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UNWRITTEN LAW: RESILIENT MANAGEMENT IN LATIN AMERICAN
ARTISANAL FISHERIES

by

Brandon Chapman

A report submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SOCIAL SCIENCE

in

Sociology

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UTAH STATE UNIVERSITY
Logan, Utah

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ABSTRACT

Unwritten Law: Resilient Management in Latin American Artisanal Fisheries

by

Brandon Chapman, Master of Social Science

Utah State University, 2004

Major Professor: Dr. Douglas Jackson-Smith
Department: Sociology

Latin American small-scale fishery production is crucial to local communities that count on fish as a key source of protein in daily consumption and for supplying the increasing demand for exported high-value species in the first world. Many small-scale fishing communities have exhibited various forms of informal institutions that serve to manage rights to the fishery, a common-pool resource (CPR). An emerging theme in the CPR management literature is that there are certain types of institutions that exist in successful informal management contexts. Seven case studies from small-scale fishing communities in Latin America are analyzed in order to determine if these model management institutions are supported. These case studies are then analyzed to determine what accounts for resilient informal management institutions in the face of commercial and outsider encroachment. The thesis is that robust shoreline activities promote reciprocity that allows for rapid collective action in the face of external threats.

(135 pages)

ACKNOWLEDGMENTS

As always with these things, there are numerous people to thank and I am sure some names will be left out. I will include as many as I can while trying not to be too long-winded, although that is probably how it will end up.

I want to start with my family. My Dad (and his partner Lisa) have had confidence in me and continue to back my life and career decisions, no matter how absurd and idealistic those decisions have sometimes been. My Mom (and her husband Larry) have never questioned those decisions and have been an unwavering source of support, no matter how far away my goals take me from my home in Illinois. I am very lucky. To have parents that have shown as much unquestioned confidence in their son's decisions, even from an early age, is quite rare. They have both allowed me, their only child, to head out to pursue things they see as greater even though they know my academic pursuits might take me far away and not place me back near them. It is this confidence that has allowed me to be as independent as I have been so early in life.

My undergraduate years at DePauw University were some of the best of my life. The friends I met there are still my friends today. Libby, Tamra, Brad, Andrew, Teri, Courtney, Angie, Phil, and Jason have all continued to stay in touch and provide relief from the everyday grind. Of course, Adam Cox continues to be my longest and closest friend. He always calls with a good story or joke from his current life or from our days in Galesburg and high school that are guaranteed to keep us rolling for hours.

My friends and faculty in Utah have been wonderful and made my first two years "out west" feel like home. Jason Leiker was my closest friend here, besides being the best

drinking buddy, blues hound, and fun seeker I ever met. Our midnight trips to the blues and bars of Ogden and Salt Lake were an occasional (and needed) escape from an increasing academic workload for both of us. We will certainly be hitting many blues festivals in future years, maybe even Pinedale if we are lucky.

Although we never established a formal working or research relationship, Rick Krannich was still the director of grad studies in the sociology department when I originally applied to the program. He was the one that smoothed my initial entrance into Utah State University and was insightful and helpful in making sure I was comfortable in my new setting.

Peg Petrzeka and I occasionally worked together, especially on revising and editing my previous research from Cotacachi, Ecuador. Peg was the most pleasant and gracious person to be around in the office. She combined professionalism and a dedicated work ethic with a humbleness and friendliness that are unfortunately two qualities all too rare in academics.

Fall semester 2003 was way and above the best period of seminars and scholarship in my very short career thus far. Having begun to question the purpose and direction of my research and academics in general, the three seminars I had that semester completely turned me around and provided new focus and enthusiasm for what my future work could be.

Jing Huang was one of my professors that semester. Jing is one of the most substantive and under-recognized professors at Utah State. His Comparative Politics and Political Development seminar was an eye-opener to what political scientific theory can

bring to development problems. Jing comes to a seminar being thoroughly prepared (his insightful lectures certainly show that) while balancing that with a sense of equity between lectures and facilitating student input. He also brought an intense sense of political fairness to the classroom, another quality that is unfortunately lacking in academics.

Randy Simmons taught me economic theory that semester. He is not only an expert in rational choice and institutional analysis, but a humorous guy to be around and work with as well. He is responsible for teaching me my theoretical background in political economy and I can only hope I use that training in the ways he has in his career.

Jon Moris provided me the best classroom experiences I have had in academics. I am sure he does not need another marginal grad student telling him this, but he has been an inspiration to not only me, but other students as well. His commitment to the practical application of social scientific principles, his love for scholarly thought, and his dedication to lifetime learning certainly shine through in the classroom. Most of all, Jon showed me the ‘big picture’ of international development and taught me how to frame and analyze everyday problems of those less fortunate and marginalized. Beyond this epiphany, he provided the most thorough listing and reviews of academic literature I have come across. His willingness to openly share this dedication and experience without hesitation is amazing. Jon’s lectures, notes, and perspective have helped me focus and commit to a future in teaching and research in international development.

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the process. Even though fisheries was not his main interest or background area, Doug was an enthusiastic chair and continued to familiarize himself with the literature I was reviewing in order to further my analysis and precision. He always stressed efficiency, but never sacrificed quality in the process. He deserves as much credit as I do for this finished product.

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Also, let me tell you a little bit about Pat. During the fall of 2003 (the 'epiphany' semester I mentioned earlier), my car suddenly and unexpectedly broke down rendering it undriveable for six weeks in lieu of major repairs. This was in the middle of the most intense academic semester of my life which also included grading stacks of literally hundreds of undergraduate reaction papers for one of my TA classes plus reading and seeking out hundreds of sources for the Plan B report you, the reader, are currently holding. I thought I was finished or, short of over-reaction, in a serious bind for

transporting myself from Richmond into Logan everyday. But Pat saw my bind. Without even hesitating, he gave me his rather nice Ford F-150 indefinitely which allowed me to continue my daily routine completely unfettered, while he used his fiancée Annie's older and sometimes questionable truck (I must thank Annie too). That is selflessness. This episode sticks out in my mind as the clearest example of who Pat is. There was so much more than just this material gesture though. Casey and Pat have both been true friends throughout my Utah stay.

I did not get the chance to say it to you guys, so I will take the opportunity now to speak directly to you both. Thanks guys, for everything. Here is to our future years hooking trophy pike north of the border, cheers!

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CHAPTER I

INTRODUCTION

Small-scale fishing has historically been and continues to constitute a large portion of fish production for both first and third world peoples (McGoodwin 1990). With half the world's fish trade currently produced out of third world nations, 94 percent of the world's fishing fleets being defined as small-scale, and 65 percent of the world's fleet defined as artisanal, it is crucial to understand the problems facing third world fisheries, especially the often overlooked low-technology sectors (FAO 2002). With about 27,000 large-scale commercial fishers in the world constituting 6 percent of the total amount of fishers, that leaves hundreds of thousands of fishers self-employed as small-scale operators (FAO 2002). In Peru for example, 70 percent of fish food for direct human consumption is from artisanal fishers (Prado and Drew 1999). Net revenues from fish trade (exports minus imports) by developing nations recently reached \$17.7 billion, a figure larger than that earned from their exports of such popular crops as tea, rice, cocoa, and coffee combined (FAO 2004).

The percentage of the world's maritime production contributed by Latin American nations has risen since 1988 from 19 percent to over 22 percent and the region continues to be the largest contributor to world production of the eleven world fishery regions (FAO 2002). Aggregate data from 28 Latin American members of the intergovernmental organization the 'Latin American Economic System' (LAES) shows that while marine fishery production has decreased since 1996, the value of fish exports

has doubled since 1988 from 3.1 billion to 6.5 billion measured in U.S. dollars (FAO 2002). One of the five emerging trends identified in worldwide fisheries by the Food and Agriculture Organization of the United Nations (FAO) is that in developing nations, trade flows will reflect the export of high-cost / high-value species and the import of low-cost / low-value species (FAO 2002).

There have been declines in both total marine production in Latin America recently and in per capita production across fishing sectors since the 1980s. Couple that drop in production with declines in income and efficiency among the small-scale sector and it becomes apparent that third world small-scale fishers are under increased pressure to maintain or increase their output of high-cost / high-value species, even though increased amounts of these most valued harvests are being exported out of the community and out of the hands of local consumers. Maintaining a stable level of production to meet growing demand at home and abroad is increasingly difficult as the commercial sector has sharply increased their harvesting efforts in or near what have traditionally been small-scale fishing territories in the last half-century. These territories are most often adjacent to and informally claimed and managed by small-scale fishers in rural communities. Low-tech fishers, often residing in a rural peripheral community with weak backward economic linkages, must then compete with much more technologically sophisticated craft for a declining number of fish. Third world fishers are facing such emerging problems in this new era of commercial encroachment.

1.1: Emerging Multifaceted Problems in Fisheries

Fishing problems are multifaceted, but small-scale fisheries and the fishers that operate within them are especially vulnerable to these problems because of their peripheral position in the emerging era of commercial encroachment and international market demands. Decreases in efficiency and productivity in formerly abundant fish catch areas, increased technologies allowing for fleet effectiveness at cross-continental distances, and national and international industry legal structures adopted to increase foreign and national commercial investment and productivity have encouraged commercial encroachment on small-scale fishing communities. Small-scale fishers are thus being increasingly marginalized and specialized. Many must choose between competing with more technologically efficient and financially backed fleets or becoming integrated by these commercial operations into national and international fish markets. These external factors, coupled with fish stock depletion ‘spillover’ effects and rising internal conflict due to externally influenced marginalization and specialization have influenced the structure and effectiveness of informal institutions created by small-scale fisher communities to manage their fishery.

There is an extensive literature that analyzes how many small-scale fishing communities have created and changed unwritten rules for rights to local fishing resources in response to these internal and external pressures. For example, fishers in a small community vulnerable to fish stock depletion can institute certain property rights systems. Fishing communities having problems with commercial encroachment can organize themselves to monitor and defend clearly defined fishing territories. These

informal management institutions take an endless variety of forms, but there are some regularities that have been documented. Ostrom (1990), Baland and Platteau (1996), and others have constructed theoretical models of several institutional design principles associated with successful small-scale, user-managed common-pool resources. As expanded on in the next chapter, there is an extensive literature that argues that all of these problems can be solved, or at least decreased and lessened, by appropriate and effective institutional design and management practices.

1.2: Research Outline

There is not only a *Crisis in the World's Fisheries* (McGoodwin 1990), but also a crisis in informal fisheries management related to increases in population, consumption, technology proliferation, and inequalities (Burger, et. al. 2001). As the continued viability of often vulnerable informal management institutions in small-scale communities are being threatened, we need to properly understand under what conditions certain institutions succeed or fail. I began this study with two broad research questions:

1. Do the often cited Ostrom (1990) and Baland and Platteau (1996) models for informal common-pool resource (CPR) management hold up in the case of Latin American fisheries?
2. What factors increase the resilience of local management systems in the face of pressures from commercial encroachment in Latin American small-scale fisheries?

The purpose of this paper is to show that there are unique cultural and social patterns in artisanal fishery communities that promote resiliency in the face of external threats. **My thesis is that ‘shoreline reciprocity networks’ account for resiliency to external threats in Latin American artisanal fisheries.** Ostrom’s seven principles are effective in promoting successful management practices in Latin American artisanal fisheries in regards to maintaining traditional environmental, economic, and social health and relationships. Thus, CPR management institutions matter, but so do specific aspects of artisanal fishing culture that contribute to the resiliency of such institutions.

This chapter serves as a short introduction to the emerging and immediate problems of fisheries worldwide, trends in third world and Latin American fisheries, and how those problems and trends are addressed by the research questions. Chapter II provides a brief review of the CPR management literature, defines relevant CPR concepts, and provides an overview of debates on property rights systems and theories of creation and change in CPR institutions. Chapter III provides a synthesis of characteristics common to fisheries and notes how these pose unique problems for local fishery management. Characteristics of third world small-scale fisheries are unique and separate them from the commercial sector and other natural-resource use communities. Chapter IV outlines seven Latin American small-scale fishery case studies drawn from various previously published works. Chapter V concludes by addressing the two research questions and how these case studies provide examples of the specific adaptive responses user groups adopt to maintain their traditional management systems in the face of external threats.

CHAPTER II

COMMON-POOL RESOURCE MANAGEMENT THEORY

There is an extensive literature that outlines how the various problems of fisheries summarized in chapter I are created, alleviated, and / or mediated by social and legal resource management institutions (McEvoy 1986). Much of the recent literature on small-scale fisheries has documented the various forms of locally designed management systems (Dyer and McGoodwin 1994). Ostrom (2001) provides the best synthesis of both resource and user characteristics that influence the likelihood that local users will create such informal management institutions in the first place. In this paper, I am more concerned with how such management systems succeed or fail once created and how they respond to external threats.

There are three main sections in this chapter. Section 2.1 defines and clarifies key concepts used through the rest of the paper and that are widely used (and often misused) in the theoretical CPR management literature. Section 2.2 briefly summarizes the historical development of the major theoretical paradigms and debates in the CPR management and property rights literatures. Section 2.3 analyzes factors influencing success or failure in the maintenance and adaptation of CPR management. This chapter provides a framework of analysis for understanding the management institutions found in small-scale fishing communities. Such a theoretical literature review provides a solid base from which to understand the problems in small-scale fisheries associated with threats from non-local fishing pressure.

2.1: CPR Concepts

A major problem with the CPR literature is that theorists have used certain concepts in vastly different ways. As Dolsak and Ostrom (2003) have most recently suggested, CPR researchers need to build a clear and precise conceptual foundation in order to effectively understand and disseminate research to each other. A common and clear conceptual language is particularly important when integrating works across diverse disciplines, from both the physical and social sciences (Pawson and Dovers 2003).

A concept I use often in this paper is ‘institution’. By ‘institutions’, I mean rules or constraints that are implemented in society in order to ensure compliance with a groups’ decisions. With respect to CPRs, ‘institutions’ are the rules and conventions that establish peoples’ relationships to natural resources (Gibbs and Bromley 1989). Institutions can be formal (codified laws) or informal (norms of behavior, conventions, self-imposed codes of conduct) that mold interactions between user groups and a CPR (North 1994).

It is crucial to distinguish between ‘common-property’ and ‘common-pool’, two often used and interchanged concepts. Dietz et al. (2002) define common-property as a certain type of resource management system imposed by users, not necessarily a characteristic of the resource itself. Common-pool is used to describe the resource itself. A common-pool resource is a resource that is unbounded. Examples of CPRs include ocean waters, pasturelands / rangelands, and the earth’s atmosphere. Management of CPRs typically creates dilemmas concerning how to prevent the potentially unlimited

exploitation and degradation that could result from unbounded access and withdrawal conditions.

Common-pool resources can be managed through different property rights systems: open-access, common-property, individual private property, regional or state government owned property, or a mixture of some or all of these (Table 1). Thus, common-pool can mean open or closed access since 'common-pool resource' is what the acronym CPR stands for and management can be the common-property closed access systems and other institutions implemented on the CPR.

Table 1. Types of Property Rights.

1. Open Access

Absence of well-defined property rights. Resource often unregulated and free to everyone.

2. Communal Property

Resource held by community of users. User community excludes outsiders. Users may self-regulate.

3. State Property

Resource rights held by government. Government can regulate access and exploitation. General public may have access as granted by government. Government can use force to enforce laws and even subsidize use by some.

4. Private Property

Individual has the right to particularly appropriate uses of the resource as socially defined. Individual also has the right to exclude others from these uses. Sometimes includes the right to prevent uses by others that interfere with his / her rights and the right to rent or sell the property to others.

(Adapted from Feeny et. al. 1990).

‘Management’ in this paper refers to humans regulating human behavior (Acheson 1981). This usually involves the creation and maintenance of social institutions, whether informal or formal, to establish rules for property rights (Schlager and Ostrom 1993) and to control and allocate resource use. In this paper, management is a broader term than institutions. ‘Management’ refers to a set of specific ‘institutional arrangements’. Institutions are the rules; management is the set of rules (thus, I refer to management ‘systems’ and management ‘institutions’).

Because fishery resources are naturally chaotic and difficult to control they pose unique organizational challenges (McGoodwin 2001). Such difficulties are a result of many factors, including the featurelessness of the resource, the open-access nature of open waters, and the fact that the extracted unit (the fish) are most of the time hidden from view and thus levels of extraction and exploitation are not easily estimated visually. Most international fisheries are pure ‘open-access’ systems with virtually no regulation from users or state actors. However, local, regional, and national fisheries have various forms of communal, state, and individual property rights systems. Understanding and further analyzing the management institutions of fisheries can have profound policy implications regarding what types of institutions work, do not work, what contexts allow for institutional adaptability to external threats, and in what contexts such successes and failures are apparent.

‘Management’ is defined rather broadly here and it is important to distinguish between what it is and is not. Management institutions should not be confused with the popular ‘cooperative’ organizations used in a majority of fishery development projects

(Sabella 1980). There is also a distinction in fisheries development between capture fishery projects and aquaculture projects, where sometimes aquaculture (the fenced in raising of certain species of fish) is promoted in a community also in a cooperative form of organization (Bort and Sabella 1992). The United Nations FAO is one of the most prominent policy designers and development project implementers concerning fisheries worldwide and it has historically viewed the cooperative as the best one-shot model of fishery development success (Meynell 1984, Jentoft 1986, Sabella and Bort 1991). The cooperative has also constituted the majority of fishery projects implemented by the World Bank (Pollnac 1991).

‘Cooperatives’ can be either user-organized or implemented top-down by a regional government, state government, or an international development agency such as the FAO and are often created to reduce risk and uncertainty. Certainly this equates with management as do the social institutions often created by the formation of a community fishing cooperative. However, there is an important difference. Cooperatives do involve collective action among fishers, but often in the form of pooling economic and technological resources for the sake of maintaining or regaining control over prices received for fish catch and control over fishing equipment used in the community. A common example in Latin America is artisanal fishermen pooling their money as collateral for bank loans in order to purchase multiple outboard motors for the collective and for ‘cooperative’ use since many of these economically peripheral fishers do not have the necessary capital alone to purchase such equipment (Sabella 1980). Fishery ‘management’, on the other hand, does not necessarily involve such pooling of resources

or gaining control of external markets. Also, 'management' involves regulating human behavior 'on the waters', while 'cooperatives' are not always associated with such institutional regulation of fishing effort. So 'cooperatives' are more concerned with community organization and institutions 'on-shore' (pooling resources and controlling external markets), while 'management' exists more abstractly and is concerned with regulating 'on the water' behavior.

