APPENDIX A: “The Unintended Consequences of Formal Fisheries Policies: Social Disparities and Resource Overuse in a Major Fishing Community in the Gulf of California, Mexico” is an article published in *Marine Policy* in March 2010, Volume 34,

pages 328–339. This study investigates the local social and fisheries impact of formal fisheries policies in Bahía de Kino, and addresses the question of whether the formal institutional structure of Mexican fishing regulations is effective in promoting responsible behavior by small-scale fishery stakeholders. I wrote this article in collaboration with William W. Shaw (my dissertation director) and Richard Cudney-Bueno (UC Santa Cruz and Packard Foundation), who are part of the PANGAS Project, which supported my dissertation research. They provided important feedback during the design and development phases of this research and in the preparation of the manuscript. Mario Rojo (from COBI), also a co-author of this study, facilitated my field work and assisted with data collection.

APPENDIX B: “Insights from the Users to Improve Fisheries Performance: Fishers’ Knowledge and Attitudes on Fisheries Policies in Bahía de Kino, Gulf of California, Mexico” is an article published in *Marine Policy* in November 2010, Volume 34, issue 6, pages 1322–1334. This study investigates the interpretation and level of support of government regulations in Bahía de Kino, and includes information on fishers’ awareness of current policies, fishers’ attitudes concerning different aspects of fisheries regulation, and fishers’ suggestions on how their fisheries should be managed. I wrote this article in collaboration with William W. Shaw (my dissertation director) who provided significant feedback throughout the development of this research and in revisions of the manuscript. Jorge Torre (from COBI), also co-author of this article, collaborated with information and in revisions of the manuscript.

APPENDIX C: “A Comparative Analysis of Small-scale Fisheries Performance in the Gulf of California, Mexico, from an Institutional Perspective: Opportunities and Challenges for Community-based Management” prepared for publication in the International Journal of the Commons. This study compares the institutional performance of two case studies of small-scale fisheries in the Gulf of California (GC), Bahía de los Ángeles and Bahía de Kino. It aims to improve our understanding of how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders’ behavior. This study also examines the role of factors (institutional, non-institutional, fishers’ attitudes and perceptions) that may potentially influence the capacity of these communities for fisheries improvement in the mid- to short-term. It also examines how these factors may potentially affect the degree to which local stakeholders could take an active role in resource management. I wrote this manuscript in collaboration with Marcia Moreno-Báez (recently graduated at the School of Natural Resources and the Environment and member of the PANGAS project), who provided fishing zone data and assisted with cartographic design and incorporation of official information into GIS. Esteban Torreblanca-Ramírez (from PRONATURA) is also co-authoring this manuscript. Esteban facilitated my field work in Bahía de los Ángeles and assisted with data collection.

APPENDIX D: Survey instrument for panga captains - Bahía de Kino.

APPENDIX E: Survey instrument for key informants - Internal organization of formalized groups and local arrangements - Bahía de Kino.

APPENDIX F: Survey instrument for panga captains - Bahía de los Ángeles.

APPENDIX G: Survey instrument for key informants - Internal organization of formalized groups and local arrangements - Bahía de los Ángeles.

APPENDIX H: Human Subjects Approval.

PRESENT STUDY

The methods, results, and conclusions of this study are presented in the papers appended to this dissertation. The following is a summary of the most important findings in this document.

The Study Area

Small-scale Fisheries in the Gulf of California

The Gulf of California (GC) in Mexico (Figure 1) is an area characterized by exceptionally high rates of primary productivity (Zeitzschel 1969; Alvarez-Borrego and Lara-Lara 1991) and biodiversity levels (Brusca et al. 2004), as well as high economic and social significance (Carvajal et al. 2004; Cisneros-Mata 2010). Fishing (large and small-scale) is a predominant economic activity throughout the GC. It is estimated that there are approximately 50,000 fishers and 25,000 boats operating in small-scale (or artisanal) fisheries in the GC, and about 10,000 fishers and 1,300 boats operating in large-scale (or industrial) fisheries (Cisneros-Mata 2010). The region is a major contributor to the national fisheries sector, producing approximately 50% of the landings⁷ and 70% of the value of national fisheries in Mexico (Carvajal et al. 2004).

⁷ Nonetheless, about 60% of these landings (as of 2002) correspond to small pelagics (mainly sardines and jumbo squid), most of which is harvested by large-scale fleets (37 industrial vessels for sardine and 1,000 small boats or pangas for jumbo squid). These fisheries combined employ a relatively small number of people and contribute with only about 10% of the total value of GC landings to the national fishery production (Cisneros-Mata 2010).

SSFs are very important in the Northern Gulf of California (NGC)⁸ (Figure 1). Recent studies revealed that small-scale fishing takes place in most of the coastline of the NGC (89%) and surrounding islands, from shore to over 100 meter depth (Moreno-Báez et al. 2010). The exact number of small-scale boats working in the NGC (and in the entire GC) is hard to determine given the vastness and complexity of the territory, and the dynamism of this type of fleet. The number of boats commonly increases and decreases, and distributes over space, in response to variations in resource abundance and other factors like market demand and cost-benefit calculations (Cudney-Bueno and Turk-Boyer 1998; Moreno et al. 2005b; Danemann and Ezcurra 2007; Cudney-Bueno and Basurto 2009; Cinti et al. 2010; Cisneros-Mata 2010; Moreno-Báez et al. 2010). Estimations made in 2005 at the scale of the NGC suggest between 1,600 and 3,000 active⁹ boats depending on the season (project PANGAS 2006, unpublished data), each with a team of two or three fishers. These boats, locally called “pangas”, target over 70 main species and more than 100 species total, including crustaceans, mollusks, fishes, echinoderms, and more recently coelenterates (PANGAS 2008). Pangas are typically fiberglass boats, 8-9 meters long, equipped with 55-115 hp outboard motors, and gross tonnage of about 1 metric ton. Small-scale fishers use a diversity of fishing gears, being the most common gillnets (for fish and crustaceans), longlines (fishes), traps (crustaceans and fishes), and

⁸ Based on observations of fish species distribution patterns, the Gulf of California has been divided in three main areas (north, mid and south) (Walker 1960). The Northern Gulf of California is defined as the area extending north of an imaginary line from San Francisquito in Baja California and Bahía de Kino in Sonora.

⁹ These are the boats that were actively fishing at the time the survey was conducted, regardless of their legal status. Note that both, counts of active pangas in a given season and official registries may not reflect the reality because of the dynamism of these artisanal fleets and the presence of outdated official information.

diving (crustaceans, mollusks, echinoderms, fishes) (Cudney-Bueno and Turk-Boyer 1998).

Small-scale Fisheries in Bahía de Kino, Northern Gulf of California

Bahía de Kino (BK) is a rural fishing community of about 5,000 inhabitants (INEGI 2005) located in the State of Sonora (Figure 1). This village is only 100 Km from Hermosillo (the state capital)¹⁰, which is the primary destination of local marine resources prior to redistribution to regional, national and international markets.

Approximately 800 fishers and 200 active pangas are involved in SSFs in this community (Moreno et al. 2005b). A total of 66 species are harvested by these small-scale fishers, of which 35 are regarded as the primary targets of fishing trips (Project PANGAS, unpublished). The main fishing gears used by the fishers of BK are gillnets, traps (for crab and fish), and commercial diving. Approximately 80 pangas are dedicated to gillnet fishing, which primarily targets small sharks (*Mustelus* spp.), rays (*Dasyatis dipterura*, *Myliobatis californica*), and related species (Guitar Fish, *Rhinobatus* spp.; Angel Shark, *Squatina californica*); sierra (*Scomberomorus* spp.), flounder (families Paralichthidae and Pleuronectidae), and shrimp (*Litopenaeus* spp.). About 20 of these pangas switch to fish swimming crab (*Callinectes bellicosus*) with traps at the onset of this fishing season and return to gillnets afterwards. Other 30 pangas are dedicated exclusively to the harvest of swimming crab with traps more regularly throughout the year. In addition, another 80 pangas are active in commercial diving. Divers mainly harvest pen shells (mostly *Atrina tuberculosa*, and occasionally *Atrina Maura* and *Pinna*

¹⁰ With 640,000 inhabitants (INEGI 2005).

rugosa), octopus (*Octopus spp.*), and fishes [mainly groupers (*Mycteroperca rosacea* and *M. jordani*) and snappers (*Hoplopagrus guentherii* and *Lutjanus novemfasciatus*)]. Sea cucumber (*Isostichopus fuscus*) is also an important diving fishery, though clandestine because no authorization to harvest this species has been granted in the area (Cinti et al. 2010). Smaller quantities of lobsters (*Panulirus spp.*), rock scallop (*Spondylus calcifer*), several species of clams (*Megapitaria squalida*, *Dosinia spp.*, and others) and snails (*Hexaplex nigritus*, *Strombus galeatus*, and others) are also harvested¹¹. In August-September, these divers and other fishers in town temporarily abandon their main fishing activity and join the shrimp small-scale fishery. About 150 pangas of the 200 active pangas in BK participate in the shrimp fishing season. Also, some pangas from BK work using other fishing gears for short periods of time in addition to their main fishing activity, like traps for fish (<10 pangas) (Meza et al. 2008), longline (<5 pangas during a couple of months per year), and hand lining (project PANGAS 2006, unpublished).

Small-scale Fisheries in Bahía de los Ángeles, Northern Gulf of California

Bahía de los Ángeles (BA) is a very small and isolated community of 527 inhabitants (INEGI 2005), situated in the state of Baja California (Figure 1) over 500 Km from the nearest major city¹² where marine resources can be marketed and redistributed to other regional, national and international markets (US and Asia).

¹¹ Some of these products are harvested in small amounts because they are overfished and consequently scarce, even though they get a high price in the market (e.g., lobster, rock scallops, some species of clams). Other species are harvested only in small quantities because they get a very low price in the market (some species of snails and clams).

¹² At 555 Km from Ensenada (~260,000 inhabitants), 650 Km from Tijuana (~1.29 million inhabitants), and 800 Km from Mexicali (the state capital) (~900 thousand inhabitants), all next to the United States (US) border.

SSFs in BA consist of about 70 fishers and 37 pangas (Avendaño et al. 2009) and make use of three main fishing gears: 1) gillnet fishing, which primarily targets flounder (*Paralichthys californicus*) and species¹³ associated to this fishery; and shark species (mainly *Mustelus spp.* and *Galeorhinus spp.*; 2) trap fishing, which mainly targets octopus (*Octopus bimaculatus* and *O. hubbsorum*) and fish species (mainly sand basses *Paralabrax auroguttatus* and *P. maculatofasciatus* and species¹⁴ associated to these fisheries); and 3) commercial diving, which targets octopus (*O. bimaculatus* and *O. hubbsorum*), sea cucumber (*Istiotichopus fuscus* and *I. inornata*), and several species of clams (e.g., *Megapitaria squalida*, *Argopecten ventricosus*) (Danemann and Ezcurra 2007; Valdez Ornelas and Torreblanca 2008; Torreblanca et al. 2009).

Legal Framework for Fisheries in Mexico (applicable to BK and BA fisheries)

Fisheries regulation in Mexico is shared by two federal agencies, SAGARPA¹⁵, the Secretary of Fisheries and Agriculture, and SEMARNAT¹⁶, the Secretary of the Environment and Natural Resources (Figure 2). SAGARPA, via CONAPESCA¹⁷, its National Fisheries and Aquaculture Commission, is the primary agency in charge of fisheries regulation, issuing licenses in the form of fishing permits (referred as CONAPESCA's permits hereafter), authorizations or concessions (Figure 2). CONAPESCA is also in charge of enforcing regulations related to fishery resources that fall under SAGARPA's jurisdiction.

¹³ Angel shark *Squatina californica*, Guitarfish *Rhinobatos productus*; Rays *Dasyatis Brevis*, *Gymnura marmorata*, and *Myliobatis californica*.

¹⁴ Whitefish *Caulolatilus princeps* and Mexican hogfish *Bodianus diplotaenia*.

¹⁵ Stands for "Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación".

¹⁶ Stands for "Secretaría de Medio Ambiente y Recursos Naturales".

¹⁷ Stands for "Comisión Nacional de Acuacultura y Pesca".

On the other hand, SEMARNAT, via DGVS¹⁸, its General Division of Wildlife, regulates the use of species listed “under special protection”¹⁹ and, in the case of benthic resources listed in this category (e.g., sea cucumber and rock scallop), may authorize their harvest through a species-specific permit²⁰ (referred to as SEMARNAT’s permit hereafter) (Figure 2). SEMARNAT is also in charge of the establishment and management of marine protected areas (MPAs) throughout Mexico via CONANP²¹, the National Commission of Natural Protected Areas. PROFEPA²², the Federal Agency for the Protection of the Environment, is SEMARNAT’s enforcement body (Figure 2). The Navy is also empowered to provide enforcement support to both CONAPESCA and PROFEPA if needed.

In the Gulf of California, and throughout Mexico, CONAPESCA’s fishing permits are the most widely used management tool²³ to grant access to marine resources. Fishing permits may be granted to any corporate entity [e.g., formalized groups like cooperatives or SPRs²⁴] or individual for four years or less (2-5 years in the new law), and they are renewable upon compliance with regulations. The permit specifies the

¹⁸ Stands for “División General de Vida Silvestre”.

¹⁹ Species included in the norm NOM-059-ECOL-1994 and subsequent modifications.

²⁰ Called “Predios Federales Sujetos a Manejo para la Conservación y Aprovechamiento Sustentable de Vida Silvestre” (Federal Polygons for the Conservation and Sustainable Use of Wildlife).

²¹ Stands for “Comisión Nacional de Áreas Naturales Protegidas”.

²² Stands for “Procuraduría Federal de Protección al Ambiente”.

²³ To date, fishing concessions have only been granted for a few benthic resources of high commercial value (e.g., abalone, lobster) on the west coast of Baja California Peninsula and the Caribbean Sea (Bourillón-Moreno 2002). In the GC only a few SEMARNAT’s permits have been issued for the harvest of sea cucumber, rock scallop, and ornamental fish used for the aquarium market.

²⁴ An SPR (Society of Rural Production) is a type of formal organization commonly used in Mexico for any type of rural industries, services and productive activities, including fisheries.

particular species (e.g., octopus permit, lobster permit) or group of species²⁵ to be harvested, within a broadly specified region (Bourillón-Moreno 2002). Generally, access to the species (or group of species) within that area is not exclusive, since several permits for the same species and area may be granted to different permit holders. Nonetheless, as we will describe later, variations in the way this tool is implemented may occur between states.

Each fishing permit specifies the number of boats²⁶ that are permitted for use to harvest the species authorized in the permit, together with technical specifications of the fishing equipment(s) (boat, motor and fishing gear). A boat that belongs to a permit holder can be registered in more than one permit. That is, the same boat can be entitled to fish several species, depending on the amount of permits registered to a specific boat. Permit holders are the only ones who can legally land and declare the catch at CONAPESCA's regional offices (Bourillón-Moreno 2002). Permit holders are also the only ones who can provide legal invoices (or "facturas") for the product extracted directly from sea²⁷. These invoices certify legal ownership of the harvest, and are necessary to sell and transport the catch to regional or international markets. Note that permit holders are only allowed to harvest and sell resources that have been caught using the fishing equipment(s) (boat, motor and fishing gear) registered in their permits. The use of one's permit to buy and sell catch caught by fishing equipments not registered in

²⁵ Some permits are issued for several species under a generic category, e.g. the escama (fish with scales) permit allows fishing about 200 species of fish, or the 'shark permit' which includes several species of elasmobranchs.

²⁶ Referred as 'número de espacios'.

²⁷ Buyers without a fishing permit are allowed to buy product from permit holders or from other buyers without a fishing permit and resell it. They have to carry on with them a document that certifies the legal possession of the catch and specifies the fishing permit under which the product in question was harvested.

the permit is locally called ‘amparo’ (‘sheltering’ catch from illegal sources) and is prohibited by law.

SEMARNAT’s permits (as well as CONAPESCA’s fishing concessions) may provide exclusive use-rights over one or more species within a specified polygon, following the guidelines of a management plan, for which a quota must be authorized (this permit does not specify a number of authorized boats as is the case of CONAPESCA’s permits). Note that this tool provides exclusive access to the species but not to the polygon since other fishers may access the area to harvest other species²⁸. This permit may be granted to any formalized group or individual for one year and it is renewable upon compliance with regulations.

MPAs have been also used as tools in the GC for conservation and fisheries management purposes. In the region, the most common type of MPA used is the Biosphere Reserve²⁹, for which zones with different degrees of protection must be delimited (typically one or more core zones with higher levels of protection and a buffer zone with lower level of protection). According to the law³⁰, preferred access to MPAs for the conduct of commercial activities should be provided to members of the communities inhabiting the area at the moment the MPA is established, following the guidelines of its management plan. Also, the law³¹ encourages participation of municipal and state governments, and members of the community, in decision-making concerning the use and management of MPAs.

²⁸ Unless the harvest of all commercial species within that area is granted to the same permit holder.

²⁹ Biosphere reserves must be established in regions of high ecological value to the country.

³⁰ ‘Ley General del Equilibrio Ecológico y la Protección al Ambiente’ (LGEEPA), www.semarnat.gob.mx, and its bylaws concerning MPAs. See Art. 48 and 64 BIS-1, LGEEPA.

³¹ Art. 67, LGEEPA.

Social and Fisheries Impact of Formal Fisheries Policies in Bahía de Kino and Management Implications Beyond this Case Study

This paper illustrates the effect of institutions on social interactions and harvesting behavior in an important commercial diving fishery of the Gulf of California. Although only one fishing community was the focus of this study, this particular case provides lessons that go beyond its boundaries, illustrating the potential impacts of some of the most widely used fishery management tools throughout Mexico.

We conducted research in Bahía de Kino from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. We gathered information on the local performance of formal and informal rules regulating access and use through participant observation, examination of secondary sources, and semi-structured and structured interviews (including open and closed-ended questions).

We found that generally marine resources targeted by commercial divers in Bahía de Kino are captured by fishers who do not own a fishing permit and do not belong (as members), to any cooperative holding permits. In reality, most permit holders are the buyers of the product. Also, most of the local corporate permit holders (principally cooperatives) that were active in 2007 function in practice as individual permit holders (locally referred as ‘permisionarios’). Cooperatives are usually constituted by a mixture of family members, others not related to the fishing activity, and a few fishers that were requested to sign at the time the cooperatives were formed. However, in practice, these ‘cooperatives’ are seldom ‘cooperatively managed’.

We argue that existing requirements to access fishing permits create an institutional environment in which people who are not necessarily closely attached to the fishing activity and/or community decide to enter the fishery for business purposes. Often, full time fishers do not have the means, the capacity, and/or the time to fulfill the requirements and successfully navigate through the bureaucracy in order to access a fishing permit. This sets a standard that is too high for direct users (fishers) to become formally involved in the fishery. In addition, because several boats can be registered as part of a fishing permit, it is common that people requesting fishing permits do so for several boats, creating the need for additional people to operate these boats.

As a result, the system tends to promote the disconnection of right holders from the resource and intensify rent-seeking interests. Resources and markets tend to be monopolized in a few hands, and an informal system of production is created. This informal labor system is practically invisible to the federal government, resulting in the exclusion of most fishers (usually more closely attached to the resources and with the most at stake if resources are overfished) from management decisions concerning the fishery. This social structure creates the wrong incentives for effective fisheries management. Because permit holders are the only ones who can provide legal invoices for the product extracted directly from sea, they are constantly tempted to shelter marine resources from boats not registered in their permits. Furthermore, if fishers do not possess a legal right to fish, they will also not have incentives to pursue the common good or to limit fishing, even if perceiving that resources are increasingly scarce.

We argue that the design of the permit (licensing) system, the most widely used tool to regulate access to marine resources throughout Mexico, provides the wrong incentives for sustainable management. It is suggested that granting secure rights to resources to those actively involved in the fishery is a necessary step for promoting sustainable fishing practices.

Assessing Fishers' Knowledge and Attitudes on Fisheries Policies in Bahía de Kino to Improve Fisheries Management

Studies of what the resource users know about and how they perceive the formal policies that regulate their activity are useful tools to assess the effectiveness of rules designed to manage natural resources to ensure sustainable harvests.

We studied the interpretation and level of support of government regulations in Bahía de Kino, Sonora. Research was conducted in Bahía de Kino from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. We gathered information on knowledge and attitudes concerning different aspects of fisheries regulation through structured interviews (including open and closed-ended questions), informal talks and participant observation.

The results presented in this article reinforce and complement the information presented in the first article by Cinti et al. (2010), from the perspective of resource-users, suggesting that:

a) There exists an unequal distribution of fishing rights. None of our interviewees had fishing permits in their names (as individual permit holders) and only 18% were

members of cooperatives holding fishing permits. Nonetheless, these cooperatives did not commercialize their harvests through their cooperatives, which means that they are also highly dependent on external buyers or other permit holders to sell their product. In addition, obtaining a more even distribution of fishing permits, granting them to the users of resources (not to absentee operators), was a major suggestion by local fishers.

b) Current policies and policy changes do not reach the fishers in a direct and formalized way, and they are shaped with no participation of local fishers. Permit holders are the only ones legally involved in the fishery, and consequently, the only ones informed about regulatory measures, policy changes, or government benefits available to them. The result is that fishers, operating under permits held by others; do not have thorough knowledge about existing rules.

c) The existing system for monitoring and enforcing current rules is inefficient as reflected by fishers' willingness to reinforce vigilance and improve authorities' response to illegal fishing.

d) There exists the need to implement additional regulatory measures on most of the species targeted by local divers because of a generalized state of overfishing.

Our results provide further evidence supporting the need for formally recognizing these small-scale fishers as key stakeholders in local fisheries, and for working cooperatively towards the design of management strategies and regulations that provide better stimulus for resource stewardship and discourage overfishing. Very importantly, this study suggests that there is strong support from resource users for implementing regulatory measures for local fisheries.

The information presented in this study could be used as a preliminary baseline to inform and guide the development of species-specific management plans for the area, as required by the recently enacted fisheries act in Mexico, the “Ley General de Pesca y Acuacultura Sustentables” (see www.sagarpa.gob.mx).

Comparative Institutional Analysis of Small-scale Fisheries Performance in Bahía de los Ángeles and Bahía de Kino

Understanding how institutions affect or shape fisheries performance is an important part of providing practical insights for the development of management strategies that promote sustainable fishing (Ostrom 1990; Hilborn et al. 2005; Grafton et al. 2008).

This paper analyses the institutional performance of two case studies of small-scale fisheries in the Northern Gulf of California, with the aim of improving our understanding of how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders’ behavior.

The on-the-ground performance of existing formal policy tools and the presence and performance of local arrangements to regulate access and resource use was assessed through examination of secondary sources, semi-structured and structured interviews (including open and closed-ended questions), informal talks and participant observation. Fishers’ attitudes and perceptions were assessed using a combination of open-ended questions and a set of statements in a 5-point Likert scale. We relied on available

literature for information on additional factors which may help explain the outcomes observed in each case.

Our results suggest that the formal policy tools in place in either community have been ineffective (at the moment) in promoting sustainable fishing practices by fishery stakeholders. Even though these communities use different management tools (to some extent), neither community has significantly modified traditional fishing practices in response to over exploited resources. The geographic jurisdictions of individual permits (of formalized groups or individuals) are generally ignored and individual fishers fish where it is more convenient to them, following seasonal and spatial changes in resource abundance of different species, and driven by market demand, weather conditions, and distance constraints, among others. Informal rights (fishers' sense of ownership) seem to play a more important role than formal regulations in fishers' decisions about where to fish, at least within community limits. In BA, and also in BK to a lesser extent, there is a tendency to willingly share the fishing grounds among all members in the community (as if use-rights or permits would have been granted to the community as a whole), and to protect these fishing grounds from outsiders.

We argue that communal property or use-rights might potentially offer a viable alternative to help protect local fishing grounds from unwanted visitors, and incentivize local fishers to organize themselves to implement and self-enforce more legitimate management measures. In Mexico, granting communal property or use-rights over marine areas is only reserved for indigenous groups. Nonetheless, administrative tools available in Mexico's fishery and environmental laws could be used to provide higher

exclusivity of access to the community within the limits of their fishing grounds, and help prevent intrusions from outside.

We also found that fishers' attitudes and perceptions about the problems affecting their fisheries were quite similar between the two fishing communities, suggesting the need for formally recognizing the fishers as key stakeholders in local fisheries, and for working cooperatively towards the design of management strategies that provide better stimulus for resource stewardship and discourage overfishing. Remarkably, this study suggests that there is strong support from resource users for implementing regulatory measures for local fisheries in both communities.

We argue that local arrangements and initiatives, if recognized and supported, may provide the basis for the development of locally supported management strategies. This would in turn lead to a higher likelihood of compliance and a higher potential for managing these resources sustainably in both communities.

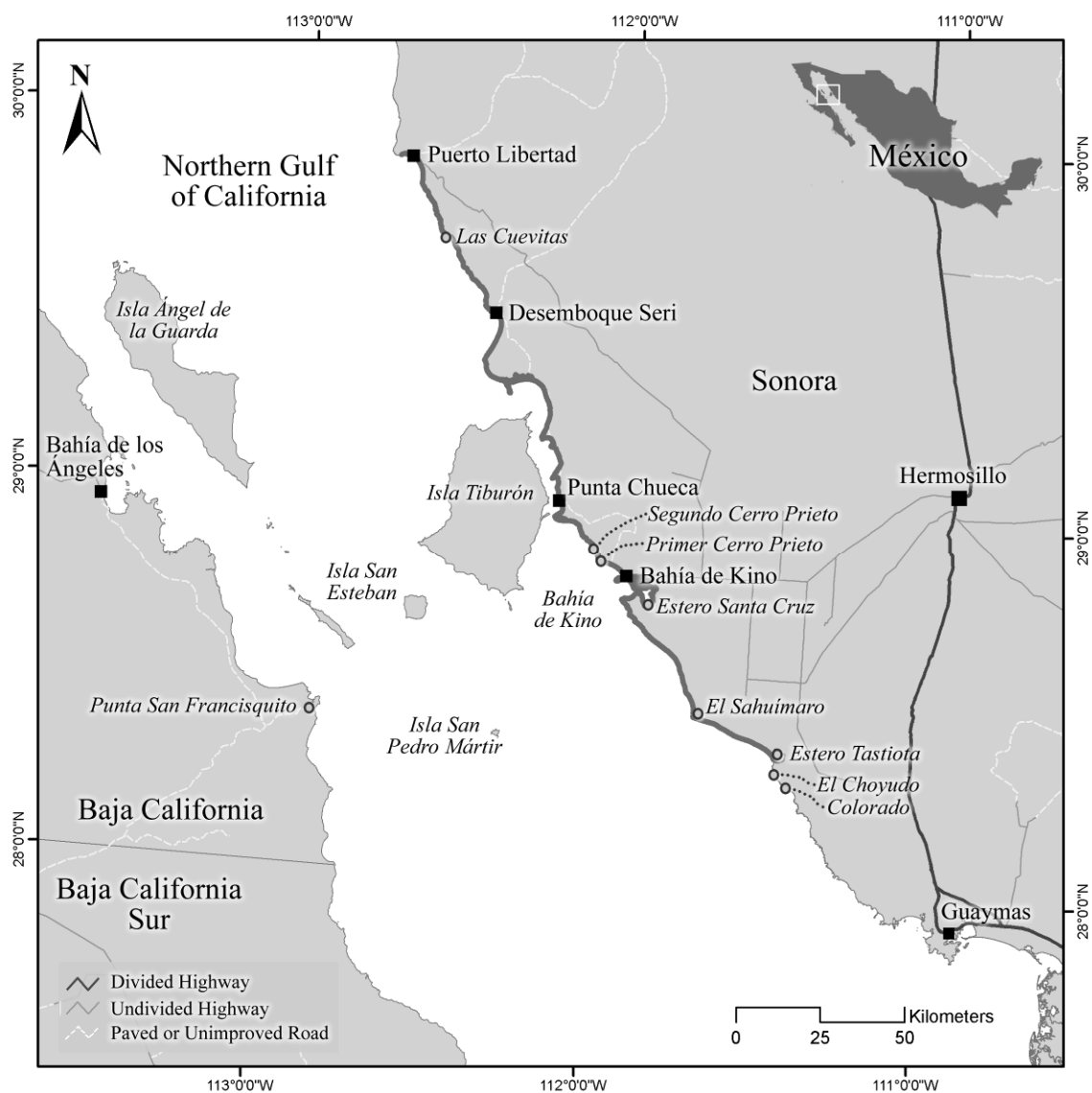


Figure 1. Map of the study area within the Northern Gulf of California (NGC). The NGC is the area extending north of Punta San Francisquito in Baja California and north of Bahía de Kino in Sonora. The thick gray line on the Sonoran coastline indicates the geographic jurisdiction of fishing permits for diving products in Bahía de Kino, extending from Puerto Libertad to Estero Tastiota. Square markers indicate the main towns or cities. Hermosillo is the capital city of Sonora. Cartographic design: Marcia Moreno-Báez and Erika Koltenuk.

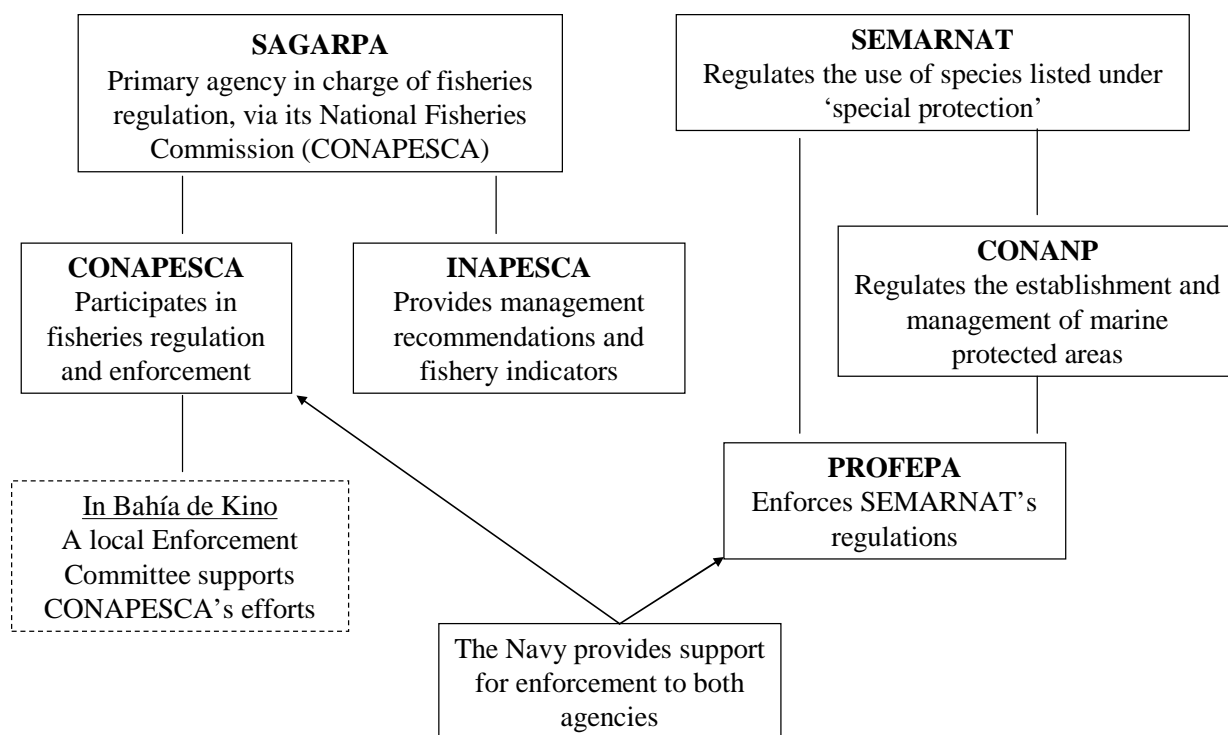


Figure 2. Federal agencies involved in fisheries regulation in Mexico and their main attributes as they relate to fisheries management.

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APPENDIX A: THE UNINTENDED CONSEQUENCES OF FORMAL FISHERIES
POLICIES: SOCIAL DISPARITIES AND RESOURCE OVERUSE IN A MAJOR
FISHING COMMUNITY IN THE GULF OF CALIFORNIA, MEXICO

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Keywords

Small-scale fishery; institution; policy; cross-scale interaction; incentive; Gulf of California.

The Unintended Consequences of Formal Fisheries Policies: Social Disparities and Resource Overuse in a Major Fishing Community in the Gulf of California, Mexico

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Abstract

This study investigates the local social and fisheries impact of formal fisheries policies in Bahía de Kino, one of the most important fishing villages in terms of extraction of benthic resources in the Northern Gulf of California, Mexico. The paper focuses on cross-scale institutional interactions, describing how existing formal policies are functioning on the ground, how these policies interact with local arrangements, and how this interaction may affect the incentives of different actors towards sustainable fisheries. Besides providing lessons on how the performance of a local fishery could be improved, this paper addresses the question of whether the formal institutional structure of Mexican fishing regulations is effective in promoting responsible behavior by small-scale fishery stakeholders. It is argued that the design of the most widely used management tool to regulate access to marine resources throughout Mexico -the permit (licensing) system- provides the wrong incentives for sustainable-use. Granting secure rights to resources to those actively involved in the fishery is a necessary step for promoting sustainable fishing practices.

1. Introduction

Institutions³² are widely regarded as important factors influencing the outcome of natural resources use by humans, whether it involves overuse or sustainable management [1, 2]. Given a set of ecological, social and institutional constraints, people consider the costs and benefits of various behaviors and act according to their perceived incentives [2, 3]. Institutions are particularly important in common-pool resources (CPRs), resources from which excluding users is difficult (the exclusion problem), and one person's harvest of the resource makes this resource unavailable to others (the subtractability problem) [4].

In fisheries, controlling who accesses a fishing ground and how the resource is harvested by those entering the fishery are critical for limiting exploitation to sustainable levels. Open-access to fisheries has had disastrous social and ecological consequences worldwide, even when resource-use rules were in place. On the other hand, decades of observation of traditional and *de novo* management practices have shown us that sustainability is achievable when the right mechanisms for controlling access and use, and for providing incentives for fishery stakeholders to pursue sustainable outcomes, are in place [4-11]. Whether developed by users themselves, by governments or other agencies, or a mix of both, some of the elements present in successful management institutions include granting of secure rights to resource users, stakeholder's meaningful participation in the full range of management (planning, science, legislation, and

³² We refer to 'institutions' as the rules, norms and strategies adopted by individuals to organize their social interactions and resource extraction [2].

implementation), government recognition and consideration of locally developed institutions and initiatives, and government support for management [5, 11, 12].

However, rules and regulations are seldom implemented and used exactly the way they are stated. The rules and practices that are actually used in field settings are called working rules or rules-in-use and they may or may not closely resemble the formal laws expressed in legislation, administrative regulation [4], or local formal agreements. Sometimes, rules in use may differ considerably -or even contradict- the existing formal rules. Rules-in-use are also different from laws or formal rules in that they are not easily observable [13]. This may lead to erroneous assumptions by analysts and managers who may believe that formal rules and rules-in-use are always the same, and/or that there are no other rules in place than formal rules [13, 14]. If managers assume that users automatically learn, comprehend, and make use of the government rules in place, management strategies may be based on administrative assumptions rather than on what is really happening in the field [2, 14]. Unfortunately, this issue is seldom addressed in studies of fishing communities, leaving us without an understanding of how government rules are functioning on the ground, and therefore how their implementation could be improved.

This paper presents the results of a study designed to describe the local social and fisheries impacts of formal fisheries policies in Bahía de Kino, one of the most important fishing villages in terms of extraction of benthic resources³³ in the Northern Gulf of

³³ Benthic species spend most of their life cycle in association with the sea bottom (i.e., mollusks, crustaceans). In Bahía de Kino, they are harvested primarily by commercial divers.

California (NGC), Mexico (Fig. 1) [15]. The Gulf of California (GC) is a region internationally known for its biological richness [16]. It is Mexico's chief supplier of fishery resources for national and international markets, and provides food and labor opportunities to thousands of people at a local level [17]. Fishing activities (large and small-scale) in the GC generate over 50,000 jobs, produce about 50% of the national fishery production, and involve around 26,000 fishing boats of which about 90% are small-scale boats³⁴ locally called 'pangas' [18].

Besides providing lessons on how the performance of a local fishery could be improved, this paper addresses the question of whether the formal institutional structure of Mexican fishing regulations is effective in promoting responsible behavior by small-scale fishery stakeholders. A number of studies of governance of marine resources by fishing communities have been developed in the Gulf of California [16, 19-23]. However, none has specifically addressed the on-the-ground performance of the main management tools for fisheries regulation and their consequences for fisheries sustainability. This study argues that the design of the permit (licensing) system, the most widely used tool to regulate access to marine resources throughout Mexico, provides the wrong incentives for sustainable management. It is suggested that granting secure rights to resources to those actively involved in the fishery is a necessary step for promoting sustainable fishing practices.

³⁴ Usually fiberglass boats less than 10m long, equipped with outboard motors.

2. Methods

The Institutional Analysis and Development Framework (IAD) [24] was used to help frame this research and identify relevant variables to explore. In this framework, three basic categories of variables are thought to influence the patterns of interaction among individuals in any given setting: 1. the rules used by participants to order their social interactions (i.e., local and government rules-in-use); 2. attributes of the biophysical world (i.e. resource characteristics); and 3. attributes of the community (i.e. socio-cultural attributes) [24] (Fig. 2).

