

**DEVELOPMENT OF
FISHERIES CO-MANAGEMENT
IN CAMBODIA:
A CASE STUDY AND ITS IMPLICATIONS**

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Abbreviations and acronyms

CF	Community Fishery
CFC	Community Fishery Committee
CFDO	Community Fishery Development Office
CPR	Common Pool Resource
DFID	Department for International Development
DOF	Department of Fisheries
IAD	Institutional Analysis and Development
ICLARM	International Center for Living Aquatic Resource Management (now WorldFish)
IFM	Institute of Fisheries Management and Coastal Community Development
ITQ	Individual Transferable Quota
MAFF	Ministry of Agriculture, Forestry and Fisheries
MRC	Mekong Research Commission for Sustainable Development
NGO	Non-Governmental Organization
OCAA	Oxfam Community Aid Abroad
POF	Provincial Office of Fisheries
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal

Abstract

The livelihoods and food security of many Cambodians depend heavily on inland capture fisheries, so the sustainable management of these fisheries is very important. Notwithstanding, the sustainability of Mekong fisheries is threatened by increasing fishing pressure and habitat modifications. Current management is considered insufficiently capable of controlling levels of exploitation and achieving equitable distribution of the resource, and the Cambodian government is promoting co-management initiatives as a way of addressing these issues. Using an institutional analysis approach, the current performance of co-management in a Mekong mainstream fishery was assessed, and factors limiting success identified. Results suggest that performance and sustainability of co-management are currently constrained by a lack of clearly defined property rights and resource boundaries, a mismatch between resource scale and management initiatives, and an absence of enabling legislation. Furthermore, objectives for management differ between stakeholders and are not well defined overall. While enabling legislation due to come into effect shortly is expected to improve performance and sustainability of co-management, boundary and scale issues will continue to pose challenges to co-management in open systems such as the Mekong mainstream. As a result, calls for innovative solutions, such as a federation of co-management schemes, will continue. In addition, increasing dependence on fishing, and external threats to resources need to be addressed if sustainability is to be improved.

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Introduction

Inland fisheries in developing countries currently face a number of threats to their sustainability. Population growth and increasing dependence on fisheries have increased fishing pressure, while changes to habitat have reduced productivity. Management in many countries is considered incapable of controlling exploitation levels, particularly in open-access fisheries. In Cambodia, a developing country where inland fisheries are of enormous importance, co-management is being introduced into small-scale fisheries. This is being done in an attempt to improve governance, and ensure more equitable and sustainable allocation of the resource. The objective of this paper is to present an assessment of one such fishery; management performance and current constraints to successful co-management are examined, and the implications of the findings for the development of co-management in Cambodia are discussed.

Inland fisheries in Cambodia are currently managed under a regime whereby the state holds the property rights, although in practice many are effectively open-access. However, top-down governance is not considered to provide food and income security (particularly for the rural poor who depend heavily on subsistence fishing), and, consequently, efforts to improve management have been proposed. Co-management is but one of a number of approaches that could be taken to improve management; others are stricter top-down governance, and the assigning of communal or private property rights. Generally, co-management can exist within any property rights regime – the term co-management pertaining to ownership of rights to make decisions about use of the resource, rather than ownership of the actual resource (Jentoft et al. 1998). Co-management has been increasingly accepted over the last ten years as an appropriate way of improving fisheries management in developing countries, reflecting a growing trend towards decentralized natural resource management (Ribot 2002).

The main argument for co-management is that it can result in more efficient management, while allowing greater involvement of resource users in management decisions. Co-management is generally considered to be more democratic (Nielsen et al. 2004), have lower transaction costs (Hanna 1995), and possibly be more sustainable than top-down management, due to better communication and less conflict amongst participating stakeholders (Jentoft 2005). Co-management covers a wide range of possible management strategies that have been classified in a number of ways, including on the basis of the relative roles of government and resource users (Jentoft and McCay 1995, Sen and Nielsen 1996, Nielsen and Vedsmund 1999), and on the basis of the emphasis placed on aspects of democracy or efficacy (Nielsen et al. 2004).

In Cambodia, co-management is being implemented through the creation of community fisheries; these involve management partnerships between a community of local resource users and the provincial office of fisheries (POF), usually supported by a non-governmental organization (NGO). While a number of policy reforms designed to support co-management have been made, the extent and success with which these reforms have been implemented at the local level is not yet well understood, and there are few documented cases of co-management in Cambodia (Try 2003, Oxfam 2003). This research provides a detailed assessment of current performance in one community fishery. The fishery is located in the upstream Mekong province of Stung Treng, where riverine fisheries have traditionally been open-access. Fieldwork was conducted in June and July 2004, and consisted predominantly of interviews with community members and external stakeholders. An institutional analysis research framework was used to characterize components of the fishery and to assess current management performance. Since this fishery is fairly typical, broader conclusions can be drawn about fishery co-management for Cambodia in general.

Section 2 of this paper describes the context of the research, detailing the background and management of Cambodian fisheries and the case study community fishery. Section 3 provides an over-view of the research methods used. Section 4 discusses co-management performance and the reasons behind current outcomes. Policy implications and recommendations for improving fisheries co-management in Cambodia are discussed in section 5, and the conclusions are presented in section 6.

Inland fisheries represent one of Cambodia's most valuable natural resources. In total, the annual yield from inland capture fisheries is estimated to be at least 300,000–400,000 tonnes, with an estimated value of US\$150–200 million (Degen et al. 2000). The importance of fisheries is probably underestimated by the official statistics, as they exclude subsistence production. Furthermore, it has been suggested that actual production is much higher (estimates ranging from 2.6 to 21 times higher) than official statistics suggest (Coates 2002); if correct, this would make the fisheries even more important. Regardless of the exact value, it is evident that freshwater capture fisheries make a major contribution to national food security and social and economic wellbeing. Many Cambodians, particularly the rural poor, rely heavily for their nutrition and livelihood on fisheries. On average, fresh and processed fish make up 75% of the dietary animal protein intake in Cambodia (Helmers and Kenefick 1999, cited in Degen et al. 2000), though this proportion is likely to be significantly higher in fishing-dependent communities (Ahmed et al. 1998). Inland fisheries in Cambodia are principally dependant on the Mekong River system, and are located along the Mekong, Sekong, Basac and Tonle Sap rivers and tributaries, and the Tonle Sap Lake. While commercial fishers operate on the Lake and in downstream areas, only subsistence fishers are supported by the small-scale fisheries in the upstream portion of the Mekong River.

Partly as a result of the annual flood pulse in the Mekong River, the Mekong River Basin has extremely high productivity and freshwater fauna diversity. Over 1200 fish species have been recorded (Sverdrup-Jensen 2002), around 120 of which are commercially traded (Coates et al. 2003). Water flow within the Mekong River Basin shows extreme variation throughout the year, reflecting the wide fluctuations in rainfall between the monsoon season (May to October) and other times of the year. At peak flow, in August and September, the river carries around 30 times as much water as it does in March and April; this results in an inundation of floodplain forests. Most significantly, a fast rise in water volume in the Mekong causes the Tonle Sap River (which usually flows from the great lake into the Mekong) to reverse its flow, expanding the area of the lake by 4–6 times (van Zalinge et al. 1999). Flooding is associated with the seasonal migration of fish between dry-season habitats and spawning grounds (permanent channels and deep pools), and wet-season feeding grounds (floodplain forest). Additionally, many Mekong fish species make extensive longitudinal migrations between upland spawning grounds in Northern Cambodia/Lao and feeding grounds in the lowland floodplains.

Numerous natural deep-water pools in upstream sections of the Mekong River have been recognized as extremely important to the ecology and life-cycles of both migratory and non-migratory fish species (Poulsen et al. 2002, Baird et al. 2001, Chea and Sean 2000), and there are known to be at least 100 deep pools in the Cambodian section of the river (Poulsen et al. 2002). Wide fluctuations in water levels in the Mekong River mean that dry-season refuges provide particularly important protection from predators, and cooler areas of water during the hottest months (Baird 2004). Deep pools are also used as spawning sites for many migratory species, the larvae and juveniles of which move downstream to floodplain areas in southern Cambodia and Vietnam and into the Tonle Sap Lake (Poulsen et al. 2002). They may thereby play a critical role in sustaining much of the country's inland fisheries. Furthermore, there is some suggestion that protection of deep pools in the Mekong mainstream may increase stocks of certain fish species (Baird 1999).

Exploitation of fish stocks is increasing, due mainly to population growth and increasing dependence on fisheries. Although overall catch in the Tonle Sap area is probably still increasing over time, individual catches have fallen (van Zalinge 2003, MRC 2003). Importantly, catch composition is changing, with a decline in larger, slower-growing (and economically very important) species, but little change in smaller early-spawning species. Change in catch composition such as this is a classic indicator of a fishery under heavy exploitation, and there is some indication that selective over-fishing of slower-growing species (the 'fishing-down' process) is occurring (MRC 2003).