There are three main types of CPR management systems: folk (often referred to as 'traditional' also), state, and co-management (Acheson 1989). Folk management systems are the focus of this paper, where local community members and / or local resource users develop and maintain rules for rights over the particular CPR (Berkes and Farvar 1989). State management is where government at any level (international, national, regional, local) is the only authority for developing and maintaining such rules. Co-management lies between these two extreme ends of the management spectrum and is a combination of these two systems, where authority is shared between local resource users and one or various levels of government.

Management systems can be informal or formal. Formal systems have written rules, while informal systems do not. Most folk systems are informal and most state systems are formal. That is, the CPR case study literature has shown that the state formally codifies various management institutions onto paper, which legitimizes such institutions in the event they are challenged legally. Meanwhile, folk management institutions often do not exist formally and instead exist cognitively by local resource users. Rules are enforced, other users monitored, rulebreakers sanctioned through

informal unwritten social norms. Unwritten law can take many forms, from more common-property to private property for example.

There are four main types of property rights systems recognized by almost all of the existing CPR literature: open-access, communal, state, and private (Burger, et. al. 2001, Feeny, et. al. 1990, see Table 1). Each or combinations of these systems can be present along the two scales of ‘informal to formal’ and ‘folk to state’. These four systems differ along four dimensions: (a) nature of ownership, (b) rights and responsibilities of owners, (c) rules of use, and (d) the center of control (Burger, et. al. 2001). These serve as conceptual anchors and do not always exist in singular and pure forms in real-world CPR situations. Edwards and Steins (1998) provide an excellent overview of ‘complex commons’, which more accurately represents how common-pool resources are operated under various property rights systems in the real world. They show that CPRs are generally mixed systems combining two or more of these concepts (for example, some individuals may hold special private areas, while the rest of the resource is held in common or by the state). Also, some users may perceive part of the CPR to be open-access, while it is actually held formally or informally under property rights.

Thus, ‘complex commons’ are those cases where a bounded CPR has either multiple property rights systems existing simultaneously or different users perceiving and attempting to use areas as open-access when they are in fact held under certain property rights. Different users use some CPRs for different extractive purposes, such as a river flowing in front of a community being used for both fishing by coastline fishers and for irrigation water by inland agriculturalists. These cases of ‘multiple-use commons’ are

often where multiple property rights systems and their respective management institutions are found. In these cases, it is not only the heterogeneity and multiplicity of users that must be taken into account, but also the heterogeneity and multiplicity of uses (with their respective management systems).

This synthesis of definitions across the CPR management literature is useful for developing a conceptual framework that has general applicability while maintaining most of the main terms used historically. In the next section, I explore how these concepts have been utilized in larger theoretical debates on why and how certain CPR management institutions are created, maintained, and changed, with emphasis on the historical development of the major paradigms and debates in the CPR management literature.

2.2: Debates Over CPR Management

I divide the historical trajectory of the CPR management theory literature into two main eras, the focus on rational choice theorizing from the 1950s to mid-1980s and the rise of collective action management and critique of rational choice theorizing from the mid-1980s to the present. While there is some disagreement, these two categories represent the main classifications of CPR literature over time and represent how CPR theorizing has been centered on rational choice theory since its origins and the various critiques of that theory arising in the mid-1980s. While a handful of empirical case studies began critiquing rational choice theory in small-steps through the 70s and 80s, it was not until 1986 with the publishing of the National Research Council's *Proceedings of the Conference on Common Property Resource Management* and Arthur McEvoy's *The*

Fisherman's Problem that such critiques of rational choice CPR theorizing were synthesized and articulated within the larger debate.

2.2.1: Rational Choice Origins

The main CPR theoretical debate has historically centered on rational choice theory. The origin of CPR management as a topic with its own distinct literature area and associated specialized theorists and scholars was the publication of Garrett Hardin's classic article "The Tragedy of the Commons" (1968). The thrust of Hardin's argument is that common-property (which he sees as a CPR lacking regulation and interpersonal information) will tend to be over-exploited until it becomes unsustainable for future generations. This is because Hardin applies rational choice theory in this article, that individuals are self-interested acting to maximize their own gain. Hardin's solution to the tragedy is "mutual coercion, mutually agreed upon" (p. 1247). Hardin's 'mutual coercion' represents a simplified pre-cursor to the user management institutions favored by so many subsequent CPR theorists.

The 'fisherman's problem' (McEvoy 1986) is an example of Hardin's tragedy as seen in relatively unregulated oceans. Under open-access conditions, fishers of all types and abilities know that the other fishers harvesting the same waters will profit from their catch and that takes away from their potential catch and profit. Economists using rational choice theory define the 'fisherman's problem' as when fishers are in competition to harvest as much as they can as efficiently as they can since they know that their potential harvest will be decreased as others fish in the same waters without limitations. When

there is no individually held value, as in many open-access CPRs, there is no reason to sustain the resource.

More recent rational choice theorists have applied these earlier models to individual and group action concerning CPR management systems (Ostrom 1990, McCay and Acheson 1987). These theorists adopt the perspective that a CPR presents ‘social dilemmas’ because of their assumptions that a CPR is a resource susceptible to open-access exploitation, as self-interested utility maximizing individuals will necessarily attempt to use as much of the resource as beneficial to them and thus create externalities for other users. Even when a community organizes collectively to create informal institutions for managing the resource, this creates a public good wherein all community users can benefit from the public good without necessarily contributing. Although monitoring and sanctioning rules can be agreed upon to solve this free-rider dilemma, this process of rule enforcing itself creates another level of public good dilemma (Ostrom 2001). From a rational choice theory of collective action, resolving such ‘social dilemmas’ is at the root of all management (Ostrom 1998). This is why rational choice theorists often use repeated game theories to reproduce and solve such dilemmas.

2.2.2: Private Property Rights

Initial problems of over-exploitation, hyper-competition, and economic inefficiency noted by rational choice theory often explain why users come together in voluntary association to create CPR management institutions. Such management institutions can protect the resource by closing access to certain users. Private property

rights can create individual user or user group incentives to sustain the value (and therefore, the extractable unit integrity) of the resource for future generations because the user(s) owns all or part of the resource. Thus, one positive argument for private property rights is it allows individuals to plan for the future.

Two of the earliest advocates of private property rights in fisheries were economists H. Scott Gordon and Anthony Scott. Gordon theorized that the marginal return from fishing is zero, which explained why many fishers are so poor. This is because under open-access conditions costs rise proportionally with the amount of effort expended. He argued that a closed-access system limiting entry should be devised because maximum economic return can be achieved only by balancing efforts / costs with amount of catch, and by eliminating hyper-competition that continually reduces the proportion of benefits as more effort is needed to harvest more fish under an increasing number of entering fishers. Privatizing the fishery would then maximize economic return and ecologically conserve the fishery (Gordon 1954). Scott has made the same claim, initially in his 1955 article and subsequently in his later works (Scott 1955, 1979, 1988).

There is considerable debate between advocates for either private property rights or common-property rights as a means for conserving natural resources. On one side, Stevenson (1991) argues that private property is more efficient than common-property, assuming that transaction costs are equal. Simmons and Schwartz-Shea (1993) argue that private property arises out of conservation concerns. The private property argument is based on two key assumptions: that private property rights are created as a response to

open-access problems and that such management institution creation is mainly for the purposes of conservation.

At the same time, the conservation of a resource has been the main reason for local CPR resource users to create common-property management institutions and to justify the costs that follow with creating, enforcing, and changing them. However, Durrenberger and King (2000) point out that informal management institutions are not necessarily created out of a conservation ethic to facilitate sustainable use of a CPR. Rather, the environmental, economic, and social dynamics that influence the creation of such informal management needs further research (2000). Certainly, some informal management institutions have no clear connection to conservation and sustainability issues. One example is the often-studied coastal fishermen of Caye Caulker just off the mainland shore of Belize (King 1997a, 1997b, 2000). However, many CPR scholars agree that whatever the initial motivation for creation or change to new forms of management institutions, the resulting maintenance of such informal institutions can curb environmental degradation that may have otherwise been inevitable under open-access conditions (Burger, et. al. 2001).

Researchers that take a less economic approach to CPR management have even argued that fisheries in particular are difficult, if not impossible, to divide up into private property and therefore automatically require collective management institutions (Burger, et. al. 2001). However, there are numerous case studies of rather successful informal management based on private fishing territories and 'visual triangulation' that rebut this side of the debate. See chapter III (section 3.3) for an overview of 'visual triangulation'

and chapter IV for Latin American examples of such case studies (Cordell 1984, Sutherland 1986).

2.2.3: Critiques of Rational Choice

Scholars of various other disciplines increasingly critiqued the rational choice model beginning in the 1970s as not adequately accounting for societal structures or forces (McEvoy 1986). What Hardin misconceptualized was the nature of the ‘commons’ itself. Rather than being an inherent flaw of common-property, open-access and poorly defined property rights are what really caused Hardin’s ‘tragedy’ (Burger, et. al. 2001). His article should have been titled “The Tragedy of Open-Access”.

Aside from Hardin’s well-documented ‘tragedy’, there is also the ‘tragedy of the anti-commons’. This is when the tragedy of over-exploitation occurs within individual private property rights, a closed-access system. This can be due to simple poor management by a private owner and is often cited by advocates of common-property. Even when resources are divisible and privately owned, ensuring conservation to protect the well-being and use needs of future generations cannot be accomplished by individuals acting out of self-interest alone (Burger et. al. 2001).

Thus, critics of Hardin have focused on his general lack of accounting for collective action. At the same time, critiques of early rational choice theorists question their behavioral assumptions and faith in private property. Ostrom (2001) is one who has questioned the assumptions of these earliest rational choice ‘economic’ type theories of fisheries, including beliefs that:

- The resource unit extracted is highly predictable and consistent
- Users are homogenous in assets, skills, discount rates, and cultural views
- Users are short-term profit maximizers that possess complete information
- Users act independently without coordinating their activities

These assumptions of rational choice theory often reduce CPR management to a one-shot or repeated game theoretic, such as a prisoner's dilemma (Dasgupta and Heal 1979). It was the main perspective on CPR management through the mid-1980s when more examples arose showing an absence of private property rights in favor of communal property, and variables explaining the heterogeneity of actors became more defined (Ostrom 2001, Petrzela and Bell 2000).

Numerous anthropologists have questioned the assumption of economic rationality or other grand theories of human nature since "man is so entangled with where he is, who he is, and what he believes" that there is no one "human nature" independent of time, place, and cultural context (Geertz 1973: 35). This human constructed culture is what enables communities to do what Hardin's theoretical pastoralists could not do: adapt their behaviors to changing environmental, economic, and social conditions by creating management institutions. Indeed, this is what makes humans human, our ability to conceive the changing world around us and consciously manipulate our relationship with it (McEvoy 1986). Experimental research on individuals' motivations to cooperate has revealed that individuals may not always act just in their own self-interest (Ostrom 1998).

It is important to note that most critiques of the rational choice paradigm are devoted to debunking some of the assumptions of the theory and has done little to refute its empirical validity (Ostrom 2001). Such critiques have also tended to over-state the assumptions of rational choice, not taking into account the inherent flexibility of this often stereotyped perspective (Mueller 2003).

Besides critiquing the generalizability of rational choice theory and the often pure private property rights advocacy of this perspective, much of the current CPR literature also critiques pure state government management as environmentally, economically, and socially inefficient when compared to more localized informal systems. Problems with state ownership include the cultural and social distance between state managers and local users, reliance on higher-tech engineering, and the need for non-local labor to monitor and maintain the system (Ostrom 2001). As a result of these critiques, co-management has emerged as one potential solution to CPR management dilemmas (Durrenberger and King 2000).

Cole (2002) concludes that there is no one type of property rights system that is a correct model for most contexts. With private property rights advocates, it is often assumed that such rights effectively decrease externality such as pollution. If it is the absence of property rights that explains pollution, then what explains the absence of property rights? Thus, Cole arrives at the heart of the problem: what are the costs of defining different forms of property rights? He concludes it is the economic, institutional, technological, and ecological context that will determine the transaction costs of all forms

of property rights systems and thus determine which type of rights are most appropriate for the specific context.

The most recent CPR management literature agrees mostly with Cole's position, expanding beyond property rights systems and noting that the wealth of case studies collected on informal CPR management systems shows us that certain environmental, social, and technological contexts allow for the creation and maintenance of diverse types of informal CPR institutions (Burger, et. al. 2001). Thus, such contexts need to be further delineated in order to better understand under what conditions informal CPR management institutions work or fail (Burger, et. al. 2001).

2.3: Creation, Maintenance, and Adaptation of Local Management Systems

The previous section briefly summarized rational choice theory that shaped the origins of what has become CPR management theory and the ensuing critiques of this paradigm that have led to increasingly complex theoretical models of CPR analysis. This section briefly summarizes three emerging complex themes in the CPR management literature. Section 2.3.1 outlines the pieces of the 'CPR Puzzle', the basic framework of requirements in managing a CPR. This compares costs and benefits between informal and formal CPR management systems regarding creating, maintaining, and changing rules. This 'CPR Puzzle' encompasses a major theoretical breakthrough of the recent CPR literature, that CPR management institutions are not static and subject to modification and change. Section 2.3.2 introduces two models outlining design principles of CPR management that have been shown effective in numerous case studies. These models are

the basis for the first research question of this paper. Section 2.3.3 expands upon the theoretical development of management as a dynamic variable. This section is the basis of analysis regarding the second research question and introduces the concept of ‘resiliency’.

2.3.1: The CPR Puzzle

Ultimately, management of CPRs through informal institutions requires two main accomplishments: limiting access (closed access conditions, deciding who will be excluded and how) and limiting harvest (because the taking by one user will affect the takings of another) (Burger, et. al. 2001).

So why are informal systems sometimes preferable to formal systems? It is important to briefly contrast perceived costs and benefits of formal vs. informal systems to better understand why one community may develop and maintain one system and another might choose a different approach. Holling (1986) shows that CPR choices can occur when management systems are vulnerable or under stress.

There are three types of transaction costs to consider when choosing between formal or informal CPR management systems. First, there are costs associated with **creating** rules. Second, there are costs associated with **enforcing** rules. With legal property rights systems, sanctioning relies on the judicial system and can exhibit high transaction costs. Libecap (1978) argues that operating through the ‘due process of law’ contributes to low efficiency in the courts and creates high time and money costs. By contrast, informal property rights systems usually involve coordination games between

users, and rules are agreed upon through some form of explicit or implicit voting procedures. Mueller (2003) provides a thorough overview of types of voting procedures. These agreed upon rules include monitoring and sanctioning to oversee and punish users that are rulebreakers or free-riders. In order for informal systems to be more attractive, they need to have low individual transactions costs for monitoring and sanctioning these rulebreakers. In a context where users have the option of choosing between formal and informal systems, the system with lower transaction costs for monitoring and sanctioning is usually more advantageous.

Third, there are also transaction costs to consider in both types of systems when users attempt to **change** these rules. Transaction costs can be high in both types of systems, but changing rules presents a different set of characteristics in each. Transaction costs to change rules tend to be higher in informal systems because, unlike in formal systems where the rules are written, a user has to prove a rule actually exists. Rules in informal systems exist not on paper, but in human behavior. To change human behavior is usually more costly and a more difficult venture than to change written law.

2.3.2: Principles of Success

There are several models in the CPR literature that discuss the institutional characteristics and context associated with successful CPR folk management systems (Ostrom 1990, Baland and Platteau 1996). These models examine the informal management institutions that have been successfully transferred across generations of CPR users in a large number of local case studies. These successful folk management

systems are also credited with maintaining and enhancing local environmental, economic, and social health.

The best-known work on local CPR management comes from Elinor Ostrom (2001, Dolsak and Ostrom 2003). Ostrom's model identifies seven 'principles' associated with successful local CPR management systems. First, **well-delineated and stable boundaries** around the resource are key since they reduce the transaction costs of identifying potential incursions by those from outside the community (Dolsak and Ostrom 2003, Ostrom 2001). Such boundaries help to alleviate potential 'tragedies' of pure open-access. Second, there must be **congruence** among key elements. Initially, the distribution of benefits and costs upon each individual user from rules must be roughly perceived as fair and equitable, as well as be fair and equitable in practice. Also, such appropriation rules assigning benefits and costs to individual users must be adapted to specific local conditions (Ostrom 2001). Thus, rules must be congruent to and coincide with real and perceived equity and unique local conditions. The third design principle involves **collective-choice arrangements** that define an oversight process whereby appropriators can change the rules if needed. If the voice and interests of these appropriators are not heard, then they may 'exit' or perhaps will even begin to cheat the rules and norms of the community causing rises in enforcement costs and potential breakdown of the management system (Hirschman 1970). Lack of input from all users decreases transfer of information among users and can endanger community management institutions by causing stagnation and slower responses to change (Ostrom 2001).

The fourth and fifth principles reflect the presence of effective **monitoring** and the use of **graduated sanctions** to make sure rulebreakers are caught and that punishment is appropriate and at least pervasive enough in order to promote rule compliance and even increase self-monitoring. If rulebreakers are not properly monitored (and this comes to the attention of many in the community) conflict-resolution mechanisms can breakdown because the cost of enforcing rules increases. Sixth, successful management systems must have efficient and effective **conflict-resolution mechanisms**. Transaction costs must be low for conflict-resolution. Finally, it is important that local, regional and state governments recognize the informal, unwritten management practices. The more **legal recognition** is given to informal management institutions, the less likely future disputes over state vs. common / private property and access to such CPRs will be challenged judicially (Ostrom 2001).

The lack of any one of these seven crucial principles (see Table 2) can cause a breakdown in the management system that can then be the catalyst for fundamental change (Holling 1986).

Ostrom's model does contain an eighth design principle, 'nested enterprises' that I do not include here because this is applicable to CPRs that are managed across analytical levels. This principle is applicable to an emerging area of theorizing in the CPR literature, that of overlapping or nested commons across temporal and spatial scales. Global commons such as air and ocean pollution are distinguishable from other singular level CPR management systems in that management institutions that can and are affected by the problem exist across local, regional, and or national levels (Burger et. al. 2001).

Table 2. Design Principles Illustrated by Long-Enduring CPR Institutions.**1. Clearly defined boundaries.**

Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself.

2. Congruence between appropriation and provision rules and local conditions.

Appropriation rules restricting time, place, technology, and / or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and / or money.

3. Collective-choice arrangements.

Most individuals affected by the operational rules can participate in modifying the operational rules.

4. Monitoring.

Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.

5. Graduated sanctions.

Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, by officials accountable to those appropriators, or by both.

6. Conflict-resolution mechanisms.

Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

7. Minimal recognition of rights to organize.

The rights of appropriators to devise their own institutions are not challenged by external government authorities.

Adapted from (Ostrom 1990: 90).

