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MANAGING THE COMMONS:
AN ANALYSIS OF INSTITUTIONAL ARRANGEMENTS INFLUENCING
THE CO-MANAGEMENT OF TROPICAL SMALL-SCALE FISHERIES

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GERALD THOMAS HOVIS

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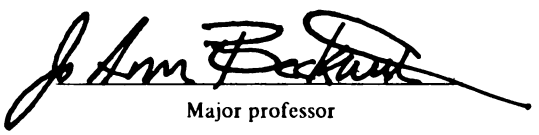

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MANAGING THE COMMONS:
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By

GERALD THOMAS HOVIS

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ABSTRACT

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GERALD THOMAS HOVIS

Co-management is one approach being considered as a solution to the present management of tropical small-scale fisheries. This research project examined the institutional principles involved in small-scale fisheries co-management. Using an institutional analysis framework, key principles facilitating co-management arrangements were identified. A content analysis of co-management cases in the literature showed that principles pertaining to definitions of boundaries and a coordinating role for external organizations dominate. Correlations were exhibited between the principles of a coordinating role for external organizations and local level leadership. The principle of congruence of appropriation rules and local conditions was correlated with the greatest number of other principles. Regression analysis showed a significant relationship between the total number of principles discussed and co-management level. Qualitative methods were then used to further explore the evolution of institutional principles and changing levels of co-management. Results suggest that a clear definition of boundaries and an external coordinating body is a critical first step for co-management. Further analysis suggested that legal protection of rights, and local level leadership are also critical for the development and implementation of suitable co-management regimes.

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Chapter 1

PROBLEM ANALYSIS

Analyzing Common Property Resource Dilemmas

One of the more stimulating analyses of common pool resources was presented by Garrett Hardin in his often quoted article the "Tragedy of the Commons"(Hardin 1968). Although it focused attention on overpopulation, the dominant legacy of the paper has been its metaphor of common property resource management. (Feeny, Berkes, McCay & Acheson 1990). The essential idea was that resources held in common, such as oceans, rivers, air, and parklands, are subject to degradation when they are in limited supply and publicly owned. Hardin explained the "tragedy" in terms of a well used English pasture in which a herdsman who wishes to add one more animal to his flock determines that since the negative utility of this addition will be shared by all, the only rational action is to add more and more animals. However, this conclusion reached by all herdsmen, locks them in a race to add more and more animals. The result of these additions is environmental degradation as each herdsman speeds toward ruin. Or as Hardin put it, "Freedom in a commons brings ruin to all" (Hardin 1968, p 1244). Hardin argued that the obvious solution to this ruin of the commons is either through privatization or state control in which entry rights would be specifically allocated. Perhaps the real significance of Hardin's theory is that it has stimulated 30 years of aggressive research into common property resource dilemmas.

All common property resources (CPRs) (e.g., fisheries, wildlife, forests, irrigation waters) have two important characteristics in common: exclusiveness and subtractability (Ostrom 1994). Exclusion is control of access or the difficulty of excluding individuals

from benefiting from a resource, or placing restrictions on use of the resource. Both efficiency of appropriation and sustainability of provision of the resource can be categorized as components of exclusion. Subtractability refers to a benefit acquired by certain individuals from using the resource that is not available to other users. This characteristic deals with issues surrounding equity of appropriation and provision of the resource. Using these characteristics as a basis, common property resources are defined as a class of resource for which exclusion is difficult and joint use involves subtractability (Feeny et al. 1996).

While the management of common property resources can be problematic, not all common property resource management situations pose dilemmas. Consequently it is important to distinguish between a CPR situation and a CPR dilemma. Gardner et al (1990) suggest that a CPR situation is defined by independent multiple appropriators harvesting a resource, however, a CPR dilemma requires two additional components. First, the strategies of the appropriators result in sub-optimal outcomes for the appropriators. Second, there exists at least in theory one other more efficient constitutionally feasible strategies for appropriation of the resource. Therefore, a CPR dilemma can only exist for resources in which it is costly to restrict users, extraction of the resource reduces benefits to future users, appropriation strategies are sub-optimal and other, perhaps better, options for appropriation exist.

Rights Structures Governing Common Property Resources

Four property rights regimes have typically been used for common property resources. First, open access is defined as the absence of any well-defined property rights

structures. Access to the resource is unregulated, free and open to the public. Second, communal property is held by an identifiable community of interdependent users who may exclude outsiders while regulating use amongst members. The rights are unlikely to be exclusive or transferable and are often rights of equal access and use. Some inshore fisheries and shellfish beds are managed as communal property. The rights of the group may be legally recognized or de facto. Third, state property rights are vested exclusively in the government, which makes decisions concerning who shall have access to the resource, the conditions and the level and nature of exploitation. The final regime is private property rights, which are vested in an individual or group who may exclude others from using the resource and regulate the use of the resource. These rights are usually recognized and enforced by the state and are usually exclusive and transferable.

Since Garrett Hardin first published the Tragedy of the Commons in 1968 it has been critiqued by many scholars (Berkes 1985; Cox 1985; Feeny et al. 1990; Berkes et al. 1989; McCay 1994; Ostrom 1994; Feeny et al 1996; Burger & Gochfeld 1998) . Most often it is suggested that his assumptions of open access, lack of constraints on individual behavior, conditions in which demand exceeds supply, and resource users who are incapable of altering rules is an inaccurate description of most common property resource systems (Feeny, Berkes, McCay & Acheson 1990). More specifically Hardin underestimates the important role of institutional arrangements that provide for exclusion and regulation of use. Additionally, cultural norms and informal solutions are critical to understanding behavior in the commons (Andersen & Simmons 1993). So the "open access" of Hardin's tragedy of the commons may in reality be a common property resource that has aspects of each of the four general property rights regimes as well as a

complex assortment of informal or formal institutional arrangements that have been established within the parameters of socio-cultural norms.

Managing the Marine Commons

Traditionally "common property" includes natural resources such as fisheries, wildlife, forests, irrigation waters, and pasture lands, which by their physical nature may be owned by individuals, but are shared by a community or group of users. CPR theory has been useful in analyzing all of these types of commons situations (Ostrom et. al. 1994). However, this thesis focuses on one type of resource in particular, small-scale tropical marine fisheries. The literature is ripe with definitions of small-scale coastal fisheries (Panayotou 1985; Platteau 1989; Kuperan and Abdullah 1994; Smith 1979). For the purposes of this analysis small-scale fisheries will be defined as any individuals, groups or communities involved in the harvest of marine organisms generally without the use of mechanized equipment or large (>10m) fishing vessels (Agardy 1997).

It is estimated, that 90 percent of the world's fishermen and over half of the fish consumed each year are captured in small-scale, inshore fisheries (Pitcher, et al. 1998). Various strategies have been utilized in an attempt to regulate small-scale marine fisheries. Historically many developing nations relied on traditional management schemes to regulate small-scale "artisanal" marine resources. However, traditional management schemes have been eroded as a result of the breakdown of traditional authority and pressure from commercial markets (Johannes 1978). Aside from these localized traditional regulations, fishery resources were for the most part open to all comers, at least in theory.

However, when factory trawlers began to ply the seas in the early 1950s many fish dependent countries were forced to independently expand their jurisdiction up to 200 miles offshore to keep foreign fishing fleets out. By 1973, 35% of the ocean was claimed by coastal states, many of which were developing countries (Worldwatch Institute 1998). In 1982 the U. N. Convention on the Law of the Sea (UNCLOS) formalized the 200-mile exclusive economic zone (EEZ). These de jure fisheries within the 200-mile EEZ limit were, in theory, state property. In practice, however, many fisheries within the 200-mile boundary are de facto open access to the citizens of that state (Feeny et al 1996). Although the state has the authority to regulate access to the fishery, enforcement is lacking, or the state does not choose to restrict access.

Additional attempts to manage small-scale artisanal fisheries have been through the use of internationally recognized marine protected areas (MPAs) (Salm 1984; McNeely 1994; Allison 1998). International organizations such as International Union for the Conservation of Nature (IUCN) together with United Nations Environmental Program (UNEP) and United Nations Educational, Scientific, Cultural Organization (UNESCO) have been involved in establishing different categories of resource protection leading to some 1,100 marine protected areas worldwide. They range in size from the Great Barrier Reef Marine Park, which covers around 344,000 km^2, to MPAs of a few square kilometers (Gubbay 1995). Since the United Nations Law of the sea Treaty (UNCLOS), fisheries management in developing nations has largely depended on EEZ rights, fishing quotas, difficult to enforce state level regulatory mechanisms and some traditional regulations (Buck 1995). However, despite the combined use of traditional rights, national and international legislation and IUCN protection status, conservation of the

marine environment has lagged behind conservation of terrestrial environments, and a sufficiently sustainable approach to the management of marine ecosystems is yet to be realized (McNeely 1994). These various strategies of fisheries management have created a fertile environment for a more dynamic approach to management, namely co-management, which is presently gaining support worldwide.

Co-Management and Participation

Co-management of marine fisheries is not new. While the reigning model of fisheries management is top-down, science based, and bureaucratic, most nation states have long histories of stakeholder involvement in fisheries management (McCay & Jentoft 1996). But what exactly is co-management? Pomeroy (1998) defines co-management as a partnership arrangement in which government agencies, the community of local resource users, nongovernmental organizations, and other stakeholders share the responsibility and authority for the management of the fishery. It should be noted that systems based solely on traditional marine tenure, traditional fisheries management and strict community-based resource management are not necessarily considered co-management because government is not involved in the decision-making process. (Sen & Nielson 1996). Further, it has been argued that despite the many advantages of these strictly community-based approaches it is unlikely that local communities can successfully implement fisheries management on their own (Pomeroy 1994).

Scholars have categorized co-management arrangements into broad types according to the role government and users play. One example includes instructive, consultative, cooperative, advisory, and informative (McCay 1993; Berkes 1994). Each

of these categories assumes a certain level of participation for the stakeholders involved with the resource. While it may be difficult to categorize and assign co-management strategies for a particular management scheme, it can be helpful in analyzing the associated formal and informal institutional arrangements that result from a particular management approach.

Rationale for Institutional Approaches

In practice, Bromley (1996) suggests there is no such thing as a common property resource; there are only resources controlled and managed as common property, state property, as private property or resources over which no property rights have been recognized. The categories for property rights regimes discussed earlier are ideal; in practice fisheries resources are often held in overlapping combinations of these regimes as a result of the various management methods (Feeny et al 1996). Even with all of these methods, fisheries have still demonstrated a persistent and in some cases disastrous tendency toward overexploitation. The most widely accepted cause of this overexploitation is the common property or open access nature of legal rights in the marine environment. (Acheson 1987). Although overexploitation has occurred its incidence is not exclusive to situations of communal property or open access as implied by the tragedy of the commons argument; degradation of the resource has also occurred under private and state property regimes (Feeny et al 1996). In fact, both natural and social scientists have reported from diverse regions of the world how certain local populations have maintained viable systems of resource management through various formal and informal institutional arrangements that successfully self-regulate resource

harvesting activities (Berkes 1985). In short, sustainable common property resource management generally and sustainable small-scale fisheries management specifically has not been shown to be intrinsically associated with any particular property rights regime (Berkes et al 1989). These results are in contradiction to the tragedy of the commons proposition as presented by Hardin, which came with its assumptions about property rights structures and user inflexibility towards new and potentially less exploitative appropriation arrangements.

Evidence from many fisheries case studies suggests that there are at least six important and sometimes overlapping categories of assumptions that underlie the tragedy of the commons approach (Feeny et al 1996): (1) behavior of regulatory authorities, (2) individual motivations, (3) characteristics of individuals, (4) interactions among users of the resource, (5) nature of existing institutional arrangements, and (6) the ability of users to create new institutional arrangements. It is the latter two categories, which focus on the role of institutions that are examined in this research paper.

Problem Statement

Fisheries co-management as an alternative to centralized command and control fisheries management is often suggested as a solution to the problems of fisheries resource conflicts and overexploitation (Kuperan & Pomeroy 1997). Co-management allows the decentralization and devolution of authority and responsibility that facilitates fisheries resources to be managed in an efficient, equitable, and sustainable manner. Pomeroy (2000) suggests that resources can be better managed when fishers and other stakeholders are directly involved in management of the resources and development of

use rights. Fisheries co-management may not in theory be revolutionary, however, the current debate about the appropriate levels and types of decentralization, user group participation and the resulting institutional arrangements presently used to manage fisheries in a more sustainable way is (McCay & Jentoft 1996).

"Institutions" can be defined as sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions (Ostrom 1990). Institutional arrangements can vary greatly from one system to the next depending upon the type of fisheries management and the property rights involved. Attempting to develop a blueprint for any aspect of these systems for application elsewhere would be unwise due to the contextual nature of the issues. However, there is merit in looking at the relationships among different types of co-management resulting from various levels of participation together with the evolution of the institutional arrangements that result. Jentoft and McCay (1995 p. 236) affirm this in stating,

> Imitation of institutional models from one country by another is problematic. Institutions cannot be framed regardless of the context that prevails in each country and fishery. However, we believe that particular design principles can be extracted from one country and employed in another, and that mutual learning is something that should be encouraged.

Pomeroy (1994) states that essential ingredients for success of any resource management system, whether community-based or centralized, are the system of incentives and sanctions-rights and rules-for influencing individual behavior of resource users and dependents. Thus at the core of any form of co-management are the issues of

property rights, resource management regimes and institutional arrangements. Many scholars would argue that the most important of these is that of institutional design, which involves developing sets of rules that participants in a process understand, agree upon, and are willing to follow (Ostrom 1992). Consequently, there is an urgent need to study key institutional principles involved in the management of common property, especially as incorporated into co-management regimes (Pinkerton 1994).

Research Problem

Presently co-management is one strategy being applied to the management of small-scale fisheries. The strategy finds its strength in the array of institutional arrangements developed by the stakeholders involved. However, more research needs to be done on these arrangements in order to determine the appropriateness of co-management for small-scale fisheries. Consequently, this research will involve an examination of institutional principles in the co-management of tropical small-scale fisheries. This is achieved through a content analysis of the institutional principles applied to 48 documented cases of co-management within tropical small-scale fisheries. The objective is to develop insights into the relationships between principles and suggest which groups of principles have a greater probability of resulting in the development of ecologically and socially sustainable small-scale fisheries co-management regimes.

The following research questions are examined:

1) How have institutional principles been discussed in the literature on co-management of small-scale tropical fisheries?

- Which principles are discussed the most?
- Which principles are discussed the least?
- What might these frequencies suggest about the importance of these principles in the co-management process?

2) Do relationships exist among institutional principles based on their frequency and patterns of discussion in the literature?

- If so, what might these relationships suggest about how institutional principles interact while implementing co-management activities in the tropics?

3) Is there a relationship between institutional principles and co-management levels?

- If so, what might these relationships suggest about the evolution of principles with various co-management levels?
- Are there unique combinations, groups or sets of institutional principles that can be identified with certain co-management levels?

Chapter 2

PROBLEM FOCUSED LITERATURE REVIEW

Chapter Overview

This chapter provides an explanation of concepts, theories, and frameworks that are relevant to the research of institutional arrangements resulting from the co-management of small-scale fisheries in the tropics. **The first** section briefly discusses the more important models that facilitate an understanding of historical solutions to common property resource management. These are the prisoner's dilemma, the logic of collective action, the free rider syndrome, and transaction costs. The **next section** describes the various levels of institutional arrangements operating within the co-managerial approach to fisheries management. The **third section** focuses upon the theoretical construction of the framework for institutional analysis including the attributes of the physical world and community, rules in use, the action arena from which patterns of interactions lead to specific outcomes and design principles that have been isolated using the framework. The **fourth section** discusses the conceptual basis for determining the key attributes of the resource, resource user and fisheries management arrangements that are identified by applying an institutional analysis design. The **fifth** section outlines several classifications systems used to categorize levels and types of participation in the various co-management styles.

Introduction

Many governments, international organizations, resource managers, and fishing communities are dissatisfied with the way in which small-scale fisheries are being managed (Pitcher et al 1998). Historically, fisheries management has emphasized an understanding of the ecology and behavior of fish stocks. However, fisheries management has undergone a significant transformation during the last decade or so with the recognition that state control of resources was having limited success, and if fisheries resources were to be maintained new and innovative management techniques needed to be considered. It is becoming increasingly clear that greater emphasis needs to be placed on an understanding of the ways in which people understand and relate to their environments and of the ways ownership (common or exclusive) works in a specific cultural and ecological setting (McCay & Acheson 1987). As a result, there is great interest in considering new systems to more efficiently manage fisheries resources. In considering these new systems government officials, scholars, resource managers, and resource users are acknowledging a need for greater collaboration among all stakeholders in the management of fisheries. One of the more favorable management systems being discussed and promoted involves co-management (Pomeroy 1998).

Because there are many stakeholders involved with fisheries issues, co-management can manifest itself in diverse ways and scholars worldwide are presently studying the concept in an attempt to better understand its components. The dominant paradigm of state or private control, fostered by Garrett Hardin's 1968 "tragedy of the commons" has given way to various concepts of co-management as many common property theorists (Berkes 1986; McCay & Acheson 1987; Bromley 1992; Feeny et al

1990; and Ostrom 1990, 1992, 1994) challenge the assumptions of open access, constraints on individual behavior, demand exceeding supply, and the inflexibility of appropriators in creating or modifying formal or informal institutional arrangements governing resources. Of particular interest is the role of rules in affecting the behavior of and outcomes achieved by fishers using fisheries resources. Ostrom (1992) defines these rules affecting behavior of resource use as institutional arrangements. Considering the importance that is presently being placed on the "rules of the game" this analysis focuses on the institutional arrangements that facilitate the management of small-scale fisheries. But the task is no small one given the complex and contextual nature of any institutional analysis, which necessarily leads to many questions. What are appropriate institutional arrangements? What should they be designed to do? Who should create them? How and under what conditions should they be created? Who should be able to modify them and why? How should they be modified? All of these questions have merit, however, they ultimately lead us to a more fundamental question – What roles do institutional arrangements play in managing fisheries? In order to answer this question this research will utilize an institutional analysis framework, which focuses on the various institutional arrangements that are utilized to manage common property resources such as small-scale fisheries.

Theories Controlling Rational Behavior

In order to develop better tools to understand the capabilities and limitations of self-governing institutions for regulating fisheries resources, it is beneficial to discuss several concepts used to provide a foundation for solutions to commons dilemmas

(Ostrom 1990). The first of these was refinement of Garrett Hardin's tragedy of the commons as the prisoner's dilemma (Dawes 1973). Earlier it was discussed that Hardin's theory has come to symbolize the degradation of the environment whenever many individuals use a scarce resource in common. One lesson learned from his theory was that resources held in "common" need to be state controlled or privatized in order to prevent overexploitation. The prisoner's dilemma envisions two thieves, involved in the same crime, who are being questioned separately by police. Each has to choose whether or not to confess and implicate the other. If both men want to minimize the time they spend in jail, the most rational decision is to confess. However, deciding to confess results in an inferior outcome for each person. The prisoner's dilemma fascinates scholars in that individually rational strategies can lead to collectively irrational outcomes. This challenges a fundamental faith that rational human beings can achieve rational results (Ostrom 1990). Although the prisoner's dilemma is a very simplified and abstract concept, it has been criticized as suggesting that the formulation of institutions regulating common property resources is a static rather than dynamic arrangement. (Berkes & Kence 1999).

A second closely related concept, promoting state, or private control of common property resources is the logic of collective action. It had been suggested by group theory that individuals in groups with common interests would voluntary act so as to try to further group interests. Olson (1965) challenged the presumption that the possibility of a benefit for a group would be sufficient to generate collective action to achieve that benefit. Instead, Olson contended that individuals who cannot be excluded from the benefits of a collective good have little incentive to contribute voluntarily to the provision

of that good (Ostrom 1990). Without some type of outside control the resource would be exposed to overexploitation. This was historically thought to be the case for fisheries and the driving impetus behind state controlled regulatory mechanisms such as the 200-mile EEZ (Bromley 1991).

The prisoner's dilemma and the logic of collective action are closely related concepts in models explaining how individuals deal with collective benefits. At the heart of each of these models is the free rider problem. A free rider is an individual who cannot be excluded from the profits of a resource, and subsequently is not motivated to contribute to the maintenance of the resource and will "free ride" on the efforts of others. For resources (e.g., forests, grasslands, and fisheries) on which whole communities may depend, the potential for free riding exists and issues of efficiency, equity and sustainability are often paramount (Gibbs & Bromley 1986). These models are useful for explaining how rational individuals can produce, under some circumstances, outcomes that are not "rational" when viewed from the perspective of all those involved (Ostrom 1990). A major weakness of these theories is that the "arrangements" or institutions that are assumed to be fixed for the purpose of theoretical analysis are often assumed to be fixed in reality and applied as such in guiding policy. Yet the reality can be quite different as institutions evolve with ever changing ecological, socio-cultural, and economic conditions.