The use of illegal fishing gear, such as electro-fishing, fishing with explosives (dynamite fishing) and with insecticide poison, has been fairly widespread and poorly monitored. Illegal fishing has been particularly widespread in Stung Treng province; estimates suggest there were at least 8000 incidences of fishing with explosives every year between 1993 and 1997 (Try 2003). Illegal fishing methods produce extremely high catches (respondents interviewed in this research reported that electro-fishing typically yields 30–40 kg/day), thereby increasing pressure on the fishery, and potential pressure on the ecosystem, including disruption of spawning and pollution. The use of illegal nets, including large mesh nets and mosquito nets, can also damage fish stocks by targeting the largest (mega-spawning) and smallest (pre-recruit) fish in the fishery (Chea 1999). Additionally, exploitation of critical habitats such as deep pools can have a disproportionate impact on the fishery, and there is some concern

that fishing in deep pools is contributing to stock depletion. In acting as dry season habitats and spawning grounds, deep pools constitute highly productive but vulnerable areas, particularly in the dry season.

Loss of floodplain forest, due mainly to agricultural expansion and illegal logging, has reduced the area of wet season lakes, thereby decreasing the potential for fish production. The main reasons behind this loss of habitat and deforestation are an increasing population, weak land tenure and a lack of alternative employment opportunities (van Zalinge et al. 1999). Similarly, upstream developments, such as dams and water abstractions, have reduced water levels in the Mekong and, therefore, the potential for fish production. The construction of dams and reservoirs along the Mekong has also led to fragmentation of aquatic habitats and obstruction of migration routes.

Management of fisheries in Cambodia

Management of all fisheries in Cambodia is the responsibility of the Ministry of Agriculture, Forestry and Fisheries (MAFF), administered through the Department of Fisheries (DOF). Within the DOF, the community fisheries development office (CFDO) is responsible for facilitating the establishment of community fisheries. National fisheries policy focuses on sustaining the catch from inland fisheries, the main concern being to manage and conserve natural aquatic resources in order to supply sufficient food for all people (Sem et al. 2003).

The current primary legal framework for fisheries in Cambodia is the Fisheries-Fiat law, which classifies all permanent and temporary waterbodies as the property of the state (Gumm 2000). Under the current law, inland capture fisheries are divided into three categories—large, medium and small-scale fisheries. Large-scale fisheries (fishing lots) are differentiated from other fisheries by being limited-access and licensed. Currently, medium and family-scale fisheries are unlicensed and open-access, but differentiated by gear type and dimensions. In general, small-scale gear is used by subsistence fishers, while medium-scale gear is used by commercial operators.

In 2001, in response to growing conflict amongst stakeholders and to the food security needs of subsistence fishers, a number of reforms were made to the fisheries sector (Levinson 2002). A considerable proportion of sites reserved as fishing lots were released (in an attempt to address inequality of access to fishing grounds), and the establishment of small-

scale community fisheries, in both open-access and former ‘lot’ areas, was encouraged. The Fisheries-Fiat law is currently under revision, and a new law is awaiting ratification. The new law will define the framework for management, development and conservation of fisheries resources, with sustainable management of socioeconomic and environmental factors as a main objective (Felsing 2004). A new sub-decree that will provide the legal framework for community fisheries is also awaiting ratification. This will allow community fisheries to establish their own rules and regulations relating to seasonal and gear restrictions. Regulations must not permit activities disallowed by the national fisheries law, but can be more restrictive (Felsing 2004).

Despite the delay in approval of the sub-decree, numerous community fisheries have already been established as part of the fisheries reforms. Additionally, other initiatives introduced by NGOs before the fisheries reform program came into effect are now recognized as community fisheries by the CFDO. However, although community fisheries are officially recognized, they do not currently have any legal right to create new laws. Rather, rules created by the community fishery tend to mirror existing national laws (previously, poorly enforced), and are backed up by voluntary agreements between members.

Tblong Kla village community fishery

To investigate the success of co-management in addressing threats to sustainability, a recently established community fishery in the upstream Mekong River, Stung Treng province, was selected as a case study (see Figure 1). Within Stung Treng province there are currently 51 community fisheries, all supported by an NGO partner. Community fisheries were first set up in the province in 1998, and consequently are at a more advanced stage of implementation than those in many other areas. The community fishery of Tblong Kla village was selected as a case study because it was of a size and nature to represent co-management arrangements in riverine small-scale fisheries.¹ Tblong Kla village is located in Ou Mreah commune, Siem Bouk district, approximately 55 km south of the provincial capital town Stung Treng. Interviews were conducted with a number of village members, key people, and external stakeholders in order to gain an understanding of the interaction between the community and the fishery. The research method used is detailed in section 3.

¹ The WorldFish Center is currently conducting research at a number of sites in Cambodia—Siem Reap, Stung Treng and Takeo provinces—where co-management is being introduced under the project ‘Aquatic Resources Valuation and Policies for Poverty Elimination in the Lower Mekong Basin’.

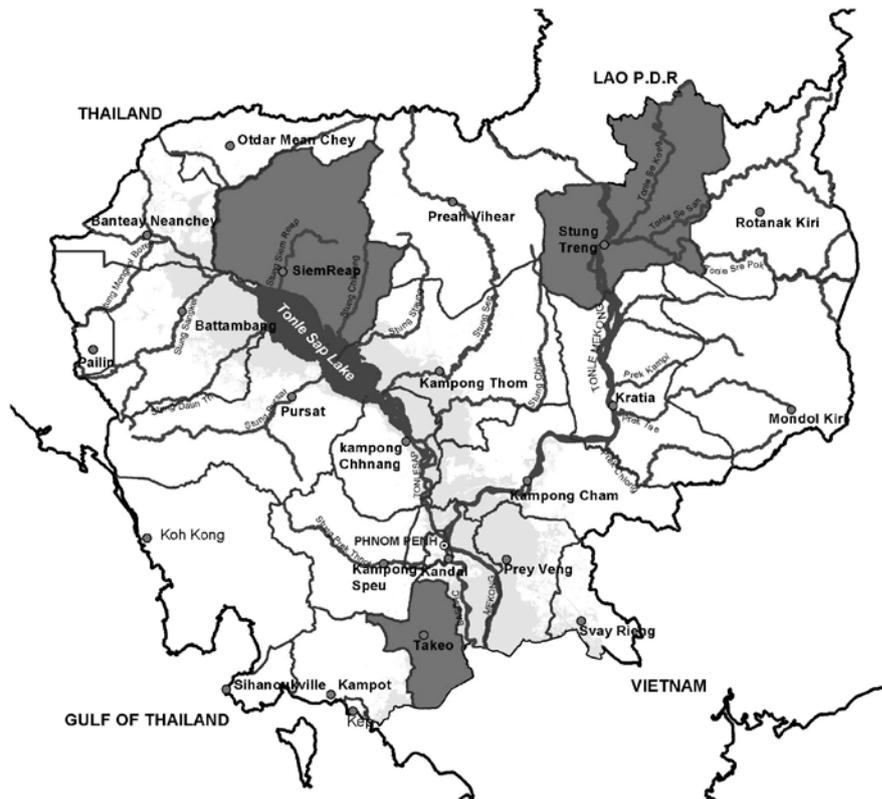


Figure 1. Map of Cambodia

The village is made up of 138 households, with a total population of 690 people. The community is fairly homogenous in structure; all households (both rich and poor) are dependent on subsistence fishing and rice farming for livelihoods, and are of similar ethnic origin and religion. Fishing represents the main income-generating activity in the village, as distance from the provincial capital limits access to markets for the sale of other goods, such as crops.

Tblong Kla village fishery consists of a 10-km stretch of the Mekong River that borders the village. Boundaries to the fishery are defined by the administrative boundaries of the village, but are not visibly marked in any way, and are only well known to community members. Currently, access to the fishery is restricted only by gear type, and the fishery is open to all. In addition to Tblong Kla villagers, the fishery is used by inhabitants of

the three other villages making up Ou Mreah commune, and by ‘outsiders’ (fishers from outside of the commune). Generally, most fishers from Tblong Kla fish within the confines of the community fishery or commune fishing grounds, as Figure 2 illustrates.