Research in Bahía de Kino (Fig. 1) was conducted from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. Information on the local performance of formal and informal rules regulating access and use was gathered through participant observation, examination of secondary sources, and semi-structured and structured interviews (including open and closed-ended questions) [25, 26]. The first phase of the research was devoted to getting used to the setting, building trust and having informal and semi-structured talks with fishers, participating in a few fishing trips (n=4) and recording observations at the beach. During the final phase of the research, a structured interview was designed based on what was learned in previous months.

The structured interview was applied to fishers belonging to the major groups of divers in town that were active in 2007 (6 groups). Even though the selection of interviewees was not random due to lack of updated information on these groups' members, whenever possible the number of interviews was distributed among groups more or less in proportion to an estimate of the number of boats working for each group

at the time interviews were performed. A total of 45 interviews were conducted (about 19% of the fishers believed to be directly involved in this activity)³⁵. Eighty nine percent of interviewees were panga captains (in charge of the boat)(n=40), of which 33 were also divers and the rest (n=7) were captains and divers' assistants (the person who assists the divers on board). One or two crew members from 40 pangas were interviewed, out of approximately 80 active pangas involved in commercial diving in town (COBI³⁶, unpublished).

In addition to interviewing fishers, interviews were performed with a local authority and a local leader of the permit holders' sector to obtain information about issues of access to fishery resources within local fishing grounds. Secondary data were reviewed, including bylaws of cooperatives, official statistics on catch for the main target species of commercial divers, and additional catch and effort data collected through a voluntary logbook program implemented by an interdisciplinary project on small-scale fisheries called PANGAS, taking place in the Northern Gulf of California (<http://pangas.arizona.edu>).

3. Bahía de Kino's Fisheries: Social and Resource Characteristics

Bahía de Kino is a rural coastal community of about 5,000 inhabitants [27] situated in the state of Sonora, Mexico, where fishing is the most important human activity [28]. About 800 fishers and 200 active pangas are locally involved in small-scale

³⁵ The exact number of fishers involved in this activity is actually unknown. An estimation was used based on the number of pangas dedicated to commercial diving in town and the number of people generally involved in any diving trip (n=3), accounting for 240 people. However, because small-scale fishing is highly dynamic, actual number of fishers actively participating in fishing activities can vary greatly.

³⁶ A local NGO, Comunidad y Biodiversidad (COBI), www.cobi.org.mx.

fisheries (COBI, unpublished). A total of 66 species are harvested by these small-scale fishers, of which 35 are regarded as the primary targets of fishing trips (project PANGAS 2007, unpublished). Species extracted are an important source of marine products at the local and regional level. A number of these species are also internationally commercialized [15, 29].

About 80 pangas are currently active in commercial diving in Bahía de Kino (COBI, unpublished), harvesting pen shells (mostly *Atrina tuberculosa*, and occasionally *Atrina Maura* and *Pinna rugosa*), octopus (*Octopus* spp.), lobsters (*Panulirus inflatus*), and fishes [mainly groupers (*Mycteroperca rosacea* and *M. jordani*) and snappers (*Hoplopagrus guentherii* and *Lutjanus novemfasciatus*)]. Sea cucumber (*Isostichopus fuscus*) is also an important diving fishery, though clandestine because no authorization to harvest this species has been granted in the area. Pangas are 8-9 meters long, equipped with 55-115 hp outboard motors. To breathe underwater, divers use a ‘hookah’, which is fabricated locally using a modified paint sprayer as the air compressor, connected to a modified beer keg as the reserve air tank [30]. One or two 100 m hoses are attached to this tank with air regulators at the end. The diving crew may include the operator or ‘popero’ (who operates the boat), one or two divers, and a divers’ assistant (who controls the air supply for the divers). However, ‘poperos’ usually act as divers’ assistants too, to increase the economic efficiency of the fishing trip (earnings are divided among less people). One of these crew members is also the person in charge of the boat or captain,

who is responsible for its maintenance and for responding to the owner³⁷ in case anything may happen to it. Fishers working in commercial diving may at times also work in other fishing activities, using gillnets (for fish and shrimp) or traps (for swimming crabs, *Callinectes* spp.). Nonetheless, based on fishers' declarations, diving is the primary source of income for 93% of the fishers interviewed and fishing (of any kind) is the only source of income for 71% of interviewees.

The state of fishery resources is not being evaluated by the federal government for any target species of commercial diving in Bahía de Kino. The only information available is landings statistics, and sometimes independent studies conducted by NGOs or other non-governmental institutions. Official historical landings in Bahía de Kino indicate a marked decrease in catches of pen shells from 1992 to 1998 (from 168 to 3 metric tons), with a tendency to a slight increase in recent years (Fig. 3). A slight increase in landing trends is also evidenced for leopard grouper and octopus in the last few years, though octopus catch has been quite variable over time (Fig. 3). Table 1 shows the average, maximum and minimum catch for octopus, lobster, pen shell and leopard grouper between 1992 and 2008. Nonetheless, official statistics should be interpreted with caution and may only be useful to show trends. Illegal fishing is likely high because of unreported catch, catch captured outside local port's jurisdiction that is declared as if it was captured inside (i.e. in another state's jurisdiction), and misidentification of species, among other factors. In Sonora, estimations by the Navy in 2006 suggested that half of

³⁷ Usually when a crew member owns the fishing equipment, he or she is the person in charge. Otherwise, the captain is appointed by an owner external to the crew.

the small-scale boats fishing in state waters were illegal (4,000 boats officially registered and about 8,000 actually fishing) (newspaper El Imparcial, August 2006).

For one of the species of interest, Moreno et al. [31] provided the first reliable estimation on the condition of pen shell populations in the fishing grounds of Bahía de Kino. These authors found densities of less than 5 individuals per 300 m² in most fishing grounds, suggesting severe overfishing. Also, additional catch and effort data collected through a logbook program indicates lower average annual catch per unit effort (CPUE) for the 2007 pen shell fishing season in an important fishing ground for Bahía de Kino's divers (1.1kg of adductor muscle/hour diving³⁸) compared with neighboring fishing grounds [2kg of adductor muscle/hour diving³⁹ inside the Infiernillo Channel (Fig. 1); and 7.3kg/hour diving⁴⁰ in a fishing bed in the southern state of Sinaloa] (project PANGAS, logbook program, <http://pangas.arizona.edu>).

4. The Formal Institutional Setting for Fisheries in Mexico and Bahía de Kino

Fisheries administration in Mexico has been traditionally centralized [32]. Nonetheless, a new fisheries Law was enacted in October of 2007, the 'Ley General de Pesca y Acuacultura Sustentables', introducing decentralization⁴¹ as one of its primary goals (see www.conapesca.sagarpa.gob.mx). Hereafter, the formal institutional setting in place at the time this study was conducted (before the new law was enacted) will be

³⁸ Based on two logbooks. Fishing site: Cerro Prieto.

³⁹ Based on one logbook.

⁴⁰ Based on one logbook. Fishing site: Teacapán, Sinaloa.

⁴¹ This law establishes that states and municipalities will have participation in decision making through the creation of State Fisheries Laws and State Fisheries and Aquaculture Councils.

described. In addition, the changes as they appear in the new law, when there was any, will be also described.

Fisheries regulation in Mexico is shared by two federal agencies, the Secretary of Fisheries and Agriculture (SAGARPA), and the Secretary of the Environment and Natural Resources (SEMARNAT) (Fig. 4). SAGARPA, via its National Fisheries Commission (CONAPESCA), is the primary agency in charge of fisheries regulation, issuing licenses in the form of fishing permits, authorizations or concessions (Fig. 4). CONAPESCA is also in charge of enforcing regulations related to fishery resources that fall under SAGARPA's jurisdiction. SEMARNAT, on the other hand, regulates the use of species listed 'under special protection'⁴² and, in the case of benthic resources listed in this category (i.e. sea cucumber, rock scallop *Spondylus* spp.) may authorize their harvest through a species-specific permit⁴³ that grants exclusive use rights within a specified polygon following the guidelines of a management plan. SEMARNAT is also in charge of the establishment and management of marine protected areas throughout Mexico via the National Commission of Natural Protected Areas (CONANP). PROFEPA, the Federal Agency for the Protection of the Environment, is SEMARNAT's enforcement body (Fig. 4). The Navy is also entitled to provide enforcement support to both CONAPESCA and PROFEPA if needed.

⁴² Species included in the norm NOM-059-ECOL-1994 and subsequent modifications.

⁴³ Called 'Predios Federales Sujetos a Manejo para la Conservación y Aprovechamiento Sustentable de Vida Silvestre' (Federal Polygons for the Conservation and Sustainable Use of Wildlife). This tool and CONAPESCA's fishing concessions provide exclusive use-rights over one species within a specified area. This implies that other fishers may access the same area to harvest other species.

Throughout Mexico, fishing permits (granted by CONAPESCA) are the most widely used management tool to regulate access to marine resources. To date, fishing concessions have been granted only for a few benthic resources of high commercial value (i.e., abalone, lobster) on the west coast of Baja California Peninsula and the Caribbean Sea [20].

Fishing permits may be granted to any corporate entity (typically a cooperative) or individual for 4 years or less (2-5 years in the new law), and they are renewable upon compliance with regulations. The core requirements to access fishing permits include (a) presenting personal documentation, (b) specifying the species, fishing area, landing port, and duration of the right to be solicited, (c) specifying and certifying technical information of boat(s), motor(s) and fishing gear(s) as registered in the Secretariat of Communication and Transportation, (d) certifying the legal possession of boat(s), motor(s) and fishing gear(s), (e) certifying the legal constitution and membership of corporate entities, (f) certifying inscription at the Federal Taxpayers' Registry (Secretariat of Economy), and (g) paying the required fees⁴⁴.

The permit specifies the particular species (i.e., octopus permit, lobster permit) or group of species⁴⁵ to be harvested within a broadly specified region [20]. Each fishing permit specifies the number of boats (referred as 'número de espacios') that are permitted for use to harvest the species authorized in the permit, together with technical

⁴⁴ The processing fee for a fishing permit was about US\$50 in 2008 (Ley Federal de Derechos, Art 191A, inciso IIa), but the actual cost of the permit varies according to the species (i.e. permits for abalone, lobster or species included in the category 'almejas' (clams) range between US\$150 and 400 each, SAGARPA's personnel, personal communication).

⁴⁵ Some permits are issued for several species under a generic category, i.e. the escama (fish with scales) permit allows fishing about 200 species of fish, or the shark permit which includes several species of elasmobranchs.

specifications of the fishing equipment(s) (boat, motor and fishing gear). Even though the number of permits to be issued per species or group of species is not formally fixed (as in limited entry systems), the tendency has been to restrict or put on hold the allocation of new permits in most small-scale fisheries in the GC because of stock decline or lack of information on the status of populations. However, there is no restriction on the number of permits each corporate entity or individual can hold, besides the cited restrictions on the allocation of new permits. Also, a boat that belongs to a permit holder can be registered in more than one permit. That is, the same boat can be entitled to fish several species, depending on the amount of permits registered to a specific boat.

When this study was conducted, fishing permits were transferable from person to person with authorities' supervision (under the new law, an existing permit has to be first rescinded by its holder or removed⁴⁶, and authorities decide who to allocate it to).

Fishing permits provide a number of benefits to their holders. Permit holders are the only ones who can legally land the catch and declare it at a Regional Office of CONAPESCA [20]. They are also the only ones who can provide legal invoices (or 'facturas') for the catch. These invoices certify legal ownership of the harvest, and are necessary to sell and transport the catch to regional or international markets. Note that permit holders are only allowed to harvest and sell resources that have been caught using the fishing equipment(s) (boat, motor and fishing gear) registered in their permits. Since permit holders are the only ones who can issue legal invoices necessary to commercialize

⁴⁶ A permit can be removed if the holder does not comply with regulations, i.e. if he or she does not initiate fishing activities when expected, suspends fishing for over 90 days without justified cause, or does not provide the required information.

the catch, they might be tempted to buy and sell resources caught with boats other than the ones registered in the permits. This practice is locally called ‘amparo’ (sheltering catch from other sources using one’s permit) and is prohibited by law. Nevertheless, as it will be later shown, it is widely practiced.

Table 2 shows the permit holders that have declared catch in 2007 (active permits) for each of the four main target species of commercial divers at the regional office of CONAPESCA in Bahía de Kino, together with the number of boats allowed to operate per permit and species, and the spatial jurisdiction of each permit (see Fig. 1 for geographical reference). Note that the total number of permits (19) exceeds the total number of permit holders (12) since one person or corporate entity can hold several permits. Also, since the same boat may be entitled to fish several species depending on the number of permits allotted to each boat, the total number of boats allowed to operate (50) does not match the sum of subtotals for the four species analyzed (97). In addition, the spatial jurisdiction of permits for the same and different species tend to overlap with one another.

On the other hand, specific regulations for resource use are defined within ‘Normas Oficiales Mexicanas’ (norms) published in the Federal Registry. Closures (temporal or permanent) and gear or size restrictions are the most common management measures in the existing norms. Generally there are no quota limits. In addition to fishery norms, the National Institute of Fisheries (INAPESCA), the scientific ‘backbone’ of CONAPESCA, develops the ‘Carta Nacional Pesquera’ (CNP) (National Fisheries Chart), which summarizes the status, management recommendations and indicators for

all Mexican fishery resources. Table 3 shows the norms that apply to the target species of commercial divers in Bahía de Kino (also applicable to the entire Gulf of California and other regions within Mexico) and the main recommendations as they appear in the CNP for the same species. Note that there is an absence of legally binding norms and knowledge of these species' population status for most of these species.

It should also be noted that the use of marine protected areas has only recently been implemented in the Bahía de Kino region. Isla San Pedro Mártir is an important fishing destination, especially for commercial divers, and in 2002, a large area surrounding this island was designated as a Biosphere Reserve [16]. Even though the area involved constitutes a small portion of local divers' fishing grounds, this is a new fisheries management strategy for this region and studies are currently underway to monitor its effectiveness in promoting sustainable populations of marine organisms targeted by small-scale fishers [16].

These regulations (access and resource-use rules) are enforced by the federal agencies cited above (Fig. 4). In Bahía de Kino, two officials from CONAPESCA are in charge of monitoring and enforcing regulations concerning fishing permits and resource-use norms under CONAPESCA's jurisdiction. The area they oversee spans over 200 km of coastline (from Puerto Libertad to Estero Tastiota; Fig. 1), and inspections are usually performed by land. There is no permanent presence of PROFEPA (in charge of enforcing regulations concerning MPAs and species under special protection) in town. However PROFEPA's officials may arrive upon demand by members of the community, the Navy, or CONAPESCA's officials. The navy provides support for enforcement to both agencies

at sea, when solicited. Resources and personnel are often in short supply, and officials are frequently unable to cover the entire area in a timely and effective manner. Also, CONAPESCA's available resources and control efforts are often invested on species subject to official norms and with the most economic importance to the federal government like shrimp. Since CONAPESCA's officials are federal agents, from time to time they are required to provide support to other communities where additional help is needed, leaving local fishing grounds without enforcement. CONAPESCA's efforts are supported locally by a committee comprised of local permit holders, the 'Comité de Inspección y Vigilancia de Bahía de Kino' or CIV (Local Enforcement Committee). Its goal is to provide support to help prevent illegal fishing in any fishery taking place in local fishing grounds (Fig. 4). However, as it will be later discussed, the performance of this committee is rather controversial.

5. De facto Institutional Setting in Bahía de Kino

In the following section, a description on how the formal institutions described above perform in practice in Bahía de Kino will be provided, particularly concerning the performance of the permit system and local cooperatives as it relates to issues of access control and enforcement.

5.1. Buyers as Right Holders and Fishers with no Rights

Generally, in Bahía de Kino marine resources targeted by commercial divers are captured by fishers who do not own a fishing permit and do not belong (as members), to any cooperative holding permits. These fishers are locally called 'pescadores libres' or

independent fishers and they are the labor force of the permit holders (individual or corporate). They possess the fishing expertise and experience, and gain legal access to resources by entering into a working relationship with the holder of a permit. In this study, 82% of respondents were independent fishers, none was an individual permit holder, and 18% were members of cooperatives holding fishing permits. In reality, most permit holders are the buyers of the product. It should also be noted that most⁴⁷ of the local corporate permit holders (principally cooperatives) that were active in 2007 (Table 2) function in practice as individual permit holders (locally referred as ‘permisionarios’). Cooperatives are usually constituted by a mixture of family members, others not related to the fishing activity, and a few fishers that were requested to sign at the time the cooperatives were formed. However, in practice, these ‘cooperatives’ are seldom ‘cooperatively managed’. Generally, only one person administers the business and concentrates most of the power.

The disparate social structure of local diving fisheries is somehow reinforced by existing requirements to obtain fishing permits and the socio-economic context in which these fisheries take place. Generally, the people who directly harvest marine resources in the Gulf of California, as is generally the case worldwide, have low educational and economic backgrounds, with few or no chances to access alternative, highly remunerated, and less risky, jobs. It is estimated that only 25% of the population in the state of Sonora

⁴⁷ The only exception at the time this study was conducted was a cooperative entirely integrated and managed by fishers (not buyers). However, they had major administrative problems. We interviewed 5 out of 12 members from this group.

between 15 and 130⁴⁸ years of age has reached an educational level higher than the third year of middle school [27]. Obtaining fishing permits requires possession and certification of ownership of fishing equipments and conducting exhaustive and time consuming paperwork, requisites that are difficult to accomplish by fulltime fishers who often lack the time, the capacity, or the means to compete with people who are more prepared, influential, and economically well positioned. There is also the issue of people needing to bribe officials to obtain permits (or to avoid being punished for not having permits), as has been pointed out in previous works [33]. In addition, since there are no restrictions on the number of boats that can be registered as users of a fishing permit, it is common that people requesting fishing permits do so for several boats. Given this, individual permit holders or corporate permit holders whose members are not fishers, necessarily have to 'hire' fishers (without contract and social provisions such as pension or insurance) to put their equipments to work. Permit holders tend to distance themselves physically from the fishing activity and become businessmen.

Although the formal system does not allow ownership of fishing equipments (boat, motor, and fishing gear), by others than permit holders, 24% of interviewees declared that they own the fishing equipment with which they worked, 47% said it was permit holder's ownership, and 29% were in the process of buying equipment from permit holders. This practice, where permit holders encourage fishers to buy their own equipment with their help, is becoming increasingly common as a way for permit holders to get rid of equipment maintenance responsibilities. The fishing equipment is bought by

⁴⁸ The Instituto Nacional de Estadística y Geografía (INEGI) (National Institute of Statistics and Geography) uses 130 years of age as the highest age value in statistical reports.

the permit holder, and the fisher starts paying for the equipment with each fishing trip, using the portion of the earnings that is retained by the boat owner for equipment repairs (1/4 of net earnings if three crew members went fishing). This practice tends to increase fishers' dependency on permit holders because as long as the fisher is in debt with the permit holder, the fisher is obliged to sell the product to the permit holder at the price he chooses. This process of fishers buying equipment from permit holders who also buy the fishing products may take years to complete. Once fishers own the equipment, they could choose to sell their product to other buyers. However, since these fishers do not hold fishing permits associated with their boat, this action would still be illegal unless they secure a fishing permit under their name.

Regardless of who owns the fishing equipment, permit holders almost always provide in advance the funds to cover the costs of the fishing trips (for gas, food, ice). This also obliges fishers to sell the product to the permit holder that provides these funds. Ninety one percent of interviewees rely on permit holders or independent buyers (with no fishing permits) to cover the cost of fishing trips, while only 9% cover these costs on their own. These fishers also rely on permit holders or independent buyers to loan them funds for other personal expenditures. Although at times a personal and respectful bond is formed between both parties, fishers are usually in debt to these permit holders.

5.2. De facto Open-access in the Presence of Regulatory Tools

5.2.1. Fishing Permits are Used to Launder Illegal Harvest

As suggested by our observations in the field and previous works [15, 20] the on-the-ground performance of current fisheries tools has been clearly ineffective in Bahía de Kino. Implementation and enforcement of current rules is also difficult in practice given the characteristics of the fleet and the coastal environment. Illegal practices as defined in legislation are known to be locally widespread. These practices may include (a) using one's permits to sell resources caught with fishing equipments other than the ones registered in the permits, known locally as 'amparar' or to shelter illegal catch, (b) buying or selling invoices⁴⁹ ('facturas') to legitimize the commercialization of products caught without a permit, (c) not complying with the species that each boat is allowed to capture, (d) unreported catch by permit holders or illegal fishing by people not holding any permission to fish in the area, (e) the use of fishing equipments not owned by the permit holder (i.e. usually the boat's name as registered in the permit is painted over the original one), and (f) the use of altered invoices to shelter catch harvested during closures.

One of the most widely prevalent illegal practices throughout the region is sheltering illegal catch under someone else's permit or 'amparo' (point (a) above) [15, 20]. This practice is relatively easy to perform and hard to detect in part because there are no quota limits associated with permits. Since permit holders are the only ones who can provide legal invoices for the product extracted directly from sea⁵⁰, they are generally perceived in the community as buyers simply because that is what they generally do, they buy product from people willing to sell their catch to them, and 'legitimize' this catch

⁴⁹ Usually in exchange for a monetary compensation per kg of product sheltered in each invoice.

⁵⁰ Buyers without a fishing permit are allowed to buy product from permit holders, or from other buyers without a fishing permit, and resell it. However, they have to carry on with them a document that certifies the legal possession of the catch, which specifies the fishing permit under which the product in question was harvested.

under their permits. To illustrate this, the average annual catch of pen shells (the species for which there was the most data) per boat declared in 2007 by permit holder (official data) was compared with the average annual catch per boat using logbook data for the same year (Table 2). Five logbooks were used, 2 from Bahía de Kino's fishers (fishing grounds surrounding Bahía de Kino) and 3 from Punta Chueca's fishers (fishing grounds inside the Infiernillo Channel) (Fig. 1). Punta Chueca was included because often the catch from the Infiernillo Channel is sold to permit holders or independent buyers from Bahía de Kino and declared (at least part of it) at the local office of CONAPESCA. Results show that one corporate permit holder (#4) has apparently fished (and declared) as much as 8 times more pen shells per authorized boat than the average annual catch per boat as estimated from logbooks (Table 2). This excess catch might potentially come from boats not registered in his permits or from outside the jurisdiction of Bahía de Kino's or Punta Chueca's fishing grounds. Although declaring a high amount of catch implies that permit holders would have to pay more taxes, the amount they get by selling so much product would counteract this cost.

5.2.2. Invasions of pangas in other Communities' Jurisdictions: What Role for Right Holders and Fishers?

Illegal access to other permit holders' jurisdictions is also common in the Gulf of California and triggers disputes between stakeholders from different fishing communities. In Bahía de Kino, access to local fishing grounds by outsider pangas is a major source of internal conflict, involving local fishers (independent or in cooperatives), permit holders and authorities. The 'invasión de pangas de fuera' (invasion of outsider pangas), as local

fishers refer to it, takes place almost every year during the fishing season of the most valuable and/or abundant resources in Bahía de Kino's fishing grounds. These pangas usually arrive from fishing communities within the state, south of Bahía de Kino (i.e. Guaymas, Fig. 1), and from southern states (mainly Sinaloa and Nayarit). Most of the invasions take place during the fishing season for fish species (mostly Sierra, *Scomberomorus* spp.; rays and sharks) and shrimp (blue shrimp, *Litopenaeus stylirostris*). However, outsider pangas may also invade local territory during the fishing seasons for benthic species like pen shell, lobster, and octopus. The number of outsider pangas arriving to town varies. The last intrusion involved about 150 pangas from Sinaloa (Sierra fishing season 2007; source: newspaper El Imparcial; March 10, 2007). According to local fishers this number may escalate to about 500 pangas during the shrimp season (as of last invasion in 2006).

In Bahía de Kino, local fishers and some permit holders react to these intrusions organizing protests (locally referred to as 'grillas') at the Regional Office of CONAPESCA or blocking the main and only paved road to town with their pangas. It should be noted that people not directly depending on the affected fisheries (villagers in general, friends and family members of fishers and permit holders) frequently participate in these 'grillas', fearing that outsider fishers may settle and begin working in other resources too. Outsiders would be competing with local fishers of any kind, thus threatening everyone's livelihoods.

Some local permit holders are involved in these intrusions, bringing the outsider pangas to work for them with the understanding that they sell their product only to them.

This arrangement can offer the newcomers ‘legal’ protection under the fishing permits of local permit holders. However, if these pangas arrive from outside, they are not the same pangas registered in local permit holders’ permits. Even if the outsider pangas would bring a permit that allows them to fish in the area of Bahía de Kino (which is the case of many escama (fish with scales) permits), these fishers usually sell the product to local permit holders and not to the owner of the permit they are bringing with them.

These intrusions can also generate conflicts between permit holders. While some permit holders may participate in bringing in outsider pangas to work for them, other permit holders see invasions as a threat to their own business and may join local fishers in protest. Permit holders compete for fishing products and for fishers willing to sell these products to them.

Access conflicts are mediated by CONAPESCA’s officials and a local committee integrated by local permit holders, ‘Comité de Inspección y Vigilancia de Bahía de Kino’ or CIV (Local Enforcement Committee). This committee was formed in 2004 to provide support to local authorities in preventing intrusions of outsider pangas and reducing illegal fishing. Its members are to provide support for surveillance activities, supplying gas, vehicles and/or pangas for officials to make the rounds, and informing authorities about illegal activities when detected. However, this committee is in some way controversial since it is integrated by the only legal actors in the fishery, local permit holders, some of whom are locally known to participate in promoting the intrusion of outsider pangas in town. In addition, because independent fishers are not allowed to participate in this committee, its actions are generally perceived as illegitimate by these

fishers. This reduces the transparency of the process and makes fishers believe that access conflicts are ‘negotiated’ between permit holders and authorities, decreasing the credibility of local authorities as law enforcers.

Access conflicts are certainly not limited to Bahía de Kino [34]. Bahía de Kino’s fishers also move to other communities to harvest resources when these are scarce or less convenient in local fishing grounds. Local divers usually move south of Bahía de Kino (Guaymas in Sonora, Nayarit, and Sinaloa), or west, crossing the gulf to fish in islands and along the coast of the Baja California Peninsula. One of these movements took place in the summer of 2007 (while this study was taking place), when divers from Bahía de Kino moved to Guaymas (Sonora) and other southern states (Sinaloa and Nayarit) to harvest pen shells after large beds of this species were found (productions of 80-150kg/panga/day, compared to 15-20 kg/panga/day in Bahía de Kino’s fishing grounds; summer 2007).

In contrast to movements of pangas promoted by permit holders, Bahía de Kino’s fishers tend to tolerate the movement of individual fishers (without pangas) between fishing communities. Local fishers are in general willing to accept people from outside the community if these fishers work with local pangas. Likewise, local fishers have more chances to be accepted in other communities (i.e. in Guaymas) if they move without their panga and work in a panga from the village they are visiting. In these movements, divers are allowed to carry their fishing gear (compressor, hose, diving suit) and crew with them. They have to prearrange this movement with fishers or permit holders from the village they are heading to and use the pangas and fishing permits (when they exist) of

the locals. This informal agreement matches the formal legislation concerning access rights as granted by fishing permits (people can move from panga to panga, but pangas must be used within a jurisdiction as specified in the permits).

However, these tacit arrangements are often relaxed if fishers have family bonds or close friendship with people in other villages, in which case they are allowed to take their pangas with them. Furthermore, regardless of fishers' discontent, movements of pangas to other communities' jurisdictions with no previous arrangements with locals are frequent in the Gulf of California region, particularly due to the absence of strong official control.

6. Is Sustainability Achievable under Current Institutions?

To a large extent, the informal world of independent fishers is not visible to the federal government which only recognizes permit holders as the sole legal actors in the fishery. Independent fishers are perceived as illegal actors by authorities and even by permit holders themselves (who depend on fishers' labor to make their living). This lack of recognition of the people who actually perform fishing activities results in exclusion of these fishers from formal decision-making processes concerning their fisheries. These fishers are also unable to access government benefits. In addition, since the permit holders who have access to regulatory agencies have little direct involvement with the harvested resources, a great deal of fishers' knowledge useful for management never reaches government agencies. Furthermore, the co-existence of unrecognized fishers and

permit holders that are often powerful businessmen, gives way to the development of incentives that discourage responsible fishing practices.

As a result, Bahía de Kino's situation resembles a de facto open-access. Interviewees expressed almost unanimously that, in spite of perceiving that local resources are severely overfished, they believe that anything left unexploited will be captured by others and this inevitably leads to overharvest. Also, because species that can be legally extracted have already become scarcer and are found at farther distances than before, banned resources (mainly sea cucumber) that command a high black market price are often harvested in conjunction with legal species to help the costs of fishing trips⁵¹.

7. Discussion

This paper illustrates the effect of institutions on social interactions and harvesting behavior in an important commercial diving fishery of the Gulf of California. Although only one fishing community was the focus of this study, this particular case provides lessons that go beyond its boundaries, illustrating the potential impacts of some of the most widely used fishery management tools throughout Mexico. However, this does not imply that the outcomes observed in Bahía de Kino's commercial diving fishery are representative of the condition of small-scale fisheries throughout the Gulf of California or anywhere else in Mexico.

⁵¹ About 30 kg of dried sea cucumber (obtained from about 150 kg of fresh, eviscerated, sea cucumber) sold at about US\$10/kg as of summer 2007 are needed to afford the cost of one fishing trip for one panga involving 3-4 days of camping (local diver, personal communication).

Existing requirements to access fishing permits create an institutional environment in which people who are not necessarily closely attached to the fishing activity and/or community decide to enter the fishery for business purposes. Often, full time fishers do not have the means, the capacity, and/or the time to fulfill the requirements and successfully navigate through the bureaucracy in order to access a fishing permit. This sets a standard that is too high for direct users (fishers) to become formally involved in the fishery. Even if direct users get to access fishing permits, since there are no requirements forcing them to continue fishing, they tend to become intermediaries as a matter of convenience because to do so is more profitable and less risky than fishing. This has been the case of some of current buyers (also right holders) in Bahía de Kino who were previously fishers. In addition, because several boats can be registered as part of a fishing permit, it is common that people requesting fishing permits do so for several boats, creating the need for additional people to operate these boats.

As a result, the system tends to promote the disconnection of right holders from the resource and intensify rent-seeking interests. Resources and markets tend to be monopolized in a few hands, and an informal system of production is created. This informal labor system is practically invisible to the federal government, resulting in the exclusion of most fishers (usually more closely attached to the resources and with the most at stake if resources are overfished) from management decisions concerning the fishery. This social structure creates the wrong incentives for effective fisheries management. With permit holders as intermediaries, they have little incentives to encourage fishers to catch less since the more they can sell the more they would earn.

Because permit holders are the only ones who can provide legal invoices for the product extracted directly from sea, they are constantly tempted to shelter marine resources from boats not registered in their permits. This is somehow facilitated by the absence of additional restrictions associated to the permit system. The regulatory system for fisheries in Mexico is meant to limit access to the fishery by controlling the number of fishing permits to be issued. However, fishing effort or catch is not generally limited⁵² and permit holders are allowed to harvest as much as they can handle using the pangas authorized in their permits. Under these conditions, while controlling the legal possession of fishing permits could be substantially improved with greater support from the government, verifying that the catch declared and processed by permit holders was harvested using only the authorized equipments is nearly impossible. While the number of fishing permits is what any administration intuitively would try to reduce to overcome resource depletion, this alone will not ensure that fishing effort and catches will be in fact reduced. Just by focusing on controlling the legal possession of fishing permits will not result in sustainable harvests. Furthermore, if fishers do not possess a legal right to fish, they will also not have incentives to pursue the common good or to limit fishing, even if perceiving that resources are increasingly scarce.

Independent fishers have the option to associate themselves into cooperatives or other forms of associations and thereby share the costs of access to fishing permits.

However, this path is difficult to pursue by fishers alone without external economic and

⁵² Unless the species is under a fishing concession or SEMARNAT's permit, for which a quota and management plan must be approved; or subject to a norm that limits the fishing effort or the type of gear to be used. These cases are uncommon in most commercial fisheries in the Gulf of California, except for species of high revenue to the nation.

administrative support. Furthermore, the experience with fishing cooperatives in several places in the Gulf of California, like the ones from Bahía de Kino, has been generally disappointing (for a historical perspective on the cooperative system see [35, 36]). In a study conducted in 2005 in 17 fishing communities in the Northern Gulf of California most fishers (63%) stated a preference for working as part of a group or cooperative rather than working as an independent fisher (34%) [37]. However, the most common incentive for fishers to access cooperatives was accessing fishing permits, reaffirming the point that obtaining permits as independent fishers is a difficult task. Nonetheless, this incentive is generally too weak to foster cooperation or collective action, not to mention sustainable harvests. Generally, fishing permits granted to individuals or cooperatives allow access to a large territory, not exclusive to one permit holder (there are overlapping jurisdictions). Since this territory is large and is shared with numerous fishers belonging to different fishing groups and even communities, there is little incentive for responsible use and little possibilities to exercise control. In a large territory with an indeterminate number of users, fishers do not have the need or the incentive to work collectively, craft their own rules, or comply with externally established rules.

The existence of inappropriate incentives for sustainable management has been identified as one of the six⁵³ major causes for unsustainable fisheries around the world [5]. Fisheries failures are believed to be largely the product of institutional failures [38], the sum of the legal, social, economic and political arrangements used to manage

⁵³ Together with high demand for limited resources, poverty and lack of alternatives, complexity and inadequate knowledge, lack of governance, and interactions of the fishery sector with other sectors and the environment.

fisheries which are directly linked to incentives [2, 7, 39-41]. Unfortunately, the case illustrated in this study presents many of the major characteristics associated with poor institutional performance worldwide [5]; like lack of incentives to comply with regulations; inefficient enforcement; lack of well defined rights; no incentives for cooperative behavior; poor involvement of major stakeholders in the elaboration of management instruments, decision making and implementation; and insufficient financial and human resources as well as information for proper management.

In this context, the need for a careful reexamination of current policies is suggested, particularly concerning the permit system and its potential consequences not only for Bahía de Kino but elsewhere in Mexico. In reexamining the system, considering alternative management approaches that tend to eliminate ‘the race for fish’ and provide incentives for fishery stakeholders to participate in management decisions and increase compliance with regulations is recommended [42, 43]. These approaches entail vesting exclusive use or property rights on the users of resources [2, 42-44] and may include rights to shares of fisheries in terms of areas (i.e., territorial use-rights in fisheries or TURFs⁵⁴, marine protected areas⁵⁵ or MPAs), effort units (i.e., allowing the use of certain types of fishing gear) or catch [i.e., individual transferable or non-transferable quotas (ITQs or IQs)], granted to individuals, groups of individuals or communities [5, 8]. However, we should be cautious that right-based approaches might also be subject to incentives’ distortion if, for example, the rights’ system tends to exacerbate wealth

⁵⁴ This right may involve the use of the surface, the bottom, or the entire water column [43].

⁵⁵ Marine Protected Area (MPA) is often used as an umbrella term covering a wide range of marine areas with some level of restriction to protect living, non-living, cultural, and/or historic resources. The permissions given within an MPA often depend on the objectives.

inequality and social division as has been the case in a number of ITQ systems (absentee quota owners, and contract harvesters with significantly less benefits than quota owners) [45-47]. Granting secure rights to resources to those actively involved in the fishery seems to be a necessary step for promoting sustainable-use.

In the fisheries addressed, the sedentary life-history characteristics of invertebrates and the nature of the fishing process⁵⁶ calls for management measures that explicitly acknowledge spatial structure [8, 48]. These may include reproductive refugia and MPAs⁵⁷ (not only restricted to no-take zones) specifically designed to enhance fisheries (considering density-dependent and larvae advection-retention processes), territorial property or use rights (traditional tenure systems, TURFs); rotation of fishing areas, among others.

Tools like the ones described above are available in Mexican legislation including species-specific use-rights within an area (CONAPESCA's fishing concessions or SEMARNAT's permits), fishery refugia, and MPAs. In the Northern Gulf of California, the few cases where granting exclusive access to a controllable marine territory have been attempted, either formally or informally, have shown promising results as to be considered for wider implementation [16, 19, 20, 23]. Chile has experience with this sort of systems on a larger scale, showing that granting TURFs to formalized groups of fishers does promote sustainable harvests within TURFs [49]. This, together with the

⁵⁶ In spatially structured fisheries, time series of catch, effort, and composition of the catch are rarely available, and even if they are, they may be dangerously misleading because of the interaction between the spatial pattern of a stock and fishers' behavior (i.e., abundance tends to drop faster than CPUE as the stock is depleted)[47].

⁵⁷ Refugia and MPAs are recommended for fisheries that combine complex spatial structure, little available information, and enforcement difficulties [47].

need to perform collective activities such as monitoring studies and surveillance, and the fact that the benefits to be derived from these resources are held, and are required to be sold, by the group; have successfully encouraged collective action and implementation of sanctions⁵⁸ (Parma et al., in preparation). However, if enforceable restrictions to fishing outside TURFs are not applied as well, fishing effort is often displaced to less restricted areas (open access areas in the case of Chile), generating a patchy environment that may impact the sustainability of the fishery in question and other fisheries as well [49]. A similar effect is expected to occur with MPAs implementation, especially with highly restrictive ones, if realistic measures to regulate fishing and enforce regulations outside MPAs are not in place [50].

With this in mind, our main recommendations to encourage sustainable use and conservation in Bahía de Kino include granting secure rights to resources to those actively involved in the fishery, as part of a broader-higher level institutional framework.