Finally, many researchers have also pointed to the importance of studying the role of transaction costs between different institutional arrangements for managing fisheries resources (Berkes 1986; Bromely 1991; Ostrom et al 1993; Kuperan & Pomeroy 1997). Transaction costs were first discussed in the economic literature by Ronald Coase (1937)

in his seminal paper "The Nature of the Firm". He argued that, if given a choice, individuals will choose the set of institutions, contracts or transactions that will minimize the cost of doing business. One of the hypothesized advantages of co-management compared to centralized management is that it will reduce transaction costs. These include the cost of gaining information about the resource and what users are doing with it, reaching agreements and coordinating with others in the group with respect to use of the resource, and enforcing agreements that have been reached (Kuperan & Pomeroy 1997). The transaction costs in fisheries co-management can be broadly categorized into three major cost items: (1) information costs (e.g., knowledge about acquisition of the resource); (2) collective fisheries decision-making costs (e.g., conflict resolution, monitoring, making policies, and communicating decisions), and (3) collective operational costs (e.g., resource distribution and maintenance).

The key factor that differentiates centralized management from co-management is the level of user participation in the design and implementation of management activities. According to Coase's theory, the extent to which the state allows for user participation in each of the management activities and the resulting co-management arrangement is a product of the acceptable transaction costs for each of the different management activities. It is therefore of critical importance to examine transaction costs when evaluating the potential of new and existing institutions as alternatives to existing institutions for fisheries management (Kuperan & Pomeroy 1997).

Levels of Institutional Arrangements

Most current analyses of CPR problems and related collective action problems focus on a single level of analysis (e.g., operational or harvesting resources). However, in reality, individuals or groups who have self-organizing capabilities switch back and forth between operational choice, collective choice and constitutional choice arenas (Ostrom 1990). It is important to understand each of these levels of institutional arrangements as well as how they may be linked (Ostrom 1994). Figure 1 shows the three levels of institutional arrangements and their potential linkages.

Operational level arrangements involve decisions that directly affect the resource by governing and regulating resource use. Operational rules directly affect the day-to-day decisions made by the users concerning when, where and how to harvest fish; who should monitor the actions of others and how; what information must be exchanged or withheld, and what rewards or sanctions will be assigned to different combinations of actions and outcomes. Operational rules can be formal (written, legitimized) or informal (unwritten, customary/ traditional). Examples include harvesting fish, enforcing fishing regulations, establishing borders, or patrolling borders.

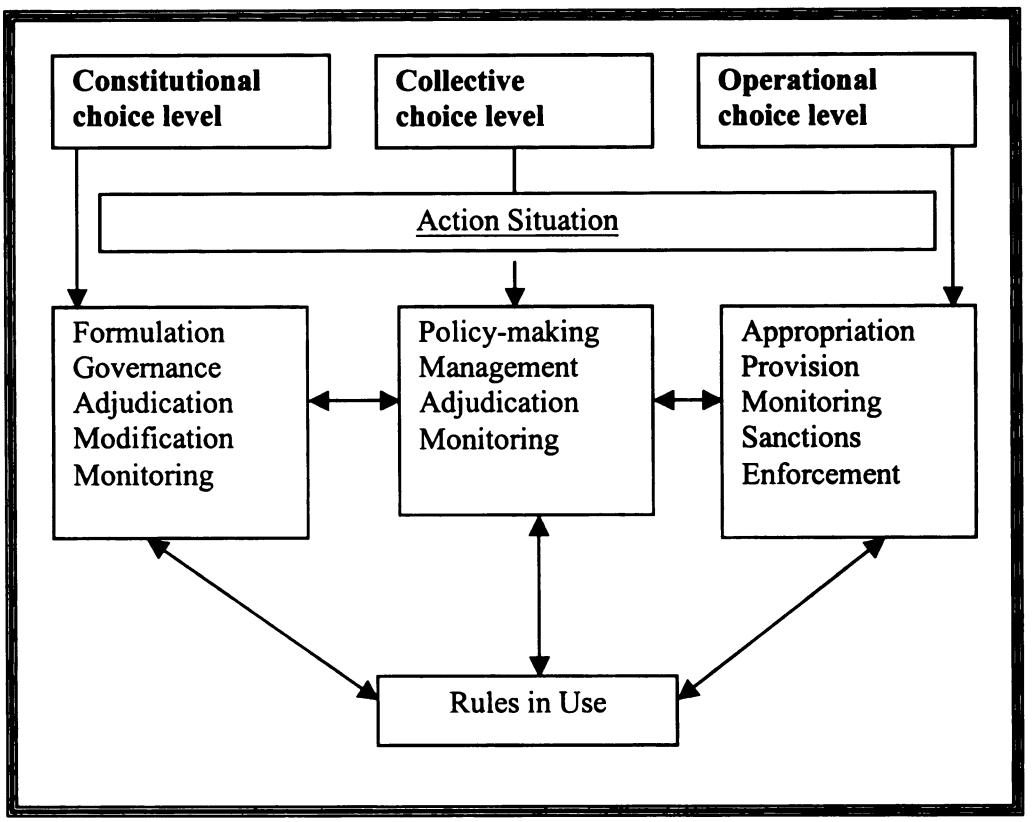


Figure 1. Linkages between levels of institutional arrangements (Ostrom 1994).

Schlager and Ostrom (1993) described the most relevant operational level property rights as being those related to "access" and "withdrawal". These are defined as:

Access: the right to enter a defined physical property.

Withdrawal: the right to obtain the "products" of a resource

Collective choice arrangements influence operational activities and results through their effects in determining who is eligible to access a resource and the specific rules to be used in changing operational rules. Such institutional arrangements are needed to adjudicate conflicts, enforce decisions, formulate and change operational rules, detect and sanction against rule violation, and hold officials accountable. Of critical importance

are the arrangements for monitoring and enforcing compliance with the operational rules and for settling disputes. When multiple levels of collective choice entities are in place, issues of coordination and control must be addressed. Examples of collective choice actions include actions taken at an annual fisheries association meeting to keep a section of the fishery closed for a specified time. Individuals that have access or withdrawal rights may or may not have the rights authorizing participation in collective choice actions. Distinguishing between rights and operational level and rights and collective choice levels is crucial (Schlager & Ostrom 1993). Simply put, it is the difference between exercising a right and participating in the definition of future rights that are to be exercised. The authority to devise future operational level rights is what makes collective choice rights so powerful. With regard to common pool resources, collective choice property rights include management, exclusion, and alienation. They are defined as follows:

> **Management**: the right to regulate internal use patterns and transform the resource by making improvements.
> **Exclusion**: the right to determine who will have access right, and how that right may be transferred.
> **Alienation**: the right to sell or lease either or both of the above collective choice rights.

Constitutional choice arrangements involve decisions about how collective choice actions will be made. Constitutional choice rules determine who is eligible to participate in the system and establish the process by which collective choice rules are created enforced and modified. Constitutional choice rules include, for example, the national

legislation, which establishes the national administrative and management structure that legitimizes a certain co-management arrangement. It is important to understand that operational or working rules are nested within collective choice rules, which are in turn nested within constitutional rules (Kaiser & Ostrom 1982). In other words, the rules affecting operational choices are typically, yet often unknowingly, made within a set of constitutional choice rules. For example, a resolution of a fisheries association, which creates an executive committee, that meets once a month to determine harvesting activities that can occur within a particular fishery. Consequently, whenever one addresses questions about institutional change, it is essential to recognize the nested nature of the issue and understand that arrangements at one level are typically influenced by arrangements at other levels (Ostrom 1994). Table 1 below describes these relationships.

Institutional Analysis and Development (IAD)

The Institutional Analysis and Development (IAD) framework has its roots in classic political economy, institutional economics, choice theory, transaction cost economics, and game theory. The IAD framework includes the attributes of the physical world and community, rules in use, and the action arena from which patterns of interactions lead to specific outcomes (Ostrom 1994). Environmental conditions and attributes of the community such as incentive structures and rules governing fisheries resources in action situations can be isolated and explored in greater detail using the IAD framework. The true utility of the IAD framework is as an evolving method for identifying appropriate questions about institutional arrangements that regulate

interactions between the physical environment and socio-cultural realms (Ostrom et. al. 1994).

Table 1. Levels of Institutional Arrangements (Ostrom 1994)

Operational level arrangements ***Decisions which occur whenever individuals directly affect resources.*** Operational rules directly affect the day-to-day decisions made by the users concerning when, where and how to harvest fish; who should monitor the actions of others and how; what information must be exchanged or withheld, and what rewards or sanctions will be assigned to different combinations of actions and outcomes. Operational rules can be formal (written, legitimized) or informal (unwritten, customary / traditional). Examples are harvesting resources, fishing regulations, establishing borders, or patrolling borders.
Collective choice arrangements ***Decisions about operational activities.*** Collective choice rules, are rules about how the resources and their exploitation should be managed (level of co-management level). Such institutional arrangements are needed to adjudicate conflicts, enforce decisions, formulate and change operational rules, detect and sanction against rule violation, and hold officials accountable. Of critical importance are the arrangements for monitoring and enforcing compliance with the operational rules and for settling disputes. There may be multiple levels of collective choice entities, depending upon the situation. For example, national level regulations may overlap with local level regulations which may overlap with customary were traditional practices. Examples are actions taken at an annual meeting of a fisheries association to keep a section of the fishery closed for a specified time.
Constitutional choice arrangements ***Decisions about how collective choice actions will be made.*** Constitutional choice rules determine who is eligible to participate in the system and establish the process by which collective choice rules are created enforced and modified. Constitutional choice rules include, for example, the national legislation, which establishes the national administrative and management structure and legitimize co-management arrangements. Operational or working rules are nested within collective choice rules, which are in turn nested within constitutional rules. In other words, the rules affecting operational choice are made within a set of constitutional choice rules. An example is the resolution of a fisheries association to create an executive committee that will meet once a month to determine joint activities to be undertaken.

Given multiple levels of analysis involved in institutional analysis, one of the first steps to be taken using the IAD approach is the identification of a conceptual unit or "action arena". The action arena is the focus of analysis, prediction, and explanation of

behavior and outcomes within six constraints. The action arena includes an action situation component and an actor component. Action situations refer to the social space where individuals interact, change goods and services, engage in appropriation and provision activities, and solve problems. A minimal action situation is characterized using seven clusters of variables: (1) participants or stakeholders in the fishery, (2) positions or roles that participants hold such as appropriators or monitors of the fisheries resource, (3) actions such as deciding to disregard fishery regulations, (4) potential outcomes including damage caused to a particular fishing location, (5) a link between inputs into some type of product or outcome such as fishing effort and the availability of fish, (6) information available to all stakeholders about the resource or rules governing the resource, (7) and the cost and benefits assigned actions and outcomes such as the cost of traveling to a fishing spot, or the fines associated with illegal actions (Ostrom et.al. 1994). Understanding the actions chosen by the actors involved in the fishery requires knowledge of the actors, preferences, information processing capabilities, selection criteria, and the resources available to the actors.

Utilizing these guidelines, Ostrom (1994) developed a generalized framework that allows for an analysis of institutional arrangements. Figure 2 shows how this framework is conceptualized. The IAD framework has been an underlying foundation for many empirical studies of common pool resources and common property regimes, particularly irrigation systems (Ostrom 1992). More recently many research projects have applied the same framework to the investigation of small-scale fisheries located in Asia (Villavicencio & Baling 1995; Pido & Pomeroy 1995; ICLARM 1997; Pido et al 1997;

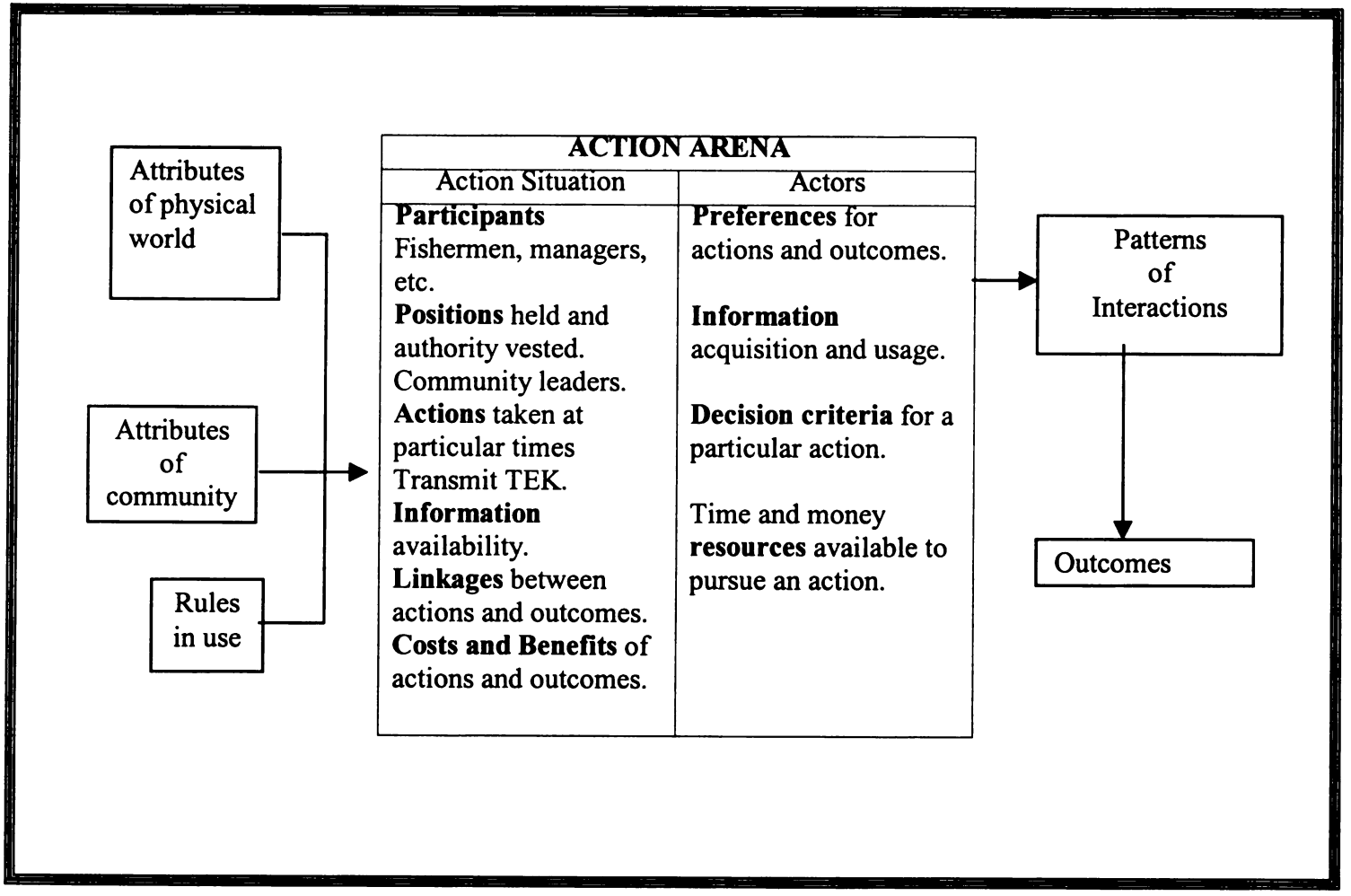


Figure 2. The Institutional Analysis and Development (IAD) Framework (Ostrom 1994).

Katon et al 1998) and in Africa (Normann, Nielson & Jensen 1997; Hara et al 1999; Malasha 1999; Njaya et al 2000).

One aspect of common property regimes that has been studied using the IAD framework is long-lasting resource systems that are regulated by the appropriators (Ostrom 1994). One of the products of this research has been a set of core principles used in many long-enduring, self-organized common property resource institutions specifically irrigation systems in developing nations. The institutions can be considered robust in that the rules have been devised and modified over time according to a set of collective choice and constitutional choice rules (Shepsle 1989). These principles are elements, conditions, or factors that through their acknowledgement or existence help to account for the success in sustaining common property resource management regimes. Further, they facilitate in gaining the compliance of generation after generation of appropriators to the rules governing a CPR (Ostrom 1992). Table 2 summarizes the principles isolated by Ostrom (1990) as characterizing long-enduring self-organized irrigation institutions.

Drawing from Ostrom's work, other scholars identified similar "principles" specifically related to fisheries co-management (Pinkerton 1994; Pomeroy et al 1998). Table 3 shows a summary of the "principles" isolated.

Table 2. Institutional principles characterizing robust CPR institutions (Ostrom 1990)

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.
Collective choice arrangements Most individuals affected by the operational rules can participate in modifying the operational rules and are better able to tailor their rules to local conditions, because the individuals who directly interact with one another and with the physical world can modify the rules overtime so as to better fit them to the specific characteristics of their setting.
Conflict-resolution mechanisms Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among the appropriators or between appropriators and officials.
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.
Contextual 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 these appropriators, or by both.
Monitoring by or for appropriators Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators.
Recognition of rights to devise their own institutions The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

Table 3. Institutional principles identified as characterizing successful small-scale fishery co-management regimes

Pinkerton 1994	Pomeroy et al 1998
Clearly defined boundaries Individuals or households who have rights to withdraw resource units from the fishery must be clearly defined, as must the boundaries of the fishery itself.	**Clearly defined boundaries** Individuals or households who have rights to withdraw resource units from the fishery must be clearly defined, as must the boundaries of the fishery itself.
Clear criteria for membership Membership to all fishery rights and associations is clearly understood	**Membership is clearly defined** Membership to all fishery rights and associations is clearly understood
Participation in local area management Local communities are involved with the management of the fishery	**Group cohesion** The degree of homogeneity in terms of kinship, ethnicity, religion, fishing gear type among the group.
Management units of appropriate scale to human resources Appropriation rules of resource units are related to local conditions and to provision rules	**Benefits exceeding costs** Individuals have the expectation that the benefits to be derived from participation in and compliance with community based management systems will exceed the costs
Local volunteer force Local community members are voluntarily involved in fishery management	**Participation is evident** Local communities are involved with the management of the fishery
Clear interception agreements Benefits from the resource are clearly distributed	**Legal right to organize** The rights of users to devise their own institutions are legally protected
Cost recovery related to local management activities Allowance for local management boards and local enhancement associations to capture some of the benefits from local production	**Cooperation and leadership at community level** There is an incentive and willingness on the part of the fishers to actively participate, with time, effort, and money, in fisheries management.
Local all stakeholder co-management boards Local board with members representing all interested parties	**Decentralization and delegation of authority** Decentralization of administrative authority and delegated management responsibility
A coordinating role for a Province-wide management board Overall regional board could coordinate management	**Coordinating body** A coordinating body is established with representation from the fisher group or organization and government

Clear legal definition of local powers Local authority is clearly defined	**Incentive structures** Appropriators/managers of the resource have a committed interest in cooperating
A degree of local control Local communities control some aspect of managing the fishery	**Financial provisions** Clear provisions for funding
	Organizational experience Communities have some previous experience with co-management activities

Table 4 summarizes additional principles that researchers of fisheries co-management suggest may be important for successful fishery co-management regimes (Ite 1996; Agbayani 1996; Takahara 1996; Horrill & Darwall 1996; Tobisson et. al. 1998; Sowman 2000; Baird 2000; & Cooke et al 2000).

Table 4. Additional principles identified from the literature as characterizing successful fishery co-management regimes

Community homogeneity The degree of homogeneity in terms of kinship, ethnicity, religion, fishing gear type among the group.
Existence of fishing cooperatives Appropriators have been or are organized into cooperative arrangements (no matter how informal) involved in the study, management, harvest, market, and distribution of the resource.
Knowledge of fishing activities The types of fishing activities/gear utilized, associated species being harvested and the cultural framework within which they operate.
Low transaction costs The costs of doing business. Transactions costs can be categorized by three major "cost" items. (1) information costs, i.e. knowledge of the fishery, (2) collective fisheries decision-making costs, i.e. participation in meetings, making rules, and communicating rules and (3) collective operational costs, i.e. monitoring and enforcement, stock maintenance, resource distribution.

Structure for transmission of knowledge
The mechanisms by which information is passed along both intra- and intergenerationally. "Channels of communication".

Support for alternative livelihoods
All levels of management from local cooperatives/fishing groups to national level government agencies involved with the resource base should be aware of and support the diversification of income generating activities. i.e. Aquaculture or tourism.

Traditional knowledge or management systems
Traditional knowledge about the resource base, its usage and management should be recognized and acknowledged as a potential source of information that can be coupled together with scientific knowledge to develop management schemes that are acceptable to the broader community of groups interested in the resource.

The studies of community governed and managed commons provides evidence of an immense diversity of physical settings and institutional rules matched to their local environment. No two managed common property resources cope in similar ways with the array of problems they face over time. Even resource management institutions that are characterized by appropriate sets of principles may fail due to threats such as rapid political change or the failure of intergenerational information transmission (Ostrom 1994). One of the more important threats is blueprint thinking. Blueprint thinking occurs whenever policymakers, donors, citizens or scholars propose uniform solutions to a wide variety of problems that are clustered under a single name based on one or more successful examples (Korten 1980). Too great a reliance on design principles may be problematic in that it limits the scope for a complete analysis of complex CPR management and facilitation of collective action initiatives aimed at sustainable management (Steins, Roling & Edwards 2000). However, with this caution in mind, it is still beneficial to use the design principles as a mechanism for gaining an initial understanding of often, complex common property resource dilemmas

Key Physical, Market, Cultural and Institutional Attributes

One of the purposes of utilizing an institutional analysis and development framework is to separate underlying rules (institutions) from the strategy of the players (organizations) (Ostrom et al 1994). However, it is also useful as a conceptual basis for determining the various key attributes of the action situation related to the resource, resource user and fisheries management arrangements (ICLARM 1996). It is precisely this flexibility in accommodating a variety of variables from a variety of disciplines that Ostrom (1994) suggests is one of the strengths of the IAD framework. The IAD framework aids in understanding not only the underlying assumptions about the rules individuals use to order their relationships, but the attributes of the physical world, and the nature of the community within which the arena occurs. These "contextual" attributes will take on different values in different situations. Yet, by utilizing a similar set of contextual variables, it is possible to conduct a systematic and comparative analysis of diverse situations and identify relationships among variables for evaluative, diagnostic and design purposes.