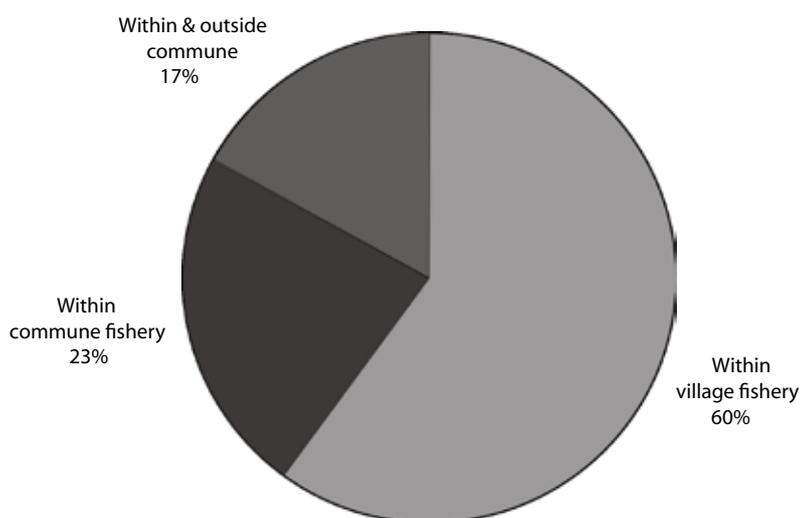


Figure 2. Proportion of households which fish within the village, commune and other areas

Source: WorldFish household survey (2004); Base: 30 respondents

Co-management was first introduced in 1998, when Oxfam Community Aid Abroad (OCAA), as part of a wider rural development project within the village, helped set up a community fishery. At the resource user level, the community fishery is represented by the community fishery committee (CFC), which provides a link between the government partner (the Provincial Office of Fisheries or POF) and the community. Rules prohibiting both illegal gear and fishing in a deep pool conservation area were created, and are jointly enforced by the community and the POF. (Although national law protecting deep pools existed previously, it was not widely known and seldom enforced.) New rules are created at meetings involving the entire community; the last such meeting took place approximately two years ago. The CFC has regular meetings with POF and OCAA representatives; these are typically held every 3-6 months.

Most fishers in the village use non-motorized boats to fish. Gill nets, cast nets and hooked long lines are used in the dry season, while bamboo traps including chan, lop and sayoeun are used in the wet season. A wide variety

Table 1. Fish species caught in the community fishery and migration patterns

Frequency 1= <i>most common</i>	Dry Season			Wet season		
	Common name	Latin name	Migration	Common name	Latin name	Migration
1	Trey Riel	<i>Cirrhinus caudimaculatus</i>	Longitudinal & lateral	Trey Riel	<i>Cirrhinus caudimaculatus</i>	Longitudinal & lateral
2	Trey Chlang	<i>Hemibagrus nemurus</i>	Lateral (to spawn)	Trey Ambong	<i>Channa micropeltes</i>	Lateral
3	Trey Kaek	<i>Morulus chrysophekadion</i>	Longitudinal & lateral (of fry)	Trey Tranel	<i>Hemibagrus filamentus</i>	Lateral
4	Trey Khya	<i>Hemibagrus wyckioides</i>	Lateral. Deep pools in dry season	Trey Chlang	<i>Hemibagrus nemurus</i>	Lateral (to spawn)
5	Trey Krai	<i>Chitala ornata</i>	Lateral (to spawn). Deep pools in dry season	Trey Khman	<i>Hampala macrolepidota</i>	Longitudinal & lateral
6	Trey Chhpin	<i>Poropuntius malcolmi</i>	Local migration to medium-sized rivers	Trey Kes	<i>Kryptopterus apogon</i>	Lateral (after spawning). Deep pools in dry season
7	Trey Tranel	<i>Hemibagrus filamentus</i>	Lateral	Trey Kahnchos	<i>Mystus singaringan</i>	Lateral
8	Trey Kes	<i>Kryptopterus apogon</i>	Lateral (after spawning)	Trey Krai	<i>Chitala ornata</i>	Lateral (to spawn). Deep pools in dry season
9	Trey Po	<i>Pangasius larnaudiei</i>	Longitudinal & lateral (to spawn)	Trey Chhpin	<i>Poropuntius malcolmi</i>	Local migration to medium-sized rivers
10	Trey Thmor	<i>Hemibagrus wyckii</i>	Non-migratory	Trey Pra	<i>Pangasius krempfi</i>	Longitudinal (downstream to spawn). Inhabits deep pools
11	Trey Chhkok	<i>Cyclocheilichthys enoplos</i>	Longitudinal (downstream to spawn) & lateral	Trey Ros	<i>Channa striata</i>	Lateral
12	Trey Klanghai	<i>Belodontichthys dinema</i>	Non-migratory	Trey Ke	<i>Pangasius conchophilus</i>	Longitudinal (upstream to spawn) & lateral
13	Trey Ke	<i>Pangasius conchophilus</i>	Longitudinal (upstream to spawn) & lateral	Trey Khya	<i>Mystus wyckioides</i>	Non-migratory
14	Trey Pra	<i>Pangasius krempfi</i>	Longitudinal (upstream to spawn). Inhabits deep pools	Trey Stuak	<i>Wallago leerii</i>	Longitudinal (downstream to spawn)

Base: 18 interviews with fishing households. Source (Latin names & migration patterns): Rainboth, 1996, FishBase 2004

of fish are caught in the fishery, although there is some seasonal variation due to the migratory nature of certain species. The species caught most commonly in the dry and wet seasons (and therefore representing the majority of catches), along with typical migration patterns are detailed in Table 1. Average catches (Table 2) vary little amongst community members, ranging between 1.3 and 2.5 kg/day, with the higher catches in the dry season (December–April), when fishers spend more time fishing and fish are easier to catch due to low water levels. Although community members all catch similar amounts, outsiders are considered to use substantially more gear and consequently obtain larger catches.

Post-harvest uses of fish catches are detailed in Figure 3 and include household consumption, sale to a commercial fish trader and processing into preserved fish sauce (*prohoc*) or paste (*praok*). Most commonly, fish catches are for household consumption, with a smaller portion being sold. However, post-harvest use is partly dependent on fish species. Trey Khya and Trey Kes are always sold fresh because they command a higher price than other species, while Trey Riel is only caught for household use, most commonly to make *prohoc*.

Table 2. Amount of fish caught per day in the dry and wet seasons^a

Catch amount	Number of households	
	Dry season (Dec-April)	Wet season (May-Nov)
0.5 kg	2	5
1 kg	2	4
1.5 kg	3	5
2 kg	3	2
3 kg	4	2
5+ kg	4	-
Average catch	2.5 kg	1.3 kg

^a Although one would generally expect estimated catch amounts reported by subsistence fishers to be over-estimated, all fish sold to the fish trader in Tblong Kla is weighed; thus, fishers have quite a good perception of catch weights. Base: 18 interviews with fishing households

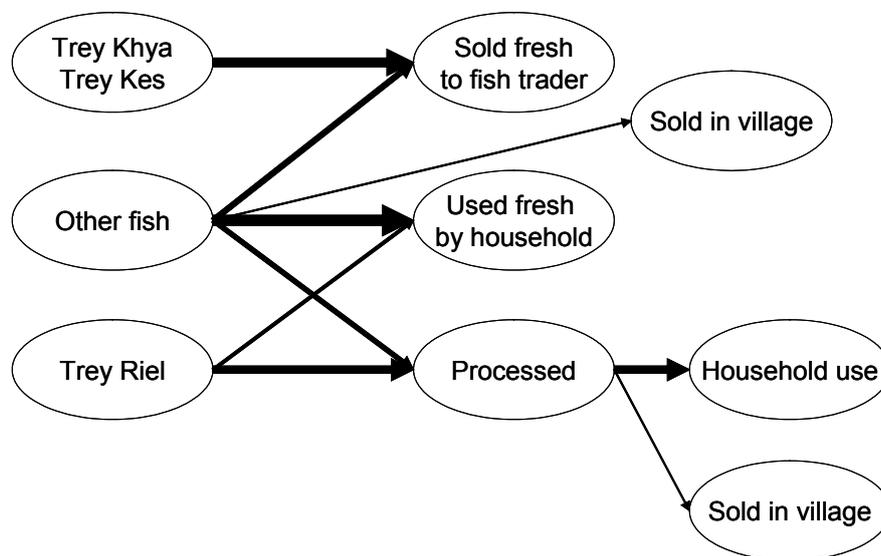


Figure 3. Post-harvest uses of fish catches: Thickness and direction of arrows indicate the relative uses of each type

Base: 18 interviews with fishing households

Having discussed inland fisheries and fisheries management in Cambodia in general, as well as the characteristics of the community and fishery of Tblong Kla village, we now turn to the methods employed in the empirical research.