Given the situation in Bahía de Kino's fishing grounds, it is suggested that an institutional tool that may provide exclusive access to the community within the limits of their fishing grounds, could serve as a protective umbrella to help avoid intrusions from outside. At the same time, providing secure individual or collective rights to local fishers for specific fisheries within these limits may provide additional incentives to avoid internal competition for resources among local groups or individuals. This set of measures may encourage and facilitate participation of fishery stakeholders in management decisions and implementation of measures to protect not only fishery but

⁵⁸ Fines for infractions are discounted from the benefits each member is entitled to receive.

ecosystem values. Furthermore, the regulation of activities other than commercial fishing (i.e. aquaculture, sport fishing, land activities affecting marine environments) could be also facilitated by a broader institutional perspective, following the principles of coastal zoning or integrated coastal management [51].

This type of institutional umbrella could be locally approached using tools available in Mexico's fishery and environmental laws. For example, through implementation of: 1) 'regional fishery ordinance plans' as incorporated into the new fishery law⁵⁹, for which the area to be incorporated into the plan, lists of users, the species subject to use, and the species-specific management plans available for this species must be provided; 2) MPAs covering the fishing grounds of the community and/or 'ecological ordinance plans' for land and/or marine environments, according to environmental legislation⁶⁰; 3) or a combination of 1) and 2). Both laws state that preferred access to fishing rights⁶¹ (permits, concessions) and MPAs⁶² should be provided to local people in the area to be managed or protected, and encourage participation⁶³ of municipal and state governments, and members of the community, in decision making. However, if tools typically associated to environmental protection (like MPAs) are to be used as a protective umbrella, defining and formalizing access rights should be one of the first and most critical steps, to engage and empower local people to manage and defend their resources [16, 34, 51].

⁵⁹ 'Ley General de Pesca y Acuicultura Sustentables' (LGPAS), www.conapesca.sagarpa.gob.mx.

⁶⁰ 'Ley General del Equilibrio Ecológico y la Protección al Ambiente' (LGEEPA), www.semarnat.gob.mx.

⁶¹ Art. 43, LGPAS.

⁶² Art. 48 and 64 BIS-1, LGEEPA.

⁶³ Art. 13 and 14, LGPAS. Art. 67, LGEEPA.

In addition, independent fishers should be formally recognized as active and essential members of the fishing sector and provided with individual or collective fishing rights. In this process, independent fishers are likely to be challenged by existing permit holders who may want to continue being in control of extraction and commercialization. Fishers will need to be supported to acquire the means and develop the necessary skills to successfully commercialize their own product, and incentives should be established for existent permit holders who are following the law and act responsibly with fishers they employ.

In any case, whatever measures are to be considered for implementation, they should be carefully evaluated for each particular context (no one solution fits all situations) and, critically, with active stakeholders' participation, especially of fishers. A more supportive role for the government should be also encouraged, for which additional human and financial resources will be needed for researchers, managers and enforcers to be able to improve their response to fisheries issues. Also, fisheries authorities should take advantage and support fishers' efforts to regulate use or restrict access of outsiders to local fishing grounds [34].

More importantly, the informal labor system that hides behind the visible face of existing permit holders should be acknowledged by the federal government and steps taken to formalize it and prevent it from continuing. Unless these fishers are formally recognized and given a secure right to enjoy the benefits from their activity, they are unlikely to contribute to enhance the health of coastal fisheries and ecosystems.

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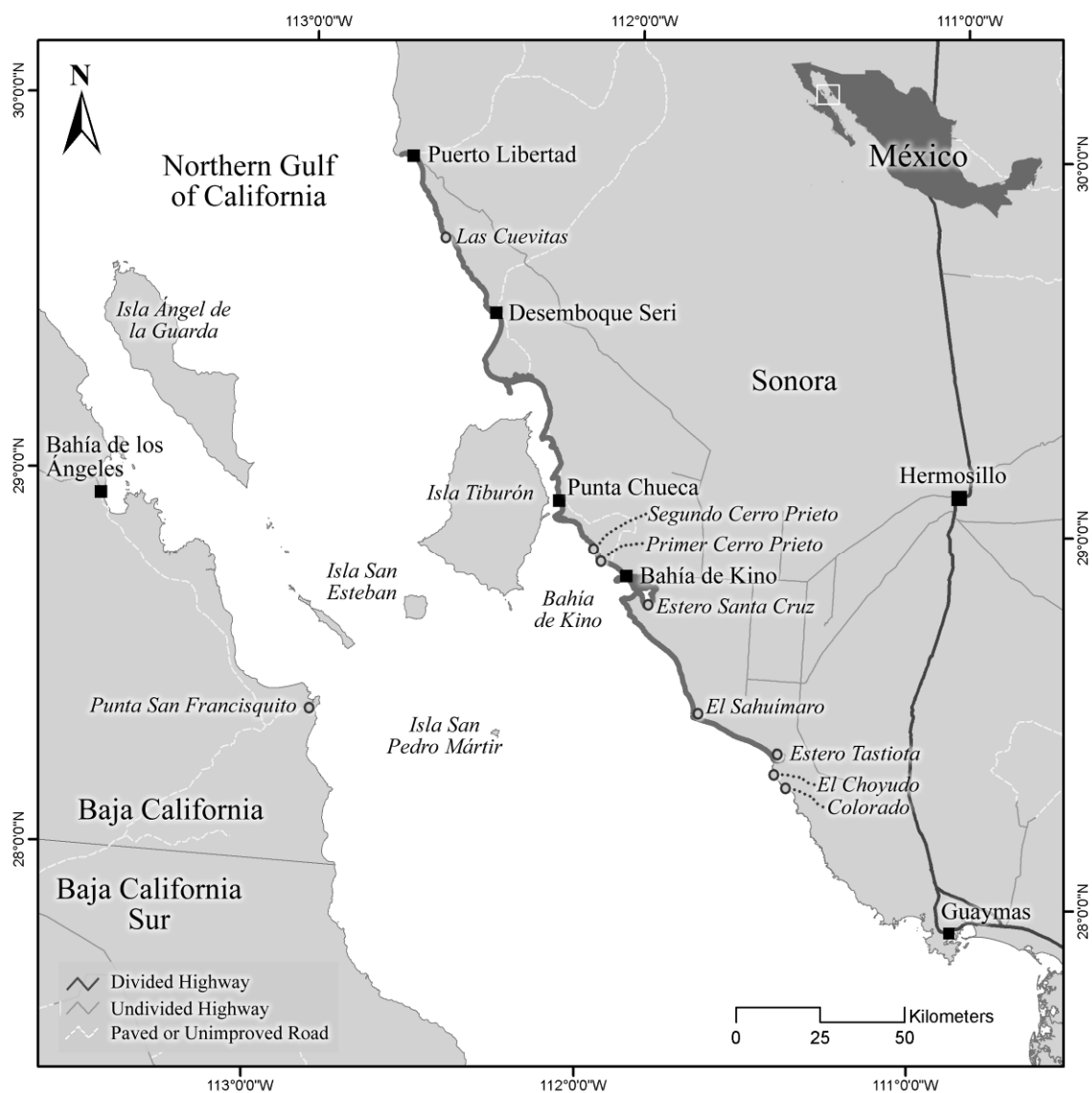


Fig. 1. Map of the study area within the northern Gulf of California (NGC). The NGC is the area extending north of Punta San Francisquito in Baja California and north of Bahía de Kino in Sonora. The thick gray line on the Sonoran coastline indicates the geographic jurisdiction of fishing permits for diving products in Bahía de Kino, extending from Puerto Libertad to Estero Tastiota. Square markers indicate the main towns or cities. Hermosillo is the capital city of Sonora. Cartographic design: Marcia Moreno-Báez and Erika Koltenuk.

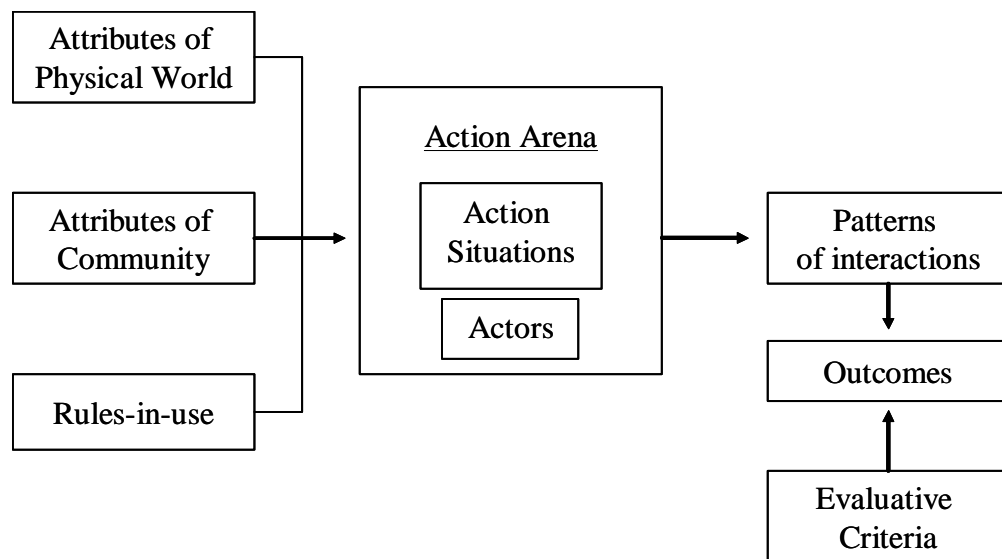


Fig. 2. A framework for Institutional Analysis [4].

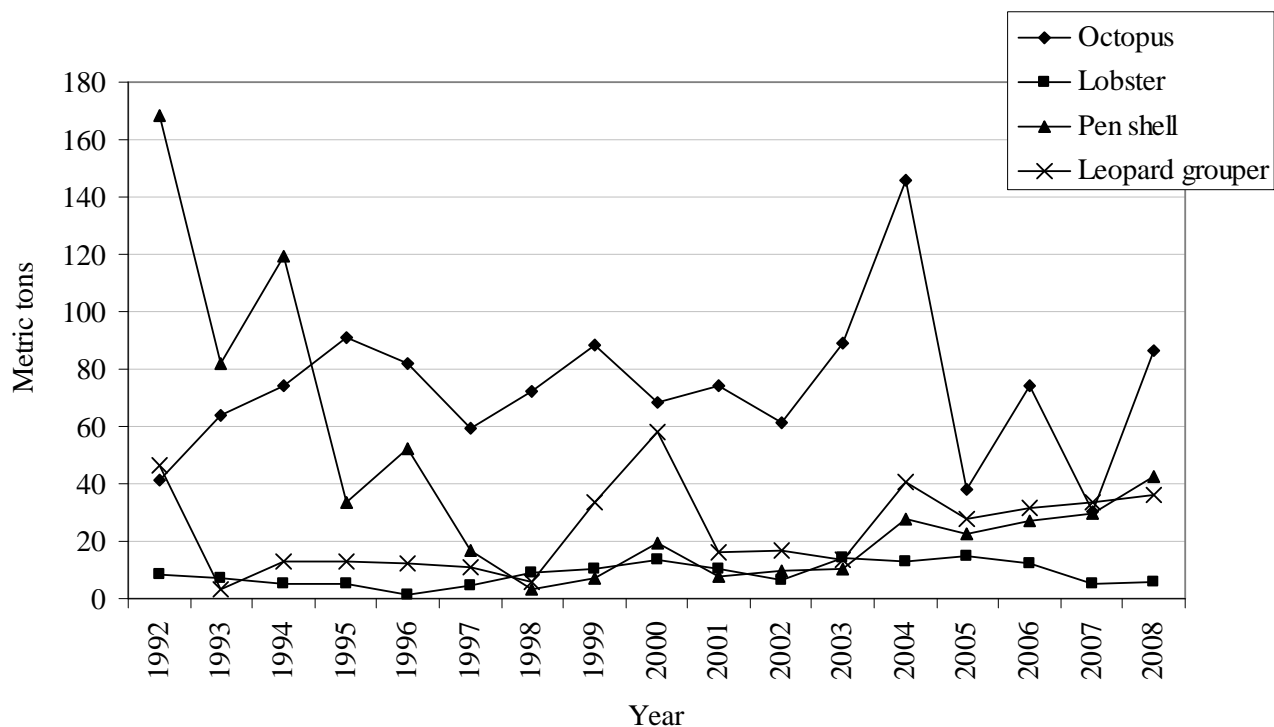


Fig. 3. Unpublished official landings (MT) for octopus, lobster, pen shell and leopard grouper declared at the regional office of CONAPESCA in Bahía de Kino. Weight of entire individuals for all species but pen shells (adductor muscle weight) is reported. Markers indicate where there is data. Lines do not imply real data. Courtesy: Personnel of the Regional Office of CONAPESCA in Bahía de Kino.

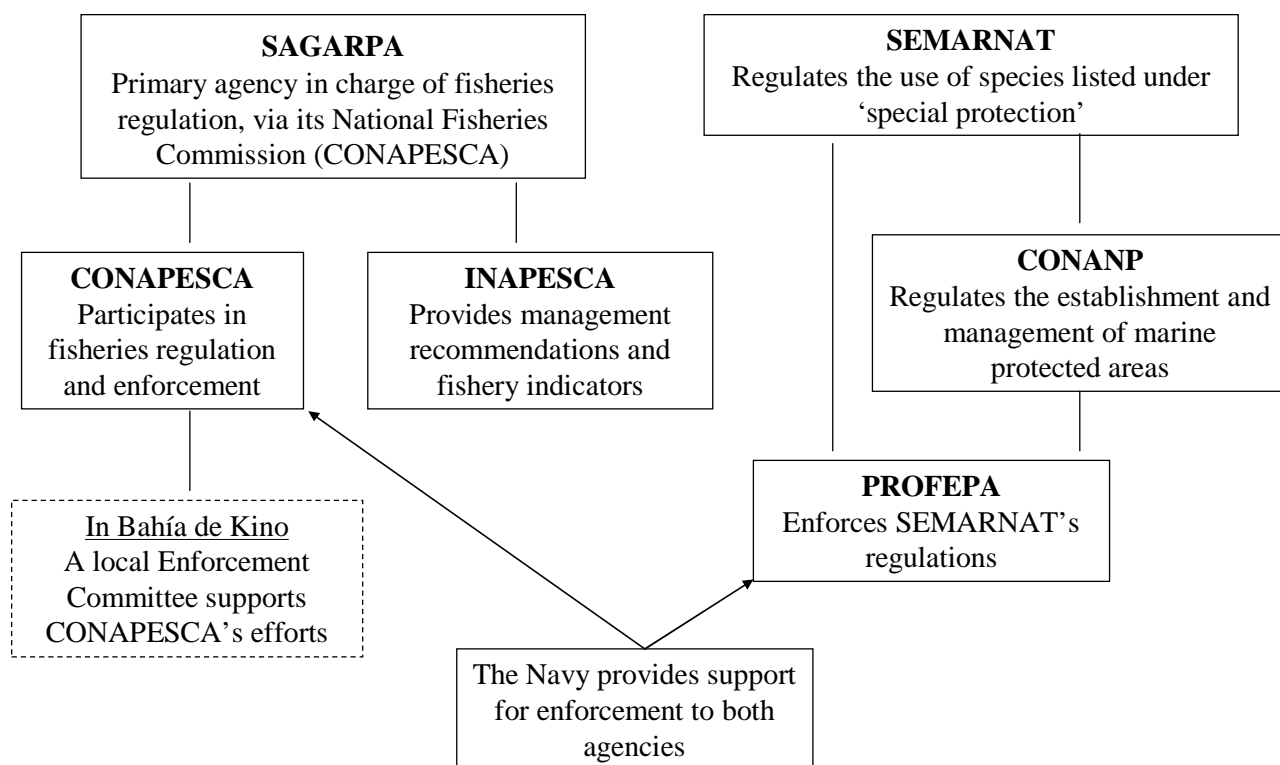


Fig. 4. Federal agencies involved in fisheries regulation in Mexico and their main attributes as they relate to fisheries management.

Table 1: Average, maximum and minimum catch (MT) for octopus, lobster, pen shell and leopard grouper between 1992 and 2008.

Species	Average annual catch (MT) (1992 – 2008)	Maximum annual catch (MT) (1992 - 2008)	Minimum annual catch (MT) (1992 - 2008)
Octopus <i>Octopus spp.</i>	72.9	145.9	30.3
Pen shell <i>Atrina spp.</i>	40.0	168.4	3.4
Lobster <i>Panulirus inflatus</i>	8.6	14.9	1.5
Leopard grouper <i>Mycteroperca rosacea</i>	24.2	58.2	3.5

Weight of entire individuals for all species but pen shells (adductor muscle weight) is reported. Source: regional office of CONAPESCA in Bahía de Kino.

Table 2: Permit holders that showed catch declarations in 2007 (active permits) at the regional office of CONAPESCA in Bahía de Kino for four main target species of commercial divers, and features of each fishing permit.

Species	Fishing permits	Permit holders	Geographic jurisdiction	Number of authorized boats	Declared catch 07 (MT)	Average annual catch per boat (declared catch/number of authorized boats)(MT)	Average annual catch per boat (logbooks)(MT)	Ratio average annual catch per boat (declared/logbooks)
Octopus	1	CPH 1	El Sahuímaro - Las Cuevitas	5	4.1	0.8		
	1	CPH 2	El Colorado - Puerto Libertad	12	5.4	0.4		
	1	CPH 3	El Colorado - Puerto Libertad	8	1.3	0.2		
	1	IPH 1	El Sahuímaro - San Esteban	3	6.5	2.2	-	-
	1	IPH 2	Bahía de Kino - Las Cuevitas	2	7.9	3.9		
	1	IPH 3	El Choyudo - Puerto Libertad	2	2.6	1.3		
	1	IPH 4	El Colorado - Puerto Libertad	6	0.3	0.1		
Subtotal	7			38	28.1			
Pen shell	1	CPH 2	El Colorado - Puerto Libertad	12	2.0	0.2	0.28	0.6
	1	CPH 4	Estero Santa Cruz	4	9.0	2.3	0.28	8.0
	1	CPH 5	Puerto Libertad - Tastiota	3	4.6	1.5	0.28	5.5
	1	IPH 1	El Sahuímaro - San Esteban	7	8.2	1.2	0.28	4.2
	1	IPH 5	Cerro Prieto - El Colorado	5	6.8	1.4	0.28	4.9
Subtotal	5			31	30.6			
Lobster	1	CPH 1	El Sahuímaro - Las Cuevitas	5	4.4	0.9		
	1	IPH 3	El Choyudo - Puerto Libertad	2	0.5	0.2	-	-
	1	IPH 6	Segundo Cerro Prieto	3	1.5	0.5		
Subtotal	3			10	6.4			
Escama permit ^a	1	CPH 1	El Sahuímaro - Las Cuevitas	5	14.8	3.0		
	1	CPH 3	El Colorado - Puerto Libertad	8	1.1	0.1		
	1	IPH 1	El Sahuímaro - San Esteban	3	0.4	0.1	-	-
	1	IPH 2	Bahía de Kino - Las Cuevitas	2	10.9	5.4		
Subtotal	4			18	27.2			
Total	19	12						

Weight of entire individuals (eviscerated) for all species but pen shells (adductor muscle weight) is reported. Logbook data is used for comparison with official landings. The average annual catch per boat estimated from logbooks was 0.28 MT, for which 5 logbooks were used. CPH: corporate permit holder (i.e. a fishing cooperative or other form of association); IPH: individual permit holder. ^aOnly includes escama permits that were used for leopard grouper caught through diving.

Table 3: Management recommendations as they appear in the National Fisheries Chart for the main target species of commercial divers in Bahía de Kino and fishery norms regulating the harvest of these species.

Species	CNP management recommendations	Existing regulations by species
Sea cucumber <i>Isostichopus fuscus</i>	Population status in Sonora, undetermined. There are no recommendations for Sonoran sea cucumber populations. SEMARNAT may authorize use. No authorization for exploitation has been granted in Sonora.	NOM-059-ECOL-1994 - Enforced by PROFEPA and the Navy - Permanent closure throughout México
Rock scallop <i>Spondylus calcifer</i>	Lumped with other 15 species under the category ‘almejas’ (clams). Population status in Sonora, undetermined. There are no recommendations for Sonoran rock scallop populations. SEMARNAT may authorize use. Only one authorization has been granted in Sonora, though not in Bahía de Kino.	NOM-059-ECOL-1994 (see above)
Lobster <i>Panulirus inflatus</i>	Population status in Sonora, undetermined. A gradual increase in fishing effort may be allowed if supported by technical studies. Recommends assessing the resource in Sonora and other states, and regularizing the use of commercial diving. This fishing gear is used in the Gulf of California, even though it is prohibited for lobster.	NOM-006-PESC-1993 - Enforced by CONAPESCA and the Navy - Applies to Federal jurisdiction of Gulf of México and the Caribbean Sea, Pacific Ocean including Gulf of California (GC) - Gear restrictions: traps, unless other gear is authorized by SAGARPA - Size restrictions: 82.5 mm (cephalothorax length) - No breeding females - Land entire specimen to enable control - Temporary closure (GC): July 1st to October 30th
Groupers, <i>Mycteroperca</i> spp. & Snappers, <i>Hoplopagrus</i> <i>guentherii</i> .	Lumped with other 200 species under the category ‘peces marinos de escama’ (marine fishes with scales). Commercial diving does not appear in the list of fishing gear used to capture these species. Population status in Sonora, undetermined. General recommendations include not increasing fishing effort in any of the species within the category, and modifying current categorization to allow administration by groups of related species (smaller groups).	None
Pen shell <i>Atrina</i> spp.	Lumped with other 15 species under the category ‘almejas’ (clams). Recommends not increasing fishing effort in Sonora and other states, and implementing the use of quotas in Sonora and Sinaloa.	None

Black murex snail <i>Hexaplex nigrinus</i>	Population status in Sonora, undetermined. Recommends assessing the resource in Sonora every 2 years. General recommendations include not increasing fishing effort in any of the states where it is fished, and implementing reproductive closures.	None
Octopus <i>Octopus</i> spp.	Under a general category 'pulpo' (octopus) including identified and unidentified species captured in Mexico. Population status in Sonora, undetermined. Recommends taking measures in Sonora if catches are lower than 100 MT. General recommendations for all octopus species include not increasing fishing effort, and reinforcing biological and fisheries studies to better regulate these fisheries.	None

APPENDIX B: INSIGHTS FROM THE USERS TO IMPROVE FISHERIES
 PERFORMANCE: FISHERS' KNOWLEDGE AND ATTITUDES ON FISHERIES
 POLICIES IN BAHÍA DE KINO, GULF OF CALIFORNIA, MEXICO

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Keywords

Small-scale fisheries, institutions, policy, fishers' attitudes, fisheries management,
 incentives, Gulf of California.

Insights from the Users to Improve Fisheries Performance: Fishers' Knowledge and Attitudes on Fisheries Policies in Bahía de Kino, Gulf of California, Mexico

A. Cinti, W. Shaw, J. Torre

Abstract

This study investigated the interpretation and level of support of government regulations in Bahía de Kino, Sonora, one of the most important fishing communities in terms of diving extraction of benthic resources in the Northern Gulf of California. Research was conducted from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. Information on fishers' awareness of current policies, fishers' attitudes concerning different aspects of fisheries regulation, and fishers' suggestions on how their fisheries should be managed, was gathered through structured interviews (including open and closed-ended questions), informal talks and participant observation. Results provide further evidence supporting the need for formally recognizing the fishers as key stakeholders in local fisheries, and for working cooperatively towards the design of management strategies and regulations that provide better stimulus for resource stewardship and discourage overfishing. Very importantly, this study suggests that there is strong support from resource users for implementing regulatory measures for local fisheries. Results could be used as a preliminary baseline to initiate the discussion among fishery stakeholders towards the development of species-specific management plans for the area, as required by the recently enacted fisheries act in Mexico, the "Ley General de Pesca y Acuacultura Sustentables".

1. Introduction

Effective management of fisheries relies not only on the development of rules that are appropriate for the biophysical and social characteristics of the fisheries in question, but also on the understanding and internalization of these rules by resource users [1-3]. Rules that are understood and deemed legitimate and functional by fishery stakeholders have the potential to lead towards robust and effective management of fishery resources.

Often, however, local practices do not resemble the formal laws expressed in legislation [4]. If managers assume that users automatically learn, comprehend, and make use of the government rules in place, the development of management strategies may be based on administrative assumptions rather than on what is really happening in the field [3]. Cross-scale interactions and coordination (between governmental and local domains) are critical to make sure that the formal rights and rules are compatible with local practices and circumstances so that negative externalities are avoided [1, 5].

As a means to begin addressing how well governmental rules are suited to local circumstances within fishing communities of the Northern Gulf of California⁶⁴ (NGC) (Figure 1), Mexico, the interpretation and level of support of government regulations was studied in Bahía de Kino, Sonora. Bahía de Kino is one of the most important fishing villages in terms of diving extraction of benthic resources⁶⁵ in the NGC (Figure 1) [7].

The Gulf of California (GC) is a region characterized by its biological richness and socio-

⁶⁴ Based on observations of fish species' distribution patterns, the Gulf of California has been divided in three main areas (north, mid, and south) [6]. The Northern Gulf of California has been defined as the area extending north of an imaginary line from San Francisquito in Baja California and Bahía de Kino (Figure 1).

⁶⁵ Benthic species spend most of their life cycle in association with the sea bottom (e.g., mollusks, crustaceans).

economic significance [8]. Fishing (large and small scale) is a predominant economic activity throughout the GC, comprising approximately 50,000 fishers and 25,000 boats operating in small-scale (or artisanal) fisheries, and other 10,000 fishers and 1,300 boats operating in large-scale (or industrial) fisheries [9]. The region produces approximately 50% of the landings and 70% of the value of national fisheries in Mexico [8].

However, in spite of the importance of small-scale fisheries (SSFs) in the region, these fisheries have received little attention from the federal government in comparison to large-scale fisheries (like shrimp and small-pelagic species) [10, 11]. This is likely because SSFs use many widely dispersed small boats that are not easy to monitor and because their economic contributions are similarly dispersed and difficult to assess. Also, despite the existence of formal regulatory tools, access to small-scale fisheries has been nearly open in practice [10]. Largely due to state subsidies and policies encouraging migration from different parts of Mexico [11], the GC has seen a significant increase in fishing pressure over the last few decades and a downtrend in total production in many primary target species [9, 10, 12, 13]. In addition, fishing communities are thought to be largely uninvolved in the development of management policies (at least formal resource management rules), and the extent of compliance with formal regulations is unclear.

A previous publication by Cinti et al. [14] described the social and fisheries impacts of fisheries policies in Bahía de Kino, and discussed whether the formal institutional structure of Mexican fishing regulations is effective in promoting conservation behavior by small-scale fishery stakeholders. These authors suggest that current rules set the standard too high for direct users (the people who go fishing) to

access fishing rights, promote the disconnection of right holders (usually absentee operators) from the resource, and intensify rent-seeking interests. This incentivizes overfishing and exacerbates social inequalities.

The present article presents additional information collected during the same research period and using the same methodology, on fishers' awareness of current policies, fishers' attitudes concerning different aspects of fisheries regulation, and fishers' suggestions on how their fisheries should be managed. Results provide further evidence supporting the need for formally recognizing these small-scale fishers as key stakeholders in local fisheries, and for working cooperatively towards the design of management strategies and regulations that provide better stimulus for resource stewardship and discourage overfishing. Very importantly, this study suggests that there is strong support from resource users for implementing regulatory measures for local fisheries. This finding, together with other information provided by the fishers could be used as a preliminary baseline to inform and guide the development of species-specific management plans for the area, as required by the recently enacted fisheries act in Mexico, the "Ley General de Pesca y Acuacultura Sustentables" (see www.sagarpa.gob.mx). This type of assessment where fishers' perspectives on management issues are gathered can be useful to improve fisheries performance, particularly in settings where participatory mechanisms are not yet in place.

2. Background Information

2.1. Bahía de Kino's Diving Fisheries: Social and Resource Characteristics

Bahía de Kino is a rural coastal community of approximately 5,000 inhabitants [15] situated in the state of Sonora (Figure 1). Fishing is the most important economic activity [7]. About 800 fishers and 200 active boats (locally called “pangas”) are involved in small-scale fisheries in this community [7]. A total of 66 species are harvested by these small-scale fishers, of which 35 are regarded as the primary targets of fishing trips (Project PANGAS, unpublished). Species extracted are an important source of marine products at the local and regional level. A number of these species are also internationally commercialized [7, 16].

[Figure 1 about here]

About 80 pangas were active in commercial diving in Bahía de Kino at the time this study was conducted (2007). Divers mainly harvest pen shells (mostly *Atrina tuberculosa*, and occasionally *Atrina maura*, *Atrina oldroydii*, and *Pinna rugosa*), octopus (*Octopus* spp.), and fishes [mainly groupers (*Mycteroperca rosacea* and *M. jordani*) and snappers (*Hoplopagrus guentherii* and *Lutjanus novemfasciatus*)]. Sea cucumber (*Isostichopus fuscus*) is also an important diving fishery, though clandestine because no authorization to harvest this species has been granted in the area [14]. Smaller quantities of lobsters (*Panulirus* spp.), rock scallop (*Spondylus calcifer*), several species of clams (*Megapitaria squalida*, *Dosinia* spp., and others) and snails (*Hexaplex nigritus*, *Strombus galeatus*, and others) are also harvested. Pangas are 8-9 meters long, equipped with 55-115 hp outboard motors. To breathe underwater, divers use a “hookah” which is

fabricated locally using a modified paint sprayer as the air compressor connected to a modified beer keg as the reserve air tank [17]. One or two 100 m hoses are attached to this tank with air regulators at the end. The diving crew may include the operator or “popero” (who operates the boat), one or two divers, and a divers’ assistant (who controls the air supply for the divers). Poperos usually act as divers’ assistants too, to increase the economic efficiency of the fishing trip (earnings are divided among less people). One of these crew members is also in charge of the boat or captain, who is responsible for its maintenance and for responding to the owner⁶⁶ in case anything happens to it. Captains are generally the most experienced and knowledgeable fishers and those who tend to make the decisions about fishing [7]. Fishers working in commercial diving may at times also work in other fishing activities, using gillnets (for fish and shrimp) or traps (for swimming crabs, *Callinectes bellicosus*). However, they are strongly dependent on fishing to make a living. Fishing is the only source of income for 71% of interviewees [14], and diving (of the set of fishing activities they develop) is the primary source of income for 93% of interviewees.

Information on fisheries performance for any species targeted by commercial diving in Bahía de Kino is scant. The only official fishery information available are landings statistics, which should be interpreted with caution given that illegal fishing is likely high because of unreported catch, catch captured outside local port’s jurisdiction that is declared as if it was captured inside (e.g., in another administrative jurisdiction), and misidentification of species, among other factors (see [14] for historical landings of

⁶⁶ Usually when a crew member owns the fishing equipment, he or she is the person in charge. Otherwise, the captain is appointed by an owner external to the crew.

main target species). The first reliable estimation of the condition of one of the main local diving fisheries, the pen shell fishery, was provided by Moreno et al. [18]. These authors concluded that the species was severely overfished.

2.2. Legal Framework

Fisheries administration in Mexico has traditionally been centralized [10]. Nonetheless, a recently enacted fisheries act (October of 2007), the “Ley General de Pesca y Acuacultura Sustentables”, introduced decentralization⁶⁷ as one of its primary goals (see www.conapesca.sagarpa.gob.mx). Some of the relevant elements of this new law⁶⁸ will be described. However, data for this study were collected in 2007 and therefore this study will focus on the formal institutional setting in place at that time (before the new law was enacted).

Fisheries regulation in Mexico is shared by two federal agencies, SAGARPA⁶⁹, the Secretary of Fisheries and Agriculture, and SEMARNAT⁷⁰, the Secretary of the Environment and Natural Resources. SAGARPA, via CONAPESCA⁷¹, its National Fisheries and Aquaculture Commission, is the primary agency in charge of fisheries regulation, issuing licenses in the form of fishing permits, authorizations or concessions. CONAPESCA is also in charge of enforcing regulations related to fishery resources that

⁶⁷ This law establishes that States and Municipalities will have participation in decision making through the creation of State Fisheries Laws and State Fisheries and Aquaculture Councils.

⁶⁸ Note that the bylaw that would make this new law operational is still under revision (as of March 2010), which means that the prior bylaw (correspondent with the old fisheries law enacted in 1992) is still in use.

⁶⁹ Stands for “Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación”.

⁷⁰ Stands for “Secretaría de Medio Ambiente y Recursos Naturales”.

⁷¹ Stands for “Comisión Nacional de Acuacultura y Pesca”.

fall under SAGARPA's jurisdiction. INAPESCA⁷², the National Institute of Fisheries, is the scientific "backbone" of CONAPESCA.

On the other hand, SEMARNAT, via DGVS⁷³, its General Division of Wildlife, regulates the use of species listed "under special protection"⁷⁴ and, in the case of benthic resources listed in this category (e.g., sea cucumber and rock scallop), may authorize their harvest through a species-specific permit⁷⁵. SEMARNAT is also in charge of the establishment and management of marine protected areas (MPAs) throughout Mexico via CONANP⁷⁶, the National Commission of Natural Protected Areas. INE⁷⁷, the National Institute of Ecology, generates scientific and technical information about the environment to provide support for decision making to SEMARNAT. PROFEPA⁷⁸, the Federal Agency for the Protection of the Environment, is SEMARNAT's enforcement body. The Navy is also empowered to provide enforcement support to both CONAPESCA and PROFEPA if needed.

Throughout Mexico, fishing permits (granted by CONAPESCA) are the most widely used management tool to grant access to marine resources. Fishing permits may be granted to any corporate entity (typically a cooperative) or individual for four years or less (2-5 years in the new law), and they are renewable upon compliance with

⁷² Stands for "Instituto Nacional de la Pesca".

⁷³ Stands for "División General de Vida Silvestre".

⁷⁴ Species included in the norm NOM-059-ECOL-1994 and subsequent modifications.

⁷⁵ Called "Predios Federales Sujetos a Manejo para la Conservación y Aprovechamiento Sustentable de Vida Silvestre" (Federal Polygons for the Conservation and Sustainable Use of Wildlife). This tool and CONAPESCA's fishing concessions provide exclusive use-rights over one or more species within a specified area.

⁷⁶ Stands for "Comisión Nacional de Áreas Naturales Protegidas".

⁷⁷ Stands for "Instituto Nacional de Ecología".

⁷⁸ Stands for "Procuraduría Federal de Protección al Ambiente".

regulations. The core requirements to access fishing permits include: (a) presenting personal documentation, (b) specifying the species, fishing area, landing port, and duration of the right being solicited, (c) specifying and certifying technical information about boat(s), motor(s) and fishing gear(s) as registered in the Secretariat of Communication and Transportation, (d) certifying the legal possession of boat(s), motor(s) and fishing gear(s), (e) certifying the legal constitution and membership of corporate entities, (f) certifying inscription at the Federal Taxpayers' Registry (Ministry of Economy), and (g) paying the required fees⁷⁹.

The permit specifies the particular species (e.g., octopus permit, lobster permit) or group of species⁸⁰ to be harvested within a broadly specified region [19]. In Bahía de Kino, the spatial jurisdiction of fishing permits for species targeted by commercial divers overlap one another (see Figure 1 for general jurisdiction of fishing permits). Each fishing permit specifies the number of boats (referred as “*número de espacios*”) that are permitted for use to harvest the species authorized in the permit, together with technical specifications of the fishing equipment(s) (boat, motor and fishing gear). Also, a boat that belongs to a permit holder can be registered in more than one permit. That is, the same boat can be entitled to fish several species, depending on the amount of permits registered to a specific boat.

⁷⁹ The processing fee for a fishing permit was about US\$50 in 2008 (“Ley Federal de Derechos”, Art 191A, inciso IIa), but the actual cost of the permit varies according to the species (e.g., permits for abalone, lobster or species included in the category “*almejas*” (clams) range between US\$150 and 400 each, SAGARPA's personnel, personal communication).

⁸⁰ Some permits are issued for several species under a generic category, e.g., the “*escama*” (fish with scales) permit allows fishing about 200 species of fish, or the shark permit which includes several species of elasmobranchs.

Fishing permits provide a number of benefits to their holders. Permit holders are the only ones who can legally land the catch and declare it at a Regional Office of CONAPESCA [19]. Permit holders are also the only ones who can provide legal invoices (or “facturas”) for the product extracted directly from sea⁸¹. These invoices certify legal ownership of the harvest, and are necessary to sell and transport the catch to regional or international markets. Note that permit holders are only allowed to harvest and sell resources that have been caught using the fishing equipment(s) (boat, motor and fishing gear) registered in their permits.

Mexico’s laws also provide a mechanism for applying for fishing concessions (i.e., exclusive fishing rights over a species within an area)⁸² and these concessions have the same requisites as for accessing fishing permits, plus detailed technical and economic information to assess the economic viability of the intended activity. Unlike fishing permits, concessions require the authorization of a quota of the resource being harvested. To date, no fishing concession has been granted in the Bahía de Kino area, or in the NGC.

Specific regulations for resource use are defined within “Normas Oficiales Mexicanas” (norms) published in the Federal Registry. Closures (temporal or permanent) and gear or size restrictions are the most common management measures in the existing norms. Generally there are no quota limits. In addition to fishery norms, INAPESCA

⁸¹ Buyers without a fishing permit are allowed to buy product from permit holders, or from other buyers without a fishing permit and resell it. However, they have to carry on with them a document that certifies the legal possession of the catch, which specifies the fishing permit under which the product in question was harvested [14].