Baland and Platteau (1996) offer a second model that succinctly summarizes other CPR models, including Ostrom's, while adding a few principles of their own (see Table 3). In addition to Ostrom's seven factors, they add:

1. Low costs of exclusion technology
2. High physical overlap between the CPR and users' residences
3. High demands for the resource
4. High user knowledge of sustainable yields
5. Small size of user group
6. High mutual obligation and concern for social reputation between users

The principles from these two models can be divided into three main categories.

Ostrom's model includes two principles that concern the physical environment characteristics of the CPR (principles #1 and #2) and the five other principles outline what forms of institutional arrangements affect successful CPR management. Baland and Platteau incorporate six of these seven principles, one physical and all of the management institutional, into their model. They add a third category of factors, characteristics of the user group that extend Ostrom's model.

The main disagreements between the two models concern the effects of user group 'size' and the importance of other social and cultural attributes of user groups. While Baland and Platteau argue size and CPR success are negatively correlated, Ostrom concludes that the data on how size and heterogeneity of users affect collective action is inconclusive (Ostrom 2001). Most of the classics on collective action through the 1960s to 1970s adopt the rational choice perspective and logically concluded that the larger a group of maximizing individuals, the less likely collective action will succeed as shown by repeated game theories (Buchanan and Tullock 1962). However, examples drawn from irrigation CPR settings provide evidence to the contrary. Tang (1992) and Lam

Table 3. Factors influencing the likelihood of successful collective action.

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1. **The resources.** The smaller and more clearly defined the boundaries of the common-pool resources, the greater the chance of success. (**Ostrom #1**)
 2. **The technology.** The lower the costs of exclusion technology (such as fencing) the better the chances of success.
 3. **Relationship between resources and user group.**
 - a. Location: the greater the overlap between the location of the common-pool resources and the residence of the users, the better chance of success
 - b. Users' demands: the greater the demands (up to a limit) and the more vital the resource for survival, the greater the chances of success
 - c. Users' knowledge: the better their knowledge of sustainable yields, the greater the chances of success
 4. **User group characteristics.**
 - a. Size: the smaller the number of users the better the chances of success, down to a minimum below which the tasks able to be performed by such a small group cease to be meaningful (perhaps because, for reasons to do with the nature of the resource, action to mitigate common property problems must be done, if at all, by a larger group). (**data inconclusive**)
 - b. Boundaries: the more clearly defined are the boundaries of the group, the better the chance of success (**similar to Ostrom #1**)
 - c. Relative power of sub-groups: the more powerful are those who benefit from retaining the commons, and the weaker are those who favor sub-group enclosure or private property, the better the chance of success (**similar to Ostrom #3**)
 - d. Existing arrangements for discussion of common problems: the better developed are such arrangements among the users, the greater the chances of success (**matches Ostrom #6**)
 - e. Extent to which users are bound by mutual obligations: the more concerned people are about social reputation, the better chance of success
 - f. Punishments against rule-breaking: the more the users already have joint rules for purposes other than common-pool resource use, and the more bite behind those rules, the better the chances of success (**Ostrom #5**)
 5. **Noticeability.** Ease of detection of rule-breaking free-riders: the more noticeable is cheating on agreements, the better the chances of success. Noticeability is also a function partly of 1, 3a, and 4a. (**similar to Ostrom #4**)
 6. **Relationship between users and state.** Ability of state to penetrate rural localities, and tolerance of locally based authorities: the less the state can, or wishes to, undermine locally based authorities, and the less the state can enforce private property rights effectively, the better chance of success. (**Ostrom #7**)
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Adapted from (Baland and Platteau 1996: 286-288).

(1998) both show that the smallest groups they studied (with only a handful of users) did not perform better on any of a series of environmental and economic performance measures compared to their largest groups (which ranged from 300 to 475 members). It is crucial when analyzing size to understand ‘jointness of supply’, whether or not the costs of providing a public good remain stable with an increase in numbers of users. With such varying examples on size, it is most accurate at this point in the debate to say that size has a curvilinear relationship to success (Ostrom 2001). Homogeneity and size are often related in the CPR management literature as many theorists often see a positive relationship between size and heterogeneity (Ostrom 2001). Homogeneity is often measured by user similarity across four main variables: assets, skills, discount rates, and cultural views / attitudes (Ostrom 2001).

For the purposes of empirically testing these models against Latin American case studies as outlined in my first of two research questions for this paper, I have combined these two models into one overall set of principles theorized to account for CPR management success (see Table 4). This synthesis includes all seven of Ostrom’s principles as well as three additional principles from Baland and Platteau (excluding ‘costs of exclusion technology’, ‘physical overlap between the CPR and users’ residences’, and ‘size’) for a total of ten principles. ‘Costs of exclusion technology’ is discounted since the case studies I will be analyzing in chapter IV do not exhibit forms of exclusion technology. Rather, exclusion of outsiders is based on monitoring and sanctioning mechanisms already covered by Ostrom’s model. ‘Exclusion technology’ is more applicable to CPR resources such as rangelands where physical exclusion markers

such as fences are present, whereas in fisheries such physical markers are often not.

‘Physical overlap’ is discounted along similar grounds as ‘exclusion technology’. This factor is more applicable to other types of CPR resources such as rangelands and forests where users’ residences can and sometimes do exist on the CPR itself. In such cases ‘overlap’ can be measured, but in fisheries, users’ residences do not exist physically on the waters, they do not overlap the CPR. ‘Size’ is discounted for reasons mentioned previously.

Table 4 presents the combined model I will be testing in chapter V. It includes principles from the three categories across both models. The first two principles are concerned with physical environment characteristics. Principles #2 through #7 are concerned with management institution arrangements. Principles #8 through #10 are from Baland and Platteau. These three are not ‘design principles’ or rule arrangements like the previous six factors that seek to control human behavior or are part of the institutional structure of CPR management, but rather they are characteristics of the user group.

Table 4. Model of Effective and Resilient CPR Management Principles.

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1. **Clearly defined boundaries.** Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself.
 2. **Congruence between appropriation and provision rules and local conditions.** Appropriation rules restricting time, place, technology, and / or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and / or money.
 3. **Collective-choice arrangements.** Most individuals affected by the operational rules can participate in modifying the operational rules.
 4. **Monitoring.** Monitors, who actively audit CPR conditions and appropriator behavior are accountable to the appropriators or are the appropriators.
 5. **Graduated sanctions.** Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, officials accountable to those appropriators, or both.
 6. **Conflict-resolution mechanisms.** Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
 7. **State tolerance of local management systems.** The rights of appropriators to devise their own management institutions are not challenged by external authorities.
 8. **Users' demands for the resource.** Demands must be high (up to a limit) and the resource needs to be seen as vital for survival.
 9. **User knowledge of sustainable yields.** Users' knowledge of sustainable yields needs to be high.
 10. **Mutual obligation and concern for social reputation between users.** The extent to which users are bound by mutual obligations and their concern about their social reputation need to be high.

Adapted from (Ostrom 1990:90; Baland and Platteau 1996:286-288).

2.3.3: Resilience to Change

In his classic work on human environmental adaptation, Holling (1986) theorizes that fundamental changes in natural resource management institutions can only occur at points of deep crisis in the environmental and social systems when the accumulation of perceived failures in those systems exceed the perceived benefits of the management institutions. It is this sort of fundamental change that can be equated with a complete breakdown in traditional management systems that have existed informally in small-scale communities for generations. Changes that were unforeseen by locals, such as the commercial fishery encroachment explained above, can cause the breakdown of informal CPR management systems. With a growing number of such examples of management system breakdown in recent years, an emerging theme in the CPR literature has been an evaluation of the resiliency of local management institutions to forces of change.

‘Resilience’ generally refers to the magnitude of disturbance a system can absorb before it fundamentally changes or breaks down (Berkes and Folke 1998). Resilience has been applied in the natural resource management literature by examining the dynamic feedback mechanisms and changes between social and ecological systems (Gunderson et. al. 1995, Gunderson and Holling 2002). Applied to informal folk CPR management, ‘resilience’ is the capacity of that management system to absorb disturbances while maintaining its traditional behavioral processes and structure (Berkes et. al. 2003).

For most authors, management is itself a variable (a part of the social system) subject to fundamental breakdown or change. Local user groups that can effectively develop particular adaptive responses to external disturbances are those that can promote

resiliency in their management system and maintain their unwritten laws. The development of appropriate adaptive responses depends on context. The main factors that most often influence such effective adaptive responses are: high user group reciprocity, rapid and inclusive collective action mechanisms, and effective management institution learning mechanisms. Institutional learning involves a continual commitment by users to gather and analyze data, whether by observational or more formally scientific means, in order to keep aware of changes and trends in the environmental and social systems that constitute the CPR system (such as integrating feedback from the ecological and social systems into management decision-making). Incorporating such observations in management discussions and operations is one major key to effective adaptive response (Berkes et. al. 2003). These three factors are highly inter-dependent.

The development of specific adaptive responses to change promotes flexibility on the part of the local users, but also enhances the long-term resiliency and maintenance of traditional informal management institutions themselves. The case studies presented in chapter IV provide evidence of the adaptive and flexible responses of artisanal fishing communities in Latin America in the face of external pressures.

Management institutions that are resilient to change over time through context-appropriate adaptations are the ones that are likely to promote environmental, economic, and social health for present and future generations (Durrenberger and King 2000, Dolsak and Ostrom 2003). Whatever types of property rights and rules an informal CPR management system exhibits, it is change over time that tests the strength and determines the resilience and stability of any unwritten law.

CHAPTER III

FISHERIES

The previous chapter outlined the ‘nature’ of the fishery as a CPR that is often times under certain types of management control and institutional design. This chapter outlines the numerous ‘problems’ specific to fisheries of all types, shows how those problems are inter-connected, and focuses on problems unique to third world artisanal fisheries. There are four sections in this chapter. Section 3.1 briefly distinguishes between the types of fisheries and fishing fleets across environmental, economic, and social variables. Section 3.2 summarizes a set of emerging and inter-linked trends and threats across all these types of fisheries. Section 3.3 provides an outline of the unique challenges faced by third world artisanal fishing communities. This section also specifies how these challenges affect small-scale fishery management institutions. Section 3.4 briefly restates the goals of the paper and relates the research questions to the specific discussions on fishery challenges and fishery management.

3.1: Types of Fisheries

Social and Economic Subsectors

The fishing industry is distinguished mainly by technology and ownership. Commercial fleets are typically harbor-landing and motorized. Commercial fleets also tend to be owned by non-operator investors, which can be public (Sabella 1980) or private (Sutherland 1986). In the commercial sector, high costs of entry and maintenance

on more advanced and modernized forms of technology most often results in the owners being distant investors, private companies, and others that are not directly the fishers themselves.

A sub-category of the commercial sector is the ‘ultra-modern’ sector (Kurien 1978). The ultra-modern sector constitutes one extreme end on a spectrum of types of fisheries, and is characterized by five factors (Platteau 1989a, Finlayson and McCay 1998):

- The use of sophisticated modern technologies of boat range and exploitation capacities that allow for international water traversing and intense fish catches often with giant trawler nets
- The employment of trained crews whose specialized qualifications and long-journey work patterns are far removed from the more generalized and close-to-shore fishing of small-scale fishers
- Orientation toward the demands of more urbanized markets and foreign consumers / investors, with few sales to the local community which often leads to ‘catch and run’ behavior
- Greater emphasis on strict quality control procedures
- Strong ties to modern processing plants

At the other end of the spectrum are small-scale fisheries. Small-scale includes fisheries of a wide array of characteristics and sizes in different contexts. Two main characteristics distinguish small-scale fishing fleets from commercial fleets. First, small-scale fleets generally consist of all beachlanding units. Second, small-scale fleet owners /

proprietors are usually the fishers themselves (Platteau 1989a). This sector uses smaller and less sophisticated technologies. The reliance on beachlanding is associated with the use of traditional wood-dug and reed-sewn canoes and rafts though modern small-scale fishers often add an outboard motor or implement new materials and designs (McGoodwin 1990). Small-scale fisheries require less heavy infrastructure such as anchoring and harboring facilities, boats can be decentralized and dispersed along a coastal shoreline or community. Because of the relatively simple technology associated with beachlanding boats, most owners are also operators. They are the local fishers themselves.

A sub-category of small-scale is 'artisanal'. The main distinguishing characteristic separating 'artisanal' as a sub-category of the small-scale sector is technology. 'Artisanal' fishers are non-motorized and typically do not purchase or use fishing materials obtained from outside the community. This is why they are 'artisanal', they rely on relatively crude local materials to fabricate all their own fishing technology. This artform requires tremendous skills, intuition, and experience to operate such self-crafted equipment (McGoodwin 1990).

The continued growth of commercial encroachment has increased the number of commercial and small-scale fishers working side-by-side in the same local and regional waters and increased complex economic integration and linkages between the two sectors. Most, if not all, fishers in this era of commercial encroachment are selling at least a portion of their catch either by delivering to regional markets or selling to closer

community markets that are linked to more distant markets and their price fluctuation dynamics.

To summarize, small-scale fishing is distinguished as all owner-operated beachlanding boats. The ‘artisanal’ fisheries are the non-motorized portion of the small-scale sector. The ‘ultra-modern’ and the ‘artisanal’ represent the two extreme ends of the fishing sector spectrum on the basis of technologies and are usually associated with their own unique economic and social organizational linkages and patterns. They constitute the ideal types of the competing sectors when analyzing commercial encroachment. However, it is important to keep in mind that beyond the main distinguishing factors for each of the four categories I have described, there are numerous examples of fishers in the middle of the spectrum that overlap these categories.

Environmental Subsectors

Fisheries are also distinguished by the environmental nature of the fishery itself. There are rather straight-forward terms such as ‘maritime’ and ‘riverine’ that describe the physical ecosystem of a fishery (oceans and rivers, respectively). The most crucial and often confused terms are ‘in-shore’ and ‘off-shore’ areas in maritime fisheries. For the purposes of this paper, ‘in-shore’ waters are the coastal territories the majority of small-scale and / or artisanal fishers in a community exploit. These territories usually form a stretch of coastline along the adjacent community shore, characterized by shallower water depths (compared to ‘off-shore’ waters) and are therefore more conducive to exploitation by fishers using low-technology crafts that are often too difficult to operate far from

shore. 'Off-shore' waters are the territories more distant from shore most often used by high-technology commercial fleets. Their technologies, such as trawler nets, are more conducive to deep-water exploitation. Although the exact distance separating 'in-shore' from 'off-shore' waters depends on the particular marine ecosystem, most often the two can be distinguished by analyzing the limits to artisanal fleet distance from shore. Commercial fleets often do enter and exploit these in-shore territories, which is an increasing problem for small-scale fishing communities.

3.2: Trends and Threats

3.2.1: Collapse of Fisheries Worldwide

At the end of the twentieth century, there is an emerging set of environmental, economic, and social problems that adversely affect all types of fisheries worldwide (see Table 5). Environmentally, over-exploitation of fish stock may be occurring in the context of exponential world population growth as measured by two factors: decreased amount of catch per unit of fishing effort (decreased efficiency) and a decrease in the world's per capita fish production (McGoodwin 1990, Fairlie 1995, Acheson et. al. 1998). Even though the total annual fish catch steadily increased from the 1850s to the 1960s, starting from 2 million tons growing to 55 million tons (with a doubling from 20 to 40 million tons in only ten years from 1950 to 1960), the rate of growth leveled off in the 1970s (growing slightly from 66 million tons in 1971 to 72 million tons by 1980, a pronounced decline in growth rate from 5 percent per year between 1945 and 1970 to only 1 percent per year through the 1970s). A more recent increase to over 90 million

tons by the end of the 1980s reflects accelerated fishing efforts and more intensive harvest technology, mainly in the commercial sector (Platteau 1989a).

Table 5. Emerging Trends and Threats in Fisheries.

	Commercial	Small-Scale
<u>Environmental</u>	Severe <ul style="list-style-type: none"> • fish stock depletion • species extinction 	Severe <ul style="list-style-type: none"> • fish stock depletion (sometimes due to spillover effects) • species extinction
<u>Economic</u>	Moderate <ul style="list-style-type: none"> • decrease in per capita fish production • profitability with rising costs 	Severe <ul style="list-style-type: none"> • decrease in per capita fish production • decrease in efficiency • level of integration with commercial encroachment • tourism encroachment
<u>Social</u>	Low	Severe <ul style="list-style-type: none"> • community survival • mgmt. institutional credibility • relations with government • level of integration with commercial encroachment • tourism encroachment

The recent growth in fish harvests does not mean the amount of fish available for harvest is increasing. Rather, advances in fishing technology (especially in the 1980s) allowed commercial and motorized fleets to harvest a wider range of species previously

unavailable at depths and places never before exploited in order to raise the overall amount of the world's fish catch (McGoodwin 1990). An early 'take-off' point in this technological advancement was when commercial fleets implemented technologies developed during the industrial boom years of World War II. By the 1960s, inexpensive steel construction, diesel engines, shipboard refrigeration and automated freezing, electronics for more precision long-distance and night navigation, long-distance communications, and bottom-imaging and fish-finding monitors all were available. This produced new 'factory-freezer trawler' fleets that were equipped to fish around the clock, over long distances, and able to sweep the oceans more efficiently with trawler nets while gathering more fish with fewer transaction costs (Finlayson and McCay 1998).

However, this 'bonanza' period of trawlers sweeping the oceans clean soon grew over-saturated, leading to a decline in efficiency and productivity in the 1970s. Also affecting the growth of worldwide fish catch may have been the more stringent U.S. policy acts of the 1970s that were enacted because of increasing concerns of ecological limits and a fundamental reconceptualizing of the human-nature relationship by the environmental movement. Policy such as the Marine Mammals Protection Act and the Fishery Conservation and Management Act lessened the contribution of U.S. catch amounts to worldwide totals over the last three decades (McEvoy 1986).

So while the total number has risen, the two key factors of catch per unit of fishing effort (efficiency) and the world's per capita fish production have steadily decreased. While commercial efficiency may be generally rising (FAO 2002, 2000), small-scale efficiency seems to be declining (McGoodwin 1990, Brown 1978). In a study

of various types and sizes of fishing fleets worldwide by the FAO through the mid-1990s, an important finding was that the extreme low-technology end of the fishery spectrum was one of the few sectors losing capital and efficiency. This was attributed mainly to over-exploitation of fishery resources and competition from more efficient and technologically sophisticated commercial capture technologies, such as purse seiners and coastal trawlers (FAO 2000, FAO 1999, NOAA 1999, Stergiou 1989, Akpalu 2002).