Institutional analysis research framework

An institutional analysis research framework is used to identify and examine key factors affecting the organization and outcomes of co-management in the Tblong Kla community fishery. Several institutional analysis frameworks have been developed to assess co-management arrangements for natural resources (Oakerson 1992, Pomeroy and Williams 1994). The framework used in this research (Figure 4) was developed by Oakerson (1992), and adapted by the fisheries co-management research project (ICLARM IFM 1998) to specifically analyze co-management arrangements in fisheries. This framework provides a structured approach to examining and documenting the origin, current status, operation and performance of fisheries co-management arrangements, and has been used to analyze many co-management arrangements, including small-scale fisheries in Asia (Pomeroy et al. 2001). Consequently, it was considered the most appropriate tool for this empirical research.

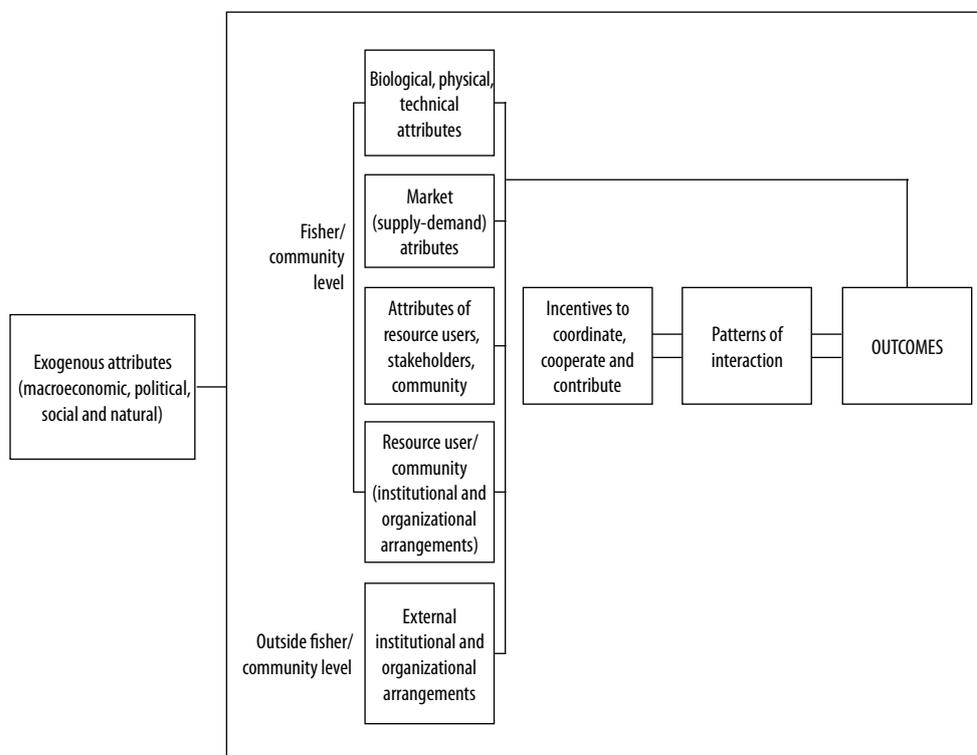


Figure 4. Institutional analysis research framework
Source: ICLARM-IFM 1998

Co-management arrangements require a certain level of cooperation and participation amongst partners; because of this, management performance is highly dependent on the actions and interactions of the resource user community and on the fishery and the institutional arrangements in place. In the context of natural resource management, institutional arrangements can be thought of as the set of rights and rules that govern the provision and appropriation of a resource by users and other stakeholders (Crawford and Ostrom 1995). The successful functioning of an institution is determined by whether or not the rules can be enforced, by the cost of enforcement and by the effectiveness of sanctions. These factors affect the incentive for individuals to behave in accordance (or discordance) with the rules. Institutional analysis provides the framework for assessment of management performance; by separating institutional arrangements from the strategies of resource users in individual decision-making situations, relationships between variables and outcomes of management can be examined (Ostrom et al. 1994).

In this research, institutional analysis was carried out at the ‘micro’ or village level. Current management performance and differences between the current (co-management) and previous (open-access) situations were assessed. The framework was used as a diagnostic tool by working backwards, starting with the outcomes of management. The patterns of interaction between variables that result in these outcomes, and the incentives shaping these actions and interactions were then examined. Research focused predominantly on the impacts of co-management on local stakeholders (subsistence fishers). Performance was assessed in terms of perceived outcomes, as this is the information available to resource users that affects their subsequent actions. Outcomes were considered both in terms of specific performance measures [efficiency (Oakerson 1992), equity and sustainability (Hanna 1995)], and the degree to which stakeholder objectives are being met.

The institutional analysis relied on both primary data collection and examination of existing data. Primary data collection consisted of qualitative in-depth interviews with individuals or small groups of community members, key people and external stakeholders. Visualization techniques commonly used in participatory rural appraisal (PRA) or rapid rural appraisal (RRA), including wealth-ranking, mapping and matrix-scoring, were used in interviews with community members [see Chambers (1997) for a discussion of these techniques]. Direct observation was used to collect additional information and, where appropriate, to verify information

provided in interviews. In total, 27 interviews were conducted with community members (including village and commune council members, the community fishery committee, fishing households and fish traders), and a number of discussions were held with external stakeholders (DOF, POF and OCAA staff). Data reviewed included internal reports and policy documents compiled by the Cambodian government, international NGOs and governmental donors (including WorldFish, Mekong Research Commission, Oxfam and DFID), in addition to published data.

The term co-management encompasses a wide range of possible decision-making arrangements; these can be classified in a number of ways. The type of co-management regime in place is determined by the aspirations and capabilities of co-management partners, and the most appropriate type of arrangement depends on the specific characteristics of an individual fishery (Sen and Nielsen 1996). Types of co-management developed by Sen and Nielsen (1996) (instructive, consultative, co-operative, advisory, and informative) were used to identify the type of co-management arrangement in place in the Tblong Kla community fishery. Although classifying a co-management arrangement as one specific ‘type’ is somewhat artificial (different management tasks may be classified as different types) and static (co-management evolves over time and is likely to change), it does provide a clear snapshot of the regime in place, sets it in the context of other co-management arrangements, and helps to determine its appropriateness to the fishery.

Conditions for successful co-management

An institution that manages a common pool resource (CPR) is generally regarded as successful if its operation is defined as being efficient, equitable and sustainable (although there are various ways of interpreting whether these outcomes are met), or more simply, as ‘durable’ (Agrawal 2001). Significant research has been conducted to identify the types of institutions able to manage CPRs successfully. Ostrom was one of the first researchers to identify the characteristics of robust, long-enduring institutions managing CPRs (Ostrom 1990), although several authors, including Wade (1988) and Baland and Platteau (1996), have identified key conditions, and, to date, at least 30 different conditions have been identified (Agrawal 2001).

In any given situation, successful management will depend on characteristics of the resource and of the resource user (Dietz et al. 2002), and no one design will ensure the success of all types of CPR (Stern et al. 2002). Key conditions for successful co-management of fisheries in Asia have been identified from an analysis of many case studies (Pomeroy et al. 2001). Many of the conditions reflect similarities with design principles illustrated by long-enduring CPR institutions (Ostrom 1990) and characteristics encouraging the establishment of institutions to manage CPRs (Ostrom 1992). While successful co-management does not always require all conditions to be satisfied, generally, the greater number of conditions that are met, the greater the chance of co-management success (Pomeroy et al. 2001).

Conditions affecting the success of co-management apply at three different levels the supra-community, community and individual levels (Pomeroy et al. 2001). At the supra-community level, key success factors are the existence of enabling policy that defines use rights to the fishery, and of an external agent of change to initiate the co-management process. At the community level, boundaries, user group membership, property rights, and management objectives all need to be clearly defined, while local leadership, government support, community participation and sustained financial resources are considered essential to success. Finally, at the individual level, there need to be incentives for participants to weigh costs against benefits.

The conditions were identified in the context of Asian fisheries (both coastal and inland), and many were found to be relevant to small-scale fisheries in Cambodia. In this research, the conditions were used to identify constraints to co-management performance in the Tblong Kla community fishery, and thus to explain current success (or lack of success), and to direct policy recommendations. The presence and absence of 'success conditions', along with current outcomes of management and the type of co-management arrangement in place, are discussed in the following section.

Characteristics of the fishery and resource user community

The Tblong Kla village community fishery is located on the Mekong mainstream and is used by all members of the village, and by fishers from neighboring villages in the commune as well as outsider fishers. All fishers use similar small-scale gear (cast and gill nets, long lines and traditional bamboo traps). Production from the fishery consists of multi-species mixed catches, and, on average, fishers catch 1.3-2.5 kg/day, with higher amounts in the dry season. Most of the species caught in the fishery undertake longitudinal and/or lateral migrations.

Tblong Kla village is small and homogenous, with a high dependence on fishing. All households have dual livelihood strategies, farming rice for household consumption, and subsistence fishing. Sale of fresh fish to a commercial trader based in the provincial capital represents the main source of household income, as there is restricted access to market for other goods.