Oakerson (1992) presented another framework that distinguished four sets of attributes or variables that can be used to describe a common property "action situation". The first describes the physical attributes of the specific resource or facility and technology used to appropriate its yield. The second includes the formal and informal decision-making arrangements that govern relationships among users, as well as relevant others. The third includes the mutual choice of strategies and consequent patterns of interaction among decision makers. Finally, the fourth combines the outcomes or consequences of the interactions between the first three attributes. This framework is no

more than a bare bones representation of the commons and is only intended to help identify factors, related in specifiable, limited ways, which can be assumed always to operate with respect to the commons.

Several organizations actively involved with the analysis of fisheries co-management such as the International Center for Living Aquatic Resources Management (ICLARM) and the Institute of Fisheries Management and Coastal Community Development (IFM) have applied this framework to small-scale fisheries in Asia and Africa (ICLARM 1998). It is evident from the list of variables isolated by ICLARM and IFM, and organized using Oakerson's framework, that many of the principles discussed earlier by Ostrom, Pinkerton and Pomeroy can be categorized for an analysis of relationships or linkages. Table 5 details the variables that facilitate in defining important attributes as applied to fisheries co-management. See Appendix A for more information on these variables.

Table 5. Key Physical, Market, Cultural and Institutional Attributes of the Action Situation (Oakerson 1992)

I. Biological, physical and technical attributes
1. Type of ecosystem (Marine Coast, Coral reef, estuary, Lake, River, floodplain, other?)
2. Boundaries (physical, administrative, restrictions in access to fish resources)
3. Health status of fish habitats (Spawning areas, nursing areas, the fishing grounds)
4. Characteristics of target fish species and stocks (migratory or sedentary)
5. Characteristics of fisheries (industrial, Artisanal, fishing technologies used, physical range of fishing operations, seasonal variations in fishing activities)
6. Post harvest utilization of catches (fresh, salted, dried, smoked, fermented, frozen, canned)
II. Socio-cultural attributes of fishing community
1. Homogeneity/ heterogeneity of fishers, fish traders, fish processors and other stakeholders (ethnicity, religion, fishing gear use, gender, ownership of boats and fishing gear)
2. Dependency on fisheries/fish trade/fish processing for livelihood; other sources of income/subsistence.
3. Indigenous knowledge relevant to fisheries management (ecological and biological

knowledge of resources and habitats, knowledge of catchability and fishing technologies)
4. Cultural factors affecting community or group attitude towards fisheries/ fish trade/fish processing and determining behavior of individuals/groups.

III. Market attributes

1. Type of fisheries taking place (commercial, recreational, subsistence)
2. Market orientation of the fisheries (local, regional, national, international markets)
3. Value of fish products (high or low value market)
4. The market structure (many or few suppliers/buyers, market dominance, power relations between suppliers and buyers, interdependencies)

IV. Resource user/community institutional and organizational arrangements

1. Community power structures and leadership (role, functioning and importance of traditional leadership structures in decision-making inside/outside the fishery sector)
2. Organizations established/appointed to serve as co-management partner (legal basis, mandate, representation, decision-making system/procedures, mechanisms for implementation of management decisions/enforcement).
3. Local regulation of access to fish resources (principles for allocation of fishing rights or for exclusion of groups or individuals)
4. Operational rules in place concerning fish catch, fish trade and fish processing, including origin of rule.
5. Legitimacy of institutional arrangements and organizational set up involving fishers and other stakeholders. Attitudes towards co-management.
6. Mechanisms for conflict resolution among resource users.

V. External institutional and organizational arrangements

1. Overall structure of national political administrative system (relation between legislative administrative system; centralization/decentralization)
2. Department of fisheries and other relevant organizational structures involving fisheries management (mandate and legal basis, structural organization, management functioning task at national, provincial, and district levels)
3. Legal basis for co-management systems (enabling legislation or administrative decree)
4. Government agencies outside the fisheries sector whose mandate and activities interfere with or impact on fisheries.
5. Power structures outside the fishing communities which impact on local power structures and leadership (influential political leaders, ranking military, police or chiefs).
6. The role of donor organizations in promoting/enabling co-management arrangements

Drawing upon the earlier theoretical and empirical work of Ostrom (1994) and Oakerson (1992) the International Center for Living Resources Management (ICLARM) developed a similar graphical representation shown in Figure 3 of the variables detailed above that are used to evaluate institutional arrangements, co-management performance analysis and characteristics of successful co-management arrangements in the Philippines.

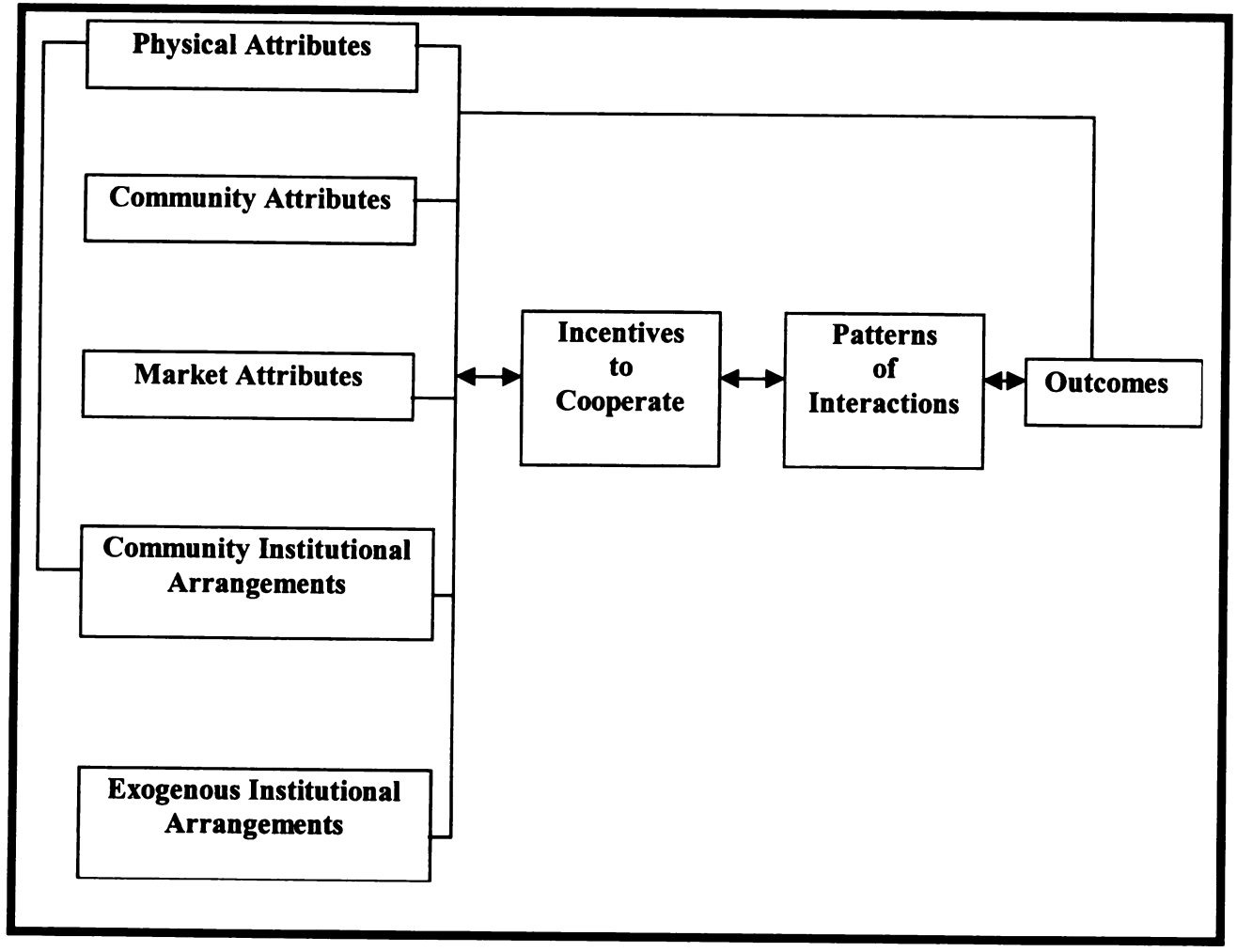


Figure 3. A research framework for institutional analysis (Oakerson 1992).

Co-management: Types of Government and Community Involvement

In the face of rapidly increasing pressures on a finite resource base generated by growing populations and rising aspirations, there is need for substantial and rapid evolution of existing resource management systems to support sustainable intensification of resource use (Pomeroy 2000). Communities or governments alone will find it increasingly difficult to manage the resources that they depend on or have been delegated to regulate. There must evolve a more dynamic partnership arrangement building on the existing capacities and evident self-interest of the local community and complemented by the ability of the state to support the development of enabling policies and institutional linkages (Korten 1986). During the last ten years, the growing realization of the need for a stronger community role in resource management has been seen in a wide range of programs and policies worldwide. "Co-management" is one of the concepts used to indicate the dissatisfaction with present systems and a movement toward decentralized systems of marine resource management (McCay & Jentoft 1996).

Co-management is defined as a partnership arrangement in which, government agencies, the community of local resource users, nongovernmental organizations, and other stakeholders share the responsibility and authority for the management of the fishery (Pomeroy 1998). Co-management is intended to be a more dynamic partnership using the capacities and interests of the local fishers and community, complemented by the ability of the state to provide enabling legislation, enforcement and other assistance (Jentoft 1989; Pinkerton; 1989; Berkes1994). Presently, there is quite some optimism that fisheries co-management will facilitate the appropriate levels of decentralization of tasks and power needed to positively influence performance indicators such as efficiency,

equity and sustainability of communities depending on marine resources. See Table 6 for a description of efficiency, equity and sustainability as used in this research.

Table 6. Performance indicators (ICLARM 1997)

Equity
Changes in the representation of stakeholder interests in the decision-making process.
Changes in the transparency and clarity of the decision-making process by the stakeholder groups (information systems and procedures established).
Convergence of expectations of stakeholders as regards the objectives of fisheries management and management process.
Changes in the distribution of the (access to) benefits from the fisheries among stakeholder groups and individuals
Participation in community affairs, and fishery management.
Influence over community affairs, and fishery management.
Control over fishery resources, satisfaction with fishery management.
Benefits from the fishery area and overall well being of the household
Efficiency
Stakeholder assessment of the return for the time and effort invested by them in the co-management arrangements (in terms of appropriateness of rules and regulations, enforcement of decisions made).
Government authorities assessment of the cost effectiveness of co-management in comparison with previous management arrangements (government expenses for establishing an operating co-management arrangement assessed in relation to the compliance with rules and the need for monitoring and control).
Collective decision-making on policies/rules governing the use of the fishery quickness of resolving community conflicts on fishery issues.
Sustainability
Changes in attitudes of fishers/stakeholders towards maintaining productivity of fishery resources and integrity of ecosystem (changes in time horizons, interest shown in monitoring of stocks and habitats, compliance with rules and regulations and participation in enforcement at the individual level).
Changes in governance (compliance at groups/community level; changes in conflict resolution, existence of effective measures/procedures for rule enforcement).
Ability of co-management arrangement to handle major changes in contextual attributes (e.g., fluctuations in resource base, changes in market structures, new entrants).
Overall well being of coastal resources.
Community compliance with fishery related rules, and knowledge of the fishery.
Exchange of information on the management of the fishery.

While much has been written about co-management, much less has been written about the specific roles and activities of governments and communities. Pomeroy and Berkes (1997) address this issue by suggesting that decentralization, a critical element for co-management, may be operationalized in the following four ways: (1) Deconcentration, or administrative decentralization; (2) Delegation, or the transfer of authority to local officials, but central government retains the right to overturn local decisions; (3) Devolution, or legislative decentralization; (4) Privatization, or to the transfer of responsibility to NGOs, community associations and private enterprises.

Accordingly co-management encompasses an array of partnership arrangements, degrees of power sharing and integration of local (informal, traditional, customary) and centralized government management systems (Pomeroy 2000). Various authors have developed elaborate schemes attempting to categorize the spectrum of co-management arrangements found worldwide (McCay 1993; Berkes 1994; Pimbert & Petty 1995; Decker & Chase 1997). Pimbert and Petty (1995) utilize an approach based on the level of participation occurring at each level. Their spectrum presented in Table 7 ranges from passive participation in which no expectations of participation are fostered to self-mobilization in which people participate in initiatives independent of external institutions. While this classification is useful in understanding participatory approaches it may go beyond the boundaries of co-management in its inclusion of community self mobilization where true "co-management" can no longer exist.

Table 7. Spectrum of participation involved in co-management (Pimbert & Petty 1995)

Passive participation: Public involvement techniques are used to change attitudes without raising public expectations of participation in the planning and decision-making process.
Participation through consultation: User groups provide input to the government agency on proposals for a conservation area, or on management plans for the area. External agents define the problems and information gathering processes. Such a consultative process does not concede any share in decision-making, and professionals are under no obligation to utilize the information that has been gathered.
Participation for material incentives: People participate by contributing resources, for example, labor, in return for food, cash or other material incentives. People have no stake in prolonging the technologies or practices when the incentives come to an end.
Functional participation: Participation is seen by external agencies as a means to achieve project goals, such as reducing resistance to the establishment of a park. People may participate by forming groups to meet predetermined objectives related to the project. Such involvement may be interactive and involve share decision-making, but tends to arise only after major decisions have already been made by external agents.
Interactive participation: People participate in joint analysis, development of action plans and formation of local institutions. Participation is seen as a right, not merely as a means to achieve project goals. The process involves interdisciplinary methodologies that seek multiple perspectives, structured learning processes and problem solving approaches. As groups take control of local decisions and determine how available resources are used, so they have a stake in maintaining structures or practices.
Self mobilization: People participate by taking initiatives independently of external institution.

Decker and Chase (1997) classify approaches to stakeholder involvement based on the relative degree of influence on wildlife policy and management decisions. Their spectrum shown in Table 8 ranges from the historical "authoritarian" approach in which there is no public input to the "co-managerial" approach where resource users give input into management as well as enforcement of the decisions they help establish.

Table 8. Spectrum of co-management (Decker & Chase (1997)

Authoritative "expert" approach: Decisions are made solely by managers without public input. Is considered vestige of the past in which managers served a very narrow constituency and relatively few stakeholder groups.
Passive-receptive approach: Managers are open to stakeholder input but do not actively solicit input. Managers consider stakeholder initiated input in their decision-making.
Inquisitive approach: Occurs when managers are agencies actively invite input from a broad array of stakeholders and from multiple members of individual stakeholder groups. This approach is often augmented by human dimensions research data to enhance understanding of stakeholders.
Transactional approach: Goes beyond the previous approaches to public involvement by allowing stakeholders to make management decisions in addition to just supplying input. This approach is important situations with many new stakeholders who hold diverse attitudes and values about management of the particular resource. A critical component of this method is that managers facilitate the process allowing stakeholders to articulate their beliefs to each other. In addition, stakeholders actually negotiate mutually acceptable weights to the various stakes expressed by the participants. Debate; and education are important ingredients in developing consensus among the participants.
Co-managerial approach: This concept allows for stakeholder involvement in multiple stages of the management process. Resource users are not only given more input into management decisions, but are asked to take responsibility in its enforcement. Often stakeholders are given specific legislative enforcement authorities to ensure compliance with management plans.

Finally, McCay (1993) and Berkes (1994) developed a spectrum of co-management according to the roles the government and users play. Their typology, outlined in Table 9, begins with an "instructive" type with minimal exchange of information between government and users. This level differs from Decker and Chase in that mechanisms for exchange exist but are largely ignored or used solely for governments to inform users of decisions they have made. At the other end of the spectrum is "informative" in which the government has delegated the authority to make decisions to the user groups.

Table 9. Co-management spectrum. Adapted by Sen and Nielson (1996) from McCay (1993) and Berkes (1994).

Instructive: There is only minimal exchange of information between government and users. This type of co-management regime is only different from centralized management in the sense that mechanisms exist for dialogue with users, but the process itself tends to be government informing users on the decisions they plan to make.
Consultative: Mechanisms exist for governments to consult with users but all decisions are ultimately made by the government.
Cooperative: This type of co-management is where government and users cooperate together as equal partners in decision-making. For some authors, this is the definition of co-management.
Advisory: Users advise government of decisions to be taken and government endorses these decisions.
Informative: Government has delegated authority to make decisions to user groups who are responsible for informing government of these decisions.

Figure 4 below depicts how this spectrum of co-management could be arranged to show the changes in the various levels of government and community control.

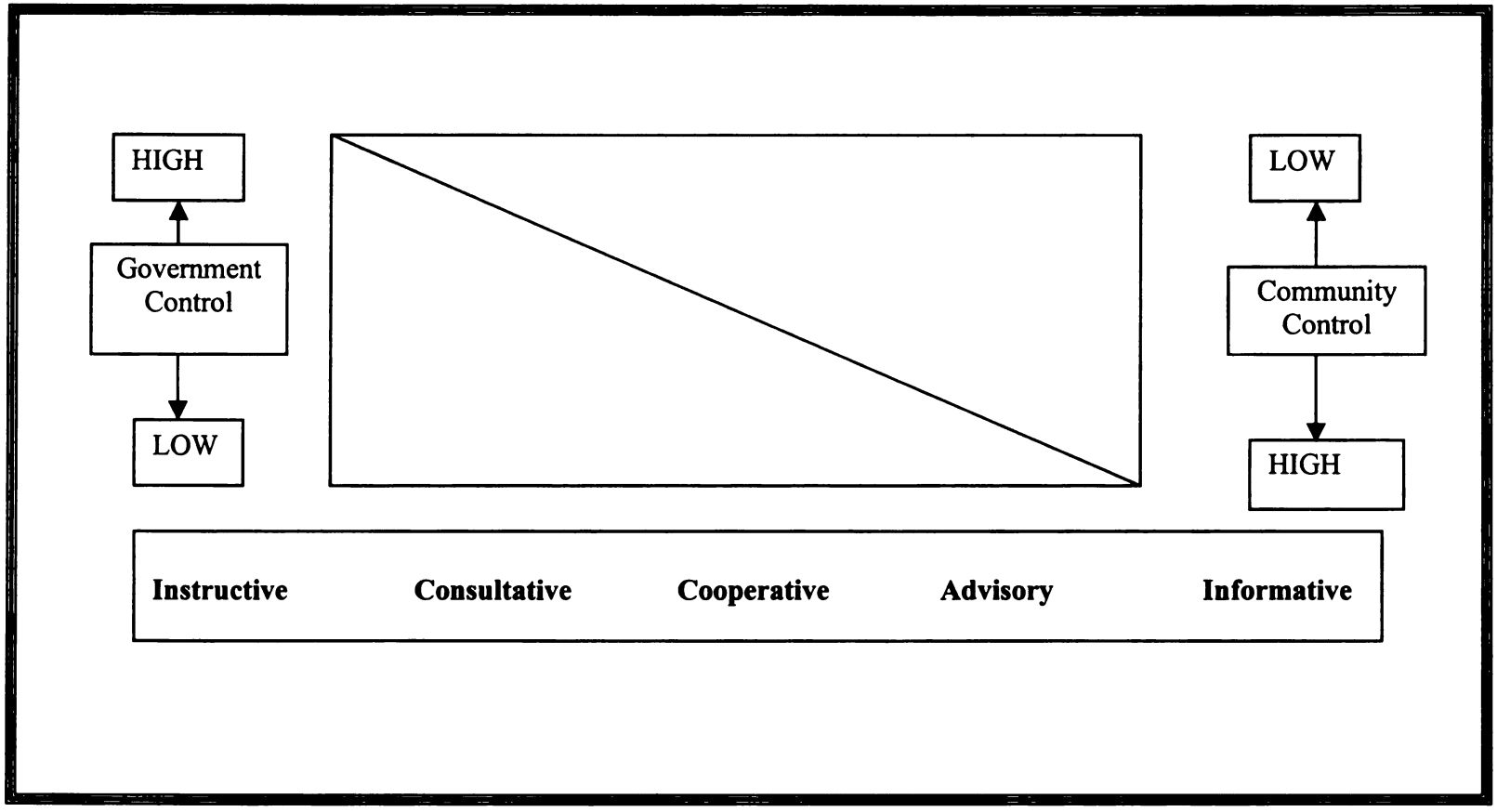


Figure 4. Spectrum of co-management arrangements (after Berkes 1994).

Chapter 3

RESEARCH METHODOLOGY

Content Analysis Research Methodology

This study employed content analysis, which is a blend of qualitative and quantitative, positivistic and interpretive methods making inferences from "texts" (Bernard 1995). The "texts" relied upon in this study were scholarly journal articles, working papers, government reviews, conference proceedings, research project updates, final project reports, and external project evaluations. The idea of the content analysis is to reduce the information in a text to a series of variables that can then be examined statistically. Bernard (1995) describes the technique as consisting of four components. The researcher starts with text (qualitative data), continues by making formal or informal hypotheses about what you think is "in there," does systematic coding and statistical analyses, and finally interprets the results in light of historical or ethnographic information. As a research tool, content analyses help organize diffuse information and can greatly facilitate the compilation and analysis of anecdotal knowledge of individual, organizational, social, and political phenomena.