⁸² For example the abalone and lobster fisheries in the Pacific coast of the Baja California Peninsula.

develops the National Fisheries Chart or “Carta Nacional Pesquera” (CNP). This chart summarizes the status, management recommendations, and indicators for all Mexican fishery resources. These recommendations become legally binding under the new fisheries law. Table 1 shows the norms that apply to the target species of commercial divers in Bahía de Kino (also applicable to the entire GC and other regions within Mexico) and the main recommendations as they appear in the CNP for each species. Note that for most species, there is an absence of norms and knowledge on these species’ population status [14].

[Table 1 about here]

The use of marine protected areas has only recently been implemented in the Bahía de Kino region. Isla San Pedro Mártir is an important fishing destination, especially for commercial divers, and in 2002, a large area surrounding this island was designated as a Biosphere Reserve [20]. Even though the area involved constitutes a small portion of local divers’ fishing grounds, this is a new fisheries management strategy for this region and studies are currently underway to monitor its effectiveness in promoting sustainable populations of marine organisms targeted by small-scale fishers [20].

These regulations (access and resource-use rules) are enforced by the federal agencies cited above. In Bahía de Kino, only two officials from CONAPESCA are in charge of monitoring and enforcing regulations concerning fishing permits and resource-use norms under CONAPESCA’s jurisdiction. The area under their responsibility spans over 200 km of coastline (from Puerto Libertad to Estero Tastiota; Figure 1), and

inspections are usually performed by land. There are approximately 350 boats operating in this area, in addition to boats from other communities that arrive in varying numbers depending on the season (see Cinti et al. [14]). There is no permanent presence of PROFEPA (in charge of enforcing regulations concerning MPAs and species under special protection) in town. However PROFEPA's officials may arrive upon demand by members of the community, the Navy, CONANP or CONAPESCA's officials. The navy provides support for enforcement to both agencies at sea when solicited. The navy is the only agency that is allowed to carry guns. Resources and personnel are often in short supply, and officials are frequently unable to cover the entire area in a timely and effective manner [14]. Insufficiency of inter-institutional agreements and coordination among the different agencies involved is also a major impediment to achieve effective enforcement in the area.

In Bahía de Kino, most permit holders are in reality the buyers of the fishing product (absentee permit holders). Marine resources targeted by commercial divers are generally captured by fishers who do not own a fishing permit and do not belong (as members), to any cooperative holding permits [7, 14]. These fishers are locally called “pescadores libres” or independent fishers and they are the labor force of the permit holders (individual or corporate). They possess the fishing expertise and experience, and gain legal access to resources by entering into a working relationship with the holder of a permit (by working in his pangas under his permits). Ironically, because most of these fishers do not own fishing permits in their name (or in the name of a cooperative of

which they are members) they are not legally registered in the fishery and consequently, they are considered illegal participants.

The relationship between permit holders and their workers is complex. These fishers are highly dependent on permit holders economically, which is often detrimental to them but also beneficial (permit holders serve as banker, lending money in case of illness, emergencies, basic needs). On the other hand, permit holders frequently benefit from this relationship but they also bear substantial risks by lending to people who have limited financial assets.

Of the sample taken by Cinti et al. [14] (which is the same sample used in this study), 82% of respondents were independent fishers, none was an individual permit holder, and 18% were members of cooperatives holding fishing permits.

3. Methods

Research in Bahía de Kino (Figure 1) was conducted from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. Information on knowledge and attitudes concerning different aspects of fisheries regulation was gathered through structured interviews (including open and closed-ended questions), informal talks and participant observation. The first phase of the research was devoted to getting used to the setting, building trust and having informal talks with fishers, participating in a few fishing trips (n=4), and recording observations at the beach. During the final phase of the research, a structured interview was designed based on what was learned in previous months.

Among additional topics published in Cinti et al. [14], the structured interview assessed fishers' knowledge of regulatory tools and procedures such as: 1. the Fisheries Act (enacted in 1992 and in use until late 2007) and its bylaws, 2. resource-use norms by species establishing how a given species may or may not be caught (closures, size restrictions, etc.), 3. procedures to request fishing permits and territorial rights (i.e., concessions), 4. penalties for infractions, and 5. anticipated changes in Mexican policies concerning fisheries, specifically about the new fisheries act (enacted in late 2007). Fishers' attitudes concerning different aspects of fisheries regulation were investigated using a combination of open-ended questions and a set of statements in a 5-point Likert scale. Open-ended questions allowed the fishers to express their opinions more freely about what was currently missing in terms of fisheries regulation in Bahía de Kino. The Likert-scale statements allowed for quantification of predetermined topics including fishers' attitudes toward access and resource-use regulations, fishers' perceptions of performance of local authorities concerning enforcement of regulations; and fishers' willingness to join cooperatives, the most common form of formal organization in the region. Additional questions on fishers' associative and labor preferences complemented this latter topic.

The structured interview was applied to fishers belonging to the major groups of divers in town that were active in 2007 (six groups). Even though the selection of interviewees was not random due to the lack of updated information on these groups' members, whenever possible the number of interviews was distributed among groups more or less in proportion to an estimate of the number of boats working for each group

at the time interviews were performed. A total of 45 interviews were conducted with 1-2 crew members from 40 pangas, out of approximately 80 active pangas involved in commercial diving in town. Eighty nine percent of interviewees were panga captains (n=40), of which 33 were also divers and the rest (n=7) were captains and divers' assistants (the persons who assist the divers on board).

Differences in responses to the Likert-scale statements among fishers were explored by contrasting the responses to each statement using non-parametric statistics (Mann-Whitney U test). The responses of fishers having two different modes of fishing operation, and also different reputations concerning compliance with fishery regulations, were compared. The first group, that was named the "island group", consisted of fishers primarily operating in oceanic islands (Isla Tiburón, I. San Pedro Mártir, I. San Esteban, I. Ángel de la Guarda, and islands of the Archipiélago de San Lorenzo) (Figure 1). The main target species for this group are rocky reef species such as lobster, octopus, fishes, and occasionally pen shells (sand-mud species). This group has the reputation of being less respectful of regulations than the second group. The second group, which was named the "bay group", consisted of fishers whose main target species are pen shells and octopus, and occasionally lobsters and fishes, in the surroundings areas of Bahía de Kino and Isla Tiburón (Figure 1). In the case of sea cucumber, there is no legal harvest on the Sonoran coast⁸³. However, it is generally acknowledged that this species is widely harvested and although it cannot be known for sure which of these groups is most active in the clandestine harvest of sea cucumber, the island group is believed to be the one that

⁸³ A few authorizations to harvest sea cucumber have been granted by SEMARNAT in the states of Baja California, and Baja California Sur.

harvests this species the most. Each of these two groups consists of several distinct subgroups primarily defined by who they work for (who they sell their product to) [14].

4. Results

4.1. Fishers' Knowledge of Fisheries Policies

In general, respondents were unaware that a Fisheries Act, a bylaw of this Act, and species-specific norms as such existed. However, they were generally aware of important things contained in these legal instruments such as which species are allowed to be captured (contained in resource-use norms), and that fishing permits are required for fishing (contained in the Fisheries Act and its bylaw).

In terms of resource-use regulations, most of respondents were aware of the permanent closure on sea cucumber fishing (NOM-059-ECOL-1994, SEMARNAT, Table 1), the temporal closure on lobster fishing (NOM-006-PESC-1993, SAGARPA, Table 1), and the lack of regulations for octopus, pen shells, fishes (groupers & snappers) and black murex snail. However, additional restrictions on lobster fishing concerning allowed size and fishing gear (Table 1) are generally ignored by respondents, as well as the permanent closure implemented on rock scallop fishing (NOM-059-ECOL-1994, SEMARNAT, Table 1).

With regards to the requirements to access fishing permits, even though 90% of respondents have never tried to request a fishing permit on their own, about 70% were aware of at least one or two main requirements for permits. Ownership and certification of ownership of fishing equipment(s) (boat, motor and fishing gear) were the most

commonly mentioned. In general, respondents perceived that accessing fishing permits was unreachable because of their high cost⁸⁴, the need to own several fishing equipments (they believed they could not access a permit having only one panga), and the notion that authorities would grant fishing permits only to formalized groups (e.g., cooperatives), not to individuals. Surprisingly, most of the fishers believed that they needed to own at least three fishing equipments to access a fishing permit. Interestingly, the law does not restrict the number of fishing equipments that can be registered in a permit. In addition, a number of respondents expressed that they did not need to request fishing permits on their own since they have always worked for permit holders (under the permits of corporate or individual permit holders), or because authorities were simply not enforcing the fishing permit requirement.

Eighty seven percent of respondents were aware that a group of fishers was allowed to request a territory at sea for management purposes. When asked about the name under which they would formally request this territory, about half of these fishers recalled a “concession”, about 10% a “reserve”, and 40% could not remember.

Nonetheless, most of these fishers were unaware or had a very limited knowledge about how to request this territory, and they generally perceived the process as very difficult, with too many requirements to fulfill.

⁸⁴ For the GC, the tendency has been to restrict or put on hold the allocation of new permits in the majority of benthic small-scale fisheries (except for new fisheries like the geoduck or panopea clam (*Panopea* spp.) fishery for which exploratory permits (*permisos de fomento*) have been recently granted in the NGC). One way in which an individual or corporate entity may obtain a permit is by transferring permits that are no longer in used by their holders. Though profiting with permits' transference is prohibited, in practice the interested party usually has to pay an extra amount than the actual cost of the permit (a bribe) to the owner of the permit and the officials that do the paperwork.

In general, respondents were well aware of the penalties they would suffer if caught in illegal fishing activities. This indicates that they are generally aware of which species are allowed to be fished and when, even if they ignore the existence of formal instruments containing these rules (Normas Oficiales Mexicanas). Respondents usually perceived that Sonoran fisheries authorities are less strict in the application of fisheries regulations compared with authorities in states of the Baja California Peninsula. This is a region often visited by fishers from Bahía de Kino, and even permit holders from that region hire divers from Bahía Kino [14, 21].

With regards to any recent changes in Mexican policies concerning fisheries, 100% of respondents were unaware that changes in fisheries legislation were underway. This is not surprising considering that most of them did not know that a fisheries act even existed. The only change in legal requirements that respondents have noticed in recent times concerns an increase in enforcement activities by local authorities within the last year or year and a half.

4.2. Fishers' Attitudes toward Fisheries Regulation

4.2.1. What is Missing in Bahía de Kino in Terms of Fishery Regulation? (Open-ended question)

The most frequent issues and suggestions expressed by respondents concerning regulatory aspects involved: 1. controlling the entrance of outsider pangas into local fishing grounds (27% of respondents) (see Cinti et al. [14] for a description of local access issues), 2. more respect for regulations (22% of respondents), 3. more support from local authorities particularly in applying and enforcing current regulations (22% of

respondents), and 4. a more even distribution of fishing permits, granting them to real fishers, not to absentee operators (22% of respondents) (Figure 2).

[Figure 2 about here]

On the other hand, only 5 of 45 respondents (11%) claimed that fewer restrictions on fishing should be imposed (Figure 2), arguing that important fishing grounds have been closed⁸⁵ to fishing through the establishment of protected areas (n=3 specifically regarding the Reserva de la Biósfera (Biosphere Reserve) Isla San Pedro Mártir, and the Parque Nacional (National Park) Archipiélago de San Lorenzo on the coast of Baja California, Figure 1); or that restrictions are too radical for some species which should be opened for fishing (n=2, both concerning sea cucumber fishing).

4.2.2. Fishers' Attitudes toward Access Regulation (*Likert-scale*)

Forty percent of respondents agreed with the idea that fishing permits were a useful tool to limit access to local fishing grounds, while 56% evaluated it negatively (Figure 3). In addition, 60% of respondents agreed with the idea that the movement of divers among fishing villages (e.g., divers from Bahía de Kino to Guaymas and vice versa) is a way in which fishers help each other and 35% did not (Figure 3).

Interestingly, a number of these fishers observed that if these divers were to arrive bringing their pangas with them, their reaction would be different. In general, local fishers are reluctant to accept the arrival of new pangas to fish in local fishing grounds

⁸⁵ Interestingly, the no-take areas within these MPAs do not comprise the entire MPAs. Two point six percent of the Isla San Pedro Mártir Biosphere Reserve and 15% of the National Park Archipiélago de San Lorenzo are completely closed to fishing. In addition, enforcement is almost absent, particularly in the second case.

[14]. When fishers were asked to evaluate whether they agreed that only people from Bahía de Kino should be allowed to dive in local fishing grounds, this statement also received a high level of support (64%)(Figure 3). Overall, there is a tendency to support the protection of local fishing grounds from outsiders, especially if this movement implies increasing the number of pangas fishing in the area. Interestingly, the fishers from Bahía de Kino are known throughout the GC for being highly migrant, entering other port's jurisdictions without permission [14, 22].

[Figure 3 about here]

4.2.3. Fishers' Attitudes toward Resource-use Regulation (Likert-scale)

Statements assessing fishers' attitudes toward resource-use regulation for each target species⁸⁶ were worded in a negative form in order to diminish the probability of influencing fishers' responses towards a pro-conservationist view: "The species does not need formal regulation to conserve the species, it recovers alone when its natural fishing season is over and the fishers start targeting other species". Results are presented in inverse order to simplify their interpretation (Figure 4). When fishers expressed that any of these species needed formal regulation, fishers' suggestions on how the species should be regulated were recorded (Table 2).

Overall, fishers' attitudes toward resource-use regulation and their suggestions on how the species should be regulated indicate that, in general: 1. respondents perceive that local resources are quite scarce with most showing signs of overuse, and 2. respondents

⁸⁶ A predetermined list of target species was used and it was only asked about the species on the list. The list was based on previous knowledge of the area.

tend to support the idea that most of their target species need some form of formal regulation to conserve the species. In general, fishers' suggestions on how their primary target species should be regulated emphasize implementing temporal closures more than any other measure, either on species without regulation (e.g., pen shells) or species with existing legal protection (e.g., sea cucumber) (Table 2). Interestingly, the use of quotas was seldom mentioned.

[Table 2 about here]

In general, respondents strongly support the need for formal regulation of the harvest of sea cucumber (87%), lobsters (89%), and pen shells (78%) (Figure 4). The main suggestions on how sea cucumber should be regulated include implementing a temporal closure (and issuing permits) rather than the permanent closure already in place (see Table 2 for suggested dates). For lobster, the main suggestions involve increasing enforcement of current temporal closure, prohibitions on harvests of small size individuals and breeding females, and the ban on nocturnal diving⁸⁷. For pen shells, most fishers suggest implementing a temporal closure (see Table 2 for suggested dates), and enforcing requirements for legal possession of fishing permits.

[Figure 4 about here]

⁸⁷ In the GC, nocturnal diving with commercial purposes is only prohibited in areas of traditional use by indigenous groups (like the Seri Indians), according to the management plan of the "Islas del Golfo de California" protected area (area of reserve and refuge for migratory birds and wild fauna), and in some other protected areas like the Bahia de Loreto National Marine Park and Isla San Pedro Mártir Biosphere Reserve. Nonetheless, respondents tend to believe that nocturnal diving with commercial purposes is prohibited everywhere.

In the case of rock scallop (*Spondylus calcifer*), although this species is not a primary target species due to its comparative scarcity and low demand, the majority of respondents support the need for regulation in order for this species to recover (58% of support vs. 35% do not support) (Figure 4). According to the fishers, this species is accessible for fishing all year round and consequently more vulnerable to overuse (Table 2). Rock scallops are often harvested as a byproduct during the harvest of more profitable species (because of price or high abundance) like octopus, sea cucumber, or rocky fishes, since they are found in rocky or near rocky habitats. Rock scallops are in fact protected by SEMARNAT (NOM-059-ECOL-1994, Table 1), though respondents were generally unaware of the existence of this regulation.

On the other hand, in the case of fish species targeted by local divers (groupers and snappers) responses were divided (52% support vs. 48% do not support the need to regulate the species) (Figure 4). Respondents not supporting the need for regulation explained that these species show seasonal variations in behavior, approaching shallower waters during cold water months, and moving deeper and becoming more active during warm water months. Even though respondents did not mention that this behavior might be related to reproduction, a migratory behavior like this has been observed in the leopard grouper (one of the main species of fish they harvest) when they aggregate to mate. The species migrate to specific sites disappearing from places where they are commonly seen, from April through June [23]. According to the fishers, this movement would make fish species inaccessible for fishing (through diving) for a period of time and consequently less vulnerable to overuse.

In contrast, respondents supporting the need for regulation of fish species would like to see an increase in enforcement of nocturnal diving (see footnote 24), especially near islands, and the establishment of size restrictions together with more enforcement, to reduce the harvest of small-size individuals (Table 2).

For octopus and black murex snail (*Hexaplex nigritus*) the majority of respondents do not support the need for regulation (66% for octopus, and 76% for black murex) (Figure 4). Most of these fishers justify their opinions on regulations for these species explaining that these species are seasonal in their accessibility, only available for fishing in coastal waters during summer and inaccessible the rest of the year. In addition, the black murex snail is rarely extracted in Bahía de Kino because of their scarcity, low demand, and low price. Nonetheless, respondents also agree that both species are caught during reproduction and are likely to be affected (Table 2).

4.2.4. Fishers' Perceptions of Performance of Local Authorities (Likert-scale)

Responses were divided when fishers were asked if they agree that “without the support of local authorities, they would not currently have any products to fish in Bahía de Kino” (44% agreed vs. 47% do not agree) (Figure 5). In other words, about half of respondents agreed that local authorities have had an important role in preventing the depletion of fishery resources in Bahía de Kino, while the other half do not support this idea. Nonetheless, 80% of respondents agreed that in order to improve the situation of local fisheries, the implementation and enforcement of current regulations by local authorities was needed.

[Figure 5 about here]

4.2.5. Fishers' Willingness to Join Cooperatives (Likert-scale)

Sixty seven percent of respondents agree that working independently is preferable to working as a member of a cooperative (Figure 6). On the other hand, 86% believe that the main motivation for joining a cooperative today is having access to fishing permits (Figure 6). In addition to the Likert-scale statements, the preferences of fishers and the reasons for their preferences were assessed through additional questions as part of the same interview. These results indicate that 40% of respondents would prefer working as a member of a group or cooperative because it would allow them to access benefits and support that would be hard to obtain as independent fishers. These benefits included access to support and increased (positive) attention from the government, access to equipment owned by the cooperative (boats, motors, and fishing gear), the possibility of buying one's own equipment through credit or loans, access to fishing permits, advantages in selling one's product (legal receipts, better prices), and social benefits such as health insurance. However, the benefits most frequently mentioned were improved access to fishing permits and fishing equipments. This result reaffirms the point that obtaining a fishing permit as independent fishers is a difficult task.

[Figure 6 about here]

In terms of incentives to join cooperatives it is clear that in general, respondents look for material benefits that are difficult to obtain as independent fishers, rather than other type of support given by the collective nature of a cooperative. Also, when

expressing their reasons for preferring to work as a cooperative member, many respondents answered in a conditional way commenting that if the cooperative functions properly, they would prefer the cooperative option. Local experiences with cooperatives have not been generally successful [14], and this insecurity is reflected in fishers' answers.

On the other hand, 53% of respondents preferred to work independently (not as a member of a group or cooperative). The reasons include having had bad experiences with cooperatives, such as poor administration and organization, unequal contributions of members to the cooperative and internal conflicts between members. Other reasons for preference for working as independent fishers included freedom on the job, and higher earnings than as member of cooperatives due to the possibility of getting a better price when selling one's product, and avoiding paying cooperative dues. Obtaining higher earnings was the most common answer from respondents who stated a preference for working independently.

In addition, the preferences of respondents with regards to the alternative ways in which they can legally access fishing and sell their catch were assessed: 1) with fishing permits of their own (individual permits), 2) as a member of a cooperative that holds fishing permits, 3) working under the permits of individual permit holders (locally called "permisionarios"), or 4) working under the permits of a cooperative (not as member of the cooperative). Interviewees were told to assume that any of the offered options was equally feasible in practice. Interestingly, 73% of respondents would prefer working with fishing permits of their own (individual permits), only 20% would prefer working as a

member of a cooperative that holds fishing permits; and no one would prefer working under the permits of individual permit holders or “permisionarios”. Ironically, this is the most common way for fishers to access fishing permits and legal authority to sell products in Bahía de Kino [14].

4.2.6. Attitudinal Differences Among Groups of Fishers (Likert-scale)

Convincing evidence of differences exist between the island and bay group concerning attitudes toward resource-use regulation for fish species ($p < 0.01$), perception of performance of local authorities ($p < 0.01$) and perception of the need for reinforcing implementation and enforcement of current rules by local authorities ($p < 0.01$) (Table 3).

[Table 3 about here]

Respondents of the bay group tend to show a more negative perception of how local authorities have performed and are more supportive of an increase in enforcement of current regulations, than respondents of the island group, who tend to be more cautious about those topics. Differences in perceptions might be explained by the fact that the primary target species of the bay group (octopus and pen shells) are not subject to any formal regulation (Table 1), while the main species targeted by the island group are subject to official restrictions (norms regulating lobster and sea cucumber harvesting) (Table 1). Respondents whose target species are already regulated may fear or be less likely to accept an increase in enforcement. Nonetheless, in spite of these differences, it should be noted that respondents of both groups tend to support the need for some kind of formal regulation for the majority of the species they harvest (including sea cucumber).

5. Discussion

Studies of what the resource users know about and how they perceive the formal policies that regulate their activity are useful tools to assess the effectiveness of rules designed to manage natural resources to ensure sustainable harvests. These kinds of studies can help policy-makers design regulations that incorporate appropriate biophysical and social characteristics of the setting, so that people's responses to these policies –and hopefully fisheries performances- are improved.

Cinti et al. [14] described the local social and fisheries impact of formal fisheries policies in Bahía de Kino, and discussed whether the formal institutional structure of Mexican fishing regulations is effective in promoting responsible behavior by small-scale fishers. These authors described a system aimed to regulate access to the fishery (the permit system) that sets the standard too high for many real fishers to access fishing permits, tends to promote the disconnection of permit holders (usually absentee operators) from the resource, and intensify rent-seeking interests. Resources and markets tend to be concentrated in a few hands (permit holders' hands), and an informal system⁸⁸ of production is created (the fishers that operate the boats and do not own fishing rights). This informal labor system is practically invisible to the federal government, resulting in the exclusion of most fishers (usually more closely attached to the resources and with the most at stake if resources are overfished) from management decisions concerning the fishery. This social structure creates the wrong incentives for effective fisheries

⁸⁸ The informality of this fishing sector is such that most fishermen do not even have national identification credentials (locally referred as "Credencial de Elector") that would allow them to vote.

management, incentivizing illegal fishing rather than discouraging it. In addition, the authors highlight their observation that overuse is also promoted by the absence of legally binding norms to regulate resource uses in most of the species targeted by local divers, the lack of knowledge on these species' population status, and an insufficient system for enforcement and control.

This article reinforces and complements the results presented by Cinti et al. [14], from the perspective of resource-users, suggesting that:

a) There exists an unequal distribution of fishing rights. None of our interviewees had fishing permits in their names (as individual permit holders) and only 18% were members of cooperatives holding fishing permits. Nonetheless, these cooperatives did not commercialize their harvests through their cooperatives, which means that they are also highly dependent on external buyers or other permit holders to sell their product. In addition, obtaining a more even distribution of fishing permits, granting them to the users of resources (not to absentee operators), was a major suggestion by local fishers.

b) Current policies and policy changes do not reach the fishers in a direct and formalized way, and they are shaped with no participation of local fishers. Permit holders are the only ones legally involved in the fishery, and consequently, the only ones informed about regulatory measures, policy changes, or government benefits available to them. The result is that fishers, operating under permits held by others; do not have thorough knowledge about existing rules.

c) The existing system for monitoring and enforcing current rules is inefficient as reflected by fishers' willingness to reinforce vigilance and improve authorities' response to illegal fishing.

d) There exists the need to implement additional regulatory measures on most of the species targeted by local divers because of a generalized state of overfishing.

e) There is a strong willingness of resource users to improve the condition of local fisheries through implementation of regulatory measures.

Even when local fishers have no formal rights to resources, weak organization, limited power, limited access to information, and insufficient institutional support, their attitudes and demands show that potential for implementation of improved fishing regulations exists. This is particularly important since it may provide the basis for the development of locally supported management strategies, with a higher likelihood of compliance and a higher potential for managing these resources sustainably.

Nonetheless, it is important to acknowledge that regardless of the strong support by local fishers towards increased enforcement of existing regulations and implementation of new ones, most of these fishers are working informally and hence, not complying with legal requirements in some aspect or another. Thus, it is suggested that before any significant change is made in how regulations are implemented and enforced, local fishers should be approached in a non-threatening way and opportunities for them to regularize their activity should be provided.

The new fisheries act adds to the pre-existing list of management tools the possibility of developing species-specific management plans, and "Regional Fishery

Ordinance Plans” (“Programas de Ordenamiento Pesquero”). Each of these plans must define the area to be incorporated into the plan, provide a list of users, the species subject to use, and the species-specific management plans available for the species of concern. As initially suggested by Cinti et al. [14], an institutional tool like this could be used in Bahía de Kino to grant exclusive access to the community (or to a group of neighboring communities) within the limits of their fishing grounds, and serve as a protective umbrella to help avoid intrusions from outside. Also, providing exclusive use or property rights on the users of resources (individually or collectively) for specific fisheries (and -controllable- areas) within these limits may provide additional incentives to avoid internal competition for resources among local groups or individuals. These could be approached through the use of rights-based mechanisms⁸⁹ already available in Mexican legislation (i.e., CONAPESCA’s fishing concessions or SEMARNAT’s species-specific permits that provide exclusive use-rights over one or more species within a specified area; MPAs that may grant exclusivity of access to certain groups or communities) or through exploring others that may have proved promising in other places under similar circumstances. Our results could be used as a preliminary baseline to initiate the discussion among fishery stakeholders from the diving sector of Bahía de Kino towards implementation of improved fishing regulations.

⁸⁹ Approaches that tend to eliminate ‘the race for fish’ and provide incentives for fishery stakeholders to participate in management decisions and increase compliance with regulations (e.g., territorial use-rights in fisheries or TURFs, marine tenure systems, use-rights to a certain gear or to an amount of a resource granted to individuals, groups of individuals or communities)(see [2] and [24]).

This does not mean to imply that the permit system has to be necessarily eliminated, but instead elements of its design modified (to reduce the chances of achieving unfavorable outcomes) and combined with rights-based mechanisms. Some of these modifications (which may be useful for the permit system beyond Bahía de Kino) might include: (a) ease the requirements for accessing fishing permits so that resource users are able to successfully request them; (b) give preference to resource users in the allocation of permits that are made available; (c) limit the number of boats each permit holder could register into the fishery. This would make room for others to access fishing rights and discourage concentration of resources in a few permit holders; (d) limit the number of permits each permit holder could hold (to avoid concentration). Nonetheless, it is advisable that permits are kept multi-specific (or that each permit holder be allowed to accumulate a number of permits for different species), to allow for diversification to better cope with resource fluctuations; (e) revoke permits that are badly used or not in use by their holders so that they can be reallocated to people with long history into the fishery; (f) be more strict in the application of the rules to revoke permits so that permit holders have more incentives to comply with rules, and permit holders that fail to comply make room for others to access these permits; (g) significantly improve control measures to increase the chances of detecting violations such as the concealing of illegal catch under current permits, particularly in processing plants considering that one of the main reasons for local fishers to harvest illegal products is the existence of buyers willing to buy them; and (h) provide incentives for rule compliance through combining the permit system with rights-based tools and more inclusive management approaches.

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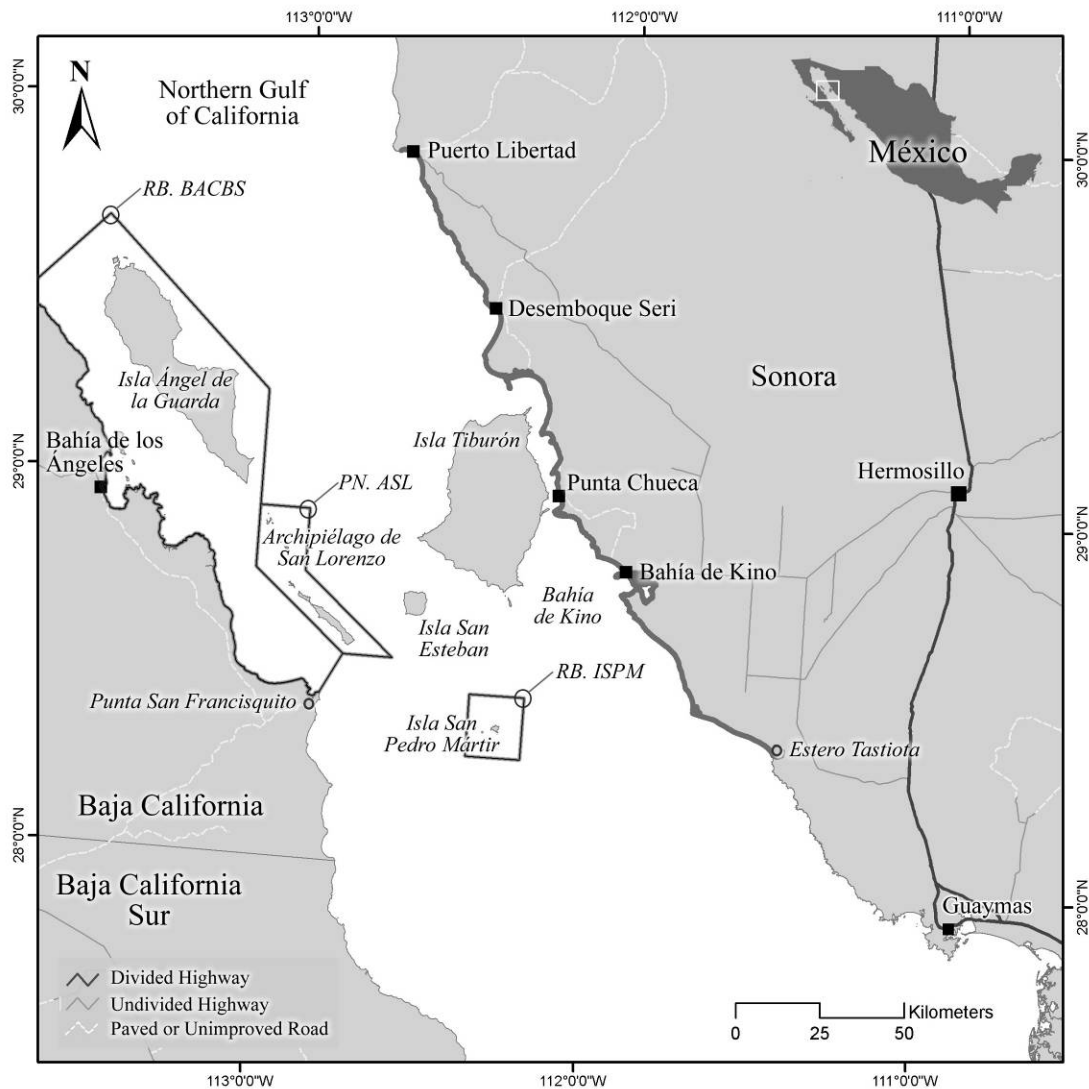


Figure 1: Map of the study area within the Northern Gulf of California (NGC). The thick gray line on the Sonoran coastline indicates the general geographic jurisdiction of fishing permits for most diving products in Bahía de Kino, extending from Puerto Libertad to Estero Tastiota. The MPAs present in the area are indicated as follows: Reserva de la Biósfera (Biosphere Reserve) Bahía de los Angeles y Salsipuedes (RB. BACBS); Parque Nacional (National Park) Archipiélago de San Lorenzo (PN. ASL); Reserva de la Biósfera (Biosphere Reserve) Isla San Pedro Mártir (RB. ISPM). Square markers indicate the main towns or cities. Hermosillo is the capital city of Sonora. Cartographic design: Marcia Moreno-Báez and Erika Koltenuk.

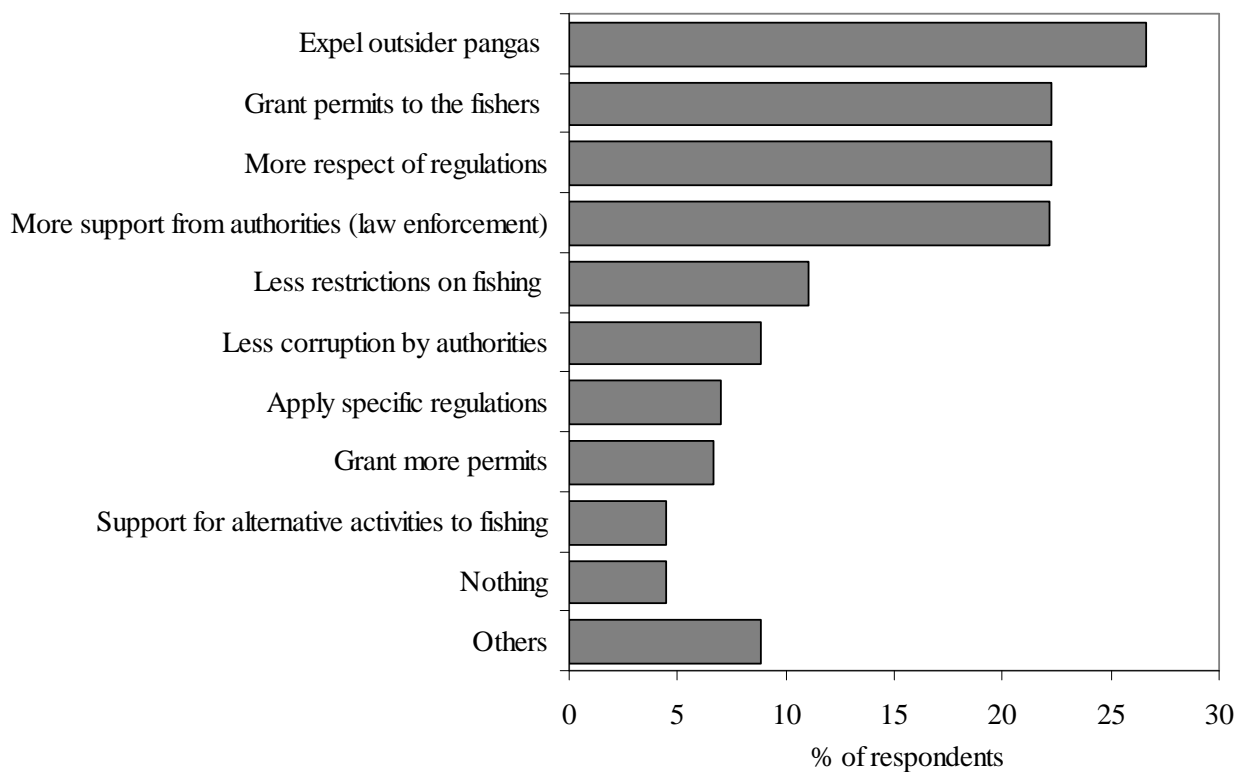


Figure 2: Fishers' responses to question: What is currently missing in terms of fishery regulation in Bahía de Kino? One person may have provided multiple answers.

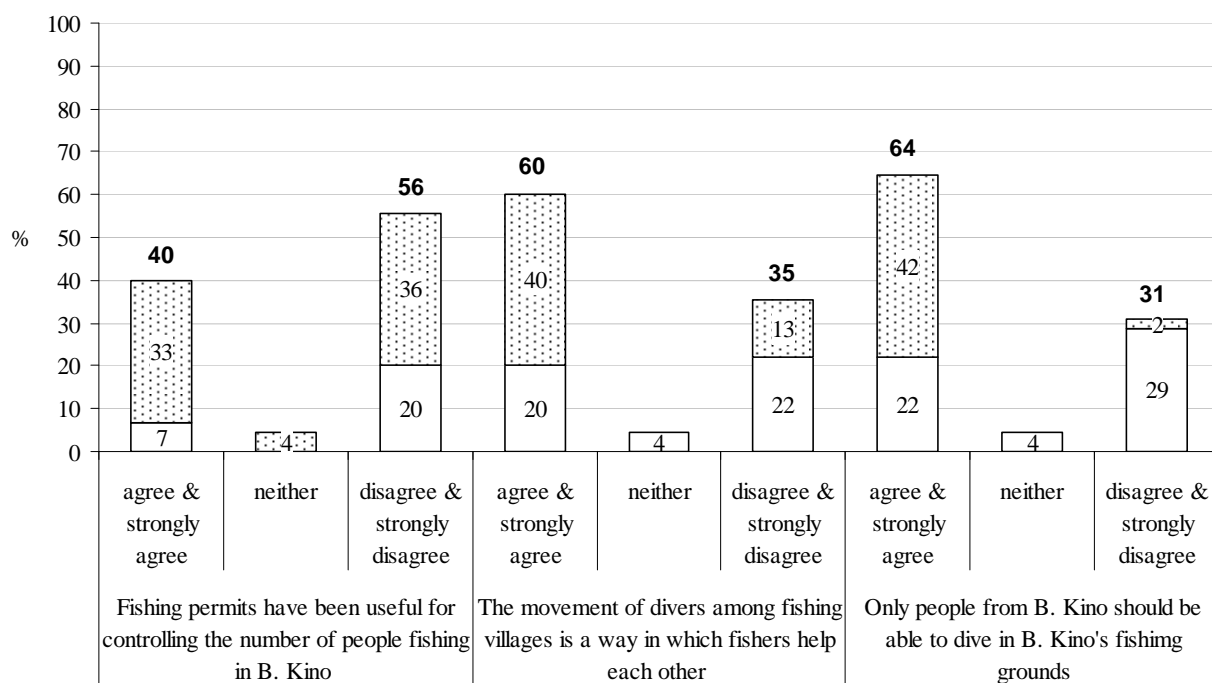


Figure 3: Fishers' attitudes toward access limitation. n=45. The numbers in bold above each bar indicate the total percentage of responses for each category or combination of categories (i.e., agree and strongly agree) with the stippled bar for the "agree" or "disagree" responses and the plain bars for the "strongly agree" or "strongly disagree" responses for each statement.