The world's per capita fish production remained steady through the 1990s at about 15 to 16 kg if China's recent boom in the last 20 years in both marine and aquaculture production are accounted for (FAO 2002). However, when Chinese production is excluded, per capita fish production appears to have steadily declined since the 1980s from about 15 kg to 13 kg in 2001 (FAO 2002, FAO 2000). While the total fish catch has continued to rise through the last decade to over 90 million tons, there is concern that the rate of increase in total fish harvests will eventually drop to zero as it reaches the ocean's maximum aggregate annual productivity level (estimated to be near 100 million tons) (McEvoy 1986).

This means there still may be a growing, stable, or decreasing absolute amount of fish in the world's seas, but such a measure does not necessarily matter. The relative amount of fish per human has decreased with the exponential growth of the world population since 1950. That, coupled with an increase in the number of fishers on the seas has caused fisher efficiency to decrease (McEvoy 1986). While the debate continues on whether or not the absolute number of fish available is growing or declining, such an argument may be erroneous as fisher efficiency and per capita productivity are steadily

decreasing, while growth in population and higher incomes have led to a rise in the demand for fish (Platteau 1989a). It no longer appears that fish will be adequate to feed the world's poor (Durrenberger and King 2000). These trends have also placed increased pressure on commercial and small-scale fisheries seeking to meet demand in nearby regional and urban markets.

Commercial fisheries also have seen an emerging problem of fish extinction and fish 'undergrowth'. There has been extensive documentation of the near extinction of the northern cod between the Labrador and the Grand Banks of Newfoundland where the use of new technologies led to over-exploitation of a major commercial fishery (Finlayson and McCay 1998, Finlayson 1994, Milich 1999, Haedrich and Hamilton 2000). The once massive anchovy reserves off the central coast of Peru were over-exploited to near extinction in the mid-70s (Clark 1977). Salmon in the Pacific Northwest (Taylor 1999) and whitefish in Canadian freshwater lakes (Handford et. al. 1977) have entered 'new evolutionary paths' of 'undergrowth' resulting from the use of technologies such as large-sweeping trawler nets with smaller and more firm mesh leading to selective harvest of larger fish that allow only smaller fish to escape and reproduce. This 'undergrowth' has been associated with a decrease in fisher efficiency, where a fisher can now catch the same number of fish in such areas, but tonnage has decreased since the fish are increasingly smaller (Russell 2003).

3.2.2: Commercial Encroachment on Small-Scale Fishing Communities

While both commercial and small-scale fisheries share the problem of fish stock depletion, there are other economic and social problems that are unique to small-scale fisheries. **Many of these problems are heavily influenced by commercial fish fleet competition and encroachment.** One example is fish stock depletion that is often the result of ‘spillover’ effects. ‘Spillover’ effects result from the fact that ocean waters are an ‘overlapping’ natural resource where a wide array of user communities from different regions and nations are connected by migrating fish stocks (Burger et. al. 2001). This ‘overlap of jurisdiction’ not only makes the oceans and their connecting waterways a CPR for management purposes, but also the ocean ecosystem itself is connected across these jurisdictional boundaries as well. Thus, more commercial fishers catching fish or even overexploiting a fish to extinction in one part of the ocean will have ‘overlapping’ effects on nearby communities that also use that ocean. Northern cod overfishing does not only affect Newfoundland, but surrounding regions fishing out of the Northern Atlantic as well. Even inland riverine fishery stocks are often not safe and adversely affected from over-exploitation in adjoining oceans (McEvoy 1986). Such environmental problems are shared by all types of fisheries, including inland riverine fisheries connected to the ocean ecosystem, and show the externalities of commercial technology and harvesting methods. This creates an emerging problem for fisheries management as institutional responses to such spillover problems will have to be coordinated between institutions, between various user communities, and across scales of management (Burger et. al. 2001).

A common explanation for decreases in efficiency and productivity emphasizes the 'open-access' nature of ocean fisheries. 'Open-access' is a case of poorly defined property rights where individuals or groups have access to extract units from a resource without any fear of sanction or punishment because there is supposedly no management system in place (Burger, et. al. 2001). However, this view ignores not only the aforementioned advances in technology, but also the formal and informal management institutions of small-scale fishing communities that often affect in-shore and off-shore sectors of a local fishery (Finlayson and McCay 1998). Thus, the reasons for over-exploitation and loss of efficiency and productivity in fisheries can be conceptualized as an institutional problem in the 'rules of the game', beyond a simple explanation of too many people chasing too few fish (McEvoy 1986).

With some commercial fleets overexploiting fish stocks or losing efficiency, many are searching for new territories on these 'open-access' seas to maintain or increase their catches to satisfy markets and the demand for fish (McEvoy 1986). Commercial encroachment is a major emerging problem in small-scale fisheries (McGoodwin 1990, Finlayson and McCay 1998). With establishments of exclusive economic zones (EEZs) under the authorities granted by the United Nation's Law of the Sea (signed by most nations in 1982, with the notable exception of the U.S.), numerous third world coastal nations are encouraging distant-water fleets to exploit their maritime resources for the potential economic gains associated with increases in foreign investment and export sales (Platteau 1989a, Royce 1987). With such legal encouragement for outside commercial encroachment facilitated by the state, small-scale fisheries are increasingly vulnerable to

not only national commercial fleets, but also an increasing body of international commercial fleets. This can destabilize local and regional markets by suddenly incorporating the small-scale fishery into a larger globalized fish trade market. This often creates forward linkages, but little to no backward linkages. It also potentially places the community in a dependent relationship within globalized north-south fish trade markets, supplying the first world with fish for relatively low prices in return. Such encroachment continues to push vulnerable small-scale fishers to more specialization and marginalization in order to compete in certain regions (McCully 1991).

It is important to note that there is not always such a stark contrast of two types of fleets competing side-by-side. Rather, in some cases economic and social absorption and incorporation can occur. Small-scale fishers may be hired to work as crew on the growing commercial fleets, they may collaborate with commercial fleets by acting as 'ferries' transporting crews and catches to and from shore with commercial fleets that are too large or lack docking facilities, and they may gain access to commercially important processing and service facilities and manufactured inputs that exist on shore (Platteau 1989a).

Even when encroachment on small-scale fishers has produced some positive benefits, there still exist problems of increasing inequality, outsider community control, and a possible increase in the peripheral status of the community within a larger economic market. McCully (1991) suggests that there is an emerging 'technological dualism' between commercial and small-scale fishers. Higher costs of production for catching fish and the introduction of highly exploitative technology such as giant trawler

nets in the last half century has only benefited large commercial fleets with access to more capital, technology, and political power than peripheral small-scale fishers. Thus, a rise in non-worker fleet owners and small-scale dependence on merchant financiers has emerged.

3.2.3: Emerging Problems in Third World Fisheries

In the third world, including Latin America, there are unique problems associated with small-scale fisheries. Historically low levels of economic development and persistent drains on national budgets from external debt makes funding regional fishery councils for licensing, issuing and monitoring quotas, and sanctioning rulebreakers very difficult (Cordell 1984). Many developed nations (such as the U.S.) fund regional councils for such management purposes, because they have enough capital to do so. Meanwhile, in the third world many local communities are left to themselves to somehow perform the costly functions of controlling open-access, limiting technological growth, and stopping or regulating commercial encroachment. This unique third world problem can sometimes generate successful collective action as communities left to their own devices seek to control technologically-advanced and well-funded fleets entering their waters. Rather than focusing all of their limited resources on community fishery management and having a state-financed body that regulates and is more connected to external fishing fleets, third world fishers often have to manage and adapt to these external threats by themselves shifting time and energy away from fishing effort and

internal fishery management (such as concentrating on monitoring and sanctioning rulebreakers).

Internal conflict between community users themselves can also arise for a variety of reasons. Rather unique to certain third world and Latin American communities is growth in inequality of fish catch between two or more groups that each have exclusive access and / or expertise in differing forms of exploitive technology, such as net building materials (Seixas and Berkes 2003). In certain isolated periphery communities that exhibit stable or dwindling traditional populations because of continued out-migration, fish stocks can not only stabilize but also increase and produce greater inequalities among community fishers due to differences in access and expertise in various exploitive technologies. Such small communities may find successful collective action difficult even though their fishery resource is quite abundant.

An additional problem specific to third world and Latin American fisheries is tourism encroachment. There is an emerging literature that attempts to understand how tourism is either destroying, integrating, or marginalizing local third world peasants' economic livelihoods. Although this topic is beyond the scope of this paper, it is important to note that tourism encroachment is significant in many Latin American small-scale fishing communities that exhibit high-amenity values (Seixas and Berkes 2003). Tourist amenities such as adequate waves for surfing, attractive shoreline landscapes, and stable mild temperatures make a community an attractive tourist destination for many first world vacationers (Balagna 2002).

3.3: Unique Challenges of Fisheries Management

The purpose of this section is to review the ecological factors and organization of work / labor that present unique challenges for fisheries management. The focus is on the characteristics common to fisheries of all types with consideration for how each of these characteristics operates within small-scale and artisanal fisheries. Often, how a characteristic operates in a fishery will be compared to how a similar characteristic operates in other natural resource sectors (agriculture, forestry, rangeland pastoralism) in order to highlight the unique nature of fisheries. These characteristics need to be taken into account when analyzing fishery communities and their respective management systems as they all can influence management creation, maintenance, and outcomes (Pollnac 1991, Acheson 1981, McGoodwin 2001).

The fisheries development literature provides information about the range of variables that define the challenges of fisheries management. These are summarized in Table 6 below. In their work on fisheries development projects, Pollnac (1991) and McGoodwin (2001) specifically account for the uniqueness of fisheries and the social variables that affect the success or failure of ‘participatory’ projects. Their conclusions are based on direct development field experiences and have been observed as occurring across fisheries of certain types. Acheson (1981) has also noted how fishers face distinctive risks and uncertainties and exhibit an organization of livelihood unique to their profession that must be accounted for when analyzing fishery communities’ management systems. These characteristics paint a more specific picture about what is most crucial in

building a theory of fishery management beyond the large literature on CPR
management.

Table 6. Unique Challenges of Fisheries.

Category	Commercial	Small-Scale	Artisanal
<u>Ecological Factors</u>			
Fishing is Inherently Unpredictable	High	High	High
Featurelessness of Open Waters	High (maritime)	High (maritime)	High (maritime)
High Rate of Perishability of Product	Moderate <ul style="list-style-type: none"> • storage facilities allow for storage beyond a few days / weeks for shipment 	Severe <ul style="list-style-type: none"> • dependent on access to refrigeration and ice-packing 	Severe <ul style="list-style-type: none"> • no refrigeration • ice used rarely • often leads to economic peripheralization
<u>Organization of Work / Labor</u>			
Irregular Work Hours	High	High	High
Shifting Residence Patterns	Moderate	High	High
Occupational Pluralism	High	High	High
Natural Resource Use / Subsistence Pluralism	Low / None <ul style="list-style-type: none"> • often not community residents with access to land or squatter land • sea-going vessel crew 	High	High <ul style="list-style-type: none"> • often subsistence users in dire need of supplements • access to adjacent land, often informally

3.3.1: Ecological Factors

Fishing is Inherently Unpredictable

There are three ways in which all types of fishing waters (maritime, riverine, etc.) across all types of fishery sectors (commercial to small-scale) are unpredictable. Those are: rapid tide and waterflow shifts due to weather change, the extracted units (sea, river, and lake creatures such as fish, plankton, etc.) are highly mobile, and these units are not easily seen (Pollnac 1991, Acheson 1981). These three unpredictabilities influence a fourth, the volatile nature of fishery production (McGoodwin 2001). All types of fisheries are vulnerable to extreme seasonal production fluctuations influenced by unpredictable weather patterns that often cause hard-to-track fish to suddenly shift location (Clark 1976, Cushing 1977).

In some cases, these four unpredictabilities do become more predictable over time as fishers continually adapt and become more experienced with a body of water. Knowledge passed down generations provides some means to reduce uncertainty (Acheson 1981). Increased predictability largely depends on whether tide / waterflow shifts and thus production occur in long-term 'seasonal' cycles or if these cycles shift more frequently on a day-to-day or week-to-week basis (McGoodwin 2001). The most predictable resources are those where there is a relatively long time period of resource stability with seasonal shifts that occur with some regularity.

The unpredictable nature of fisheries ecology can influence the types of and evolution of CPR management institutions (McGoodwin 2001). In order to be resilient, management institutions need to be flexible and allow the re-allocation of fishing

territories (if specific territories are used by specific fishers) when seasonal shifts cause a decrease in particular fishing spots or the entire fishery managed by a community (Acheson 1981). In cases where specific territories suddenly decrease in production, management institutional mechanisms for redistribution of catch or territorial allotment that are perceived as inclusive and fair by fishers can ease the impacts of such drastic changes in the fish stock (Pollnac 1991). In cases where an entire community fishery witnesses a drop in production, management institutional mechanisms for maintaining local / regional market linkages and ‘middle-men’ that are often a main source of income for small-scale fishers can prepare for such downshifts by surplusings, increasing the resilience of the system (Acheson 1981).

Featurelessness of Open Waters

The ‘featurelessness’ of open water hinders dividing the resource into specific parcels for the sake of privatizing property rights or fishing territories (McEvoy 1986). With other natural resources and CPRs parceling is easier since forests, rangelands, and croplands are land-based often having stable boundary-markers that can be securely allocated (Smith 1977). The unpredictabilities of specific fishing spots further hinder boundary maintenance efforts among community fishers (Pollnac 1991). With fisheries then, the transaction costs of allocating and enforcing private property rights can often be the highest of any natural resource (Acheson 1981, Smith 1977). This characteristic is most severe in maritime fisheries where the ‘openness’ and ‘featurelessness’ of the open sea is so vast that specific fishing territories can only be marked by ‘visual triangulation’

(Pollnac 1991, Forman 1970). This process of ‘visual triangulation’ of boundary-marking private property rights, sea-tenure, and other forms of fishers rights to specific fishing territories is most often done on the basis of two visual features: shoreline markers and distance from shore (Chapman 2003, Sutherland 1986). These features serve as a visual guidepost to fishers while out on the waters and enable them to familiarize themselves enough with specific territory markers in order to more effectively place nets and gear within their area. When the community group of fishers recognizes this visual information, conflict decreases as each one understands where they are supposed to be fishing.

An obvious connection between featurelessness and management institutions is Ostrom principle #1, having clearly defined boundaries (see Table 2). In most successful case studies, boundaries of the community and / or particular user group’s CPR needs to be clearly defined and understood by all users in order to effectively operate within the CPR itself and in order to effectively defend and maintain the CPR against outsider encroachment (Ostrom 1990). The featurelessness of the resource also influences informal management institutions by often requiring strict monitoring and sanctioning mechanisms (see Table 2, principles #4 and #5) in order to maintain private fishing territories (when they exist) and also to effectively socially sanction ‘free-riders’ who access territories that are not their own.

High Rate of Perishability of Product

Unlike other natural resource sectors (e.g. most agricultural crops, livestock, and timber), most fish and sea creatures are quite perishable once harvested (Acheson 1981). As a result, the commercial fishery sector has extensive capital investments in higher-end technologies such as refrigeration and dense ice-packing facilities on-shore, and many times these facilities exist on the boat itself (Acheson 1981). By contrast, the small-scale and artisanal sectors most often do not own or have access to refrigeration, with a few utilizing on-shore or small in-raft ice (McGoodwin 2001). With either method, the degeneration and loss of fish harvest can be significant (Pollnac 1991, Leap 1977).

The lack of storage facilities forces artisanal fishers to sell their catch on a daily basis at local and regional markets (Norr 1975). This is also one reason why fish harvest losses are relatively high compared to agriculture, pastoralism, and forestry. If the harvest is not immediately sold or consumed by the artisanal fishers or their families, then it quickly becomes commercially worthless. Thus, small-scale and artisanal fishers are often in a position of dependency on local and adjacent regional markets. This further hinders artisanal fishers from participating in regional, national, and international markets.

3.3.2: Organization of Work / Labor

Irregular Work Hours

Since fish stocks are highly unpredictable due to ecological factors such as weather and tide shifts, fishers in all types of fisheries are often forced to fish during ‘off-

hours' very early in the morning or overnight while most other people in their communities are sleeping (White 1977). This is in contrast to small-scale agriculturalists that can often operate on a more set daily schedule since their harvested unit is set in the ground and immobile (though weather events can disrupt planting and harvests).

Artisanal fishers are especially prone to working in the 'off-hours' since their rudimentary boats are vulnerable to being water-logged, tipping over, or breaking down during high tides. Thus, safety is one reason why artisanal fishers in Huanchaco, Peru often fish during the lowest tides occurring overnight (Chapman 2003). In Huanchaco, fishers that do go out on the open sea during mid-day at high tide most often go in pairs (two reed boats side by side) in order to fish and have a human 'safety net'. Maritime artisanal fishers often work during such 'off-hours' overnight because sometimes lower tides occur then and because these low tide (calmer water) periods are the most stable and productive periods to catch fish (Royce 1987). Working at such odd hours, along with residing on often isolated and narrow shorelines geographically separated from the rest of the community (a point expanded upon later) have resulted in artisanal fishers being social outcasts in many communities (Pollnac 1991, Acheson 1981, McGoodwin 1990).

Shifting Residence Patterns

Another adaptive response to ecological variability is shifting residence patterns (Acheson 1981). Periodicity in the availability of desired species and the highly mobile and often unpredictable nature of fish migration often forces artisanal fishers to migrate with their fish. They might do this by either moving to a family members' or

acquaintances' residence nearer the desired catch or even living temporarily on their craft (Pollnac 1991). This temporary, seasonal, and sometimes unpredictable shifting of residence place and type is a characteristic of many small-scale and artisanal fishers (Acheson 1981, McGoodwin 2001), and makes artisanal fishers more comparable to pastoralists than agriculturalists (Pollnac 1991).

Seasonal shifts in residence presents problems for informal management. The boundary definitions, inclusiveness, and collective decision-making processes that are crucial in maintaining informal management institutions can be weakened unless properly accounted for by the users themselves (McGoodwin 2001). When such shifts are more predictable and regularly seasonal in nature, then inclusive collective action is less costly as fishers can migrate together or can be contacted regarding management of a certain part of the fishery. If migration is not only seasonally predictable, but also geographically predictable (i.e., fishers migrate seasonally to the same territories), this further lessens costs of management.

Occupational Pluralism

Since small-scale and even commercial fishing often bring in relatively small incomes, many fishers supplement their meager fishing income with other work, engaging in 'occupational pluralism' (Finlayson and McCay 1998). While some find work in natural resource extraction jobs (forestry, mining) or other jobs available within the community (McGoodwin 2001), such second and third jobs can often require long-distance migration to urban centers or other manual labor work such as highway

construction. Many fishers do it despite the often heavy costs involved with long-distance migration (Acheson 1981). This is a characteristic not necessarily unique to fisheries as subsistence agriculturalists and pastoralists, along with forestry employees also engage in multiple occupations to supplement meager income from their primary natural resource work (Leap 1977). However, it is important to understand this characteristic in the specific context of fisheries, especially as it relates to natural resource use pluralism.