The content analysis methodology was chosen for two reasons related to the research questions posed in Chapter 1. First, a content analysis methodology incorporates multiple sources of qualitative information. This form of "triangulation" increased research validity, as multiple descriptions of the same co-management regime were drawn upon wherever available. Creswell (1994) states that "triangulation" in conjunction with other data sources helps neutralize any bias inherent in particular data sources, investigator, or method and can dramatically increase the validity of the

research. Second, Ostrom (1990) suggests that the principles isolated using the IAD framework – many of which were isolated from irrigation projects - can be applied to other CPR dilemmas such as those found in small-scale fisheries. The fourth research question stated in Chapter 1 - what relationships exist between levels of co-management, and the evolution of institutional arrangements - exemplifies the utility that Ostrom envisioned for the list of principles generated. Yin (1984) suggests that a content analysis lends itself to describing the incidence or prevalence of principles in situations other than where they were first identified. Subsequently, both the exploratory and predictive components of this research suggest that the use of a content analysis would be appropriate.

Finally, the researcher needs to be aware that due to the complex nature of a content analysis certain methodological shortcomings need to be recognized. A content analysis depends on often complicated coding of words based on specific criteria typically accomplished by a single researcher. Bernard (1995) discusses that if one researcher codes the data then construct validity and reliability may be low, however, using multiple coders demands proper coder training to insure intercoder consistency and reliability. The development of the coding system utilized in this study is discussed later in this chapter. Additionally, while every attempt is made to collect as much information available related to a given case some authors may simply omit certain details. This could be due to the logistical problems associated with collecting certain types of data or related to a specific disciplinary bias. Regardless, any researcher wishing to employ a content analysis should acknowledge that some valuable information will always be missing. In

an effort to minimize this limitation, many different sources of literature were sought and utilized during this analysis.

Selection of Cases

In 1994, the Institute of Fisheries Management (I FM) at the North Sea Center (NSC), Denmark, and the International Center for Living Aquatic Resources Management (ICLARM), Philippines, began a five-year worldwide collaborative research project on fisheries co-management. The two collaborating institutions have developed relationships in selected countries throughout Asia and Africa with local research partners aimed at conducting studies of fisheries co-management. Due to the work of IFM and ICLARM there is an abundance of information related to fisheries co-management from locations within Asia and Africa including: Bangladesh, Benin, Cote d'Ivoire, Indonesia, Malawi, Mozambique, the Philippines, South Africa, Thailand, Vietnam, Zambia, and Zimbabwe.

Upon review of the readily available literature on small-scale fisheries management it was decided that several locations in the Caribbean and South America were sufficiently involved in co-management studies that they should also be included in this study (Smith & Berkes 1993; Fiske 1992). Therefore, in an attempt to broaden the scope of research it was decided to include several examples from the Caribbean and South America including: Belize, Bonaire, Galapagos Islands, Puerto Rico and St. Lucia. Consequently, the final selection of cases for this study came from the Caribbean, South America, Africa, and Southeast Asia/Oceania.

It was necessary to isolate case studies that would specifically address the research questions. The criteria decided upon were ultimately drawn from the Marine

Conservation Project for San Salvador, Philippines, one of the more rigorously studied co-management projects in Asia. The criteria used in the selection of cases for study outlined by ICLARM (1997) focused on an examination of performance according to three measures: efficiency, equity, and sustainability. The specific criteria that studies should meet are as follows: (1) a base of published knowledge; (2) sustainability of the fisheries management interventions at the site after project completion; (3) a sharing of responsibility and authority for fisheries management between the government and the village; (4) an obvious existence of institutional and organizational arrangements (property rights and rules); and (5) an obvious establishment of resource management technology and demonstration of tangible project outcomes.

Initially 115 published descriptions of small-scale fisheries management studies were collected from the literature and reviewed. Since systems of traditional marine tenure, traditional fisheries management, and strict community-based resource management are not considered to be co-management because government is not involved in the decision-making process (Sen & Nielson 1996), these cases were dropped from the analysis. Further, those cases, which did not meet the ICLARM study criteria, were also removed. This left 74 cases, each of which focused on co-management regimes in sufficient detail to allow an analysis of the institutional arrangements involved. In an attempt to increase reliability and validity one final criteria developed by the author for the specific purpose of addressing stated research questions was added. This criterion stated that a particular study must include a discussion of at least half of the principles that were relied upon in the analysis. The criterion was included such that a reasonably reliable evaluation of the management activities could be obtained. Using this criterion

the 74 studies isolated using the criteria developed by ICLARM were reduced to 48 cases. Figures 5, 6, and 7 show the locations of the co-management case selected for review in this study. Appendix B contains additional information about each of the locations chosen.

Data Collection Procedures

Choice and coding of principles

The choice of principles for use in this study began with Ostrom's (1990) list of principles that characterize the majority of robust CPR institutions she has studied. As discussed earlier, these principles are elements, conditions, or factors that through their acknowledgement or existence help to account for the success in sustaining common property resource management regimes. Further, they facilitate in gaining the compliance of generation after generation of appropriators to the rules governing a CPR. Two additional studies (Pinkerton 1994; Pomeroy et. al. 1998) applying the IAD framework to isolate similar "principles" associated specifically with successful fisheries co-management regimes were also drawn upon. From these studies another collection of principles was obtained along with the principles provided by Ostrom. This pool of "principles" or "conditions" was drawn upon to select the final group of institutional principles used in this research. Not surprisingly there was some overlap between each of the three (Ostrom, Pinkerton, Pomeroy) groups. Consequently, specific selection criteria were developed to select the appropriate institutional principles to use in this study.

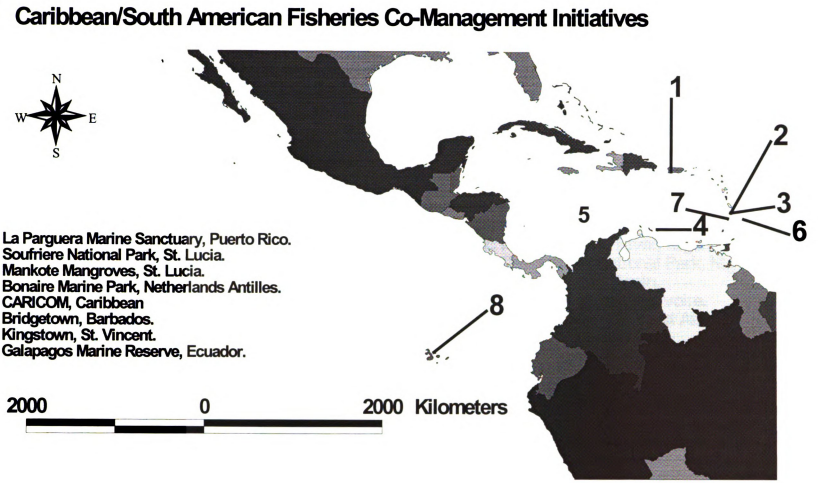


Figure 5. Locations of the Caribbean / South American small-scale fisheries co-management initiatives reviewed for this study.

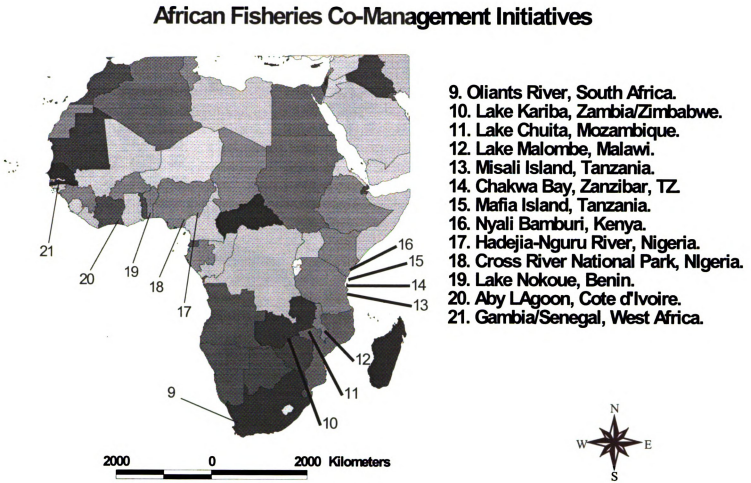


Figure 6. Locations of the African small-scale fisheries co-management initiatives reviewed for this study.

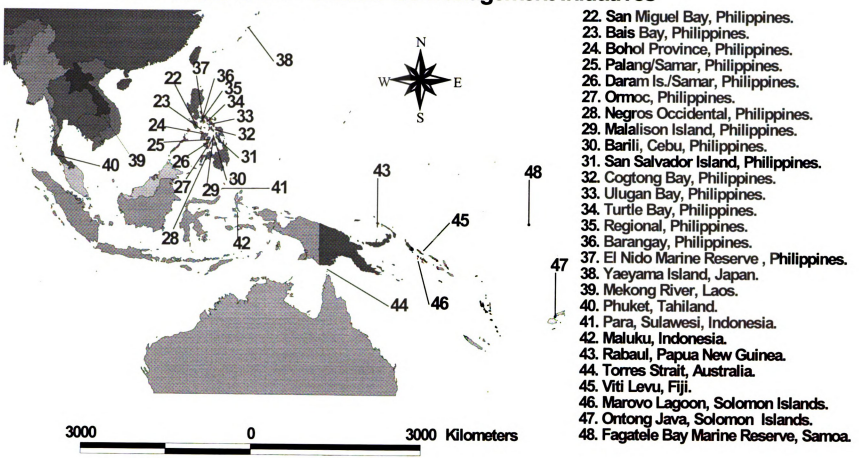


Figure 7. Locations of the S. E. Asian / Pacific small-scale fisheries co-management initiatives reviewed for this study.

The criteria used for selection of the final principles analyzed in this study were: (1) the principle is sufficiently unique and distinct from other principles; (2) the principle is an institutional arrangement or shows clear linkages with institutional arrangements that can be demonstrated in the literature; and (3) the principle is sufficiently discussed in the literature that a meaningful analysis would be possible. Several of the principles isolated by Ostrom, Pinkerton, and Pomeroy were identical or very similar and thus were categorized as one variable. An example of this was the principles "clearly defined boundaries", "clear criteria for membership", and "criteria for participation being clearly defined" which were grouped as the principle labeled "boundary definition". After applying the first and second criteria of uniqueness and linkages with institutional arrangements respectively, the initial collection of principles was reduced to a smaller set of unique institutionally linked principles. It was then necessary to apply the final criterion of determining whether or not a principle was discussed sufficiently in the literature. While all principles identified for successful co-management of fisheries are important, it was more important to focus on principles that were sufficiently discussed such that a meaningful analysis would be possible. Utilizing this third criterion, the total number of principles used in this research on small-scale tropical fisheries was established at 20. Generally, there were two ways in which a principle was considered evident. First, a principle could be acknowledged, such as acknowledging that traditional knowledge about the resource existed within the community of users and could be drawn upon for management purposes. Second, a principle could actually exist, such as the existence of fishing related associations or cooperatives. Table 10 describes the 20

principles used in this research that characterize a majority of successful fisheries co-management activities in the tropics.

Table 10. Descriptions of the 20 principles used in this analysis. Assembled using Ostrom 1990, Pinkerton 1994, and Pomeroy et al 1998

Alternative livelihood support All levels of management from local cooperatives/fishing groups to national level government agencies involved with the resource base should be aware of and support the diversification of income generating activities. i.e. Aquaculture or tourism.
Boundary definition Rights of individuals, organizations and agencies involved in appropriation, provision, and management of the fishery must be clearly defined, as must the boundaries of the fishery itself.
Collective choice arrangements Individuals affected by the operational rules can participate in modifying the operational rules
Community cohesion The degree of homogeneity in terms of kinship, ethnicity, religion, fishing gear type among the group.
Congruence of appropriation 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.
Contextual graduated sanctions Appropriators who violate operational rules are assessed graduated sanctions (depending on the seriousness and context of the offense) by other appropriators, by officials accountable to these appropriators to, or by both.
Cooperatives or associations related to fishing Appropriators have been or are organized into cooperative arrangements (no matter how informal) involved in the study, management, harvest, market, and distribution, of the resource.
Coordinating body A coordinating body is established, external to the local group or organization and with representation from the fisher group or organization and government to monitor the local management arrangements, resolve conflicts, and reinforce local rule enforcement.

Cost < benefits
Individuals have the expectation that the direct economic benefits to be derived from participation in and compliance with co-management systems will exceed the costs of investments in such activities.

Experience with organizations
The community has some prior experience with collaborative or community based systems of management or have had some degree of exposure to such activities through neighbor communities.

Fishing activities
The types of fishing activities/gear utilized, associated species being harvested and the socio-cultural framework within which these operate.

Funding arrangements
Funds need to be available to support various operations and facilities related to planning, implementing, coordinating, monitoring, and enforcement.

Incentives for cooperation
Appropriators/managers of the resource have a committed interest in cooperating to manage the resource in a "sustainable" fashion such that they will strengthen socio-cultural institutions and maintain the ecological integrity of the resource.

Legally protected local rights
The rights of appropriators to devise their own management institutions are legally protected and not challenged by external governmental authorities.

Local level leadership
Local fishers, chiefs, or other government officials actively help organize, coordinate and implement fisheries management activities.

Monitoring by or for appropriators
Monitors, who actively audit fishery conditions and appropriator behavior, are accountable to the appropriators or are the appropriators

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

Traditional knowledge or management systems
Traditional knowledge about the resource base, its usage and management should be recognized and acknowledged as a potential source of information that can be coupled together with scientific knowledge to develop management schemes that are acceptable to the broader community of groups interested in the resource.

Transaction costs
The costs of doing business. Transactions costs can be categorized by three major "cost" items, (1) information costs, i.e. knowledge of the fishery, (2) collective fisheries decision-making costs, ie participation in meetings, making rules, and communicating rules and (3) collective operational costs, ie. Monitoring and enforcement, stock maintenance costs and resource distribution costs.

Transmission of knowledge
Mechanisms by which information is passed along both intra- and intergenerationally. "Channels of communication".

The 48 cases were reviewed again and the 20 principles were assigned a value based on whether or not they were discussed in a particular case. If a principle was discussed, regardless if it was discussed in a negative fashion or a positive fashion, it was assigned a value of (1). If a principle was not discussed, it was coded as (0). This coding system was used to facilitate addressing the first two research questions, which were: 1. How have institutional principles been discussed in the literature on co-management of small-scale tropical fisheries? 2. Do relationships exist among institutional principles based on the frequency of their discussion in the literature? If so, what might these relationships suggest about the interactions of institutional principles characteristic of small-scale fishing activities? This data was entered into a Statistical Package for the Social Sciences (SPSS) database.

Development of a Refined Co-management Spectrum

The third question was: Is there a relationship between institutional principles and co-management levels? If so, what might these relationships suggest about the evolution of principles with co-management level and which combinations of institutional principles best facilitate particular co-management levels? In order to address this question it was necessary to develop an appropriate co-management spectrum and develop clear definitions of the various levels of the co-management arrangements that lie within it. Co-management is defined as an arrangement where responsibility for resource management is shared between the government and user groups (Sen & Nielson 1996). While it was helpful to draw upon definitions of co-management from several authors (Pimbert & Petty 1995; Beaumont 1997; Decker & Chase 1997; Chase et al

2000) it was ultimately decided to build upon the spectrum of co-management discussed by Sen and Nielson (1996) that had been adapted from earlier work by McCay (1993) and Berkes (1994). This decision was based on the following observations of the three classification systems. First, Pimbert and Petty included a self-mobilization level that sufficiently excludes government involvement, which is intrinsic in the co-management concept. Second, Decker and Chase developed their classification system based largely on the relative degree of influence on wildlife policy and management decisions, which tends to be appropriate for co-management activities in developed nations but less so for co-management activities in developing nations where such policies are in their infancy if they exist at all. Finally, the classification system of Sen and Neilsen which was adapted from McCay (1993) and Berkes (1994), focused on the roles the government and users play which is the fundamental basis of co-management.

The primary modifications this research presents to the Sen and Neilson spectrum of co-management, presented in Table 9, centered on clarification of the specific roles the government and the community can have. Drawing upon the classification systems developed by Pomeroy and Berkes (1997), Sen and Nielson (1996), McCay (1993), and Pimbert and Petty (1995), a fourth classification system was developed to define each of the levels of co-management more clearly. The following criteria were applied to the development of a more definitive co-managerial spectrum: (1) Government control / Community control; (2) Input not actively sought / Input actively sought; (3) No formal arrangements for information exchange / Formal arrangements for information exchange; (4) Information exchange limited to basic input / Information exchange expanded to management issues; (5) Low percent of stakeholder groups involved / High percent of

stakeholder groups involved; (6) Rights of stakeholders not legally endorsed / Rights of stakeholders are legally endorsed. Table 11 presents the revised typology of levels of co-management.

Table 11. Levels of Co-management (Modified from McCay 1993; Berkes 1994; Pimbert & Pretty 1995; Decker & Chase 1997)

Level I: Authoritarian (Government 90% - Community 10%) Government controls Not receptive to input May inform users of decisions No information exchange arrangements Few stakeholder groups involved. Rights not informally or legally endorsed.
Level II: Passive-Instructive Government controls Receptive to input, but not actively sought No formal information exchange arrangements Information exchange limited to basic input Few stakeholder groups involved Rights not informally or legally endorsed.
Level III: Passive-Consultative (Functional) Government largely controls resource with some community control Community input utilized but it is not actively sought Formal information exchange arrangements exist Information exchange limited to basic Selected stakeholder groups involved Rights may be informally acknowledged but not legally endorsed.
Level IV: Active-Cooperative (Interactive) Government and community regulate resource Input is actively sought Formal information exchange arrangements exist Information exchange mostly basic with some about management of resource Interested stakeholder groups involved Rights are informally acknowledged but not necessarily legally endorsed.

Level V: Active-Advisory (Transactional) Community largely controls resource with active government facilitation Input is actively sought Formal information exchange arrangements exist Community supplies basic input as well as management input about the resource All stakeholders involved Government typically endorses community decisions but is not obliged to do so
Level VI: Active-Informative (Community 90% - Government 10%) Community delegated legal authority to manage the resource Community actively regulates input levels actively Formal information exchange arrangements exist Information exchange about all aspects of the resource. All stakeholder input is actively sought Government legally obliged to endorse community decisions

By incorporating the spectrum criteria presented above the researcher was better able to classify the cases according to co-management type from level 1 (Authoritarian), to level 6 (Active informative). Subsequently, each of the 48 cases was coded respectively 1 to 6. This created a new variable indicating the level of co-management identified for each case (Plevel). A copy of the scoring sheet used to evaluate the principles discussed, how they were discussed, and the co-management level of each case can be found in Appendix C.

Data Analysis Procedures

The data collected from the above procedures were tabulated in a spreadsheet and analyzed to answer the three research questions outlined in Chapter 1. First, in order to address how each of the institutional principles had been discussed in the literature on co-management of small-scale tropical fisheries, totals were calculated for the number of times a principle was discussed across all cases. This was used to calculate principle

frequencies indicating the percentage of times a specific principle was discussed or not discussed for all 48 cases. These frequencies were then analyzed allowing an examination of the most frequently and least frequently discussed principles for all cases. Additionally, the total number of principles discussed, and those not discussed for each case was calculated. This new variable, labeled as TOTAL, indicated the total number of principles discussed and not discussed for each case was used to address the third research question.

The second analysis examined two classes of relationships. The first entailed an examination of the important relationships existing among principles. Second, was the relationship between co-management level *(Plevel)* and the total number of principles discussed per case *(TOTAL)*. In light of the limitations imposed by the type of data used, this analysis focused on those principles that had multiple correlations with other principles, and / or were discussed with high (>70%), or low (<50%) frequencies. No correlations will be assessed between principles and Plevel or principles and TOTAL as the limited variation within principles makes interpretation difficult.

A Spearman's rho correlation was used to test for associations. The Spearman's rho is a non-parametric version of the Pearson correlation coefficient that is more appropriate for categorical data, ordinal data, or for interval data that do not satisfy the normality assumption. Inherent problems with this procedure exist as categorical variables with similar splits will necessarily tend to correlate with each other, regardless of their content (Gorsuch 1983). Thus any resulting associations would need to be examined with care. Nonetheless, it is common to use dichotomies in interval level

techniques like correlations and regressions and for the purposes of this research study it is appropriate.

Third, a regression analysis was used to examine the relationship between the total number of institutional principles discussed for each of the co-management levels. The regression used the co-management level variable (Plevel), ranging from 1 to 6, as the dependent variable, and total number of principles discussed for each specific case (TOTAL) as the independent variable. A potential limitation of this type of test is the use of the (Plevel) variable as interval data. However, in a similar fashion Likert scales are very commonly used with interval procedures provided the scale item has at least 5 and preferably 7 categories (Zumbo & Zimmerman 1993). Further, Jaccard and Wan (1996 p. 4) suggest, "For many statistical tests, rather severe departures (from intervalness) do not seem to affect Type I and Type II errors dramatically."

Finally, the cases were grouped according to their assigned Plevel and principle frequencies were calculated for each specific co-management level. This information was then analyzed to examine the deeper relationship of the most frequently and least frequently discussed principles for each specific co-management level. These subsets were used to examine how the discussion of principle frequencies evolved with various co-management levels.