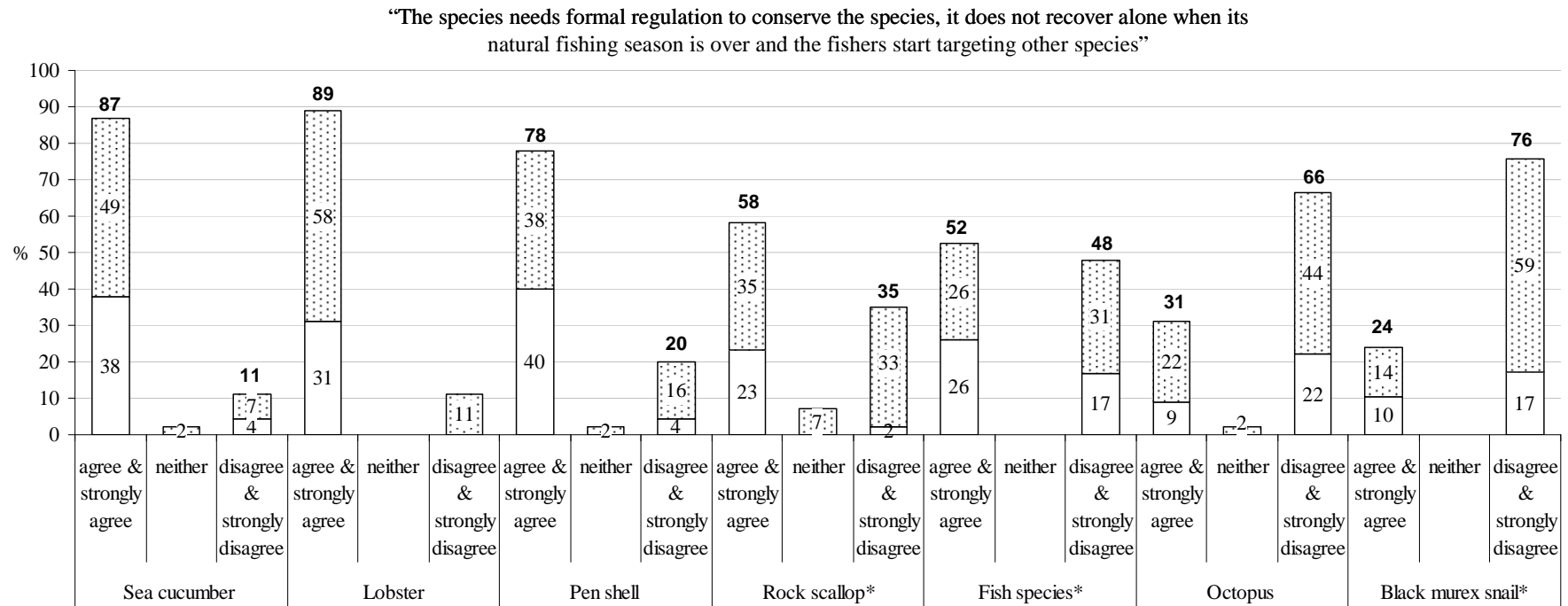


Figure 4: Fishers' attitudes toward resource-use regulation by species. $n=45$, except for species with asterisks: rock scallop ($n=43$), black murex ($n=29$), and fish species ($n=42$). The numbers in bold above each bar indicate the total percentage of responses for each category or combination of categories (i.e., agree and strongly agree) with the stippled bar for the “agree” or “disagree” responses and the plain bars for the “strongly agree” or “strongly disagree” responses for each statement.

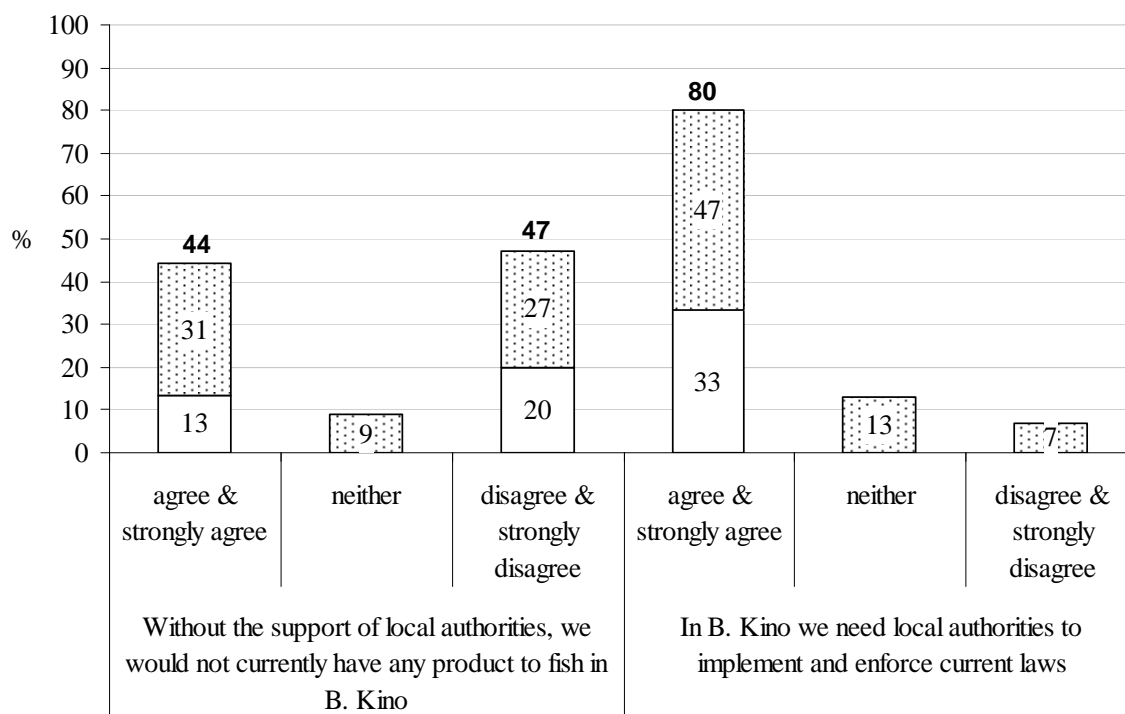


Figure 5: Fishers' attitudes toward authorities' performance. n=45. The numbers in bold above each bar indicate the total percentage of responses for each category or combination of categories (i.e., agree and strongly agree) with the stippled bar for the "agree" or "disagree" responses and the plain bars for the "strongly agree" or "strongly disagree" responses for each statement.

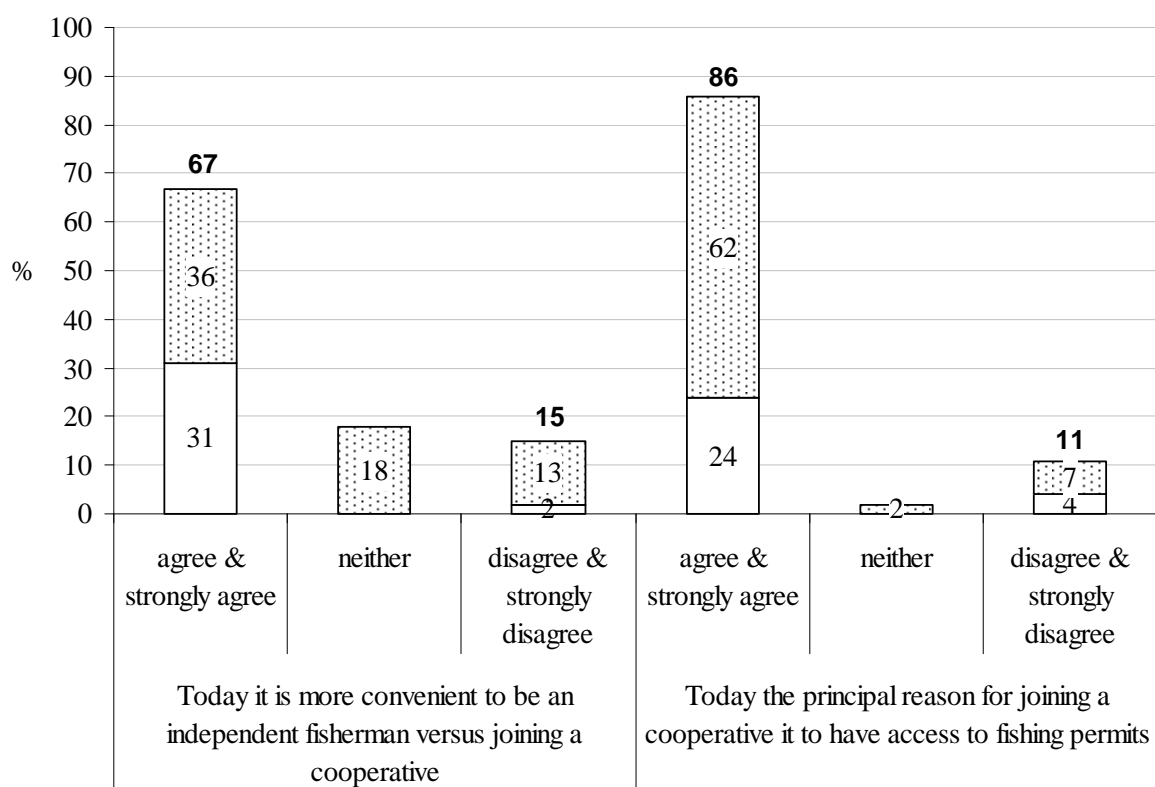


Figure 6: Fishers' willingness to join cooperatives. $n=45$. The numbers in bold above each bar indicate the total percentage of responses for each category or combination of categories (i.e., agree and strongly agree) with the stippled bar for the "agree" or "disagree" responses and the plain bars for the "strongly agree" or "strongly disagree" responses for each statement.

Table 1: Management recommendations as they appear in the National Fisheries Chart (Carta Nacional Pesquera or CNP) for the main target species of commercial divers in Bahía de Kino, and fishery norms regulating the harvest of these species.

Species	Existing regulations by species	CNP management recommendations
Sea cucumber <i>Isostichopus fuscus</i>	NOM-059-ECOL-1994 - Enforced by PROFEPA and the Navy - Permanent closure throughout México	Population status in Sonora, undetermined. There are no recommendations for Sonoran sea cucumber populations. SEMARNAT may authorize use. No authorization for exploitation has been granted in Sonora.
Rock scallop <i>Spondylus calcifer</i>	NOM-059-ECOL-1994 (see above)	Lumped with other 15 species under the category “almejas” (clams). Population status in Sonora, undetermined. There are no recommendations for Sonoran rock scallop populations. SEMARNAT may authorize use. Only one authorization has been granted in Sonora, though not in Bahía de Kino.
Lobster <i>Panulirus</i> spp.	NOM-006-PESC-1993 - Enforced by CONAPESCA and the Navy - Applies to Federal jurisdiction of Gulf of México and the Caribbean Sea, Pacific Ocean including Gulf of California (GC) - Gear restrictions: traps, unless other gear is authorized by SAGARPA - Size restrictions: 82.5 mm (cephalothorax length) - No breeding females - Land entire specimen to enable control - Temporary closure (GC): July 1st to October 30th	Population status in Sonora, undetermined. A gradual increase in fishing effort may be allowed if supported by technical studies. Recommends assessing the resource in Sonora and other states, and regularizing the use of commercial diving. This fishing gear is widely used in the GC, even though it is prohibited for lobster.
Groupers, <i>Mycteroperca</i> spp. ^(a) & Snappers, <i>Hoplopagrus guentherii</i> .	None	Lumped with other 200 species under the category “peces marinos de escama” (marine fishes with scales). Commercial diving does not appear in the list of fishing gear used to capture these species. Population status in Sonora, undetermined. General recommendations include not increasing fishing effort in any of the species within the category, and modifying current categorization to allow administration by groups of related species (smaller groups).
Pen shell <i>Atrina</i> spp. & <i>Pinna rugosa</i>	None	Lumped with other 15 species under the category “almejas” (clams). Recommends not increasing fishing effort in Sonora and other states, and implementing the use of quotas in Sonora and Sinaloa.
Black murex snail <i>Hexaplex nigrinus</i>	None	Population status in Sonora, undetermined. Recommends assessing the resource in Sonora every 2 years. General recommendations include not increasing fishing effort in any of the states where it is fished, and implementing reproductive closures.

Octopus <i>Octopus</i> spp.	None	Under a general category “pulpo” (octopus) including identified and unidentified species captured in Mexico. Population status in Sonora, undetermined. Recommends taking measures in Sonora if catches are lower than 100 MT. General recommendations for all octopus species include not increasing fishing effort, and reinforcing biological and fisheries studies to better regulate these fisheries.
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^(a) *Mycteroperca jordani*, *Mycteroperca prionura*, and *Mycteroperca rosacea* are enlisted as endangered, near threatened and vulnerable, respectively, in the IUCN red list of threatened species.

Table 2: Fishers' suggestions on how the species should be managed.

Species	Fishers' suggestions on how the species should be managed
Sea cucumber <i>Isostichopus fuscus</i>	<ul style="list-style-type: none"> – Need urgent attention. Overexploited (very scarce, very small sizes left). – Closure is not respected, extracted all year round. – Fishers suggest temporal closure during reproduction with strict enforcement (and provide permits to regularize fishing), rather than a useless permanent closure. Or close it permanently, but substantially enhancing enforcement. – Suggested time for temporal closure: summer time (~May-August) based on fisher's observations of reproductive season. – Fishers also suggest controlling the buyers. Reinforce control in processing plants.
Rock scallop <i>Spondylus calcifer</i>	<ul style="list-style-type: none"> – Overexploited (very scarce) – Infrequently fished due to scarcity, low demand and low price. It is fished as secondary species during octopus fishing season. – Apply temporal closure in the summer (when they believe it reproduces) or ban it for several years. – Fishers believe that it takes longer to recover than other species (low growth).
Lobster <i>Panulirus</i> spp.	<ul style="list-style-type: none"> – Need urgent attention. Overexploited (very scarce, very small sizes left). – Closure is not respected, extracted all year round. – More enforcement is needed to avoid extraction during closure. – Control nocturnal diving^a, limit extraction of breeding females and small size individuals. – Fishers consider that current closure dates are wrong. Lobsters start reproducing in late May-early June. Closure should start one month earlier (including June).
Fishes Groupers, <i>Mycteroperca</i> spp. & Snappers, <i>Hoplopagrus guentherii</i> .	<ul style="list-style-type: none"> – Fishers agreeing with the need for regulation generally claim for controlling nocturnal diving^a, and increasing vigilance in islands. – According to the fishers, the fish approach shallower waters during cold water months, and move deeper and become more active during warm water months. This makes harder their capture using harpoon. – A temporal closure should be established when the water gets cold (~two months, probably in November-December). – Impose size restrictions. Small sizes are not respected.
Pen shell <i>Atrina</i> spp.	<ul style="list-style-type: none"> – Most of the fishers suggest temporal closure during reproduction in summer (from May-June-until August-September). – Enforcement could be facilitated since most fishers stop fishing it naturally in the summer because extraction is no longer convenient (muscle turns very thin), though some local and foreign fishers still fish it. – Fishers also suggest controlling legal possession of fishing permits (and the number of boats allowed per permit). – Some fishers suggested setting a quota since today everyone fish in the same fishing sites until it is over.
Black murex snail <i>Hexaplex nigritus</i>	<ul style="list-style-type: none"> – It is infrequently worked in Bahía de Kino because of scarcity, low demand and low price. – Most of the fishers agreed that it may recover alone since it is seasonal (only accessible during the summer when it aggregates to mate and inaccessible (buried) the rest of the time). Yet, they also agree that it is caught while it reproduces. – Only 10% of the fishers said that it would need regulation (temporal ban during the summer or permanent closure for

	several years until it recovers).
	— Most of the fishers agreed that it may recover alone since it is a seasonal resource (only accessible in coastal areas during summer and inaccessible for fishing the rest of the time). Yet, they also agree that it is caught while it reproduces.
	— ~ 30% of the fishers believed that even if it is seasonal, it may need regulation since it is overexploited and it is caught during reproduction. These fishers suggest:
Octopus	1. Temporal closure during last months of natural fishing season (July and August) when it have laid their eggs for incubation.
<i>Octopus</i> spp.	2. Give preference for extraction to local fishers.
	3. Establish a quota.

^(a) In the GC, nocturnal diving with commercial purposes is only prohibited in areas of traditional use by indigenous groups, according to the management plan of the “Islas del Golfo de California” protected area (area of reserve and refuge for migratory birds and wild fauna), and in some other protected areas like the Bahia de Loreto National Marine Park. Nonetheless, even though it is widely practiced, respondents tend to believe that nocturnal diving is prohibited everywhere.

Table 3: Results of Mann-Whitney U tests between fishers of the island and bay group per statement. Values between brackets indicate the number of respondents. *Significant differences at $p < 0.05$.

Statements	Mean rank		
	Island group	Bay group	P value
Fishers' Attitudes toward Access Regulation			
(1) Fishing permits have been useful for controlling the number of people fishing in Bahía de Kino	25.4 (27)	19.4 (18)	0.114
(2) The movement of divers among fishing villages (e.g., divers from Bahía de Kino to Guaymas and vice versa) is a way in which fishers help each other	25.2 (27)	19.7 (18)	0.150
(3) Only people from Bahía de Kino should be able to dive in the area of Bahía de Kino	20.9 (27)	26.2 (18)	0.154
Fishers' Attitudes toward Resource-use Regulation			
(4) <u>Pen shells</u> do not need for formal regulation to conserve the species, they recover alone when its natural fishing season is over and the fishers start targeting other species	24.9 (27)	20.2 (18)	0.212
(5) <u>Sea cucumber</u> do not need for formal regulation to conserve the species, it recover alone when its natural fishing season is over and the fishers start targeting other species	25.3 (27)	19.5 (18)	0.109
(6) <u>Octopus</u> do not need for formal regulation to conserve the species, it recover alone when its natural fishing season is over and the fishers start targeting other species	25.7 (27)	18.9 (18)	0.069
(7) <u>Lobsters</u> do not need for formal regulation to conserve the species, they recover alone when its natural fishing season is over and the fishers start targeting other species	23.5 (27)	22.3 (18)	0.742
(8) <u>Rock scallops</u> do not need for formal regulation to conserve the species, they recover alone when its natural fishing season is over and the fishers start targeting other species	24.0 (26)	19.0 (17)	0.180
(9) The <u>black murex snail</u> do not need for formal regulation to conserve the species, it recover alone when its natural fishing season is over and the fishers start targeting other species	16.6 (14)	13.5 (15)	0.269
(10) <u>Fish species</u> targeted by divers do not need for formal regulation to conserve the species, they recover alone when its natural fishing season is over and the fishers start targeting other species	28.0 (25)	11.9 (17)	0.000*
Fishers' Perceptions of Performance of Local Authorities			
(11) Without the support of local authorities, we would not currently have any product to fish in Bahía de Kino	27.2 (27)	16.7 (18)	0.007*
(12) In Bahía de Kino we need local authorities to implement and enforce current laws	18.8 (27)	29.3 (18)	0.005*
Fishers' Willingness to Join Cooperatives			
(13) Today it is more convenient to be an independent fisherman versus joining a cooperative	24.1 (27)	21.4 (18)	0.491
(14) Today the principal reason for joining a cooperative it to have access to fishing permits	24.4 (27)	20.9 (18)	0.301

APPENDIX C: A COMPARATIVE ANALYSIS OF SMALL-SCALE FISHERIES
PERFORMANCE IN THE GULF OF CALIFORNIA, MEXICO, FROM AN
INSTITUTIONAL PERSPECTIVE: OPPORTUNITIES AND CHALLENGES FOR
COMMUNITY-BASED MANAGEMENT

TO BE SUBMITTED TO THE INTERNATIONAL JOURNAL OF THE COMMONS

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Keywords

Gulf of California, institutions, small-scale fisheries, incentives, policy, local rules,
fishers' attitudes.

A Comparative Analysis of Small-scale Fisheries Performance in the Gulf of California, Mexico, from an Institutional Perspective: Opportunities and Challenges for Community-based Management

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Abstract

Understanding how institutions affect or shape fisheries performance is an important part of providing practical insights for the development of more effective management strategies. This paper analyses the institutional performance of two case studies of small-scale fisheries in the Northern Gulf of California, Mexico, with the aim of understanding how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders' behavior. Results suggest that existing policy tools have been ineffective in promoting sustainable fishing practices by fishery stakeholders in both communities. The geographic jurisdiction of individual permits is generally ignored and individual fishers fish where it is more convenient to them, following seasonal and spatial changes in resource abundance. There is a tendency to willingly share local fishing grounds among community members (as if use-rights would have been granted to the community as a whole), and to protect them from outsiders. In addition, available permits are being used to cover the product that is harvested by most of the fishers in these communities, regardless of whether individual fishers are legitimate permit holders. We argue that communal property or use-rights might potentially offer viable alternatives to increase protection from outsiders, and incentivize local fishers to craft, implement and self-

enforce more legitimate measures. Tools available in Mexico's fishery and environmental laws could provide higher exclusivity of access to these communities. Importantly, there was strong support from resource users (fishers) for implementing regulatory measures for local fisheries in both communities. Increased attention should be given to local arrangements and initiatives to develop locally supported regulations.

1. Introduction

Fisheries management failures are thought to be largely the product of institutional (or policy) failures, the sum of the legal, social, economic, and political arrangements used to manage fisheries (Ostrom 1990; Hilborn et al. 2005; Grafton et al. 2008). Fishers and other stakeholders work within a set of ecological, social, and institutional constraints to consider the costs and benefits of various behaviors and act according to perceived incentives. Understanding how institutions affect or shape fisheries performance is therefore an important part of providing practical insights for the development of management strategies that promote sustainable fishing.

The Gulf of California (GC) (Figure 1), in Mexico, is a region characterized by its biological richness and socio-economic significance. The region is a major contributor to the national fisheries sector, producing approximately 50% of the landings⁹⁰ and 70% of the value of national fisheries in Mexico (Carvajal et al. 2004). Recent estimations

⁹⁰ Nonetheless, about 60% of these landings (as of 2002) correspond to small pelagics (mainly sardines) and jumbo squid, most of which is harvested by large-scale fleets (37 industrial vessels for sardine and 1,000 small boats or pangas for jumbo squid). These fisheries combined employ a relatively small number of people and contribute with only 12% of the total value of GC landings to the national fishery production (Cisneros-Mata 2010).

suggest that there are approximately 50,000 fishers and 25,000 boats (or pangas)⁹¹ operating in small-scale (or artisanal) fisheries in the GC, and another 10,000 fishers and 1,300 boats in large-scale (or industrial) fisheries (Cisneros-Mata 2010).

In spite of the existence of formal fisheries policies intended to regulate fishing practices, access to most small-scale fisheries (SSFs) in the GC –and generally in Mexico- has been practically open (at least to Mexican citizens) (Alcalá 2003; World Wildlife Fund 2005a,b). Fueled by state subsidies and policies that encouraged migration from different parts of Mexico (Alcalá 2003; Greenberg 2006), the GC has seen a drastic increase in fishing effort over the last decades and a downtrend in production of many of the over 70 species targeted by SSFs (Cudney-Bueno and Turk-Boyer 1998; Sala et al. 2004; Sáenz-Arroyo et al. 2006; PANGAS 2008). It is estimated that 85% of the Gulf fisheries are either at their maximum harvesting capacity or overexploited (Cisneros-Mata 2010).

SSFs in the GC are affected by a number of institutional weaknesses commonly associated with poor institutional performance worldwide (FAO 2002). These include poor enforcement capabilities, no well defined rights; poor involvement of major stakeholders in the elaboration of policies and regulations, decision making and implementation; and insufficient financial and human resources, and information for proper management (Bourillón-Moreno 2002; Alcalá 2003; Carvajal et al. 2004; Danemann and Ezcurra 2007; Cudney-Bueno et al. 2009; Cinti et al. 2010a).

⁹¹ Typically fiberglass boats 8-9 meters long, equipped with 55-115 hp outboard motors.

In this institutional context and in a region where external (governmental) management and enforcement capabilities will likely never be adequate, optimizing implementation and performance of current policies and encouraging local stakeholders to take responsibility in resource management, becomes critical. Several authors have suggested that one solution to problems like these involves devolving or sharing management responsibilities with fishery stakeholders to provide incentives for better management of fishery resources (Pinkerton 1989; Berkes 1994, Pomeroy and Williams 1994, Jentoft and McCay 1995). Local involvement in management decisions may also help remove burden from government institutions. Also, limited governmental resources could be differentially allocated to fishing communities that are most in need and are less likely to cope by themselves with internal or external threats. In this context, it is important to assess how current policies are performing on-the-ground and the presence of factors or circumstances that may potentially favor a more active role of local stakeholders in resource management.

This paper analyses the institutional performance of two case studies of small-scale fisheries in the Northern Gulf of California (NGC)⁹², with the aim of improving our understanding of how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders' behavior. We provide insights from two case studies situated in different states, Bahía de Kino in Sonora and Bahía de Los Angeles in Baja California. Comparatively, these

⁹² The GC has been divided in three main areas (north, mid and south) based on observations of fish species distribution patterns (Walker 1960). The NGC is the area extending north of an imaginary line from San Francisquito in Baja California and Bahía de Kino in Sonora (Figure 1).

communities show similar limitations in the on-the ground performance of the formal policy tools used to manage fisheries, and similarly poor fisheries performance (in terms of sustainability). However, they show noticeable differences in demography, geography, level of fishers' organization within their communities that may result in different potentials for fisheries improvement in the mid- to short- term and for successful devolvement of management authority to the local level.

We describe: 1) the non-institutional attributes of Bahía de los Ángeles (BA) and Bahía de Kino's (BK) fisheries (demographic, geographic, and fishery characteristics), 2) the institutional attributes (formal and informal), and 3) fishers' perceptions concerning fisheries policies and management issues. Since the institutional component of BK has been described in detail in two prior publications (Cinti et al. 2010a; Cinti et al. 2010b), we will emphasize the most important differences and similarities among the case studies and refer the reader to those publications for further detail.

2. Methods

We used the Institutional Analysis and Development Framework (IAD)(Ostrom 1999) to guide this research and identify relevant variables to explore. Three basic categories of variables are thought to influence the patterns of interaction among individuals in any given setting: 1. the rules used by participants (e.g., local arrangements and government rules); 2. attributes of the biophysical world (e.g., resource characteristics); and 3. attributes of the community (e.g., socio-cultural attributes)

(Ostrom 1999). In this study we collected information on these three components using primary and secondary sources of information.

The on-the-ground performance of existing formal policy tools and the presence and performance of local arrangements to regulate access and resource use was assessed through examination of secondary sources, semi-structured and structured interviews (including open and closed-ended questions), informal talks and participant observation. We relied on available literature for information on additional factors which may help explain the outcomes observed in each case.

Secondary sources included documents and information such as laws and bylaws concerning fisheries (fishery and environmental laws), bylaws of formalized groups (e.g., fishing cooperatives), and official information (fishing permits issued, norms by species, decrees, official statistics).

The semi-structured interviews with key fishers were aimed at collecting information about the internal organization of formalized groups and the presence of fishery-related local arrangements in both communities. In addition, we conducted semi-structured interviews with key informants from the federal agencies involved in fisheries and environmental protection, to get insights about the local implementation of tools and regulations, enforcement and access issues.

The structured interviews assessed fishers' occupational aspects (fishing activity, primary target species, sources of income, etc.), association to formalized groups, how they accessed fishing targets and how they commercialized their products (whose permits and fishing equipment they used for fishing and selling products), and their attitudes and

perceptions about different aspects of fisheries regulations. Fishers' attitudes and perceptions were assessed using a combination of open-ended questions and a set of statements in a 5-point Likert scale. Open-ended questions allowed the fishers to express their opinions more freely about what was currently missing in terms of fisheries regulation in BA and BK. The Likert-scale statements allowed for quantification of predetermined topics including fishers' attitudes toward access and resource-use regulations, fishers' perceptions of performance of local authorities concerning enforcement of regulations; and fishers' willingness to join formalized groups.

We conducted research in BK from April to August 2007, focusing on the small-scale fisheries sector of commercial divers. We focused on this sector because this is one of the most important communities in terms of extraction of benthic resources in the NGC. We conducted seven semi-structured interviews, five with key fishers focused on internal organization of formalized groups (typically fishing cooperatives) and the presence of fishery-related local arrangements in the community. Two additional interviews focused on the local implementation and enforcement of regulations and were conducted with a local governmental authority⁹³ and a local leader of the permit holders' sector.

In BK, the structured interview was applied to fishers belonging to the major groups of divers in town that were active in 2007 (six groups), covering the topics described in previous paragraphs. Because of the high number of fishing groups in BK, we added a set of questions about fishery-related local arrangements that was not used in

⁹³ From CONAPESCA (the National Fisheries and Aquaculture Commission) (the role and full name of governmental agencies are described later on).

the BLA interviews. Even though the selection of interviewees was not random due to the lack of updated information on these groups' members, whenever possible the number of interviews was distributed among groups more or less in proportion to an estimate of the number of boats working for each group at the time interviews were performed. In BK, a total of 45 structured interviews were conducted with 1-2 crew members from 40 pangas, out of approximately 80 active pangas involved in commercial diving in town (resulting in information from ~50% of active pangas at the time). Eighty-nine percent of interviewees were panga captains (n=40). The captain is the person in charge of the boat and is generally the most experienced and knowledgeable fisher and the one who tends to make the decisions about fishing (Moreno et al. 2005).

We conducted research in BA from mid November to early December 2008, focusing on the entire small-scale fisheries sector (diving, gillnet and trap fishing). This was possible given the small size of this community that allowed us to extend the study to include other fishing sectors in addition to diving. We conducted eight semi-structured interviews total. Five of these interviews were conducted with key fishers and focused on internal organization of formalized groups (typically *Sociedades de Producción Rural* or SPRs⁹⁴) and fishery related local arrangements in the community. Three interviews targeted officials representing governmental fisheries and environment agencies⁹⁵ and these interviews focused on local implementation of regulations, enforcement, and access

⁹⁴ An SPR (Society of Rural Production) is a type of formal organization commonly used in Mexico for any type of rural industries, services and productive activities, including fisheries.

⁹⁵ One from each of these agencies: 1) CONAPESCA (the National Fisheries and Aquaculture Commission), 2) SEMARNAT (the Secretary of Fisheries and Agriculture), and 3) CONANP (the National Commission of Natural Protected Areas) (the role and full names of governmental agencies are described later on).

issues. The structured interviews were conducted with 30 panga captains out of 37 active pangas dedicated to small-scale fishing in this town (Avendaño et al. 2009), on the same topics as for BK (except for the section on local arrangements). This resulted in information from ~80% of active pangas at the time. In addition, we conducted seven unstructured interviews with key informants aimed to explore the link between the presence of communal land tenure and the emergence of a strong sense of use-rights over local fishing grounds as perceived by community members

3. Non-institutional attributes of Bahía de los Ángeles and Bahía de Kino's fisheries

The main non-institutional attributes of these communities' fisheries are summarized in Table 1.

3.1. Demographic, geographic, and fishery characteristics

Bahía de los Angeles (BA) and Bahía de Kino (BK) are both rural communities situated by the coast of the Gulf of California (GC), Mexico (Figure 1). They differ significantly in size and isolation from major urban centers. BA is a very small and isolated community of 527 inhabitants (INEGI 2005), situated in the state of Baja California over 500 Km from the nearest major city⁹⁶ where marine resources can be marketed and redistributed to other regional, national and international markets (US and Asia). In contrast, BK is a much larger community of about 5,000 inhabitants (INEGI 2005) located in the State of Sonora. BK is only 100 Km from Hermosillo (the state

⁹⁶ At 555 Km from Ensenada (~260,000 inhabitants), 650 Km from Tijuana (~1.29 million inhabitants), and 800 Km from Mexicali (the state capital) (~900 thousand inhabitants), all next to the United States (US) border.

capital)⁹⁷, which is the primary destination of local marine resources prior to redistribution to regional, national and international markets.

Historically, commercial extraction of marine resources began and boomed more or less simultaneously in both communities. In the surroundings of BA, mining was the main economic activity during mid twentieth century, but the importance of marine resources exploitation started to increase steadily beginning in the late 1930's⁹⁸ (Danemann and Ezcurra 2007). In BK, the first registries of permanent human (modern) settlements were fishers in rudimentary fishing camps in the 1920's, and fishing activities started to increase dramatically in the 1930's and 1940's (Bahre and Bourillón 2002; Fernández 2003; Moreno et al. 2005b). The growth in fisheries was largely due to an increasing demand for the marine resources for national and international consumption like the totoaba⁹⁹ (*Totoaba macdonaldi*), shark species¹⁰⁰, and sea turtles¹⁰¹ (mainly black and green turtles *Chelonia spp.*) (Bahre and Bourillón 2002; Fernández 2003; Danemann and Ezcurra 2007). Both communities harvested these species.

Also, the development rate and population growth of these communities was quite different, as evidenced by current population sizes. Because of its remote location, BA was less subject to rapid influxes of new settlers. Thus, relatives of the families that first

⁹⁷ With 640,000 inhabitants (INEGI 2005).

⁹⁸ Earnings from mining fluctuated widely and by the 1950's the local economy shifted to sea turtle exploitation (Danemann and Ezcurra 2007).

⁹⁹ The totoaba is a fish endemic to the Gulf of California. From about 1910-mid 1920's the gas bladder of the female totoaba was the only part of the animal that was traded to Asian markets and the rest of the fish was usually discarded. Large amounts of totoaba flesh started to be exported to US markets around mid 1920's (Bahre and Bourillon 2002).

¹⁰⁰ Commercial fishing for shark developed in late 1930's for shark liver (a major source of vitamin A), shark skin, and shark fins (Bahre and Bourillon 2002).

¹⁰¹ Sea turtle fishing increased during the 1950's, as turtle flesh became popular in Mexico as well as in the United States (Fernandez 2003). By the 1990's, sea turtle populations had declined dramatically and the species were protected and the legal fishery eliminated.

settled permanently in the area comprise most of the population today (Danemann and Ezcurra 2007). In contrast, BK has received several immigration pulses of people displaced from other economic activities (mainly agriculture) from different parts of Mexico as well as fishers from within Sonora and southern states (Fernandez 2003, Moreno et al. 2005). Consequently, BK shows a more heterogeneous population than BA. The higher growth rate experienced by BK and other communities in the Sonoran coast of the GC was fueled by a series of governmental policies that stimulated migrations to the coast (all over Mexico) during economic hardships (Alcalá 2003; Greenberg 2006), and technological innovations like irrigation systems and roads¹⁰² that facilitated the proliferation of human settlements and extensive agricultural fields near the coasts (Fernández 2003; Moreno et al. 2005b). BA was comparatively less affected by these influences due to its isolated location. Nonetheless, today both communities are growing rapidly, as are other villages and cities in the GC region (Bahre and Bourillón 2002; Danemann and Ezcurra 2007).

Today, most of the economic activities occurring in both communities depend upon marine and coastal resources. However, the size of the SSF fleet and the number of fishers and species involved are substantially smaller in BA compared with BK. SSFs in BA consist of about 70 fishers and 37 boats (Locally called ‘pangas’) (Avendaño et al. 2009) and make use of three main fishing gears: 1) gillnet fishing, which primarily targets flounder (*Paralichthys californicus*) and species¹⁰³ associated to this fishery; and

¹⁰² The road that connects Bahía de Kino with the state capital (Hermosillo) was built in 1953 (Fernandez 2003).

¹⁰³ Angel shark *Squatina californica*, Guitarfish *Rhinobatos productus*; Rays *Dasyastis Brevis*, *Gymnura marmorata*, and *Myliobatis californica*.

shark species (mainly *Mustelus spp.* and *Galeorhinus spp.*; 2) trap fishing, which mainly targets octopus (*Octopus bimaculatus* and *O. hubbsorum*) and fish species (mainly sand basses *Paralabrax auroguttatus* and *P. maculatofasciatus* and species¹⁰⁴ associated to these fisheries); and 3) commercial diving, which targets octopus (*O. bimaculatus* and *O. hubbsorum*), sea cucumber (*Istiotichopus fuscus* and *I. inornata*), and several species of clams (e.g., *Megapitaria squalida*, *Argopecten ventricosus*) (Danemann and Ezcurra 2007; Valdez Ornelas and Torreblanca 2008; Torreblanca et al. 2009). Fishers' dependency on fishing is high, with 60% of respondents with no alternative occupation other than fishing. Additionally, about half of respondents with alternative occupations other than fishing, have fishing as their primary source of income.