Institutional arrangements

The community fishery represents a management partnership between the community and the POF supported by the NGO (Oxfam Community Aid Abroad). Within the community, the organization is represented by the community fishery committee (CFC), which consists of five elected community members. The CFC meets regularly with the POF and OCAA; meetings involving the entire community are less frequent.

The rules of the community fishery prohibit fishing with ‘illegal’ gear (including electro-fishing, bombing and large mesh nets), and any fishing within the deep pool conservation zone. Sanctions for breaking this rule are gear confiscation and fines for illegal gear use (imposed by the POF), and verbal warnings for fishing in the deep pool. All members of the community are responsible for monitoring, while enforcement is the responsibility of the CFC, commune leader and police, and POF.

External institutional arrangements

Management of all fisheries in Cambodia is the responsibility of the MAFF, through the DOF. The DOF operates from a central base and through provisional offices (located in all provincial capitals) and district fisheries officers. Within the DOF, the community fisheries development office (CFDO) is responsible for facilitating the establishment of community

fisheries. Currently, community fisheries are officially recognized by the POF and DOF, but do not have any legal right to create new laws. Therefore, rules created by the community fishery mirror existing national fisheries law (such as the prohibition of illegal fishing gear) and may be reinforced by voluntary agreements amongst members (such as not fishing in the deep pool conservation zone).

Outcomes of co-management

Outcomes of co-management are assessed in terms of the degree to which management objectives are met, as well as in terms of specific performance indicators (equity, efficiency and sustainability). It should be mentioned that here we focus predominantly on perceived, rather than actual, management performance, and thus the assessment is somewhat subjective.

Degree to which management objectives are being met

The main management objectives for community members, the CFC and the POF (defined in Table 3) are to conserve fish stocks and maintain consistent catches by limiting fishing effort; to control the use of illegal gear and; to protect fish spawning grounds. However, management objectives for community members also include increasing future catches and restricting outsiders from the fishery. The main objectives for OCAA are food security for community members and empowerment of the community to manage the fishery.

Based on community members' and external stakeholders' perceptions of management performance (Table 4), it appears that currently some, but not all, management objectives are being met. First, the community fishery has caused a significant decrease in illegal fishing. Awareness and understanding of stock conservation and the role of the deep pool has also been raised, and capacity-building has gone some way to empowering community members to manage the fishery. However, all those interviewed reported a decrease in individual fish catches over the last five years (since the creation of the community fishery), and an increase in the number of fishers, particularly outsiders, using the fishery. Additionally, fish spawning grounds (i.e., the deep pool) are not effectively protected, as fishing in the deep pool is believed to occur quite frequently. As a result, food and income security is currently not being achieved, and while community members can *generally* catch sufficient fish for daily household consumption, there is little certainty that this will continue in the future. Catches are also somewhat uncertain

Table 3. Stakeholder objectives

Stakeholder	Objectives for community fishery (Number of households mentioning each objective)
Community members	Limit amount of gear used in the fishery (11)* Fish conservation and protection of fish stock (10) Control illegal fishing (9) Increase fish catches in future (8) Control outside fishers (5) Protect deep pool and fish breeding grounds (4) Protect endangered fish species (3)
Community Fishery Committee	Control illegal fishing Achieve sustainable fishing Protect fish breeding grounds and endangered fish species
Provincial Fisheries Office	Conserve and increase fish stock to achieve sustainable production Decrease occurrence and improve monitoring of illegal fishing Ban fishing in deep pools Limit fishing effort by limiting amount and size of gear Enable the community to manage the fishery and control fishing Raise awareness and understanding of conservation
Oxfam Community Aid Abroad	Food security: ensure all community members can catch sufficient fish for household consumption Empowerment: ensure all community members have an equal and effective say in management decisions

Base (community members' responses): 27 interviews with fishing households, fish traders and other key people

Table 4. Stakeholder perceptions of community fishery achievements

Stakeholder	Achievements of the community fishery (Number of households mentioning each achievement)
Community members	Decreased illegal fishing (still some electro-fishing) (15)* Raised awareness about fish conservation (10) Brought people in community together (6) Raised awareness about fishing law and management (5) Few benefits for community (4)
Community Fishery Committee	Decreased illegal fishing Defined conservation area Trained committee in management Raised awareness of community fishery organization in community Defined gear restrictions (though rules not yet in use)
Provincial Fisheries Office	Decreased illegal fishing Decreased fishing in deep pools
Oxfam Community Aid Abroad	Decreased illegal fishing Created community fishery rules Built capacity within community and committee Not possible to increase fish stocks until community has greater power to control illegal fishing completely and regulate access to community fishery

Base (community members' responses): 27 interviews with fishing households, fish traders and other key people

(fishers may catch nothing on some days), and not all households catch a sufficient amount to regularly process fish and thereby create the preserved stores of fish needed for food security. Although community members generally believe the community fishery will help conserve fish stocks for the future, current stock status is unknown and so it is not possible to determine whether the objective of conserving fish stocks is being met to any extent.

Performance measures

Table 5. Stakeholder perceptions of rule compliance

Rules	Perceived level of compliance and reasons
Community member perceptions <i>Illegal fishing</i>	<p><i>Most community members comply</i> See link between decreasing fish production and illegal fishing Afraid of being caught and fined Own no illegal gear <i>Some outsiders do not comply</i> 'Powerful' individuals – bribe/intimidate CFC and POF Want to catch as much fish as possible (not concerned with stock conservation)</p>
<i>Fishing in deep pool</i>	<p><i>Some community members comply with rule</i> Follow regulations Pool too deep to use nets/traps Want to protect dolphins (sacred) <i>Some community members do not comply</i> Good place to catch big fish Know they can get away with it (no sanctions) Few other places to fish during dry season If they see others fishing in deep pool likely to join them <i>Outsiders do not comply</i> Don't see reason to comply Want to catch as much fish as possible (not concerned with stock conservation) Not aware of regulations</p>
Community Fishery Committee perceptions <i>Illegal fishing</i>	<p>Ten outsiders given warnings for using illegal gear (large mesh nets) since community fishery creation Three outsider boats known to use illegal fishing gear still fishing in area</p>
<i>Fishing in deep pool</i>	<p>No community members <i>caught</i> fishing within deep pool conservation area Few outsiders caught and cautioned</p>
Provincial Fisheries Office perceptions <i>Illegal fishing</i>	<p>Still some electro-fishing and use of large mesh nets by outsiders Still some stream-blocking and use of large mesh nets by community members</p>
<i>Fishing in deep pool</i>	<p>Some fishing in the deep pool by outsiders and community members Community members make voluntary agreements to abide by regulations Outsiders may not even be aware of regulations</p>

Based on the perceptions of community members and on direct observations at the study site, it is possible to draw some broad conclusions in terms of performance measures.² First, management is more equitable as a result of co-management; this is demonstrated by increased community participation, understanding and empowerment. Furthermore, management is also providing a better stewardship role, as illegal fishing has decreased. It is unclear, however, whether or not co-management has increased sustainability of the fishery. Local fishers perceive that catches have declined over recent years and have remained low despite the co-management initiative. However, comparative data suggest that the total yield achieved in the fishery is high; they do not support the perception that productive capacity has been degraded (Cookson 2004). Likewise, analysis of the catch size (i.e., fish length measurement) of key species indicates that only the largest-sized species are likely to be overfished. Hence, there is little evidence that current exploitation levels are unsustainable, nor that co-management has positively affected the status of the resource.

Patterns of interaction

Interactions between resource users and the fishery, reflected in rule compliance and enforcement, influence the co-management process.

Currently, there is fairly low compliance with the rule prohibiting fishing in the deep pool, but high compliance with the rule banning illegal fishing gear (Table 5). Illegal electro-fishing occurs at low levels, carried out by a few outsiders and ‘powerful’ individuals (who are considered to escape punishment by fishing at night or through the use of bribes and intimidation), but overall the rule is quite well enforced. Likewise, illegal large mesh nets are used to a small extent, mainly by outsiders, and often in the deep pool area. In contrast, enforcement of the ban on fishing in the deep pool is low; few sanctions have been issued and there is little active monitoring by community members.

Community cooperation with and contribution to co-management is quite low. Although the community fishery committee holds regular meetings with external stakeholders, meetings about the fishery that involve the entire community are infrequent (the last being held two years ago). Additionally, there is little active monitoring of fishing in the deep pool by community members.

² Outcomes of management are considered in terms of equity, efficiency and sustainability, although it should be noted that assessing performance on these indicators is highly subjective and open to wide interpretation.