Assumptions and Limitations

Assumptions

In studying the institutional arrangements supporting fisheries co-management regimes the researcher needs to be aware of any assumptions or limitations that prevent a

valuable and credible analysis (Creswell 1995). The first assumption is that the principles isolated by Ostrom from irrigation projects can be applied to fisheries co-management situations. The second assumption is that the reviewed literature will allow an examination of the critical issues concerning institutional arrangements of fisheries co-management. The third assumption is that a representative sample of the literature related to fisheries co-management was chosen such that a meaningful analysis can be completed. A fourth assumption is that the authors of the literature reviewed, discussed all of the pertinent institutional arrangements for a particular case and not just the arrangements that they were particularly skilled at addressing. A fifth assumption is that the content analysis methodology, particularly the coding of qualitative information, was applied in a sufficiently analytical fashion using clearly defined criteria so as to adequately transform it for statistical analysis.

Limitations

The information on institutional arrangements in co-management regimes was derived primarily from scholarly journal articles, working papers, government reviews, conference proceedings, research project updates, final project reports, and external project evaluations. Such written documentation is potentially biased in the information it provides, as it is dependent upon the target audience. The researcher hoped to overcome this limitation by using a variety of literature written by individuals from a variety of backgrounds including scholars, various members of government, research institutes, and international and national nongovernmental organizations. Second, often the documentation relied upon does not provide an adequate description of actual co-

management activities or underlying institutional arrangements potentially resulting in insufficient detail to facilitate analysis. In order to account for this limitation the researcher has attempted as much as possible to review the findings of a particular location/case using multiple sources of documentation. This form of triangulation while not entirely perfect did provide a more complete description of many cases. Another limitation of this research methodology is trying to compile anecdotal information from multiple sources for use in statistical analyses. West and Brechin (1991) suggest there are special difficulties imposed by the fact that the case studies utilized are often based on qualitative, impressionistic evidence that various analysts might interpret differently, and by the fact that the case studies were not coordinated to include a consistent set of questions, hypotheses, variables, or measurements. However, many of the cases that were drawn upon for the analysis relied heavily on the IAD framework developed by Ostrom and consequently focused on a uniform set of initial attributes.

Finally, personal insight into the management of coastal areas was obtained during two-years as a Peace Corps volunteer in East Africa, and four years as a professional teacher on the Caribbean island of Curacao, Netherlands Antilles and in Mexico. Experience with the topic was also obtained during a one month research assistantship observing fishing activities with Operation Wallacea in Wakatobi National Park, in the Tukang Besi archipelago of Southeast Sulawesi, Indonesia.

Chapter 4

DATA ANALYSIS

Discussion of Institutional Principles in the Literature

As discussed, a set of 20 principles was isolated from the literature on the co-management of small-scale fisheries and used to examine 48 case studies of fisheries co-management regimes in the tropics. Utilizing the methods outlined in Chapter 3, the frequencies that the principles were discussed in the literature were obtained. Table 12 shows how the institutional principles were discussed in the literature for all 48 cases. An inspection of these frequencies reveals several interesting observations.

Table 12. Discussion of institutional principles in the literature

Institutional Principles	Frequency of discussion in literature (n=48)
Boundary definition ***(boundary)***	98%
Coordinating body ***(coordination)***	98%
Collective choice arrangements ***(choice)***	92%
Local level leadership ***(localleader)***	92%
Monitoring by appropriators ***(monitor)***	83%
Legally protected local rights ***(legalpro)***	81%
Experience with organizations ***(experience)***	73%
Fishing activities ***(fishing)***	71%
Alternative livelihood support ***(altlivelihood)***	69%
Cooperatives related to fishing ***(cooperatives)***	69%

Resolution mechanisms for conflict ***(resolve)***	63%
Transmission of knowledge ***(transmission)***	63%
Incentives for cooperation ***(incentives)***	60%
Community cohesion ***(cohesive)***	58%
Traditional management systems ***(tradknowl)***	56%
Costs < benefits ***(cost/ben)***	52%
Congruence of appropriation rules and local conditions ***(congruent)***	50%
Funding arrangements ***(funding)***	46%
Contextual graduated sanctions ***(context)***	40%
Transaction costs ***(transcosts)***	33%

Four principles stand out as being discussed in almost every one of the 48 cases reviewed. These include a clear definition of boundaries *(boundary)*, and coordinating body *(coordination),* at 98%, and collective choice arrangements *(choice)*, and local level leadership *(localleader)*, each at 92%. These results support the fact that co-management is defined as a partnership arrangement in which government agencies, local resource users, nongovernmental organizations, and other stakeholders share responsibilities and authority for the management of a particular resource (Pomeroy 1998).

It should not be surprising that issues related to definition of the resource boundary and roles in management (both of which were included in this principle) were discussed as one of the most important principles. Defining boundaries of the fishery and of those who are authorized to use and manage it can be considered a first step in organizing for common property resource co-management (Ostrom 1992). The individual

fishers or households with rights to fish in the bounded area and participate in area management should be clearly defined. As long as the boundaries of the resource and / or the individuals who can use and manage it remain uncertain, no one knows what they are managing or for whom. Without defining the boundaries of the fishery and its management local appropriators face the risk that non-contributing users will reap any benefits both in terms of direct benefits from the resource or political power or prestige accorded from its management.

Pomeroy, Katon and Harkes (1998) found that clearly defined boundaries were of "high" importance to successful implementation of co-management. In San Salvador Island, and Malalison Island, Philippines the marine sanctuaries had boundaries established by all stakeholders and identified with buoys to inform outsiders of its existence. They assert that without a clear identification of "boundaries" those who invest in the fishery may not receive as high a return as they expected. In addition this clarity allowed for greater efficiency in harvesting and monitoring by fishers and managers.

Discussed with equal frequency in the literature was the reliance on an external coordinating body. This principle, as defined in the study, considered whether or not there was discussion of some type of an external coordinating group consisting of representatives from appropriators, government agencies, or other interested stakeholders that independently monitored management arrangements. Pomeroy et al (1998) found this principle to be of "medium" importance for the implementation of co-management in San Miguel Bay, Philippines where the San Miguel Bay Authority helped coordinate fishing activities. They suggest that formal coordinating bodies are not common because they are often difficult to establish and maintain, however, informal coordination through

dialogues, meetings and consultations was evident in other cases in the Philippines. Other cases from Africa seemed to echo this finding. Sowman et al (1997) discussed that less than 50% of the respondents answered positively when asked if a newly established coordination committee was effective in facilitating co-management of the Olifants River fishery in South Africa. The major problem in this case was the lack of coordination offered by the government agency involved in the project to provide capacity building and scientific support to the co-management initiative. Other authors studying projects in Africa promote similar findings (Andrews 1999; Abdullah 2000; Hale 2000; Hara et al 1999).

However, based on the amount of discussion about the use of coordinating organizations in the literature it appears to be a common element of co-management activities. Obviously adequate coordination is needed and particularly important when several partners are involved or when more than one intervention is taking place in a single area. Still, Ostrom (1994) cautions against the use of difficult to maintain external coordinating bodies to resolve conflicts and mediate management activities, and suggests that it can also undermine local stewardship initiatives. Perhaps informal, more flexible independent bodies with representatives from the different user groups would better facilitate the quick and efficient decision-making, conflict resolution, planning and cooperation needed for more effective management.

Consideration needs to be given to co-management approaches that best incorporate and define involvement at the local level. Membership in local associations or in local management boards need not be limited to local residents. Pinkerton (1994) suggests the use of local all-stakeholder co-management boards, which would be the

fundamental building block for cooperative management. Boards could provide the forum for discussion of all local fisheries management questions, development of plans, and the review of management actions. Of course the boards would be most effective if parties had more to gain by participating and solving dilemmas than by disrupting the process. Additionally, governments would have to respect the decisions made by the boards and all parties would need to commit themselves to maintaining the resource rather than acting out of self-interest.

Collective choice arrangements and local level leadership were discussed with the next highest frequencies. Collective choice arrangements imply that those individuals affected by the operational rules of management can participate in modifying those rules. Andrews (2000), evaluating Mafia Island Marine Park in Tanzania, identified that appropriators and managing agencies need to coordinate patterns of appropriation and provision, if they are able to effectively identify resource boundaries and exclude nonusers from access and appropriation rights. Further, the Mafia case suggested that incentives for local stewardship are stronger when all stakeholders take part in defining boundaries and management roles. Finally, Katon et al (1997) suggest that appropriate coordination in defining the resource also facilitates an accurate knowledge of the resource boundary in that it is based on an ecosystem that both fishers and managers (if in fact they are different) can easily observe and understand.

Ostrom (1992) suggests that systems using collective choice arrangements are better able to tailor rules to local circumstances, since the individuals who interact directly with one another and with the physical world can modify their rules over time to better fit them to the specific characteristics of their setting. In their discussion of co-

management arrangements in Cogtong Bay, Philippines, Katon et al (1998 p. 161) supported this when they observed:

> Co-management requires a conscious effort to develop and strengthen the capacity of resource users and stakeholders for collective action, dialogue, leadership and sustainable resource management. At Cogtong Bay, managers placed a premium on training and social preparation in the initial phase of project implementation which facilitated the sustained involvement of all stakeholders in the identification, development and implementation of arrangements aimed at reversing effects of destructive and unsustainable resource use practices.

Active attention to the use of collective choice arrangements appeared repeatedly in the literature as being critical to the development of co-management arrangements that, more often than not, were able to reduce the level of illegal and inappropriate resource use behaviors.

Local level leadership was the final principle discussed over 90% of the time. Collective action in developing appropriation and provision plans for fishery management requires a considerable degree of collaboration between government agencies and the local leaders. Local leaders in particular can have profound impacts on co-management activities by setting examples for other to follow, set out courses of action, provide energy, and generally provide direction for the co-management process. Fiske (1992) discussed that in Fagatele Bay, American Samoa where local leaders were consulted appropriately there is now a marine sanctuary and functioning co-management activities. However, in La Parguera, Puerto Rico where leaders were left out of the planning process completely the co-management project was scrapped. Further, several of the cases indicated that traditional community leaders might not always be the appropriate leaders for co-management. In some instances the leadership will need to be developed out of the user group itself. Members of this group may be more respected

than local political leadership and more likely to remain concerned about the resource. Subsequently, an important part of the co-management process is to identify, and or develop local leadership through training and education efforts that build leadership skills among a variety of individuals within the community so that the project does not become dependent upon any one individual or group.

Two additional principles worth mentioning because of the high frequency at which they were discussed were monitoring by or for the appropriators *(monitor)* and legal protection of appropriation and provision rights *(legalpro)* at 83% and 81% respectively. Up to this point, discussion has been based on the somewhat idealistic premise that so long as co-management activities are developed collaboratively and with shared visions of the future there should be no need for monitoring of the resource. However, in the majority of cases reviewed monitoring of resource use and distribution, and the legal basis by which such monitoring can occur was discussed frequently. Ostrom (1990) explains that monitoring of a CPR will necessarily follow the establishment of rules through collective action. She also points out that in the most successful cases the appropriators themselves will conduct the monitoring, as it is a by-product of their own strong motivations to continue benefiting from the resource. The results of this study somewhat support her observations in that the discussion of monitoring activities followed that of the establishment of appropriation and provision rules. However, this study suggests that even when rules are established through collective action there is still the need for formal legal protection.

Finally, the results show that the legal protection of appropriation and provision rights *(legalpro)* is also an issue given considerable discussion in the literature. Many of

the cases explained that local bodies take themselves more seriously and put out greater effort when there is enabling legislation or clarification of rights sufficient to give local management boards confidence that their work will not be disrupted by outside forces (Pinkerton 1994). In other cases, particularly in the Philippines (Magpayo 1994) and the South Pacific (Hyndman 1993), territorial use rights (TURFs) are being given some basis in the constitution. This aspect of co-management needs to be examined more deeply as a possible tool to help coastal communities gain access, control and management of their resources.

It is interesting to note that only four of the eight principles with frequencies greater than 70 percent belonged to the group of principles identified by Ostrom (1990) as essential components of successful long enduring CPR systems. These four principles are: boundary definition; collective choice arrangements; monitoring by appropriators; and legally protected local rights. If all principles discussed greater than 50 percent of the time were included then resolution mechanisms for conflict *(resolve)* discussed at 62% would also need to be identified with those listed above. Still the fact that all of Ostrom's principles did not show up in the top eight suggests that the review conducted in this study of tropical small-scale fisheries does not sufficiently represent all possible types of common property resource management regimes identified by Ostrom. Another explanation could be the biased research focus of scholars trained in specific disciplines. Perhaps Ostrom (1994, p.36) offers a better explanation for this by stating:

> The specific type and number of rules in use differ markedly from one case to the next. Given this great variation, the sustainability of these resources and their institutions cannot be explained by the presence or absence of particular rules. Part of the explanation for the sustainability of these systems is based on the fact that the particular rules do differ, taking into account specific attributes of the related physical systems; cultural worldviews and the economic and political relationships that exist in the setting.

In contrast to those principles discussed with high frequencies, four principles were not discussed at all in at least 50% of the cases or less. These included, transaction costs *(transcosts)* at 33%, contextual graduated sanctions *(context)* at 40%, funding arrangements *(funding)* at 46%, and congruence of appropriation rules and local conditions *(congruent)* at 50%.

Attempting to lower transaction costs was the principle discussed with the least frequency. This principle was added to the analysis group based on literature suggesting its potential importance in facilitating co-management regimes (Ite 1996; Ablong 1994). Ease of establishing new managerial institutions around groups or relationships that have already been established is one example of its usefulness. Another is the utility of drawing upon traditional knowledge when developing management strategies, which may reduce the "costs" of obtaining information about the resource boundaries and stocks. However, the lack of its discussion in the literature suggests that it is an area needing greater consideration.

Kuperan and Pomeroy (1997) discuss transaction costs - the cost of gaining information about the resource and what users are doing with it, reaching agreements and coordinating with others in the group with respect to use of the resource, and enforcing agreements that have been reached - as being an important yet little studied aspect of small-scale fisheries management. Their analysis of transaction costs in San Salvador Island, Philippines suggests that individuals involved in co-management will make an effort to reduce costs of management through informal agreements that are more flexible and easier to establish. They further assert that the costs of monitoring and enforcing boundary restrictions will tend to be reduced when appropriate collective choice

arrangements facilitate compliance as a greater number of community stakeholders become involved in their development and implementation. Here we see an example of the nested nature of institutional arrangements as both operational (monitoring) and collective choice (informal agreements) level arrangements are positively influenced by a reliance on preexisting conditions of the co-management environment.

The results also indicate a lack of discussion about contextual graduated sanctions *(context)*. Ostrom (1990) identified this as one of the seven critical principles characterizing long-enduring common property management regimes. She described this principle as necessarily following the establishment of regulations through collective action and intimately coupled with monitoring. Evidence from work done on other CPR systems (Ostrom 1992) suggests a clear linkage with reducing transactions costs in that when more contextual sanctions are developed (typically involving socio-cultural forms of punishment), the relative costs of enforcing those sanctions will be reduced as violators are more likely to obey them. Their lack of discussion in the literature should not be misinterpreted as a lack of sanctions in co-management arrangements but rather that there is still reliance upon sanctions that are formulated outside of the context of the fishery.

Arranging for funding *(funding)* was another principle discussed with relatively low frequency. Co-management requires financial resources to support the process. Funds need to be available to support various operations and facilities related to planning, implementing, coordinating, monitoring, and enforcement. However, heavy reliance on external funding is one of the factors that Ostrom (1994) identified as being a threat to co-management initiatives. First, relying on external financial support can undercut the

capacity of local institutions to sustain themselves over time. When appropriator are directly involved in supporting co-management operations there is greater likelihood that they will partake in maintaining all aspects of the managerial process. Second, external funding can often focus the orientation of the process towards the desires of those who are releasing the funds. Andrews (2000 p. 272) asserts that this was one of the major problems encountered with co-management activities on Mafia Island by describing:

> The degree to which international conservation agencies invested in the park for the park's sake rather than for conservation outcomes, is evidenced by the fact that the project was heralded as an innovative and model project well in advance of any conservation gains. International agencies have considerable investment in the notion of marine parks and this becomes a prescribed outcome with too little care for the individual contexts.

Finally, there was also limited discussion of congruence of appropriation rules and local conditions *(congruent)*. This principle was considered separate from contextual graduated sanctions *(context)* in that the former deals with rules related to harvesting the resource and the latter deals with penalties imposed when those rules are violated. Formulating appropriate strategies for appropriation is another principle identified by Ostrom (1990) as characteristic of robust common property resource management systems. Pinkerton (1994) supports this and points out that a management area should be small enough for effective monitoring by community members and large enough to encompass a sufficient diversity of available stocks. Baird (2000) identifies the willingness and ability of villagers to adjust resource management strategies to meet local conditions as a critical reason why the aquatic resource co-management program along the Mekong River in southern Laos has been a success in the eyes of the villagers. Other studies have suggested that in dealing with complex coastal ecosystems understanding how local conditions affect appropriation can increase cooperation and lower transaction

costs by allowing the identification of appropriate incentive structures (Calumpong 1996). Surprisingly this principle was not discussed with great frequency, however, its importance will not be overlooked as it was identified as having associations with many other principles. It is to these associations, and several other significant associations that the analysis will now turn.

Associations Among Institutional Principles and Other Selected Variables

The second step in the analysis was to examine relationships between the 20 principles and the association between the co-management level (Plevel) and the total number of principles discussed per case (TOTAL). As discussed in Chapter 3, due to the nature of the data and resulting limitations only salient groups of relationships will be discussed. The results of the positive associations are presented in Table 13.

Table 13. Significant positive associations

ASSOCIATED VARIABLES	POSITIVE CORRELATIONS
Coordination / Localleader	0.484**
Cohesive / Fishing	0.387*
Congruent / Tradknowl	0.378*
Congruent / Legalpro	0.374*
Resolve / Context	0.363*
Resolve / Monitor	0.346*
Experience / Altlivelihood	0.343*
Cost/Ben / Altlivelihood	0.343*
Legalpro / Transcosts	0.340*

Experience / Localleader	0.336*
Boundary / Monitor	0.326*
Plevel / TOTAL	**0.501****

(* p < .05. ** p < .01.)

The results presented in Table 14 show that coordinating body *(coordination)* and local level leadership *(localleader)* had the strongest positive correlation between principles. We saw in the last section that both of these principles were discussed in over 90% of the cases. However, this new result suggests that they are also most likely discussed in corresponding cases which implies a deeper relationship than might be thought based on their discussion in the literature alone. Revisiting Table 5 and Figure 3, the potential relationship between these two principles becomes more apparent. The results presented here, and supported by Oakerson (1992), demonstrate that institutional attributes of the community are related to the external institutional arrangements of the action situation both of which are related to the other attributes and various incentives to cooperate.

Connections between some type of external coordinating body and local level leadership were repeatedly identified in the literature (Horrill 1992; Villavicencio and Baling 1995; Yap 1996; Agbayani 1996; Pido and Pomeroy 1996; Baird 2000). Gutierrez (1996 p. 39) summarizes this relationship:

> Effective local level leadership is important in maintaining good relations with external stakeholders, government agencies and coordinating bodies charged with overseeing management operations. Establishing good links between these groups is necessary as the willingness or unwillingness of people to actively participate in regulating the resource can be influenced by the credibility they have for external stakeholders as determined by community leaders.

Calumpong (1996) discusses that the political leaders of the area greatly facilitated cooperation between the local community and other stakeholders involved in managing the resource in Negros Oriental, Philippines. As a result not only did management activities run more smoothly, but a significant amount of support was supplied for alternative sources of income generation. In other parts of the Philippines the contributions and expertise of the coordination committees gave critical fuel to projects by supplying technologies, funding support and research study data from other projects (Agbayani 1994). In some cases coordinating committees also facilitated with the recognition and formalization of territorial use rights (TURFs). This not only legitimized the rights but also enhanced a sense of community ownership and responsibility for the fishery (Pido et. al. 1996).

On the other hand several cases demonstrated that poor relationships between local leaders and coordinating bodies resulted in conflicts. Villavicencio and Baling (1995) in studying the El Nido Marine Reserve in Palawan, Philippines discuss that, conflicts between leaders of local management units and steering committees caused confusion with definitions of project boundaries and subsequent monitoring activities. In another case, Yap (1994) explains that local politicians hindered the operation of the project because they felt the coordinating committee posed a threat to their political standing in the community.

The results show that other individual associations do exist, however, for the purposes of this analysis it is more beneficial to focus on principles that show multiple correlations and / or were discussed with high or low frequencies in the previous section. Using these guidelines it should be pointed out that congruence of appropriation rules and

local conditions *(congruent)* was discussed only 50% of the time (see Table 12) but correlated with five other principles. The first two of these relationships are positive (see Table 13), and include the legal protection of local rights *(legalpro)*, and knowledge of traditional management systems *(tradknowl)*. The other three are negative (Table 14).