Natural Resource Use / Subsistence Pluralism

A characteristic of many small-scale and artisanal fishers is not only occupational pluralism, but also natural resource use pluralism (Acheson 1981). This is when fishers supplement their fishing income by also engaging in small-scale agriculture, animal grazing for meat and wool products (pastoralism), gardening, wood gathering, and / or hunting (McGoodwin 2001, Leap 1977). Such natural resource use can also be considered ‘work’ and falls under the previous category of ‘occupational pluralism’ since these activities often generate supplemental income. They require the same amount of time (if not more) than primary fishing activities and they can sometimes require temporary or seasonal residence shifts (Leap 1977).

Although occupational pluralism is a characteristic among all fishery sectors from the commercial to the small-scale, natural resource use pluralism is unique to the small-scale and artisanal sectors (McGoodwin 2001). This is often because commercial fishers may not have a permanent residence in the community (they tend more to be migrant workers or working on a long-distance commercial fishing craft in waters quite distant

from their permanent residence) and therefore do not have access to the necessary land for supplemental agricultural or grazing activities (McGoodwin 1990). Also, commercial crew fishers receive a monetary income and often benefit packages from the vessel owner (whether a public or private entity), while small-scale and artisanal fishers tend to rely solely on natural resources for subsistence and / or income (Acheson 1981).

Natural resource use pluralism influences previously mentioned shifting residence patterns. Where a maritime artisanal fisher resides during certain periods throughout the year often depends on two main factors: how productive nearby coastal and inland lands are in regards to agriculture or grazing and during what times of the year fish catch peaks. Thus, if inland land is available and at all conducive to agriculture or grazing, maritime artisanal fishers may reside inland in order to farm or graze during part of the year and then shift residency to the coast during another season (Pollnac 1991). Coastal land is often unproductive agriculturally. This is because of thin shorelines with high and rapid inland slopes or coastal deserts too far from distant mountains, both of which hinder access to water runoff for irrigation. This creates unique problems for maintaining informal management institutions in temporary fishing settlements because many fishermen migrate to the coast or around the coast following sought after species without their families or children (Pollnac 1991, Acheson 1981).

Historically, artisanal fishers have been social outcasts in many communities since they often reside on these isolated and narrow shorelines geographically separate from the rest of town while also working in the 'off-hours' (Pollnac 1991, Acheson 1981,

McGoodwin 1990). In some cases, they are separated from the rest of the community by both space and time.

The major factor affecting local informal management concerning occupational and natural resource use pluralism is time spent by users on these supplementary activities. Often with occupational pluralism, a local fisher leaves the community and their residence for a stretch of time of weeks to months for another wage labor job. Depending on how staggered local fishers are in their respective time spent outside their communities relative to each other performing wage labor can adversely affect Ostrom's principles #3, #4, and #5 (see Table 2). If there is a set season or fishing 'off-season' time period where it is known throughout the user group that many local small-scale fishers will be leaving the community for supplemental work or spending more time and energy tending to other natural resource work while maintaining their residence, then this is more annually predictable and management institutions are more likely to be adjusted accordingly to account for seasonal loss of fishers. However, if such supplemental work is staggered across the user group inconsistently, then a local fisher could experience less access to collective-choice arrangements (such as status within the group or access to voting or decision-making procedures). Also, if a local fisher leaves for supplemental work that serves as a monitor or a locally respected official that is crucial in deciding and administering sanctions, their access to such a position within an informal management structure can be jeopardized.

3.4: Goals of the Paper

Chapter I introduced the importance of third world small-scale fisheries and outlined the problems of these fisheries and how the research questions relate to those. Chapter II reviewed the CPR management literature that explains how and what type of informal institutions small-scale communities devise in order to manage a CPR. Chapter III elaborated on the emerging problems facing small-scale fisheries and analyzed unique challenges narrowing the discussion of CPR management down to small-scale and artisanal fishery management. The next chapter presents seven case studies of small-scale and artisanal fishing communities across the Latin American region taken from previously published books and journal articles. Chapter V concludes with a synthesized analysis of the case studies concerning the research questions. As originally presented in chapter I, my two research questions are:

1. Do the often cited Ostrom (1990) and Baland and Platteau (1996) models for informal CPR management hold up in the case of Latin American fisheries?
2. What factors increase the resilience of local management systems in the face of pressures from commercial encroachment in Latin American small-scale fisheries?

The continued viability of informal fisheries management institutions in many Latin American fishing communities are being threatened by outsider encroachment. Thus, it is crucial to properly understand what principles promote effective management and healthy CPRs (research question #1) and under what conditions these principles continue to exist despite external threats (research question #2).

CHAPTER IV

LATIN AMERICAN ARTISANAL CASE STUDIES

This chapter outlines seven case studies from Latin American artisanal fishing communities. Section 4.1 outlines three criteria most often used to classify artisanal fisheries as being a ‘success’ or ‘failure’. Section 4.2 provides descriptions of relevant factors within each separate case study that have been previously defined and outlined. Most of the data, being qualitative / ethnographically descriptive in nature and extracted from the case studies, is included there.

4.1: Defining Success and Failure

In order to answer my first research question, I need to determine whether local management systems ‘work’ or not in the context of Latin American artisanal fisheries. To do this, I will first establish a set of criteria to distinguish between ‘successful’ and ‘failed’ artisanal fisheries. Much of the CPR management case study literature is concerned with preparing policy recommendations for furthering effective natural resource management practices. As a result, a majority of cases are defined at some point as either ‘succeeding’ or ‘failing’ by various criteria determined either by the author, previous researchers, or the local CPR users themselves.

However, there is little clear consensus about how to define success and failure of a CPR. Numerous criteria ranging from formalized clusters of variables to more informal observations of a few variables have been utilized. However, there are some regularities

among criteria that can be categorized. Three general categories that often serve as criteria for determining success and failure are: environmental / ecosystem health, economic performance, and social stability. Applying these criteria to artisanal fisheries, success would be determined by:

- **Environmental Health:** fish stock, species renewal, levels of ecosystem degradation, levels of catch and production
- **Economic Performance:** resource unit output, prices, income levels
- **Social Stability:** community isolation, cohesion, factioning, splintering, inequality

Such measures provide a starting point to determine success and failure in a fishery. In the case studies analyzed in this paper, these three criteria are sometimes mentioned in passing and not necessarily supplemented with quantified data. Even in such cases, the level of environmental, economic, and social health can be determined as relatively a 'success' or 'failure' since most of the case study literature on artisanal fishery failure paints a picture of those variables being in such dire conditions that determining success relative to such deteriorating conditions can be achieved. Thus, the case study literature on artisanal fisheries has tended to show success and failure on the edges of a spectrum, with ecological and social systems either working quite smoothly or nearing complete collapse.

For the first research question, success and failure will be determined by those three criteria. I will then examine the existence of the ideal types of CPR management

principles to test if they are effective and are present in the ‘successful’ cases and absent in the ‘failed’ cases. For the second research question concerning resilient management, success and failure (resilient or not) will be determined by the continued existence of traditional management institutions during and / or after periods of external threat. In all of these case studies, commercial and other outsider ‘on the water’ fishing encroachment is the primary threat to local management systems. ‘Resilient’ management will be determined by the continued existence and functioning of traditional management institutions among locals faced with such encroachment.

There is variation across the case studies on who determines ‘success’ and ‘failure’ along these criteria. In most of the cases, the authors present these criteria and often forward their own evaluation on whether the fishery and fishers are ‘succeeding’ or ‘failing’. However, in some cases the author(s) determine success or failure based on previous research performed by other fieldworkers in the same communities, or the author(s) proclaim success or failure based on interviews or sample surveys of local artisanal fishers. Thus, there are three main groups that are determining success or failure: the author(s), previous researchers, and the local artisanal fishers. As I elaborate on each case study briefly in the next section, I will distinguish how these criteria have been measured and who is making the determination.

4.2: Case Study Descriptions

I use seven case studies from the Latin American region drawn from previously published literature in order to answer my two research questions. Table 7 provides

references, a basic summary of the setting for each case study, and brief notes on results concerning the two research questions. Five are located in Brazil, one in Peru, and one in Belize. Four are maritime fisheries, two are riverine (Brazilian Amazon), and one is an enclosed lake (Lake Titicaca, Peru). Five are almost completely artisanal (consisting of non-motorized, beachlanding, owner-operated fishing fleets) and the other two are small-scale (at least a quarter of the boats are motorized, but almost all exhibit the two characteristics of small-scale). Two of the seven case studies are longitudinal with analysis of community and management system dynamics dating back at least a few decades. The five non-longitudinal studies are more grounded in the ‘ethnographic present’ and systems are analyzed as resilient, successful, and so forth at the time of data collection (spanning over months) without accounting for long-term historical trajectories. All seven communities and regions have experienced moderate to severe outsider fishing encroachment. These experiences with outsider encroachment range from commercial sector fishing fleets moving in and fishing in what have traditionally been territories fished by local community fishers to state-owned fleets and even recreational fishers exploiting traditional territories and nearby waters.

Six of the seven have been defined by their respective authors as ‘successful’ by the set of three criteria listed in section 4.1. In some cases, the fishers themselves have been interviewed and have echoed the author’s interpretation or provided such an interpretation for the author.

Table 7. Brief Summary of Latin American Case Studies.

Location / Source	Fishery Type	Model Principles	Resilient Management
Bahia, Brazil Cordell (1984, 1992 with McKean)	Maritime (with lots of mangrove and reef areas) Artisanal	9 present - #9 inconclusive	- Defense of in-shore territories from commercial encroachment - High reciprocity - Robust shoreline activities
‘Baixo’ Region, Brazil McGrath (1993)	Riverine and enclosed lakes Artisanal	8 present - lacks #6 (may exist, perhaps not resilient) - #9 inconclusive	- ‘Shift to nearby lakes during rainy season, commercial encroachment on rivers - High reciprocity
Caye Caulker, Belize King (2000), Sutherland (1986)	Maritime Small-scale	6 present - lacks: #2, #4, #10 - #9 inconclusive	- Informal mgmt. institution breakdown - Relatively less reciprocity and shoreline activities - Costs of maintaining traditional mgmt. outweigh benefits - High influxes of outside capital and technology

Table 7. *Brief Summary of Latin American Case Studies (continued)*

Location / Source	Fishery Type	Model Principles	Resilient Management
Coqueiral, Brazil Forman (1970)	Maritime Artisanal	9 present - #9 inconclusive	<ul style="list-style-type: none"> - Defense of in-shore territories from commercial encroachment - High reciprocity - Robust shoreline activities
Lake Titicaca, Peru Levieil and Orlove (1990) Orlove (2002)	Enclosed lake Artisanal	9 present - #9 inconclusive	<ul style="list-style-type: none"> - Defense of communal territories from outsider encroachment - High reciprocity (inter and intra community exchange) - Robust shoreline activities (totora reed collection)
Rio De Janiero and Sao Paulo States, Brazil Begossi (1998, 2001)	Maritime Small-Scale	10 present	<ul style="list-style-type: none"> - Defense of in-shore territories from commercial encroachment - High reciprocity (information exchange)
Rio Grande, Brazil Castro and Begossi (1995, 1996)	Riverine Artisanal	4 present - lacks: #3, #4, #5, #6, #10 - #9 inconclusive	<ul style="list-style-type: none"> - Unsuccessful fishery - Few effective mgmt. institutions

The rest of this section provides a profile of the seven case studies. While these represent a good portion of Latin American artisanal fishery cases documented in the past three decades, this is not an exhaustive list. These seven were picked mainly because they fit the ‘type’ criteria for this analysis (small-scale and / or artisanal, informal management with an absence of state management institutions) and discussed (whether at length or briefly) the model principles and resiliency factors to be tested in each of the two research questions. For a thorough listing of these and other fishery case studies in Latin America (from journal articles to dissertations), along with an exhaustive bibliography spanning all sectors of CPRs across world regions and citations of early theory works in the CPR management literature, see Fenton Martin’s *Common Pool Resources and Collective Action: A Bibliography* (1989).

Bahia State, Brazil - Cordell (1984, 1992 with McKean)

John Cordell is the primary author of the two chapters cited for this case (the latter co-authored with Margaret McKean) and the data were collected through various periods through the 1970s, as early as 1973. Fourteen rural maritime artisanal fishing communities on the southern coast of Bahia state in northeastern Brazil are analyzed in this case study. Only a handful of local fishers operate small-scale motorized craft. The vast majority are artisanals that build dugout wood canoes, some with sails attached to harness prevailing winds to maneuver through these swampy tropical coastal waters. Bahia fishers are called ‘beirados’ (‘shore-dwellers’) because of their focus on exploiting in-shore waters that are characterized by lots of swampy mangroves; coral reefs, and tiny

'caye' islands. It is these sorts of 'messy' ecological features of this northern Brazilian coastline that used to keep inland populations away from fishing this region until descendants from black plantation laborers inland moved to this area as a means for subsistence. Most of the current beirado and community population are descendants of these inland black plantation laborers. Beirados use their catch for both subsistence and for income from sale in local and regional markets. Some beirados have established connections with 'middle-men' who transport and market their harvest in nearby regional markets. Over 200 different species of fish and shellfish are harvested. A beirados' catch must be stored, sold, or transported quickly once landed as ice is not brought on craft as it hinders the maneuverability of the wooden canoes, even the few motorized ones.

Beirados use a mix of individual and communal forms of property rights on the coastal waters of these communities. The often sheltered nature of this specific coastline with the cayes, mangroves, and coral reefs allow for easier visual triangulation methods in marking individual fishing territories relative to other maritime coastlines lacking such ecological features. These territories exist mostly on the 'in-shore' waters that are defined as out to 50 meters from the shore. Individual territories range from 400 to 600 square kilometers in size. Individual and communal territories are shifted seasonally in a complex system in order to follow fish that migrate along the coast according to cycles of the moon that influence tide shifts (see Cordell 1974). Since much of the potential catch moves with these tides, the beirados do the same, moving their territories on a seasonal basis to maintain their livelihood through the year. Six factors are used by 'mestres' ('canoe bosses') who are the experienced and respected beirado leaders in order to

determine where territories are to be established during each season: current shifts, tide-level shifts, lighting conditions corresponding with various moon phases, interactions of wind and current, slope of the sea bottom, and sea bottom conditions.

Brazil's national Ministry of Fisheries, 'Superintendencia do Desenvolvimento de Pesca' (SUDEPE), maintain that all of Brazil's coastal waters are public property under national law. Although this technically and legally means that Bahia coastal waters are under pure open-access conditions, this has not been the way it has played out in reality since the beirados have instituted their own informal management system. Low budget allocations to the fisheries ministry has hindered any state management or monitoring mechanisms along any of Brazil's coast, especially in the rural and swampy northeastern Bahia.

Commercial fleet encroachment is becoming a problem as the number of high-tech fleets trawling the off-shore waters along the entire Brazilian coastline (including Bahia) are increasing. This encroachment increased sharply in the early 1970s when SUDEPE began implementing national policies designed to increase economic incentives for current and potential commercial entrepreneurs and investors. During this period, SUDEPE passed three laws influencing the ability of commercial fleets to operate with increased flexibility. These were: tax exemptions on up to 75 percent of personal income from fishing, suspensions of import tariffs on advanced fishing technology and craft, and selective suspensions of federal taxes on catch being shipped to luxury internal and certain export markets. These factors at the macro level subsidize capital investment by

commercial fleets and increase their ability to encroach upon small-scale communities along the Bahia coastline.

Beirados land about 70 percent of the total fish catch along the southern half of Bahia state. This production level has remained steady and is evidence of environmental success and lack of over-exploitation. Despite this large contribution of the beirados' harvest to the local and regional cuisine, there have historically been economic hardships and a persistence of widespread poverty in this tropical coastal region. This is due mainly to low prices for species harvested. However, while local market prices may remain low enough to keep most of the artisans in more of a subsistence mode, these incomes have remained rather stable along with total catch. Socially, beirados exhibit a high rate of reciprocal exchange as observed by Cordell. The author has deemed this case study an ecological and social success.

In Bahia, in-shore waters are easier to defend by artisans, since their technology is more suited for shallower in-shore exploitation. Beirados have successfully defended their in-shore territories and maintained their informal management system. Cordell emphasizes how reciprocity and cooperation are high in Bahia, especially concerning shoreline activities.

Baixo Region, Brazil - McGrath et. al. (1993)

Thirteen rural communities along the Amazon floodplain (known as the 'varzea') of the 'Baixo' region of the Brazilian Amazon are analyzed in this case study. The Baixo is the varzea region that stretches from its western border at the convergence of Para and

Amazonas states east to the mouth of the Xingu River. Local fishers are riverine artisanal. The year is split into two main seasons by weather conditions, the rainy and dry seasons. In the rainy season, the varzea rivers overflow and most of the floodplain region is inundated with water up to the tree-tops. There is such an extreme increase in standing water that water craft can travel for tens of kilometers north to south beyond the normal dry season boundaries of the rivers without even touching dry land. This rainy season creates a major ecological feature of the varzea, lakes that are otherwise small standing pools during the dry season that range in size from a few thousand square meters to several hundred square kilometers. These lakes are numerous during the rainy season and hold a large amount of fish that migrate from the connected rivers for the plankton that develops as a thick coat on the lakes' surface.

Artisanals use fish both for subsistence and for income from sale in local and regional markets. Lacking ice and refrigeration, artisanals have traditionally used salt to dry store their catch. This dry salted fish has been the trademark of the fish sold in the region. Many travelers (rubber trappers and traders) boating through the region have stopped and bought this salted fish. Their fish has also been a main portion of the diet for the urban poor of Belem, the nearest urban area in Para state.

Artisanals are natural resource use pluralists engaging in a rotation of fishing, small-scale agriculture, and pastoralism. Traditionally and up through the early 1970s, these three activities were rotated and labor time and energy was near equally split between them. A decline in the value of jute (the main agricultural crop) has been

attributed to the introduction of synthetic fibers to Brazil and has influenced the shift towards more artisanal fishing labor.

Communal property rights exist in the varzea lakes, no individual territories exist. Communal territories are based on the location of a community relative to the lake and the lake is divided fairly evenly between the communities surrounding a lake. Artisanal fishers informally manage these floodwater lakes during the rainy season. The varzeiros view the lake as theirs in the community sense, while the rivers are more perceived as open-access and are not under informal management control. Access to the lakes is therefore limited to those collectively recognized as local community fishers. Certain technologies, such as gillnets and other new technology inputs, are restricted collectively, especially when lake waters begin to recede heading into the dry season. Motors are collectively restricted on the lakes. Ice is also prohibited, which restricts the amount one fisher can catch since they have to take the time and energy to salt the fish instead. These are informal management techniques by the varzeiros to prevent over-exploitation during the 'lean' season allowing for less seasonal variation in actual and potential harvest.