In contrast, in BK approximately 800 fishers and 200 active pangas are involved in SSFs in this community (Moreno et al. 2005b). A total of 66 species are harvested by these small-scale fishers, of which 35 are regarded as the primary targets of fishing trips (Project PANGAS, unpublished). About 80 pangas were active in commercial diving in BK at the time this study was conducted (2007). Divers mainly harvest pen shells (mostly *Atrina tuberculosa*, and occasionally *Atrina maura*, *A. oldroydii* and *Pinna rugosa*), octopus (*Octopus spp.*), and fishes [mainly groupers (*Mycteroperca rosacea* and *M. jordani*) and snappers (*Hoplopagrus guentherii* and *Lutjanus novemfasciatus*)]. Sea cucumber (*Isostichopus fuscus*) is also an important diving fishery, though clandestine because no authorization to harvest this species has been granted in the area (Cinti et al. 2010a). In contrast, the sea cucumber fishery is legal in BA. Smaller quantities of lobsters

¹⁰⁴ Whitefish *Caulolatilus princeps* and Mexican hogfish *Bodianus diplotaenia*.

(*Panulirus spp.*), rock scallop (*Spondylus calcifer*), several species of clams (*Megapitaria squalida*, *Dosinia spp.*, and others) and snails (*Hexaplex nigritus*, *Strombus galeatus*, and others) are also harvested¹⁰⁵. BK fishers are also highly dependent on fishing to make a living, with fishing being the only source of income for 71% of interviewees and commercial diving being the primary source of income for 93% of interviewees (Cinti et al. 2010a).

3.2. Condition of fishery resources

The Midriff Islands Region, where these two communities are situated, is one of the most productive regions in the GC. Due to topographic and oceanographic features that generate strong currents and water mixing, this region shows the highest surface temperature, nutrients, and CO₂ of the GC (Álvarez-Borrego 2007). This results in exceptionally high levels of primary productivity and biological diversity (Zeitzschel 1969; Alvarez-Borrego and Lara-Lara 1991; Brusca et al. 2004).

Nonetheless, even in this highly productive environment, although the two communities have many demographic and geophysical differences, many of the primary fisheries in both communities (e.g., totoaba, sharks, and sea turtles) have experienced similar boom and bust cycles throughout their history. Over the last few decades, the state of fishery resources has followed similar tendencies in both communities as is the case of other regions in the GC. Top predator fisheries (sharks, Gulf Coney *Epinephelus acanthistius*, groupers *E. itajara* and *Mycteroperca spp.*) have been replaced with

¹⁰⁵ Some products are harvested in small amounts because they are overfished and consequently scarce even though they get a high price in the market (e.g., lobster, rock scallops, some species of clams). Other species are harvested in small quantities because they get a very low price in the market (some species of snails and clams).

fisheries harvesting species in lower trophic levels (herbivores), smaller in size and with lower market prices (Sala et al. 2004; Sáenz-Arroyo et al. 2005; Valdez et al. 2007). In addition, important declines in production have been observed in many current target species in both communities. In BA, recent assessments conducted in 2007 through analysis of biometric measures and/or fishing effort suggest that populations of main target species appear to be deteriorating, showing signs of severe decline in some cases [e.g., sea cucumber, sharks (particularly *Galeorhinus spp.*), sand bass, and flounder] (Valdez and Torreblanca 2008). In BK, the primary target species of commercial divers (as well as other species harvested in the community) are thought to be overexploited (Moreno et al. 2005a; Moreno et al. 2005b; Cinti et al. 2010a, Cinti et al. 2010b). However, this assertion is mainly based on fishers' perceptions of resource abundance since information on fisheries conditions is either unavailable or unreliable (see section 4.2.2.1. for a description of the problems with official statistics in both communities).

Perhaps, a useful qualitative indicator of resource condition in each community's fishing grounds might be how far the fishers move in search for resources that are no longer readily available close to their home communities. It has been documented that three decades ago BK's fishers did not need to travel long distances to find profitable catches, and used to fish for the day in the surrounding areas of BK (Fernández 2003; Moreno et al. 2005b). The high immigration rate and increasing demand for marine resources over the years resulted in increasing fishing pressure, and consequently decreasing resource abundance (Moreno et al. 2005b). Nowadays, BK fishers (particularly the divers) are known throughout the GC for being highly migrant, using

areas as far as Isla de Ángel de la Guarda and the coast of the Baja California Peninsula (Fernández 2003; Moreno et al. 2005b; Moreno-Báez et al. in press) (Figure 1) and states south of Sonora (Sinaloa or Nayarit) (Cinti et al. 2010a).

In contrast, BA fishers still find it profitable to fish in the surrounding areas of BA and generally do not move further (Danemann et al. 2007) (Figure 1). Nonetheless, as mentioned earlier this does not necessarily imply that local fishing grounds are in good shape. An important observation is that even though BA is difficult to access by land, accessing BA's fishing grounds by sea is relatively easy (Valdez and Torreblanca 2008). While the minimum distance (straight line distance by sea) between the Sonoran coast and BA is only 87 Km, the closest fishing communities on the Baja California peninsula are at 250 Km (San Felipe to the north) and 300 Km (Santa Rosalía, in Baja California Sur, to the south) from BA (straight line distances by sea). This may explain why BA's fishing grounds are more frequently visited by small-scale fishers from Sonora (particularly from Guaymas, Bahía de Kino, Puerto Libertad and Puerto Peñasco) and the Pacific side of the Baja California peninsula (e.g., Guerrero Negro) (Danemann and Ezcurra 2007)¹⁰⁶. These communities are highly populated and may represent a real threat to the marine resources of BA, together with other fleets' impacts (large-scale and sport fishing).

¹⁰⁶ Nonetheless, sport fishers from San Felipe and Santa Rosalía are frequent visitor of the islands surrounding BA (Danemann and Ezcurra 2007).

4. Institutional attributes of Bahía de los Ángeles and Bahía de Kino's fisheries

The main institutional attributes of these communities' fisheries are summarized in Table 1.

4.1. Legal framework for fisheries in Mexico (applicable to both fishing communities)

Fisheries regulation in Mexico is shared by two federal agencies, SAGARPA¹⁰⁷, the Secretary of Fisheries and Agriculture, and SEMARNAT¹⁰⁸, the Secretary of the Environment and Natural Resources. SAGARPA, via CONAPESCA¹⁰⁹, its National Fisheries and Aquaculture Commission, is the primary agency in charge of fisheries regulation, issuing licenses in the form of fishing permits (referred as CONAPESCA's permits hereafter), authorizations or concessions. CONAPESCA is also in charge of enforcing regulations related to fishery resources that fall under SAGARPA's jurisdiction.

On the other hand, SEMARNAT, via DGVS¹¹⁰, its General Division of Wildlife, regulates the use of species listed "under special protection"¹¹¹ and, in the case of benthic resources listed in this category (e.g., sea cucumber and rock scallop), may authorize their harvest through a species-specific permit¹¹² (referred to as SEMARNAT's permit hereafter). SEMARNAT is also in charge of the establishment and management of marine protected areas (MPAs) throughout Mexico via CONANP¹¹³, the National

¹⁰⁷ Stands for "Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación".

¹⁰⁸ Stands for "Secretaría de Medio Ambiente y Recursos Naturales".

¹⁰⁹ Stands for "Comisión Nacional de Acuacultura y Pesca".

¹¹⁰ Stands for "División General de Vida Silvestre".

¹¹¹ Species included in the norm NOM-059-ECOL-1994 and subsequent modifications.

¹¹² Called "Predios Federales Sujetos a Manejo para la Conservación y Aprovechamiento Sustentable de Vida Silvestre" (Federal Polygons for the Conservation and Sustainable Use of Wildlife).

¹¹³ Stands for "Comisión Nacional de Áreas Naturales Protegidas".

Commission of Natural Protected Areas. PROFEPA¹¹⁴, the Federal Agency for the Protection of the Environment, is SEMARNAT's enforcement body. The Navy is also empowered to provide enforcement support to both CONAPESCA and PROFEPA if needed.

In the Gulf of California, and throughout Mexico, CONAPESCA's fishing permits are the most widely used management tool¹¹⁵ to grant access to marine resources. Fishing permits may be granted to any corporate entity [e.g., formalized groups like cooperatives or SPRs (see footnote number 4)] or individual for four years or less (2-5 years in the new law), and they are renewable upon compliance with regulations. The permit specifies the particular species (e.g., octopus permit, lobster permit) or group of species¹¹⁶ to be harvested, within a broadly specified region (Bourillón-Moreno 2002). Generally, access to the species (or group of species) within that area is not exclusive, since several permits for the same species and area may be granted to different permit holders. Nonetheless, as we will describe later, variations in the way this tool is implemented may occur between states.

Each fishing permit specifies the number of boats¹¹⁷ that are permitted for use to harvest the species authorized in the permit, together with technical specifications of the fishing equipment(s) (boat, motor and fishing gear). A boat that belongs to a permit

¹¹⁴ Stands for "Procuraduría Federal de Protección al Ambiente".

¹¹⁵ To date, fishing concessions have only been granted for a few benthic resources of high commercial value (e.g., abalone, lobster) on the west coast of Baja California Peninsula and the Caribbean Sea (Bourillón-Moreno 2002). In the GC only a few SEMARNAT's permits have been issued for the harvest of sea cucumber, rock scallop, and ornamental fish used for the aquarium market.

¹¹⁶ Some permits are issued for several species under a generic category, e.g. the escama (fish with scales) permit allows fishing about 200 species of fish, or the 'shark permit' which includes several species of elasmobranchs.

¹¹⁷ Referred as 'número de espacios'.

holder can be registered in more than one permit. That is, the same boat can be entitled to fish several species, depending on the amount of permits registered to a specific boat. Permit holders are the only ones who can legally land and declare the catch at CONAPESCA's regional offices (Bourillón-Moreno 2002). Permit holders are also the only ones who can provide legal invoices (or "facturas") for the product extracted directly from sea¹¹⁸. These invoices certify legal ownership of the harvest, and are necessary to sell and transport the catch to regional or international markets. Note that permit holders are only allowed to harvest and sell resources that have been caught using the fishing equipment(s) (boat, motor and fishing gear) registered in their permits. The use of one's permit to buy and sell catch caught by fishing equipments not registered in the permit is locally called 'amparo' ('sheltering' catch from illegal sources) and is prohibited by law.

SEMARNAT's permits (as well as CONAPESCA's fishing concessions) may provide exclusive use-rights over one or more species within a specified polygon, following the guidelines of a management plan, for which a quota must be authorized (this permit does not specify a number of authorized boats as is the case of CONAPESCA's permits). Note that this tool provides exclusive access to the species but not to the polygon since other fishers may access the area to harvest other species¹¹⁹. This permit may be granted to any formalized group or individual for one year and it is renewable upon compliance with regulations.

¹¹⁸ Buyers without a fishing permit are allowed to buy product from permit holders or from other buyers without a fishing permit and resell it. They have to carry on with them a document that certifies the legal possession of the catch and specifies the fishing permit under which the product in question was harvested.

¹¹⁹ Unless the harvest of all commercial species within that area is granted to the same permit holder.

MPAs have been also used as tools in the GC for conservation and fisheries management purposes. In the region, the most common type of MPA used is the Biosphere Reserve¹²⁰, for which zones with different degrees of protection must be delimited (typically one or more core zones with higher level of protection and a buffer zone with lower level of protection). According to the law¹²¹, preferred access to MPAs for the conduct of commercial activities should be provided to members of the communities inhabiting the area at the moment the MPA is established, following the guidelines of its management plan. Also, the law¹²² encourages participation of municipal and state governments, and members of the community, in decision-making concerning the use and management of MPAs.

4.2. Formal institutional setting in Bahía de los Ángeles and Bahía de Kino's fisheries and its performance on-the-ground

4.2.1. Presence of fisheries authorities

Even though the presence of fisheries authorities is quite different in each community (absent in BA and permanent in BK), the outcomes in terms of enforcement are similar —very little enforcement in either community.

In BA, there is no permanent presence of governmental agencies in charge of fisheries regulation or enforcement (CONAPESCA or PROFEPA). This represents a major impediment for local inhabitants to fulfill administrative paperwork (they have to travel ~550 Km) and for these agencies to provide adequate support for monitoring and

¹²⁰ Biosphere reserves must be established in regions of high ecological value to the country.

¹²¹ 'Ley General del Equilibrio Ecológico y la Protección al Ambiente' (LGEEPA), www.semarnat.gob.mx, and its bylaws concerning MPAs. See Art. 48 and 64 BIS-1, LGEEPA.

¹²² Art. 67, LGEEPA.

enforcement. Information collected through interviewing suggests that PROFEPA (in charge of enforcing MPAs rules and SEMARNAT's permits) may have visited the community only twice in 2008. In addition, it was common to hear that information regarding CONAPESCA's rounds (to enforce fisheries rules) is often available to the community in advance to this agency's visit, and local people behave differently (e.g., do not go out fishing) while they are visiting. CONANP, in charge of administering local MPAs, is the only agency with permanent presence in BA, but monitoring and enforcing fisheries' rules is not its role. CONANP could only inform the corresponding agencies when illegal activities are detected. Due to logistical constraints, by the time these agencies arrive (when they do) any evidence of illegal behavior has already vanished.

In BK, on the other hand, even though there is permanent presence of fisheries authorities (only CONAPESCA), their enforcement capacity is also limited because resources and personnel are often scarce and inter-institutional agreements and coordination among the different agencies involved (CONAPESCA, PROFEPA and the navy) is often lacking (Moreno et al. 2005b; Cinti et al. 2010b).

4.2.2. Management tools

The most common management tool used for the harvest of fish and invertebrate species in BA and BK are CONAPESCA's fishing permits. In addition, a few of SEMARNAT's permits have been granted in BA (none in BK) for the harvest of sea cucumber, and both communities have biosphere reserves within the limits of their fishing grounds.

4.2.2.1. CONAPESCA's permits

Table 2 shows the permit holders with permission to operate in BK in 2007 (for four main target species of commercial diving only¹²³) (Cinti et al. 2010a) and in BA in 2008 (for all fishing sectors) (Source: Subdelegación de Pesca de SAGARPA, Ensenada), and number of boats allowed to operate per permit and species. Note that each permit holder may hold several permits (one for each species) and the same boat may be entitled to fish several species (the boats of a permit holder that are registered under different species are usually the same).

[Table 2 about here]

There are important differences but also similarities in the way this tool and the requirements associated to this tool are implemented and their performance in practice in both communities.

One of the similarities shared by these two fishing communities is that fishery statistics associated with permits are poor indicators of local fishery production. This is in part because fishing takes place in areas outside of these communities' jurisdictions (in another port's jurisdiction) and these harvests are declared as if they were harvested within port jurisdictions (among other reasons)¹²⁴. Nonetheless, this takes place through different paths in each community.

In BA, there are permit holders with authorization to fish in the BA area who do not operate (nor reside) in the community. These permit holders use their permits to

¹²³ Permits for species targeted by other fishing sectors in BK are not shown.

¹²⁴ Other factors may include unreported catch, species that are declared under other species names or under generic categories, lack of records of changes in fishing effort or in technological innovations over time.

shelter catch captured outside BA's jurisdiction (Danemann et al. 2007). Of the 19 permit holders authorized to fish locally in 2008, only 8 (5 individual permit holders and 3 *Sociedades de Producción Rural* or SPRs) resided or were based (in the case of SPRs) in the community, totaling 37 pangas with authorization to operate in the area. The rest (9 individual permit holders and 3 SPRs) were based in major cities within the state of Baja California (e.g., Ensenada, Tijuana, Guerrero Negro), totaling 30 pangas with authorization to operate in the area. Locally based permit holders operate almost exclusively in BA, commercializing most of the fishing products captured by local fishers. In contrast, permit holders based outside BA are generally dedicated to commercializing fishing products that they buy and/or extract in places others than BA (usually localities within the state from the Gulf and the Pacific side of the peninsula). These permit holders use their fishing permits to shelter catch harvested outside BA jurisdiction, or simply make profit by selling their invoices ("facturas") to "legitimize" the commercialization of products caught without a permit.

In BK, on the contrary, even though most permit holders working in commercial diving operate (and reside) in the community, it is common that these permit holders commercialize (and declare at least in part) product harvested in other communities' jurisdictions (e.g., in BA's fishing grounds) primarily because of the highly mobile nature of local fishers (Cinti et al. 2010a).

Another similarity between communities involving permits is that the number of pangas authorized to each permit holder is rarely respected and permit holders generally buy product (and shelter it using their permits) from any local fishermen willing to sell

(e.g., a permit holder with a permit for octopus may buy octopus from any panga harvesting octopus in town). Although illegal, this practice is widely prevalent throughout the GC region (Bourillón-Moreno 2002; Cinti et al. 2010a). In both cases, available permits are not effective in limiting the amount of product that is being harvested since they are being used to launder the product that is harvested by most of the fishers in these communities.

Nonetheless, in BA locally based permit holders and local fishers do appear to comply with regulations in terms of the species they are allowed to capture. This is not the case in BK. Note that the primary targeted species in BA (for all fishing gears) are species for which local permit holders have permits (octopus, sea cucumber and fish species), which does not seem to be the case of BK where, for example, sea cucumber or shrimp are major unauthorized¹²⁵ fisheries. Lobster fishing is another good example of a species for which no permit has been issued for BA and it is not a target species of BA fishers. However, BK divers cross the GC to harvest lobsters inside BA's fishing grounds and shelter these catch using BK's lobster permits. Also, the need to have a fishing permit (the fishers themselves or someone else in the community to whom they could sell their product to) to legally harvest species was a recurrent complaint among BA fishers, more than in BK (see section 5.1). At least in some aspects there seems to be a stronger "culture of legality" in BA compared to BK. Interestingly, BA fishers' tendency to operate legally occurs in spite of the fact that there is an almost total absence of enforcement authorities.

¹²⁵ In 2008, a few shrimp permits (for about 10-20 pangas total) were up-to-date in BK, though about 200 pangas fish the species every year.

Another difference between communities is how fishing permits are allocated by authorities. In the state of Baja California (which includes the BA region), permits for individual benthic species (e.g., octopus permits) are granted to different permit holders without spatial overlap, while in BK these permits generally overlap (see Cinti et al. 2010a). Although fisheries laws are common to both states (they are federal laws), there are variations in the way each state's authorities interpret and implement this legislation. In Baja California, avoiding granting fishing permits for benthic species that overlap geographically whenever possible is a strategy to avoid conflicts between permit holders that may arise from the common use of the same area (SAGARPA's personnel, Pers. Comm.).

At least in theory, CONAPESCA's permits for benthic species as implemented in BC are similar to fishing concessions or SEMARNAT's permits in that they all provide exclusive access to a species within an area, though they do not prevent other fishers from entering the area to fish other species. Nonetheless, insights from interviews suggest that each permit holder's individual boundaries are not taken into account and local fishers (and permit holders) fish wherever they can find resources. This is part of an unwritten agreement among local residents stating that as long as you belong to the community (i.e., perceived as local resident), you are allowed to fish anywhere within the limits of BA fishing grounds. Individual boundaries start to matter when there are outsiders coming in. The affected permit holders generally do not complain about this because they (and the fishers that sell their product to them) also fish inside other permit holders' polygons. Furthermore, they report that many times these polygons are not even

suitable for finding the species that was granted. Similarly, in BK permits' jurisdictions are generally not taken into consideration and local fishers fish where it is convenient to them, within or beyond their jurisdictions (Cinti et al. 2010a).

Finally, in BA locally based permit holders (not the ones that operate outside BA) generally participate in fishing trips (with some exceptions) and are generally perceived by local fishers as legitimate members of the community (also with some exceptions). In BK instead, permit holders are usually absentee operators, commonly perceived by the fishers as a totally separate group that acts –almost always- against fishers' interests.

4.2.2.2. SEMARNAT's permits

Figure 2 shows the polygons and volumes (quotas) that were authorized to each BA permit holder (with SEMARNAT's permits) from late 2007-late 2008 for the harvest of sea cucumber. The performance of SEMARNAT's permits as a management tool is similar to CONAPESCA's permits in that polygons are not generally taken into account and sea cucumber is fished wherever it can be found in harvestable amounts. These permits may also be easily used to shelter sea cucumber captured far from BA fishing areas or fished by others than the people authorized in the permits.

4.2.2.3. Biosphere reserves

In BA, the 'Reserva de la Biósfera (biosphere reserve) Canal de Ballenas y Salsipuedes' (RB. CBSS), was formally established in June 2007. This presidential decree occurred after a long process that was initiated in 1999 and involved the participation of members and social organizations of the community, federal and state agencies, and others (researchers, NGOs, etc) with interest in the area (SEMARNAT

2005). The reserve comprises about 385,000 hectares and has the dual purpose of preserving ecological values and enhancing fishery productivity. Importantly, its decree specifically states that preferred access to commercial activities inside the reserve must be granted to members of the community adjacent to the reserve. Also, the reserve extends over the full range of local fishers' fishing grounds (Figure 1), which is uncommon in the GC.

However, given the recent implementation of the reserve, in late 2008 (when this study was taking place) there were still no restrictions to fishing in place, besides a number of core (non-extractive) zones¹²⁶ that are relatively small (~200 hectares total) and do not affect important fishing zones (Figure 2). The management plan of the reserve was still being developed at that time. This plan, when developed and adopted is expected to set regulations for fishing and other commercial activities within the reserve. This is consistent with insights from interviews that suggest that fishing activities still continue to be as they were before the implementation of the reserve, with fishing taking place where it is convenient to the users, mainly guided by factors like resource abundance (when and where they can find resources), the market, climate conditions, and distance constraints.

Similarly, the Reserva de la Biósfera Isla San Pedro Mártir (RB. ISPM) was established in 2002 in the surrounding of the San Pedro Mártir island (Figure 1), with the same purpose and following a participatory process as the BA reserve (Cudney-Bueno et al. 2009). The island is an important fishing destination for BK fishers (mainly

¹²⁶ Estero San Rafael, Estero La Mona, Ensenada Los Choros, Campo Polilla, Estero de Las Caguamas (East and West) (Figure 2).

commercial divers but also trap fishers) [16], but unlike the BA reserve, it comprises a small fraction of local divers' fishing grounds. This reserve was not the focus of our study, but recent studies suggest that although enforcement and compliance with rules are still inadequate, a reduction in the number of boats fishing inside the core zone (covering 2.6% of the reserve surface) (Figure 2) has been observed over the years (Meza et al. 2008). In addition, a monitoring program of the reserve's species and habitats has been recently implemented, which involves the participation of knowledgeable BK commercial divers who are highly respected and connected with others in the community. This program shows promise to create stewardship and to further incorporate the users in the administration of the reserve.

4.2.3. Fishers' possession of fishing rights and control of means of production

Comparatively, a larger amount of BA fishers hold fishing rights, own the fishing equipment in which they work, and self-support the cost of fishing trips.

4.2.3.1. Possession of fishing rights

In BA 47% of respondents were independent fishers (without fishing permits in their name), 13% were individual permit holders, and 40% were members of two formalized groups holding permits (SPRs). However, one of these groups owns a fishing permit for a species that they rarely harvest and commercializes their main target species (for which they do not own a permit) through permits held by other permit holders in town. Consequently, 63% of respondents (not 47%) depend on external permit holders or independent buyers (without fishing permits) to legally sell their catch.

In BK, in contrast, 82% of respondents were independent fishers, none was an individual permit holder, and 18% were members of formalized groups holding permits. However, none of these groups commercialized their product on their own, meaning that 100% of respondents were dependent on external permit holders or independent buyers to commercialize their catch.

4.2.3.2. Ownership of fishing equipment

In BA, 60% of respondents declared that they own the fishing equipment with which they worked, compared with only 24% in BK. In BK, another 29% of respondents were in the process of buying the equipment from permit holders. This practice, where permit holders encourage fishers to buy their own equipment with permit holders' help, is becoming increasingly common in BK as a way for permit holders to get rid of equipment maintenance responsibilities. It also tends to increase fishers' dependency on permit holders because as long as the fisher is in debt¹²⁷ to the permit holder, the fisher is obliged to sell the product to the permit holder and the permit holder sets the price he chooses (Cinti et al. 2010a).

4.2.3.3. Self-support of fishing trip expenses

Borrowing money in advance to cover the costs of the fishing trips (for gas, food, ice) obliges the fishers to sell the product to the permit holder who provides these funds. In BA only 20% of respondents rely on permit holders (who buy their product) to cover these costs, and 77% cover them on their own or rely on the group to which they are

¹²⁷ The equipment is bought by the permit holder, and the fisher starts paying for the equipment with each fishing trip, using the portion of the earnings that is retained by the boat owner for equipment repairs.

members to cover them. In BK, 91% percent of respondents rely on permit holders or independent buyers to cover the cost of fishing trips, while only 9% cover these costs on their own.

4.2.4. Fishers' formal organization

In BA, the three formalized groups holding fishing permits at the time this study was taking place (SPRs) were constituted almost entirely by fishers (as members) and most showed cooperative behavior (members meet more or less regularly, make monetary contributions to the group, and have developed some rules to work collectively). Only one of these groups functioned as an individual permit holder with a couple of members in control of the group (absentee operators) and the remaining members working as independent fishers (providing the fishing product and not having additional compensations for being members of the group).

In BK, in contrast, most of formalized groups holding fishing permits (principally cooperatives) function in practice as individual permit holders (Moreno et al. 2005b; Cinti et al. 2010a). They are usually constituted by a mixture of family members, others not related to the fishing activity, and a few fishers that were requested to sign at the time the cooperatives were formed. These organizations are seldom cooperatively managed. The few cooperatives holding fishing permits for commercial diving products whose members were all fishers (2 at the time the study was underway) had major administrative problems and did not work cooperatively either.

4.3. Informal institutional setting in Bahía de los Ángeles and Bahía de Kino' fisheries

4.3.1. Perception of fishing grounds' boundaries: the role of land tenure and permits' jurisdictions

In BA, the presence of a coastal ejido¹²⁸ (a system of communal use-rights over the land) has apparently had an important role in how local residents perceive their rights over the marine territory adjacent to the *ejido* land, as if the land rights have been extended to include the sea.

The *ejido* Tierra y Libertad¹²⁹ was founded in 1970, consisting of 415,804 ha and 62 members (Vargas et al. 2007) (Figure 1). It was a “fishing *ejido*” since its foundation, with most of their members dedicated to fishery-related activities and a small percentage to cattle ranching. Today, it consists of about 90 members, with 90% of *ejidatarios* dedicated to fishery-related activities and/or tourism and only 10% to ranching (F. Smith Pers. Comm.).

Interviews suggest that this informal “sense of ownership” over the sea among BA residents and the defense of this territory, started to emerge when the *ejido* and a specific group in close association with the *ejido*, the “Sociedad Cooperativa de Producción Pesquera Ejidal Canal de Ballenas” or SCPPECB (a fishing cooperative), were formed. The SCPPECB was the first formalized fishing organization in BA and was founded in 1970, following the foundation of the ejido. Apparently, one of the

¹²⁸ The ejido system is a system of land reform based on agricultural communal land created by constitutional reform in 1917 (Article 27 of the Mexican Constitution) (Jones 1996). Ejidos consist of a defined governing body (or comisariado), land parcels (or parcelas) and members (or ejidatarios), thus creating an agrarian community or town (or ejido). Ejidal land is communally held, but individuals have long-term use rights to particular parcels that they cultivate (or simply own) individually (Brown 2004).

¹²⁹ Short form of “Ejido Ganadero, Turístico y Pétreo Tierra y Libertad”.

primary reasons for its foundation was the need to acquire fishing permits to legally harvest sea turtle (highly demanded at that time), which were only to be granted to formalized groups (I. Verdugo, Pers. Comm.). Originally the cooperative consisted of about 60 members (most ejidatarios) and 15-20 small-scale boats, which targeted sharks, sea turtle¹³⁰ (locally called caguama or cahuama), clams, and fish species (like groupers) (Figure 3 shows a historical invoice of this cooperative for the delivery of sea turtle by a local fishermen).

When *ejidos* were established in the area, adjacent *ejidos* started to claim the fishing grounds within their limits as theirs, and these limits were generally respected without the need of external intervention (F. Smith Pers. Comm.). The relationship between neighboring *ejidos* and communities (e.g., between ejidos “Tierra y Libertad” and “Confederación Campesina”) (Figure 1) has always been relatively good and crossing each others limits was generally accepted provided that only members of these communities were involved. Nonetheless, it was not until recently (5-10 years ago) that BA residents started to enforce these limits more vigorously, upon the arrival of pangas from distant communities from Sonora (from Bahía de Kino, Puerto Libertad, Guaymas), and the pacific side of the Baja California peninsula more recently (from Guerrero Negro) (Figure 1). Unlike the arrival of pangas from adjacent communities, boats from more distant communities are considered an intrusion by BA residents, which motivates the demand for support to fisheries authorities (often without satisfactory response),

¹³⁰ During the 1960's, BA was the main producer of sea turtle of Mexico (Caldwell 1963), and the SCPPECB was the only group allowed to legally harvest and commercialize them in town. The permit granted to this group allowed them the harvest of 60-100 turtles per month.

including formal requests by the *ejido* leader (*comisariado*) to expel the outsiders. Local residents generally resent not only the intrusion of pangas but also the arrival of outsider fishers that may have the opportunity to work as crew members in local pangas.

Interestingly, the boundaries of the biosphere reserve established in 2007 in BA coincided almost perfectly with the boundaries of the *ejido*, since local fishers operate within these limits and the reserve was intended to include the full range of local fishing grounds (Figure 1). Considering this and the fact that the decree creating the reserve mandates that preferred access to fishing (and other commercial activities) within the reserve must be granted to those residing next to the reserve; it could be argued that the reserve somehow “formalized” pre-existing informal rights over local fishing grounds. However, for this to be effective BA fishers must still be granted legal rights to fish in the area by fisheries authorities (CONAPESCA) in the form of permits or concessions (to individuals or formalized groups), even when the reserve is administered by a different agency (SEMARNAT through CONANP).

In BK, although local residents do not have a history of ownership of the land adjacent to their fishing grounds, they also tend to resent (and reject) the intrusion¹³¹ of pangas from other fishing communities to fish locally. However, unlike BA they are generally willing to accept people from outside the community if these fishers work as crew members in local pangas (Cinti et al. 2010a). Likewise, local divers have more

¹³¹ Access to local fishing grounds by outsider pangas (from southern Sonora, Sinaloa, Nayarit) is a major source of internal conflict, involving local fishers, permit holders, authorities, and other community members (for a description of these conflicts see Cinti et al. 2010).

chances to be accepted in other communities (at least within Sonora) (e.g., in Guaymas) if they move without their panga and work as crew members in local pangas.

Interestingly, while BK divers perceive as their own territory the area within the general jurisdiction of all fishing permits granted in the community for the species they target (Figure 1), whether or not they individually hold a fishing permit, in BA local fishers tend to perceive as their own territory the area within ejido borders. That is, they do not seem to take much into consideration the geographic jurisdiction of the fishing permits held by them or by others in the community. Note that for example fish species' permits generally include a wider area than the delineated by the ejido (e.g., some are valid for the entire GC), and benthic species permits generally include small sectors granted within ejido borders. Overall it seems that neither BK nor BA fishers conform to or enforce the individual boundaries of the permits they hold (or work under), but they do care about and defend¹³² an area that they perceive as belonging to their community as a whole, particularly when there are “outsiders” coming in (though who is considered an outsider varies between them).

5. Fishers' attitudes toward fisheries regulation in Bahía de los Ángeles and Bahía de Kino fisheries

In spite of the many differences between these two communities, fishers' attitudes concerning different aspects of fisheries regulation were quite similar (Table 3).

¹³² In BK, fishers (and other residents) react organizing protests to authorities or blocking the main and only paved road to town with their pangas. In BA, the whole community organizes to expel outsiders, generally without authorities' intervention. The isolation of BA makes it relatively easy for local residents to try simple strategies like agreeing not to sell or provide drinking water to “intruders” to deter them from staying longer in the community.

5.1. What is missing in (BK or BA) in terms of fishery regulation to improve the condition of fishery resources? (open-ended question)

Granting fishing permits to local fishers and increasing support from fisheries authorities (in enforcement and local presence) were two common concerns frequently mentioned by BA and BK fishers (Table 3 shows the 4 most frequently mentioned categories for each case). For BA, these two categories showed the highest percentages of response (57% and 43% of respondents, respectively). Easing the requirements and paperwork for local fishers to access fishing permits and regulating resource-use (e.g., implementing temporal closures, mesh size, quotas) were additional main concerns of BA fishers (~20% of respondents each). In BK, the four most mentioned categories obtained similar percentages of response (between 22 and 27%). Controlling the entrance of outsider pangas and increasing respect of regulations were additional main concerns of BK fishers.

5.2. Perception of performance of fisheries authorities (Likert-scale)

Both communities showed relatively high percentages of respondents (>50%) disagreeing with the idea that fisheries authorities have had an important role in preventing the depletion of fishery resources, and this percentage was higher in BA (77% in BA vs. 50% in BK, Table 3). Also, over 80% of respondents in both communities agreed that in order to improve the situation of local fisheries, implementation and enforcement of regulations by local authorities was needed.

5.3. Attitudes towards access and resource-use regulations (Likert-scale)

Both communities showed a large percentage of respondents (>60%) agreeing that only people from their own community should be allowed to fish in local fishing grounds. However, this percentage was considerably higher in BA (87% in BA vs. 64% in BK, Table 3). Generally, there is a tendency to support the protection of local fishing grounds from outsiders, especially if outside encroachment involves not just fishers but pangas from outside the community.

In both cases, fishers' attitudes toward resource-use regulations suggest that most respondents tend to support the idea that most of their target species need some form of formal regulation to conserve the species (Table 3). However, respondents generally perceive that species with seasonal accessibility (e.g., species that migrate or that are not accessible for fishing all year round) are not so vulnerable to overfishing and thus would not need much formal protection compared to species that are available for harvest year round (see percentages by species in Table 3).

5.4. Usefulness of fishing licenses to limit access (Likert-scale)

Fisher's perception of the usefulness of fishing permits to limit access to their fishing grounds were similar for both communities, with about half of respondents agreeing with the idea that fishing permits were a useful tool to limit access to local fishing grounds (50% in BA vs. 40% in BK) and the other half evaluating this tool negatively (47% in BA vs. 60 in BK) (Table 3).

5.5. Usefulness of the biosphere reserve (only for BA)

In BA we asked the fishers if the nearby reserve had benefitted them and how, if it had been detrimental to them and how, and whether or not, if given a choice, they would support the existence of a reserve. Around 70% of respondents said that the reserve was neither beneficial nor detrimental to them (Table 3). This lack of strong feelings on the topic may simply reflect the fact that the reserve was created recently and there has been little time to evaluate it. In BA, if given a choice, 47% of respondents would support the establishment of a reserve (Table 3). Taking care of resources was one of the main reasons for this response, but for this to be effective respondents commented that enforcement should be increased. Another 30% of respondents would decide not to have a reserve because they fear it would bring additional restrictions on fishing (they already complain about current restrictions to land and camp on islands). Finally, another 10% said it would not make any difference to them if there is or there is not a reserve in place.

5.6. Fishers' incentives to join formalized groups

About half of respondents from both communities would prefer working as a member of a formalized group, mainly because it would allow them improved access to fishing permits and governmental benefits (Table 3). The other half would prefer working independently (not as a member of a group or cooperative) because of the difficulties of working as part of a group (disagreements, conflicts); and greater independence for working and selling one's product that leads to higher earnings.

6. Discussion

By comparing the institutional performance of two case studies of small-scale fisheries in the Gulf of California (GC), this paper aims to improve our understanding of how formal policy tools and local arrangements interact in different settings and under what circumstances they are effective in influencing stakeholders' behavior. This paper also examines the presence of factors (institutional, non-institutional, fisher's attitudes and perceptions) that may influence the capacity of these communities for fisheries improvement in the mid- to short- term and for local stakeholders to take a more active role in resource management.

Our findings suggest that neither Bahía de los Angeles (BA) nor Bahía de Kino's (BK) fishery stakeholders have been able to manage their resources sustainably. Regardless of these communities' differences particularly in terms of isolation from major roads and cities (and markets) and in the number of fishers and boats, fishery resources are clearly over exploited in both communities, and this occurs in one of the most productive regions in the GC. Although many factors may be acting to produce this outcome, we argue that the open access nature of both communities is probably the most important factor. This open access results from a variety of factors including the lack of enforceable restrictions (formal or informal) on the number of people who access the fishery (the exclusion problem) and on the amount of resources that the people entering the fishery are able to harvest (the subtractability problem) (Berkes et al. 1989; Ostrom 1990). These problems (exclusion and subtractability) are characteristic of the

exploitation of common-pool resources and are at the roots of overfishing (Ostrom 1990; National Research Council 2002; Hilborn et al. 2003).

In BK, the existence of open access is less surprising because this village is easy to access by road and by sea, there is high demand for marine products (for local, regional, and international markets) and there are many local buyers ready to receive these products and transport them quickly to distribution centers either directly or through intermediaries. Also, the amount of people (local and from other villages) participating in small-scale fisheries is high and difficult to limit. And finally, the likely impact of other fishing sectors (industrial and sport fishing) on marine resources in this region is also high. The larger scale and complexity of BK small-scale fisheries may explain why local efforts to limit access and sustainably manage resources in BK have had little success.

Unexpectedly, in a highly isolated environment (at least by road) and with a much smaller number of fishers and boats in the community, BA's fishers have not been able to manage their resources sustainably either. Homogeneity of resource users (e.g., people with similar interests) and a small number of users, both attributes of BA, are characteristics believed to facilitate the emergence of collective action for sustainable use of common-pool resources (Ostrom 1990; National Research Council 2002). However, the impact of a smaller number of users may be small or large depending on the size of the resource base that they exploit. Also, given the same resource base, a smaller number of users may overexploit these resources if they comparatively harvest a larger amount per fishing unit (boat or individual) than a larger number of users. This is a reminder that

both exclusion and subtractability aspects must be considered in understanding fishing (and other CPRs') dynamics.