The results from Table 13 and Table 14 show that congruence of appropriation rules and local conditions *(congruent)* may be more important as a principle than its discussion in the literature demonstrates as it has significant linkages with five other principles. The strongest of these associations is with the incorporation of traditional knowledge into management schemes *(tradknowl)* of small-scale fisheries. Johannes (1981) hinted at the importance of utilizing traditional knowledge in designing contextually appropriate management schemes in his description of fishing and marine lore in the Palau district of Micronesia. Subsequently the discussion of traditional knowledge in the literature has focused on a formulation of concepts, definitions and cases (Inglis 1993; Burgess 1999), and incorporated ecosystem sustainability (Kurien 1998; Lalonde & Akhtar 1994), customary tenure (Dahl 1988; Ruddle et. al. 1992) biodiversity conservation (Gadgil et. al. 1993; Meyer 1998,) linking social and ecological systems (Hana et. al. 1995; Rova 2000), marine reserves (Polunin 1983; Neis 1994), and further research of its integration into management regimes (Dahl 1989; Gadgil 1991; Ruddle 1994; Hipwell 1998). Given this array of possible applications its not surprising that the results show it has an association with appropriation rules and local conditions.

This linkage is further supported by the IAD framework presented in Figure 2, which shows that the transmission of traditional knowledge is an action component of the action situation influenced by the attributes of the community and the rules in use

developed through collective action. Consequently, development of appropriation rules that are in conflict with the existing knowledge of the resource environment could lead to agreements that are difficult – or impossible – to monitor and enforce. Pinkerton (1994) supports this, discussing that the success or failure of any local management system depends vitally on the active support of local fishers and communities. This support is dependent upon the extent to which local knowledge has been incorporated. Local parties are in an optimal position to propose and debate concrete options regarding the management of resources as their intimate relationship with the local environment affords them insight that would take outsiders too long to obtain.

A significant positive association is also demonstrated between congruence of appropriation rules and legal protection of local rights *(legalpro)*. The results suggest that whether or not appropriation rules are developed with consideration for the local environment determines the legitimacy of the legal recognition of those rights. Sowman (2000 p. 14) recognized this in her discussion of the acceptability and legitimacy of regulations in force on the Olifants River Estuary:

> There are conflicting views amongst fishers regarding the legitimacy of these rules and they are urgently in need of review. In particular, rules affecting boundaries of the restricted fishing area and the presence of diamond recovery boats in the estuary need to be reviewed and amended. Unless fishers support the rules and regulations governing their fishery, compliance will not be achieved and conflicts may arise among members of the group as well as between the fishers and the regulatory authority.

Given these conflicts, perhaps greater emphasis needs to be put on informal arrangements.

Ostrom (1990) points out the increased efficiency and feeling of equity when local fishers devise extensive rules defining who can use a fishing ground and what kind

of equipment can be used. Provided government officials give at least minimal recognition to the legitimacy of such rules, the fishers may be able to enforce the rules themselves thus reducing the "costs" of management. Horrill and Darwall (1996) support this in their study of Mafia Island stating that the incorporation and consideration of the local users within the management strategy should eliminate past problems of local resentment and further reduce the manpower and finances needed to police the area. Furthermore, it is hoped a philosophy of stewardship and ownership will be reinforced amongst the local people leading to their vested interest in the success of the project.

The co-management project undertaken in the Yaeyama Archipelago of Southwestern Okinawa, Japan supports Ostrom's assertion of greater equity but only when a combination of formally and informally legitimized territorial use rights were used to regulate resources (Ruddle1987). Is appears that the combination of formal and informal regulations was the most appropriate for a situation where there were strong fisheries cooperatives setting the overall framework for management (collective choice level decisions) and strong traditional village institutions governing day to day operations of the resource (operational level decisions). The outcomes of the project suggest that perceptions of greater equity, measured by a feeling that community affairs had an important influence in fisheries, also increased the level of meaningful participation in the management and control of resources.

The other three principles are negatively related (Table 14). They include, the existence of cooperatives or associations related to fishing *(cooperatives)*, incentives for cooperation *(incentives)*, and costs < benefits *(cost / ben)*. The fact that each of these principles was negatively associated with congruence of appropriation rules with local

conditions is intriguing. First, these results suggest that the existence of cooperatives or associations somehow interferes with the establishment of appropriation rules that are congruent with local conditions. It may be that fisheries cooperatives become too political over time and lose any meaningful understanding of local conditions. Perhaps fisheries cooperatives, being somewhat external organizations, sway the focus of the co-management project away from local needs and onto the needs or desires of external agencies.

Table 14. Significant negative associations

ASSOCIATED PRINCIPLES	NEGATIVE CORRELATION
Fishing / Funding	-0.422**
Tradknowl / Cooperatives	-0.413**
Cost/Ben / Experience	-0.364*
Cooperatives / Congruent	-0.315*
Altlivelihood / Monitor	-0.302*
Incentives / Congruent	-0.298*
Cost / Ben / Congruent	-0.292*
Transcosts / Experience	-0.290*

(* $p < .05$. ** $p < .01$.)

The next two negative associations were related to incentives for cooperation, and benefits of the project outweighing costs. These result suggest that when rules are established with consideration for the local conditions there is less discussion of the need for incentives to cooperate or benefits being greater than costs. Figure 3 shows the link between incentives, market attributes, and community institutional arrangements such as

the formulation of congruent appropriation rules. In considering this figure it should be kept in mind that "incentives" involve more than just financial rewards and penalties, which is why the principle was identified as separate from benefits outweighing costs. Ostrom (1992 p 24) describes incentives as,

> .....the positive and negative changes in outcomes that individuals perceive as likely to result from particular actions taken within the set of working rules, combine with the relevant individual, physical, and social variables that also impinge on outcomes.

Creating contextually appropriate rules facilitates the ease with which these rules are developed and implemented. Appropriators are more likely to adhere to, and self-regulate rules that are developed in accordance with location conditions. Such regulations will not only afford them monetary benefits *(costs < benefits)* but also opportunities for distinction, prestige and personal power in the community *(incentives to cooperate)*.

Other principles significantly correlated with at least three other principles were monitoring by / for the appropriators *(monitor, resolve, boundary, and altlivelihood)*, support for alternative livelihoods *(altlivelihood, monitor, cost / ben, and experience)*, and costs < benefits *(cost / ben, altlivelihood, experience, and congruent)*. The significance of this observation is to point out the importance of understanding the imbedded nature of institutions involved in common property management regimes. Figure 1 shows these levels and their linkages. In each of the groups of associations multiple levels of arrangements are involved. As an example, monitoring (which has aspects at all levels) is linked with boundary definition (operational level), conflict resolution (operational choice level and collective choice level), and support for alternative livelihoods (collective choice level and constitutional choice level). This

observation is supported by Schlager and Ostrom (1993), who describe operational arrangements (access, withdrawal), imbedded within collective choice arrangements (managing conflict), imbedded within constitutional choice arrangements (policies stimulating other economic activities).

Finally, the results show that the co-management level (Plevel) and the total number of principles discussed per case (TOTAL) had a strong positive correlation (0.501, $p < .01$) This implies that as the co-management level increases and a greater number of participants are involved, the number of principles discussed per case also increases. Subsequently, it can be assumed that the number of principles governing a particular resource will necessarily become greater as all stakeholders develop and implement the complex array of institutions needed to ensure equity, efficiency, and sustainability of the resource. Table 6 describes how each of these indicators is operationalized in establishing co-management activities. McCay and Acheson (1987) support this increased intricacy while discussing the historical and ethnographic research of communal property which demonstrates its complexity by encompassing a wide variety of institutional arrangements that delimit access and impose restrictions on use within informally and formally managed activities such as fishing, hunting, and trapping. More importantly, however, the fact that an association exists between co-management level and the number of principles discussed focuses the analysis on the final research question.

Relationships between Institutional Principles and Co-management Levels

Having examined how principles have been discussed in the literature and some of the salient associations between principles based on these frequencies it is now time to

turn to the final research question. What relationships exist between institutional principles and co-management levels? What might these relationships suggest about the evolution of principles with various co-management levels? And are there unique combinations, groups or sets of institutional principles that appear to be identified with certain co-management levels?

The research to this point has focused on relationships that exist between principles. However, this section will examine the relationships that exist between levels of co-management and principles that enable efficient, equitable, and sustainable management of fisheries resources. It was hypothesized that the number of principles discussed in the literature will become greater as the type of co-management becomes more complex and levels and degrees of stakeholder responsibilities increase. Ostrom (1990) suggests enduring CPRs are organized in multiple layers of rules in use including, appropriation, provision, monitoring, enforcement, conflict resolution and governance activities that become more complex as an increased number of management roles are defined and redefined.

These complexities result from partnerships in which many stakeholders share responsibility and authority for decision making over the management of a fishery. In the previous section it was suggested that these partnerships, and the subsequent institutional arrangements that result, necessarily fluctuate as a greater number of stakeholders becomes involved in management issues. Pomeroy (2000 p. 115) describes the process by stating:

> Co-management is not a regulatory technique but a flexible management strategy in which partnerships are pursued, strengthened and redefined at different times depending on the existing policy and legal environment, the political support of

government for community-based actions and initiatives, and the capacities of community organizations to become government partners.

Figure 8 presents the total number of principles discussed in the literature plotted against the co-management level that was determined to be operating in each case. This was done to establish a relationship between the level of co-management and the number of principles at each level. The full spectrum of co-management levels ranges from the largely government controlled level I (Authoritarian) to the largely community controlled level VI (Active-Informative). However, the analysis demonstrated that the majority of the projects examined were level III (Passive-Consultative), level IV (Active-Cooperative (Interactive), and level V (Active-Advisory

With these co-management levels in mind, an examination of Figure 8 suggests that as the level progresses from the Authoritarian level I (government centered) towards the Active-Informative level VI (community centered) the number of principles discussed in the literature about co-management regimes increases. Consequently, a regression analysis was performed on the data to determine the significance of this relationship.

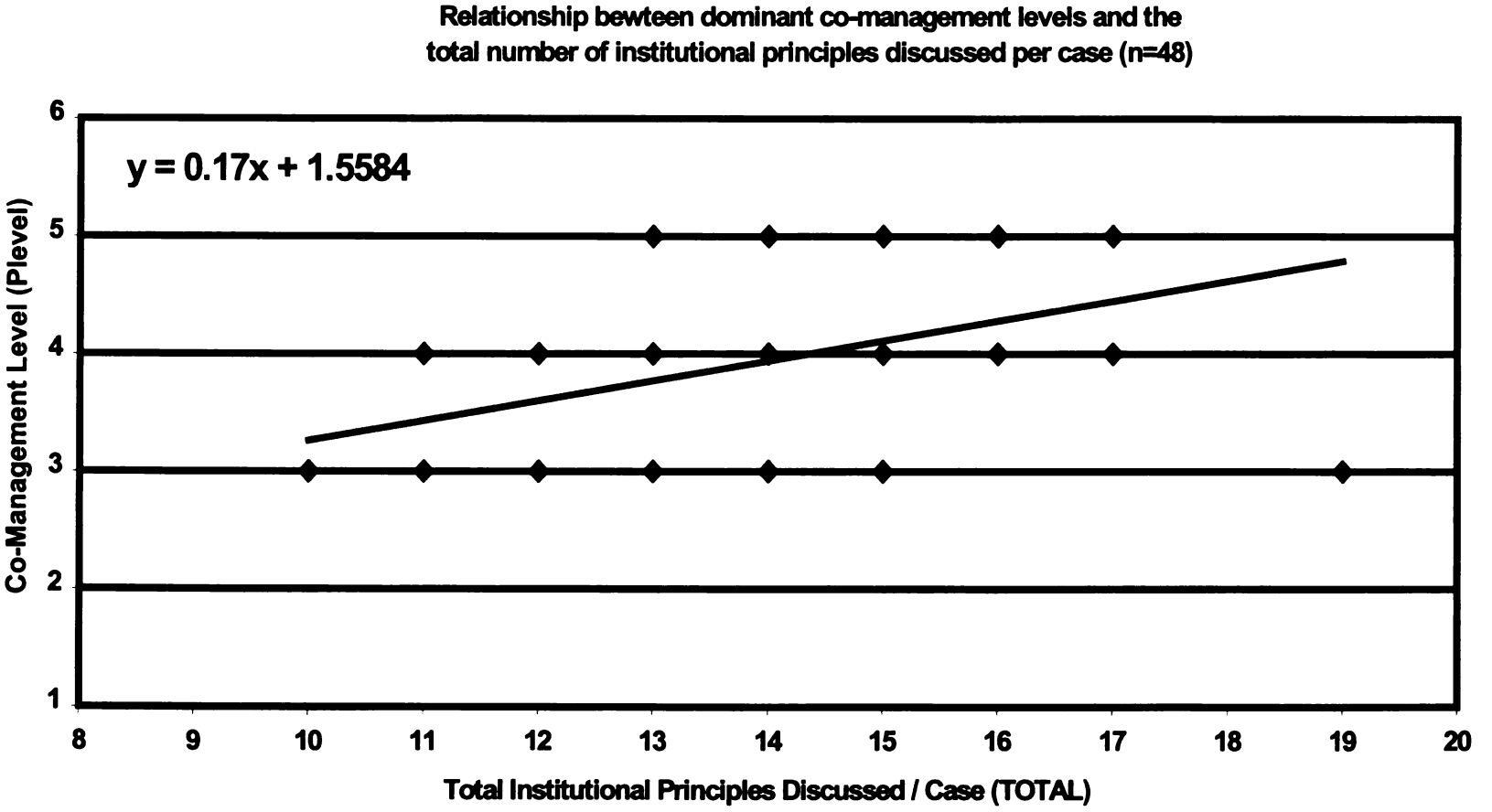


Figure 8. Relationship between the dominant co-management levels (5, 4 and 3) and number of principles discussed per case.

Two important considerations about the data need to be acknowledged. First, the author selected co-management level as the dependent variable for this analysis. However, it is not presently clear at this point if co-management level is dependent on the number of principles, or if the number of principles operating is dependent on the co-management level. Further, it should be noted that if a relationship between the two variables exists, it would be presumptive to assume that a simple addition or subtraction of principles will facilitate a desired co-management level. Clearly co-management arrangements are much more dynamic than that being contingent upon the mix of social, economic, political, and ecological conditions of the system in question. Nonetheless, the analysis was performed and the results are displayed in Table 15 below.

Table 15. Regression analysis of co-management level (Plevel) and total principles discussed per case (TOTAL).

R Square = 0.158		F = 9.242		Sig. F = 0.004	
Variables in the Equation (N=48)					
Variable	B	SE B	Beta	T	Sig. T
TOTAL	0.170	0.056	0.421	2.029	0.004
(Constant)	1.558	0.768		3.040	0.049
Dependent variable: Plevel y=0.17x + 1.5584					

The results of the regression displayed in Table 15 clarify that the relationship between the total number of discussed principles (TOTAL), and the co-management level (Plevel) is indeed significant. Caution should be employed in utilizing this for anything

more than a starting point for a discussion of the relationships between principles and the level of co-management being implemented. Consequently, the analysis focused on examining more carefully how principle occurrence in the literature changed with differing co-management levels.

The evolution of design principles with changing co-management level

The first step in the examination was to divide the 48 cases according to their respective co-management levels. Frequencies were calculated for the principles discussed for each of the co-management levels dominating the literature. These included, Level III (Passive-consultative), level VI (Active cooperative), and level V (Active-advisory). Results of the relative discussion of principles for co-management level III, IV, and V are shown in Figure 9.

Four observations are immediately apparent from these results. First, discussion of 12 of the 20 principles *(boundary, choice, cohesive, context, coordination, fishing, legalpro, localleader, monitor, resolve, tradknowl, and transmission)* increased as co-management level changes from level III to level V. Second, 5 of the 20 principles *(cooperatives, cost / ben, funding, incentives, and transcosts)* were shown to increase in discussion at co-management level IV, and then decrease at co-management level V. Third, 2 of the 20 principles *(altlivelihood, and experience)* were show to decrease in discussion from Plevel III to Plevel V. Finally, only 1 of the 20 principles *(congruent)* showed a decrease in discussion from level III to level IV, subsequently increasing at level V. Appendix D shows a summary of frequencies at each co-management level.

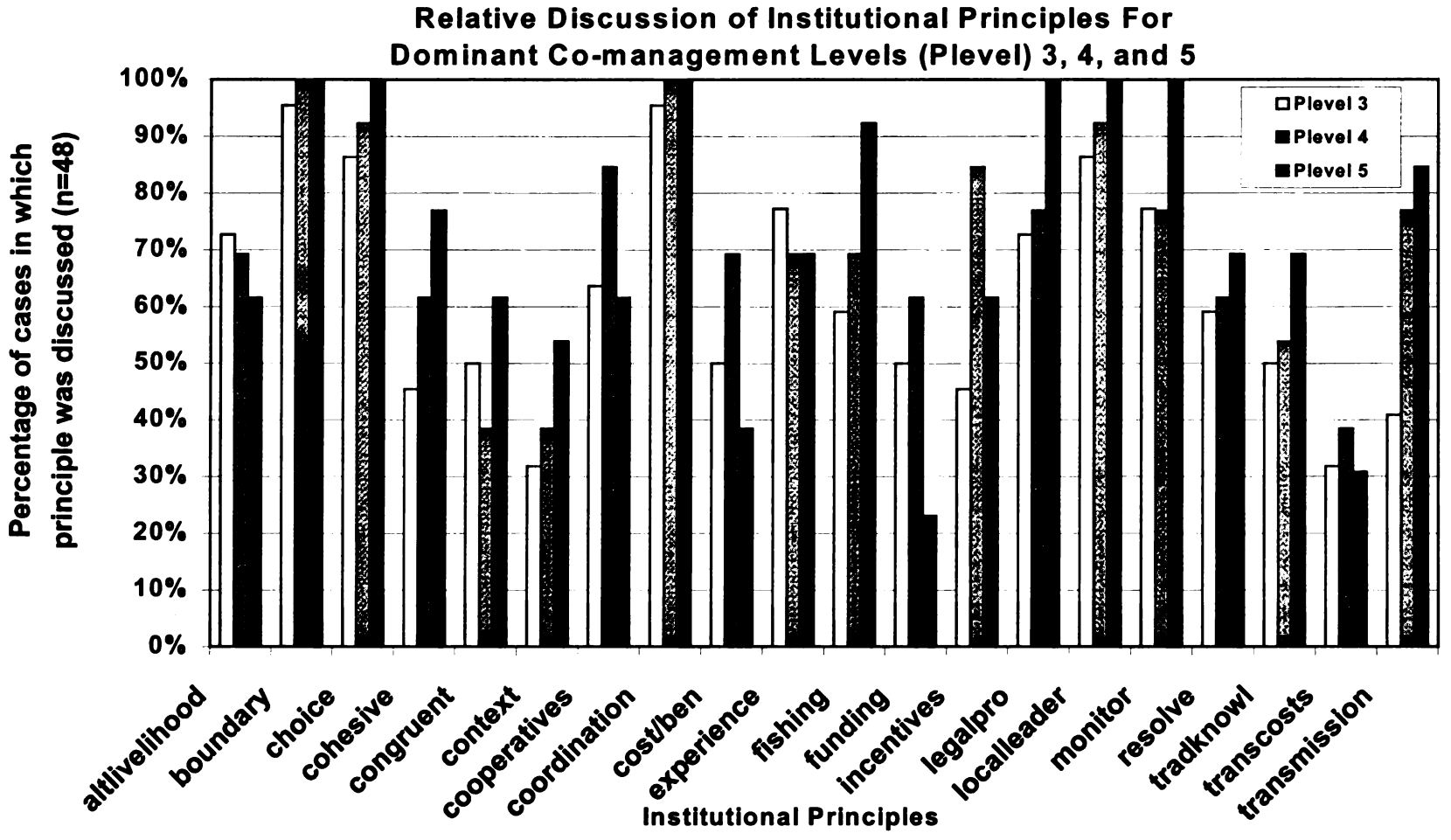


Figure 9. Frequencies of discussed institutional principles for co-management levels 3, 4 and 5.

The first observation supports the previously discussed premise that as stakeholder involvement increases – as is expected in changing from Plevel III to Plevel V – the number of principles, or institutional arrangements, involved also increases. However, looking more closely at the type of principles is more helpful in addressing the third research question of understanding the sets or groups of principles that are necessarily identified with specific co-management levels. Oakerson's key attributes of the actions situation presented in Table 5 can act as an analytical framework by which the principles can be organized. Utilizing this framework the twelve principles discussed as increasing from level III to level V were placed in the following groups: biological/physical attributes (boundary, and fishing); socio-cultural attributes (cohesive, tradknowl, and transmission); community attributes (resolve, monitor, context, localleader, and choice); external attributes (legalpro, and coordination). From this grouping we see that principles from all levels except market attributes were included. However, the majority of those seen to be increasing were lumped into the community institutional / organizational category.

These results are supported by scholarly observation that when implementing co-management activities initial emphasis needs to be focused on community institutional arrangements. McCay and Jentoft (1996) arguing that early, systematic, and meaningful participation of community groups in the management process can create the kind of the vested interest that argues for, not against, the collective good. This includes the establishment of operational level arrangements such as boundaries delineating access to the resource, as well as collective choice arrangements, which define membership into organizations or associations that are involved in developing and implementing

management strategies. Keep in mind these results should not minimize attention paid to other attributes of the action situation, but rather facilitate focusing efforts during the initial stages of the co-management process.