Incentives to comply and cooperate with co-management

Use of illegal fishing gear

Fishing with illegal gear, such as electro-fishing, yields much larger catches than does legal gear (30–40 kg/day in comparison with 1.3–2.5 kg/day); there is, therefore, a strong incentive for its use. However, electro-fishing is considered unacceptable by community members because it is perceived to have depleted fish stocks in the past, resulting in low current catches. Community members feel some sense of ownership towards the fishery and believe that it is in their interest to secure future stock levels. There is an understanding that fish stocks need to ‘recover’ and that catch amounts should be limited. Consequently, electro-fishing is not used by community members and is closely monitored. Some fishers report that any community member known to use illegal gear is shunned by other villagers. Additionally, electro-fishing gear is very expensive, making it out of the reach of almost all villagers, and therefore not an option.

Within the community, it is generally recognized that large mesh nets are particularly harmful to fish stocks because they target larger, spawning fish. Preservation of spawning fish was generally considered to be one of the most important ways of maintaining fish stocks; because of this, most community members see an incentive to follow the rule banning large mesh nets, and their use is highly monitored. However, while it is recognized that spawning fish should be preserved to help maintain stocks, they are also a highly prized and valuable product of the fishery.

Fishing in the deep pool

The deep pool is recognized as an important spawning ground and dry season refuge, and there is some belief that protecting the deep pool will lead to an increase in fish productivity. Fishing in the deep pool is very easy to monitor, as the area is highly visible and located close to the village centre. Therefore, high rule compliance might be expected. However, the deep pool is considered to be one of the most productive areas in the community fishery. Several fishermen stated that they find it quite difficult to catch fish in other areas and, consequently, have no choice but to fish in the deep pool, in order to catch sufficient amounts. Additionally, individuals are reluctant to give up fishing in the deep pool while others continue to do so.

Compliance with future rules

While the current operational rules of the community fishery do not limit access or the amount of gear used, these issues are covered in proposed future rules. A number of incentives exist for community members, but not outsiders, to comply with and participate in enforcement of these rules. First, community members all use a similar amount of fishing gear, which generally allows them to catch enough for subsistence consumption plus a little extra income. Any gear restriction would therefore have a small and fairly uniform impact on all community members. However, outsiders (according to community members' perceptions) tend to use more gear (in addition to fishing for longer) and consequently catch more fish. Secondly, although the community fishery is open-access, community members feel they have more 'right' to fish there than outsiders. Conversely, outsiders do not have any 'ownership' of the fishery, and see little incentive to limit current fishing effort to protect future stock. Rather, it is in their interest to maximize catches in the short term.

Co-operating with the co-management process

Currently, there are few incentives for community members to participate with and contribute to the community fishery. Community members are reluctant to invest time and effort in it because they see no tangible benefits. They recognize that illegal fishing has decreased—and many attribute this to the establishment of the community fishery—but they note that, despite this, individual catches have declined over time. Consequently, they perceive few benefits from co-management because it is not yet achieving one of their main objectives—that is, increased or sustained catches.

One of the main incentives for the government to engage in co-management is that it delivers a means of improving compliance with fishing regulations, and, thereby, achieving sustainable productivity in the fishery. Prior to the development of the community fishery, levels of compliance were very poor; there were high levels of illegal fishing and minimal awareness or enforcement of the ban on fishing in the deep pool. The community fishery potentially offers the government a low-cost and effective means of improving compliance with both rules, although currently only compliance with the ban on illegal gear is being achieved. The community fishery is also supported by an external NGO donor (OCAA), which further reduces the requirement for government funding.

Type of co-management arrangement in place

In terms of the five types of co-management proposed by Sen and Nielsen (1996), the co-management arrangement in Tblong Kla village community fishery is best described as co-operative, although the type varies with tasks, as Table 6 shows. Co-management becomes less resource-user based, the higher the level of decision-making. Local users have quite a lot of responsibility for management decisions at the operational level. Management tasks, including resource estimation, monitoring, control and enforcement, are jointly undertaken by resource users and the POF, and operational rules are jointly developed by both. The original planning process for co-management can also be considered to have been co-operative, as both partners played a role in the decision to create the community fishery, a process that was coordinated by an NGO acting as an intermediary between community and government partners. However, at higher decision-making levels (e.g. policy formulation), management decisions are primarily the responsibility of the government, with little input from resource users. At this level, co-management can be considered as instructive. Similarly, in the wider context, implementation of co-management in Cambodia could be more accurately described as consultative or instructive. The development of community fisheries is being promoted by central government (as part of new fisheries policy aimed at improving food security for the rural poor) in a top-down approach. Although resource users have some say in whether or not to start a community fishery organization, they do not play an equal co-operative role in co-management design or implementation.

Currently, the capabilities and aspirations of the community are conducive to co-operative co-management; an established community-based user group promotes empowerment of resource users and participation in the management process. However, lack of boundaries and lack of control over access limit the role resource users can effectively play in certain management activities (e.g. resource users do not have responsibility for controlling the level of exploitation in the fishery), and prevents more

Table 6. Types of co-management arrangement in place for different management tasks

Management task	Type of co-management arrangement
Operational level tasks	Co-operative
Rule creation	Co-operative/consultative
Planning and implementation	Consultative/instructive
Co-management design	Instructive

resource user involvement in co-management. Additionally, the current political and social environment is not conducive to the domination of resource users in fishery management, although capacity-building efforts by OCAA have been attempting to change this. Traditionally, governance in Cambodia has been fairly authoritarian, and individuals are unaccustomed to having much say in the management of natural resources. State administration is highly bureaucratic, following a hierarchy of national, provincial, district, commune and village levels in management decision-making and implementation.

Based on this assessment, the type of management regime currently in place (cooperative co-management) seems to be the most appropriate given the physical features of the fishery and the capabilities of the resource users. However, this may (and indeed should) change as constraints to management are addressed, as greater control is devolved to the community and as capacity-building efforts, led by OCAA, increase the capabilities and confidence of community members in managing the resource. Factors affecting the direction of change are further discussed in section 5.

Presence of co-management success conditions

A number of the factors identified by Pomeroy et al. (2001) as promoting successful co-management were found to be present in the Tblong Kla community fishery (Table 7). Importantly, there is evidence of an external agent of change, long-term government support, and incentives for individuals to participate in the process. However, this assessment also revealed that many other conditions are absent or only partially present. As a result, co-management performance is limited.

Conditions promoting co-management

First, the community fishery was initiated and is supported by an NGO partner (OCAA), which can be considered an ‘external agent of change’. OCAA helped the community define the problem (high levels of illegal fishing and declining individual catches), and provided ideas for a solution (creation of the community fishery). OCAA further assists the co-management process with awareness-raising and management training in the community, and with support to the government partner in the form of training and funding for POF staff. While OCAA provides support to enable the community to make decisions (e.g. rule creation), it does not directly

Table 7. Presence of co-management 'success conditions' in the Tblong Kla community fishery

	Condition	Present	Current status
1	Enabling policy and legislation	No	Community Fishery sub-decree not yet passed.
2	External agent of change	Yes	NGO very much involved.
3	Appropriate scale and defined boundaries	No	Scale doesn't represent ecosystem and boundaries poorly defined. No exclusion or clear rights of ownership.
4	Clearly defined membership	No	Members of community living in village included but other users of resource not included.
5	Group homogeneity	To some extent	High level of homogeneity between community members (and members of other villages within commune). Community members and outside fishers less homogeneous.
6	Participation by all affected in management decisions	No	All community members participate but other users of resource not included.
7	Appropriate local leadership	Yes	Elected committee of community members.
8	Empowerment, capacity-building and social preparation	To some extent	NGO support to increase capacity and community participation, but empowerment limited as little transfer of power to community.
9	Community organization	Yes	Active community fishery committee.
10	Long-term support of local government	Yes	POF involvement and support.
11	Property rights over the resource	No	Officially state property but effectively open-access.
12	Adequate and sustained financial resources	No	Currently funded by NGO (no sustained funding).
13	Community ownership of co-management process	Yes	But quite weak (considered to 'belong' to CFC and NGO).
14	Accountability	Yes	Committee members elected by community, and process regularly evaluated by NGO.
15	Conflict management mechanism	No	Conflicts between users rare, but no distinct management mechanism.
16	Clear objectives	Yes	Clear, but not all objectives are realistic, and different stakeholders have different objectives.
17	Enforcement of management rules	To some extent	Rule prohibiting fishing in deep pool poorly enforced. Prohibition of illegal fishing better enforced.
18	Individual incentive structure	Yes	Incentives for government and resource users to participate in co-management exist.

Source: Pomeroy et al. (2001)

participate, and can therefore be considered to fulfill the role of ‘catalyst’, rather than co-management partner.