In the case studies analyzed, even though the extent of each community's fishing grounds (in resource abundance) is unknown (and nearly impossible to determine), the total areas fished by each community's fishers differ significantly, with about 4,300 and 700 squared kilometers in BK and BA, respectively (Duberstein 2009). Although we cannot know for certain, these differences in fishing ground sizes may suggest that the local impact over the resource base of a smaller fleet like the BA fleet can still be significant when the size of the area that they exploit is relatively small. In both communities, the likely impact of small-scale fishers from outside communities plus the sport and industrial fleets should also be considered because they can and often do access these fishing grounds by sea.

In addition, our results clearly suggest that the formal policy tools in place in either community have been ineffective (at the moment) in promoting sustainable fishing practices by fishery stakeholders. Even though these communities differ in a number of ways, neither community has had notable success in developing sustainable fisheries systems. The geographic jurisdiction of individual permits (of formalized groups or individuals) is generally ignored and individual fishers fish wherever it is more convenient to them.

In both communities, informal rights (fishers' sense of ownership) seem to play a more important role than formal regulations in influencing fishers' decisions about where to fish. In BA, regardless of the existence of geographically specific fishing permits (for

benthic species), as long as you belong to the community (i.e., perceived as local resident), local fishers do not object if you fish anywhere within ejido limits. In BK, individual permits' jurisdictions overlap geographically and access of fishing grounds is generally open and unconstrained for local fishers. However, community-defined fishing zones do seem to matter when there are outsiders encroaching into these areas. This resentment of outsiders exists even though “Kineños” (as locally called) themselves are known throughout the GC for being highly migrant and for not respecting other communities' jurisdictional (formal) or informal limits (Cudney-Bueno and Basurto 2009; Cinti et al. 2010a).

In addition, restrictions on the number of pangas allowed to operate per fishing permit are not respected in either community. Permits are not effective in limiting the amount of product that is being harvested since permits are frequently used to register the products that are harvested outside permitted areas and using fishing equipments not registered in these permits.

This raises the question of whether the most commonly used tool in the Region (CONAPESCA's permits) is the most appropriate. Even if enforcement is substantially increased- and if available alternative tools with higher spatial definition and exclusivity (like SEMARNAT's polygons and fishing concessions) were implemented, there is still some question whether fishing behavior of the fishers in these communities would actually change.

However, these results also suggest some potentials that could lead to more sustainable fishing practice in both communities. There is a tendency to willingly share

the fishing grounds among all members in the community (as if use-rights or permits had been granted to the community as a whole), and to protect these fishing grounds from outsiders. In this context, communal property or use-rights might be viable strategies to increase protection of local fishing grounds from unwanted visitors, and incentivize local fishers to craft, implement and self-enforce more legitimate management measures.

The case of the Seri indigenous community of Punta Chueca, situated right next to BK to the north (Figure 1), is unique in the region as an example of communal¹³³ property-rights over the marine area comprised of the Canal del Infiernillo (or Infiernillo Channel) (Figure 1). Formalization of these property rights by the Federal government helped strengthen preexisting informal rights of the Seri tribe over the area and encouraged the emergence of locally-crafted rules to control access by outsiders and to internally restrict use, which have been essential for the sustainability of Seri fisheries (Bourillón-Moreno 2002; Basurto 2005; Basurto 2006). Governmental recognition and support is key in efforts to promote and sustain local-level management systems and/or to develop new ones (Christy 1982; Schlager et al. 1994; Pomeroy and Berkes 1997; Ribot et al. 2006).

However, in Mexico, granting property rights over marine areas is reserved for indigenous groups (like the Seri), and conceding communal rights (of property or use) is not a possibility within Mexican legislation. In spite of this, there are administrative tools available in Mexico's fishery and environmental laws that could be used to provide a

¹³³ These property rights were formally granted to a fishing cooperative within the Seri community. However, in practice these rights are actually considered (by the Seris, and Mexican authorities and citizens) as belonging to the Seri community.

higher level of exclusivity to these communities within the limits of their fishing grounds. For example, through implementation of: 1) ‘regional fishery ordinance plans’ as incorporated into the new fishery law¹³⁴; 2) MPAs covering the fishing grounds of the community and/or ‘ecological ordinance plans’ for land and/or marine environments, according to environmental legislation¹³⁵; 3) fishing concessions granted to formalized groups (e.g., cooperatives or SPRs), although for it to act as a communal right, all or most of the members of the community should be part of the group receiving the right); 4) or combinations of those.

BA is an example of the second alternative. The existence of informal communal rights over the marine area demarcated by the ejido and their geographic overlap with an institutional framework recognized by the Mexican government (the biosphere reserve), makes BA an excellent candidate for strengthening resource stewardship through formalization of preexisting rights. Nonetheless, for this to be effective, given that the reserve is administered by environmental authorities (SEMARNAT via CONANP) and fishery resources are under the jurisdiction of fisheries authorities (SAGARPA through CONAPESCA), fishing rights must be granted by CONAPESCA¹³⁶ (in the form of permits or concessions) to the fishers participating in local fisheries (for the area and species within the reserve). Only then will the clause of the reserve’s decree stating that

¹³⁴ ‘Ley General de Pesca y Acuicultura Sustentables’ (LGPAS), www.conapesca.sagarpa.gob.mx. For ordinance plans, the area to be incorporated into the plan, lists of users, the species subject to use, and the species-specific management plans available for this species must be defined.

¹³⁵ ‘Ley General del Equilibrio Ecológico y la Protección al Ambiente’ (LGEEPA), www.semarnat.gob.mx.

¹³⁶ Unless the species in question is listed as under special protection in which case SEMARNAT through the General Division of Wildlife is the agency in charge. Of the species targeted by these communities’ fishers, only sea cucumber is protected in BA, and sea cucumber and rock scallop in BK (for commercial diving).

preferred access to commercial activities inside the reserve should be granted to members of the community adjacent to the reserve be made effective (at least for fishing activities). The reserve's council and management plan could be used as a forum for communal discussion, conflict resolution and decision making, and for setting management measures which could be communally accepted and enforced¹³⁷. However, for the fishers to be able to participate in this council and in the development of the reserve's management plan, they have to be formally recognized as fishers through granting them fishing rights. Efforts should be coordinated among the agencies to formalize preexisting informal rights of local residents to the marine area in question and for the joint management of the area so that the existing social capital is used in favor of the management of the area.

This study suggests that the extension of ejido jurisdiction into marine areas may incentivize collective conservation behavior. On the other hand, the current trend toward subdivision and privatization of many coastal ejidos may make such collective behavior unlikely. Most of the land surrounding BA is under the ejido system, but the rate of exchange of this community-owned property regime into multiple "small" privately owned properties has increased significantly since 2001 (Vargas et al. 2007), with the purpose of establishing large scale urban, touristic and residential developments. Formalization of fishing rights (and other activities) in the hands of local residents, together with the development of the reserve's management plan and ecological

¹³⁷ For example, setting quotas, rotation of areas, reproductive refugia, temporal closures, gear restrictions.

ordinance plans¹³⁸ for land and/or marine environments may be crucial to safeguard against potentially harmful developments.

In BK, on the other hand, implementation of regional fishery ordinance plans or ‘planes regionales de ordenamiento pesquero’ (alternative number 1 above) is now being considered by authorities as an alternative management framework for the area (J. Torre from COBI¹³⁹, personal communication). Although for BA the transition to increasing exclusivity of access for local residents might be easier than for BK due to the characteristics highlighted above and the higher level of fishers’ formalization¹⁴⁰, fishery ordinance plans might also constitute a viable alternative to achieve that goal in BK (see previous works by Cinti et al. for additional recommendations).

Regardless of these communities’ differences, both communities show potential for fisheries improvement. Fishers’ perceptions about the problems affecting their fisheries were quite similar between them, suggesting the need for formally recognizing the fishers as key stakeholders in local fisheries, and for working cooperatively towards the design of management strategies that provide better stimulus for resource stewardship and discourage overfishing. Remarkably, this study suggests that there is strong support from resource users for implementing regulatory measures for local fisheries in both communities. Local arrangements and initiatives, if recognized and supported, may provide the basis for the development of locally supported management strategies, with a

¹³⁸ ‘Ley General del Equilibrio Ecológico y la Protección al Ambiente’ (LGEEPA), www.semarnat.gob.mx.

¹³⁹ NGO Comunidad y Biodiversidad A.C.

¹⁴⁰ BA shows a larger amount of fishers holding fishing rights (though still low), belonging as member to formalized groups with cooperative behavior, and having control over the means of production, than BK. An NGO (Pronatura Noroeste) with long history in the community (the same which supported the implementation of the reserve) have had a key role in helping the fishers fulfill the requirements to formalize groups and to request fishing rights to authorities.

higher likelihood of compliance and a higher potential for managing these resources sustainably.

7. Conclusions

This study suggests the presence of a number of factors that present challenges to the development of sustainable fisheries in the region:

- a) There exists an unequal distribution of fishing rights. The percentage of fishers holding fishing rights and actually using them to report and commercialize catch was quite small in both communities. Also, granting fishing rights to the users of resources (not to absentee operators) was a major suggestion by local fishers in both communities.
- b) Current policies and policy changes do not reach the fishers in a direct and formalized way, and they are shaped with no participation of local fishers.
- c) Current policy tools show poor performance in practice and have been ineffective (at the moment) in promoting sustainable fishing practices by fishery stakeholders (neither community has been able to manage their resources sustainably).
- d) Enforcement of regulations by fisheries authorities is insufficient as reflected by fishers' willingness to reinforce vigilance and improve authorities' responses to violations, particularly to the arrival of outsiders to fish locally.

In spite of the factors above, this study also revealed some aspects of these fishing communities that could lead to more sustainable fishing practices in both communities:

- e) The presence of informal rights (fishers' sense of ownership) over the fishing grounds in the surroundings of their home communities. Generally, local fishers do not conform to or enforce the individual boundaries of the permits they hold (or work under), but they do care about and defend an area that they perceive as belonging to their community as a whole, particularly when there are "outsiders" coming in.
- f) The presence of strong support from resource users for implementing regulatory measures for local fisheries.

Increased attention should be provided to local arrangements and initiatives that, if formally recognized and supported, may provide the basis for the development of improved and locally supported regulations.

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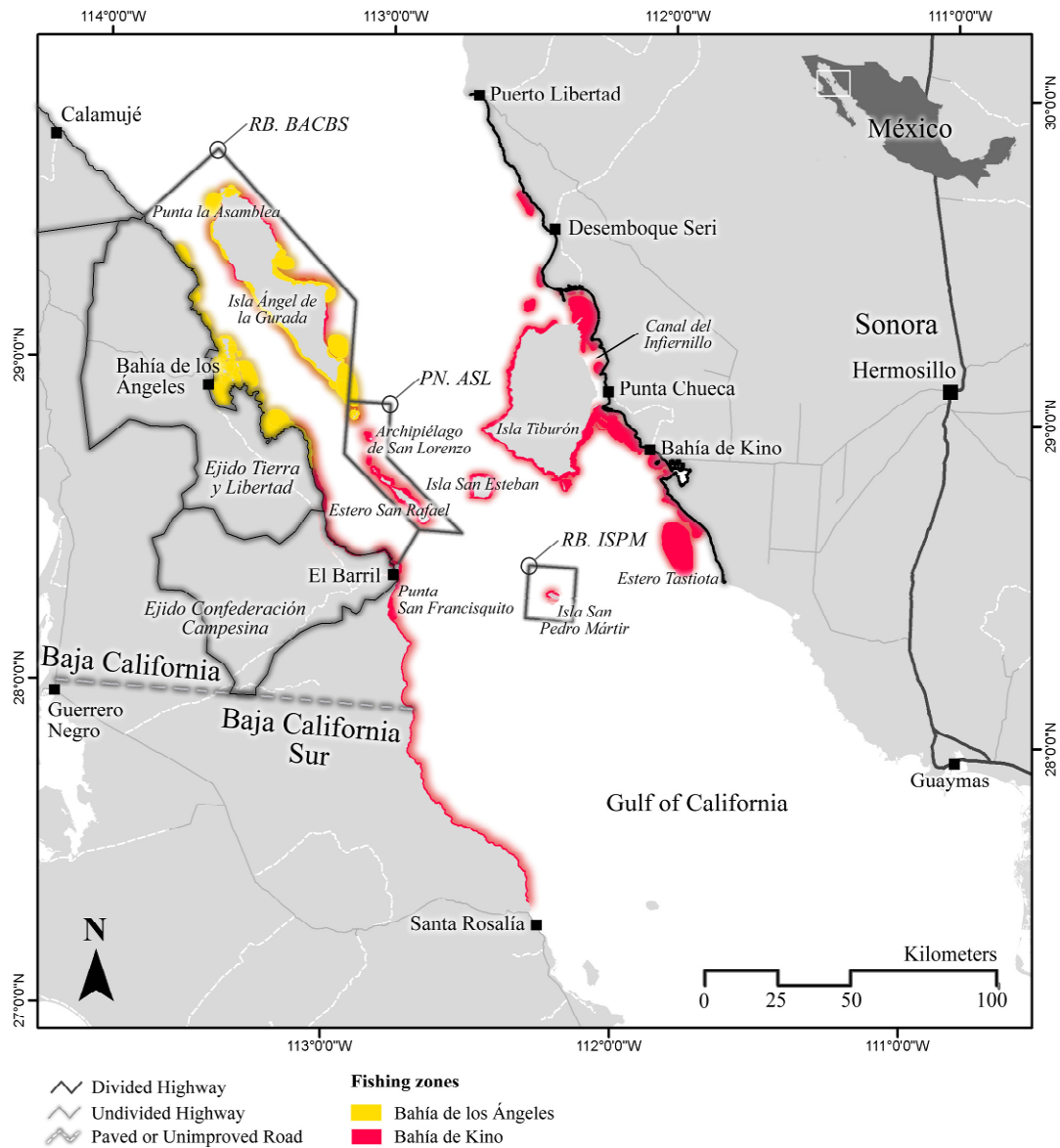


Figure 1: Map of the study area within the northern Gulf of California (NGC). The thick gray line on the Sonoran coastline indicates the geographic jurisdiction of fishing permits for diving products in Bahía de Kino (BK), extending from Puerto Libertad to Estero Tastiota. The MPAs present in the area are indicated as follows: Reserva de la Biósfera (Biosphere Reserve) Bahía de los Ángeles y Salsipuedes (RB. BACBS); Parque Nacional (National Park) Archipiélago de San Lorenzo (PN. ASL); Reserva de la Biósfera Isla San Pedro Mártir (RB. ISPM). Square markers indicate the main towns or cities. Hermosillo is the capital city of Sonora. The fishing zones of BK's divers are shown in red and the fishing zones of Bahía de los Ángeles fishers (all fishing sectors included) are shown in yellow.

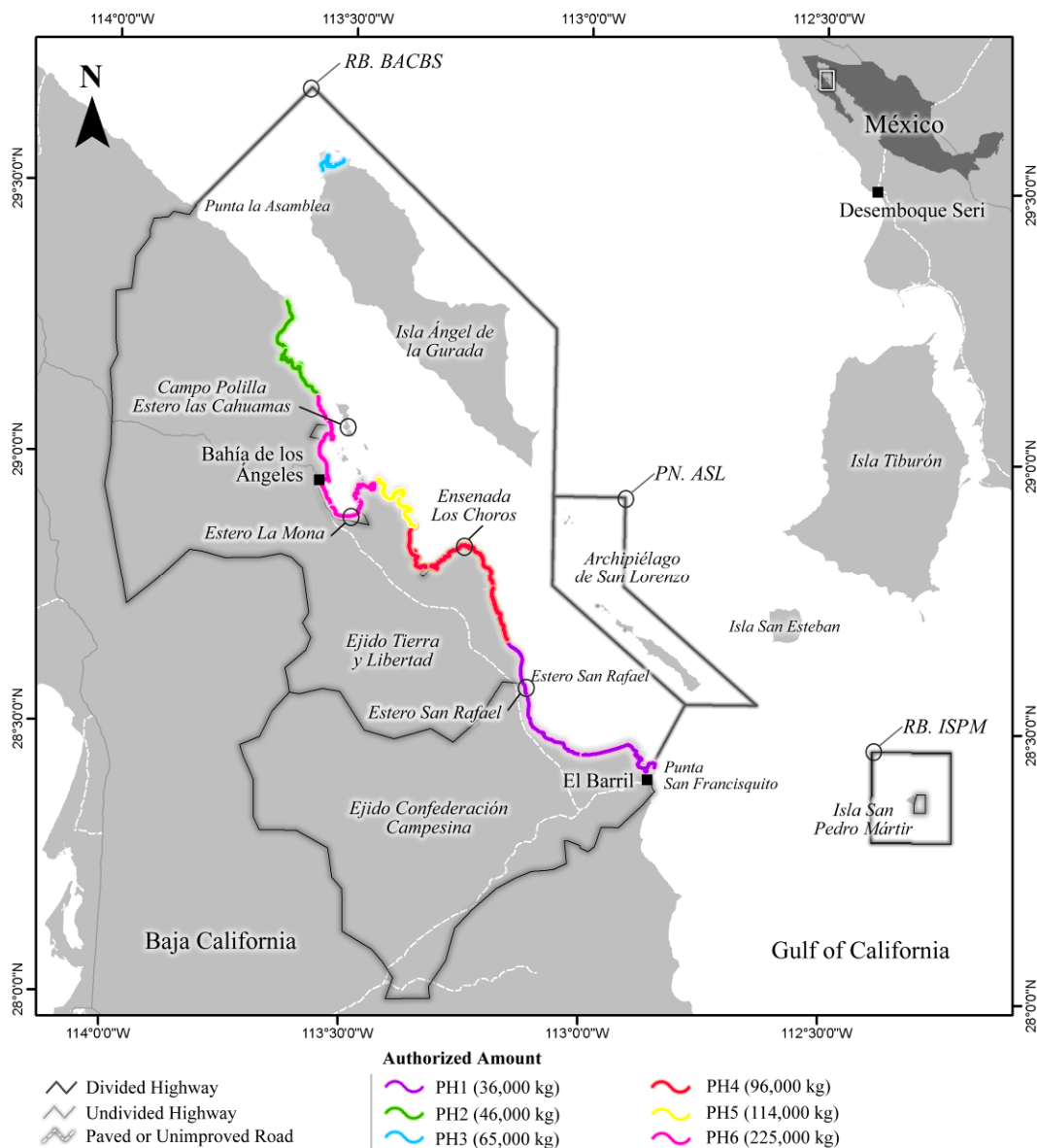


Figure 2: Location and volume (Kg) of each fishing permit granted by SEMARNAT for the harvest of sea cucumber in the Bahía de los Ángeles (BA) area from late 2007 to late 2008. PH: Permit Holder. RB. BACBS: Reserva de la Biósfera (Biosphere Reserve) Bahía de los Ángeles y Salsipuedes. The general location of this reserve's core zones are indicated with circles (Estero San Rafael, Estero La Mona, Ensenada Los Choros, Campo Polilla, and Estero Las Caguamas). PN. ASL: Parque Nacional (National Park) Archipiélago de San Lorenzo. RB. ISPM: Reserva de la Biósfera Isla San Pedro Mártir. The exact location of this reserve's core zone is indicated (rectangular area next to the island).

Soc. Coop. de Producción Pesquera Ejidal
Canal de Ballenas, S. C. L.
 BAHIA DE LOS ANGELES, B. C.
 S. I. C. 2684-P R. F. C. S. C. P. 731230-001

Fecha 12 octubre de 1981
 Nombre: Juan Romero Amador
 Domicilio: _____

CANT.	Especies	Kgs.	PRECIO
1	cahuama blanca	44	
		Total \$	

Recibido por: _____ Nº 1154

Figure 3: Historical invoice of the “Sociedad Cooperativa de Producción Pesquera Ejidal Canal de Ballenas” or SCPPECB for the delivery of 44 Kg of sea turtle or cahuama by a local fisherman (Source: Juan Romero Amador, fishermen and ex-member of the cooperative).

Table 1. Summary of non-institutional and institutional attributes of Bahía de los Ángeles (BA) and Bahía de Kino's (BK) small-scale fisheries. Only the diving sector was evaluated in BK (data from 2007) and all fishing sectors in BA (data from 2008). Percentages are relative to each sample.

<i>Non-institutional attributes</i>	<i>BA</i>	<i>BK</i>
Population	~500 inhabitants	~5,000 inhabitants
Distance from major cities	Large. >500 km through one-way, unimproved road.	Small. ~100 through highway.
Accessibility from sea	Moderate	High
Main resources/fisheries	Gillnets: flounder, sharks. Traps: octopus, fishes. Diving: octopus, sea cucumber.	Diving: pen shells, octopus, fishes, sea cucumber, lobster, clams. Trap and gillnet fishing are also important fisheries, though only diving was included in this study.
Resource productivity	High	High
Condition of fishery resources	Overfished	Overfished
Number of small-scale fishers and boats	~70 fishers and 37 boats total (all species).	~800 fishers and 200 boats total (all species). ~80 boats in commercial diving.
Fishers' dependency on fishing (% relative to the sample)	High. 60% of respondents with no occupation other than fishing. About half of respondents with alternative occupation have fishing as primary source of income.	High. 71% of respondents with no occupation other than fishing. Commercial diving is primary source of income for 93% of respondents (of the set of fishing activities they develop).
<i>Institutional attributes</i>		
Presence of governmental agencies	No permanent presence of fisheries authorities (CONAPESCA or PROFEPA). Permanent presence of CONANP (in charge of MPAs administration).	Permanent presence of fisheries authorities (only CONAPESCA). No permanent presence of CONANP.
Fisheries management tools	Fishing licenses (CONAPESCA's and SEMARNAT's). Biosphere reserve covering the full range of local fishing grounds.	Fishing licenses (only CONAPESCA's) Biosphere reserve covering a very small portion of local divers' fishing grounds.

Performance of management tools	Poor	Poor
Fishers' possession of fishing rights (% relative to the sample)	63% of respondents depend on other permit holders or independent buyers to legally sell their catch.	100% of respondents depend on other permit holders or independent buyers to legally sell their catch.
Ownership of fishing equipment (% relative to the sample)	60% of respondents own the fishing equipment.	24% of respondents own the fishing equipment. 29% were in the process of buying equipment from permit holders.
Self-support of fishing trip expenses (% relative to the sample)	20% of respondents rely on permit holders to afford these costs. 77% afford them on their own.	91% rely on permit holders or independent buyers (with no fishing permits) to afford these costs. 9% of respondents afford them on their own.
Fishers' formal organization	Most formal organizations holding fishing permits generally constituted by fishers and showing cooperative behavior.	Most formal organizations holding fishing permits rarely constituted by fishers and not showing cooperative behavior.
Informal rights over local fishing grounds (perception of fishing grounds' boundaries)	Informal "sense of ownership" over fishing grounds within the <i>ejido</i> limits. Strong defense of this territory. Rejection of outsider boats and fishers.	Informal "sense of ownership" over fishing grounds within the jurisdictional limits of fishing permits granted in the community. Strong defense of this territory. Rejection of outsider boats. Acceptance of outsider fishers if they work as crew members in local boats.

Table 2. Permit holders (CONAPESCA's) with permission to operate in Bahía de Kino (BK) in 2007 (for four main target species of commercial diving only) and in Bahía de los Ángeles (BA) in 2008 (for all fishing sectors), and number of boats allowed to operate per permit and species.

		Species							
	Permit holders	Octopus	Pen shell	Lobster	Geoduck	Giant squid	Escama permit ¹	Mullet	Shark permit ²
BK	CPH 1	5		5			5		
	CPH 2	12	12						
	CPH 3	8					8		
	CPH 4		4						
	CPH 5		3						
	IPH 1	3	7				3		
	IPH 2	2					2		
	IPH 3	2		2					
	IPH 4	6							
	IPH 5		5						
	IPH 6			3					
Total		38	31	10			18		
BA	CPH1					2			
	CPH2	5					6	6	3
	CPH3	3					3		
	CPH4	3					3		
	CPH5							4	
	CPH6	7							
	IPH1				3				
	IPH2					3	3		2
	IPH3					2	2		2
	IPH4						1		
	IPH5						1		
	IPH6	2					6		2
	IPH7	5					5		
	IPH8	2					2		
	IPH9							2	1
	IPH10	5						5	
	IPH11	4							
	IPH12	Ns							
	IPH13	1							
IPH14	7								
Total		44			3	7	32	17	10

CPH: corporate permit holder (mainly cooperatives in BK and SPRs in BA); IPH: individual permit holder.

Ns: not specified. ¹The "escama" (fish with scales) permit allows fishing about 200 species of fish. In BK there were 30 escama permits but only 4 were used for commercial diving species (the ones showed here). ²

The shark permit allows fishing several species of elasmobranchs including rays, sharks and related species.

Table 3: Fishers' knowledge of regulations and fishers' attitudes toward fisheries regulation in Bahía de los Ángeles (BA) and Bahía de Kino's (BK) small-scale fisheries. Percentages are percentages of respondents relative to each sample.

	<i>BA</i>	<i>BK</i>
Fishers' knowledge of regulations	Respondents unaware of the existence of formal instruments (laws and norms), but generally aware of important things contained in these legal instruments.	Respondents unaware of the existence of formal instruments (laws and norms), but generally aware of important things contained in these legal instruments.
Fishers' awareness of recent changes in legislation	100% unaware that fisheries legislation had been recently modified.	100% unaware that changes in fisheries legislation were underway (In mid 2007).
What is missing in terms of fishery regulation?	<ul style="list-style-type: none"> • Grant fishing permits to local fishers (57%). • Increase support from authorities (in enforcement and local presence) (43%). • Ease/fasten paperwork for locals to access permits (20%). • Regulate resource-use (temporal closures, mesh size, quotas) (23%). 	<ul style="list-style-type: none"> • Grant fishing permits to local fishers (22%). • Increase support from authorities (in implementation and enforcement of current regulations) (22%). • Control entrance of outsider pangas into local fishing grounds (27%). • More respect of regulations (22%).
Fishers' perception of usefulness of fishing licenses to limit access	<ul style="list-style-type: none"> • 50% agreed with the idea that fishing permits were a useful tool to limit access to local fishing grounds. • 47% disagreed with the statement. 	<ul style="list-style-type: none"> • 40% agreed with the idea that fishing permits were a useful tool to limit access to local fishing grounds. • 60% disagreed with the statement.
Fishers' perception of performance of fisheries authorities	<ul style="list-style-type: none"> • 23% agreed that fisheries authorities (CONAPESCA and PROFEPA) have had an important role in preventing the depletion of fishery resources in BA, while 77% disagreed with the statement. • 87% agreed that in order to improve the situation of local fisheries, implementation and enforcement of regulations by local authorities was needed. 	<ul style="list-style-type: none"> • 50% agreed that fisheries authorities (CONAPESCA) have had an important role in preventing the depletion of fishery resources in Bahía de Kino, while 50% disagreed with the statement. • 80% agreed that in order to improve the situation of local fisheries, implementation and enforcement of regulations by local authorities was needed.

Fishers' attitude toward access regulation	<ul style="list-style-type: none"> 87% agreed that only people from BA should be allowed to fish in local fishing grounds. 	<ul style="list-style-type: none"> 64% agreed that only people from Bahía de Kino should be allowed to dive in local fishing grounds
Fishers' attitude toward resource-use regulations	<ul style="list-style-type: none"> Strong support (>70%) for the need for formal regulation of the harvest of species like sea cucumber (100%), octopus (70%), and sand bass (72%). Intermediate support (~50%) for flounder. Low support for highly migratory species (sharks and related species). 	<ul style="list-style-type: none"> Strong support (>70%) for the need for formal regulation of the harvest of species accessible for fishing all year round like sea cucumber (87%), lobsters (89%), and pen shells (78%). Low support for species showing seasonal accessibility like fishes (groupers & snappers) and octopus.
Fishers' incentives to join formalized groups	<ul style="list-style-type: none"> 47% would prefer working as a member of a formalized group because it would allow them improved access to fishing permits and governmental benefits. 53% would prefer working independently because of the difficulties of working as part of a group and greater independence for working and selling one's product that leads to higher earnings. 	<ul style="list-style-type: none"> 40% would prefer working as a member of a formalized group because it would allow them improved access to fishing permits and governmental benefits. 53% would prefer working independently because of the difficulties of working as part of a group and greater independence for working and selling one's product that leads to higher earnings.
Usefulness of the biosphere reserve (only for BA)	<ul style="list-style-type: none"> 71% of respondents said the reserve has not benefitted nor being detrimental to them. <p>If given again the choice of establishing a reserve in BA:</p> <ul style="list-style-type: none"> 47% of respondents would again decide to have a reserve to take care of fishing products. 30% of respondents would decide not to have a reserve because they fear it would bring additional restrictions on fishing. 10% said it does not make any difference to them if there is or there is not a reserve. 	-

APPENDIX D: SURVEY INSTRUMENT FOR PANGA CAPTAINS - BAHÍA DE

KINO

Proyecto PANGAS***Conectando Gente y Ciencia por la Salud de Nuestra Pesca***

Entrevista sobre Conocimiento y Percepción sobre Reglas Gubernamentales

Asegurarse de entregar una copia con la explicación del proyecto antes de comenzar y explicar verbalmente su contenido

Entrevistador: _____

Código de entrevista: _____

Fecha: _____

Duración de entrevista: _____

Lugar: _____

1. INFORMACIÓN GENERAL DEL ENTREVISTADO

1.1 ¿Cuántos años tiene? _____

1.2 ¿Dónde nació? (lugar/estado) _____

1.3 ¿Dónde vive actualmente? _____

1.4 ¿Cuánto tiempo tiene viviendo aquí? # años _____

2. TRABAJO

2.1 ¿Cuánto tiempo lleva pescando en pangas en la región? # años _____

2.2 ¿Cuánto tiempo lleva dedicándose al buceo en la región? # años _____

2.3 Es usted:

01 Buzo

02 Popero

03 Matador

PANGA _____

2.4 ¿En el tiempo que lleva trabajando en buceo, se ha dedicado mayormente a eso.....ej: a ser buzo?

01 Si 02 No (*hacer pregunta 2.4.1*)

2.4.1 ¿A qué se ha dedicado más? _____

2.5 ¿A lo largo de un año, a qué especies se dedica más (**NO SOLO DE BUCEO**)?:

Especies principales	Arte de pesca			
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____
	01 Buceo	02 Chin	03 Trampa	Otras_____

Solo si usa otros artes de pesca además de buceo

2.6 ¿Diría usted que el buceo es su actividad principal en pesca de pangas?

01 Si (*salto a 2.7*) 02 No (*hacer 2.6.1*)

2.6.1 Cuál? _____

2.7 ¿Tiene algún otro trabajo además de la pesca de pangas?

01 Si (*hacer 2.7.1 y 2.7.2*) 02 No (*salto a sección 3*)

2.7.1 ¿Cuál/es? _____

2.7.2 ¿Diría usted que vive más de la pesca que de su/s otro/s trabajo/s?

01 Sí 02 No

3. ORGANIZACIÓN

3.1 ¿Es socio de algún grupo (Ej: **unión de buzos**) o **cooperativa** relacionada con la pesca?

01 Sí (*hacer 3.1.1 a 3.1.6*) 02 No (*salto a 3.2*) 03 No sé

3.1.1 ¿Cuál/es? _____

3.1.2 ¿Cuánto tiempo tiene como socio en este grupo? # años _____

3.1.3 ¿Ocupa algún puesto? 01 Sí (Puesto _____) 02 No

3.1.4 ¿Por qué ingresó al grupo o cooperativa?

3.1.5 ¿Para usted fue bueno haber ingresado a ese grupo o cooperativa?

01 Sí 02 No 03 No sé

3.1.5a ¿Por qué?_____

3.1.6 Si pudiera cambiar algo del grupo al que pertenece, ¿Qué cambiaría?

3.2 ¿Por qué no es socio de un grupo o cooperativa relacionada con la pesca?

3.3 Alguna vez ha sido socios de alguna cooperativa? Cuál?_____

3.4 ¿En términos generales, cómo preferiría trabajar más (leer opciones)?

01 Como socio de un grupo o una cooperativa

02 Sin estar asociado a ningún grupo o cooperativa

03 No sé

3.5 ¿Por qué prefiere eso?

4. ACCESO A LA PESCA: *Ahora le voy a preguntar un poco más sobre cómo trabaja...*

4.1 ¿Cuentas con un permiso propio?

01 Sí 02 No

4.2 ¿Alguna vez has intentado sacar un permiso a tu nombre?

01 Sí (*hacer 4.2.2*) 02 No (*hacer 4.2.1 y saltar a 4.3*)

4.2.1 ¿Por qué no lo has intentado?_____

4.2.2 ¿Por qué no has logrado tenerlo? _____

4.3 ¿A quién le entregas tu producto? _____ # años entregándole: _____

4.4 ¿Trabajas bajo el permiso de algún permisionario o cooperativa____; o solo le entregas tu producto a un comprador____? 01 Sí 02 No

4.4.1 ¿Qué cooperativa o permisionario? _____

4.5 ¿Cuánto tiempo llevas trabajando así? _____

4.6 ¿Quién te habilita para los gastos de las salidas de pesca? _____

4.7 ¿La panga y el motor con el que trabajas habitualmente son tuyos, de quien te habilita...otro?

Panga _____

Motor _____

4.8 ¿Qué arreglo tienes con el permisionario o cooperativa que te ampara con sus permisos (qué tienes que dar a cambio)?

4.9 ¿Y con quien te habilita? _____

4.10 ¿Cambian esos arreglos si eres dueño de la embarcación? _____

4.11 Si pudiera Ud. decidir cómo trabajar, cómo preferiría trabajar más (*elegir una sola opción*):

01 Como socio de una cooperativa que tenga permisos

02 Con un permiso a su nombre

03 Amparado por un permisionario

04 Amparado por una cooperativa, sin ser socio

05 Otra _____

4.12 ¿Por qué preferiría eso?

5. REGULACIONES

5.1 Está al tanto de las regulaciones o normativas para la pesca que realizas?

01 Si 02 No

¿Cuáles conoces?:

¿Conoce que haya?		¿Dice algo esa reg. sobre cómo usted debiera realizar su pesca?	¿Me nombraría alguna cosa que diga esa regulación sobre cómo usted debiera realizar su pesca? Lo que usted recuerde...
5.2) Una Ley de Pesca	01 Si hay (pasar a 5.2.1) 02 No hay 03 No sabe	5.2.1) 01 Si (pasar a 5.2.1a) 02 No 03 No sé	5.2.1a)
5.3) Un Reglamento de la Ley de Pesca	01 Si hay (pasar a 5.3.1) 02 No hay 03 No sabe	5.3.1) 01 Si (pasar a 5.3.1a) 02 No 03 No sé	5.3.1a)
5.4) Normas que digan cómo deben pescarse las especies de buceo (sobre vedas, tallas mínimas...).	01 Si hay (pasar a 5.4.1) 02 No hay 03 No sabe	5.4.1) Pedir que comente qué dicen esas normas (por especie de buceo de las que él trabaja)	

5.5 ¿Una persona sin ser pescador puede solicitar un permiso de pesca?

01 Sí 02 No 03 No sé

5.6 ¿Para solicitar un permiso, qué tendría que hacer uno (requisitos)? ____No sé

5.7 ¿Un grupo de pescadores podría solicitar una zona en el mar para que solo ellos pudieran explotarla?

01 Sí 02 No 03 No sé

5.8 ¿Qué tendrían que hacer para solicitarla (requisitos)? _____ No sé

5.9 ¿Si lo sorprenden los inspectores de PESCA o PROFEPA con algún producto sin tener permiso para su captura, cómo es el castigo?

5.10 ¿Conoce que haya habido algún cambio en la legislación pesquera últimamente?

01 Sí supe (*hacer 5.10.1*) 02 No supe

5.10.1 ¿Qué me puede contar de esos cambios?

Percepción sobre reglas gubernamentales

5.11 ¿Desde su opinión, qué está faltando en Kino en tema de regulación pesquera para que mejore la situación de la pesca?

5.12 Para cada una de las ideas siguientes preguntar al entrevistado si esta *De acuerdo* o *En desacuerdo* con lo que expresa cada idea. Una vez que haya respondido si está o no de acuerdo, volver a preguntar si esta *muy de acuerdo* (ó en desacuerdo), *solo de acuerdo* (o en desacuerdo) o *solo un poco de acuerdo* (o en desacuerdo).