The second observation is that five of the principles increase in discussion at level IV subsequently decreasing at level V. This appears to occur, as the type of information exchanged becomes more management oriented, a greater number of stakeholders are involved, and the legal protection of rights becomes more formal. Decker and Chase (1997) point out that more collaborative approaches may be time-consuming and costly in the short-term, however, the upfront costs are worthwhile over the long-term as greater stakeholder consensus is accomplished through education, discussion, and debate. Studies by Luchavez (1996) and Ablong (1996) support this showing that initially, defining appropriate incentive structures was a difficult component of the initial phases in the establishment of co-management projects in the central Philippines, yet, these difficulties ultimately became reduced though discussion and the presence of responsible leadership.

Applying Oakerson's framework of attributes again the principles identified as initially increasing and subsequently decreasing could all be classified into the market class of attributes (cooperatives, cost / ben, funding, incentives, and transcosts). Other scholars may disagree with this classification, however, one of the utilities of Oakerson's framework is the flexibility with which it can be applied for analytical purposes. Oakerson (1992 p 43) describes its application as,

> A tool for identifying types of factors, related in specifiable, limited ways, which can be assumed always to operate with respect to the commons. It should not be construed as a fully specified causal model that includes all and relevant variables and relationships in every case. Although not a model to feed data into and crank out predictions from, the framework is a heuristic tool for thinking through the logic of a situation and considering alternative possibilities. It can be elaborated in

particular cases to whatever level of complexity and completeness that may be desired.

These results suggest that market attributes, more than other attributes, can be expected to take center stage at intermediate levels of co-management where the types of changes discussed above, and detailed in Table 11, are seen to occur.

The third observation is that two of the principles *(altlivelihood, and experience)* continued to decrease in discussion frequency from Plevel III to Plevel V. Support for alternative livelihoods was one of the three principles identified in the previous section as being associated with three other principles, one of which was experience with previous collaborative systems of management *(experience)*. Both of their frequencies of discussion in the literature were around 70%.

These principles proved to be difficult to categorize using Oakerson's framework. They seem to share aspects of socio-cultural, community institutional, market, and external institutional attributes. Perhaps the fact that they have overlapping characteristics explains why their discussion in the literature is seen to decrease from level III to level V. It could be argued that they are too nebulous, and often overlooked as non-essential components of co-management initiatives. It could also be argued that specifically addressing them in co-management schemes is redundant as they may be natural by products of other institutional arrangements. Whatever the case may be this analysis suggests that they should be given more attention. This conclusion is based on their limited frequency of discussion overall, their discussion at higher levels of co-management, and their degree of association with other principles.

Only one principle *(congruent)* initially decreased in discussion but subsequently occurred with greater frequency at co-management level V. Once again the results show the uniqueness of this principle, which was discussed less than 50% of the time, yet, was associated with five other principles. Attempts to classify this principle showed it also shared characteristics with several of Oakerson's attributes. It could be placed into almost any one of the attribute groups with the potential exception of external institutional arrangements. However, even this group could be included if one was inclined to consider that congruent appropriation rules operate with greater efficiency when they are formally recognized by external institutional arrangements.

The fact that it was the only principle to decrease in frequency of discussion as co-management schemes developed deserves attention. It could simply imply that other principles took precedence as greater input was sought from an increasingly larger group of stakeholders. Ostrom (1990) may support this in suggesting that once resource users have made contingent arrangements about appropriation, they turn to other more pressing concerns such as monitoring the established arrangements, enforcing sanctions, and resolving conflicts. It is presumed that after some period, during which local conditions change, that attention would once again need to be focused on reformulating appropriation rules. Perhaps this oscillating attention to appropriation rules is somehow manifest in the oscillating frequency of discussion as is demonstrated by the results.

Another interesting observation focused on the principles that seem to become critically important, as evidenced by the fact that they are discussed in all of the 48 cases. The results in Figure 9 show that at level III none of the principles are discussed in all of the 48 cases. This changes at level IV, as two principles, boundary, and coordination are

discussed in each of the 48 cases. Finally, at level V, six principles, boundary, coordination, choice, legalpro, localleader, and monitor were discussed in all of the 48 cases reviewed. This observation suggests that the number of principles necessary increases as the arrangements involved in co-management become more complex. Further, the results suggest that clearly defined boundaries and a coordinating body charged with overseeing co-management activities are the first two principles to become critically important. Ostrom (1994) supports these results by pointing out that defining the boundaries of the CPR and those authorized to use it can be thought of as the "first step" in organizing for collective action. Appendix E shows the individual frequencies for each level.

The complexity of the situation becomes apparent at level V as four additional principles are added to the "critical group". These principles are *choice, legalpro, localleader, and monitor*. These results may be informative about the importance of principles in co-management as six belong to the group identified by Ostrom as characterizing robust CPR institutions. From these results it can be seen that external authority or collective choice arrangements do not automatically solve issues associated with compliance to rules. Legal protection, local leadership and vigilant monitoring are also important contributors to the co-management process. Still these principles supporting co-management may be ineffective without appropriate coordination of management activities. This emphasizes the importance of the debate about the appropriate degrees and types of government and community involvement.

The above examples demonstrate some of the complexities involved with co-management and the dynamic institutional arrangements upon which it relies. Co-

management is not a panacea to all the ills of coastal resource management. Communities, governments and organizations that decide to engage in such endeavors need to recognize the importance of clear objectives and sustained commitments. Finally, the planning and implementation of these systems will require the development of new legal, administrative and institutional arrangements at national, and community levels. Further, these new arrangements will need to complement contemporary political, economic, social and cultural conditions. However, considering 1 billion people rely on fish for food, at least 50 million people in developing countries are directly involved in the harvesting, processing and marketing of fish and other aquatic products, and worldwide fish production provides some 150 million people with employment (ICLARM 2000), striving to develop such arrangements is critical.

Ch 5

CONCLUSIONS AND RECOMMENDATIONS

Summary

An analysis of principles related to the co-management of tropical small-scale fisheries can provide valuable insights to the relationships between principles and their role in managing common property resources. This study examined the following research questions. How have institutional principles been discussed in the literature on co-management of small-scale tropical fisheries? Do relationships exist among institutional principles based on their frequency and patterns of discussion in the literature? Is there a relationship between institutional principles and co-management level? A summary of the answers to each of these questions is given below.

It was seen that a definition of boundaries and the use of a coordinating body to oversee management operations dominated the cases reviewed at 98%. Additional principles discussed with slightly less, but significantly high frequencies, were the use of collective choice arrangements and local level leadership both at 92%. The remaining four principles discussed with a frequency of at least 70% were monitoring by appropriators (83%), legally protected local rights (81%), experience with previous organizational activities (73%), and knowledge of fishing activities (71%). In contrast, the principle discussed with the least frequency was transaction costs at 33%. This principle was followed by contextual graduated sanctions (40%), funding arrangements (46%), and congruence of appropriation rules and local conditions (50%). It is interesting to note that four of the top eight, and two of the bottom four principles made up the collection identified by Ostrom (1992) as principles that characterize robust CPR

institutions. Further, the results suggest that these principles are presently the most critical factors that need to be considered when implementing co-management initiatives.

The second research question focused on the relationships existing among institutional principles based on their frequency and patterns of discussion in the literature. The strongest positive correlation was between co-management level and the total number of discussed principles for a given case (see Table 13 and 14). The strongest correlation between principles was with the discussion of a coordinating management body and the discussion of local level leadership. While many additional associations existed, most notable was the observation that congruence of appropriation rules and local conditions was correlated with the most other principles. Further, monitoring by appropriators, costs < benefits, and support for alternative livelihoods were all correlated with three other principles. No other principles showed such significant multiple correlations as these.

The third research question addressed the relationship between institutional principles and co-management levels. What might these relationships suggest about the evolution of principles with changing co-management levels, and whether or not there are unique combinations, groups or sets of institutional principles that can be identified with certain co-management levels? Four different patterns of principle evolution emerged as co-management level changed from level III to level V (Figure 9). First, discussion of twelve principles *(boundary, choice, cohesive, context, coordination, fishing, legalpro, localleader, monitor, resolve, tradknowl, and transmission)* increased as co-management level changed from level III to level V. Second, five principles *(cooperatives, cost / ben, funding, incentives, and transcosts)* were shown to increase in discussion at co-

management level IV, then decrease at co-management level V. Third, two principles *(altlivelihood, and experience)* decreased in discussion from Plevel III to Plevel V. Finally, one principle *(congruent,)* showed a decrease in discussion from level III to level IV, subsequently increasing at level V.

Another interesting observation focused on the principles that seem to become critically important, as evidenced by the fact that they are discussed in all of the 48 cases. The results in Figure 9 showed that at level III none of the principles were discussed all of the time. However, at level IV two principles, boundary definition, and coordinating body emerged as being discussed in all of the cases. Finally, at level V, six principles, boundary definition, coordinating body, collective choice arrangements, legally protected local rights, local level leadership, and monitoring by appropriators were discussed in all of the 48 cases reviewed.

Conclusions

In Chapter 1, common property was strictly defined in terms of exclusion and subtractability. However, this study has demonstrated that a far more dynamic definition, based on the institutional arrangements constructed by an identifiable community of interdependent users, is needed. These formal and informal arrangements are defined and redefined within a framework established by the local community, private interests, and the state. The wealth of social and intellectual resources that exists within this framework is sufficient to develop appropriate management regimes capable of preventing CPR dilemmas from occurring. Earlier these dilemmas were discussed in terms of sub-optimal outcomes and viable alternatives. However, the real dilemma results from the difficulty of governments, local resource users, associations, and other stakeholders, in

acknowledging the most appropriate strategies for managing common property resources.

Consequently, CPR theorists have developed frameworks that facilitate the identification and analysis of critical institutional principles such as those identified in Table 10. This study utilized an institutional analysis and development approach towards understanding the relationships between principles involved in the co-management of tropical small-scale fisheries. Principles identified as characterizing successful fisheries co-management regimes were analyzed in relationship to various levels of co-management.

Theoretical frameworks like those drawn upon in this study show great promise in facilitating the analysis of the interplay between institutional principles. Scholars studying such interactions can be misled by the array of arrangements that exist for the maintenance of a given coastal resource. The IAD framework presented by (Ostrom 1990) and attributes describing common property resources identified by (Oakerson 1992) allow for the systematic identification of factors, related in specifiable ways that operate within a common property resource management regime. This study has found the frameworks beneficial in that they are broad enough to encompass the various arrangements operating, yet specific enough to permit meaningful analysis.

Co-management as a viable management option for common property resources has its roots in common property theory. Many definitions exist but all center on a mutual adaptation between the government and the local community in resource management (Acheson 1989). The degree to which each of these groups of stakeholders is involved depends on the types of resources (e.g., physical, social, cultural etc.) that exist within a particular system.

As demonstrated by the overall frequencies of discussion presented in Table 12 and the evolution of principle discussion presented in Figure 9, this study suggests the initial steps in implementing a co-management initiative should be to ensure that boundaries, both physical and membership, are clearly defined. The results also point to the importance of some type of appropriate coordinating body charged with overseeing co-management activities, that include but are not limited to, facilitating the legitimization of local use rights, assisting with monitoring of resource appropriation rules, and fostering relationships with local level leaders.

This last point deserves a bit more attention in that the use of a coordinating body to help with co-management activities was significantly correlated to the discussion of local level leadership. This was the strongest inter-principle correlation observed (see Table 13). Fisheries managers and researchers agree that a fishery cannot be effectively regulated without the coordination of fishers and other stakeholders in formulating rules and other management activities (Pomeroy & Berkes 1997). However, the magnitude and type of coordination is still being debated. One fundamental argument about co-management, related to the control coordinating bodies can delegate, is whether local leaders and resource users can be entrusted to manage their resources. This in turn, rests on the local leadership's ability to demonstrate that it can control the resource in an equitable, efficient and sustainable manner (Pomeroy 2000).

The results presented in Tables 13 and 14 also hint at the importance of the development of appropriation rules that are congruent with local conditions, as evidenced by the large number of principles that congruent was correlated with. As an example of this importance, it was seen that one of those associations was with transaction costs,

which happens to be the principle that was discussed the least. In their study of San Salvador, Philippines, (Kuperan and Pomeroy 1997) identified three major cost items that could be reduced by greater reliance on established community resources. They suggest that one mechanism by which transaction costs could be lowered would be through the utilization of traditional knowledge in establishing appropriation rules. This would allow the use of established information transmission mechanisms, which would facilitate developing and implementing co-managerial arrangements more efficiently.

The cases have demonstrated that coastal management issues do not markedly differ across a wide range of societal and geographic settings. Environmental degradation and socio-economic instability are resulting from rapid population growth and inadequate regulatory mechanisms worldwide. Correspondingly, the objectives of the majority of coastal management initiatives are focusing on improving the quality of life in communities, which depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems (Olsen & Christie 2000). Co-management, in its various forms, has been offered as one mechanism that facilitates the development of appropriate institutional arrangements focused on addressing these holistic objectives.

This study supports this relationship, showing that a significant correlation exists between the total number of principles discussed per case and levels of co-management. Co-management means different things to different groups of stakeholders. The co-management levels developed in this study focused on a refinement of level of stakeholder involvement and control, information supplied, and acknowledgement of collective choices. Figure 6 showed that those co-management approaches that allowed

for a more meaningful collaboration tended to show a greater number of principles operating. The cases reviewed in this research suggest that three dominant types of co-management are presently being applied to problems of environmental degradation and socio-economic inequality. Environmental, socio-cultural and political variations exist to an extent that all of these approaches should be considered viable. It is clear that a certain degree of collaboration is needed if proper regulations are to be developed and adhered to. However, the type and degree is contingent upon the specific attributes of the system in question, and determining this will be easier if objectives are clearly defined from the start.

Establishing the appropriate co-management arrangement is difficult and requires an understanding of the factors that may inhibit its success. Ostrom (1994) describes eight threats to sustainable community-governed commons that may be applied to tropical small-scale fisheries: (1) Blueprint thinking; (2) Over reliance on rules that have not been agreed upon by all; (3) Rapid political and social change; (4) Information transmission failures; (5) Frequent external assistance; (6) Inattention to traditional knowledge; (7) Corruption; and (8) Lack of necessary support from government agencies. While all of these threats are important, the results from each of the three analyses points to the lack of some type of coordinating body, problems with local level leadership, and incongruent appropriation rules as the three most important barriers to successful co-management in tropical small-scale fisheries.

Recommendations for Future Research

Theoretical frameworks are immensely helpful in establishing project goals and research priorities. However, in order for their continued effective use they should be continuously modified based on current empirical studies. Therefore, it is important that some research should be focused on evaluating theoretical frameworks in relation to tropical small-scale fisheries. The present work on co-management conducted by ICLARM is one attempt at incorporating theoretical evaluation as a vital component of their research. Yet, as co-management of these resources becomes more prevalent, research into the effectiveness of present CPR frameworks needs to spread to other areas throughout Asia, Africa, and the Caribbean.

The incorporation of appropriation rules that are congruent with local conditions was seen to be a significant barrier to the success of many co-management initiatives. One method by which this could be realized is through the incorporation of traditional knowledge into co-management arrangements. Its usefulness in lowering transaction costs and promoting acceptable appropriation rules is just beginning to be realized. Unfortunately, population pressures and the encroachment of market economies throughout the world are rapidly modifying local communities and eroding the existence of traditional knowledge. Consequently, research needs to be focused on identifying traditional knowledge in relation to appropriation and provision of resources, where it still exists, and how it can be incorporated into co-management arrangements. Scholars should be playing a greater role in facilitating the identification of appropriate traditional knowledge as well as explaining why that knowledge is useful for management. This type of research could potentially be used to increase community credibility with

coordinating agencies by demonstrating to agencies that local communities are interested and knowledgeable about resource management.

Finally, several authors have identified the need to distinguish between co-management and community-based co-management (Pomeroy 1991; Pomeroy 1998; Olsen & Christie 2000; Kuperan 2000). For advocates of community-based management the crucial issue is determining whether an initiative is community-led. However, Korten (1987 p. 4) describes community-based resource management as including several elements:

> A group of people with common interests, mechanisms for effective and equitable management of conflict, community control and management of productive resources, local systems or mechanisms for capture and use of available resources, broadly distributed participation in the control of resources within the community, and local accountability in management.

The importance of such research stems from the observation that co-management arrangements demonstrating the greatest number of principles in this study are by most definitions community-based. Clarification of this concept may facilitate the implementation of "collaborative" conservation activities by more appropriately defining the roles of all stakeholders.

APPENDICES

APPENDIX A

Key attributes of the resource, resource user, and fisheries management arrangements (Oakerson 1992).

I. Biological, physical and technical attributes.
Problems and constraints over resource use most often originate in the biological and physical attributes of the resource and in harvesting technology used. Interactions between the natural world and fishers are commonly structured by the biophysical technological environment of the fishery. The vulnerability of fishers to scarcity and uncertainty in supply impact their incentives to engage in collective action. Collective action situations have been shown to develop in groups of individuals that are highly dependent on the resource and when availability of the resource is uncertain or limited. If the resource availability problem is repeatedly experienced, and if it exists within a single community of users, the users are likely to develop institutional arrangements to deal with the problem. Any institutions that fishers develop require an understanding of the fishing grounds, fish stocks, fishing activity, boundary conditions and fishing technology.

1. Type of ecosystem (Marine Coast, Coral reef, estuary, Lake, River, floodplain, other?)
2. Boundaries (physical, administrative, restrictions in access to fish resources)
3. Health status of fish habitats (Spawning areas, nursing areas, the fishing grounds)
4. Characteristics of target fish species and stocks (migratory or sedentary; status of stocks) wound
5. Characteristics of fisheries (industrial, Artisanal, fishing technologies used, physical range of fishing operations, seasonal variations in fishing activities)
6. Post harvest utilization of catches (fresh, salted, dried, smoked, fermented, frozen, canned)

II. Socio-economic and socio-cultural attributes of fishing community.
Community attributes include religious beliefs and practices, conditions and customs, sources of livelihood, the degree of social, cultural, economic and vocational heterogeneity or homogeneity, asset ownership, level of community integration into the economy and politics. Whether individual or in combination with others, each of these attributes potentially affects incentives to cooperate. General assumptions about fishers and stakeholders are related to how they behave both individually ending groups. Stakeholders, indirectly dependent upon the fishery for their livelihood, such as fish traders, processors in transporters, are also included since the relationship with fishers can provide incentives or disincentives for the fishers to cooperate.

1. Homogeneity/ heterogeneity of fishers, fish traders, fish processors and other stakeholders (ethnicity, religion, fishing gear use, gender, ownership of boats and fishing gear)
2. Dependency on fisheries/fish trade/fish processing for livelihood; other sources of income/subsistence.
3. Indigenous knowledge relevant to fisheries management (ecological and biological knowledge of resources and habitats, knowledge of catchability and fishing technologies)
4. Cultural factors affecting community or group attitude to fisheries/ fish trade/fish processing and determining behavior of individuals/groups.

III. Market attributes.
Resource problems are often market based. Market attributes (price, structure, stability) can effects the incentives for the resource use activities, effort levels and compliance with rules. Market attributes include those related to the operation and function of the market and those related to fisher and fish trader relationships. The first of these comprise market availability and orientation (local, regional, national, international), stability and transparency of supply in demand over time and competitive situation. The second include such attributes as credit linkages between fishers and fish traders, and rules on market behavior.

1. Type of fisheries taking place (commercial, recreational, subsistence)
2. Market orientation of the fisheries (local, regional, national, international markets)
3. Value of fish products (high or low value market)
4. The market structure (many or few suppliers/buyers, market dominance, power relations between suppliers and buyers, interdependencies)

IV. Resource user/community institutional and organizational arrangements.
Institutional arrangements concern the rights and rules, which apply to and regulate the fisheries in which community members take part. The research focuses on power structures at local level, decision-making arrangements, participation of fishers and stakeholders, legitimacy, mechanisms for enforcement and compliance with rules. Organizational arrangements concern the characteristics of decisions that are made and collective actions taken at the local level. Important issues are representation, decision-making procedures, implementation of decisions in the field, and interface with other related but separate issues such as tourism. Fisheries co-management arrangements often identified community level as the most important level for partnership and sharing of management responsibility. Therefore institutional analysis at this level is a crucial importance to understanding of co-management arrangements.

1. Community power structures and leadership (role, functioning and importance of traditional leadership structures in decision-making inside/outside the fishery sector)

2. Organizations established/appointed to serve as co-management partner (legal basis, mandate, representation, decision-making system/procedures, mechanisms for implementation of management decisions/enforcement).
3. Local regulation of access to fish resources (principles for allocation of fishing rights or for exclusion of groups or individuals)
4. Operational rules in place concerning fish catch, fish trade and fish processing, including origin of rule. The
5. Legitimacy of institutional arrangements and organizational set up involving fishers and other stakeholders, and attitudes towards co-management.
6. Mechanisms for conflict resolution among resource users.

V. External institutional and organizational arrangements.
Institutional and organizational arrangements at higher levels than the community level most often affect the institutional and organizational arrangements at the community level. The relations can vary widely. Some community level institutional arrangements (e.g. the establishment of operational rules for fishing in waters adjacent to the local community) may have been subject to constitutional approval and may be supported by both enabling legislation and government enforcement. Organizational arrangements at the community level may have been developed and designed at higher levels and need to fit into a multiple layer, nested structure. They may for this reason have to follow rules and procedures that are more or less compatible with the local conditions. Institutional and organizational arrangements outside the fisheries sector may impact on community institutional and organizational arrangements.