Secondly, there is some evidence of fairly long-standing cooperation between government and local co-management partners. This is demonstrated by the fact that monitoring is undertaken by community members, rule-breakers are apprehended by the CFC and commune police, and sanctions are issued by POF staff. Additionally, the community should (in theory) receive 50% of fines collected by the POF from fishers caught using illegal gear within the community fishery. This would, in theory, encourage further cooperation and responsibility-sharing between partners, and provide an additional incentive for the community to participate in law enforcement. However, members of the community do not have any power to directly enforce rules of the community fishery, and reliance on government authorities undermines the perceived power of the organization to some extent. Additionally, this enforcement structure could be viewed as a continuation of top-down management with community-based monitoring, rather than true co-operative co-management.

Thirdly, an incentive structure encouraging individual co-management partners to participate exists to some extent. At the community level, a number of incentives exist. These include lack of property rights and representation, declining individual catches and the fact that the catches of community members are smaller than those of outsiders and illegal fishers. Additionally, poverty, high dependence on fishing, and lack of opportunities to leave the village, both currently and in the future, are incentives to manage the fishery in a more sustainable manner.

Co-management has been endorsed and is actively promoted by central government, and current fishing policy (e.g. the government’s 10-year plan) promotes community fisheries as a key management tool. Therefore, the government has a strong incentive for co-management to succeed in community fisheries, and is likely to support the process. Incentives for government to take part in co-management include the threat of overexploitation and unsustainability in the fishery, poor levels of compliance with regulations, and the lack of resources for monitoring, control and enforcement under top-down management. The promotion of co-management by an external donor offers a further incentive for government participation in the process.

Other conditions that promote co-management include the presence of an accountability mechanism, local leadership and a community organization. In terms of accountability, the co-management process is monitored to some extent by the involvement of OCAA, which conducts regular project evaluations. Although the NGO cannot be considered to be completely neutral (in initiating and supporting the community fishery they have a vested interest in its success), it is unlikely to be influenced by corruptive forces. Additionally, OCAA remains somewhat external to the co-management process because it does not participate or greatly influence actual management decisions. However, currently, there is no legal documentation of accountability (such as a management plan or agreement) within the CFC or between co-management partners.

Local leadership is represented quite clearly by the CFC, which is made up of elected community members. The CFC appears to fulfill its intended role of providing direction and assuming responsibility for initial implementation of co-management. Leadership skills have been developed through capacity-building initiatives led by OCAA. Likewise, the CFC clearly represents a community organization that is formally recognized by way of its registration with the POF. In theory, the community fishery has the potential to influence the direction of local policy and decision-making, demonstrated by the decision to actively protect the deep pool by the creation of a conservation zone. In the future (under the community fisheries sub-decree), community fisheries should have some power to impose gear, temporal and spatial restrictions in the form of locally created bylaws (which will be subject to approval by the POF).

Constraints to successful co-management

Most importantly, property rights to the fishery are not clearly defined or assigned to resource users.³ The fishery is still under open-access management and, crucially, local resource users have no greater right to the resource than outsiders. As Pomeroy et al. (2001) state, without property rights it is difficult to greatly change user attitude and behavior towards conservation. Villagers perceive catches to be declining over time and understand that limiting fishing effort could lead to a recovery in stocks.

³ There are examples of successful co-management arrangements occurring within the context of all types of property rights regimes, including state property (Jentoft et al. 1998). However, management rights have generally been delegated to the defined resource-user group, which then has the power to limit access to the resource.

However, there has been little change in behavior since creation of the community fishery. This is because community members are reluctant to decrease their own fishing effort unless other users (including outsiders) decrease theirs.

All inhabitants of Tblong Kla village have similar rights to fish in the fishery and to participate in management decisions. However, other fishers (members of other villages in the commune and outsiders) are not included as members of the community fishery. Additionally, there is little homogeneity between community members and outsiders. These latter come from other areas, have greater reliance on fishing, and appear to fish more intensively.

Another crucial factor limiting management success is the lack of relevant enabling legislation. Currently, the community fishery can create rules, but the scope is limited to gear restrictions and no-take areas, and it has no power to control access. Rules created by the community fishery depend on the POF or other institutions, such as the commune police, for enforcement. Consequently, there is little transfer of power to resource users. The future community fishery sub-decree will recognize community fisheries as legitimate institutions with rights to manage the resource; this may raise the Tblong Kla community fishery's profile and lead to better enforcement of management rules.

Although management objectives for the fishery have been clearly defined, there are two main problems. First, different stakeholders have slightly different objectives for the community fishery. The objectives of OCAA concentrate on food security, the POF is primarily concerned with controlling illegal fishing and making the fishery sustainable, while community members aim to sustain or increase individual catches. While objectives are broadly similar, they do not appear to have been developed jointly. Additionally, objectives such as increasing fish production are not easily attainable under current management and exploitation levels. Unattainable objectives risk leading to disillusionment and lack of ownership in the co-management process.

Another constraint to management relates to the physical boundaries to the resource (which are indistinct) and the scale (which is not very appropriate). Furthermore, the most appropriate scale varies with ecosystem and management boundaries. The physical characteristics of the fishery do not lend themselves well to a small-scale co-management arrangement. For

example, while physical boundaries to a riverine fishery can be defined in theory, it is difficult to do so in practice. Perhaps more importantly, the community fishery does not reflect a natural ecosystem; it is not a discrete waterbody, but a small portion of the Mekong mainstream, and fish are in no way restricted by its boundaries. At least half of the predominant species undertake longitudinal migrations, and therefore the fishery represents only one seasonal habitat. Attempts to conserve fish by limiting effort within the community fishery are unlikely to be effective if there are no similar controls in the local and (for migratory species) wider area.

Additionally, although the community fishery is currently funded by an NGO, there are no sustained financial resources to support future management and enforcement. Community members have not made any financial investment in the community fishery, and the only potential funding from the POF (50% of fines collected for illegal gear use in the community fishery) represents a fairly unreliable source of income.

Overall, the sense of ownership of the community fishery is quite low amongst community members, and this probably also hinders the co-management process (e.g. it results in minimal monitoring of fishing in the deep pool). One reason for the lack of 'ownership' amongst community members may be that objectives for the community fishery were not jointly developed by all stakeholders. Additionally, corruption within the fishery (use of illegal gear by individuals in positions of power, fish trading during the closed season, and obstruction of law enforcement through intimidation or bribery) undermines the co-management process, and makes the establishment of trusting relationships more difficult.

Finally, there is no specific arrangement for the management of conflict within the fishery (although conflict management mechanisms exist within the community generally). This is not currently seen as a constraint to the co-management process as, due to the relative lack of activity and enforcement within the community fishery to date, few conflicts have occurred, and there has consequently been little need for a conflict resolution mechanism.

Having discussed the type of co-management arrangement in place, the current outcomes of management, and factors constraining success in management in the Tblong Kla community fishery, we turn now to the wider implications of these results for development of co-management in Cambodia.

Overall, this assessment suggests that co-management is not currently functioning very successfully. Most importantly, introduction of co-management does not appear to have improved sustainability or productivity in the fishery. However, not all outcomes are negative; co-management is achieving some of its objectives, including improved equity and community empowerment. Additionally, co-management is still being implemented and it may be premature to judge management performance as failing at this stage. Nonetheless, several important constraints limiting the success of co-management have been identified, and these apply generally to co-management in Cambodian fisheries. They include lack of boundaries and lack of access control, poorly defined property rights, lack of enabling legislation, and somewhat unrealistic objectives. They are not easy issues to address, but a number of measures could be initiated to improve management performance.

Improving management in community fisheries

Access boundaries and property rights

The community fisheries sub-decree will provide the enabling legal framework for co-management, thereby giving local resource users some rights to manage fisheries. However, as previously discussed, these rights are likely to be limited, and will do little to address the lack of resource boundaries. Assigning property rights to a defined group of users (such as, the community members in Tblong Kla village) would be one way to define access boundaries to the resource and to increase ownership and legitimacy of community fisheries. Alternatively, greater control of management rights (including access right) could be transferred to the community. However, either move raises the question of equity—whether or not it is fair to let one group of resource users have exclusive rights to a part of the river and deny access to other users (e.g. outsiders)⁴. Before this can be answered, it is necessary to obtain an understanding of the position and motivations of outsiders. Once this is done, outsiders should either be included in the management process or effectively excluded from the fishery. This will be of key importance, as failure to effectively exclude outsiders from co-management arrangements can further weaken enforcement capability (Ahmed et al. 1997). Mitigation measures may need to be taken, in order to provide excluded fishers with other means of livelihoods, and/or incentives not to fish in the area.

⁴ This question is similarly raised by Jentoft and McCay (1995), who identify the problem of defining who can legitimately be included in a 'resource user group' in an assessment of co-management arrangements in fisheries.