Commercial encroachment appeared in the early 1970s and has steadily increased since then. Two major factors influenced the rise of commercial encroachment in the Baixo, post-1950s technology increases of the Brazilian commercial fleets that allowed for traveling of greater distances and longer trips from port, and a sharp increase in urban food demand with the hyper-urbanization of the 1970s across Latin America. With commercial fleets entering the varzea rivers, varzeiro artisanal fishing has been declining in productivity. Traditionally, varzeiros fished more during the beginnings of the dry

season in August and September when the two most sought after species, characins and catfish, migrated upstream in the rivers. However, with commercial fleets focusing on these species during this time, the catfish especially is the biggest portion of the Baixo commercial export market, artisans are turning more to the lakes in order to maintain production levels.

This case study is successful according to the three criteria. Environmentally, varzeiros have maintained their fish catch by shifting from river to lake exploitation as discussed earlier in the face of commercial encroachment. Economically, varzeiros continue to use their fish catch for both subsistence and income at stable levels. Socially, varzeiros have found a new sense of collective identity in recent decades since the rise of commercial encroachment. The urban commercial fleet outsiders that have encroached along the riverbanks of the Baixo communities have served as a reinforcement of varzeiro collective identity since they have had to shift to lake fishing and build informal management institutions appropriate to those resources while also attempting to defend their local communities against further takeover by commercial enterprises.

Caye Caulker, Belize - King (2000), Sutherland (1986)

Data for this case study spans from the 1960s up to 1997 and is represented by Anne Sutherland's book (1986) that provides data up to 1986 and Thomas D. King's follow-up study (2000), which provides data through 1997.

Caye Caulker is a small island northeast of Belize City off the Atlantic coast of mainland Belize. Caye Caulker is 5 miles from north to south and only half a mile wide at

its widest point. Such small islands that dot the coast of Belize and other Latin American nations are often referred to as 'cayes'. There are numerous neighboring cayes to Caulker of similar size such as Caye Chapel 200 miles south. Caye Caulker is also the name of the one community on this particular island that is home to about 1,000 residents as of 1997. The population has more than doubled since the 1980 census that showed 413 residents. The village itself is nestled on the east side of the cayes stretching one mile north to south and only three blocks east to west. The village is this small because most of the cayes consists of swampy mangrove areas that are too marshy for building stable houses. The nearest urban center is Belize City twenty miles to the southeast of the village, but separated by about 10 miles of ocean between the cayes and mainland Belize. Commercial and small-scale owner / operator ferry craft provide transportation from mainland to the cayes multiple times daily.

Caye Caulker fishers are almost all small-scale maritime fishers since they have motorized craft. Traditional fishers are the descendants of the original inhabitants of Caye Caulker, refugees from the War of Castes who migrated to the cayes from the Yucatan region of Mexico just north of Belize around 1848. Almost all Caye Caulker residents, including fishers, are multi-lingual fluent in both English and Spanish. Small-scale fishers focus mostly on lobster utilizing trapezoid-shaped traps fabricated from wood about four feet long by one-and-a-half feet wide.

Caye Caulker fishers have been organized in a cooperative since 1960, the Northern Fishermen Cooperative Society (NFCS). Although this cooperative does what is outlined in chapter II concerning pooling of capital and attempting to control external

markets through setting production levels and such, the organization also acts as a meeting place for the fishers who also informally manage their resource. NFCS meetings are a venue where some of the informal decisions concerning fishing are made and informal management institutions are created and discussed. Since all the fishers that are a part of the cooperative also participate in informal management, collective action management generally occurs within the context of a cooperative meeting. A local fisher has to be in one to be a part of the other. To be legitimized as a local fisher is to be a cooperative member.

A mix of individual and communal property rights existed up to 1986 when individual territories completely saturated all of the accessible coastal waters. Visual triangulation methods are used to determine individually held territories. Many fishers have multiple territories recognized as their own and have room to place anywhere from 40 to 100 lobster traps at one time in each territory. Access is regulated through cooperative registration and most fishers act as monitors for spotting any outsiders that are not supposed to be accessing their territories.

There are numerous characteristics unique to the Caye Caulker case study compared with the other six cases. Having access to lobster has allowed fishers to reap the rewards of extraordinarily high demand beyond local and regional markets. Fishers process and export to the first world and with their strong cooperative membership and participation, have effectively maintained strong economic linkages through these external markets. These high financial returns have allowed the purchase of numerous technological inputs besides storage and processing facilities, including extra fuel for

craft and ice for plant or residence storage. However, there is increasing evidence of economic stratification as certain fishers are accumulating upwards of 1,500 to 2,000 lobster traps that they now import instead of fabricate. Other forms of technology are being accumulated at a rapid rate by a small number of fishers.

The NFCS built a small processing plant for fishers' use to store, process, package, and export their spiny lobster catch as a group without having to establish connections with 'middle-men'. The NFCS was able to build this facility since they have received increasingly high returns on the highly sought-after lobster species they mostly sell to the first world. A private entrepreneur from the U.S. even invested in the building of this facility. Caye Caulker is in a position of having access to a unique and valuable species in demand by first world consumers.

Commercial fleet encroachment has not occurred at Caye Caulker as it has in most of the other case studies. However, outsider encroachment in the form of private wealthy individuals with linkages to regional and global lobster markets is occurring as they are increasingly purchasing the traditional territories of small-scale fishers. This is not 'on the water' encroachment initially and does seem to produce less conflict since transactions occur between private individuals. However, this outsider encroachment is similar to commercial fleet encroachment in that 'on the water' conflict between outsider fishers or fleets and traditional fishers can eventually occur when these outsider investors employ or contract out to commercial fleets to harvest the lobster. Sometimes, the investor has contracted through an individual that registers with the cooperative, acquires similar technology, and fishes using traditional methods. In other cases, the investor is

actually an experienced fisher from another area who performs the work himself.

Whichever of these scenarios, outsider encroachment has increased as the market for spiny lobster has grown.

Caye Caulker has developed CPR management institutions that have historically protected all three indicators of success. Environmentally, production levels have been stable over three decades from 1964 to 1997. There are no significant signs of over-exploitation. Economically, Caye Caulker is the biggest success story among all seven case studies with respect to price levels and economic linkages. As of 1997, lobster prices were ranging from \$12 to \$15 (U.S.) per pound. Socially, high levels of intra-fisher and community solidarity exist. However, while this case study supports some of the effective model principles, management has not been resilient within the last decade and has begun to breakdown from outsider encroachment. Specific reasons for this are elaborated on in chapter V, section 5.2.

Coqueiral, Brazil - Forman (1970)

Shepard Forman authored the book cited for this case study. In 1965, Forman lived in the small rural community of Coqueiral and collected the data for his ethnography. Coqueiral is located on the Atlantic coast in Alagoas state of northeastern Brazil. Coqueiral has approximately 852 residents with about 85 of those being active maritime artisanal fishers. None of the fishers' crafts are motorized, so they are all considered artisanal. Fishing is the primary economic activity of Coqueiral. Artisanals use hook and line technology from the 'janganda' rafts they build from locally gathered

materials such as light balsa wood ('piuba') and vegetable fibers. Some artisanals attach sails to their janganda craft to harness prevailing off-shore winds. Artisanal fishers are called 'jangadieros' ('raft fishermen') locally after their rudimentary wooden craft. Jangadieros use their catch both for subsistence and for income from sales in local and regional markets. They often have connections with 'middle-men' known locally as 'fish-hawkers' (Forman counted 12 in Coqueiral) who will transport and market their catch in adjacent markets.

Jangadieros use a mix of individual and communal property rights. Individual fishing territories are marked by visual triangulation methods. Jangadieros line up community markers on-shore and then use depth perception along with 'hand-marking' (using hand-length to determine distances visually between two markers on-shore) to measure how far out from shore they are. When jangadieros lose sight of visual markers, often around 50 meters out, they count time corrected for prevailing winds while journeying beyond sight of the shoreline. When they feel they have reached their specific territory, they will drop a plumb line to touch the ocean bottom and bring it back up for a smell test. Rocky bottoms smell sweet, gravel has a distinct 'bad odor', and muddy bottoms smell more foul. Since each jangadiero intimately knows his particular territory and the composition of its bottom, this method has historically worked well.

These individual territories exist in a grid system along the coastal stretch of Coqueiral. They are partitioned taking into account the two main factors the jangadieros consider as affecting productivity of a fishing spot: depth and ocean bottom composition. Each of these territories is named after the two visual markers used to triangulate its

location. Jangadieros distinguish between individual spots, communal territories, and 'lisos' which are unproductive territories that no one fishes in because of their plain level and sandy ocean bottoms. Both individual and communal territories reach out to 100 meters off-shore where the edge of the continental shelf is and ocean depth drops substantially and rapidly. Jangadieros distinctly divide the ocean waters between these two categories of in and off shore waters. Beyond the continental shelf and into the 'off-shore' deeper ocean waters, jangadieros say that this part of the ocean is evil and filled with 'sea monsters'. A jangadiero is 'tempting the devil' if he attempts to travel beyond the in-shore waters beyond 100 meters.

Local residents have noticed commercial fleets trawling along the 100 meter mark in the years prior to and during the 1965 field study. Various types of fleets in this region include larger motorized boats with seiners or longer nets than the jangadieros'. These fleets have been trawling along and entering the territories of jangadieros.

Coqueiral is portrayed as a success along the three criteria, especially concerning social criteria. Environmentally, there is no evidence of over-exploitation as production levels have remained stable over seven months of Forman's fieldwork. Economically, income from fish production is steady. Socially, jangadieros show a high amount of reciprocity including shoreline work activities and 'hanging out' that occurs daily both intra and inter family. In addition, there is a high amount of inter-generational transfer of traditional ecological knowledge (TEK) concerning mostly species migration and weather patterns and information about traditional individual property rights.

Janganda craft are easily water-logged because the piuba they are made of is extremely light and porous, piuba wood often weighs less than a similar sized piece of cork. Such rudimentary technologies need repair often. Thus, shoreline activities are robust at Coqueiral, a group of jangadieros can be seen daily either repairing their jangadas or nets along the shoreline or when technology is not in need of repair, simply 'hanging out' engaged in idle conversation. This is where inter-family networks of reciprocal exchange form and are reinforced. Generally, there is high reciprocity within and between families in Coqueiral. Food and crafts are the two most often exchanged items 'leaving little need for money' in the community.

Lake Titicaca, Peru - Levieil and Orlove (1990), Orlove (2002)

This case study is represented by a book authored by Benjamin S. Orlove and one article co-authored by Dominique P. Levieil and Orlove. Their work studies 151 artisanal and small-scale fishing communities that surround the highest elevated enclosed lake in the world, Lake Titicaca, Peru between 1976 to 1984. These are all rural communities as they do not include the urban lakeshore city of Puno, the nearest urban area and market. This is the only 'lake' case study included in my analysis. All 151 communities are on the Peruvian side of the lake (Lake Titicaca crosses the Peru-Bolivia national border) and average 20 artisanal fishers per community. Over 95 percent of all local community fishers on the lake are non-motorized artisanal fishers. Half of these artisans use wood craft and the other half used reed-sewn 'balsa' rafts the materials for which are gathered

from reed beds that exist adjacent to each community's informal fishing territory along the shoreline.

Artisanal fishing is done overnight, with most nets being retrieved in the early morning hours around dawn. One-sixth of the total catch is used for subsistence and most, two-thirds, is sold for cash in local and regional markets. Artisanals are natural resource use pluralists engaging in small-scale agriculture on individually held plots and pastoralism on communally held grazing pastures in and surrounding their respective communities. They are also occupational pluralists working in such income-generating activities as handicraft production and migratory wage labor available in the high lake region. Although fishing takes 33 percent of an artisanal's labor time on average, it generates 50 to 75 percent of an artisanal's household income. This is why fishing is seen as the primary work by artisanals in the region and other natural resource work and wage occupations are viewed as supplemental income. Fish species harvested include the endemic 'Orestia', accounting for 67 percent of total annual catch, and introduced non-native species (including rainbow trout and silverside) account for 15 percent of the harvest weight.

Each community exercises informal common-property rights over one fishing territory. That is, there are at least 151 different fishing territories that fit under the 'communal' definition of type of property rights (see Table 1). Each lakeshore community has a specifically defined rectangular territory of aquatic space based on visual triangulation. The width of the lakeshore community determines the width boundaries and the length out into the middle of the lake for each territory depends on

factors such as lake bottom depth, slope level, and species available at these certain depths. Each community informally recognizes neighboring communities' rights to their respective communal territories. With communal property rights, all fishers in a community have access to the entire community rectangular territory rather than individual fishers maintaining separate individual fishing spots. This communal form of property rights seems to have been an adaptation to the lake's fish species that show high variability in migration and size both seasonally and annually. Communal rights allow fishers to exploit a larger territory to respond to such variability rather than maintaining much smaller individual spots.

The Peruvian national government claims formal / legal rights to the entire waters of the lake, including the territories informally marked by local artisanals. Registration of all fishers, regardless of sector, is the responsibility of the national Ministry of Fisheries according to written law. Enforcement of national rights is the responsibility of the Coast Guard, but low budgets have hindered such registration and enforcement practices from their full effective potential.

Still, the Coast Guard does patrol the lake occasionally and it is this, along with inland 'lakeshore community outsiders' that has encroached on traditional fishing territories. The high proportionate income seen by local fishers and the impoverished subsistence conditions of the nearby inland Andean peoples have influenced community outsiders to attempt to fish on informally allocated fishing territories. The Coast Guard has occasionally entered the communal territories of certain communities and confiscated nets from artisanals who are accused of excluding outsiders from attempting to fish in the

lake. Since the entire lake is formally under the jurisdiction of the Peruvian state, the Coast Guard officially has the authority to encroach on local management institutions without fear of legal challenge.

This case study is deemed a success by the authors on numerous occasions. Studies prior to the 1990 article (Levieil 1986, Levieil 1987) up to Orlove's 2002 synthesis have noted stable fish harvest levels and no signs of environmental over-exploitation. Economically, the previously mentioned focus on fishing as accounting for half to three-quarters of an artisanal's household income has been stable across the study period, fishing has been perceived for years as the main income generator for the region's artisans. Numerous surveys and interviews reveal high levels of reciprocity and cooperation between fishers and the fishing communities. Thus, the authors deem this case study a success based largely on the social data gathered from the fishers themselves.

It is crucial to note that this is the only case study that explicitly cites one of the two CPR models I have used in my analysis. Orlove (2002) cites Ostrom's (1990) model as an excellent synthesis of principles found in successful informal CPR management systems and claims that the Lake Titicaca communities support Ostrom's entire model.

At Lake Titicaca, successful resilient management has been confirmed by government and researcher censuses of local artisanal fishers. Resiliency has been achieved through adaptive responses of collective verbal and physical interference and destruction or theft of outsiders' nets. High reciprocity is present and has been influenced by high homogeneity and endogamy in lakeshore communities (50 percent of marriages

are intra-community). There is high inter-community reciprocity as there are frequent accounts in surveys and interviews of informal reciprocal exchanges occurring between adjacent community fishers that wish to fish on another community's territory. These exchanges take various forms from exchanging agricultural products, portions of fish catch, or buying another fisher a beer. A key shoreline activity for Lake Titicaca artisans is totora reed collection.

Rio de Janeiro and Sao Paulo States, Brazil - Begossi (1998, 2001)

Small-scale maritime fishers of the Atlantic Forest coast in southern Brazil are analyzed in these two book chapters authored by Alpina Begossi. The data was collected through various periods in the early and mid-1990s. The study included eight small adjacent rural communities that lie on the Atlantic coastline between the two nearest urban centers, Rio de Janeiro to the north and Sao Paulo to the south. These eight communities are deemed 'small' by the author since they have a range from only 26 to 100 families residing in each. Residents share common cultural roots (the population is referred to as 'Caicarás', native Indian descendants with some mestizo from mixing with Portuguese) and the cultural homogeneity of this case study is high. Houses in each community are geographically arranged according to the oldest male's residence. Thus, nuclear families live in separate houses adjacent to the 'father' or 'grandfather'.

Caicarás fishers build wood canoes, use encircling or gill nets, and also various types of hook and line methods. Some are artisanal and use paddles and some are small-scale and have motors attached. Caicarás have traditionally been natural resource use

pluralists shifting between two activities: agriculture and fishing, both of which provide for subsistence as well as income from sales to local and regional markets. On average, 90 percent of fish catch is sold for income and the other 10 percent is used for subsistence. Caicaras fishers often use ‘middle-men’ to transport and sell their catch to larger communities in the region. Small-scale agriculture here includes four main crops: manioc, potatoes, yams, and beans. Agriculture was the primary work activity until the 1950s when the Caicaras began shifting to fishing since the market price dropped for manioc, their main crop. Since then, fishing has become the main source of income for Caicaras and takes up a majority of their labor time and energy. Two other factors influenced this shift away from agriculture. First, there is a decreasing amount of land available since federal and state designated conservation areas are growing along the Atlantic rainforest. Second, further conflict has erupted between the Ministry of the Environment and the Caicaras concerning the state’s conservation regulations on land and the Caicaras traditional practice of slash and burn agricultural techniques.

Fish is the main source of protein for Caicaras, constituting over half of their annual animal consumption. A wide variety of fish are harvested including bluefish, squid, halfbeak, mullets, sand drum, snook, and catfish. A total of 115 species are identified by folk name, which correspond to 105 biologically separate species.

The Caicaras’ property rights system is a mixture of individual and communal. There are some specific fishing territories informally recognized as spots belonging to certain individuals or families. Besides those spots, territories are based on community location with community fishers having rights to that specific communal territory.

Commercial encroachment from industrial fishing fleets trawling along the off-shore coastal waters has been increasing in the last decade. Sepetiba Bay off the shore from the community of Itacuruca is experiencing the most intense commercial fleet encroachment.

Caicarás fisheries are deemed a success by the author. Fish stock abundance and catch amounts have been stable throughout the study periods. While the prices of agricultural crops such as manioc have fluctuated widely, the income generated from fishing has remained relatively stable, as have amounts of catch available for subsistence. Socially, fishers exhibit a high rate of information sharing across various topics from locations of certain species to weather warnings.

There is successful resilient management to commercial fleet encroachment in this case. Caicarás' adaptive response is 'marking their spot' by constantly being out on the waters fishing their individual, family, and communal territories to physically resist in-shore encroachment. They define their in-shore waters by 'marking their spot'. Caicarás exhibit high reciprocity with high rates of information exchange between fishers.