1. Overall structure of national political administrative system (relation between legislative administrative system; centralization/decentralization)
2. Department of fisheries and other relevant organizational structures involving fisheries management (mandate and legal basis, structural organization, management functioning task at national, provincial, and district levels)
3. Legal basis for co-management systems (enabling legislation or administrative decree)
4. Government agencies outside the fisheries sector whose mandate and activities interfere with or impact on fisheries.
5. Power structures outside the fishing communities which impact on local power structures and leadership (influence of political leaders, high-ranking military or police chiefs)
6. The role of donor organizations in promoting/enabling co-management arrangements.

V. Exogenous attributes.
A variety of factors exogenous to the fishery resource, fisher and community have an impact on fisher or community institutional arrangements. These are factors, which are beyond the control of the fishers and the community, and at

times also higher-level entities. These are surprises or shocks to the community or management system, brought about by macroeconomic, social, political or natural occurrences or interventions, which affect the survival of the institutional arrangements. They may include typhoons, war, civil unrest, changing political systems, or economic crisis. Institutional analyses should always be viewed with this historical dynamic perspective.

1. Political and economic context of co-management arrangements (changing political system and overall economic development since colonial time; major events which impact on the survival of institutions (market liberalization)
2. Disasters caused by war/civil unrest, typhoons, earthquake, flooding which impact on the survival of institutions.

Incentives to cooperate and coordinate.
The contextual variables and institutional and organizational arrangements for decision-making, and implementation of decisions made, give incentives and disincentives for individuals and groups to cooperate, engage collective actions or coordinate activities to achieve desired outcomes. The focus of the research should be on the relative importance of the various variables and arrangements in creating incentives for fishers and stakeholders to coordinate, cooperate and contribute as individuals and as groups. The contextual situation and the institutional arrangements in place also give government authorities responsibility for fisheries management incentives and disincentives to coordinate and cooperate with fishers and other stakeholder groups at various administrative levels. The dominant incentives for government agencies may to a large degree relate to the exogenous economic and political attributes and to institutional and organizational arrangements external to the local community.

Patterns of interactions between co-management partners.
The incentives for groups of fishers, stakeholders and government agencies responsible for fisheries management to coordinate and cooperate will be reflected in the pattern of interactions between the parties. For research of co-management arrangements the analytical focus will be on the institutional and organizational arrangements established for the co-management partnership to materialize as well as on the evolution of the partnership. The analysis will enable typology of the co-management arrangement in question but should also provide detailed information on how the practical aspects of fisheries co-management are dealt with in the action situation at various administrative levels. This includes monitoring of fish stocks and fishing effort, the enforcement of fishing regulations, regulatory interference with fish markets, and structural adjustments. t is the pattern of interaction between the co-management partners in the action situation, which determine the dynamics of the co-management (evolution) process and ultimately the outcome of co-management. How co-management arrangements evolve overtime is of particular interest.

1. Major incentives for groups of fishers and other stakeholders to engage in fisheries co-management
2. Major incentives for government agency to engaging co-management
3. Origin and development of co-management initiative; driving forces in the process.
4. Characteristics of co-management arrangement in place (type of arrangement)
5. Ways and means of communication between the co-management partners.
6. Mechanisms in place for conflict resolution between the co-management partners.

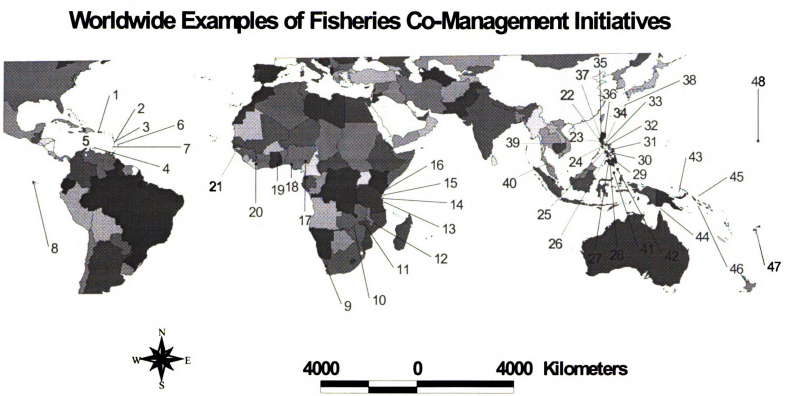
APPENDIX B

Locations of the small-scale fisheries co-management initiatives selected for this study.

Map #	Author(s)	Year of Article(s)	Location	Country	Marine Protected Area	Approximate Duration of Initiative (yrs)	Plevel
1	Fiske	1992	La Parguera Marine Sanctuary	Puerto Rico	Yes	6	2
2	Sandersen & Koester	2000	Soufriere National Park	St. Lucia	Yes	8	4
3	Hudson	1997	Mankote Mangrove	St. Lucia	Yes	20	5
4	Dixon et. Al.	1993	Bonaire Marine Park	Neth. Antilles	Yes	20	4
5	White	1994	CARICOM	Caribbean	No	5	3
6	Brown	1997	Bridgetown	Barbados	No	20	3
7	Jentoft/Sand	1996	Kingstown	St. Vincent	No	15	3
8	Heylings & Cruz	1998	Galapogos Marine Reserve	Ecuador	Yes	7	5
9	Sowman et. al.	2000	Olifants River	South Africa	No	7	3
10	Malasha et. Al.	1999	Lake Kariba	Zambia / Zimbabwe	No	4	5
11	Njaya et. al.	2000	Lake Chuita	Malawi / Mozambique	No	5	4
12	Hara et. Al.	1999	Lake Malombe/Shire River	Malawi	No	3	3
13	Abdullah et. al.	2000	Misali Island	Tanzania	Yes	3	5
14	Hale/Tobisson	2000	Chakwa Bay	Zanzibar	No	2	4
15	Andrews	2000	Mafia Island Marine Park	Tanzania	Yes	7	3
16	Hale et. al.	2000	Nyali Bamburi	Kenya	No	2	4
17	Thomas	1995	Hadejia-Nguru River	Nigeria	No	5	2
18	Ite	1996	Cross River National Park	S.E. Nigeria	Yes	5	2
19	Atta-Mama	1998	Lake Nokoue	Benin	No	5	5
20	Kponhassia & Konan	1998	Aby Lagoon	Cote d'Ivoire	No	10	4
21	Kebe et. al.	1998	Banjul/Saint Louis	Gambia/Senegal	No	10	3
22	Pomeroy & Pido	1995	San Miguel Bay	Bicol, Philippines	Yes	15	3
23	Calumpong	1996	Bais Bay	Philippines	Yes	4	3
24	Reyes	1996	Pitogo	Bohol, Philippines	NA	2	4
25	Baritua	1996	Palapag Island	Samar, Philippines	Yes	5	3

Map #	Author(s)	Year of Article(s)	Location	Country	Marine Protected Area	Approximate Duration of Initiative (yrs)	Plevel
26	Magpayo	1996	Daram Island	Samar, Philippines	Yes	4	3
27	Yap	1996	Leyte	Ormoc, Philippines	No	4	3
28	Luchavez/Ablong	1997	Negros Island	Visayas, Philippines	Yes	3	3
29	Agbayani	1997	Malalison Island	Philippines	Yes	6	5
30	Gutierrez	1997	Barili,	Cebu, Philippines	No	4	4
31	Katon & Pomeroy	1997	San Salvador Island	Luzon, Philippines	Yes	10	5
32	Katon, Pomeroy et al.	1998	Cogtong Bay	Visayas, Philippines	No	10	5
33	Sibal,Sulog,Marcelo	1996	Ulugan Bay	Palawan, Philippines	No	3	3
34	Santa Cruz	1996	Turtle Bay	Palawan, Philippines	Yes	4	4
35	Cimagala	1996	Tahong-Tahong	Bohol, Philippines	Yes	5	4
36	Takahara et. Al.	1996	Barangay	Philippines	Yes	7	3
37	Baling	1996	El Nido Marine. Reserve	Palawan, Philippines	Yes	5	4
38	Ruddle	1987	Yaeyama Archipelago	S.W. Okinawa, Japan	No	10	5
39	Baird	2000	Mekong River	Laos	No	5	5
40	Tokrisna et al.	1997	Songkhla	Southern Thailand	No	5	4
41	Mantjoro	1996	Sulawesi/Para	Indonesia	No	10	3
42	Nikijuluw	1994	Maluku Islands	Indonesia	No	20	4
43	Hyndman	1993	Rabaul	Papua New Guinea	No	20	5
44	Haines et al.	1997	Torres St.	Australia	No	15	3
45	Cooke et al.	1997	Viti Levu	Fiji	No	6	3
46	Ruddle & Hviding	1992	Marovo Lagoon	Solomon Islands	No	20	5
47	Doulman	1993	Ontong Java	Solomon Islands	No	10	3
48	Fiske	1992	Fagatele Bay Marine Park	American Samoa	Yes	15	5

Map for APPENDIX B



Geographic locations of the 48 small-scale fisheries co-management initiatives reviewed for this study.

APPENDIX C

Scoring sheet used to evaluate co-management case studies.

Author_____ **Date**_____

Case_____

Alternative livelihood support
altlivelihoods

Boundary definition
boundary

Collective choice arrangements
choice

Community cohesion
cohesive

Congruence of appropriation rules and local conditions
congruent

Contextual graduated sanctions
context

Cooperatives or associations related to fishing
cooperatives

Coordination between government and community
coordination

Costs < Benefits
cost/ben

Experience with organizations
experience

Success_____
Subjective assessment.

Players_____
Government/Community/NGO/Private

Scoring
1= Discussed
0= Not discussed

Fishing activities
fishing

Funding arrangements
funding

Incentives for cooperation
incentives

Legally protected local rights
legalpro

Monitoring by appropriators
monitor

Local level leadership
localleader

Resolution mechanisms for conflict
resolve

Traditional knowledge or mgmt. systems
tradknowl

Transaction costs
transcosts

Transmission of knowledge
transmission

Plevel_____

Gov. control/Community control?

Passive/Active involvement ?

Formal arrangements/Not?

Exchange limited to basic/ to management issues?

Few Stakeholder/All Stakeholders?

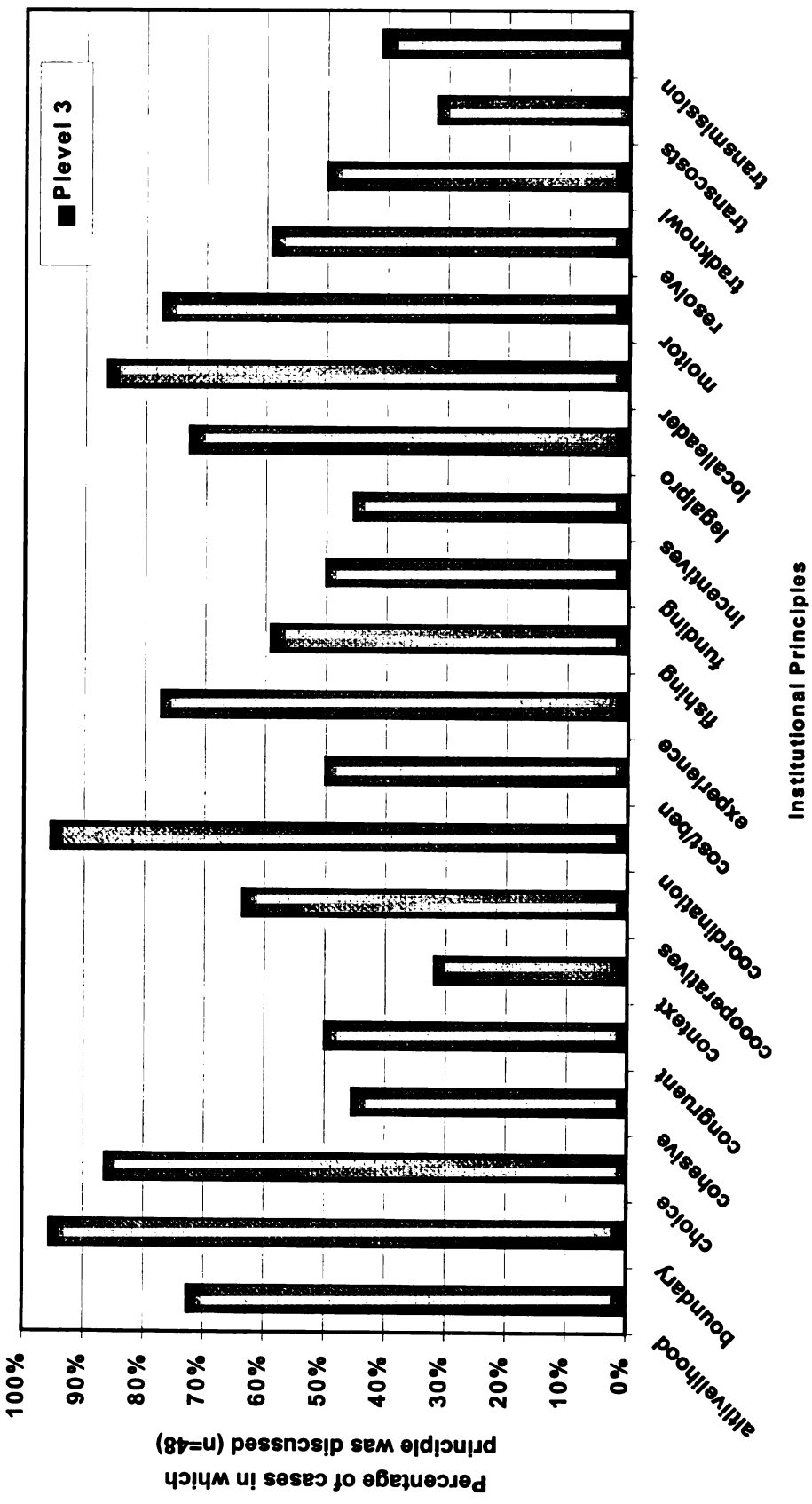
Rights not endorsed/Legally endorsed?

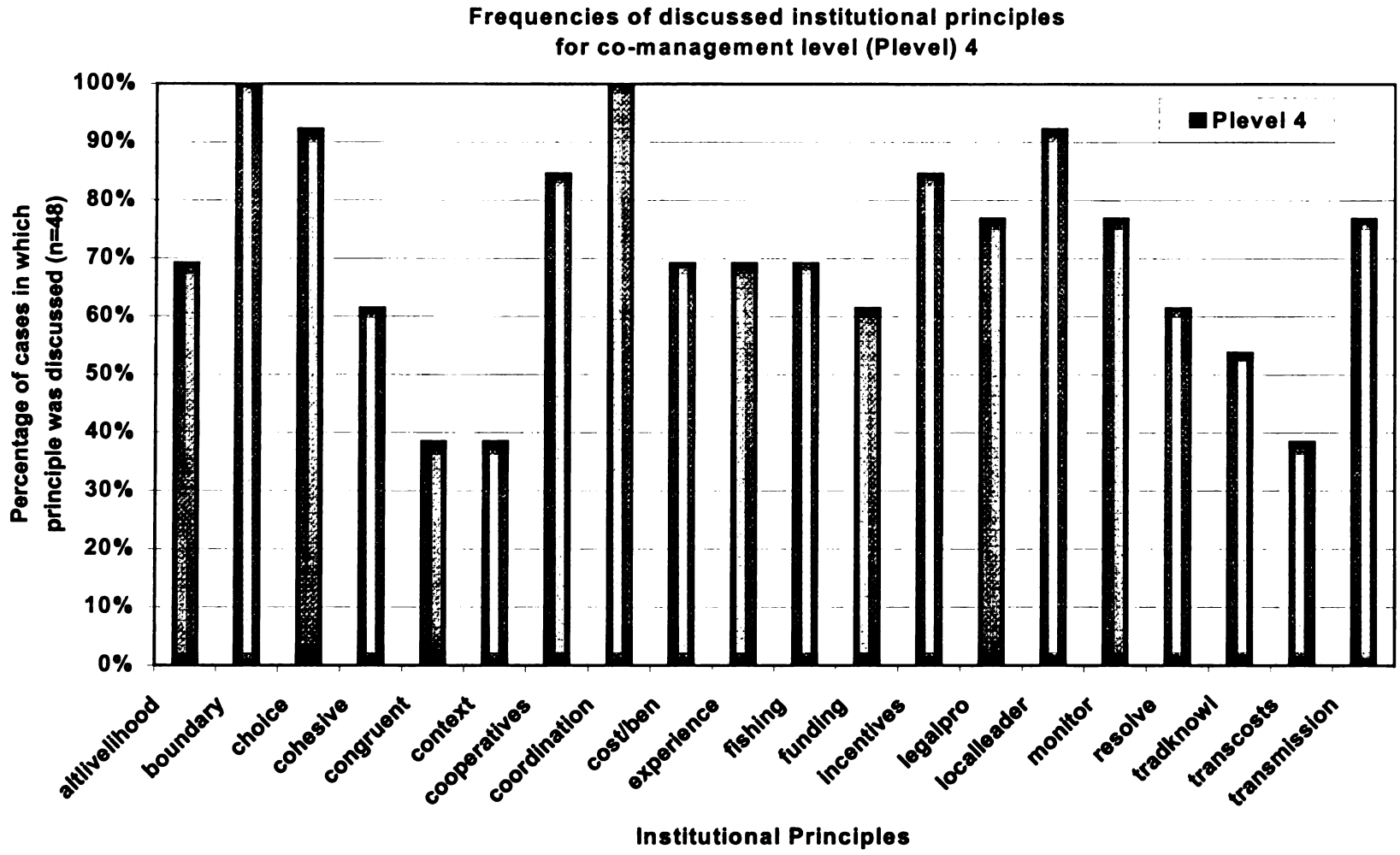
APPENDIX D

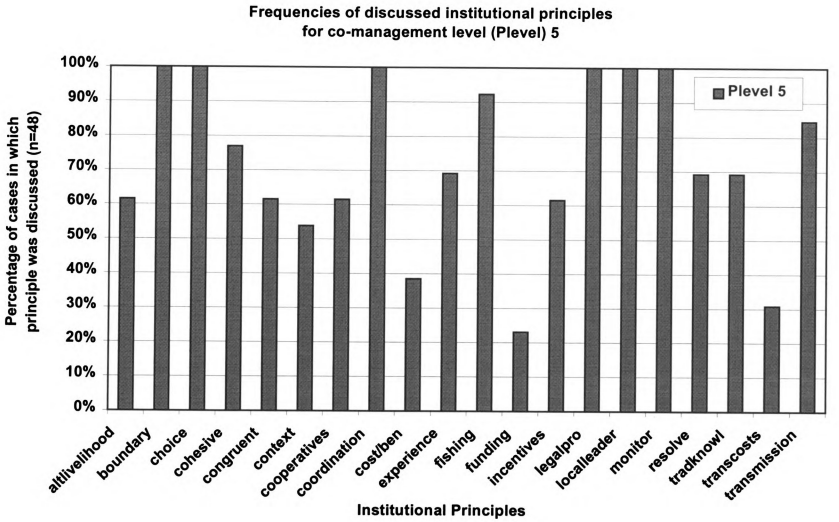
Summary of Most and Least Commonly Discussed Principles for the Dominant Co-management Levels 3, 4 and 5.

Discussed Level 5	**Not Discussed Level 5**	**Discussed Level 4**	**Not Discussed Level 4**	**Discussed Level 3**	**Not Discussed Level 3**
Boun 100%	Fund 23%	Boun 100%	Tranco 38%	Boun 95 %	Tranco 32%
Coll 100%	Tranco 31%	Coor100%	Cont 38%	Coor 95%	Cont 32%
Moni 100%	Cost 38%	Coll 92%	Cong 38%	Coll 86%	Tran 41%
Legal 100%	Cont 54%	Locall 92%	Trad 54%	Locall 86%	Ince 45%
Locall 100%	Ince 62%	Coop 85%	Cohes 62%	Moni 77%	Cohes 45%
Coor 100%	Coop 62%	Ince 85%	Fund 62%	Expe 77%	Trad 50%
Fish 92%	Alte 62%	Moni 77%	Reso 62%	Legal 73%	Fund 50%
Tran 85%	Cong 62%	Legal 77%	Alte 69%	Alte 73%	Cost 50%
Cohes 77%	Trad 69%	Tran 77%	Fish 69%		Cong 50%
	Expe 69%		Cost 69%		Fish 59%
	Reso 69%		Expe 69%		Reso 59%
					Coop 64%

APPENDIX E


Frequencies of discussed institutional principles
for co-management level (Plevel) 3
Plevel 3
Percentage of cases in which
principle was discussed (n=48)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
allivelihood
boundary
choice
cohesive
congruent
context
cooperatives
coordination
cost/ben
experience
fishing
funding
incentives
legalpro
localleader
motior
resolve
tradknowl
transcosts
transmission
Institutional Principles


Frequencies of discussed institutional principles
for co-management level (Plevel) 4
Plevel 4
Percentage of cases in which principle was discussed (n=48)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
altlivelihood
boundary
choice
cohesive
congruent
context
cooperatives
coordination
cost/ben
experience
fishing
funding
incentives
legalpro
localleader
monitor
resolve
tradknowl
transcosts
transmission
Institutional Principles


Frequencies of discussed institutional principles
for co-management level (Plevel) 5
Percentage of cases in which principle was discussed (n=48)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Plevel 5
altlivelihood
boundary
choice
cohesive
congruent
context
cooperatives
coordination
cost/ben
experience
fishing
funding
incentives
legalpro
localleader
monitor
resolve
tradknowl
transcosts
transmission
Institutional Principles

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