The main reason why individual community members are not complying with the rule prohibiting fishing in the deep pool is that the immediate benefits of higher catches outweighs the costs of being caught and of the decline in future stocks. Short time-horizons are commonly associated with open-access fisheries. Addressing issues such as boundaries and access rights is likely to alter the incentive structure for resource users and therefore increase rule compliance. Clear demarcation of fishery boundaries and no-take areas, along with graduated sanctions, could also improve compliance.

Scale

The conservation benefits of community fisheries are likely to be much greater if efforts are coordinated and focused on a wider scale. In terms of management efficiency, the village level is probably too small to effectively implement management strategies. The commune level may be more appropriate, and in this study many community members fish in the wider area of the commune fishing grounds.⁵ Likewise, fellow members of the commune are considered to have similar ‘rights’ to fish in the community fishery, while non-commune members are considered ‘outsiders’. However, appropriate scale for a fisheries management regime may be the fish stock ecosystem boundaries (Jentoft and McCay 1995), and conservation objectives will undoubtedly be better met if the community fishery represents a discrete ecosystem. In practice, this would be difficult to implement, as exact ecosystem boundaries for any fish population in a riverine habitat are difficult to define. Catches in small-scale fisheries are almost always multi-species, and different species will have different ecosystem boundaries, particularly as many species undertake extensive migrations (the entire Lower Mekong Basin is obviously not an appropriate scale for a co-management arrangement). Nonetheless, coordinated efforts between adjacent community fisheries are likely to have a greater impact than isolated efforts and protected areas.

One solution to the problem of scale may be the establishment of a ‘federation of management zones’, in which individual co-management arrangements are linked, share common conservation objectives and impose similar harvest controls. This has been achieved to some extent in nearby southern Lao PDR, where many environmental characteristics

⁵ The CFs in Ou Mreah are in the process of establishing a commune collective (enforcing and monitoring cooperation between the four CFs in the commune).

and livelihood strategies are very similar to northern Cambodia. These co-management arrangements represent a number of distinct co-management arrangements, each with individually created and adapted regulations, but all following the same overall framework. In terms of conservation, there seem to be synergistic and positive impacts if many communities independently take responsibility for fish stocks, particularly local migratory and sedentary species, in their individual areas of control (Baird 1999).

Setting objectives

While the objectives of different stakeholders in the Tblong Kla community fishery do not differ greatly, they have not been developed jointly. Discussion amongst stakeholder groups, in order to re-define a set of common objectives, would increase understanding amongst parties. Objective-setting in community fisheries should also involve local resource users and external partners, and objectives need to be realistic. If increasing productivity in the fishery were the main objective, total catch would need to be greatly reduced in order to allow stock recovery. However, sustaining rural livelihoods will be a more pertinent objective for small-scale fisheries, and this should be reflected in policy and practice. Reductions in fishing pressure are unlikely to increase total yield, but may well improve returns to effort (i.e. catch per unit of effort).

Financial support

Finally, co-management arrangements are unlikely to be sustained in the long term if they rely solely on NGO partners for financial support. An alternative means of funding administration and enforcement should be established, whether this be charging outsiders to use the fishery, reserving a portion of catch for community funds or imposing fines for non-compliance. A requirement for users of the fishery to invest in management and, thereby, carry some of the costs of the system may have the added benefit of increasing legitimacy of the co-management arrangement (Karlsen 2001).

Appropriateness of co-management

Co-management is generally assumed to be the best institutional model for a legitimate and robust management system in subsistence fisheries (Jentoft et al. 1998), although it is recognized that it is not necessarily the most appropriate approach for every case. Community fisheries in

Cambodia represent a mixture of cooperative, consultative and instructive co-management, which is fairly appropriate to the current situation. For a number of reasons, co-management is probably also more appropriate than the alternative options of community-based, market-based or bureaucracy-based management.

First, the lack of physical boundaries to riverine fisheries makes policing access difficult, even if property rights have been clearly assigned. Government involvement can increase legitimacy, and some degree of government support is generally always required to impose effective management regulations in such situations (Pomeroy et al. 2001). Secondly, management regimes without government involvement require a high level of community or individual management capacity. This study suggests that, while resource users are keen to participate in management, local capacity and aspirations are probably not sufficient for autonomous fisheries management. However, complete state management that would require greater resources than those available, is generally considered undemocratic, and, of course, has not proven effective in meeting management objectives in the past. Lastly, a market-based approach (e.g. individual transferable quotas or ITQs) is not well suited to a multi-species fishery where divisibility and targeting of individual species is difficult, and where certain species have a higher value than others when sold (Bjorndal and Munro 1999).

Future development of community fisheries

Co-management is an evolving process, and will adjust and change in response to internal and external events and factors. Future development of co-management will depend principally on three main factors: first, the long-term goals for community fisheries; secondly, the degree of management responsibility granted to resource users; and thirdly, the extent to which external events shape change.

The long-term goals for community fisheries overall will obviously have an impact on the objectives of individual fisheries, and greatly affect how the fishery is managed. Small-scale fisheries in Cambodia function as part of a diversified, semi-subsistence livelihood strategy for rural communities. Ultimately, it could be argued that maintaining sustainable livelihoods is more relevant than improving sustainability in the fishery, and will best be achieved by promoting diversification as this will allow shocks and seasonal variation in food security to be better absorbed. Therefore, if the

main goal of community fisheries is promotion of rural livelihoods and food security, harvest and effort will need to be controlled to some extent, while equitable access and distribution of yield will be of key importance. Additionally, promotion of supplementary livelihood options, such as agriculture, aquaculture, tourism or forestry, can serve to reduce fishing pressure, while retaining the benefits of part-time fishing (Smith et al. 2005). Conversely, managing the resource to increase productivity is only likely to be worthwhile if there is specialization in fishing (i.e. the establishment of a commercial fishery). However, even stringent restrictions on effort, and tight control of access boundaries will not guarantee an increase in yield, unless the restrictions apply to all habitats of migratory species.

Currently, community fisheries represent a mixture of co-operative and consultative co-management at the collective choice level, with higher management decisions being made principally by government (i.e. instructive co-management). If resource users are to be allowed greater management control, they need to be given enabling power, through both legislation and capacity-building activities, and have the desire to participate in co-management. The rights apportioned to resource users by the community fishery sub-decree will dictate the direction of change in terms of the type of co-management regime in place. It should be recognized that the greater the degree of responsibility transferred to resource users, the greater the say they will have in determining the direction of development. This will be dependent on and reflect local perceptions of the resource and its perceived value, as well as external factors. For example, if the resource is perceived principally as an income generator, rather than as a food source, increasing productivity in the fishery may become the most important objective for community members.

External factors will also play a role in the development of community fisheries. First, population growth is likely to exert increasing pressure on small-scale fisheries in Cambodia. As the number of dependent users increases, individual catches (and catch per unit effort) are likely to decrease. One possible solution is to lower fishing pressure in the riverine capture fishery by developing additional or alternative fishing grounds. Pond or rice-field fisheries could be used for household consumption or to generate community funds. The presence of the fish trader also exerts pressure on the fishery by representing a continual market for fish and thereby attracting fishers to the area. As trading fish represents the main or only income

generator for many fishing communities, the development of alternative livelihood options would seem the only feasible way of addressing this problem. For example, access to markets for other goods could play a key role in lessening dependence on fisheries for income generation.

Although a successful co-management arrangement can address local threats and so help improve sustainability within the fishery, other factors are largely beyond the control of co-management arrangements in small-scale fisheries. Often, successful co-management is dependent on the creation of external mechanisms for resource protection (Pinkerton 1989), in addition to local conditions. Agriculture development, flooded forest clearing and upstream water abstractions are likely to remain as threats to fishery resources, and need to be addressed at the basin level. On the wider global scale, increasing market integration and globalization will also affect the direction of co-management development. For example, if there is increasing need for cash income, subsistence fishing may no longer be a viable way of supporting rural livelihoods.

Although there is the potential for successful co-management in Cambodian small-scale fisheries, it is currently limited by some important constraints. These include the lack of clearly defined enabling legislation, of property rights, of resource boundaries and of access control. Additionally, management objectives are, in some cases, inappropriate and there is little agreement among co-management partners, on whether the objective is improving sustainability in the fishery or maintaining rural livelihoods. Currently, the transaction costs of co-management outweigh the benefits to local resource users, although the introduction of co-management has improved democracy and equity with regards to decision-making and distribution of the resource. Unless there is successful integration of management initiatives over the entire ecosystem, co-management is unlikely to have any impact on biological sustainability in riverine fisheries. Additionally, increasing fishing pressure and external threats to productivity need to be addressed on a wider scale. Unless alternative livelihood options become available and more attractive than fishing to resource users, fishing pressure is likely to remain high, with resultant low catch per unit effort and low individual catches.

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