Rio Grande River, Brazil - Castro and Begossi (1995, 1996)

Two journal articles, both authored by Fabio de Castro and Alpina Begossi, with data collected over a one year span from March 1988 to February 1989, represent this case study. The authors collected data through formal and informal interviews, survey questionnaires, and participant observation while on artisanal craft during 'on the water'

fishing labor. Two rural communities, Icem and Frontiera, on the Rio Grande in Brazil are analyzed in this case study. About 41 riverine artisanal fishers exist in these two communities bordering two states, Icem on the Sao Paulo state side and Frontiera on the Minas Gareis side. Icem's population was measured at about 6,500. With only 41 fishers, fishing is not a major part of the local economy and has decreased in importance over 20 years. Local fishers say that many fellow artisanals outmigrated between the 1970s and 1980s. The construction and opening of a hydroelectric plant upstream in the community of Marimbondo in 1974 has reduced the quality and economic importance of fishing in surrounding communities by enticing local fishers to work in the plant. Only three of the 41 fishers still around operate motorized craft, the rest are considered artisanal and build aluminum canoes. There are three main technologies used for harvesting: gill nets, cast nets, and longlines. Artisanals use their catch for both subsistence and for income by selling in local markets.

There are two annual seasons determined by weather patterns at Rio Grande, the wet 'cheia' season from November to March and the dry 'seca' season from May to September (April and October considered a third category of ecological conditions, transition months). Fish stocks are much more abundant in the wet season as productivity rises sharply and amount of catch per unit of fishing effort increases during these months. Total fish catch by artisanals drops to only 7 percent in the dry season of what is caught in the wet season. Dry season income from fish harvest is only 10 percent of what it is in the wet season. Thus, seasonality is both extreme and quite predictable on Rio Grande. Fishing work is performed almost exclusively by artisanals during the abundant 'cheia'

wet season. However, Icem and Frontiera artisanals are both natural resource use and occupational pluralists during the 'seca' dry season. Roughly 60 percent of artisanals engage in one or more of the following during the dry half of the year: small-scale agriculture, wage labor at the nearby distillery, and wage labor in regional construction. Fishing shifts from the primary income generator in the wet season to a mostly supplemental subsistence activity in the dry season when wage labor often provides most income.

Artisanals informally define individual fishing territories on Rio Grande. There is no evidence of any other communal property rights present. An informal management system based on these individual territories exists according to fishers. Individual territories are recognized informally between fishers, who also resist encroachment by outsiders whose lines are cut if caught fishing from shore.

Outsider encroachment in this case is mostly tourist / recreational fisher encroachment. Tourism increased sharply during the late 1970s and has resulted in conflict between tourists and artisanals over individual fishing territories, mostly during the transition between the wet and dry seasons. Tourists that fish from the shoreline often cast their lines into the artisanals' territories as they move more towards the artisanals' traditional fishing areas away from the shorelines adjacent to the vacation homes and developing tourist spots downstream.

The authors and fishers interviewed in this case study do not directly deem this CPR management system as a success or failure. However, there is ample evidence to deem it failing considering the three main criteria. Environmentally, the highly priced and

sought-after first grade fish such as ‘pintado’ have decreased in abundance over two decades. During this decline in first grade fish, a hydroelectric plant was built upstream in the town of Marimbondo in 1974. General fish mortality has increased since. Economically, the most abundant fish are now all second grade (and lower priced) species. Artisanals struggle to harvest any grade fish during dry season and most are increasingly turning to wage labor to maintain a primary income. Socially, there has been reports of not only artisanals outmigrating from the communities, but also of intra-group conflict increasing with decreases in valued fish to catch. Disputes over individual territories have also occurred.

Rio Grande is the one case study that is generally failing across the three criteria. Although artisanals have created property rights and an informal management system, it does not exhibit many of the model design principles that are found in the more successful case studies. Only two of the ten principles are found at Rio Grande, compared to the other case studies that exhibit at least half or more. Most of these model management institutions are not present and there are few similarities between the other forms of outsider encroachment detailed in the other studies and tourist fisher encroachment present in this case. Therefore, this case study is eliminated from the analysis concerning resilient management in the second research question.

CHAPTER V

SYNTHESIS AND CONCLUSIONS

This chapter synthesizes the qualitative data from the seven case studies for the purpose of answering the two research questions of this paper. Section 5.1 addresses the first research question by consolidating the data on the management design principles (outlined in the consolidated model of principles) across the case studies. Section 5.2 addresses the second research question by summarizing the importance of ‘shoreline activities’ in artisanal fishing communities and analyzing how these activities affect the continued existence and functioning of traditional management institutions in the face of outsider encroachment. Section 5.3 provides a brief synthesis of the main arguments and discussion of the results. Section 5.4 concludes with a discussion on the limitations of the case study data and suggestions on how those limitations can be improved upon in future research.

The case studies show that there are unique cultural and social patterns in artisanal fishery communities that promote resiliency in the face of external threats such as commercial encroachment. The case study approach has proven very useful in identifying and illuminating the questions of common-property and the management institutional structures that lead to success or failure in dealing with CPRs (Burger, et. al. 2001).

5.1: Research Question #1

This section consolidates the descriptive data from the seven case studies concerning the ten principles of the synthesized model outlined in chapter II (see Table 4). This first research question is: do the often cited Ostrom (1990) and Baland and Platteau (1996) models for informal CPR management hold up in the case of Latin American fisheries? Each principle is briefly discussed by outlining which case studies exhibit that respective principle as a sort of ‘test’ of the model. This will help determine whether the six successful case studies exhibit all, most, or a certain set of principles compared to the one unsuccessful case study (Rio Grande). Elaboration is provided on certain case studies that exhibit uniquely effective or ineffective results concerning each respective principle.

1. Clearly Defined Boundaries

The first criterion for successful CPR management is that the boundaries of the resource be clearly established. All seven case studies, even the one deemed ‘unsuccessful’ exhibit clearly defined boundaries that are informally recognized and adhered to by most local fishers. There are two types of boundaries covered by this design principle. First, when individual and / or communal rights to territories exist, the boundaries of those territories must be coherent and collectively recognized by users. Also, the entire CPR itself (within which those individual and / or communal rights exist) must be highly coherent and collectively recognized. Three case studies (Bahia, Coqueiral, Lake Titicaca) show the most rigid and collectively recognized boundaries

concerning the entire CPR area under informal management relative to the other case studies. However, all seven cases do exhibit highly coherent boundaries on both individual and communal territories.

2. Congruence between Appropriation and Provision Rules and Local Conditions

The second criterion for successful CPR management is basically that there be rules in place that restrict technologies and / or harvesting amounts that are not appropriate for the user group given the environmental, economic, and social conditions of the CPR and the user group. Six of the seven case studies show high congruence in their appropriation and provision rules (Bahia, Baixo, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States, Rio Grande).

The Coqueiral and Rio de Janeiro / Sao Paulo States case studies show that technology diffusion from outsiders occurs mainly when it is congruent with local ecological and social conditions. For example, opportunities to integrate more advanced boats by the raft fishermen of Coqueiral were rationally discarded as not being potentially as congruent with maneuvering in the swampy coastal areas of the northern Brazilian coast despite the more sturdy and advanced structures of the boats (Forman 1970).

In the Baixo case study, varzeiros developed access rules that are congruent with local conditions. The drastic shifts in floodwater levels and seasonality in the Baixo led varzeiros to collectively enforce restrictions on gillnets during the most productive parts of the year in order to maintain enough catch during less productive times when the floodwaters recede and they must compete with commercial fishers on the rivers.

The Bahia, Lake Titicaca, and Rio Grande cases show high congruence especially concerning technology provisions appropriate for local conditions. The one case that shows less is the Caye Caulker case. The rapid increases in imported technology through high returns on lobster sales have contributed to this. There exist few to no informal mechanisms for restricting technological advancement and there is a growing potential for over-exploitation, over-saturation, and non-congruence at Caye Caulker.

3. Collective-Choice Arrangements

The third criterion for successful CPR management is that decision-making processes concerning creating and changing rules are inclusive of the entire user group. Six of the seven case studies show high levels of inclusiveness in collective decision-making (Bahia, Baixo, Caye Caulker, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States). In these six cases, there were few fishers that had claimed to have been unjustly excluded from the informal fishers' organizations. Those that do complain of discrimination are recognized by active fishers as having deserved such social sanctions because they had broken informal rules (see the next two principles, monitoring and sanctions). Fishers report few problems with inclusiveness in these cases.

The Rio Grande case study illustrates a case where collective decisions are less inclusive. With high rates of outmigration of artisanal fishers to other communities (often for wage labor) collective-choice arrangements are beginning to disintegrate. The main factor here is technology. While most of the fishers have adhered to technological provisions congruent with their Amazonian riverine ecosystem, a few artisanals have

turned small-scale by leasing motorized boats from newly formed local boat rental shops that are serving mostly tourists. These fishers have gone outside the user group to acquire such motorized tech and this has caused the erosion of informal management enforcement and inclusion.

4. Monitoring

The fourth criterion for successful CPR management is that monitors exist, are collectively recognized, and are accountable to the other users. Monitoring responsibilities include watching other users' activities while they use the CPR in order to prevent any rulebreaking and also watching for community outsiders that are not supposed to use the CPR. Five of the seven case studies exhibit effective monitoring mechanisms that hold members accountable to the other fishers through effective collective-choice arrangements (Bahia, Baixo, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States).

In Bahia, 'mestres' are experienced and respected artisanals that constitute leadership in beirados' informal management system. They are the group most responsible for monitoring, not only for the lunar-tide cycles that determine where territories are to be setup, but also for community outsiders and rulebreakers on the waters.

At Lake Titicaca, totora reed bed collection is a major factor in monitoring. Totora reeds grow in what are often termed 'sunken gardens' (or 'reed beds') that stand adjacent to the shoreline of fishing communities. The collection of totora reeds promotes

monitoring for outsiders on the community fishing territory. Also, artisanal fishers are very familiar with each other since they tend to fish solo on their own separate craft and average over 200 fishing trips out 'on the water' each year. The recognizability of traditional fishers and the shoreline activity of totora collection promote informal monitoring at Lake Titicaca. The Baixo, Coqueiral, and Rio de Janeiro / Sao Paulo States cases all have systems that rely on well-known and respected fishers (as in Bahia) whose job is to watch for rulebreakers and monitor weather patterns.

By contrast, the Caye Caulker case has no monitoring mechanisms, but effective graduated sanctions. Caye Caulker lobster fishers have historically had a small portion of their daily catch stolen from their traps by a few long-time community members and some regular outsiders that enter the community. It is common for a fisher to retrieve his traps and find at least one or two of them being empty. This is contributed to the lack of monitoring mechanisms discussed earlier. The lack of monitoring has resulted in this small 'robber economy' allowing a few certain individuals to routinely steal a few lobsters per day. Over the years these robbers have been spotted inadvertently at various times and have become the 'known thieves' of the community. Since fishers have at least 40 traps or more that they retrieve daily, this is not a big enough dent in their livelihood to necessarily implement monitoring mechanisms to keep eye on such robbers. Fishers here tend to view the time and energy costs of monitoring as outweighing the benefits of saving a few lobster per day since Caye Caulker lobster are so highly demanded, sell at such high prices across scales, and catch amounts are rather steady.

In the Rio Grande case, fishers show neither monitoring mechanisms nor graduated sanctions. With a riverine fishery that has a smaller CPR area than the other cases, it seems as though this is one reason why individual fishers have not been given specific responsibilities of monitoring.

5. Graduated Sanctions

The fifth criterion for successful CPR management is that graduated sanctions (punishments) exist and are enforced appropriately considering the seriousness of the offense. Six of the seven case studies exhibit graduated sanctions where active social ostracization or other informal methods of punishing known rulebreakers effectively keep these rulebreakers from repeating a similar act (Bahia, Baixo, Caye Caulker, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States).

In Bahia, sanctions are brought against rulebreakers that fish in territories not their own. Sanctions include sabotaging equipment and crossing or entangling nets. The lack of monitoring at Caye Caulker was discussed earlier and how ‘known thieves’ are present and tolerated as long as they only take a certain small portion of an otherwise bountiful harvest. However, strong collective mechanisms exist to socially ostracize thieves and ensure they never gain membership in the NFCS cooperative. When a ‘known thief’ does take an extraordinary amount, fishers have been known to extract revenge in some cases.

At Lake Titicaca, sanctions are brought against outsiders who crossover communal territory boundaries. A survey of 251 local artisans with follow-ups on

reported victims of sanctioning verifies the existence of such mechanisms. The Baixo, Coqueiral, and Rio de Janeiro / Sao Paulo States cases show similar evidence of sanctioning mechanisms. However, Rio Grande artisans seem to have lower levels of sanctioning compared to the other six cases.

6. Conflict-Resolution Mechanisms

The sixth criterion for successful CPR management is that there be specific mechanisms for resolving conflict between users that are accessible to most, if not all users in the group. Five of the seven case studies show strong informal mechanisms for resolving user group conflicts. The Bahia and Rio de Janeiro / Sao Paulo States cases show the most intricate management institutional arrangements. In the Rio de Janeiro / Sao Paulo States case, there are two main types of Caicarás conflict resolution mechanisms depending on which community one is in. One is based on a kinship lineage system, where elderly men who are well respected provide the final say in collective action decision-making and disputes. The other type is based on participation and experience, where the same sort of mechanisms exist, but management leadership is based not as much on age, but on a history as an active participant in collective resource management.

In Bahia, when disputes arise among beirados, ‘aconselheiros’ (‘mediators’) are sought after to resolve conflicts. Aconselheiros are either retired and well-respected fishers or sometimes even the widows of retired fishers. These aconselheiros are informally placed in such a respected position collectively by beirados due to their vast

fishing and community experience and have been successful in maintaining high levels of ‘respeito’ among beirados with little intra-group splintering.

The Baixo and Rio Grande cases show relatively weak conflict resolution mechanisms. Varzeiros fishers in the Baixo region are successful and exhibit a majority of the other model principles, but access to conflict resolution seems weak as there is some evidence of internal and external conflict persisting in a few cases. Conflict-resolution mechanisms, especially concerning insiders v. commercial outsiders, are less well developed and there has been evidence of increased conflict since the arrival of commercial encroachers on the rivers. This may be a signal that while other effective management institutions of the varzeiros have shown resiliency in the face of external threats, conflict-resolution mechanisms are perhaps the exception and have broken down with increased pressure from urban outsiders entering their isolated rural communities. At Rio Grande, artisanals are increasingly involved in conflict within their artisanal user group concerning access to motorized technology and with respect to recreational fishing tourists on-shore. This weakening or absence of conflict-resolution mechanisms is perhaps due to the growing technological dualism between artisanal and a few small-scale fishers. Such increased dualism may result in more differences and splintering between the fishers that are converting to small-scale technology.

7. State Tolerance of Local Management Systems

The seventh criterion for successful CPR management is that local management institutions are not seriously challenged or threatened by external government authorities.

While the Lake Titicaca case reveals some efforts by the state to thwart informal / local management systems and implement their own system, all seven case studies do exhibit informal management systems and even in the Lake Titicaca case, are experiencing little to weak enforcement by the state. Even in the Brazilian coastal cases (Bahia, Coqueiral, Rio de Janeiro / Sao Paulo States) where the Brazilian government technically and legally can enforce their 'ocean as public property' law, the state does not possess the necessary resources to effectively fund formal enforcement mechanisms.

The remaining cases also show that while the state is not linked or integrated operationally with local informal systems, these governments have historically tolerated these systems. Thus, a relationship of 'separated tolerance' is perhaps the best way to describe these case studies (excluding the Lake Titicaca case) since the states are not legitimizing these informal management systems, but are also not attempting to enforce their own state property rights or management institutions to supercede local institutions. Again, this is often due to a lack of capital to fund regional and local fishery councils and other formal enforcement mechanisms.

8. Users' Demands for the Resource

The eighth criterion for successful CPR management is that there be high demand for the resource from users and that the resource is perceived as a vital contributor to their continued survival. All seven case studies show high demand for the resource by users. These fisheries are either the main provider of subsistence and income for local families in a line of other natural resource work (Baixo, Lake Titicaca, Rio de Janeiro / Sao Paulo

States, Rio Grande) or are nearly the exclusive provider of subsistence and income and constitute almost all labor inputs (Bahia, Caye Caulker, Coqueiral). Whether substantially engaged in natural resource use pluralism or not, these fisheries provide the majority of subsistence and income for these local families.

9. User Knowledge of Sustainable Yields

The ninth criterion for successful CPR management is that users exhibit high knowledge of the amount of resource units that can be extracted while allowing for that same amount to be extracted into the future. The highest user knowledge seems to be among the Caicarás fishers in the Rio de Janeiro / Sao Paulo States case. High traditional ecological knowledge (TEK) is present among the Caicarás and indigenous maybe the distinguishing factor for this principle as the Caicarás are the only Indian fisher group out of the seven case studies. There is partial evidence for other groups, such as the northeastern Brazilian artisanals in the Bahia and Coqueiral cases having specific TEK in areas besides sustainable yields (such as seasonal weather patterns, tide shifts, how ocean bottom content affects species catch and migration, and so forth). However, the data on sustainable yields in these specific studies remains somewhat incomplete and inconclusive.

10. Mutual Obligation and Concern for Social Reputation between Users

The tenth criterion for successful CPR management is that there be a strong sense of concern and commitment for mutual obligation between users. This is quite similar to

the concept of ‘reciprocity’. Reciprocity, like mutual obligation, is an act of exchange between two persons, acts of self-sacrifice or unsolicited kindness. In a small-scale fishing community, some examples include buying a beer or meal for another fisher or potential fisher, offering to carry materials or offer materials to help repair one another’s boat or net, sharing portion of a day’s catch when a fisher experiences a surplus (Pollnac 1991). Such acts need not necessarily be immediately ‘repaid’ by the recipient and can take a variety of forms.

Five of the seven cases exhibit high levels of reciprocity between users (Bahia, Baixo, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States) compared to the two other cases (Caye Caulker, Rio Grande). The highest reciprocity levels are in two cases that also exhibit almost all of the other model principles (Bahia and Lake Titicaca). This reciprocal exchange is one main factor that accounts for resiliency of the other effective management institutions across the five case studies. Factors that account for reciprocity in these cases, such as robust shoreline activities, are elaborated on in the next section.

5.2: Research Question #2

This section attempts to answer the second research question by expanding the arguments on what accounts for adaptive responses and resiliency of effective management institutions. The second research question is: what factors increase the resilience of local management systems in the face of pressures from commercial encroachment in Latin American small-scale fisheries? Adaptive management responses are present in the five case studies where moderate to high levels of fisher reciprocity are

also present. In such cases with high reciprocity, especially in the Bahia, Coqueiral, and Lake Titicaca examples, this reciprocity is influenced by shoreline activities.