5.12.1 Acceso a la pesca

a) Los permisos de pesca han servido para controlar la cantidad de personas que pescan en Kino

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) Hoy en día sin permiso la gente igual trabaja

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

c) El movimiento de buzos de una comunidad a otra (ej: buzos de kino a guaymas y viceversa) es una forma de echarse la mano entre pescadores

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

d) Solo la gente que vive en Kino debería poder bucear en el área de Kino

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

5.12.2 Cooperativas/organizaciones

a) Hoy en día conviene más trabajar independiente (por su cuenta) que asociarse en cooperativas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) Hoy en día la gente busca asociarse en cooperativas más que nada para acceder a un permiso y poder trabajar

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

5.12.3 Medidas específicas (normas, vedas, tallas)

a) El callo de hacha no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) El pepino no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

c) El pulpo no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

d) La langosta no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

e) El callo de escarlopa no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

f) El caracol chino no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

g) El pescado de primera (garropa, pargos) no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

<i>especie</i>	<i>¿Qué regulación propone?</i>	<i>Descripción (época/talla/detalles)</i>
<u>callo de hacha</u>		
<u>pepino</u>		

<u>pulpo</u>		
<u>langosta</u>		
<u>callo de escarlopa</u>		
<u>caracol chino</u>		
<u>pescado</u>		

5.12.4 Rol de autoridades (inspección y vigilancia)

a) Gracias al apoyo de los de Pesca todavía tenemos producto que pescar en Kino

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) Para que mejore la situación de la pesca en Kino lo que hace falta es que los de Pesca hagan respetar las reglas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

6. DECISIONES SOBRE PESCA

6.1 Cuando se prepara para salir a pescar en un día cualquiera....

6.1.1 De qué depende que vaya a un lugar y no a otro? (*Pregunta abierta y luego ofrecer opciones incluyendo la que él haya dado si no fue considerada y que seleccione las dos más importantes*)

_____	1° _____
_____	2° _____

6.1.2 De qué depende vayas a un producto y no vayas a otro? (*Idem anterior*)

_____	1° _____
_____	2° _____

6.1.3 De qué depende que traiga poquita o mucha cantidad de producto? (*Idem anterior*)

_____	1° _____
_____	2° _____

En tarjetas:

01. De cuestiones naturales (*el estado del tiempo, las mareas, corrientes...*)

APPENDIX E: SURVEY INSTRUMENT FOR KEY INFORMANTS - INTERNAL
 ORGANIZATION OF FORMALIZED GROUPS AND LOCAL ARRANGEMENTS -
 BAHÍA DE KINO

Proyecto PANGAS
Conectando Gente y Ciencia por la Salud de Nuestra Pesca
Entrevista sobre Organización Interna y Reglas Locales

Asegurarse de entregar una copia con la explicación del proyecto antes de comenzar y explicar verbalmente su contenido

Entrevistador: _____

Código de entrevista: _____

Fecha: _____

Duración de entrevista: _____

Lugar: _____

Grupo u organización: _____

REGLAMENTOS

1. ¿En su grupo tienen algún reglamento escrito o acta de reunión donde hayan acordado reglas para trabajar en conjunto? (Solicitar acceso a estos reglamentos).
 1. Si 0. No
2. ¿Además -o en lugar- de un reglamento escrito, tienen reglas o acuerdos que no estén escritos en ninguna parte pero que igual los usen para trabajar en el grupo?
 1. Si 0. No
3. ¿Me puede contar sobre estos acuerdos (escritos y no escritos)?

ACCESO AL GRUPO

4. ¿Qué condiciones o requisitos debe cumplir alguien que desee ingresar como socio?

5. ¿Los hijos u otros familiares de los socios tienen mayores posibilidades de ingresar como socios al grupo que alguien que no lo es? 1. Si 0. No

Para la Unión de Buzos:

6. ¿Qué condiciones o requisitos debe cumplir alguien que desee inscribirse en la lista interna de la agrupación?

Para grupos que amparan con sus permisos a pescadores libres (no socios):

7. ¿Qué condiciones o requisitos debe cumplir alguien para trabajar amparado por los permisos del grupo?

DECISIONES

8. ¿Cómo toman la decisión de dejar o no entrar como socio a una persona? (En junta? ¿Con el voto de la mayoría de los socios?)
9. ¿Cuándo tienen que tomar decisiones sobre OTROS temas, lo hacen de la misma manera? 1. Si 0. No (¿Cómo?)

Para la Unión de Buzos:

10. ¿La decisión de dejar ingresar a una persona como miembro del listado interno de la agrupación la toman de la misma manera? 1. Si 0. No (¿Cómo?)

Para grupos que amparan con sus permisos a pescadores libres (no socios):

11. ¿La decisión de permitir que alguien trabaje amparado por un permiso del grupo la toman de la misma manera? 1. Si 0. No (¿Cómo?)

POSICIONES Y FUNCIONES

12. ¿Los socios de la agrupación pueden ocupar distintos cargos o funciones dentro del grupo? 1. Si (¿Cuáles?) 0. No

13. ¿Han formado comités para dividir las tareas en el grupo? 1. Si (¿Cuáles?) 0. No

14. ¿Cómo llega uno a tener esos cargos o a integrar esos comités?

15. ¿Cuáles son los derechos y obligaciones de las personas que están en esos cargos o comités? ¿Qué pueden hacer y que no deben hacer?

Para la Unión de Buzos:

16. ¿Las personas que están en el listado interno pueden ocupar los mismos cargos o comités dentro del grupo? 1. Si 0. No

INFORMACIÓN

17. ¿Se da a conocer algún tipo de información al grupo? 1. Si 0. No

17.1 ¿Qué tipo de información se da a conocer?

17.2 ¿Cómo se da a conocer esa información (en reuniones, cada cuánto tiempo)?

Para grupos que amparan con sus permisos a pescadores libres (no socios):

18. ¿A los pescadores libres amparados por los permisos del grupo se les da a conocer algún tipo de información? 1. Si 0. No

23.1. ¿La misma que a los socios? 1. Si 0. No (¿Cuál?)

CONVIVENCIA

19. Tienen reglas que digan cómo debe comportarse un socio:

19.1. ¿En las juntas u otras reuniones del grupo? 1. Si (¿Cuáles?) 0. No

- 19.2. ¿En el lugar de trabajo (dónde desembarcan, guardan, refaccionan sus pangas)? 1. Si (¿Cuáles?) 0. No

Para grupos que amparan con sus permisos a pescadores libres (no socios):

20. ¿Estas reglas también aplican para quienes están amparados por los permisos del grupo pero no son socios? 1. Si 0. No

PESCA

21. Existe alguna regla o acuerdo entre ustedes para NO pescar:

- 21.1 ¿En una zona en particular? 1. Si 0. No

21.1.1 ¿Cuáles zonas?

21.1.2 ¿Para qué recursos?

21.1.3 ¿Por qué crearon esos acuerdos?

- 21.2. ¿Un producto en particular? 1. Si 0. No

21.2.1. ¿Cuáles?

21.2.2. ¿Por qué crearon esos acuerdos?

- 21.3. ¿Con un arte de pesca en especial? 1. Si 0. No

21.3.1. ¿Cuáles artes?

21.3.2. ¿Para qué recursos?

21.3.3. ¿Por qué crearon esos acuerdos?

21.4. ¿En alguna época del año en particular?

1. Si 0. No

21.4.1. ¿Cuáles épocas?

21.4.2. ¿Para la pesca de qué recursos?

21.4.3. ¿Por qué crearon esos acuerdos?

21.5. ¿Una cantidad en particular?

1. Si 0. No

21.5.1. ¿Qué cantidades?

21.5.2. ¿De qué recursos?

21.5.3. ¿Por qué crearon esos acuerdos?

Derechos de uso

22. ¿El pertenecer o trabajar amparado por este grupo le da derecho exclusivo a pescar un producto en particular o una cantidad en particular de algún producto, al que otros que están fuera del grupo no tienen acceso? 1. Si 0. No

22.1. Especificar los términos de derecho:

22.2. ¿Es una regla del gobierno (permiso de pesca o concesión) o un acuerdo local?

22.3. Especificar recursos, zonas y/o cantidades incluidas en el derecho

22.4. Especificar cómo se asignan los derechos entre los miembros del grupo (también si se trata de permisos de pesca, cómo se reparten su uso)

ACTIVIDADES QUE REQUIERAN AUTORIZACIÓN DE OTROS EN EL GRUPO

23. ¿Hay alguna actividad que requiera el visto bueno de otros pescadores del grupo para que un pescador la pueda realizar? (Por ejemplo, que alguien pueda salir a pescar solo si otros pescadores del grupo lo acompañan) 1. Si 0. No

23.1. ¿Cuál?

23.2. ¿Por qué la/s implementaron?

APORTES Y REPARTICIÓN DE BENEFICIOS

24. ¿Los socios tienen que aportar dinero u otro tipo de ayuda al grupo? 1. Si 0. No

24.1. ¿Qué aportes tienen que hacer?

24.2. ¿Por qué motivo/s?

25. ¿Cuando reparten las ganancias/utilidades del grupo, todos los socios reciben la misma parte? 1. Si 0. No (¿Quiénes reciben menos y por qué?)

26. ¿Cómo es la repartición de las ganancias entre los tripulantes de la panga?
 26.1. ¿Cambia la repartición según el producto que agarren? 1. Si 0. No

Para grupos que amparan con sus permisos a pescadores libres (no socios):

27. ¿Quienes están amparados por los permisos del grupo tienen que hacer los mismos aportes al grupo que un socio? 1. Si 0. No (¿Cuáles?)

28. ¿Tienen alguna participación en la repartición de utilidades? 1. Si 0. No
 28.1. ¿Cómo es su participación?

SANCIONES

29. ¿Han pensado en sanciones para quienes no siguen las reglas establecidas por el grupo? 1. Si (¿Cuáles?) 0. No

- 29.1. ¿Sancionan a quien no asiste a las reuniones? 1. Si 0. No
 29.1.1. ¿Cómo?

- 29.2. ¿Sancionan a quien no hace los aportes correspondientes al grupo? 1.Si 0.No
 29.2.1. ¿Cómo?

- 29.3. ¿Sancionan a quien trae algún recurso o pesca en alguna zona no permitida por el grupo? 1. Si 0. No
 29.3.1. ¿Cómo?

30. ¿Son graduales las sanciones? 1. Si (Especificar) 0. No

31. ¿Cuál es la sanción más fuerte que has visto aplicar en el grupo?

31.1. ¿Por qué motivo?

Para grupos que amparan con sus permisos a pescadores libres (no socios):

32. ¿Estas sanciones aplican también para los que trabajan amparados por el grupo?

1. Si 0. No

MONITOREO DE REGLAS

33. ¿Cómo se organizan para vigilar que los socios -o quienes están amparados- sigan las reglas establecidas por el grupo?

REGLAS LOCALES EN LA COMUNIDAD (pasadas y presentes):

34. ¿Hay en la actualidad, o alguna vez hubo, esfuerzos para limitar el acceso a pescar las principales especies de buceo que se trabajan en Bahía de Kino? Cuénteme acerca de eso.

35. ¿Quién tiene o tenía derecho a pescar y quienes no?

36. ¿Qué recursos incluía el acuerdo o esfuerzo?

37. ¿Esos esfuerzos surgieron por la iniciativa de pescadores de la comunidad o fue algún grupo externo o autoridad el que los inició?

38. ¿Llegaron a ponerse en práctica esos esfuerzos?
38.1 ¿Por qué?

1. Si 0. No

39. ¿Hay alguna documentación escrita donde se cuente sobre esos esfuerzos, o son/fueron parte de un acuerdo informal entre la gente que lo inició?

1. Si (conseguir?) 0. No

APPENDIX F: SURVEY INSTRUMENT FOR PANGA CAPTAINS - BAHÍA DE LOS

ÁNGELES

Proyecto PANGAS***Conectando Gente y Ciencia por la Salud de Nuestra Pesca***

Entrevista sobre Conocimiento y Percepción sobre Reglas Gubernamentales

Asegurarse de entregar una copia con la explicación del proyecto antes de comenzar y explicar verbalmente su contenido

Entrevistador: _____

Código de entrevista: _____

Fecha: _____

Duración de entrevista: _____

Lugar de entrevista: _____

1. INFORMACIÓN GENERAL DEL ENTREVISTADO

1.1. ¿Cuántos años tiene?

1.2. ¿Dónde nació? (lugar/estado)

1.3. ¿Dónde vive actualmente?

1.4. ¿Cuánto tiempo tiene viviendo aquí? # años

2. TRABAJO

2.1. ¿Cuánto tiempo lleva dedicándose a la pesca en la región? # años

Es usted: 01 Buzo [(buzo (), popero (), asistente de buzo ()]

02 Pescador comercial

03 Pescador deportivo

2.2. ¿Cuál de estas actividades le genera mayores beneficios económicos?

01 Buceo

02 Pescador comercial

03 Pescador deportivo

2.3. ¿Cuáles son los productos que mas trabaja comercialmente? Nota: Indicar arte de pesca específico entre paréntesis, ej. Pulpo - Buceo (trampa)

Productos	Arte de pesca
	01 Buceo () 02 Pesca comercial ()
	01 Buceo () 02 Pesca comercial ()
	01 Buceo () 02 Pesca comercial ()
	01 Buceo () 02 Pesca comercial ()
	01 Buceo () 02 Pesca comercial ()

2.4. ¿Tiene algún otro trabajo además de la pesca (además de buceo/pesca comercial o deportiva)? 01 Si 02 No

2.4.1. ¿Cuál/es?

2.5. ¿Diría usted que vive más de la pesca (en general) que de su/s otro/s trabajo/s?

01 Sí 02 No

3. ORGANIZACIÓN

3.1. ¿Es socio de alguna organización relacionada con la pesca? 01 Sí 02 No

3.1.1. ¿Cuál?

3.2. ¿Por qué decidió formar parte de esta organización?

3.3. ¿Por qué no es socio de alguna organización relacionada con la pesca?

3.4. ¿En términos generales, cómo preferiría trabajar más (si no existiera restricción respecto a permisos)?

01 Como socio de un grupo o una cooperativa

02 Sin estar asociado a ningún grupo o cooperativa

03 No sabe/no contesta

3.4.1. ¿Por qué prefiere eso?

4. ACCESO A LA PESCA: *Ahora le voy a preguntar un poco más sobre cómo trabaja...*

4.1. ¿Cuenta con un permiso a su nombre?

01 Sí (especie, # pangas y arte autorizados) 02 No

4.2. ¿Trabajas bajo el permiso de algún permisionario o cooperativa (); o solo le entregas tu producto a un comprador ()?

4.2.1. ¿Bajo el permiso de quien trabajas (describir especies)?

4.3. ¿A quién le entregas (vendes) tu producto (preguntar por especie)?

4.4. ¿Quién te habilita los gastos de las salidas de pesca?

4.5. ¿Eres dueño de la panga () y el equipo () con el que trabajas habitualmente? (consultar si la está pagando aun)

01 Sí 02 No (dueño: _____)

4.6. ¿Tienes algún compromiso con quien te facilita sus permisos o con quien te habilita? ¿Cuál?

4.7. ¿Si pudieras escoger libremente como trabajar, cómo preferirías trabajar mas (elegir una sola opción)?:

01 Como socio de una cooperativa (u otro grupo formal) que tenga permisos

02 Con un permiso a su nombre

03 Amparado por un permisionario

04 Amparado por una cooperativa (u otro grupo), sin ser socio

05 Otra

4.7.1. ¿Por qué preferirías eso?

5. REGULACIONES

5.1. ¿Conoces que exista una Ley de pesca en México? Que sabes de ella?

5.2. ¿Conoces que existan normas que digan como cada especie debiera pescarse (sobre vedas, etc)? Preguntar para las especies que indicó.

5.3. ¿Para solicitar un permiso de pesca, qué tendría que hacer uno?

5.4. ¿Sabe si un grupo de pescadores podría solicitar a las autoridades una zona en el mar para que solo ellos pudieran trabajarla? ¿Cómo tendría que hacer para solicitar esa zona?

5.5. ¿Conoce que haya habido algún cambio en las legislación pesquera últimamente? (has oído hablar de una nueva ley de pesca?) 01 Sí 02 No

5.6. ¿Se permite pescar en cualquier parte de BLA? ¿Dónde si y donde no?

5.7. ¿Sabes si esta zona es una reserva o área protegida? ¿Conoces las zonas núcleo, cuáles son?

5.8. ¿La gente de BLA tiene preferencia por sobre gente de fuera para pescar en la reserva? Las leyes dicen algo acerca de eso?

5.9. ¿Si lo sorprenden los inspectores de PESCA o PROFEPA locales con algún producto sin tener permiso para su captura, cómo suele ser el castigo?

Percepción sobre reglas gubernamentales

5.10. ¿Desde su opinión, qué está faltando en BLA en tema de regulación pesquera para que mejore la situación de la pesca?

5.11. Explicar al entrevistado la dinámica de estas preguntas. Usar escala con caritas para esta sección.

5.11.1. Acceso a la pesca

a) Los permisos de pesca han servido para limitar/controlar la cantidad de personas que pescan en BLA

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) Solo la comunidad de BLA debiera poder pescar en la reserva de BLA

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

c) Solo la comunidad del Barril debiera poder pescar en San Lorenzo

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

d) Solo ambas comunidades (BLA y el Barril) debieran poder pescar en la Reserva y San Lorenzo (Reserva y San Lorenzo para ambas comunidades)

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

e) No importa de donde sea la persona, lo que importa es que tenga permiso para pescar en la región

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

5.11.2. Medidas específicas (normas, vedas, tallas)

a) El pepino no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) El/la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

c) El/la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

d) El/la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

e) El/la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

f) El /la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

g) El /la _____ no necesita de ninguna regulación para que siga habiendo en el futuro, se recupera solo al cambiar las temporadas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

<i>Producto</i>	<i>¿Cómo debiera regularse/cuidarse?</i>	<i>Especificaciones</i>
<i>pepino</i>		

5.11.3. Rol de autoridades (inspección y vigilancia)

a) Gracias al apoyo de las autoridades de Pesca y Profepa todavía tenemos producto que pescar en BLA

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

b) Gracias al apoyo de las autoridades de CONANP todavía tenemos producto que pescar en BLA

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

c) Para que mejore la situación de la pesca en BLA lo que hace falta es que las autoridades hagan respetar las reglas

Muy en desacuerdo__ en desacuerdo__ ni uno ni otro__ de acuerdo__ muy de acuerdo__

Percepción sobre la reserva (Sabes que hay una reserva en la bahía desde 2007...)

5.12. ¿Te ha beneficiado en algo la reserva? ¿En qué?

5.13. ¿Te ha perjudicado en algo la reserva? ¿En qué?

5.14. ¿Si regresáramos el tiempo atrás y pudieras escoger tener o no tener reserva, qué preferirías?:

- 01 Tener reserva
- 02 No tener reserva
- 03 ns/nc

5.14.1. ¿Por qué?

Nota: Si el tiempo lo permite preguntar por límites de ejidos y zonas de pesca, y conflictos de acceso en la comunidad.

Muchas gracias por su valiosa colaboración!

Notas:

[illegible]

APPENDIX G: SURVEY INSTRUMENT FOR KEY INFORMANTS - INTERNAL
 ORGANIZATION OF FORMALIZED GROUPS AND LOCAL ARRANGEMENTS -
 BAHÍA DE LOS ÁNGELES

Proyecto PANGAS
Conectando Gente y Ciencia por la Salud de Nuestra Pesca
Entrevista sobre Organización Interna y Reglas Locales

Asegurarse de entregar una copia con la explicación del proyecto antes de comenzar y explicar verbalmente su contenido

Entrevistador: _____

Código de entrevista: _____

Fecha: _____

Duración de entrevista: _____

Lugar de entrevista: _____

Grupo: _____

socios:

Cuénteme como se formó la sociedad, ¿Por qué la formaron?

1. ACCESO AL GRUPO

1.1. ¿Cualquier persona podría ingresar a la organización? ¿Qué condiciones debiera tener una persona para ser socio de la organización (indagar características personales, laborales, parentesco, aportes en dinero o trabajo)?

2. DECISIONES

2.1. ¿Cómo toman la decisión de dejar o no dejar entrar a una persona?

2.2. Cuando tienen que tomar otras decisiones, ¿las toman de la misma manera?

3. POSICIONES Y FUNCIONES

3.1. ¿Qué beneficios obtienen los socios al estar en la organización?

3.2. ¿Qué obligaciones tienen los socios? ¿Qué deben y no deben hacer?

3.3. ¿Los socios de la agrupación pueden ocupar distintos cargos o funciones dentro del grupo?
¿Cuáles?

3.4. ¿Cómo llega uno a tener esos cargos?

3.5. ¿Han formado comités o comisiones de trabajo para dividir las tareas en el grupo? ¿Cuáles? (describir funciones).

3.6. ¿Cómo llega uno a integrar esos comités?

4. INFORMACIÓN

4.1. ¿Qué tipo de información se da a conocer a los socios?

4.2. ¿Cómo se da a conocer esa información (en reuniones, cada cuánto tiempo)?

4.3. ¿Cuántas reuniones han tenido en el último año (2008)?

5. CONVIVENCIA

5.1. ¿Tienen reglas que digan cómo debe comportarse un socio (qué no debe hacer) durante las juntas, en el lugar de trabajo? Describir.

6. PESCA (ACUERDOS INTERNOS Y REGLAS LOCALES)

Derechos de pesca:

6.1. ¿El pertenecer o trabajar para este grupo le da derecho a pescar un producto en particular?

6.2. Número de permisos (permisos de la sociedad y/o individuales):

6.3. Especies autorizadas:

6.4. Zonas autorizadas para cada especie:

6.5. ¿Teóricamente, esas son zonas de uso exclusivo para ustedes para esas especies?

6.6. # espacios (pangas):

6.7. ¿Son las mismas pangas para las distintas especies?

Reglas de uso:

6.8. ¿Se han puesto de acuerdo (en su grupo o en la comunidad) para trabajar un producto de una manera en particular, por ejemplo: Dejar descansar un producto por un tiempo, cuidar una zona, dejar de usar (o modificar) un arte de pesca que sea muy dañino para un producto, sacar de un determinado tamaño, o limitar la cantidad? Describir (productos, zonas, épocas del año, otras medidas).

6.9. ¿Se han puesto de acuerdo para limitar/controlar el acceso de gente a los campos pesqueros de la región? Describir.

6.10. ¿Qué resultados han tenido esos esfuerzos?

7. APORTES Y REPARTICIÓN DE BENEFICIOS

7.1. ¿Cómo se reparten los beneficios en el grupo? ¿Todos los miembros de la organización reciben la misma cantidad de dinero? Describir arreglos.

7.2. ¿Hay aportes anuales/mensuales/diarios que los socios deben hacer al grupo? Describir.

7.3. ¿Se descuenta una parte del producto entregado por cada socio para la agrupación (ej. tantos pesos por kilo de producto entregado quedan para la agrupación)?

7.4. ¿En qué se utilizan estos fondos?

7.5. ¿Cómo es la repartición de las ganancias entre los tripulantes de la panga?
¿Varía según el producto, según la actividad (buzo, popero, ayudante), según sea dueño de equipo?

8. SANCIONES

8.1. ¿De qué manera sancionan a quienes no sigan los acuerdos creados por el grupo?

8.2. ¿Sancionan a quienes no asisten a las reuniones? ¿Cómo?

8.3. ¿Sancionan a quien no hace los aportes al grupo (ej. A quien vende el producto por fuera de la cooperativa)? ¿Cómo?

8.4. ¿Las sanciones son mas fuertes cuanto mas grave es la falta? Describir.

8.5. ¿Cuál es el castigo más fuerte que le hayan aplicado a alguien en el grupo? ¿Por qué motivo?

8.6. ¿Alguna vez han echado a alguien del grupo? ¿Por qué motivo?

No-socios

8.7. ¿Además de los socios, hay personas que trabajen para el grupo sin ser socios (ej. Personas amparadas por los permisos del grupo)? ¿Cuántos trabajan así?

8.8. ¿Estas personas se ubican en las pangas de la sociedad o aportan sus propias pangas?

8.9. ¿Hay pangas de socios o no-socios que estén dadas en comodato a la sociedad (Cuántas)? ¿Cuál es el compromiso que adquiere el dueño de panga mediante el comodato?

8.10. ¿Las personas que trabajen para el grupo sin ser socios tienen obligaciones diferentes que un socio normal? ¿Qué deben dar a cambio y qué beneficios reciben al trabajar para el grupo?

9. REGLAS ESCRITAS

NO OLVIDAR solicitar acceso a reglamento escrito, minutas de reuniones, y registros de asistencia.

APPENDIX H: HUMAN SUBJECTS APPROVAL

Human Subjects Protection Program

THE UNIVERSITY OF
ARIZONA
 TUCSON ARIZONA

1235 N. Mountain Avenue
 P.O. Box 245137
 Tucson, AZ 85724-5137
 (520) 626-6721
<http://www.irb.arizona.edu>

Ana Cinti, M.S.
 Advisor: William W. Shaw, Ph.D.
 Renewable Natural Resources
 College of Agriculture and Life Sciences
 P.O. Box 210043

April 24, 2007

BSC: B07.125 FORMAL AND INFORMAL RULES AFFECTING RESOURCE USE IN THE NORTHERN GULF OF CALIFORNIA, MEXICO: THE CASE OF COMMERCIAL DIVING

Dear Ana Cinti:

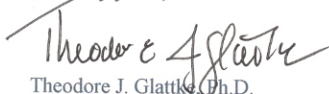
We received your research proposal as cited above. The procedures to be followed in this study pose no more than minimal risk to participating subjects and have been reviewed by the Institutional Review Board (IRB) through an Expedited Review procedure as cited in the regulations issued by the U.S. Department of Health and Human Services [45 CFR Part 46.110(b)(1)] based on their inclusion under *research category 7*. As this is not a treatment intervention study, the IRB has waived the statement of Alternative Treatments in the consent form as allowed by 45 CFR 46.116(d)(2). Although full Committee review is not required, a brief summary of the project procedures is submitted to the Committee for their endorsement and/or comment, if any, after administrative approval is granted. This project is approved with an **expiration date of 24 April 2008**. Please make copies of the attached IRB stamped consent documents to consent your subjects.

The Institutional Review Board (IRB) of the University of Arizona has a current *Federalwide Assurance* of compliance, **FWA00004218**, which is on file with the Department of Health and Human Services and covers this activity.

Approval is granted with the understanding that no further changes or additions will be made to the procedures followed without the knowledge and approval of the Human Subjects Committee (IRB) and your College or Departmental Review Committee. Any research related physical or psychological harm to any subject must also be reported to each committee.

A university policy requires that all signed subject consent forms be kept in a permanent file in an area designated for that purpose by the Department Head or comparable authority. This will assure their accessibility in the event that university officials require the information and the principal investigator is unavailable for some reason.

Sincerely yours,



Theodore J. Glattke, Ph.D.
 Chair, Social and Behavioral Sciences Human Subjects Committee

TJG/rkd

Cc: Departmental/College Review Committee

APPROBADO POR EL IRB DE LA UNIVERSIDAD DE
ARIZONA ESTE SELLO DEBE APARECER EN TODOS
LOS DOCUMENTOS USADOS PARA OBTENER EL
CONSENTIMIENTO DEL PARTICIPE
FECHA: 4-24-07 VENCIMIENTO: 4-24-08

Proyecto PANGAS

Conectando Gente y Ciencia por la Salud de Nuestra Pesca
Autorización de Entrevistas

Buenos(as) días/tardes. Mi nombre es [nombre del entrevistador]. Trabajo como parte de un proyecto llamado PANGAS (Pesca Artesanal del Norte del Golfo de California: Ambiente y Sociedad). El Proyecto PANGAS es un programa de investigación coordinado por la Universidad de Arizona en colaboración con dos organizaciones no gubernamentales - El Centro Intercultural de Estudios de Desiertos y Océanos (CEDO) y Comunidad y Biodiversidad (COBI) - así como otras dos instituciones de investigación: el Centro de Investigación Científica y de Estudios Superiores de Ensenada (CICESE) y la Universidad de California en Santa Cruz.

En este momento me encuentro realizando un estudio acerca de las regulaciones existentes para las pesquerías ribereñas en el Norte del Golfo de California. Como parte de este trabajo, estoy entrevistando gente con experiencia en el tema en la región, con el propósito de obtener su opinión acerca de ellas y sus sugerencias para mejorar su funcionamiento. Quisiera invitarlo a participar en forma voluntaria en este proyecto. Usted puede participar ya que es un [pescador ribereño, autoridad] con experiencia en la pesca del Norte del Golfo de California. Su participación involucrará una entrevista sobre el tema que le acabo de mencionar. Las entrevistas serán realizadas en un lugar de su conveniencia y cada una durará aproximadamente entre 0:45-1:20 horas. No existen riesgos asociados a su participación en estas entrevistas y tampoco se espera ningún beneficio directo de su participación. Así mismo, no existe ningún costo para usted excepto su tiempo, pero tampoco será compensado en forma monetaria por su participación.

La información que proporcione es estrictamente confidencial y solo se usará para fines de investigación. Durante las entrevistas tomaré notas con el fin de ayudar a recordar lo que se dijo. Sólo el investigador principal tendrá acceso a su nombre. Para mantener su anonimidad su nombre no será presentado en ningún reporte que resulte de este estudio y la información de las entrevistas estará guardada en un gabinete seguro bajo llave.

Su participación en este estudio es completamente voluntaria y puede dejar de participar en cualquier momento si lo considera necesario. Cualquier pregunta que usted tenga será contestada y puede decidir qué preguntas quiere o puede contestar. Sin embargo, todas sus opiniones son muy importantes para nosotros y espero que desee participar.

Al participar en las entrevistas, usted nos está dando permiso para poder usar su información para fines de investigación.

Puede obtener mayor información del proyecto contactando al investigador principal, Ana Cinti (001-520-626-4203), o visitando nuestra página de Internet: <http://pangas.arizona.edu>. Si tiene alguna pregunta sobre sus derechos como participante en esta investigación, puede contactar la oficina del Programa de Protección de Sujetos Humanos en la Universidad de Arizona al teléfono 001-520-626-6721



Human Subjects
Protection Program

1235 N. Mountain Ave.
P.O. Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
<http://irb.arizona.edu>

Continuing Review Determination

Investigator: Ana Cinti
Project No. : 07-0304-02 (Previously: B07.125)
Project Title: Local and Governmental Rules and Small-scale Fisheries Sustainability:
Lessons from Mexican Chilean Experiences [NEW TITLE]

Project Status	
<input checked="" type="checkbox"/> Enrollment in Progress or Still Planned	<input type="checkbox"/> Data Analysis Only
<input type="checkbox"/> Enrollment Closed: study procedure/intervention ongoing	<input type="checkbox"/> Concluded
<input type="checkbox"/> Enrollment Closed: follow-up only	<input type="checkbox"/> Study Not Begun

IRB Comments: Protocol changes (changing study title to "Local and Governmental Rules and Small-scale Fisheries Sustainability: Lessons from Mexican Chilean Experiences" and collecting additional data on catch and effort over time) and revised Subjects Disclosure Form (reflecting title change and additional data on catch and effort over time) and personnel change (removing Rivera) approved concurrently.

Documents Approved Concurrently:	Documents Reviewed Concurrently:
<input type="checkbox"/> N/A	<input checked="" type="checkbox"/> N/A
<input checked="" type="checkbox"/> Consenting Instruments: Subjects Disclosure Form (English) Subjects Disclosure Form (Spanish) Re-consent: <input type="checkbox"/> All <input type="checkbox"/> Current Only <input checked="" type="checkbox"/> Not Required	<input type="checkbox"/> Investigator's Brochure
<input type="checkbox"/> Protocol Amendments	<input type="checkbox"/> Progress Reports
<input type="checkbox"/> Protocol	<input type="checkbox"/> Study Related Problems
<input checked="" type="checkbox"/> VOTF signed 4/4/08	<input type="checkbox"/> Protocol Deviation
<input type="checkbox"/> Other:	<input type="checkbox"/> Other

Period of Approval: 4/24/08 — 4/21/09

- ☒ Expedited Review
☐ Full Committee Review
☐ Facilitated Review



Date Reviewed: 4/24/08

Elaine G. Jones, Ph.D., Chair
Social and Behavioral Sciences Committee

Arizona's First University – Since 1885



Reminder: Continuing Review materials should be submitted 30 – 45 days in advance of the current expiration date to obtain re-approval (projects may be concluded or withdrawn at any time using the forms available at www.irb.arizona.edu).

Proyecto de investigación

“Reglas Locales y Gubernamentales y Manejo Sustentable de Pesquerías de Pequeña Escala: Experiencias en México y Chile”

Autorización de Entrevistas

Mi nombre es Ana Cinti, soy estudiante de doctorado en la Universidad de Arizona, en Tucson, Arizona, Estados Unidos. Trabajo como parte de un proyecto llamado PANGAS, Pesca Artesanal del Norte del Golfo de California: Ambiente y Sociedad. El Proyecto PANGAS es un programa de investigación coordinado por la Universidad de Arizona en colaboración con dos organizaciones no gubernamentales: El Centro Intercultural de Estudios de Desiertos y Océanos (CEDO) y Comunidad y Biodiversidad (COBI), así como otras dos instituciones de investigación: el Centro de Investigación Científica y de Estudios Superiores de Ensenada (CICESE) y la Universidad de California en Santa Cruz.

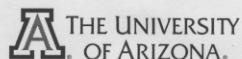
Mi tema de investigación tiene que ver con las reglas y acuerdos sobre la pesca creados por los pescadores (cómo se organizan para pescar) y por la administración pesquera (reglas del gobierno), y cómo estas reglas afectan la sustentabilidad de las pesquerías ribereñas o artesanales en comunidades pesqueras de México y Chile. En otras palabras, estoy interesada en conocer cómo la legislación actual y las reglas creadas por los pescadores a nivel local están funcionando en la práctica, y proponer maneras para intentar mejorar su funcionamiento.

Como parte de este trabajo estoy entrevistando gente con experiencia en el tema en la región, con el propósito de conocer cuáles son las reglas que las comunidades pesqueras usan para pescar y los resultados que han tenido. Quisiera invitarlo a participar en forma voluntaria en este proyecto. Usted puede participar ya que es un [pescador ribereño o artesanal, o autoridad] con experiencia en temas pesqueros en su región. Su participación involucrará una entrevista sobre el tema que le acabo de mencionar. La entrevista será realizada en un lugar de su conveniencia y durará aproximadamente 45 minutos.

- No existen riesgos asociados con su participación en este estudio ni tampoco deben esperarse beneficios directos por su participación.
- Así mismo, no existe ningún costo para usted excepto su tiempo.
- La información que proporcione será estrictamente confidencial y solo se usará para fines de investigación.
- Durante la entrevista se tomarán notas con el fin de ayudar a recordar lo que se dijo.
- Sólo el investigador principal tendrá acceso a su nombre. Para mantener su anonimato su nombre no será presentado en ningún reporte que resulte de este estudio y la información proporcionada será guardada en un lugar seguro.
- Su participación es completamente voluntaria y puede dejar de participar en cualquier momento si lo desea.
- Cualquier pregunta que tenga será debidamente contestada y puede decidir qué preguntas contestar o dejar sin contestar.
- Sin embargo, toda información que pueda proveer es muy importante para nosotros y esperamos que desee participar.
- Al participar en las entrevistas, usted nos está dando permiso para poder utilizar la información para fines de investigación.

Puede obtener mayor información del proyecto contactando al investigador principal, Ana Cinti, al teléfono 001-520-318-0146, correo electrónico: acinti@email.arizona.edu, o visitando nuestra página de Internet: <http://pangas.arizona.edu>. Si tiene alguna pregunta sobre sus derechos como participante en esta investigación, puede contactar la oficina del Programa de Protección de Sujetos Humanos en la Universidad de Arizona al teléfono 001-520-626-6721.

APPROBADO POR EL IRB DE LA UNIVERSIDAD DE
ARIZONA. ESTE SELLO DEBE APARECER EN TODOS
LOS DOCUMENTOS USADOS PARA OBTENER EL
CONSENTIMIENTO DE LOS PACIENTES.
FECHA: 4/24/08 VENCIMIENTO: 4/24/09



Human Subjects
Protection Program

1618 E. Helen St.
P.O. Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
<http://www.irb.arizona.edu>

Continuing Review Determination

Investigator: Ana Cinti, MS Student

Advisor: William Shaw, PhD

Project No.: 07-0304-02

Project Title: Cross-Scale Interactions in Small-Scale Fisheries of the Northern Gulf of California, Mexico: Exploring the Local Impact of Government Rules [NEW TITLE]

Project Status	
<input type="checkbox"/> Enrollment in Progress or Still Planned	<input checked="" type="checkbox"/> Data Analysis Only
<input type="checkbox"/> Enrollment Closed: study procedure/intervention ongoing	<input type="checkbox"/> Concluded
<input type="checkbox"/> Enrollment Closed: follow-up only	<input type="checkbox"/> Study Not Begun

IRB Comments: Protocol change (changing study title to "Cross-Scale Interactions in Small-Scale Fisheries of the Northern Gulf of California, Mexico: Exploring the Local Impact of Government Rules") approved concurrently and final version of dissertation proposal acknowledged concurrently.

Documents Approved Concurrently:	Documents Reviewed Concurrently:
<input type="checkbox"/> N/A	<input type="checkbox"/> N/A
<input type="checkbox"/> Consenting Instruments: Re-consent: <input type="checkbox"/> All <input type="checkbox"/> Current Only <input type="checkbox"/> Not Required	<input type="checkbox"/> Investigator's Brochure
<input type="checkbox"/> Protocol Amendments	<input type="checkbox"/> Progress Reports
<input type="checkbox"/> Protocol	<input type="checkbox"/> Study Related Problems
<input checked="" type="checkbox"/> VOTF: 4/20/09	<input type="checkbox"/> Protocol Deviation
<input type="checkbox"/> Other:	<input checked="" type="checkbox"/> Other: Final version of dissertation proposal [Sept 2008]

Period of Approval: 04/24/09 — 04/23/10

Elaine G. Jones PhD, RN, FNAP
Chair, IRB 2 Committee
UA Institutional Review Board

EGJ:mm

☒ Expedited Review
☐ Full Committee Review
☐ Facilitated Review
Date Reviewed: 04/23/09

Arizona's First University – Since 1885

Reminder: Continuing Review materials should be submitted 30 – 45 days in advance of the current expiration date to obtain re-approval (projects may be concluded or withdrawn at any time using the forms available at www.irb.arizona.edu).