Adaptive Responses and Resilient Management

Many adaptive responses by artisanal fishers involve defining and negotiating in-shore (near-shore) waters as their fishing territory. Such a response is only a first step, but since artisanal technology often prohibits distant water fishing from the shoreline, many remain within a mile of the shore when on the waters (McGoodwin 1990). When coastal lagoons and 'caye' islands dot the coastal shoreline, these often act as unofficial boundaries between 'in-shore' and 'off-shore' waters (Cordell 1984, King 2000, Sutherland 1986). Thus, in the cases of reciprocity and effective informal management institutions, small-scale and artisanal fishers respond first by defining and negotiating access to in-shore waters with commercial fleets. These agreements may allow the commercial sector to operate on the more distant waters off-shore from the community.

Adaptive responses that promote resiliency in the face of outsider encroachment, including the successful defense of in-shore waters and traditional fishing territories, are influenced by two main factors. The first is reciprocity and the other is that the benefits of relying on traditional territorial use and management systems outweigh the costs of keeping them. The existence of high user group reciprocity and situations where the perceived benefits outweigh the perceived costs of continued use and informal management of the fishery promote the adaptive responses that constitute resiliency. More specifically:

- Reciprocity is highly dependent on robust shoreline activities often found in artisanal fishing communities. These activities provide the opportunity contexts within which reciprocal exchange is first offered and then repeated to create reciprocity networks. Artisanal fishers will often rely on such reciprocal exchange concerning labor activities because of the high risks and uncertainties associated with fishing outlined in previous chapters.
- Cost-benefit analysis includes two main variables: costs of defending territories is shared more or less equally between users, the perception of benefits of maintaining traditional management versus the perception of benefits possible by allowing outsiders to enter and alter that system must side with traditional management.

In cases of robust shoreline activities and where perceived benefits outweigh perceived costs by local fishers, adaptive responses to outsider encroachment do exist. Shoreline activities are especially robust in three case studies showing the highest levels of reciprocity and resiliency (Bahia, Coqueiral, Lake Titicaca).

In the case study that is not showing resiliency in the face of outsider encroachment, Caye Caulker (where outsiders are encroaching on traditional territories and little to no defense responses from local fishers are occurring) the two main factors of shoreline activities and benefits outweighing costs are not present. Since the Caye Caulker fishers are almost all motorized 'small-scale' (and not artisanal), concentrated shoreline activities have not been as robust as in most other case studies with higher percentages of artisanal fishers. Also, there are two main factors that have uniquely

influenced Caye Caulker fishing that are not present in the other cases. The first is that lobster is a unique and highly demanded species that is connected to globalized markets and has generated relatively high economic returns. The cooperative organization instituted by local fishers themselves has actually helped by maintaining strong market positions through collective action and creating relatively strong backward economic linkages. With lobster prices rising, each fisher has seen a rapid jump in income along with the fisher cooperative group as a whole.

This rapid influx of capital has influenced the second factor concerning cost-benefit analysis, the rapid rise in the use of sophisticated fishing technology. Recent influxes of monetary capital have been used to purchase new technology. Technology has thwarted traditional territories since they expanded the exploitation capabilities of some local fishers. High economic returns from lobster resulted in higher intra-group and community social stratification between cooperative and non-cooperative fishers. With such luxuries, some of these fishers now see more costs than benefits in maintaining traditional management practices and territories.

Also with higher financial returns, fishers are now able to pay for their sons' formal education in Belize City or abroad and send them off to school instead of teaching them fishing techniques and handing down their property rights. As King documented in 1997, the next generation are beginning to out-migrate, threatening the familial line of traditional fishing. Since fathers have no family member to pass their territory on to, increasingly small-scale fishers are selling their fishing territories to community outsiders. These outsiders are usually either regional migrants that want to break into

fishing or representatives of private fish marketers who wish to contract with a fisher to exploit lobster and sell directly to them for a lower price.

Informal management institutions are breaking down at Caye Caulker with increasing outsider control of fishing territories. The two main factors influencing this breakdown are the high influxes of capital from a highly demanded lobster species and the increased use of imported technology. This technology increase has led to accessible waters being exploited to the point that most fishers say it is not worth the costs of traveling out to farther off-shore waters to attempt and find new territories.

Unlike at Caye Caulker where new technology broke down traditional management systems, technology produced a different result in Coqueiral. Because it was congruent with local conditions and control over technological innovations was regulated by local 'big-wigs', jangadieros were able to institute informal technology restriction mechanisms to collectively control their adoption of new technologies. The local land-owning 'big-wigs' at the top of the Coqueiral social and economic hierarchy are often the ones that have the external connections and capital for new forms of technology. Thus, they are often the ones that introduce new technology to the peasants in the community, and unless these new technologies are congruent with the jangadieros' traditional practices and ecological fishing conditions, they do not adopt it.

Shoreline Activities

It is crucial when analyzing artisanal fishers and the operation of the fishery to distinguish between 'on the water' work activities (fishing, gathering nets, etc.) and 'off

the water' shoreline work activities (McGoodwin 1990, Pollnac 1991, Acheson 1981). Shoreline work activities are an important characteristic unique to artisanal fishing that set it apart from other sectors of fishing and from other natural resource sector work. While the stereotypical view of fishers involves the 'on-water' work of gathering fish, the reality is that most of their time is spent 'on-shore' (Pollnac 1991). Artisanal fishers spend time and energy 'off the waters' gathering, building, and maintaining / repairing their fishing technology (McGoodwin 1990).

This intimately relates back to two points discussed earlier. In the first place, artisanal fishers rely on non-motorized and simple fishing technology (boats, nets, hooks, lines, and so on) often made by hand from locally gathered materials. The use of local materials reflects a lack of the necessary financial capital to purchase or import synthetic materials. In addition, artisanal fishers most often perform their 'on the water' labor during one stretch of time, whether overnight (as discussed earlier) or at other hours. A day's fishing trip 'on the waters' varies in length depending on numerous factors such as type of technology used, seasonal period of fish availability, and many of the other ecological factors previously mentioned. The point is since most artisanal fishing trips are done in one stretch of time seldom lasting more than one-third to one-half of the day, that leaves the rest of the day or night to the gathering, building, and maintaining of artisanal fishing technology.

The two most common used materials to construct fishing craft by artisanal fishers are wood and reeds (although aluminum and other materials are sometimes used). A reed is a finger-thin, flexible / bendable, greenish-brown fiber that can grow in tightly

packed bunches of dozens or more in marsh mixtures of salt and fresh waters that often exist adjacent to coastal shorelines (Chapman 2003). Reeds see heavy use in Latin America in ecosystems where wood does not grow or is not closely available, such as before wood was imported to the Lake Titicaca region of Peru and currently on the hyperarid desert coast of Peru in artisanal fishing communities such as Huanchaco and Chiclayo where wood does not exist (Orlove 2002, Chapman 2003). Since they grow and thrive in such marsh and floodplain type environments, reeds are easily grown along coastal shorelines of oceans, large lakes, and even rivers where such ecological conditions exist.

How close such materials are to the shoreline will also influence the amount of their use for fishing purposes. Costs of gathering and carrying such wood or reed materials are lessened the closer they are to shore. Artisanal fishing technology tends to degenerate quickly, especially for maritime fishers who have to deal with higher concentrations of rough and corrosive salt water (Acheson 1981). Reeds often exhibit faster deterioration than wood and reed craft. The hand-woven 'caballitos de totora' of Huanchaco and Chiclayo Peru corrode so rapidly that they are replaced an average of every 30 to 40 days by the fishers (Balagna 2002, Chapman 2003). Constructing a new craft every month or few months, along with the constant maintenance of re-tying and stitching fishnets, gathering used soda bottles to use as bobbers, gathering nearby wood or reeds and carrying it to shore, and setting up finished craft on-shore are all just some of the shoreline labor activities often done during mid-day by artisanal fishers (McGoodwin 1990).

One reason why these activities take place on the shoreline is because it is less costly to gather the materials that are already close to shore and work with them there instead of constantly hauling these materials (when in the case of wood and reeds for craft can be quite large bundles weighing upwards of hundreds of pounds) back and forth between a fishers' residence (which can sometimes be quite distant if engaging in natural resource use pluralism and farming inland) and the shoreline. Since the fishing technology is used for 'on the water' labor, then it is advantageous to keep such cumbersome gear as close to the water as possible. This is one reason why in many artisanal fishing communities, craft can be seen standing upright leaned up against barricades or shoreline walls that separate nearby shoreline roads or tracks from the sand beach. In other contexts, artisanal fishers store their wood boats in the water tied to shore docks or some other stable device on shore by rope.

There are other labor inputs not directly associated with the actual harvesting of the extracted unit in other natural resource sectors such as agriculture, pastoralism, and forestry. However, the specific dynamics of shoreline activities with artisanal fishing are quite unique and set it apart from these other natural resource sectors and apart from other fishing sectors as well. It is these shoreline activities that not only account for the majority of artisanal fisher labor, but it is also this unique spatial and temporal quality to labor that promotes strong informal reciprocity bonds between fishers (McGoodwin 1990, McGoodwin 2001). Working on fishing technology along the shoreline can influence reciprocal exchanges of labor and goods between fishers. These shoreline activities associated with artisanal fishing coupled with benefits outweighing costs in

maintaining traditional management institutions may account for the adaptive responses in times of external threat.

So what exactly are ‘shoreline reciprocity networks’ in regards to artisanal fishing? Artisanal fishers spend most of their work time not on the waters fishing, but on the shoreline gathering, building, and repairing their fishing technology as discussed earlier (Pollnac 1991). This is the context in which reciprocity occurs (Cordell 1984, Forman 1970, Orlove 2002). Examples of ‘shoreline reciprocity’ are vast and include acts both on the waters fishing and non-fishing activities (McGoodwin 1990). Reciprocity networks are built between certain fishers that are either kin or have developed a friendship (often based on networks of kin ties) (Cordell 1984, Cordell and McKean 1992). This reciprocity in practice increases each fishers’ opportunities to show their worth through acts of self-sacrifice and also allows each to measure the worth and ‘sense of fair play’ involved with other fishers (Cordell 1984).

It is crucial to distinguish between types of reciprocities. Sahlins’ (1972) typology serves as a guidepost to distinguish between three basic types of reciprocities: generalized, balanced, and negative. These three types differ across three variables: immediacy (in practice as well as in expectation) of returns, equivalence of returns, and the material and mechanical dimensions of exchange.

In the five case studies exhibiting high reciprocity, this reciprocity is most often times balanced. There is an expectation of return without which will result in social consequences such as loss of rights or ostracization. There is almost always an expectation of equal to near equal return depending on the ability of the indebted fisher to

‘repay’ (Cordell 1984). However, this shoreline reciprocity in the five case studies does not meet the ideal criteria of ‘perfect’ or ‘precise’ balanced reciprocity since exchange rarely occurs without delay and it is expected that time will pass before a reciprocal act is repaid. The giver of such acts often remembers acts of self-sacrifice and it is this cognitive mechanism that serves as the informal measure of trust and worth of fellow fishers in these case studies.

Such reciprocity is one major factor that accounts for the responsiveness and inclusiveness of collective action mechanisms required for successful informal CPR management, especially in response to pressures for change. When there is a high sense of reciprocity present in a fisher community, the fishers are more likely to respond rapidly, promote inclusiveness in decision-making, and incorporate observational information from more fishers in decision-making.

5.3: Conclusion and Implications

Table 7 summarizes the presence or absence of CPR model principles (from Table 4) across the case studies. The six successful Latin American artisanal case studies exhibited a majority of the model principles (six or above, most had at least eight) while the one unsuccessful / failing case study exhibited the lowest number of these principles, only four. The case studies support the validity of Ostrom’s ideal-type CPR management principles. However, the additional factors added by Baland and Platteau are only partially supported. Three of the Baland and Platteau additional principles were discounted beforehand (‘costs of exclusion technology’, ‘physical overlap between the

CPR and users' residences', and 'size') due to the first two being incongruent with fisheries and 'size' being discounted because of theoretical questions raised by other scholars. One of the remaining three, 'knowledge of sustainable yields' is inconclusive. However, the remaining two Baland and Platteau principles, 'user demands for the resource' and 'mutual obligation' seem to be supported by the case studies. The physical environment and specific institutional factors from Ostrom's model are influential in promoting effective informal artisanal fishery management. In addition, the two characteristics of the user group cited by Baland and Platteau are influential as well.

While these models of design principles have been empirically tested, they have not been thoroughly examined specifically concerning Latin America or Latin American artisanal fisheries before this analysis. Schlager and Ostrom (1993) represents one of the most thorough tests of Ostrom's model in a comparative analysis of thirty artisanal and small-scale coastal fishery case studies worldwide from a variety of first and third world regions. Their study is primarily concerned with examining variation among fishers that hold more or less 'powerful' bundles of rights. Their findings show that fishers holding rights of exclusion and transferability over their territory or within the larger fishery itself are much more successful at reducing conflict and assignment problems and limiting technological externalities. Their work evaluates how certain property rights arrangements in a fishery influence success across a range of environmental, economic, and social criteria. They find that different levels of rights held by users affect management effectiveness. In general, Ostrom's model is supported by their results.

The present analysis complements their study by focusing on Latin America and expands their discussion on how resilience of management institutions is achieved. The results seem to indicate that while Ostrom's model is strong, parts of the Baland and Platteau model may not be generalizable across the fishery sector. However, Baland and Platteau do add perhaps the most crucial factor in regards to the promoting resilience of the other principles, that being 'mutual obligation' / 'reciprocity'.

The failed case study specifically lacks the more 'community' and inclusive mechanisms such as effective collective-choice arrangements, monitoring, sanctioning, and conflict resolution measures (along with exhibiting high 'mutual obligation') that most of the other more successful cases exhibit. These management institutions require high levels of intra-group trust and the tenth factor of 'mutual obligation' seem to be the most crucial in determining the three broad criteria of success and maintaining traditional fishery management.

An interesting note to research question #2, the cases also show a major commonality in that there are fewer costs associated with transferring individual property rights / fishing territories when these individual territories are based in high homogeneity (family / kin) networks. Five of the seven case studies show that when the user group is highly homogeneous in terms of familial relations, transferring rights inter-generationally has historically been effective discounting any large influxes of capital and / or adoption of technologies (Bahia, Caye Caulker, Coqueiral, Lake Titicaca, Rio de Janeiro / Sao Paulo States). Homogeneity in this particular context seems to facilitate the longevity of

property rights systems and can also increase perceived benefits when facing costs associated with defending territories.

The results suggest that CPR management institutional design and procedures do matter in regards to the overall success and stability of fisheries. However, fishery shoreline activities influence reciprocity networks and strengthen effective adaptive responses of defending in-shore territories from various types of outsider encroachment. Shoreline activities and in-shore territories are two unique ‘spatial elements’ of artisanal fishing communities that need to be taken into account when analyzing resilience of traditional livelihoods in the face of outsider encroachment and other forms of external threat.

5.4: Study Limitations and Future Research

Availability of relevant data has been a limitation of this report. As a masters degree student lacking the funds to support original field research, I have had to rely on published scholarly journals and books to provide case study data. I have had access to Utah State University libraries, University of Utah libraries, and an inter-library loan system for searching and gathering Latin American artisanal fishery case studies. I feel that I have covered all of the readily available cases of research on artisanal fisheries in Latin America. Nevertheless, I may have unintentionally missed some appropriate and relevant studies, such as those presented in unpublished manuscripts or data reports sitting in other libraries.

This limited availability of published research has influenced the time and spatial scope and significance of the data as well. Two cases, Bahia and Coqueiral, are at least three decades old and although two of the cases are longitudinal (Caye Caulker and Lake Titicaca), none have data within a half-decade of this report. Therefore the significance of the results for early 21st century fishing industry dynamics may be limited by changes in the underlying social, political, and market conditions. As stated above, these studies are defined as a success or failure by the given criteria at the time of data collection. As a result, it is not known if the ‘success’ documented above has extended into more recent periods.

It would certainly be interesting and fruitful for future researchers to return to one or more of these study sites and document what change has occurred. The arguments on destabilization vs. integration outlined in chapter III could be a crucial focus of such analyses. Also, one could examine if more technologies among commercial fishing fleets have had new and more potent impacts on traditional management systems. Are those traditional management institutions that continued to exist a few months to years after the first signs of commercial encroachment still in existence and operating effectively? Have they been replaced by different informal management institutions adapted to a new context of survival or competition with commercial fleets? If commercial fleets continued to exist in and around the community fishery, there is a greater chance that artisanal fishers are more likely to have been integrated into these commercial networks.

Future research could also improve upon the spatial limitations of this report in three respects. First, access to a wider range of works could allow for a wider

geographical range of studies to be selected. Four of the seven cases in this report are from coastal Brazil and two are from Peru, leaving many Latin American nations and their respective fisheries unrepresented. A wider sample could allow for more confidence that the observed patterns are typical of the Latin American region. A larger sample could also examine differences in the various types of Latin America fisheries (e.g., maritime, riverine, and lake). For example, in-shore territories such as mangrove swamps and ‘caye’ islands might be easier for artisanals to defend from outside encroachment. Finally, since there is one case study in this report (Caye Caulker, Belize) that can also technically be classified as ‘Caribbean’ because of its heavily English-speaking population and historical cultural roots linked more to black Caribbean populations, cultural arguments concerning reciprocity and shoreline activities specific to the Latin American region are difficult. Building a theory of cultural elements common to Latin American small-scale fisheries is not possible in this report.

Most of all, future studies should focus on the relationships among adaptive management, reciprocity network structures and shoreline activities. Distinguishing between types of reciprocity found in these types of artisanal fisher groups and focusing more on how shoreline reciprocity networks arise, persist, and change would add to the artisanal fishery literature. While this report has often sacrificed in-depth analysis on certain topics for a more general review of various literatures, a detailed case study on reciprocity network dynamics and structure would help verify and extend the arguments presented here.

Future research would also be able to examine two other issues that were ignored in this report. First, the larger community context within which fishing sub-communities exist should be examined in more detail. This would entail gathering details on the dynamics between larger community social relations and how those affect fisher group relations. Also, research is needed on the emerging trend of tourism development in third world fishing communities that are 'physically attractive' and offer high-amenities to foreign tourists. Specifically, the effect of tourism on economic linkages across segments of the fishing industry and an evaluation of how it might support or marginalize traditional forms of resource use (such as small-scale fishing) will influence whether tourism serves as possible stable form of future economic development in these regions.

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